Draft
Archaeological Inventory Survey Report for the Block M Project, Kaka‘ako, Honolulu Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK: [1] 2-3-002:001 (portion)

Prepared for
Victoria Ward Limited/Howard Hughes Corporation

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September 2014

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Management Summary

Reference	Archaeological Inventory Survey Report for the Block M Project, Kaka‘ako, Honolulu Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK: [1] 2-3-002:001 (portion) (Hawkins et al. 2014)
Date	September 2014
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: KAKAAKO 122
Investigation Permit Number	CSH completed the archaeological inventory survey (AIS) investigation under Hawai‘i State Historic Preservation Division (SHPD) permit number 14-04, issued per Hawai‘i Administrative Rules (HAR) §13-13-282.
Land Jurisdiction	Private, Victoria Ward, Limited (VWL) / Howard Hughes Corporation (HHC)
Project Funding	VWL
Project Location	The Block M project is a discrete project within the larger Ward Neighborhood Master Plan project. The project area is located within Ward Village and is bounded to the northeast by Queen Street, to the southeast by Kamake‘e Street, to the southwest by Ward Theaters, and to the northwest by Ward Industrial Center. The project area is depicted on the 1998 Honolulu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle.
Project Description	The Block M 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 Hawaii Community Development Authority (HCDA). The Block M project will consist of the construction of a high-rise residential tower with commercial space located on the ground floor. Ground disturbance associated with project construction will include demolition and removal of existing buildings and structures in Ward Village, 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 4.0 acres (1.6 hectares)
Area of Potential Effect (APE)	The project’s APE is defined as the entire approximately 4.0-acre project area. The project area’s surrounding built environment is urban (paved streets, low-rise commercial buildings, and high-rise residential 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 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 the Block M component of the Ward Neighborhood Master Plan was accepted in an SHPD §6E historic preservation review (10 January 2014, LOG NO.: 2013.6926; DOC NO.: 1401SL10)(APPENDIX A). This archaeological inventory survey report was prepared to address the Block M project and was prepared in accordance with the requirements for an archaeological inventory survey report (AISR) as stated in HAR §13-276-5.
Fieldwork Effort	Fieldwork was accomplished between 13 January 2014 and 1 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., Veronica Morris, M.A., Doug Inglis, B.A., Nifae Hunkin, B.A., Pablo Rivera, B.A., Andrea Kay, M.A., Andrew Soltz, B.A., Scott Belluomini, B.A., Malina Reveal, M.Sc., Kimi Matsushima, B.A., Amanda Eggers, B.A., Timothy Zapor, B.A., Jessica Leger, M.A., Tyler Turran, B.A., Pua Guanzon, B.A., Laura Ortiz, M.A., Leandra Medina, B.A., Jim Thain, B.A., Tara del Fierro, B.A., Karl Van Ryzin, B.A., Fred LaChance, B.A., Nigel Kingsbury, B.A., Abbey Mierzejewski, B.A., Brittany Enanoria, B.A., and Tom Martel, B.A.
Consultation	Consultation with the SHPD and Native Hawaiian individuals (recognized cultural descendants of the adjacent Ward Village Shops project) was conducted both prior to the commencement of AIS fieldwork and following the completion of fieldwork on 1 June 2014. Consultation included presentation of the AISP testing strategy and a discussion of the testing results of the completed AIS. Consultation also included presentation of the AIS results to the O‘ahu Island Burial Council (OIBC).

Historic Properties Identified	Portions of two historic properties were identified within the Block M project area: 1. State Inventory of Historic Properties (SIHP) # 50-80-14-7429 consists of a previously identified subsurface cultural deposit, including an isolated human skeletal element (Hammatt 2013). The boundaries of SIHP #-7429 were extended into the Block M (current project) and Block I (adjacent project that identified features including human remains associated with SIHP #-7429; report in progress) AIS investigations. AIS investigation of SIHP # -7429 in Block M documented a second, overlying historic cultural deposit in the Block M project area. Sixteen features were identified as associated with SIHP # -7429 within the Block M project area, including traditional-type pit features, water channel features, and historic features. No human remains were observed during the Block M AIS. 2. SIHP # 50-80-14-7686 consists of buried twentieth century commercial infrastructure remnants including warehouse concrete foundations and footings and asphalt road surfaces associated with the warehouse complex. Documented during the current Block M AIS, it was also observed outside the Block M project area in the adjacent Block I AIS investigation (report in progress).
Historic Property Significance	SIHP # 50-80-14-7429, subsurface cultural deposits, was previously determined significant under Hawai‘i significance criteria “d” (has yielded, or may be likely to yield information important in prehistory or history) and “e” (has cultural significance to an ethnic group, usually applied to human remains), pursuant to HAR §13-275-6 (Hammatt 2013:1:824). This previous assessment indicated “SIHP # -7429 has provided, and can potentially provide, additional information on late pre- to early post-Contact habitation, historic land use, and pre- and post-Contact burial practices and distribution within Kaka‘ako” (Hammatt 2013:1:824). The current AIS project results substantiate these prior determinations, in this case assessed under HAR §13-284-6, although again, no human remains were documented within the Block M AIS. SIHP # 50-80-14-7686, newly identified in the current AIS, subsurface historic infrastructure remnants, is assessed as significant under Hawai‘i significance criteria “d” (has yielded, or may be likely to yield information important in prehistory or history) pursuant to HAR §13-284-6. Based on integrity of location and materials, SIHP # -7686 has provided additional information on twentieth century commercial infrastructure within Kaka‘ako.
Effect Recommendation	CSH’s project specific effect recommendation is “effect, with agreed upon mitigation commitments.” The recommended mitigation measures will reduce the project’s effect on SIHP #s -7429 and -7686, and any additional, as yet unidentified, historic properties within the project area.

Mitigation Recommendations	This AIS indicates the Block M project area contains 1) an area of buried natural sand deposits, which extends from the eastern corner of the project area (the corner of Queen and Kamake‘e streets) to the vicinity of the western corner, essentially cutting a diagonal across the project area; and 2) an area of natural, unmodified wetlands located *makai* (seaward) of the sand deposits. Portions of two historic properties were identified within the Block M project area. SIHP # -7429, subsurface cultural deposits, is located within the zone of sand deposits. SIHP # -7686, buried historic infrastructure remnants, is located over historic fill deposits and straddles both zones. Based on results of the current AIS testing, and in consultation with the SHPD, CSH recommends that project construction proceed under an archaeological monitoring program. The monitoring program shall consist of a twofold approach: 1) on-site monitoring of all project-related ground disturbance activities below 2 ft within the zone of natural sand deposits; and 2) on-call monitoring with weekly spot-checks within the zone of natural wetland deposits. In addition, the on-site monitoring shall include targeted monitoring of specified features associated with SIHP # -7429. The details of the monitoring program will be included in the project’s archaeological monitoring plan to be reviewed and approved by the SHPD. The monitoring program will facilitate the identification and proper treatment of any archaeological deposits disturbed by project construction, including any potential historic properties, features, or human burials not identified during the project AIS.

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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 Block M project area, Kaka‘ako, Honolulu Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK: [1] 2-3-002:001 (portion). The 4.0-acre (1.6-hectare) Block M project is located within Ward Village. It is bound to the northeast by Queen Street, to the southeast by Kamake‘e Street, to the southwest by Ward Theaters, and to the northwest by Ward Industrial Center. The project area is depicted on a portion of the 1998 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 of VWL's approximately 60.5-acre (24.5-hectare) Ward Neighborhood Master Plan, 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 Hawaii Community Development Authority (HCDA).

The Block M project will consist of construction of a high-rise residential tower with commercial space located on the ground floor. This is a private development owned and funded by VWL/HHC.

Ground disturbance associated with project construction will include demolition and removal of existing buildings and structures, 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 January 2014 (LOG NO.: 2013.6926; DOC NO.:1401SL10). This archaeological inventory survey report was prepared to address the Block M 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.

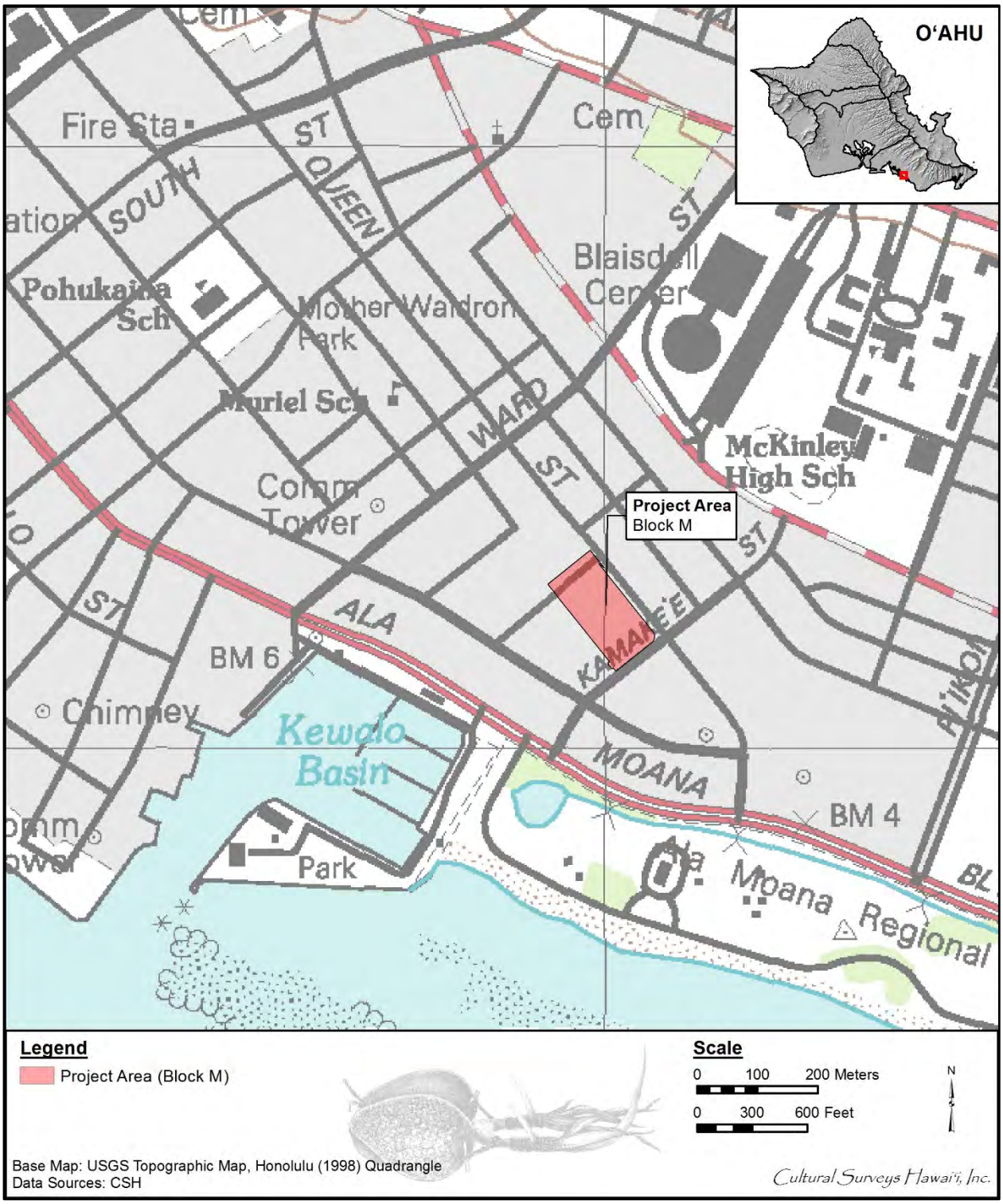

Figure 1. 1998 Honolulu USGS 7.5-minute topographic quadrangle showing the location of the Block M project area *makai* (seaward) of the intersection of Queen and Kamake‘e streets

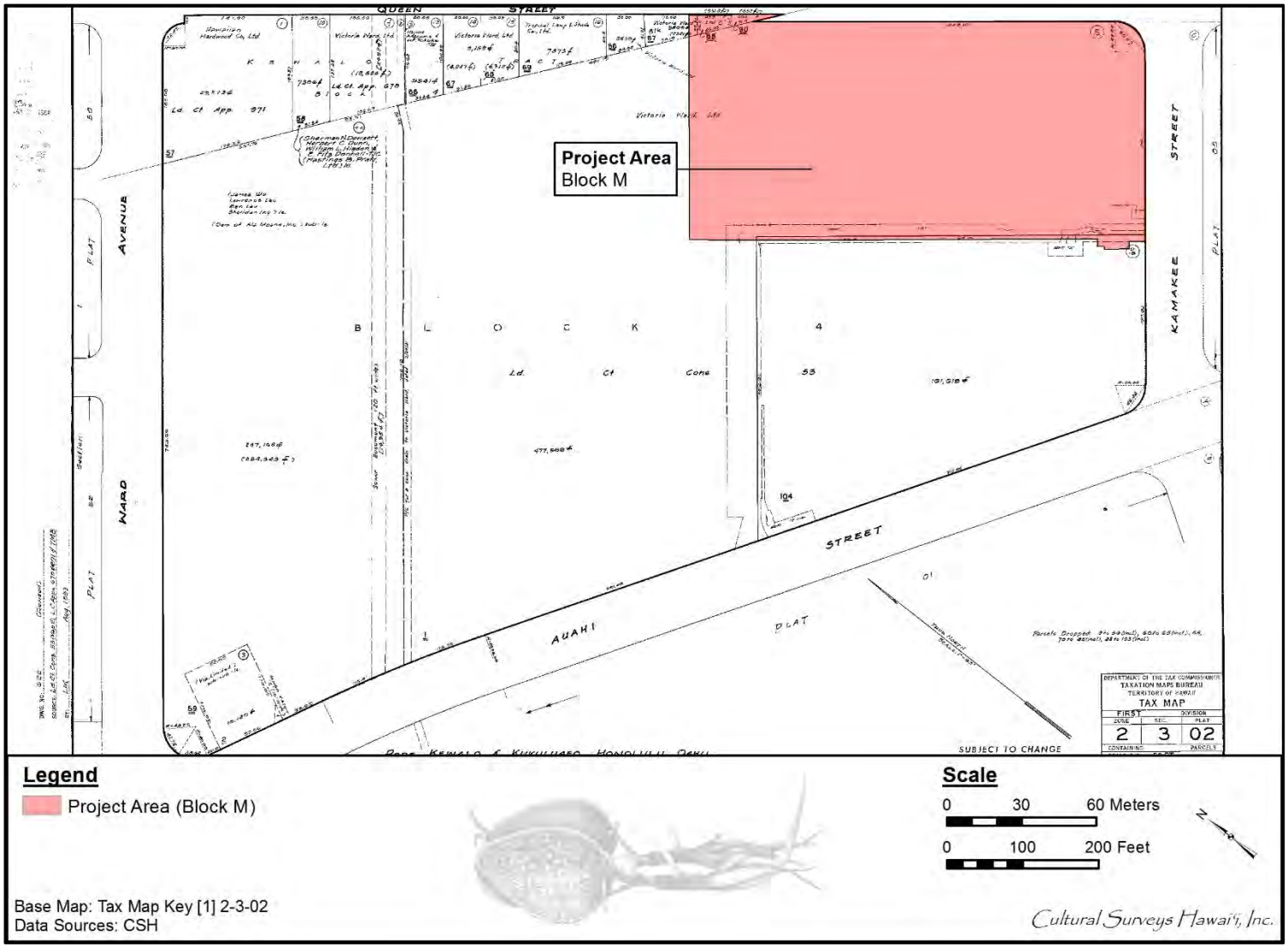

Figure 2. Tax map key (TMK): [1] 2-3-02, showing the location of the Block M project area (Hawai‘i TMK Service 2012)

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

1.3 Environmental Setting

1.3.1 Natural Environment

The Block M 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 (Macdonald et al. 1983; Stearns 1978); 2) the mid- to late Holocene approximately 1.5-2.0 m highstand 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 5,000-6,000 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 M 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 highstand 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 (Athens and Ward 1997; Fletcher and Jones 1996; Grossman and Fletcher 1998; Grossman et al. 1998; Harney et al. 2000; Stearns 1978). During this highstand, 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 4. The authors describe fill land as follows: “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 M indicates natural Jaucas sand (JaC) may be encountered underneath portions of the Block M study area. Foote et al. (1972) describe Jaucas sand as follows:

> 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 & Associates 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.

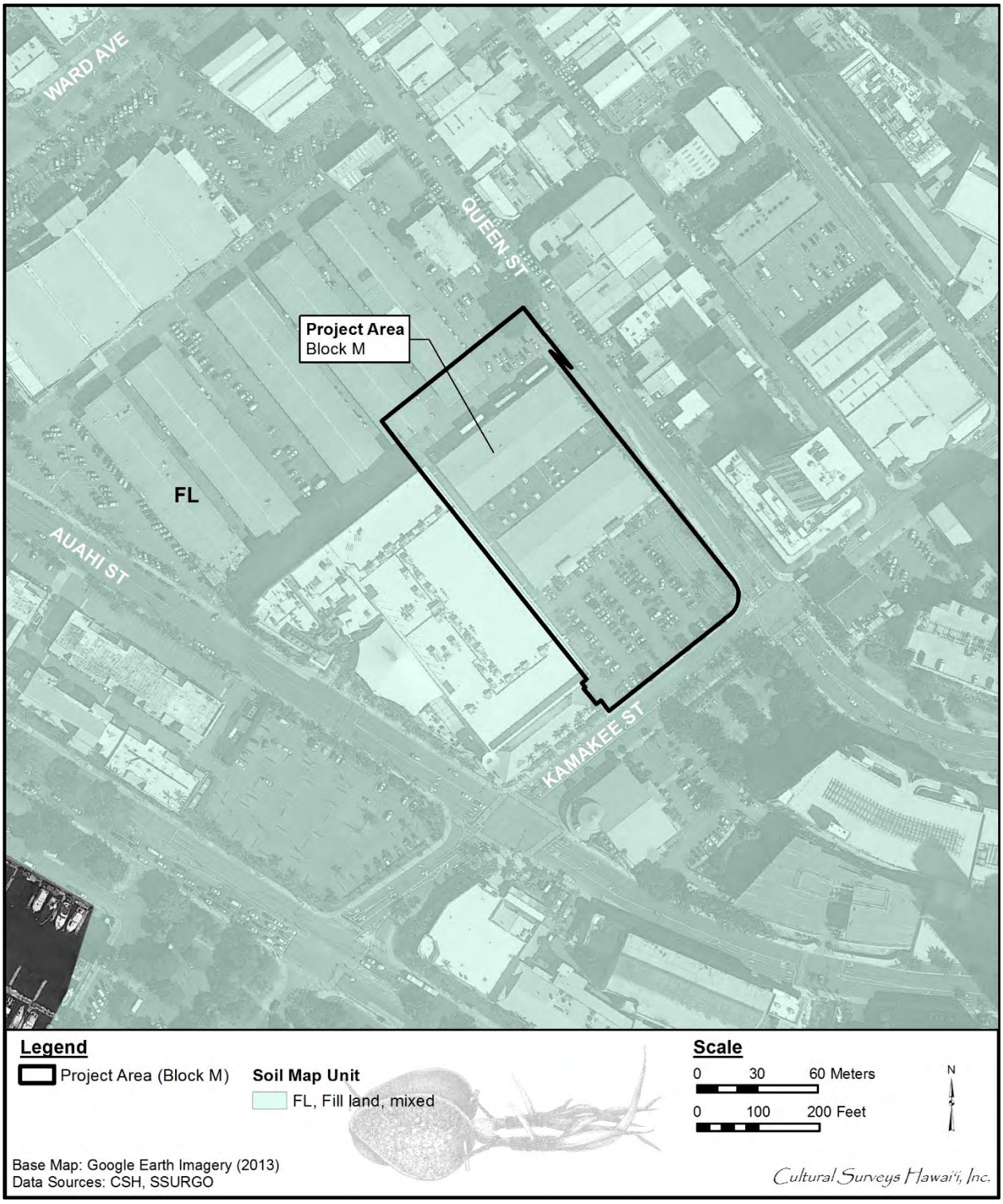

Figure 4. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), showing Fill lands (FL) within and surrounding the Block M project area (base map: Google Earth 2013)

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 M project. This research design, from the SHPD-accepted AISP (Sroat et al. 2014), meets specifications for an AISP outlined in HAR §13-284-5.

2.2 Research Design

The research efforts described in the AISP (Sroat et al. 2014) 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 and previous archaeological investigations, two specific research objectives were formulated within the AISP for the Block M project area:

1. Previous archaeology within and immediately adjacent to the Block M project area (Hammatt 2013; Winieski and Hammatt 2001; Medina et al. 2013—*draft*) documented a buried A horizon and Jaucas sand beneath overlying fill deposits. How continuous are these natural deposits within the project area? In addition, two test excavations for the Honolulu High Capacity Transit Corridor Project (HHCTCP) City Center AIS (Hammatt 2013) contained possible traditional Hawaiian cultural material within the buried A horizon. Does the Block M project area contain cultural deposits in the form of traditional Hawaiian and/or historic material and features? If so, how can we characterize the function, spatial distribution, and chronology of these deposits? What do these cultural deposits tell us about pre- and post-Contact usage of Kaka‘ako and its environment?
2. What evidence exists of the various historic reclamation projects within the project area and can any deposits be correlated with specific landscape reclamation projects?

2.4 Pedestrian Survey

A 100% 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 modern development. 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 conducted as part of the project's AISP, potential archaeological cultural resources located within the project area include culturally enriched A horizon deposits, human burials, remnants/artifacts from the Rifle Association firing range, artifacts/debris associated with twentieth century commercial and residential use, and reclamation fill deposits, including historic trash layers or incinerated fill.

In order to locate and document these potential archaeological cultural resources, 62 test excavations were originally proposed for Block M, distributed generally throughout the project area (Figure 5). Four of these test excavations (T-18, 25, 51, and 52) specifically targeted areas along Queen Street within which previous archaeological investigations had documented trace amounts of cultural material within a buried sand A horizon.

During the AIS investigation, following the survey strategy provisions of the AISP, a certain number of the test excavations required slight locational shifts. Trench location shifts were made largely to avoid subsurface utility corridors, blocking ingress/egress to commercial businesses, and interior commercial space infrastructure obstacles. Utility corridors were located along the *makai* (seaward) edge of the project area (within the alleyway between the Ward Theatres and the current commercial building within the Block M project area), within the alleyway along the northwestern boundary of Block M, and between Queen Street and the current commercial building. While the majority of the shifted test excavations were moved only slightly, T-28 required being relocated entirely due to the complete lack of excavation space alongside the Ward Theatres. Pursuant to the provisions of the AISP, it was relocated to an area of high archaeological potential in the northwest alleyway, as indicated by the completed test excavations in this area (Figure 6). Alongside Queen Street, Test Excavations 18 and 25 (both targeted excavations) were rotated perpendicular to the proposed locations and hand excavated in order to seek for any openings between the dense utility lines; this also necessitated the shortening of both test excavations in order to stay within the property boundary.

During the timeframe of the Block M AIS fieldwork, refinement of the Ward Neighborhood Master Plan project's engineering plans also necessitated a slight expansion of the Block M project area to the northwest (Figure 7). The expansion of Block M required the appropriation of small portions of the adjacent Block I and Block N East project areas and shifted six test excavations, previously located within Blocks I and N East, to the Block M project area—thus adding Test Excavations 63 through 68 (Figure 6).

On average, the test excavations measured 0.6 by 6.1 m (2 by 20 ft), with the main exceptions being Test Excavations 18 and 25. All test excavations extended to the coral shelf or to below the water table, unless obstructed by subsurface infrastructure.

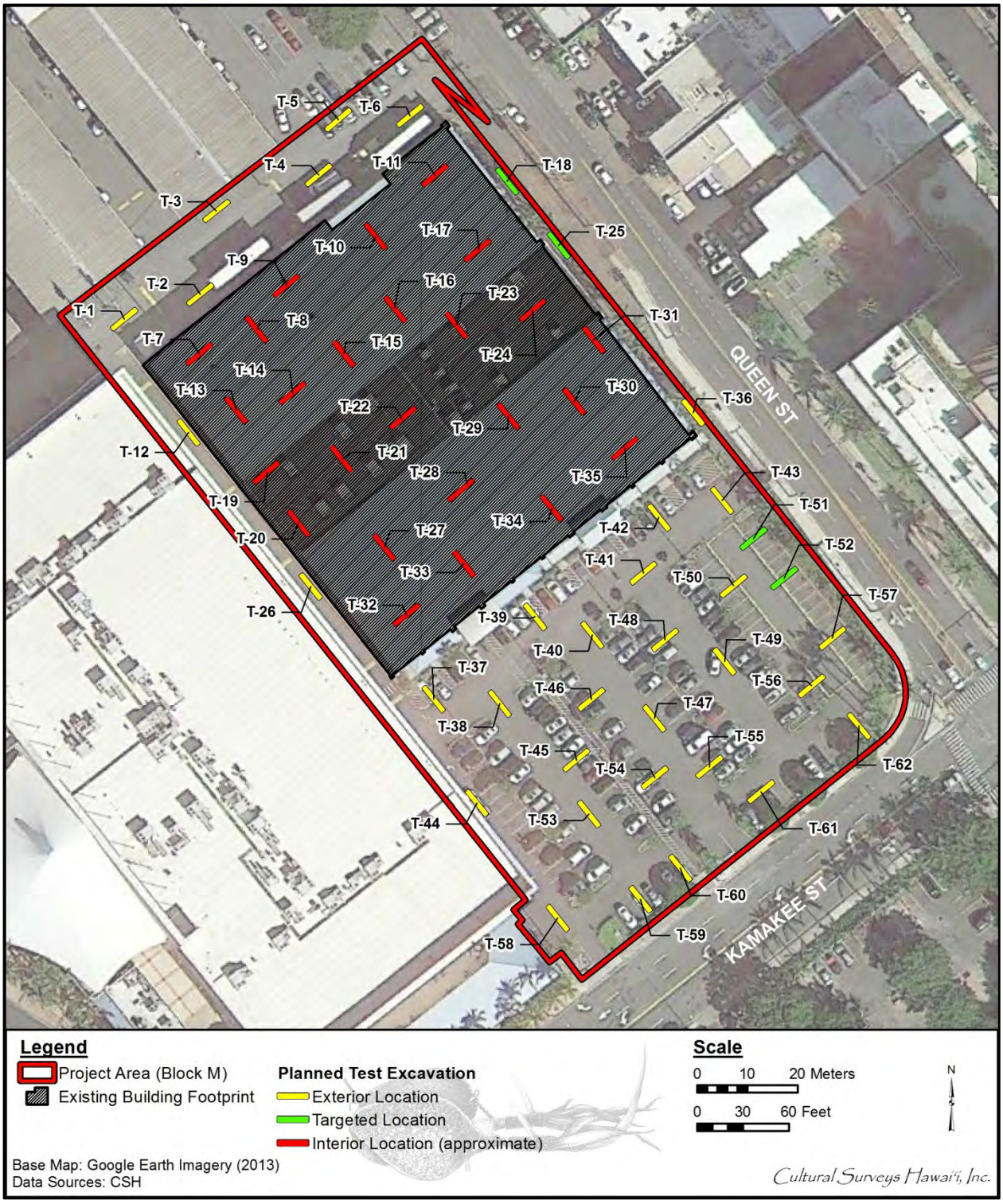

Figure 5. Aerial photograph showing the location of the 62 AISP-proposed Block M test excavations (base map: Google Earth 2013)

Figure 6. Aerial photograph showing the updated Block M project area, the adjusted locations of the 62 AISP-proposed test excavations, and the location of the six additional test excavations (T-63 through T-68) incorporated as part of the expanded project area (base map: Google Earth 2013)

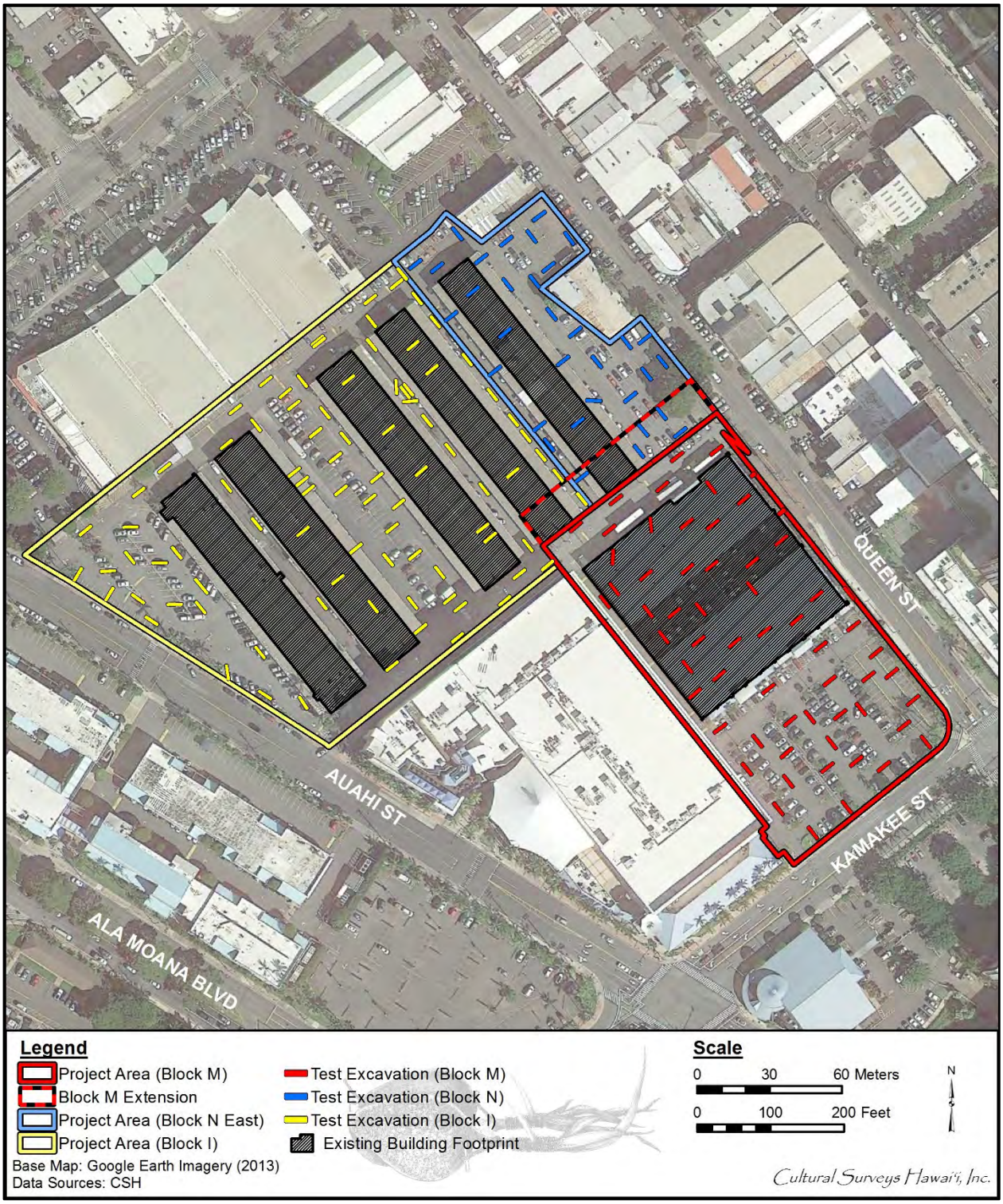

Figure 7. Aerial photograph showing the expansion of the Block M project area (red-black dashed line), which incorporated portions of the Block I (yellow) and Block N East (blue) project areas (base map: 2013)

Initial excavation methods consisted of saw cutting the asphalt parking lot surface (exterior excavations) or commercial flooring (interior excavations). Removal of the underlying fill deposits was undertaken via backhoe (both exterior and interior). Fill deposits included various layers of base course material, imported fill sediments, and Kaka‘ako reclamation fill deposits consisting of crushed coral and hydraulic dredge clay obtained from the Kewalo coastline. 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 were excavated by hand. Hand excavation also included a fill sand deposit located directly overtop the natural sand A horizon as this was believed to represent translocated natural materials with the potential for cultural content. Hand excavation continued to just above the water table through the underlying natural sandy clay strata. Slow mechanized bucket scrapes were then utilized to excavate the thick clay deposits which extended from the water table to the coral shelf. Within areas of natural wetland sediments lacking sand deposits, the testing strategy allowed for slow removal via thin mechanized shovel scrapes.

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 were recorded using tape measurements and a building interior blueprint 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. In areas which contained a natural sand A horizon, a portion of the A horizon, ranging from 1 to 20 gallons and collected from either the trench floor or sidewall, was screened through 1/8-inch screen mesh in the field. All potential cultural material was collected, bagged by provenience, and taken to the CSH laboratory for further identification and analysis. Field screening was also conducted for all identified subsurface pit features associated with the sand A horizon.

In areas which contained natural wetland sediments, column samples were selectively collected from throughout the extent of the wetlands in order to obtain appropriate pollen samples for palynological analysis. Column samples generally consisted of multiple vertical subsamples from multiple wetland strata or sub-strata. In addition, bulk sediment samples of wetland deposits, ranging from 1 to 5 liters, were variously collected in order to have reserve samples should further interpretation or better characterization of a sediment be needed.

While no historic trash pits, privies, or other historic pit features were identified within the Block M project area, various historic artifacts and fragments were observed within fill deposits and features. Most consisted of very small fragments (such as tiny glass pieces) and were most notable for their presence in a stratum. While not always collected, the artifacts were noted and photographed if deemed warranted. In other cases, fill deposits contained larger, more identifiable historic artifacts or a concentration of historic artifacts. Representative samples of these historic artifacts were collected and taken to the CSH laboratory for analysis of function, association, and age.

2.7 Laboratory Methods

Materials collected during AIS fieldwork were identified and catalogued at CSH's laboratory facilities on O‘ahu. 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 Artifact Analysis

Traditional Hawaiian artifactual material was identified, and forms and functions determined using standard reference material (e.g., Barrera and Kirch 1973; Brigham 1974; Buck 2003; and Emory et al. 1968). Historic artifacts were identified using standard reference materials and resources available on the Internet (e.g., Elliott and Gould 1988; Fike 1987; Kovel and Kovel 1986; Lehner 1988; Lindsey 2010; Lockhart 2004–2010; Millar 1988; Toulouse 1971; Whitten 2009; and Zumwalt 1980). 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 and/or features.

2.7.2 Faunal Analysis

Faunal material consisted of both vertebrate and invertebrate remains. Vertebrate remains were all identified as non-human skeletal material by CSH's staff osteologist Malina Reveal, M.Sc. Vertebrate 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, Adams and Crabtree 2011). Vertebrate analysis particularly focused on evidence of food consumption, as indicated by post-mortem cut marks and striations. Invertebrate remains were identified to genus and species, weighed, and analyzed. Common marine shells were identified and analyzed at the CSH laboratory using an in-house comparative collection and reference texts (e.g., Abbott and Dance 1990; Eisenberg 1981; Kay 1979; and Titcomb 1979).

2.7.3 Radiocarbon Dating

One sample was sent to Beta Analytic, Inc. of Miami, Florida for radiocarbon dating analysis. The sample was analyzed using the Accelerator Mass Spectrometry (AMS) method. The conventional radiocarbon age determined by Beta Analytic, Inc. was calibrated to calendar age using the OxCal calibration program, Version 4.2, developed by the University of Oxford Radiocarbon Accelerator Unit (ORAU), and available as shareware over the Internet.

2.7.4 Pollen Analysis

Palynology is the branch of science concerned with the study of pollen, spores, phytoliths, and other palynomorphs. Palynomorphs are often preserved in sediment samples and, following physical and chemical extraction, can be identified using light microscopy. This information can potentially identify the types of plants that made up the local environment, or the local watershed, at the time the sediment was deposited. CSH submitted two column samples, comprising six sub-samples, of natural wetland sediments to Dr. Michael Twieten of SkyCedar Research in Port Townsend, Washington for pollen analysis to facilitate paleoenvironmental reconstruction.

2.7.5 Wood Taxa Identification

The identification of wood taxa found in an archaeological context can give insight into the vegetation of the surrounding area at the time the woods were burned. This information can then be used to interpret the environment as well as possible cultural use of specific plants. In addition, the screening of charcoal samples for the absence of historically introduced plants gives some assurance that the sample does not represent the remains of modern activities. One charcoal sample was sent to the International Archaeological Research Institute, Inc. (IARII) for taxa identification where it was viewed under magnification of a dissecting microscope and then compared with anatomical characteristics of known woods in the Pacific Islands Wood Collection at the Department of Botany, University of Hawai‘i, as well as published descriptions.

2.8 Disposition of Materials

All collections resulting from the AIS process, including samples and artifacts, 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 Waimānalo, 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 was conducted as part of the project’s AISP. Background research included a review of previous archaeological studies on file at the SHPD 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 Bishop Museum Archives; study of historic photographs at the Hawai‘i State Archives and the Bishop Museum Archives; study of historic maps at the Hawai‘i 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 10 July 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 Kaka‘ako cultural descendants (Ka‘anohi Kaleikini, Keala Norman, Kepo‘o Keli‘ipa‘akaua, and Kahili Norman), O‘ahu Island Burial Council (OIBC) representative Hinaleimoana Wong-Kalu, HHC representatives (John Simon, David Striph, and Nick Vanderboom), CSH principal investigator Matt McDermott, and Ku‘iwalu 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 Kaka‘ako, and to develop cultural guidelines for the project. The cultural descendants were very supportive of the idea of incorporating *mo‘olelo* (stories) of the area into the Hawaiian architecture and the use of native plants within the landscaping designs. They further suggested establishing resource gardens where Native Hawaiians could gather native plants. 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 10 July 2012 meeting was Mr. Manny Kululoio, a cultural descendant of the Honolulu and Kaka‘ako areas. Mr. Kululoio 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. Kululoio to discuss any input he might have regarding development of the Ward Neighborhood Master Plan project and AIS plans. Mr. Kululoio acknowledged receipt of the archaeological literature review and predictive model document, but did not have any specific comments at that time.

On 20 July 2012, Nick Vanderboom of HHC and Matt McDermott of CSH met with the SHPD Administrator, Dr. Pua Aiu, and the SHPD O‘ahu 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 Hawaii 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 6 November 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 5 November 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 15 November 2013, Mr. Nahalea confirmed that Mr. Ayau should continue to be the point of contact for Hui Mālama.

On 8 November 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 13 November 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 18 November 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-accepted 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 21 November 2013 to Dr. Lebo summarizing the 18 November 2013 consultation meeting and expressing the agreement of meeting participants to allow limited interior space test excavations within the project areas prior to the SHPD acceptance of the AISPs.

AIS fieldwork for the Block M project area commenced on 13 January 2014 and was completed on 1 June 2014. On 14 May 2014, near the completion of the AIS fieldwork, Matt McDermott of CSH gave an informational update to the OIBC of the Ward Neighborhood Master Plan project's ongoing AIS fieldwork, including the Blocks B East, C West, I and M project areas.

Following completion of all Block M AIS fieldwork, a follow-up meeting was held with the Ward Village Shops project'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 Block M, Block B East, and Block C West, as well as 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 M AIS testing or findings.

Section 3 Background Research

The following Background Research section is copied from the SHPD reviewed and approved Block M AISP (Sroat et al. 2014). While not required to be included within this document, it is provided here for the benefit of the reader.

3.1 Traditional Background Research

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 M 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 terrace)—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.

3.1.2 Legendary Accounts

The Block M 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 or in the index to Fornander’s Collection of Hawaiian Antiquities and Folklore.

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]
O Makiki la ke ēwe,	At Makiki the placenta,
I Kānelā‘au i Kahehuna ke piko,	At Kānelā‘au at Kahehuna the navel cord,
I Kalo i Pauoa ka ‘a‘a;	At Kalo at Pauoa the caul;
I uka i Kaho‘iwai i	Upland at Kaho‘iwai, at
Kanaloaho‘okau . . .	Kanaloaho‘okau. . .

[Kamakau 1991:24]

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

[*Ka makaua ua kahi o ‘Ewa*]	[The increasing “first rain” of ‘Ewa]
Ua puni ka i‘a o Mokumoa,	Overcomes the fish of Mokumoa,
Ua kau i‘a ka nene;	Washes up fish to the nene plants;
Ua ha‘a kalo ha‘a nu;	Lays low the taro as it patters down;
Ha‘a ka i‘a o kewalo,	Lays low the fish of Kewalo,
Ha‘a na ‘ualu o Pahua,	Lays low the sweet potatoes of Pahua,
Ha‘a ka mahiki i ***Pu‘ukea****,*	Lays low the mahiki grass at **Pu‘ukea**,
Ha‘a ka unuunu i Pele‘ula,	Lays low the growing things at Pele‘ula
Ha‘a 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 ‘ai ‘na ka i‘a o Maunalua*] . . .	[Eating the fish of Maunalua] . . .

[Kamakau 1991:24-25]

The chant mentions the *mahiki* grass of Pu‘ukea 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 ‘*aki‘aki*, 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 *‘aki‘aki* 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 Kukuluāe‘o coast was a good habitat and thus a favored place for healers to collect this type of grass. The literal meaning of Pu‘ukea is “white hill” (Pukui et al. 1974:199), although it may have alternate meanings. Pu‘ukea is also the name of a small land division within the ‘*ili* of Kukuluāe‘o, 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 ‘*ili* it is located within, so it is possible that Pu‘ukea Heiau was also near the junction of Halekauwila and Cooke streets. The majority of the house sites in the mid-nineteenth century in Kukuluāe‘o 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 *pu‘u kea* (white hill).

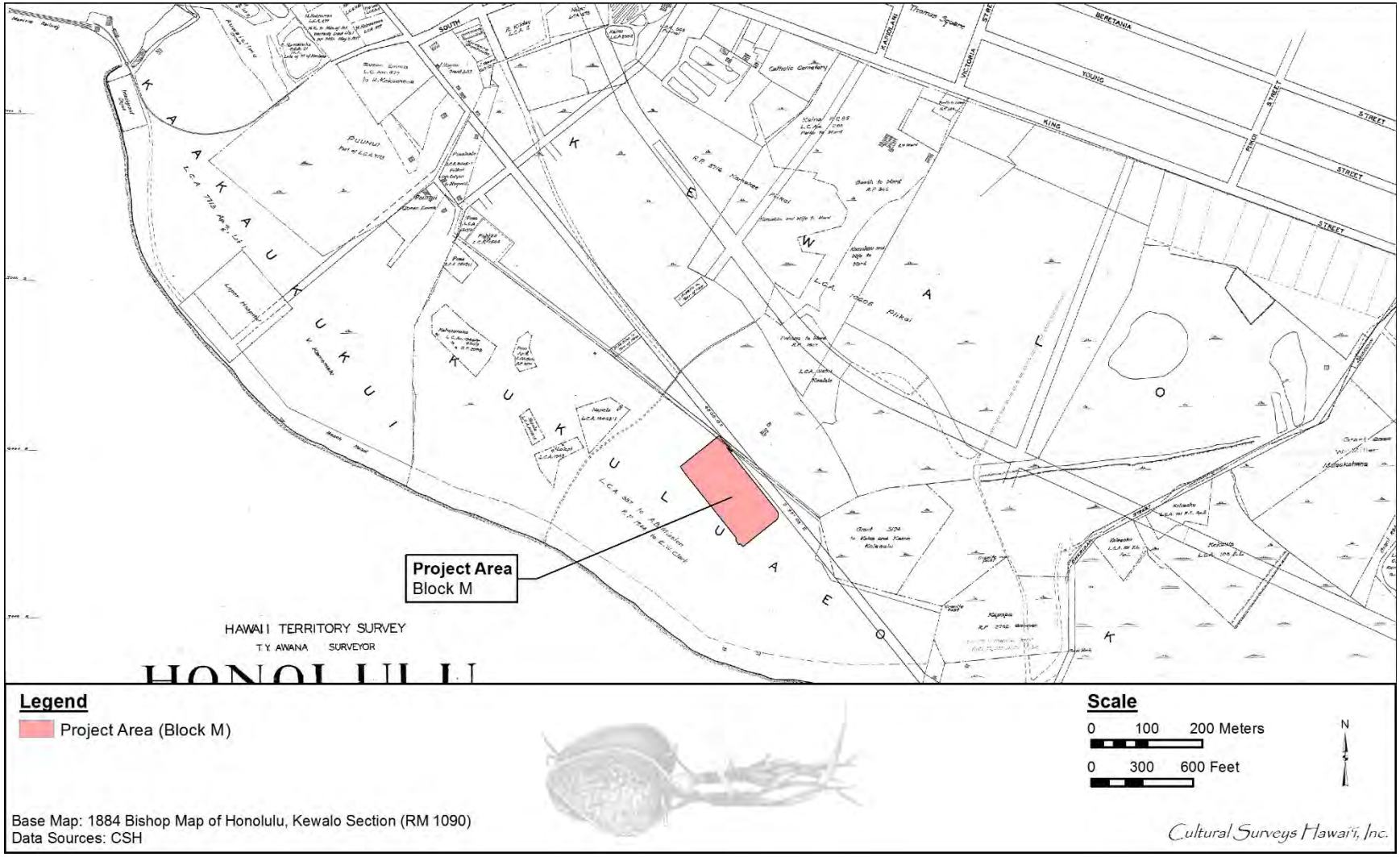

Figure 8. 1884 map of Honolulu, Kewalo Section (portion) by S.E. Bishop, showing place names and Land Commission Award (LCA) locations within and near the project area (Hawai‘i Land Survey Division, Registered Map 1090)

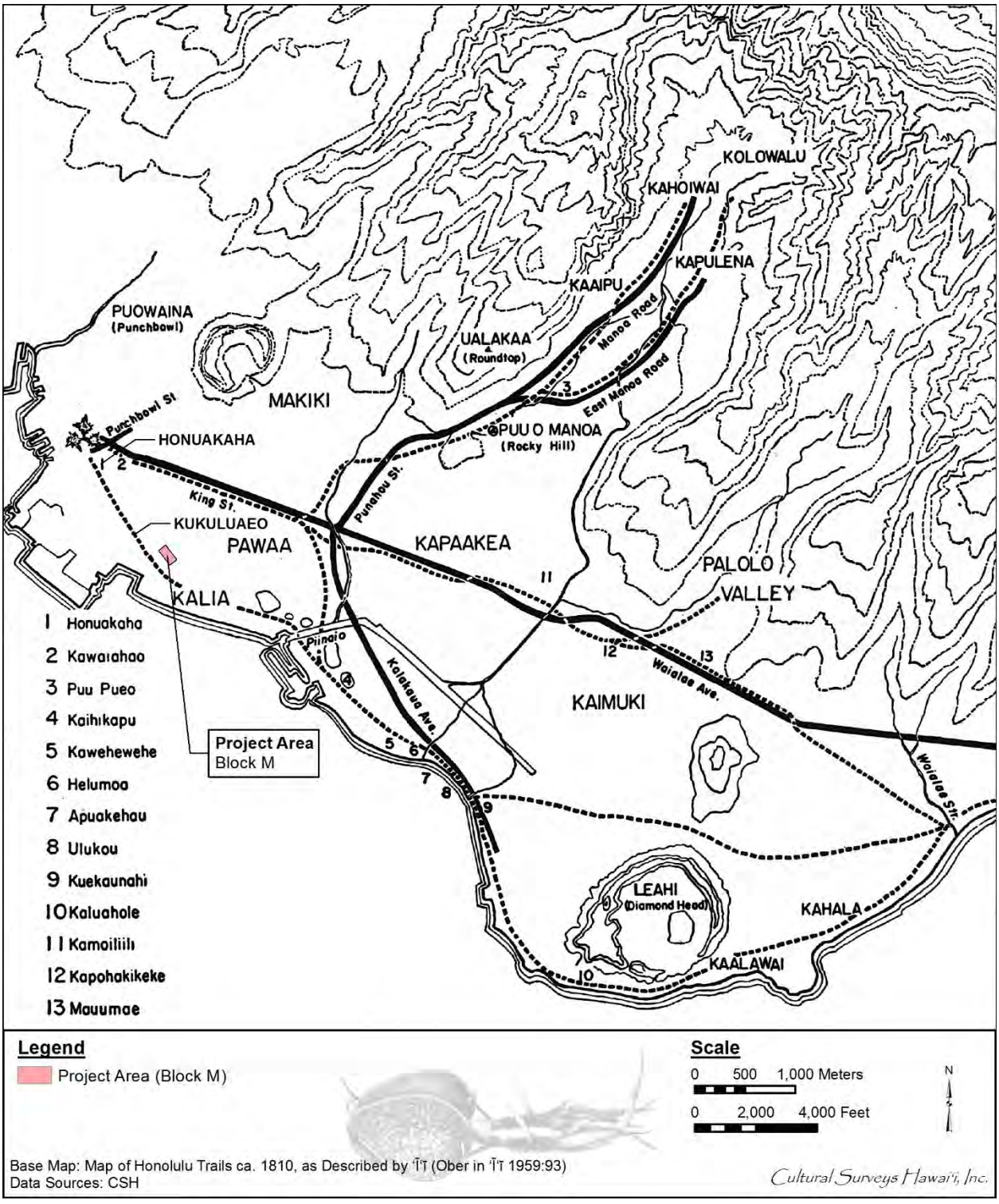

Figure 9. Early nineteenth century (ca. 1810) trails on the southwest coast of O‘ahu (illustration by Gerald Ober from ‘Ī‘ī 1959:93), showing the location of Honuakaha, Kukuluāe‘o, and Kālia

From these legendary accounts it can be seen that Kukuluāe‘o 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 Pu‘ukea 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.

3.2 Historical Background

3.2.1 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 irrigated 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; it 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 Nu‘uanu and Pauoa Valleys and the harbor. [W.D.] Westervelt . . . wrote that ‘Honolulu 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 Kukuluāe‘o 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 Kukuluāe‘o 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 Kukuluāe‘o 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 Kaka‘ako 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

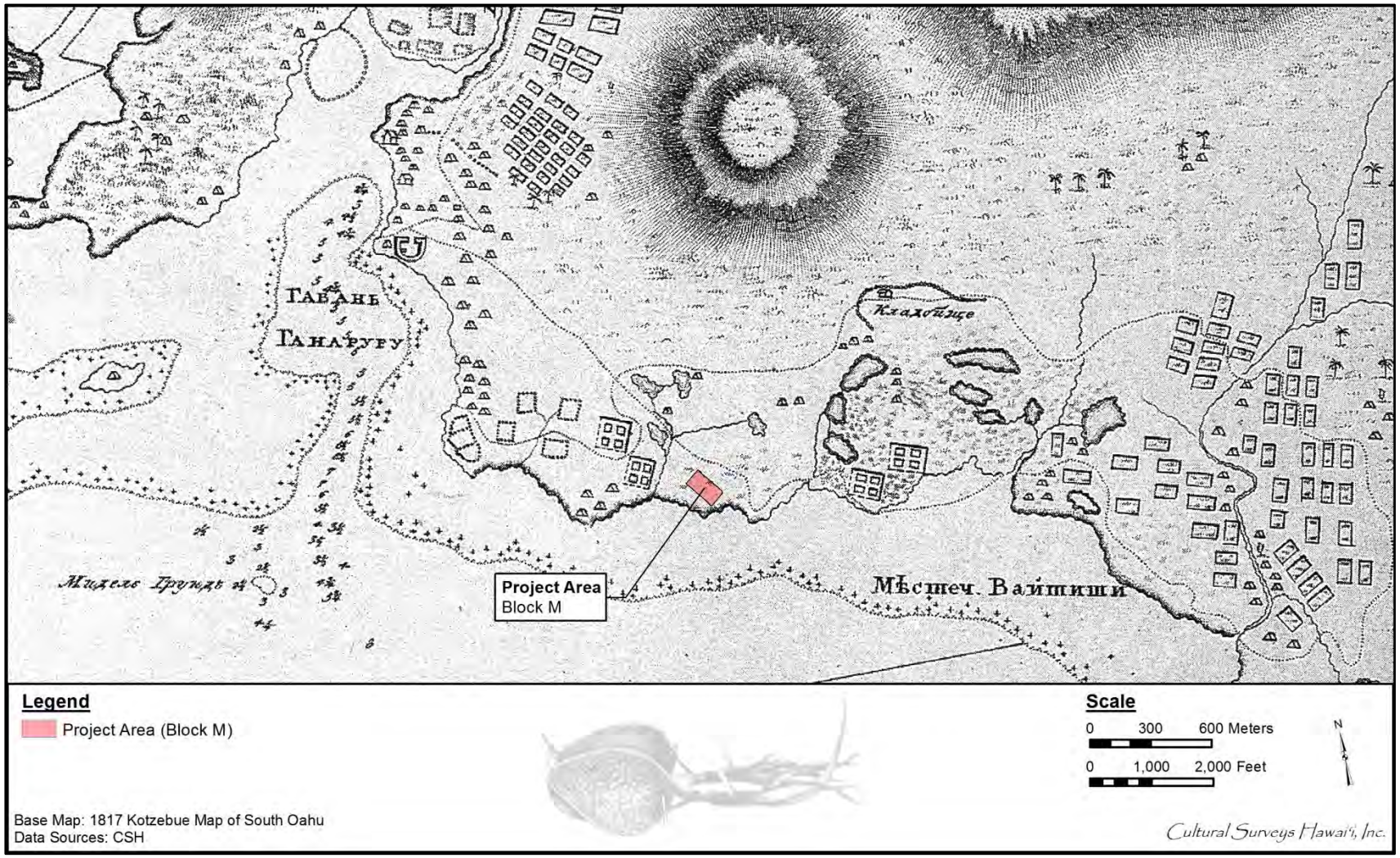

Figure 10. The 1817 map by Otto von Kotzebue of the Russian ship *Rurick*, shows taro *lo‘i*, fishponds and salt pans in Honolulu and Waikīkī; few habitations are depicted along much of the shoreline portions near the project area (map reprinted in Fitzpatrick 1986:48-49).

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 covered by King Street). The project area would be *makai* and left (east) of the church along the shore. An 1887 photograph (Figure 13 and 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 Kawaiaha‘o 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).

3.2.2 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 Hawaii, the *ali‘i,* 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 *ali‘i* 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 *‘ili* of Kukuluāe‘o (LCA 387) was awarded to the American Board of Commissioners for Foreign Missions. 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 Kawaiaha‘o 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]

In the Māhele, however, this sea land became “detached” from the Mānoa award and was instead given to the pastor of the Kawaiaha‘o 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

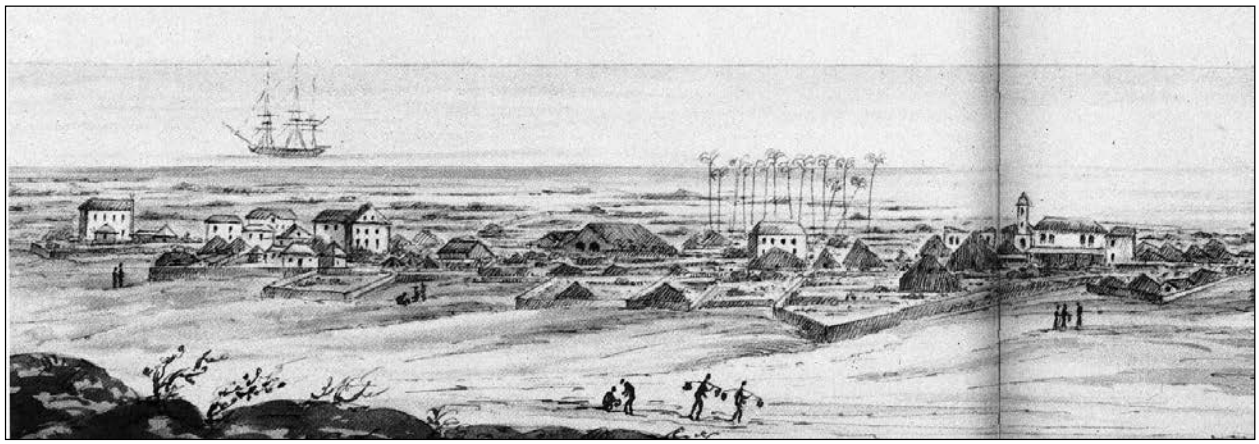

Figure 11. “Town of Honolulu: Island of Woahoo: Sandwich Islands,” portion of 1834 sketch by anonymous illustrator; the project area is west and south (left and back) of Kawaiaha‘o Church, the long thatched structure in the center of the sketch (original sketch at Bernice Pauahi Bishop Museum; reprinted 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 Kawaiaha‘o Church (structure with steeple completed in 1842) (original sketch at Hawaiian Historical Society; reprinted in Grant 2000:5)

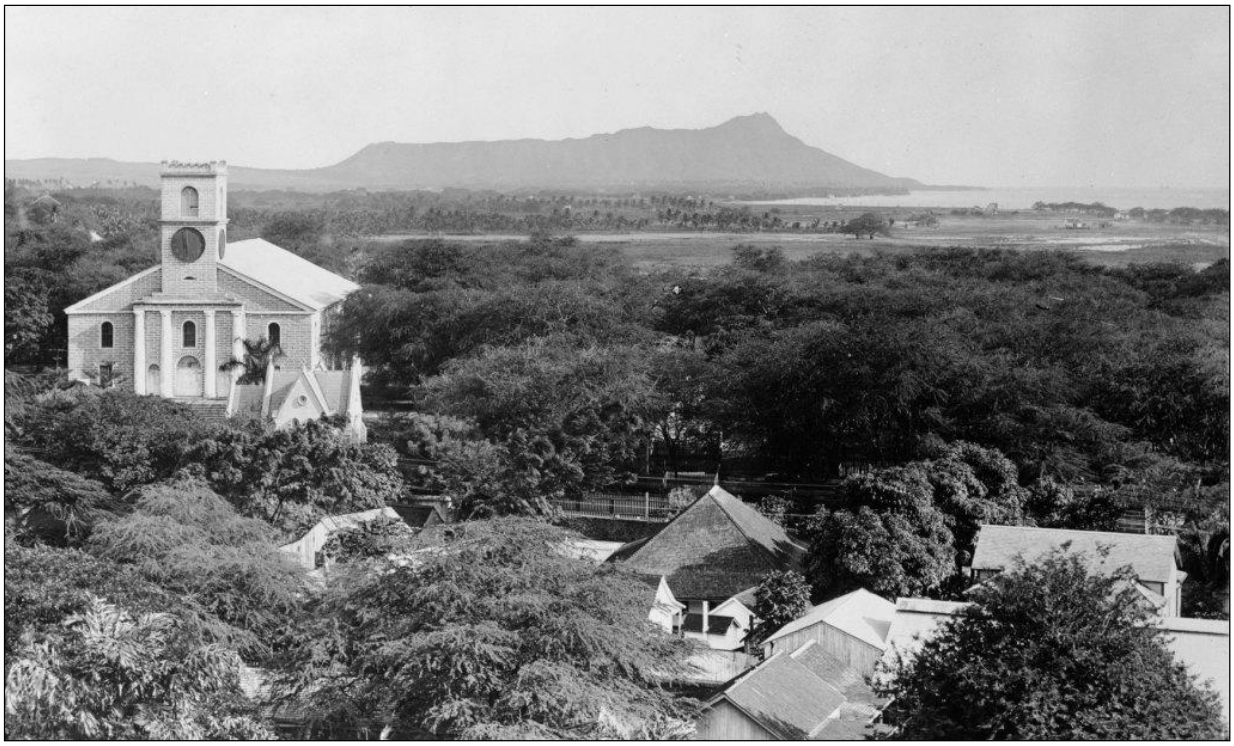

Figure 13. Kawaiaha‘o Church and Honuakaha Village, ca. 1887 photograph; the Ward’s House roof cupola, on the *mauka* end of Old Plantation, can be seen to the left of the church steeple; the project area is within the marshlands in the right upper background (Hawai‘i State Archives, Henry L. Chase Collection;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

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

> 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]

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.

No LCA *kuleana* lots are within the project area. Two LCA claims are west of the Block M study parcel, LCA 1903 to Lolohi and LCA 10463, *‘Āpana* 1 and *‘Āpana* 2 to Napela. In Lolohi’s claim, he mentions the parcel contained two salt beds, two *hooliu* (salt water drainage ditch), two *poho kai* (depression where salt is gathered), and one salt *kula* (dry field). 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).

LCA 10463 to Napela is for two lots, on which there were two ponds, a ditch, two deposits, a house site, and a salt land section in two pieces. Both *‘āpana* are shown on the 1884 Bishop map north and west of LCA 1903. The testimony indicates the house site was in *‘Āpana* 1, the easternmost parcel. The 1884 Bishop map has a small square at the northern border of the lot, which may represent the location of the house. Like Lolohi, Napela claimed the land was given to him in the time when Kīna‘u was the *kahuna nui* of Hawai‘i, sometime between 1832 and 1848 (the year of the award).

3.2.3 Nineteenth Land Use in Kukuluāe‘o

3.2.3.1 Salt-Making

In the testimony for LCA 10463, salt lands, ditches, and deposits (probably related to salt) are mentioned. 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 *ālia* (high tide), the *ho‘oliu* (drain) 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, located just to the north, 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

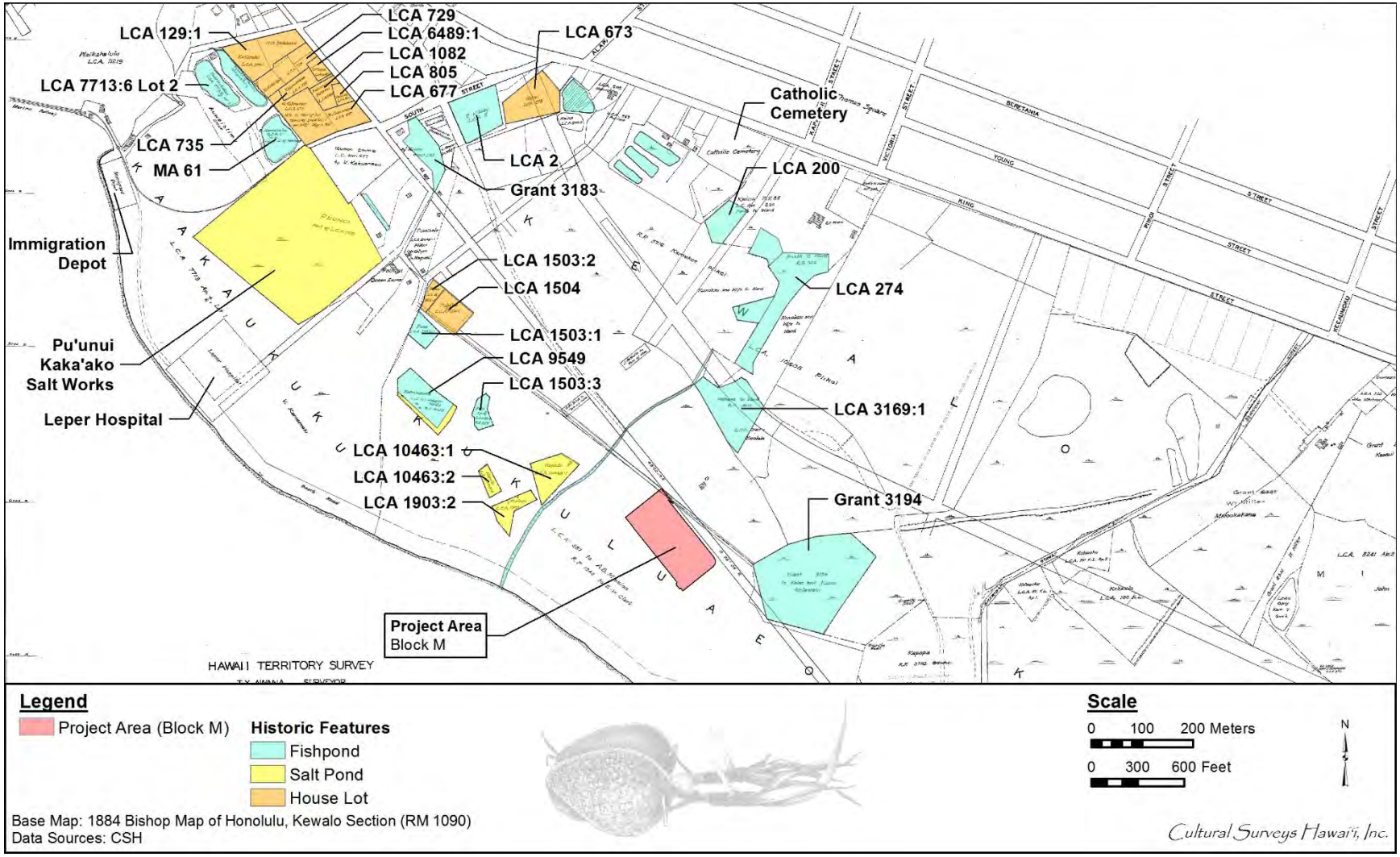

Figure 15. 1884 map of Honolulu, Kewalo Section, portion, by Sereno Bishop (Hawai‘i Land Survey Division, Registered Map. No. 1090), showing the locations of LCA parcels, fishponds, salt lands, and house lots surrounding the project area

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.

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 Pa‘akai (Salt Lake in Moanalua) and at Pu‘uloa on the western loch of Pearl Harbor. Kamakau (1961:409) reported "The king and Isaac of Pu‘uloa 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 Kaka‘ako.

> 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 Kaka‘ako Salt Works shown on historic maps did not extend to the Block M 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]

3.2.3.2 The Ward Estate

The *mauka* portion of the Ward Estate (north of Queen Street) is within the *‘ili* 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

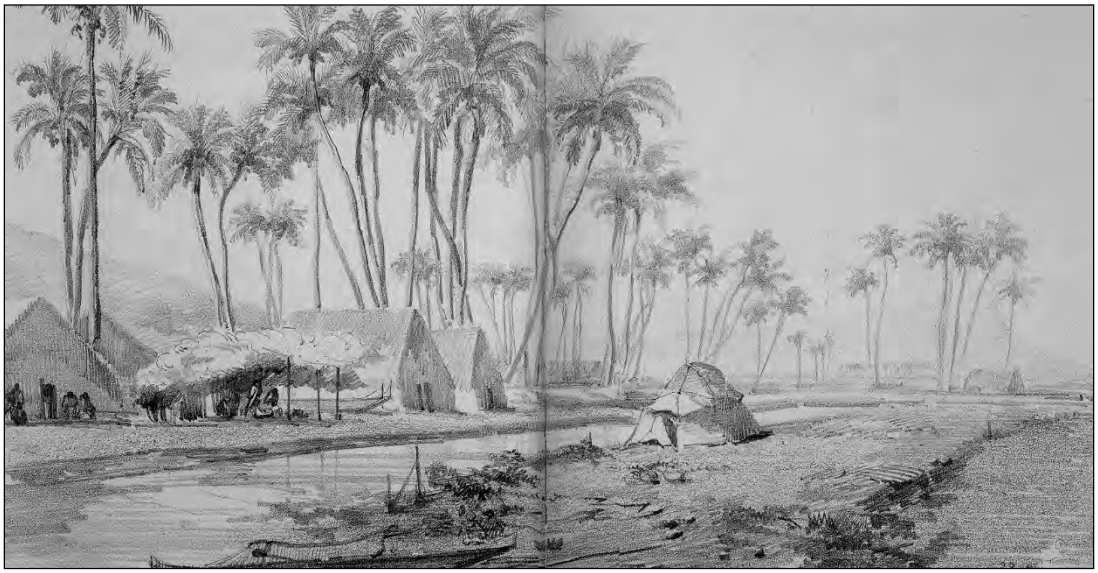

Figure 16. “Honolulu Salt Pan, near Kaka‘ako,” 1838 sketch drawn by a French visitor, Auguste Borget (original sketch at Peabody Essex Museum, Salem, Massachusetts; reprinted in Grant 2000:64-65)

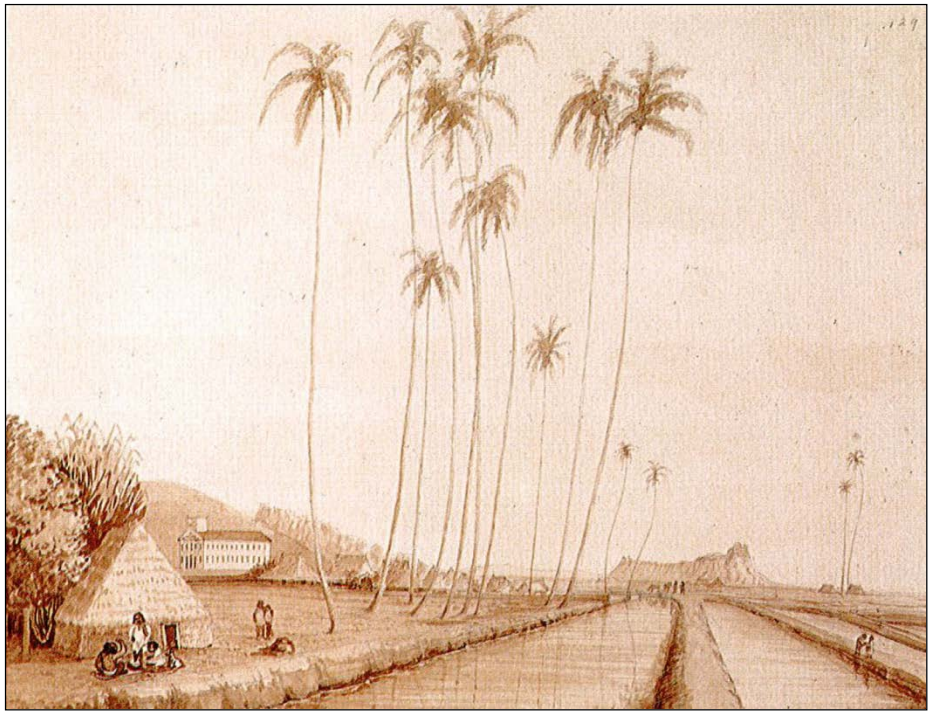

Figure 17. “Native Church [Kawaiaha‘o Church], Oahu, from the Old Salt Pans,” 1845 sketch drawn by John B. Dale, from the U.S. Exploring Expedition led by Lt. Charles Wilkes (J. Welles Henderson Collection, reprinted in Forbes 1992:126); the sketch is probably from the salt pans in Ka‘ākaukukui, west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

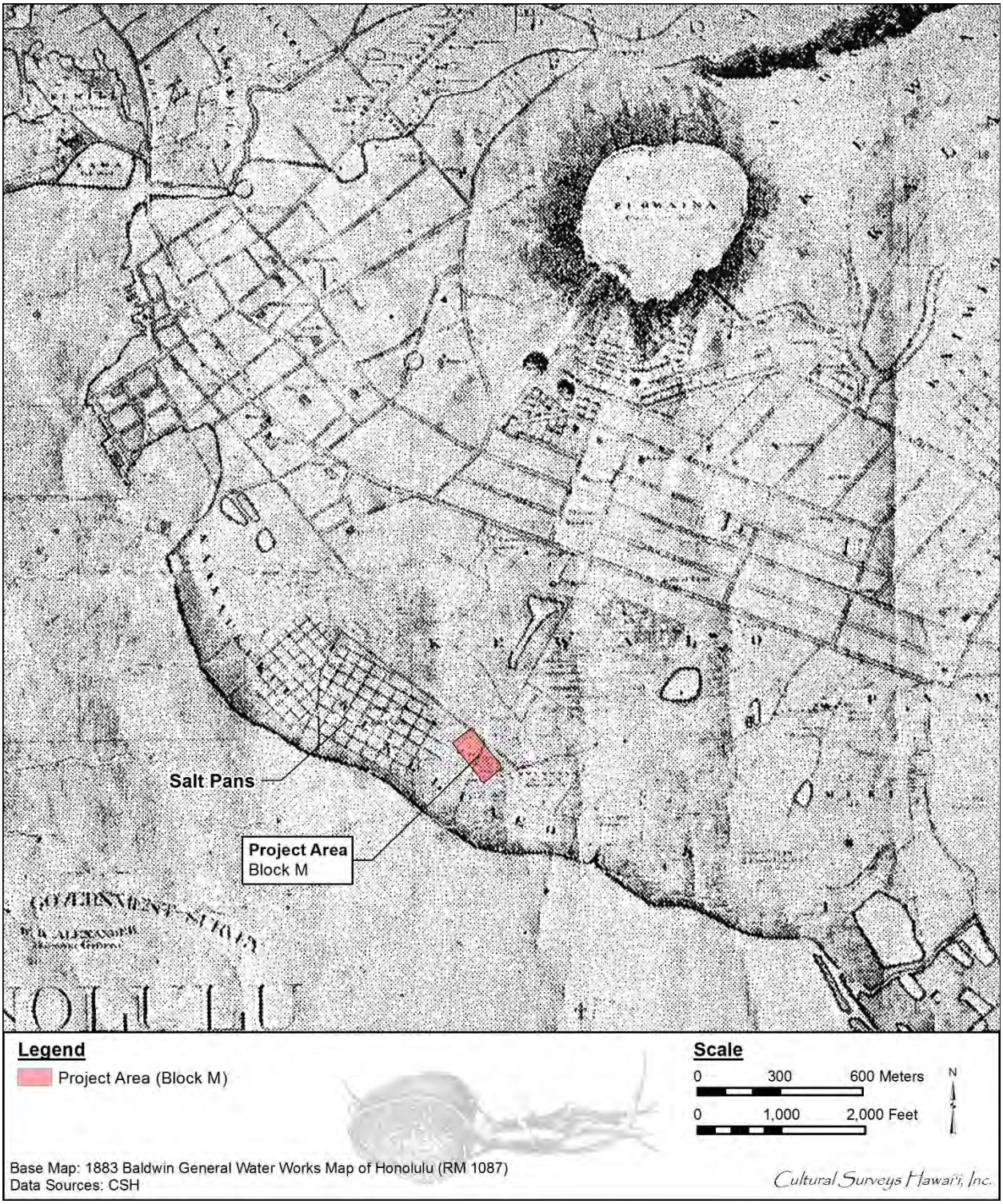

Figure 18. 1883 map of the Honolulu Water Works System by E.D. Baldwin (1883) (Hawai‘i Land Survey Division, Registered Map 1087); the grid symbol outside the project area represents salt pans

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 *‘ili* 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.

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 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.

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

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

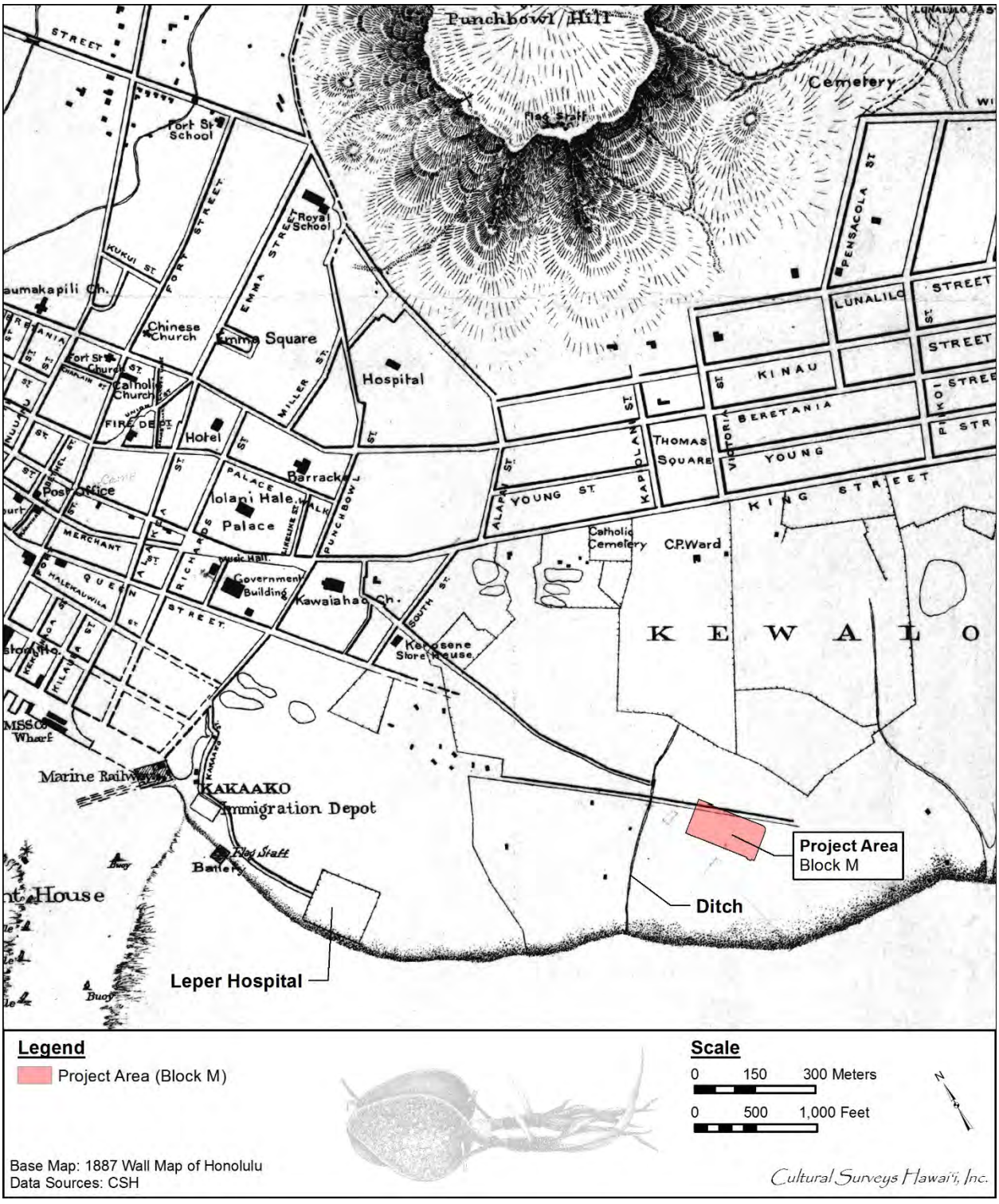

Figure 21. 1887 map of Honolulu (portion), by W.A. Wall (copy at Library of Congress, Geography and Map Division), showing the project area location

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."

> 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]

W.A. Wall's map shows the Ward property including the ditch (see Figure 21). 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).

3.2.4 Twentieth Century Land Use

3.2.4.1 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 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 in 1930 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 Ka‘ākaukukui 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).

3.2.4.2 Kaka’ako 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 (Hawaii Department of Transportation, Harbors Division 2007:3).

By the 1880s, filling-in of the mud flats, marshes, salt ponds in the Kaka‘ako and Kewalo area 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, ‘Kaka‘ako,’ 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 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

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

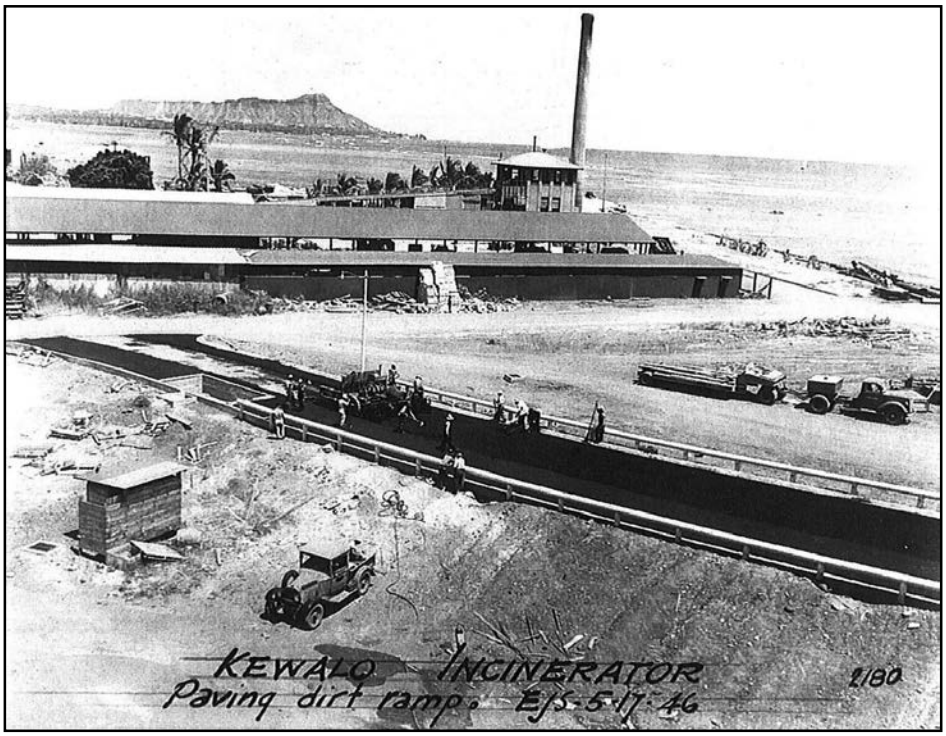

Figure 23. 1946 photograph of the Kewalo Incinerator No. 1, west side of Kewalo Harbor (Mason Architects 2002)

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 Hawai‘i 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.” 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 Kapi‘olani 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."

3.2.4.3 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 Kukuluāe‘o and Ka‘ākaukukui), which had numerous ponds (Hawai‘i 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 Reports 1915:331). 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 Kukuluāe‘o 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 Kukuluāe‘o 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).

3.2.4.4 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 Kamake‘e Street. It had been used as a canoe landing in pre-Contact times. In 1919, the Hawai‘i 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).

3.2.4.5 Waikiki 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.

Twentieth Century Commercial and Residential Development

Subsequent maps and aerial photographs from 1897 to 1982 (Figure 25 through Figure 35) show the future development of the Kukuluāeʻo 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 Kukuluāeʻo, including the conversion of taro *loʻi* to rice fields.

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. Kakaʻako 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). 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 ʻEwa (westward) of the project area, and the "arm" of streets projecting from downtown Honolulu into Kakaʻako and Kewalo. It is on this map that Kamakeʻe Street first appears, running from Queen Street and dead-ending *mauka* of Waimanu Street towards where Kapiʻolani Boulevard would eventually be constructed. A large portion of Kakaʻako, 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 surround by a bicycle racing track in the Kewalo area. This was located on the *makai* side of Kapiʻolani Avenue between Cooke Street and Ward Avenue.

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

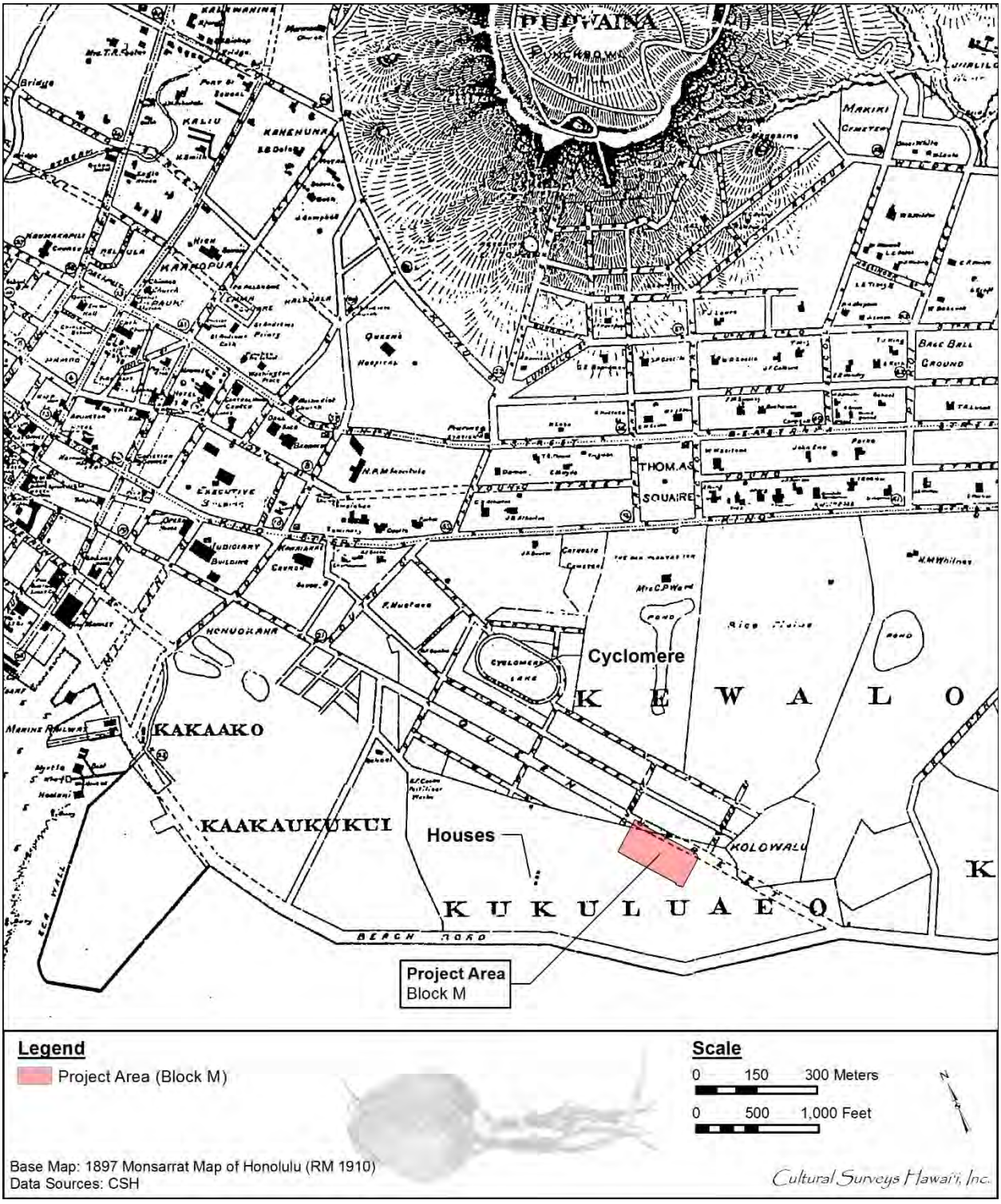

Figure 25. 1897 map of Honolulu by M.D. Monsarrat (1897) (Hawai‘i Land Survey Division, Registered Map 1910), showing the location of the project area; the map also shows the location of the “Cyclomere”

Figure 26. 1903-1909 (published 1917) U.S. Engineer’s map of O‘ahu (portion) depicting Kaka‘ako; 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

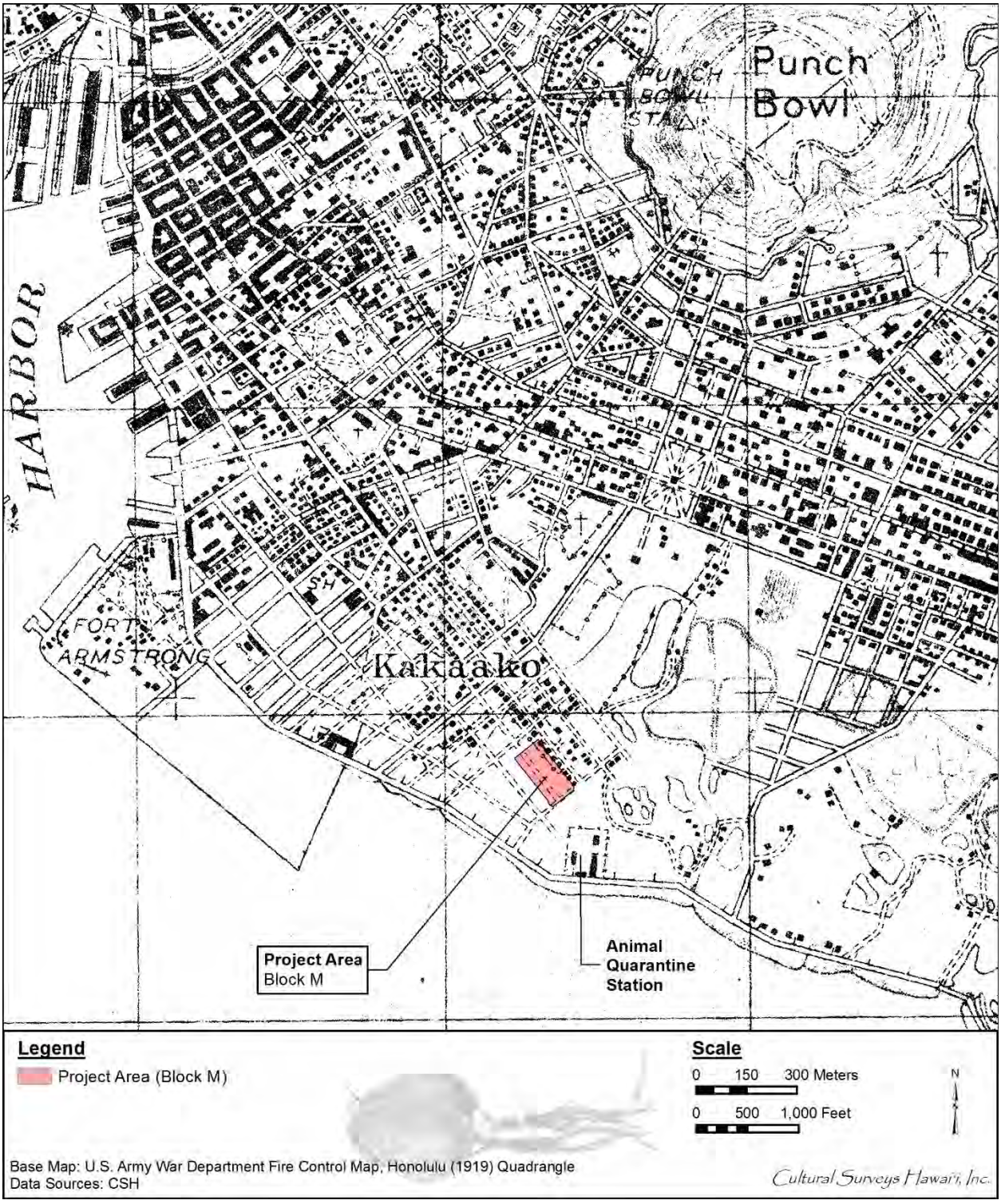

Figure 27. 1919 U.S. Army War Department Fire Control map of O‘ahu, Honolulu Quadrangle, showing the location of the project area within a grid of streets; solid lines denote paved streets, while dotted lines represent unpaved streets or planned streets

Figure 28. 1927 USGS aerial photograph of the Kaka‘ako area, showing a single residence within the northern corner of Block M (USGS; mosaic of photograph sheets from Hawai‘i Coastal Geology Group)

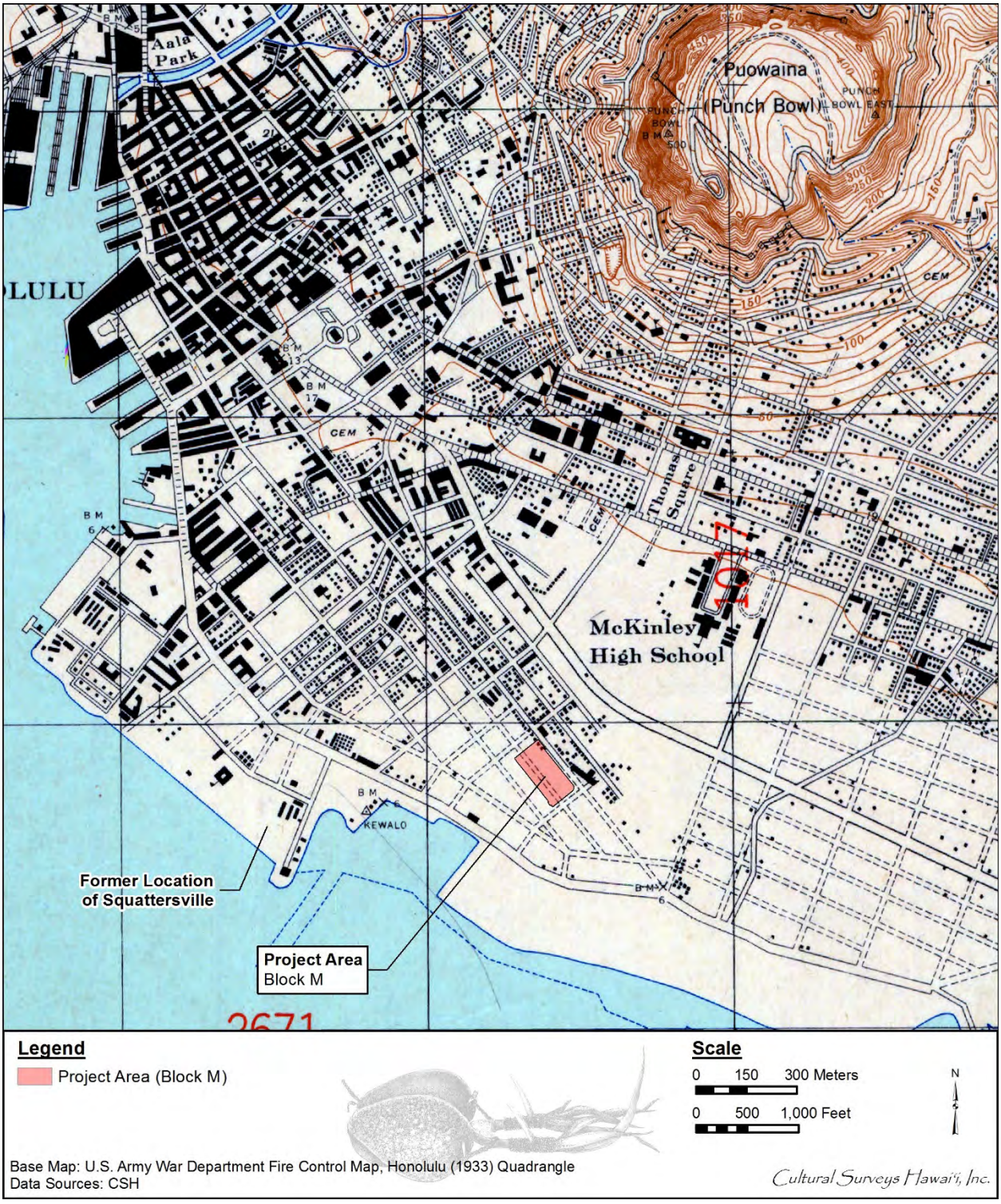

Figure 29. 1927-28 (published 1933) U.S. Army War Department Fire Control map of O‘ahu, Honolulu Quadrangle, showing the project area with grid of streets; note the former location of Squattersville, adjacent to Kewalo Basin and east of Fort Armstrong

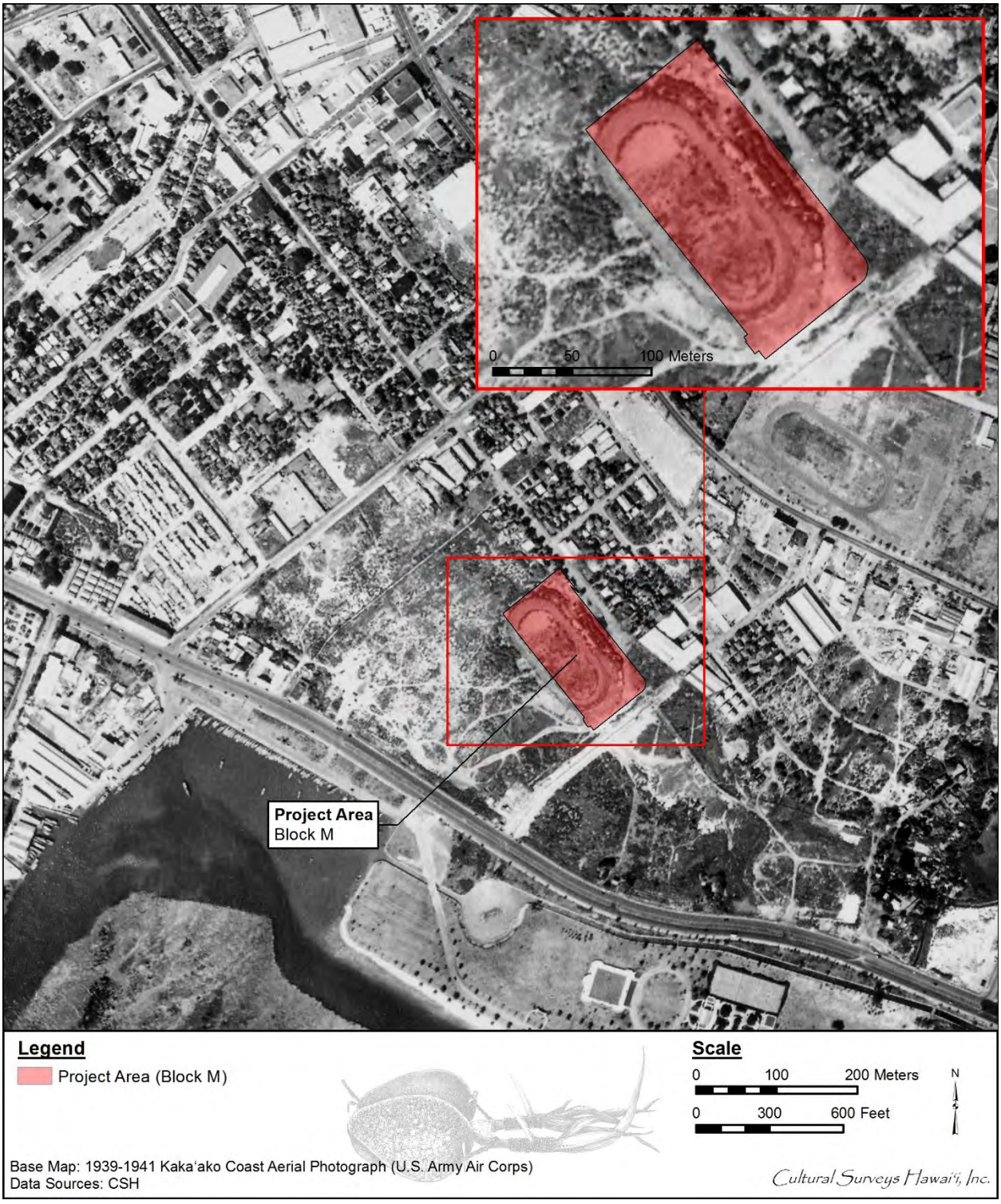

Figure 30. 1939-1941 aerial photograph (U.S. Army Air Corps) of Kaka‘ako; note the completion of Kewalo Harbor to the west and the construction of Ala Moana Park to the east along the shore

Figure 31. 1943 U.S. Army War Department Fire Control map of O‘ahu, Honolulu Quadrangle; note the location of three structures within the Block M project area

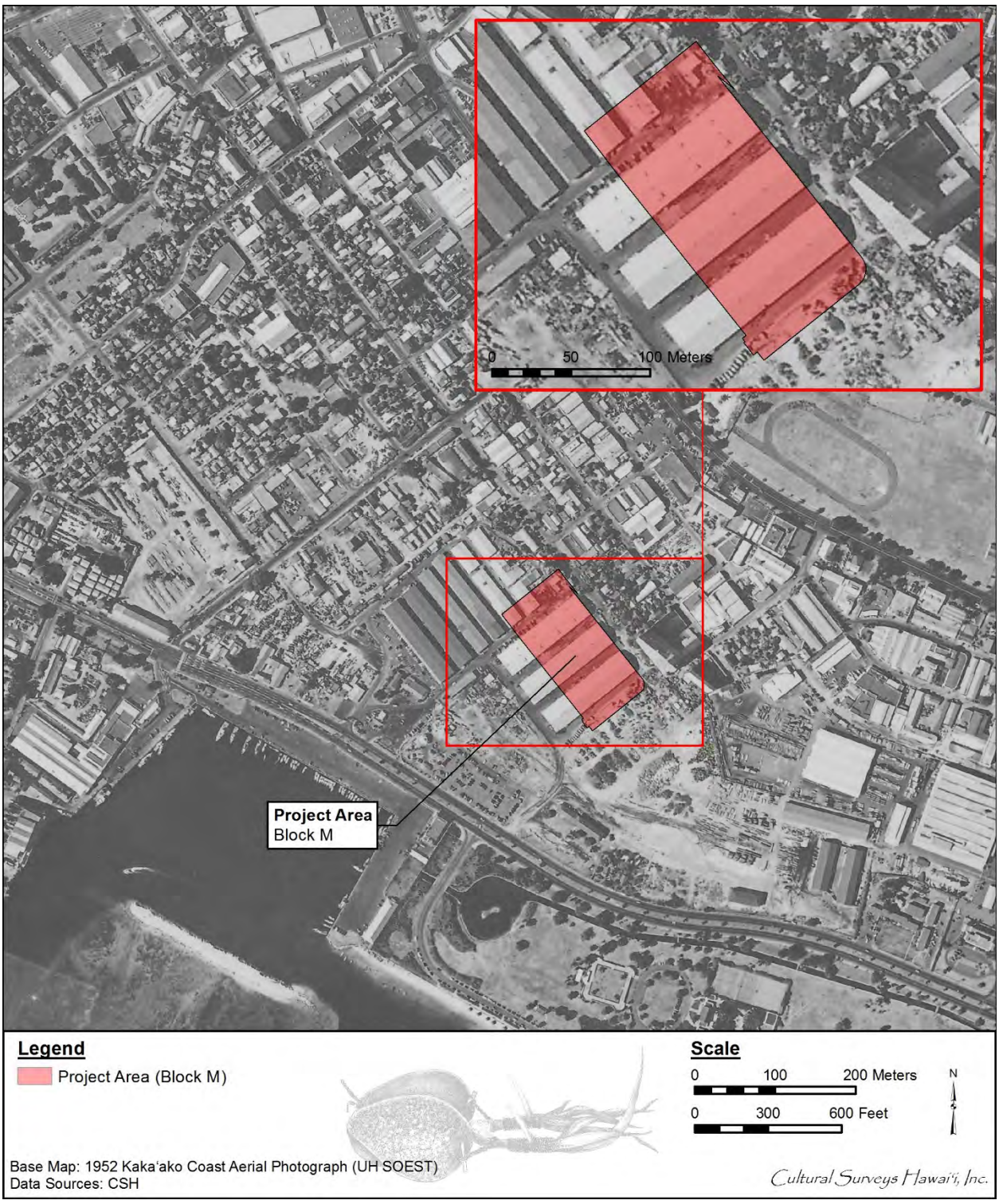

Figure 32. 1952 aerial photograph, showing three large warehouses within the project area (U.S. Army Air Corps, mosaic of sheets from Hawai‘i Coastal Geology Group)

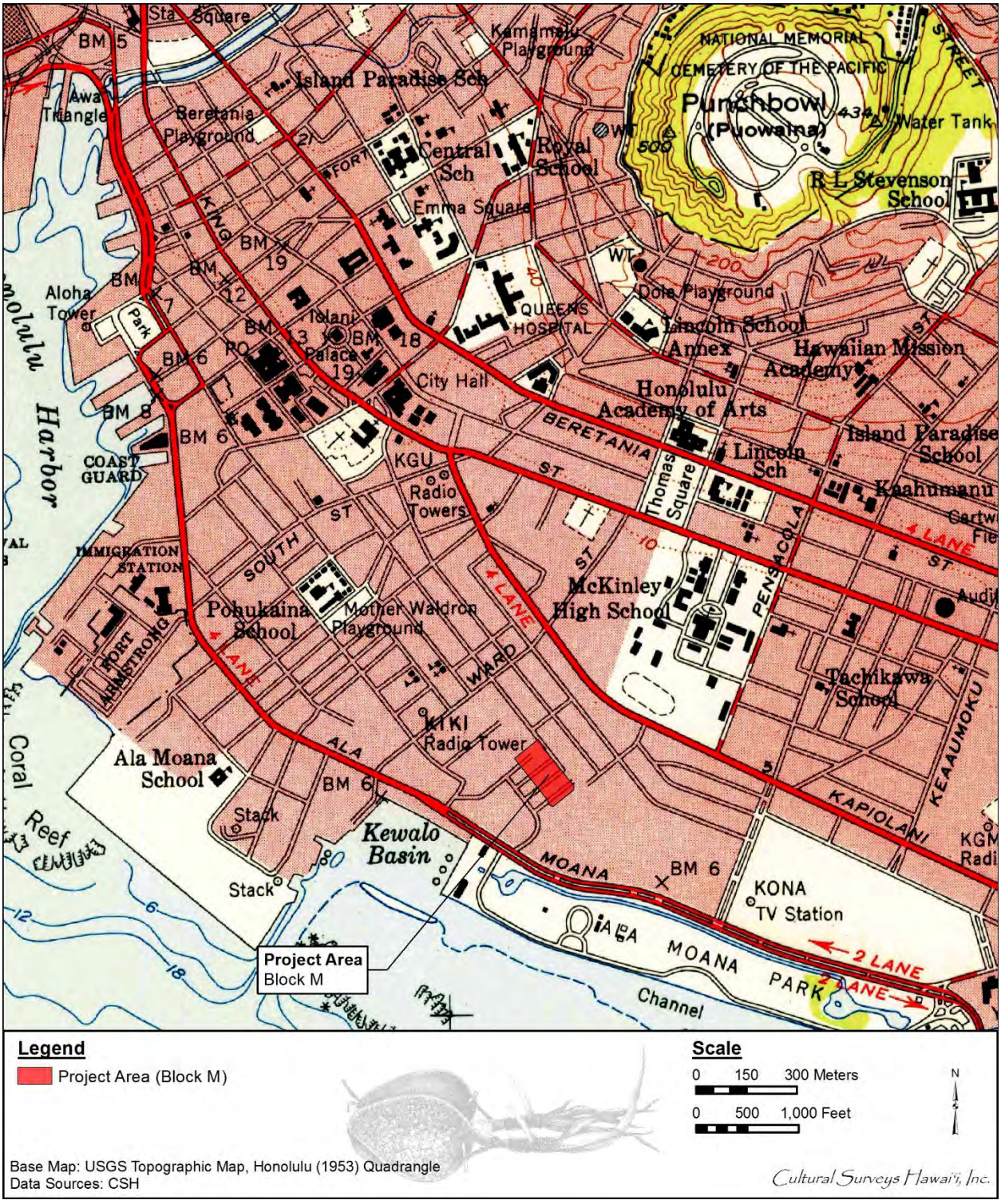

Figure 33. 1953 U.S. Army Mapping Service map of O‘ahu, Honolulu Quadrangle, showing project area within an improved street grid

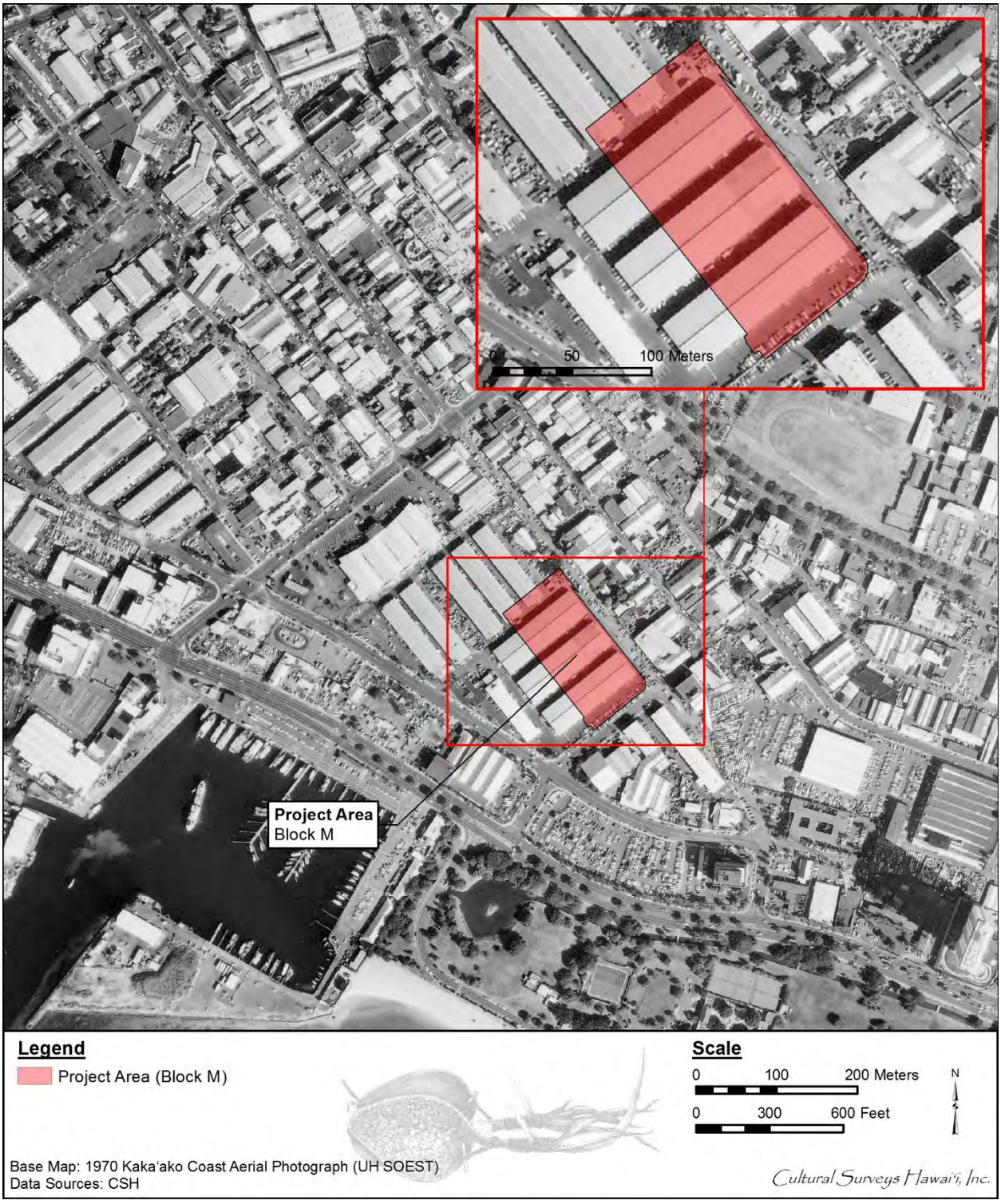

Figure 34. 1970 aerial photograph (R.M. Towill), showing the project area

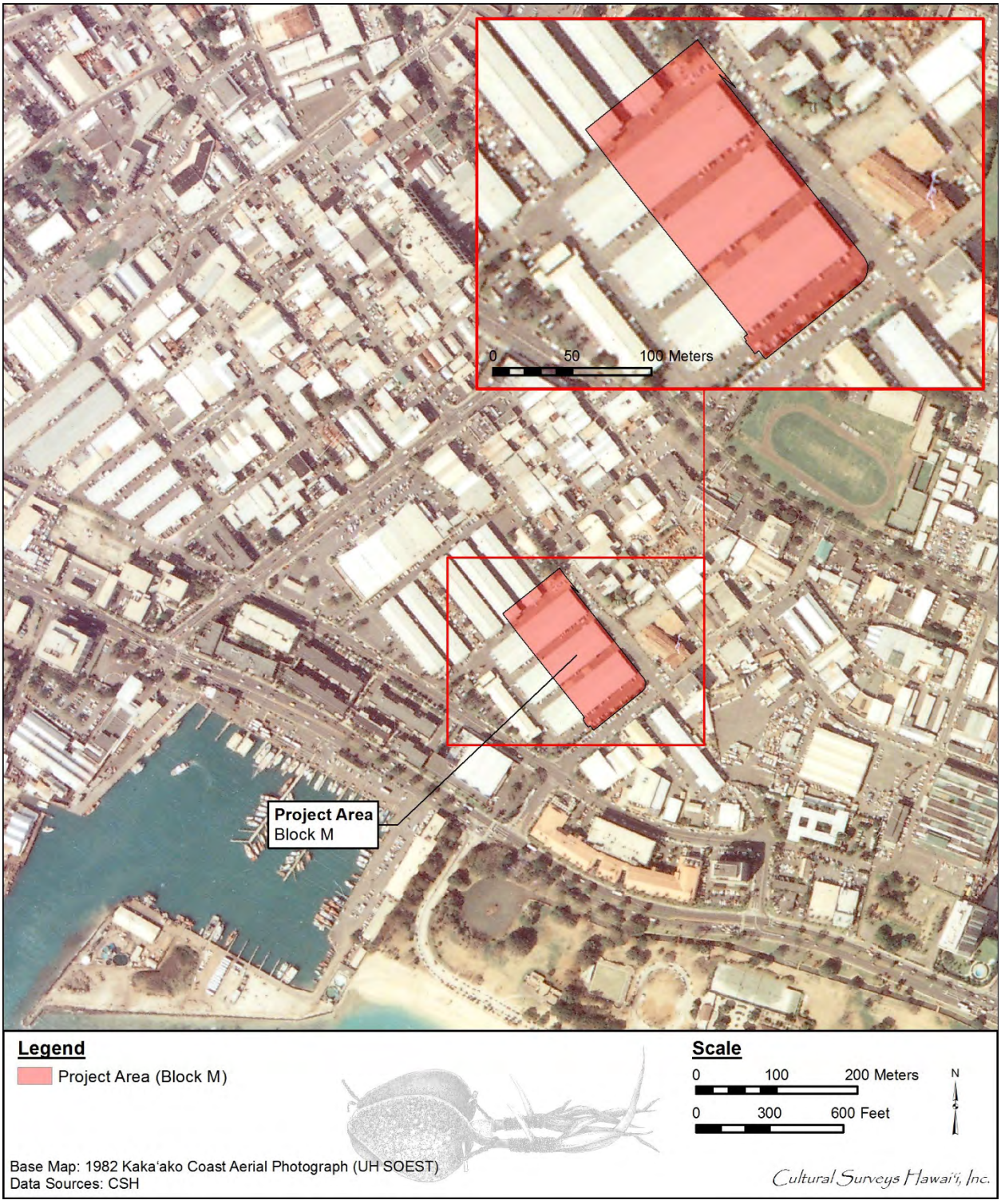

Figure 35. 1982 USGS aerial photograph, depicting large warehouses throughout Kaka‘ako

A 1903-1909 U.S. Engineer’s map (Figure 26) depicts houses clustered around the few paved roads, including along Queen Street within the project area, and 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 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 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, shown near the eastern end of the project area. Kewalo Basin is an ill-defined dredged area of deep water east of Fort Armstrong. Block M appears undeveloped with the exception of one or two residences in the northern corner.

A 1933 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. 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. An oval track now occupies the majority of Block M.

On a 1943 Army War Department Fire Control map (Figure 31), this eastern section of Kaka‘ako is an area of open lumber yards and large warehouses, including Block M which now contains three 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. 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. Large warehouses are still located within the Block M 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 35). 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.

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.

3.3 Previous Archaeological Research

3.3.1 Geological Study of Kaka‘ako and Kewalo

For his master's thesis 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 was 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 calls 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 (Figure 36). 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 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

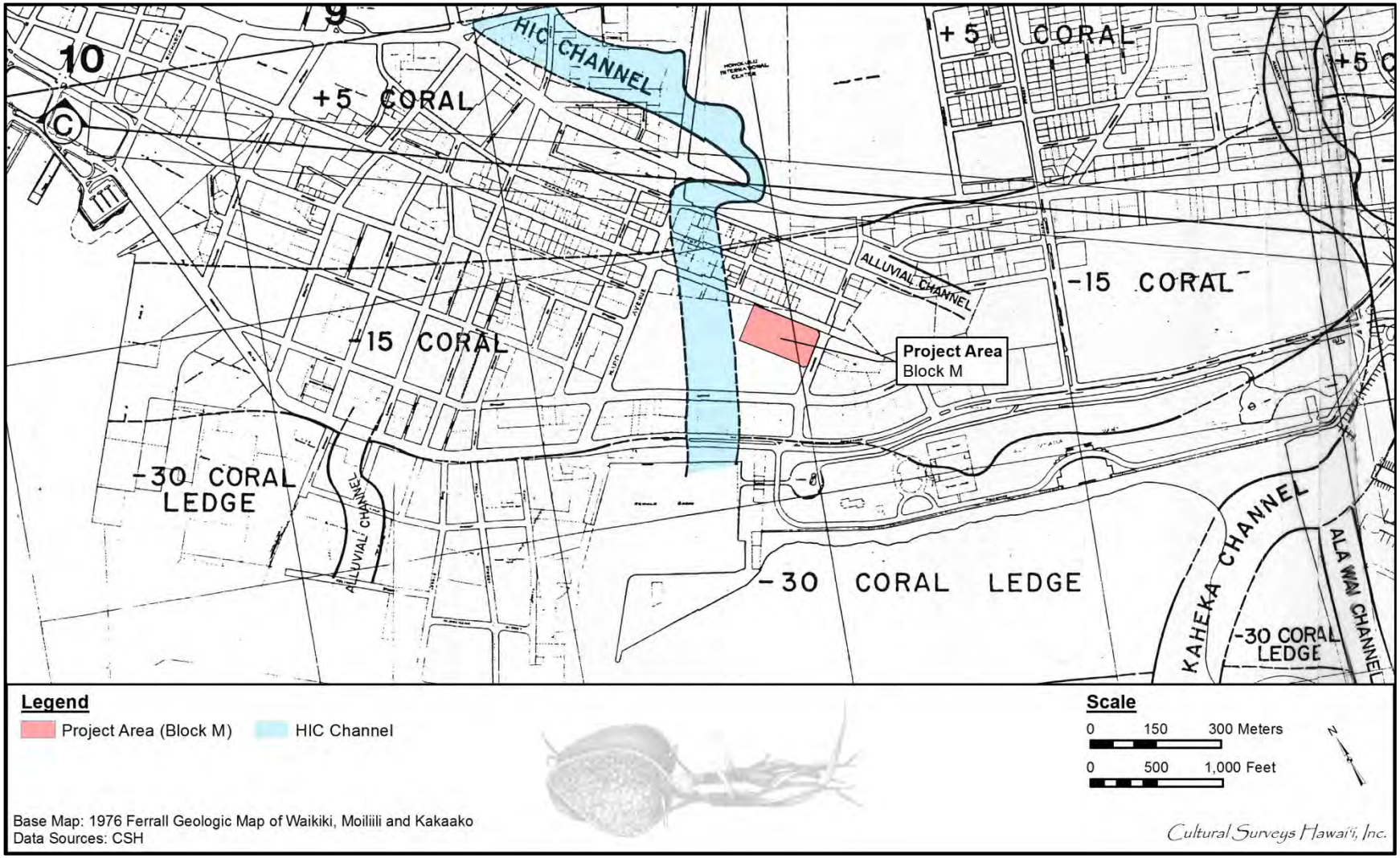

Figure 36. Coral shelf depth (+/- feet above or below sea level) and possible location of the HIC channel just west of the project area (modified figure of outsize map in Ferrall 1976)

> 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 sealevel, 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 foot coral ledge zone, *makai* of the +5 coral ledge and *mauka* of the -30 coral ledge.

3.3.2 Engineers Boring Logs

The engineering firm of Ernest K. Hirata and Associates, Inc. (1992) excavated numerous exploratory borings in the Kaka‘ako area in 1991 and 1992. The focus of the borings was to provide information related to load-bearing attributes and subsurface conditions for major underground utility improvements (e.g., main storm drains, sewer, and water). Although none of the boring holes were placed in the Block M project area, one bore (B9-2204) was located on Kamake‘e Street southwest of Block M. This bore was excavated to a depth of 7.3 m (24 ft) to the coral shelf. Two sand layers were noted below the asphalt and fill layers.

Table 1. Ernest K. Hirata & Associates Boring Log Information

Bore ID (Street)	Depth (m)	Depth (ft)	Classification	Deposit Type
B9-2204	0-0.3	0-1.0	Asphalt and base course	Road
(Kamake‘e)	0.3-1.4	1.0-4.5	Mottled tan silty sand	Sand
	1.2	4.0	Water table	
	1.4-7.3	4.5-24	Light gray silty sand	Sand
	7.3	24	Coral	Coral shelf

3.3.3 Archaeological Background

Most traditional Hawaiian surface structures had been demolished in the Kaka‘ako area by the time of the first scientific archaeological surveys (e.g., Griffin 1987). In his report on the survey of O‘ahu 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 Pu‘ukea Heiau (discussed in Section 2.2.4), which Kamakau (1991:24-25) placed in Kukuluāe‘o, 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]

Recent archaeological investigations within the Kaka‘ako area have included several within the vicinity of the Block M project area as well as several test excavations within the eastern boundary

of Block M for the Honolulu High-Capacity Transit Corridor Project (City Center) AIS (Hammatt 2013). The most relevant investigations are summarized in Table 2 and the following text. Figure 37 shows the locations of the previous archaeological investigations and recorded profiles. Figure 38 shows the location of documented historic properties and burials.

3.3.4 Ward Village Phase II (Ward Theaters)

In 2000, CSH 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 adjacent to the Block M project area and is bounded by Auahi Street to the south and Kamake‘e Street to the east. 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 (see Figure 37). The open cut excavation component of the pile installation involved excavation of typically 4 by 4 m 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 building’s footprint 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, within or along the western boundary of the current 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 was encountered within the sand matrix during the adjacent Kaka‘ako Improvement District 7 Project (SIHP # 50-80-14-6377).

3.3.5 Kaka‘ako Improvement District 7 (ID-7)

The Kaka‘ako Improvement District 7 (ID-7) project constructed improvements to drainage, water, sewer, and utility systems on Kamake‘e 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 the realignment of the existing Kamake‘e Street between Auahi Street and Ala Moana Boulevard.

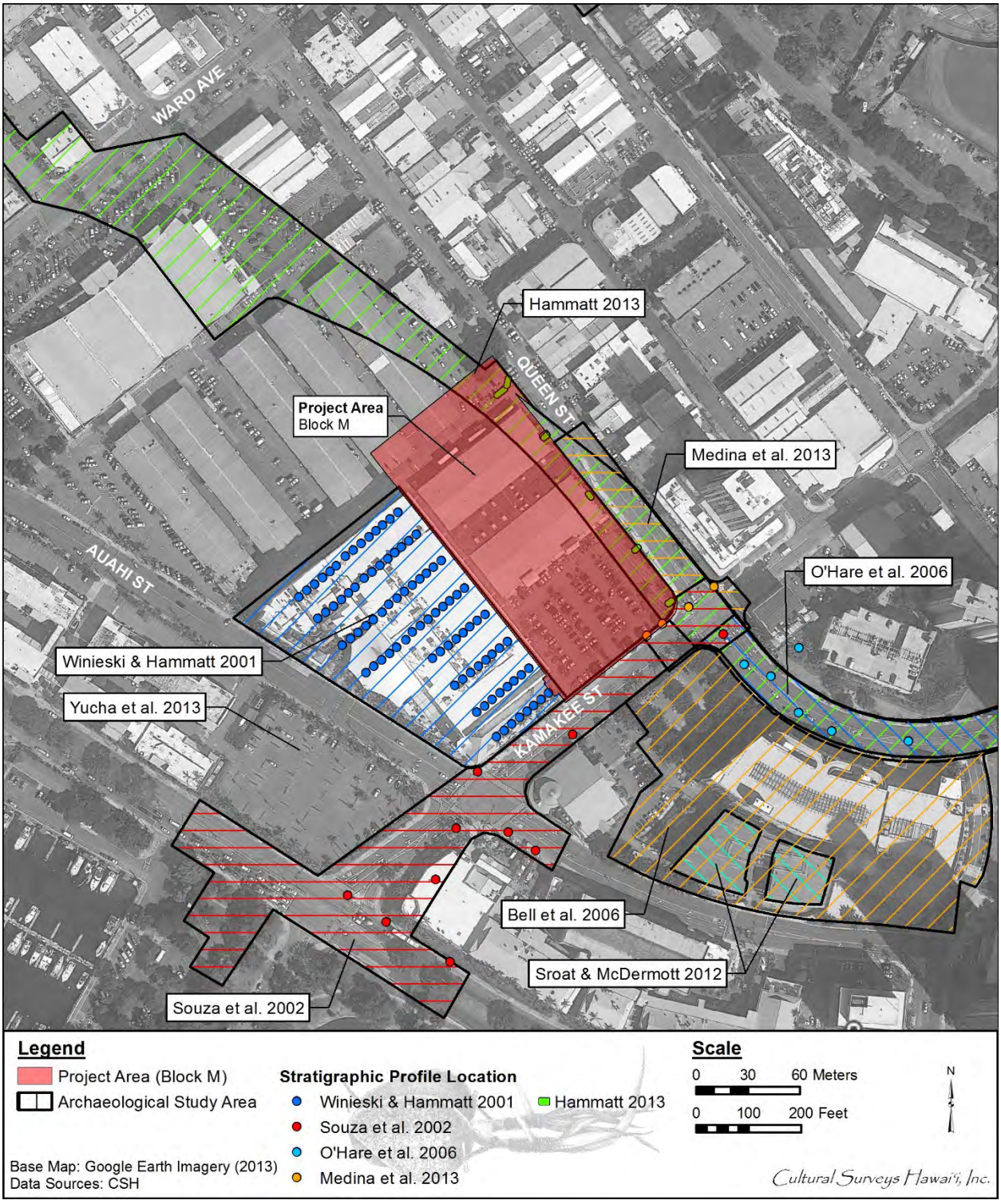

Figure 37. Previous archaeological studies within the immediate vicinity the Block M project area, showing the location of recorded profiles (base map: Google Earth 2013)

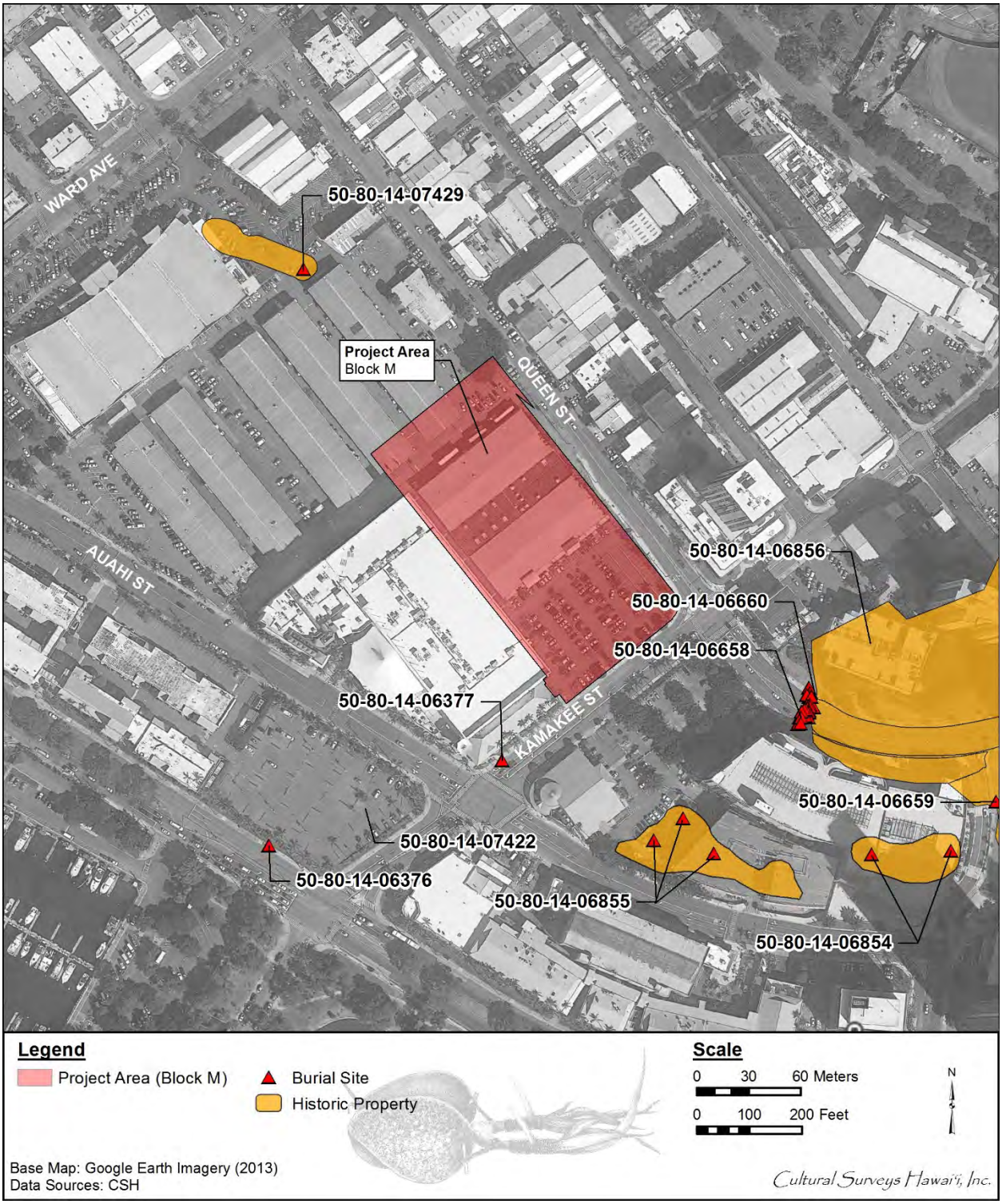

Figure 38. Previously identified archaeological sites within the immediate vicinity of the Block M project area, showing the location of subsurface deposits (yellow) and burials (red triangles) (base map: Google Earth 2013)

Table 2. Previous Archaeological Studies Conducted in the Vicinity of the Project Area

Reference	Project Name	Type of Study	Results
Winieski and Hammatt 2001	Ward Theaters	Archaeological monitoring	No burials or cultural deposits found; old A horizon found in pile caps in NW and SE corners
Souza et al. 2002	Kaka‘ako ID-7	Archaeological monitoring	Three disturbed pre-Contact burials recorded (SIHP # -6376, -6377, -6378); old A horizon found in seven of ten profiles; SIHP # -6378 location unknown as burial retrieved from large back dirt pile
Bell et al. 2006	Victoria Ward Village Shops	Archaeological inventory survey	86 test trenches identified three historic properties: 1) SIHP # -6854, subsurface cultural layer/activity area remnant with five human burials; 2) SIHP # -6855, activity area remnant comprised of pronounced subsurface traditional Hawaiian cultural layer and six human burials; and 3) SIHP # -6856, Kolowalu Fishpond remnant; three stratigraphic zones identified: 1) natural low-lying salt flats, marsh, or pond sediments, 2) natural Jaucas sand beach deposits, and 3) areas where modern/historic fill episodes have removed former natural land surface, leaving only low-energy lagoonal deposits
O’Hare et al. 2006	Kaka‘ako ID-10	Archaeological monitoring	Documented cemetery of 28 historic burials (SIHP # -6658), two isolated disturbed burials (SIHP # -6659), and historic trash pit (SIHP # -6660)
Sroat and McDermott 2012	Victoria Ward Village Shops	Supplemental archaeological inventory survey	Five test units within or adjacent to SIHP # -6855, substantiated extrapolated boundaries of cultural layer; no additional finds identified
Hammatt 2013	Honolulu High-Capacity Transit Corridor (HHCTCP) – City Center (Section 4)	Archaeological inventory survey	No historic properties documented within or adjacent to Block M; within 500 m or less of the project are these historic sites: SIHP # -7429, buried A horizon containing six pits and one isolated human cranial fragment; SIHP # 06377, a burial; SIHP # -06376, a human burial; and SIHP # 06856, an historic fishpond remnant
Medina et al. 2013—Draft	Queen and Kamake‘e St. Traffic Signal	Archaeological monitoring	No historic properties noted in existing utility trenches; pockets of sand strata still remain below fill layers

Reference	Project Name	Type of Study	Results
Yucha et al. 2013	Ward Neighborhood Block C	Archaeological inventory survey	Identified burned trash layer (SIHP # -7422); majority of project area contained sand or peat A horizon and Jaucas sand beneath reclamation fill layers

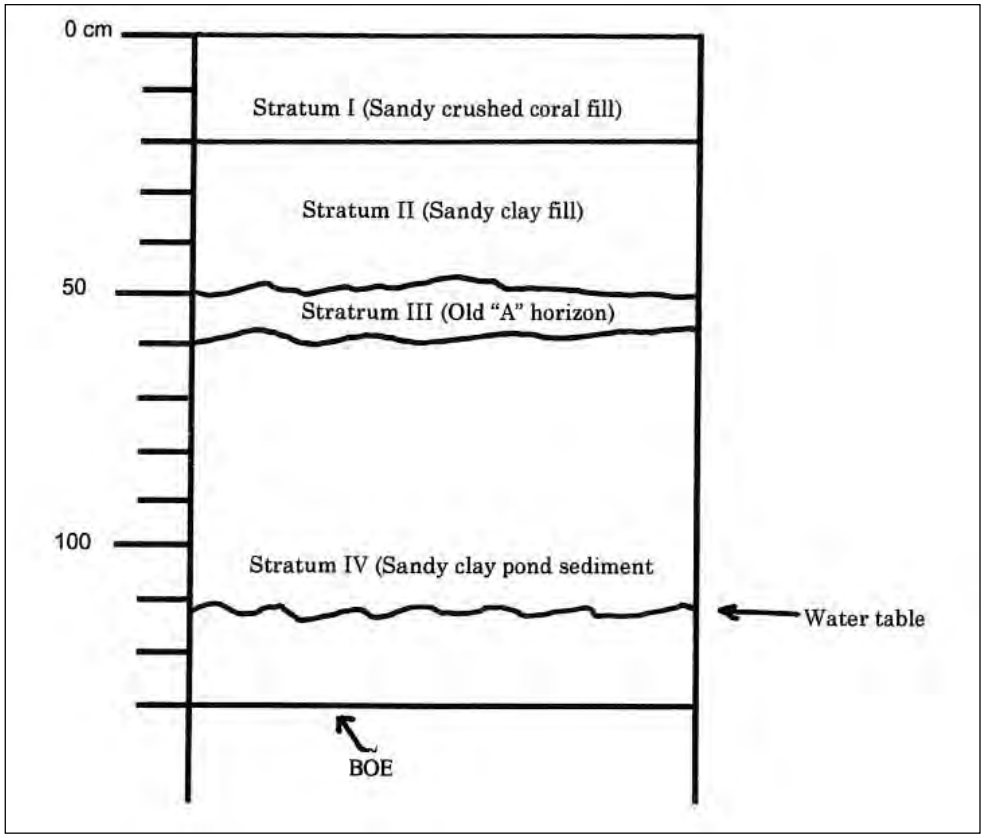

Figure 39. Profile of pile cap excavation in northeast corner of Ward Village Phase II footprint (Ward Theaters) showing old A horizon and pond sediment (Winieski and Hammatt 2001)

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 Kaka‘ako 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 Kamake‘e Street. Burial 2 (SIHP # -6377), an adult individual, was encountered by an archaeologist during backhoe excavations for a box drain on Kamake‘e 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 Kamake‘e 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 ‘Ewa (west) and Diamond Head (southeast) sides of Kamake‘e Street extending down to Ala Moana Boulevard. An old A horizon was observed in seven profiles.

3.3.6 Ward Village Shops Project

In 2006, CSH performed an archaeological inventory survey for the Victoria Ward Village Shops project (Bell et al. 2006). A total of 86 trenches were excavated in the Ward Village Shops Project area. Three historic properties were identified: 1) SIHP # -6854, a subsurface cultural

layer/activity area remnant with an immature pig skeleton, remnants of historic privy, remnants of a culturally enriched A horizon (containing both traditional Hawaiian and historic cultural material), and five human burials; 2) SIHP # -6855, an activity area remnant comprised of a pronounced subsurface traditional Hawaiian cultural layer and six human burials; and 3) SIHP # -6856, an historic fishpond remnant, part of Land Commission Grant 3194, “Kolowalu,” awarded to Kalae and Kaaua (see Figure 38).

The study identified three stratigraphic zones: 1) natural low-lying salt flats, marsh, or pond sediments, 2) natural Jaucas sand deposits; and 3) areas where modern/historic fill episodes have removed the former natural land surface, leaving only low-energy lagoonal deposits (Figure 41). The northwestern portion of the project area, located along Kamake‘e Street across from the Block M project area, contained natural wetland sediments. A representative stratigraphic profile of the area nearest Block M is shown in Figure 42.

In 2012, CSH conducted a supplemental archaeological inventory survey of the Ward Village Shops Phase II project area (Sroat and McDermott 2012). Five test units were excavated within or adjacent to the extrapolated location of SIHP # -6855. The stratigraphy observed in the five test excavations substantiated the previously extrapolated boundaries of SIHP # -6855, including concentrated areas of traditional Hawaiian deposits.

3.3.7 Kaka‘ako Improvement District 10 (ID-10)

Between 2003 and 2004, CSH conducted archaeological monitoring for the Kaka‘ako Community District 10 (ID-10) Queen Street Extension project which extended Queen Street from its former ending point at the intersection with Kamake‘e Street to its new intersection with Pi‘ikoi Street (O’Hare et al. 2006). During monitoring of the construction, 30 human burials were found and disinterred. Twenty-eight of the burials, constituting a discrete cemetery (SIHP # -6658), were located at the lip of Kolowalu Pond (SIHP # -6856) and contained associated grave goods indicating cemetery dates between the 1840s and the 1880s (see Figure 38). All 28 burials were found at the base of a stratum of undisturbed beach sand, which was stratigraphically below several modern fill layers. The two other burials consisted of isolated disturbed burials (SIHP # -6659). In addition, a historic trash pit with historic artifacts including metal, ceramics, glass bottles, and other materials was found adjacent to the north side of the cemetery (SIHP # -6660). Bottle dating analysis indicated a date range of the 1920s to the 1930s.

3.3.8 Queen and Kamake‘e Traffic Signal Project

In 2010, CSH monitored utility relocation for the Queen and Kamake‘e Traffic Signal project (Medina et al. 2013—*Draft*). No historic properties were encountered. In general, stratigraphy within the project area consisted of various fill materials overlying a remnant or truncated sand A horizon, Jaucas sand, and the coral shelf. Four profiles were drawn for excavated utility trenches at the junction of Queen and Kamake‘e Streets, including two (Profiles 1 and 2) along the curb of Kamake‘e Street adjacent to Block M (see Figure 37). Both Profiles 1 and 2 showed extensive previous disturbance to the natural strata; however, portions of the A horizon and Jaucas sand deposits were still present. Figure 43 shows the stratigraphy of Profile 2 which was recorded in Trench D6.

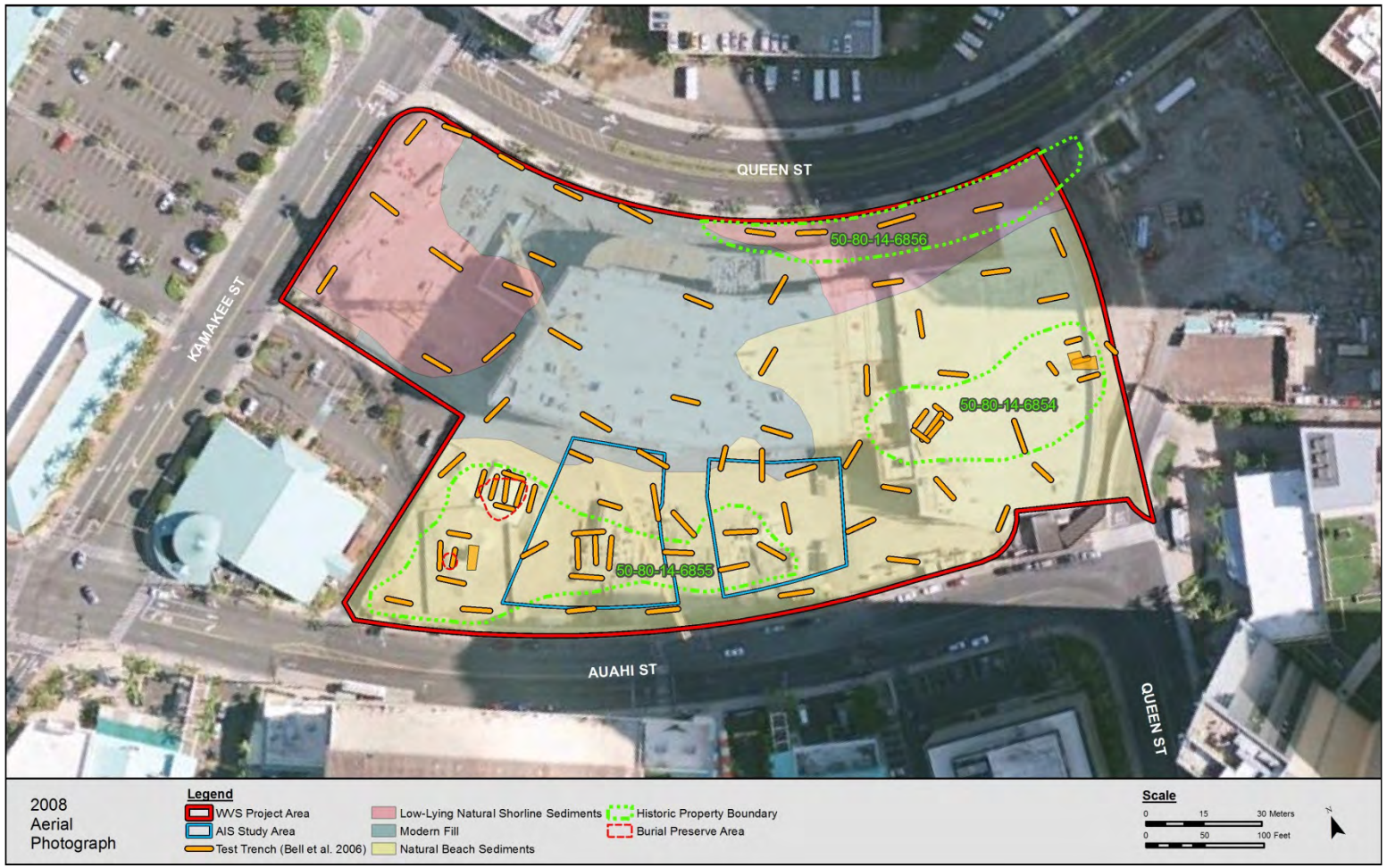

Figure 41. The aerial photograph summarizes the Bell et al. (2006) AIS investigation of the Ward Village Shops project, including the boundaries of subsurface deposit types. Stratigraphic zones were divided into three categories: natural sand (yellow); areas where the natural sediments have been removed and replaced with fill deposits (grey); or low lying wetland—either salt pan, marsh or pond (pink). (Note: the northern corner of the project area, the portion closest to the current Block M project area, contained wetland sediment)

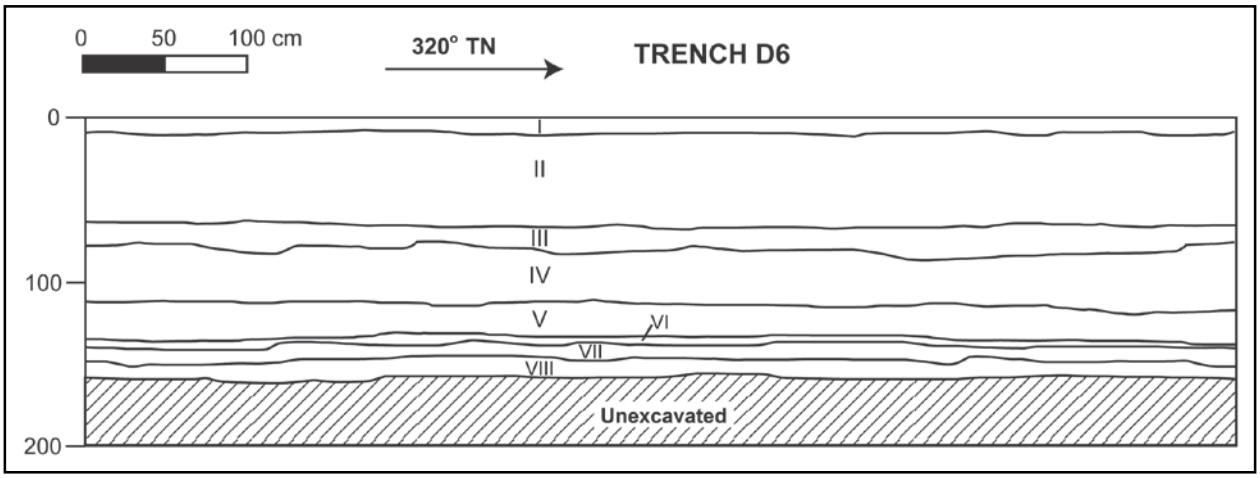

Figure 42. Profile D6 (Bell et al. 2006) showing various fill layers (Strata I-VI) overlying a sandy clay A horizon (Str. VII), clay sand lagoonal sediments (Str. VIII), and the coral shelf

3.3.9 Honolulu High-Capacity Transit Corridor Project (City Center)

Between November 2011 and February 2013, CSH conducted an archaeological inventory survey for the Honolulu High-Capacity Transit Corridor Project (HHCTCP)–City Center, which extended from Kalihi Stream in the west to the Ala Moana Center in the east (Hammatt 2013). Two hundred-fifty test excavations were documented. A total of 19 historic properties were identified along the length of the project corridor. Although no historic properties were identified within the immediate vicinity of Block M, seven test excavations were completed within the Block M project area along the *mauka* boundary (Figure 44). Natural sand was documented within six of the seven trenches, with an upper boundary located between 60–120 cm below surface. Four test excavations also contained an overlying A horizon, with an upper boundary between 39–108 cmbs. The A horizon contained possible traditional Hawaiian cultural material within Test Excavations 175A and 177, consisting of possible marine shell midden, a piece of volcanic glass debitage, and charcoal (see Figure 44). A profile and photograph of Test Excavation 177 are shown in Figure 45 and Figure 46.

3.3.10 Ward Neighborhood Block C Project

Between December 2012 and January 2013, CSH conducted an archaeological inventory survey of the Ward Neighborhood Block C project, located south of the current project area within a parking lot at the intersection of Ala Moana Boulevard and Kamake‘e Street (Yucha et al. 2013). Forty-one test excavations were distributed across the project area. Only one historic property was identified, a burned trash layer located near the corner of Kamake‘e and Auahi Streets (SIHP # 50-80-14-7422). Stratigraphy within the project area was largely consistent. A deposit of hydraulic fill associated with the reclamation infilling of Kaka‘ako during the 1913–1930 period was found within the north, west, and south portions of the project area. 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.

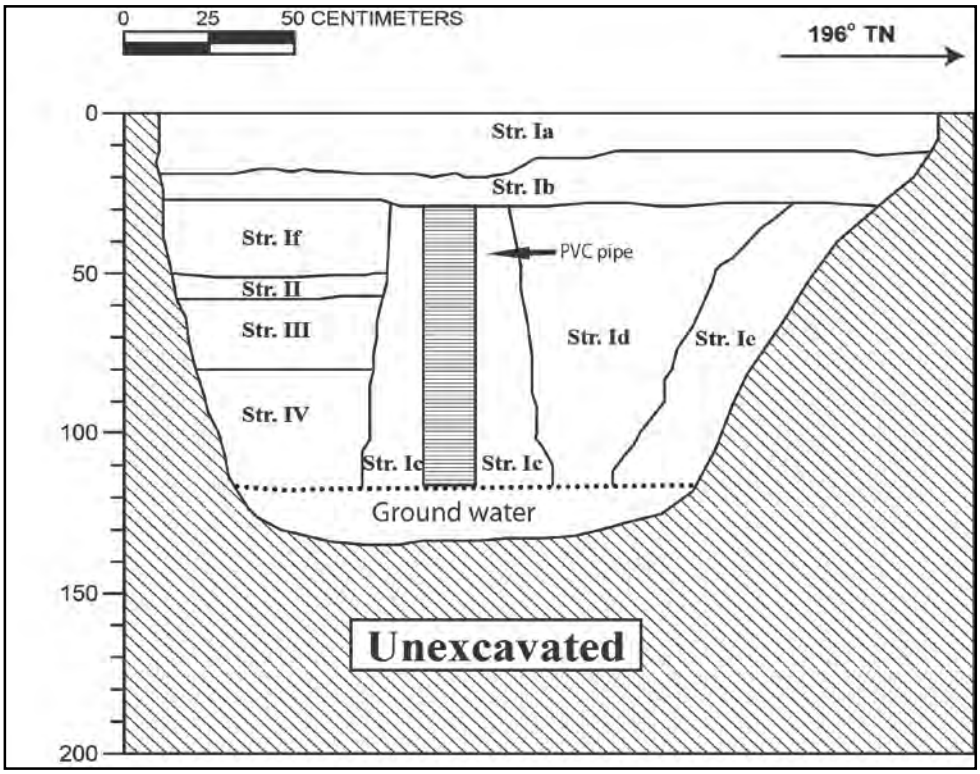

Figure 43. Profile 2 (Medina et al. 2013—Draft) located within Kamake‘e Street along the southeastern border of Block M

Stratum Description

Ia Asphalt
Ib Fill; 10YR 6/1, gray; base course gravel
Ic Fill; 5YR 4/3, reddish brown; cindery clay loam
Id Fill; 10YR 4/2, dark grayish brown; silty sand
Ie Fill; 10YR 6/3, pale brown; sandy silt
If Fill; 10YR 7/2, light gray; sandy clay
II Natural; 10YR 5/3, brown; sandy loam; A horizon
III Natural; 10 YR 7/3, very pale brown; fine to medium sand
IV Coral shelf

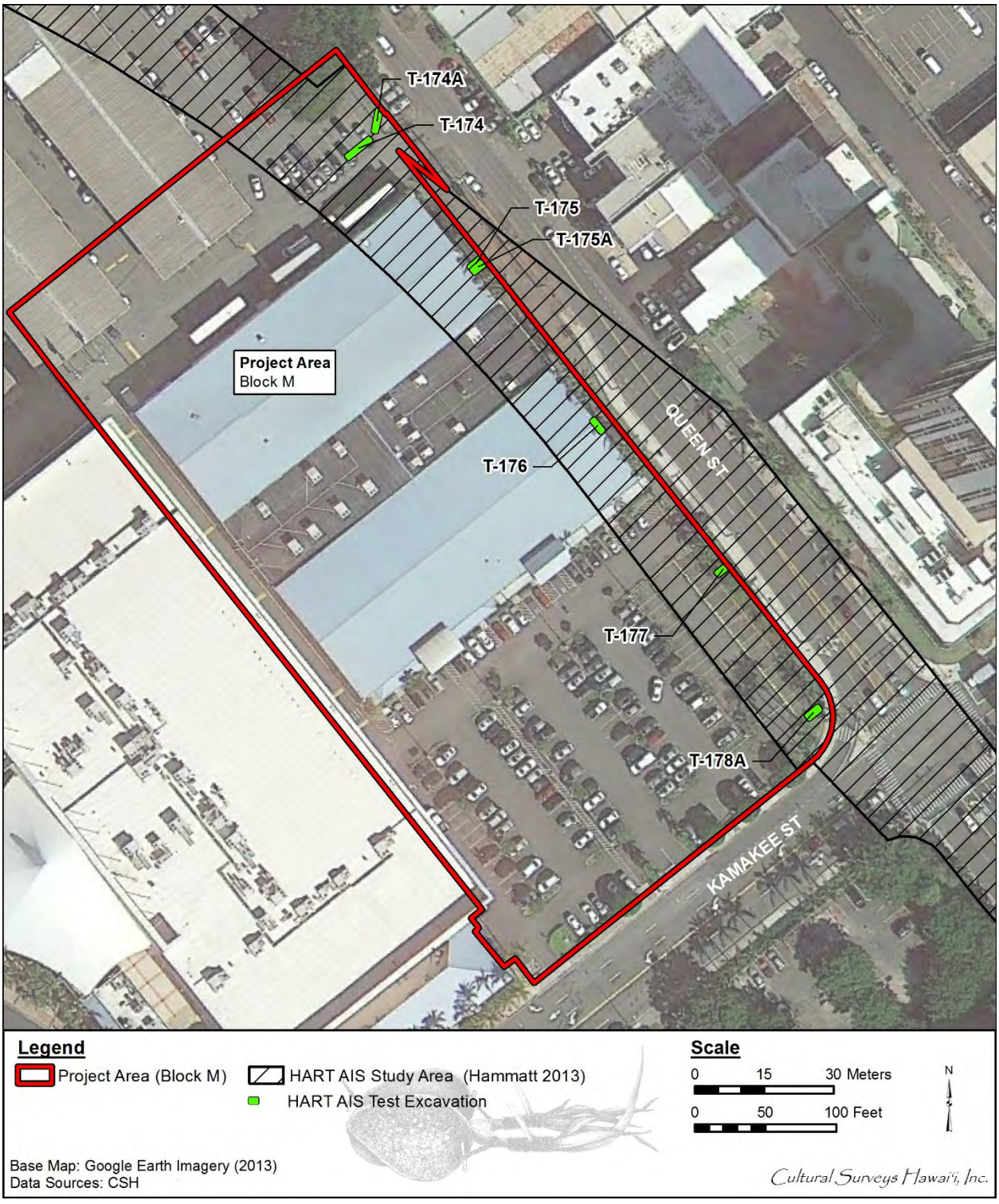

Figure 44. Aerial photograph showing the location of HHCTCP City Center AIS test excavations (Hammatt 2013) within the Block M project area

Figure 45. Profile wall of T-177 (HHCTCP City Center AIS), located within the *mauka* portion of the Block M project area, showing a buried sand A horizon overlying natural Jaucas sand (Hammatt 2013)

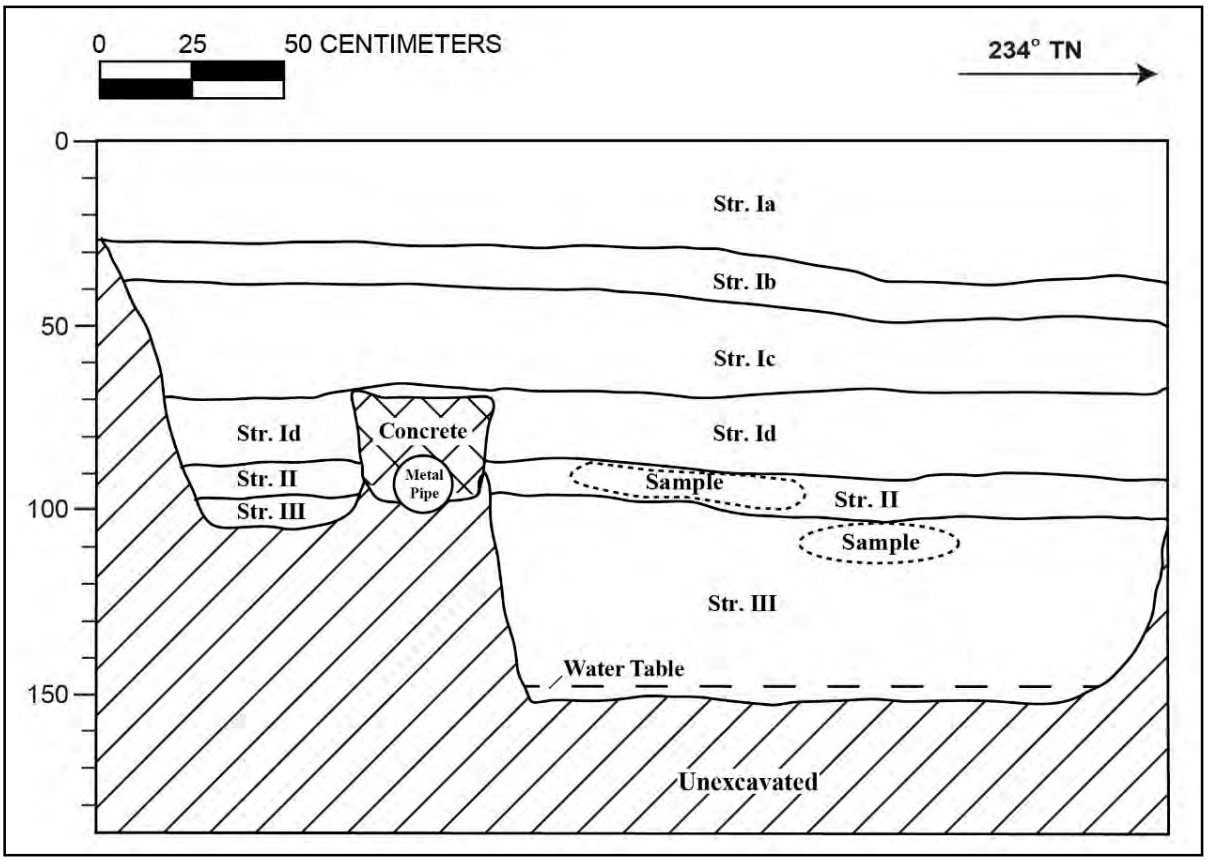

Figure 46. Profile of T-177 (HHCTCP City Center AIS), showing a buried A horizon (Str. II) overlying Jaucas sand (Str. III) (Hammatt 2013)

Stratum Description

Ia Fill; 7.5YR 3/2, dark brown; clay loam; topsoil
Ib Fill; 10YR 4/3, brown; gravelly silty loam
Ic Fill; 10YR 3/1, very dark gray; gravelly silty loam
Id Fill; 10YR 6/3, pale brown; silty clay; hydraulic fill
II Natural; 10YR 4/2, dark grayish brown; silty sand; A horizon; containing charcoal, volcanic glass debitage, and possible marine shell midden
III Natural; 10 YR 7/4, very pale brown; medium-grain sand; Jaucas sand

A majority of the project area (35 test excavations) contained Jaucas sand. No cultural material or features were observed within the test excavations or within screened and bulk sediment samples.

3.3.11 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 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 the 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 year before present.

Section 4 Results of Fieldwork

The fieldwork component of this archaeological inventory survey was conducted between 13 January 2014 and 1 June 2014. CSH archaeological field personnel consisted of Ena Sroat, B.A. (project director), Megan Hawkins, M.A., Veronica Morris, M.A., Doug Inglis, B.A., Nifae Hunkin, B.A., Pablo Rivera, B.A., Andrea Kay, M.A., Andrew Soltz, B.A., Scott Belluomini, B.A., Malina Reveal, M.Sc., Kimi Matsushima, B.A., Amanda Eggers, B.A., Timothy Zapor, B.A., Jessica Leger, M.A., Tyler Turran, B.A., Pua Guanzon, B.A., Laura Ortiz, M.A., Leandra Medina, B.A., Jim Thain, B.A., Tara del Fierro, B.A., Karl Van Ryzin, B.A., Fred LaChance, B.A., Nigel Kingsbury, B.A., Abbey Mierzejewski, B.A., Brittany Enanoria, B.A., and Tom Martel, 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 survey followed by a subsurface testing program. The pedestrian survey confirmed that there were no surface historic properties within the Block M project area. The pedestrian survey concluded that the entire surface of the project area has been modified as a result of twentieth century commercial development. 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 68 backhoe-assisted test excavations were completed, including both exterior (asphalt parking lots and roadways) and interior (commercial space) test excavations (see Figure 5 and Figure 6). 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 and subsurface structural features. 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.

4.1 Stratigraphic Summary

This section provides a discussion of nomenclature and geomorphology and an overview of the stratigraphy observed within 68 backhoe test trenches excavated within the Block M 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.

4.1.1 Nomenclature and Geomorphological Considerations

According to the USDA Web Soil Survey, the Kakaʻako area is comprised of mixed fill land that is suitable for waste related actives, urban and recreational activities, and wildlife (Web Soil Survey 2014). Additionally, background research and previous archaeological investigations documented comprehensive deposits of crushed coralline sand and hydraulic (dredge) material used to in-fill low-lying areas. All fill layers are considered sediments that were deposited through the lateral movement and deposition of both local and non-local sediments and soils by way of

cultural transforms. All natural strata are considered to be either an O, A, or C horizon, developed in situ, through natural transforms, and therefore are defined soils.

The term “wetland environment” is used to describe all natural, saturated deposits believed to have once existed in a low-lying, submerged, or partially-submerged terrain that was not associated with the Jaucas series. The U.S. National Academy of Science defines the term “wetland” as:

> …an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The minimum essential characteristics if a wetland are recurrent, sustained inundation or saturation at or near the surface and presence of physical, chemical, and biological features reflective of recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydroponic vegetation. These features will present except for where specific physiochemical, biotic, or anthropogenic factors have removed them or prevented their development. [Mitsch and Gosselink 2007: 25]

While it is recognized that the term “wetland” encompasses four types (marshes, swamps, bogs, and fens) with a myriad of additional terms, it is unclear at this time the specific nature of the wetland environment that previously existed in the Kaka‘ako area. However, based on archival research and the results of pollen analyses conducted for Block M, it seems valid that the wetland area was either a marsh or a fen. Marshes are formed in environments along coastal margins, lakes, ponds, and stream beds. Marshes are subjected to consistent flooding and, as a result, are nutrient rich and support a variety of reeds and grasses. Conversely, a fen is a peat-accumulating wetland that receives some drainage from surrounding mineral soil and usually supports marsh like vegetation (Mitsch and Gosselink 2007). Block M pollen results reveal the presence of Herbaceous species, indicating that the vegetation consisted of herb and grass or sedge dominated communities. Additionally, high samples of aquatic Foraminifera shells in the lower samples suggest that the environment may have been more frequently or deeply inundated during earlier depositional periods (see Section 2.7.4 for additional information).

These wetland deposits are the remnant of either a former lagoon or estuary; however, necessary information needed to distinguish between the two is either non-existent or not currently available. It is impractical, and beyond the scope of this project, to evaluate these deposits further, as lagoons and estuaries are both complex environments with similar features that develop under different geomorphological conditions.

Namely, lagoons form parallel with the coastline, in a *depositional coastal* environment, where sediments accumulate to create landforms and are dominated by marine coastal processes, terrestrial fluvial processes, or a combination of both. However, estuaries are formed perpendicular to the coast, in a *submerged coastal* environment, in an embayment that extends inland from the coast where both terrestrial and coastal processes interact to produce a brackish-water environment rich in marine fauna. In most cases, these sediments are reworked by waves and currents into tidal flats and marshes around the margin of the estuary (Waters 1992:255−258). Both estuaries and lagoons contain varying degrees of internal salinity and they retain similar features such as sand bars, tidal flats, and marshes. Additionally, biogenic structures and bioturbation will vary within an estuary and/or a lagoon depending on the specific depositional location within said environment (e.g., mudflats—sand flats and supratidal zones—subtidal zones) (see Waters 1992 and Reineck

and Singh 1975 for additional information). Therefore, establishing a criteria for differentiating between a lagoon and estuary is not possible at this time.

The wetland deposits were observed and documented either in place of the Jaucas sand, or underlying Jaucas sand when present. Typically, this saturated deposit was characterized as either a pale yellow brown, fine sand to sandy clay, or clayey sand, to a greenish grey, gravelly sand to sandy clay, or clayey sand that commonly contained fine roots and brackish water shells. An appreciable amount of the wetland deposits in Block M appear to have undergone at least one of the four pedogenic processes required for soil formation. Therefore, this sequence is considered to be a horizon with distinctive physical and chemical properties that was superimposed on previously deposited sediment (see Waters 1992:41). Additionally, the older soils found resting over the coral shelf appear to represent a separate depositional sequence than the Jaucas series or wetland horizon (s) above. This rationale is based on the documentation of roots and other organic material within this lower sequence, and, in order for a soil profile to develop, the sedimentary deposit must be stable. Stability means that the surface underwent minimal erosion and deposition in order for pedogensis to occur and vegetation to develop within the upper boundary. Between the Jaucas series and the lower wetland series, a thin indurate layer of coarse sand was commonly observed throughout the project area. While the evolution of this layer is not yet clear, it may either represents a vertical transition in depositional environments, or, compaction from the weight of overlying deposits combined with water table fluctuations and calcification of the sediment grains.

According to Deenik and McClellan (2007:7), the *makai* region of Kaka’ako is comprised of Entisols, beaches, coral, marsh land, rocky land, and fill land, while the *mauka* region is comprised primarily of Inceptisols and Mollisols. Based on observable characteristics of the wetland deposits identified within Block M, it is plausible to assert that these deposits are representative of either an Entisol, Inceptisol, or a combination of each.

Entisols are poorly developed mineral soils with no distinct subsurface soil horizon and includes the Jaucas sand series. They are either recent soils in the early stages of soil formation, or they may be paleosols with unaltered parent material (i.e., no evidence of pedogenisis). Hawai‘i Entisols are predominantly sandy soils developed from coral limestone in low-lying coastal areas, with an organically rich surface horizon (Deenik and McClellan 2007: 5). Conversely, Inceptisols are young soils that show poor profile development. Inceptisols are developed in river valleys from alluvium and generally create fertile soils with poor drainage that is well suited for wetland agriculture. Ancient *lo‘i* (agricultural pond fields) are still cultivated on Inceptisols throughout Hawai‘i (Deenik and McClellan 2007:4). This is worth noting as background research indicates that the Honolulu Plain was blanketed with fishponds and salt beds and a system of irrigated *lo‘i* fed by streams descending from Makiki, Mānoa, and Pālolo valleys (see Section 3).

4.1.2 Stratigraphic Overview

The stratigraphic sequence within Block M, from the present land surface to the coral shelf, typically included: the modern developed land surface; variable layers of imported fill; overlying historic buried surfaces that once served as a commercial infrastructure (SIHP # -7686); additional mixed fill; overlying crushed coralline sand and hydraulic (dredge) reclamation fill; overlying two buried, culturally enriched deposits (SIHP # -7429); and natural terrestrial deposits and/or wetland deposits that contained an O or A horizon at the upper boundary (Table 3).

Historic buried surfaces (SIHP # -7686) were documented below the modern developed land surface, underlying the current commercial structure within Block M (Figure 47). These surfaces were documented between 7 and 100 cmbs with an average depth of 28.9 cmbs. The modern and historic surfaces and fill layers were universally designated as Stratum I.

Of note, T-63 and T-64, located in the northwest end of the project area near Queen Street and ‘Ewa of the current commercial structure, contained a discontinuous layer of burnt trash mixed with crushed coralline sand fill. Stratum II reclamation fill also appeared to have been previously truncated and later intercalated with the mixed fill and historic trash. The historic trash consisted of glass bottle and ceramic fragments, clay and glass marbles, wood, brick, oxidized and fire affected metal, broken utility pipe material, fire-altered basalt cobbles, faunal remains, and marine shell fragments. These two layers appeared to incorporate historic trash most likely related to nineteenth-twentieth century residential houses along Queen Street, but did not appear to have served as a living surface or discrete trash deposit.

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. A total of 59 test excavations contained reclamation fill, documented between 20−148 cmbs, with an average depth of 72 cmbs. The reclamation fill deposits consisted of structureless, crushed coralline sand and hydraulic-dredged marine clays, which were predominantly massive but occasionally single-grained depending on the sand content. The color of the hydraulic dredge ranged from a pale brown to a greenish grey gley. When present, the gleyed material was located at the lower boundary of the hydraulic dredge fill and was indicative of prolonged saturation in an anaerobic environment. The gleyed characteristics were the result of natural, post depositional processes, which occur in low lying wetland environments with a shallow water table (Figure 48). The hydraulic dredge material also displayed alternate banding and downward grading from coarse to fine material, as well as ferrous manganese stains (Figure 49). Early 1900s land reclamation fill deposits were designated as Stratum II.

Background research indicates land reclamation activity within the project area occurred sometime between 1919 and 1927, following allocation of territorial funds for the dredging of Kawelo Basin in 1919 and prior to a 1927 aerial photograph which shows a white coral deposit covering the project area (see Figure 28). The narrow date range of these reclamation fill deposits provided a relative age indicating that the underlying strata were deposited prior to 1919 while all overlying strata were deposited after 1927.

A pre-land reclamation fill deposit was observed below the hydraulic land reclamation fill in 23 test excavations (33.8 %), between 39−115 cmbs, at an average depth of 71.9 cmbs. Typically, this layer was observed overlying a natural A horizon, composed of locally procured soil and sediment that often exhibited brackish water snails, and was truncated during previous ground disturbing activities. When cultural material or evidence of cultural activity was present, this layer was designated as SIHP # -7429. The majority of the pre-reclamation fill was culturally sterile; however, faunal material and milled wood posts were documented originating from this stratum (i.e., SIHP # -7429) (Figure 50). Of these 23 test excavations, five contained either an exceptionally thick pre-reclamation fill stratum or more than one prereclamation fill sub-stratum. In these cases, the fill stratum appeared to be spatially associated with modified natural sand dunes, and in close proximity to irrigation features and a historic residential area. Four of these five test excavations

(T-5, 26, 63, and 64) are located in the northwest portion of the project area, in close proximity to the above mentioned historic residential area, and displayed noticeably thicker and darker deposits. It is possible that incinerated material such as ash and refuse were incorporated with the fill. This fill stratum is believed to represent pre-reclamation landscape modifications and likely served as the former ground surface for a prolonged period of time. This layer was universally designated as Stratum III when underlying reclamation fill.

The natural environment was documented below the recent historic fill deposits and consisted of Jaucas beach sand in the *mauka* portion of the project area, along Queen Street, that transitioned to a marsh-like, wetland environment in the *makai* portion of the project area, near the Ward Theater parking structure (Figure 51 and Figure 52). The Jaucas series is considered a C horizon that consists of excessively drained, calcareous soils that occur in narrow strips on coastal plains, adjacent to the ocean, and is considered to be a common Entisol found in the Hawaiian Islands (Foot et al. 1972: 48; Deenik and McClellan 2007:5).

Designation of the natural strata was dependent on overlying strata, and classification of natural strata commonly ranged from Stratum III and higher. A natural, in situ, organic horizon was documented in 58 test excavations (85%), between 30–159 cmbs, at an average depth of 89.1 cmbs. While 86% of the organic horizons were characterized as an A horizon, eight of the 22 wetland organic horizons were characterized as O horizons. This distinction was based on the visible accumulation of decomposing organics within the eight test excavations. Of the 58 organic horizons observed, 32 developed with Jaucas beach sand, 22 developed within a wetland deposit, and four developed over a natural transition from wetland to terrestrial sand. When cultural material or evidence of cultural activity was present, the buried, natural A horizon was included with SIHP # -7429. Typically, the natural organic horizon appears to have been truncated by previous ground disturbance activities and is believed to have been altered prior to land reclamation landscape management activities.

Table 3. General Stratigraphic Layers Present within Each Stratum Designation

Stratum Designation	Stratigraphic Layers Present
Stratum I	
	Asphalt or concrete surface Historic buried surfaces associated with SIHP # -7686 Local and non-local mixed fill sediment Burnt historic trash and mixed fill sediment
Stratum II	
	Crushed coralline sand fill sediment associated with the Kaka‘ako land reclamation (1919–1927) Hydraulic pump dredge fill sediment associated with the Kaka‘ako land reclamation (1919–1927)
Stratum III	
	Locally procured, early twentieth century fill sediment Culturally enriched, locally procured, early twentieth century fill sediment associated with SIHP # -7429 In situ buried A horizon or O horizon Culturally enriched, in situ, buried A horizon associated with SIHP # -7429 Jaucas sand series
Stratum IV, Stratum V, and Stratum VI	
	Locally procured, early twentieth century fill sediment Culturally enriched, locally procured, early twentieth century fill sediment associated with SIHP # -7429 In situ buried A horizon Culturally enriched, in situ, buried A horizon associated with SIHP # -7429 Wetland horizon(s)

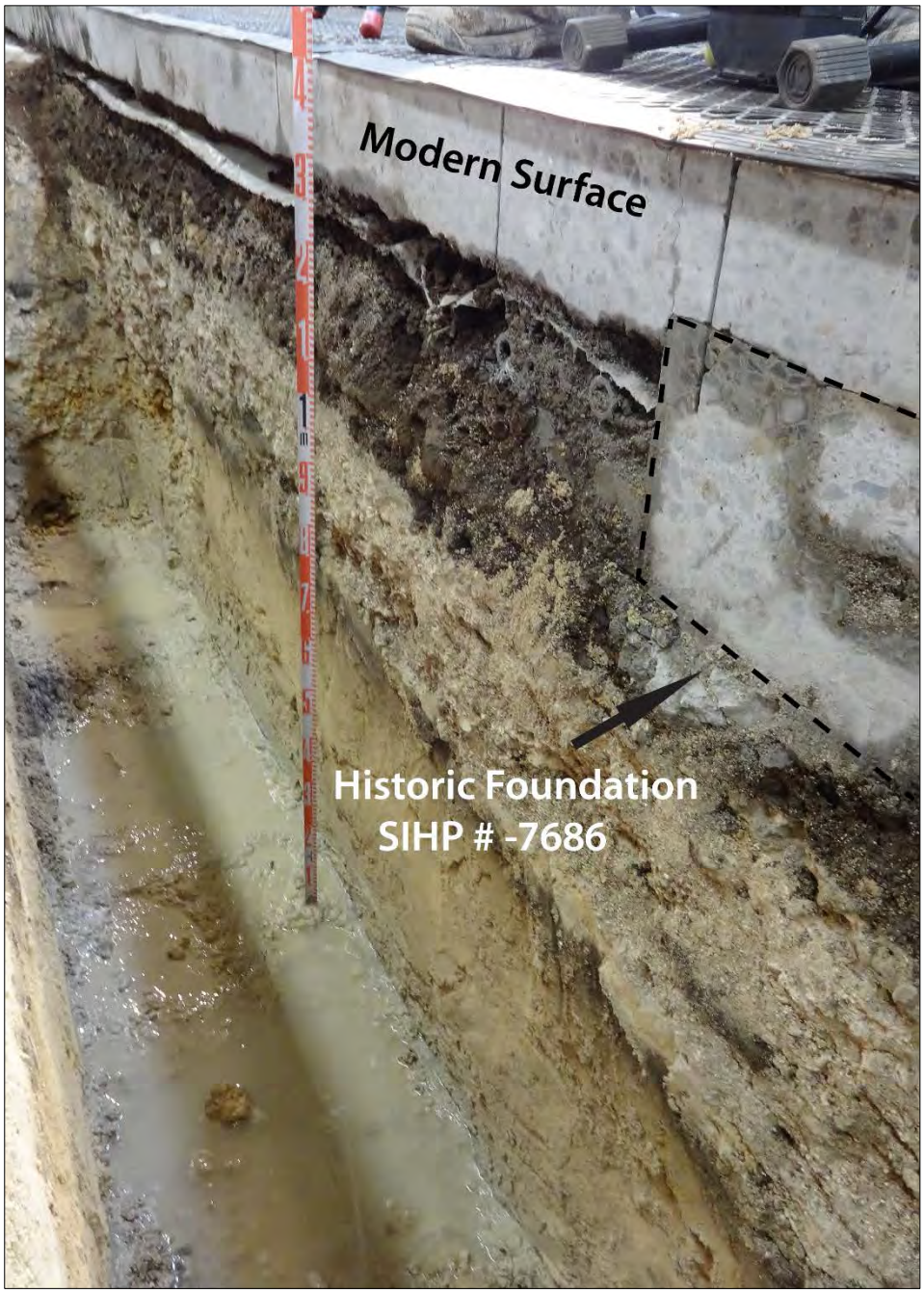

Figure 47. Subsurface historic concrete foundations associated with SIHP # -7686

Figure 48. Early 1900s hydraulic (pump) dredge with post-depositional gleyed lower boundary

Figure 49. Hydraulic dredge material with ferrous manganese stains

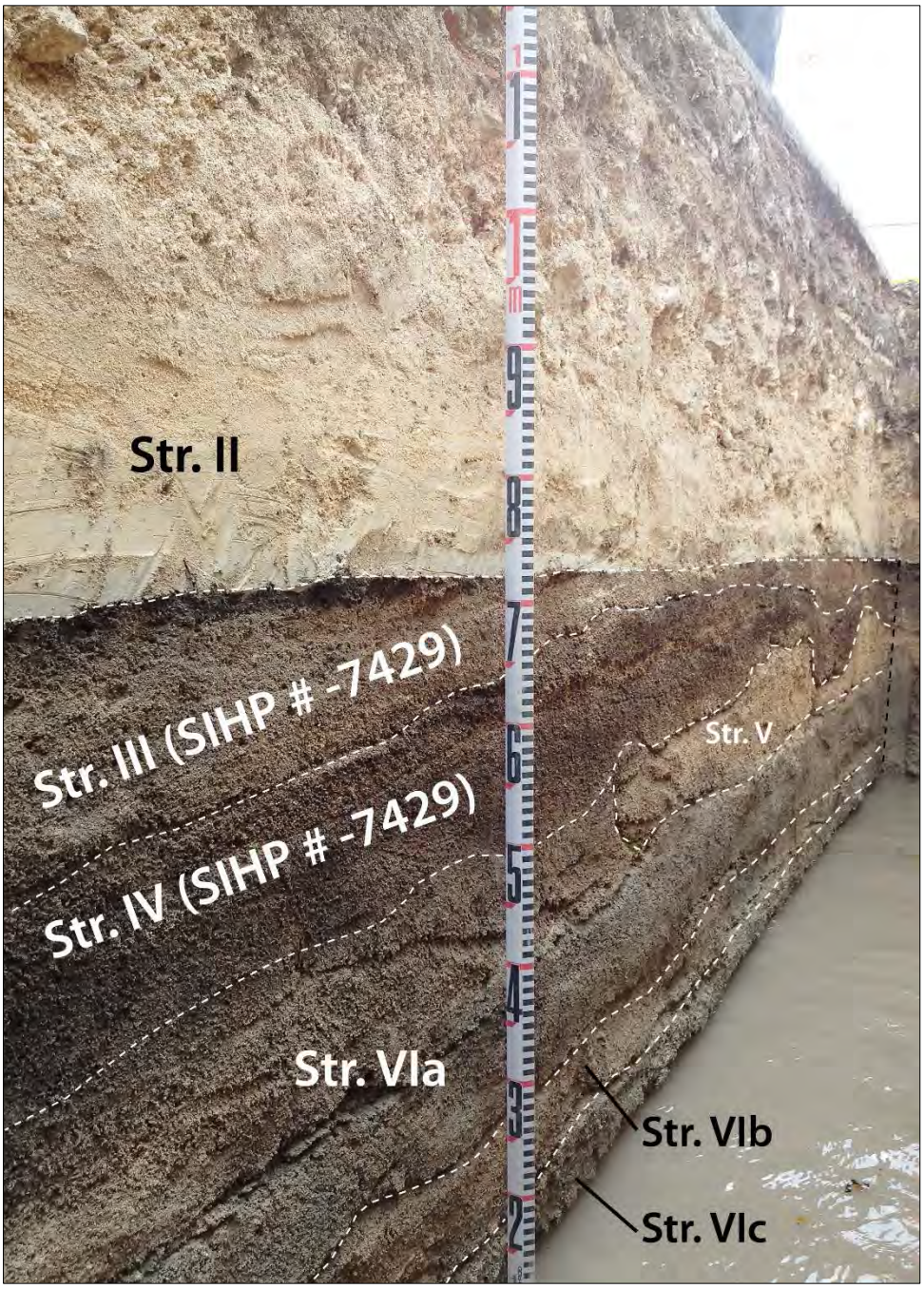

Figure 50. Component 1 and Component 2 of SIHP -7429

Figure 51. Natural subsurface environment that consisted of an A horizon over either calcareous Jaucas sand (right), wetland sediment (left), or an environmental transition between sand and wetland (center)

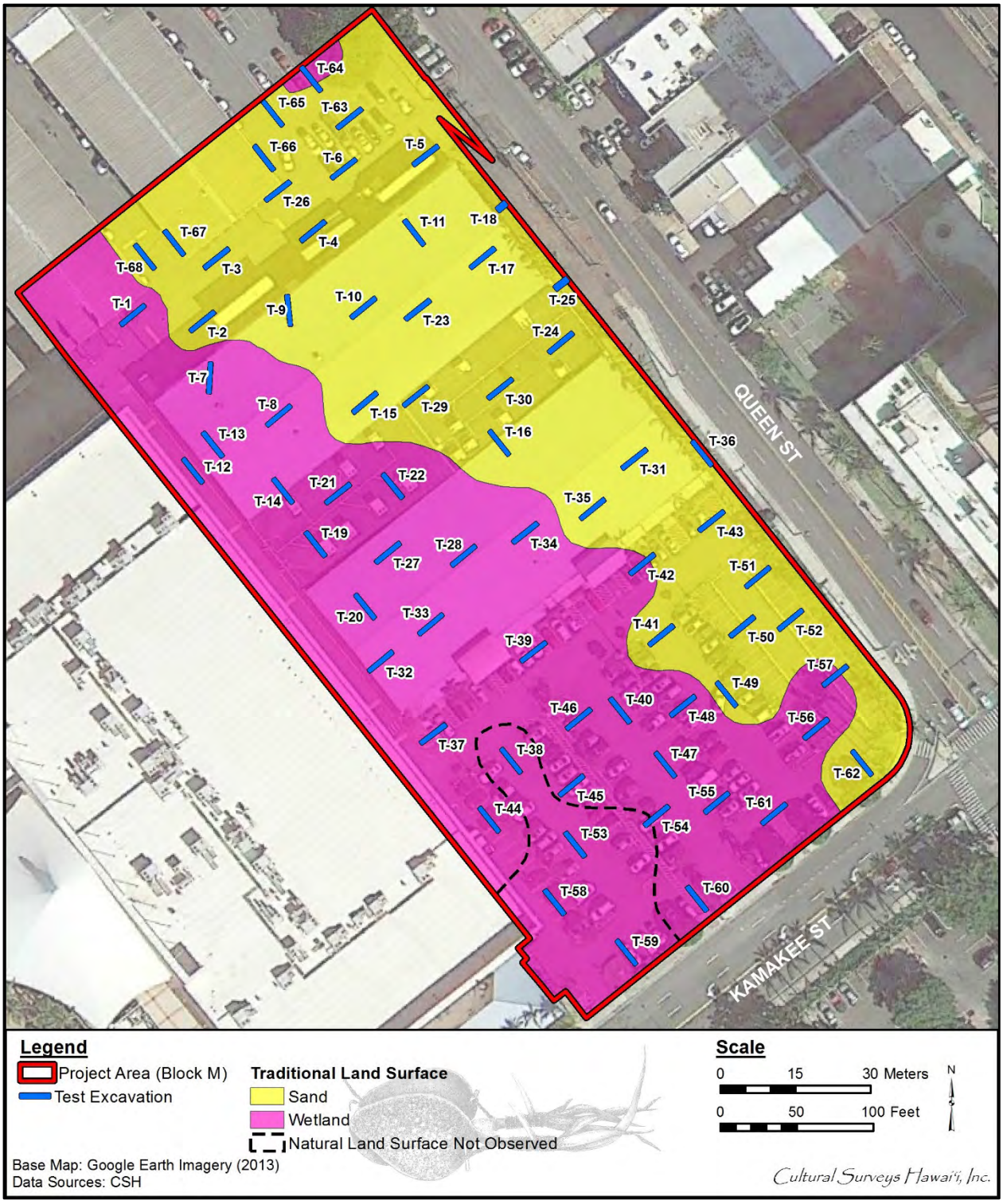

Figure 52. Aerial photograph of the Block M project area showing the location of subsurface natural sand deposits (yellow) and wetland deposits (pink)

4.2 Test Excavation Results

4.2.1 Test Excavation 1 (T-1)

Test Excavation 1 (T-1), an exterior excavation located in the alleyway between the current Office Depot building and Warehouse Building 4, was oriented northeast-southwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.37 mbs. The stratigraphy of T-1 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), very gravelly sand fill (Stratum Ic) and fine sand fill (Stratum Id) overlying 1919-1927 Kaka‘ako reclamation fill deposits consisting of coarse sand (crushed coral) (Stratum IIa) and hydraulic (dredge) sandy clay (Stratum IIb), overlying a redeposited, locally procured loamy sand (Stratum III), overlying a natural clay wetland deposit (Stratum IVa), an organic clay sand wetland deposit (Stratum IVb), and a layer of sand and decomposing coral shelf (Stratum V) (Figure 53 through Figure 55, and Table 4). A cinder block footing and a utility pipe were encountered within the *makai* portion of the trench during excavation and as a result this portion of T-1 was left unexcavated.

T-1 documented recent fill deposits (Strata Ia–Id), overlying historic fill deposits (Strata IIa, IIb, III), resting over a natural wetland environment. Strata IIa and IIb consisted of crushed coral and hydraulic dredge material associated with Kaka‘ako land reclamation efforts dating to 1919–1927. Underlying the hydraulic fill was a heavily mixed, culturally sterile, sand fill material (Stratum III), likely composed of locally procured sand and soil. This local fill material appeared to have been deposited to level and/or build up the ground surface and served as a historic land surface for a period of time prior to reclamation activities. The natural wetland A horizon appeared to have been removed during previous ground disturbance activities, which truncated the wetland clay sand (Stratum IVa).

Figure 53. Photograph of T-1 northwest wall, view to northwest

Figure 54. Photograph of T-1 showing a cinder block footing and utility lines within the *makai* portion of the test excavation and wetland sediments underlying modern and historic fill deposits within the *mauka* portion

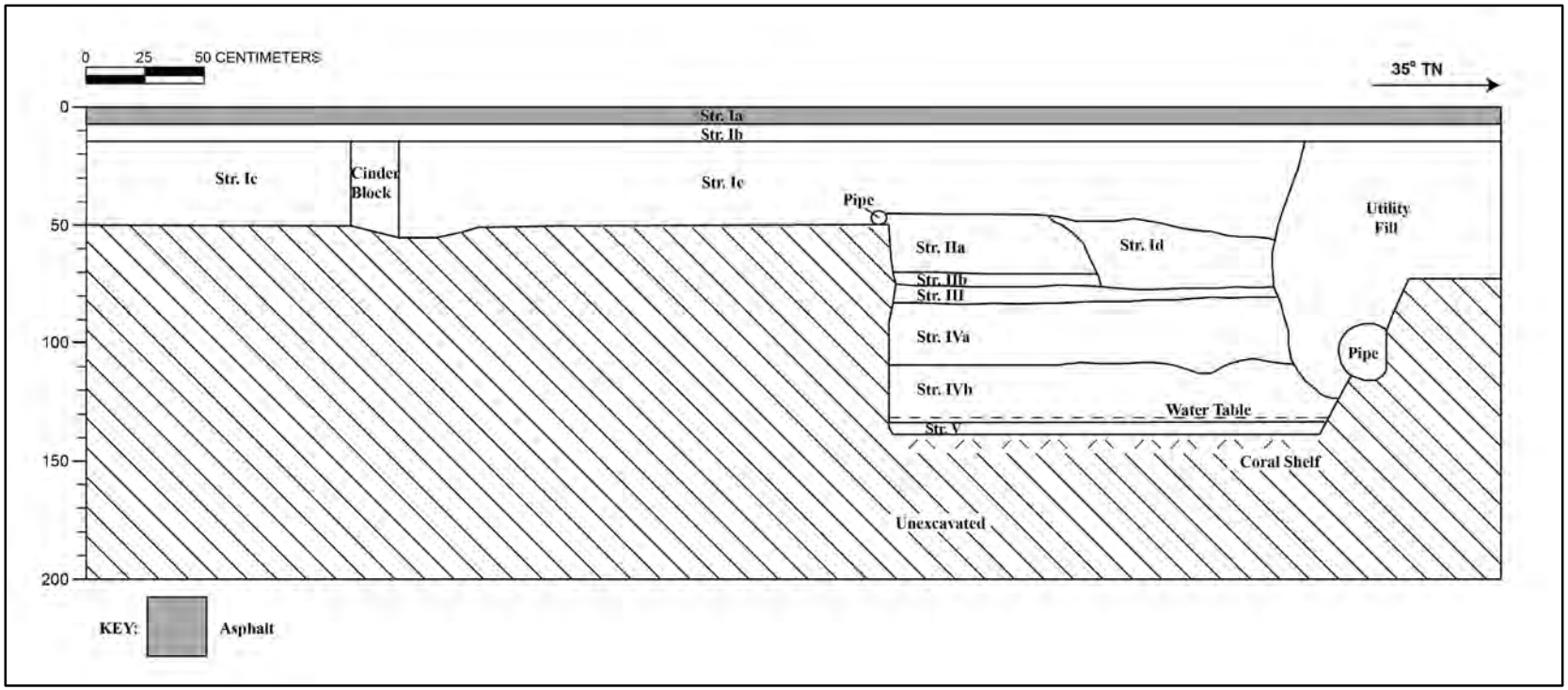

Figure 55. T-1 northwest profile

Table 4. T-1 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–15	Fill; 10YR 3/2, very dark grayish brown; extremely gravelly sandy loam; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course consisting of mixed fill and coral cobbles
Ic	15–55	Fill; 2.5Y 7/2, light gray; very gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral; contained a utility pipe and cinder block alignment
Id	47–76	Fill; 2.5Y 7/3, pale yellow; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary
IIa	45–70	Fill; 10YR 8/2, very pale brown; fine sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; multiple layers of very fine to fine sand associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	70–75	Fill; 10Y 7/1 (GLEY 1), light greenish gray; sandy clay grading to clay; structureless (massive); moist, firm consistence; plastic; marine origin; abrupt, smooth and discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	75–83	Fill; 2.5Y 5/2 to 5/3, grayish brown to olive brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth and discontinuous lower boundary; redeposited, likely locally procured sand utilized for land modification; contained rusted metal fragments and slag
IVa	80–112	Natural; 10Y 5/1 (GLEY 1), greenish gray; clay sand; weak, fine, granular structure; moist, very friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; wetland sediment; contained brackish water snails
IVb	108–133	Natural; 10Y 7/1 (GLEY 1), light greenish gray; clay sand; weak, fine, granular structure; moist, very friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; common, fine roots; wetland sediment with decomposing roots
V	133–137 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; coarse gravelly sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; coarse sand and decomposing coral shelf; overlying coral shelf

4.2.2 Test Excavation 2 (T-2)

Test Excavation 2 (T-2), an exterior excavation located in the alleyway between the current Office Depot building and Warehouse Building 4, was oriented northeast-southwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.5 mbs. The stratigraphy of T-2 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib) and gravelly sand fill (Stratum Ic) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) sandy clay (Stratum IIb), overlying a natural loamy sand A horizon (Stratum IIIa), Jaucas sand (Stratum IIIb), and two clay sand wetland deposits (Strata IVa and IVb) (Figure 56 through Figure 59, and Table 5).

T-2 documented a natural loamy sand A horizon (Stratum IIIa), considered part of SIHP # -7429. The A horizon contained light cultural content consisting of fire-altered basalt cobbles and charcoal and four features, SIHP # -7429 Features 8–11. Feature 8, which measured 0.86 m long by 0.75 m wide and approximately 0.15 m deep, consisted of a wide, shallow pit containing charcoal-stained soil and fire-altered basalt and coral cobbles backfilled with Jaucas sand (Figure 59 through Figure 61). A 10-gallon (100%) screened sample of Feature 8 yielded marine midden consisting of *echinothrix diadema* sp. (*wana*, or sea urchin) (1.8 g), *Tellina palatam* (19.0 g), and *Turbo sandwicensis* (13.1 g). Feature 8 was interpreted as a fire pit for food consumption (*imu*). Charcoal collected from Feature 8 was sent for taxa identification and radiocarbon dating. The plant species present within the charcoal sample were identified as native Hawaiian species (*‘āheahea*, *kulu‘ī*, and *‘ūlei*) or Polynesian-introduced species (*kukui*). Radiocarbon dating yielded a relatively early pre-Contact date range of AD 1333-1337 (0.7% probability) or AD 1398-1449 (94.7% probability). Feature 9, which measured 0.4 m in diameter and 0.19 m deep, similarly contained charcoal staining and fire-affected basalt cobbles, and was interpreted as a fire pit for food consumption (*imu*) (see Figure 58 and Figure 61). A 100% screen yielded a small amount of marine midden consisting of *Tellina palatam* (1.0 g) and crustacean (0.1 g). Feature 10 was a slight discoloration of the soil matrix that protruded from Stratum IIIa (see Figure 59 and Figure 62). Feature 10 measured 0.14 m long by 0.1 m wide and 0.17 m deep and contained a small amount a marine shell midden (Isognomidae) (see Figure 62). The function of Feature 10 is indeterminate. Feature 11, which measured 0.14 m in diameter and 0.12 m deep, was also a slight discoloration of the soil matrix and was absent of material culture (see Figure 58). The function of Feature 11 is indeterminate; however, the light stains suggests ephemeral use or activities.

The A horizon (Stratum IIIa) and underlying Jaucas sand (Stratum IIIb) descended slightly towards the *makai* end of T-2 and transitioned from a terrestrial environment to a wetland environment at the southeast corner of the test excavation (see Figure 59). The A horizon became heavily compacted in this *makai* area and contained brackish water snails, *Melampus* sp., and shell fragments, also indicative of a transition to a wetland environment. This transition from a terrestrial to a wetland environment is substantiated by the clear presence of wetlands within both T-1 and T-7, located immediately *makai* of T-2.

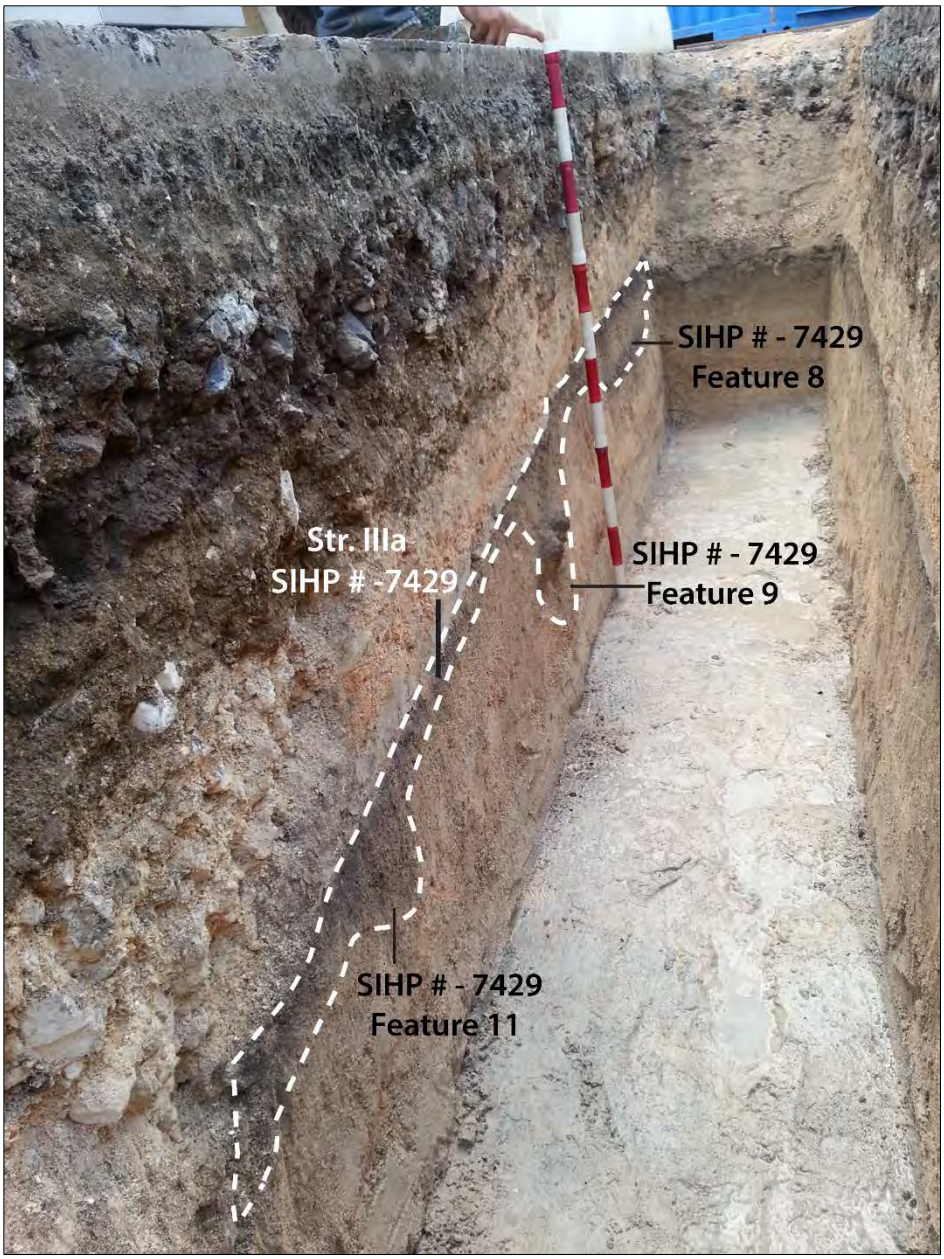

Figure 56. Photograph of T-2 northwest wall showing Stratum IIIa SIHP # -7429 Features 8, 9, and 11, view to north

Figure 57. Photograph of T-2, showing both sidewalls

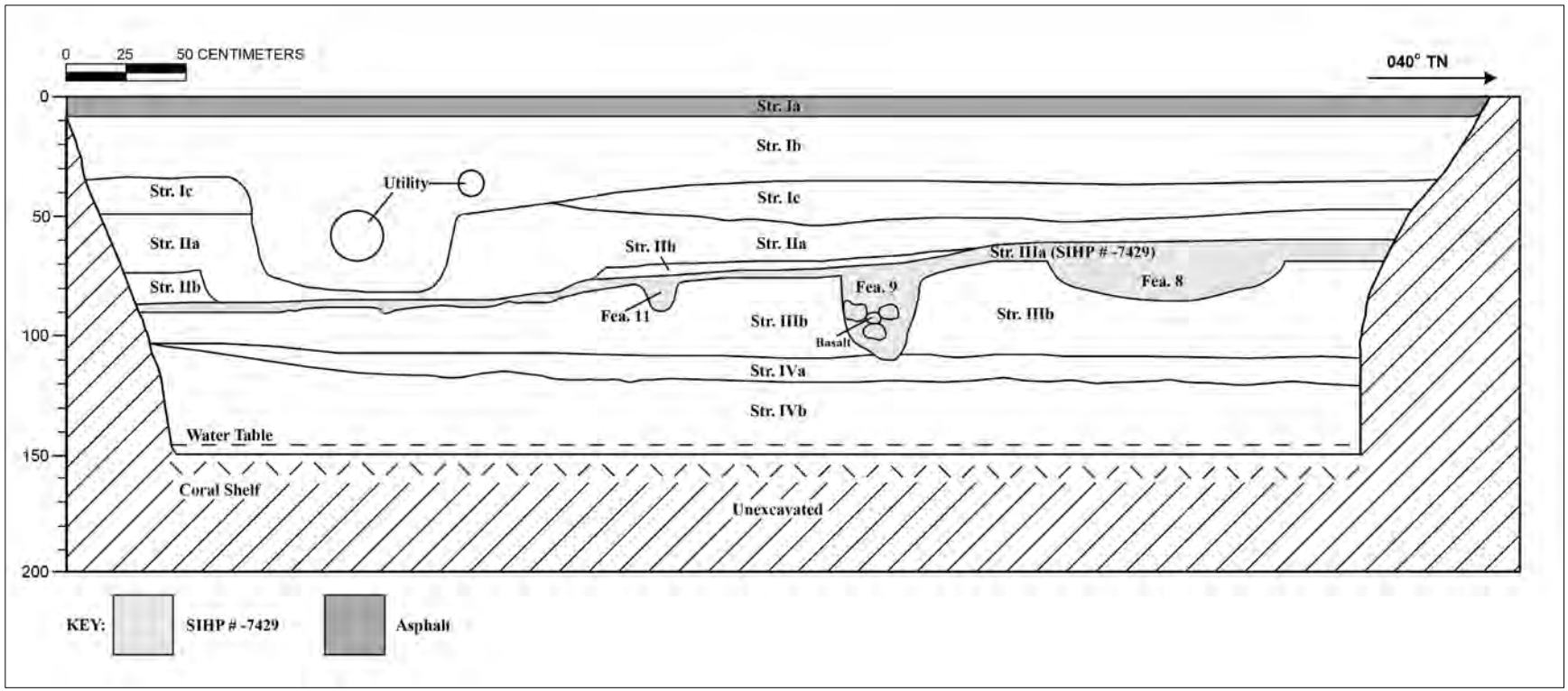

Figure 58. T-2 northwest profile, showing SIHP # -7429 Features 8, 9, and 11

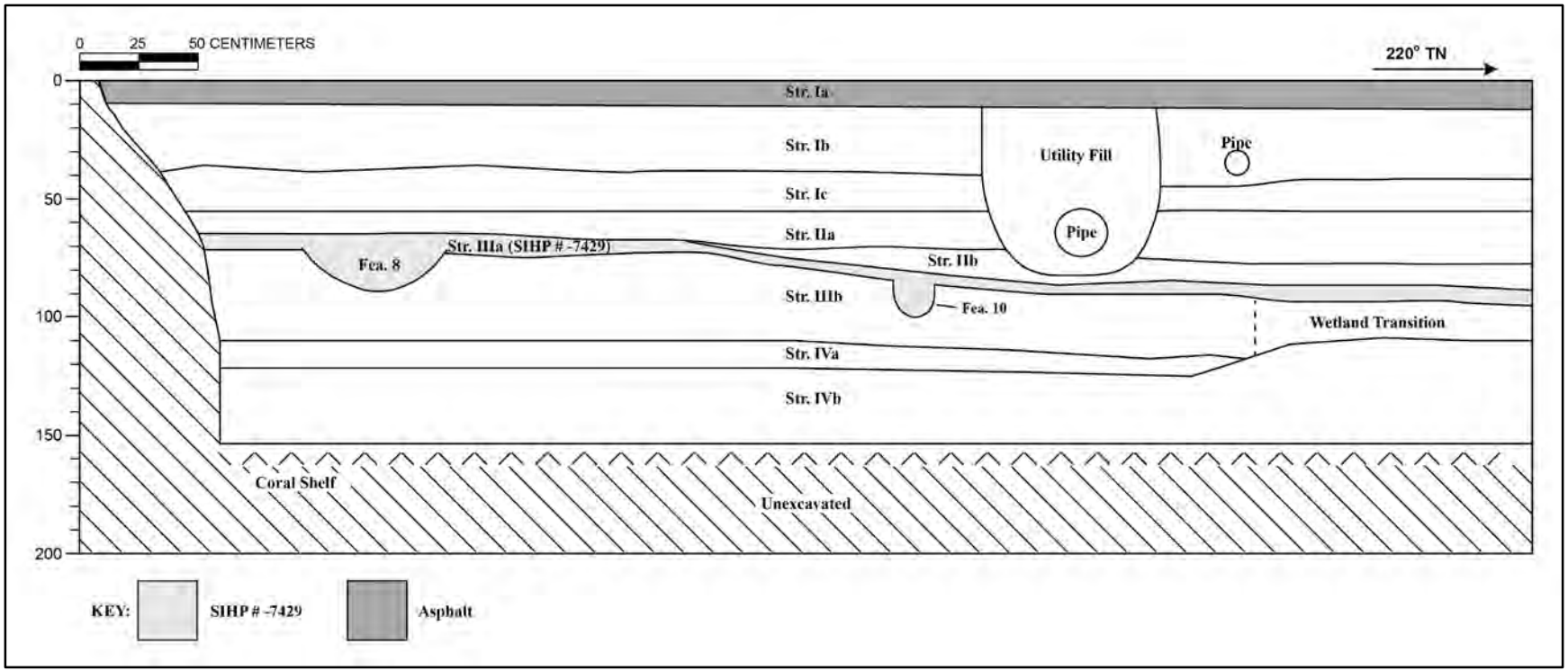

Figure 59. T-2 southeast profile, showing SIHP # -7429 Features 8 and 10

Table 5. T-2 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–35	Fill; 5YR 3/2, dark reddish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course consisting of mixed fill and coral cobbles
Utility fill		Fill; 10YR 5/3, brown; very gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt, discontinuous lower boundary; utility line pit fill
Ic	35–90	Fill; 10YR 4/4, dark yellowish brown; very gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; mixed loam coral fill
IIa	47–73	Fill; 10YR 7/6, yellow; gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	63–80	Fill; 10Y 7/1 (GLEY 1), light greenish gray; fine sandy clay; structureless (massive); moist, firm; slightly plastic; mixed origin; clear, broken/discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	60–90	SIHP # -7429; 10YR 3/2, very dark grayish brown; loamy sand; weak, medium course; crumb structure; moist, loose consistence; non-plastic; mixed origin; diffuse, smooth lower boundary; A horizon; contained fire-altered rock, charcoal, and natural marine shell; contained SIHP # -7429 Features 8–11
IIIb	70–105	Natural; 10YR 7/4, very pale brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand
IVa	105–119	Natural; 10YR 7/4, very pale brown; clay sand; moderate, fine, blocky structure; wet, very friable consistence; non-plastic; marine origin; clear, smooth lower boundary; common, fine roots; wetland sediment containing abundant decomposing roots
IVb	119–150 (BOE)	Natural; 5Y 7/2, light gray; clay sand; weak, medium, crumb structure; wet, slightly sticky consistence; non-plastic; marine origin; clear, smooth lower boundary; few, fine roots; wetland sediment with decomposing roots; overlying coral shelf

Figure 60. Photograph of T-2, SIHP # -7429 Feature 8, view to northeast

Figure 61. Photograph of T-2, *mauka* end, showing SIHP # -7429 Feature 8 (rear) and Feature 9 (fore), view to northeast

Figure 62. Photograph of T-2, SIHP # -7429 Feature 10, view to south

4.2.3 Test Excavation 3 (T-3)

Test Excavation 3 (T-3), an exterior excavation located in the alleyway between the current Office Depot building and Warehouse Building 5, was oriented northeast-southwest and measured 6.0 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.47 mbs. The stratigraphy of T-3 consisted of asphalt surface (Stratum Ia), base course (Stratum Ib), and very gravelly sandy loam fill (Stratum Ic) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of cobbly sand (crushed coral) (Stratum IIa) and hydraulic fine sandy clay (Stratum IIb), overlying a natural loamy sand A horizon (SIHP # -7429) (Stratum IIIa), Jaucas sand (Stratum IIIb), and sandy clay wetland sediment (Stratum IV) (Figure 63 and Figure 64, and Table 6). An extremely cobbly sand pit feature was observed in the *makai* portion of T-3, extending through Strata IIa–IIIb.

A 1-gallon bulk sample of the A horizon (Stratum IIIa) was screened in the field, yielding only natural water worn marine shell. Careful troweling of the A horizon yielded a single ceramic sherd.

Figure 63. Photograph of T-3 northwest wall, view to southwest

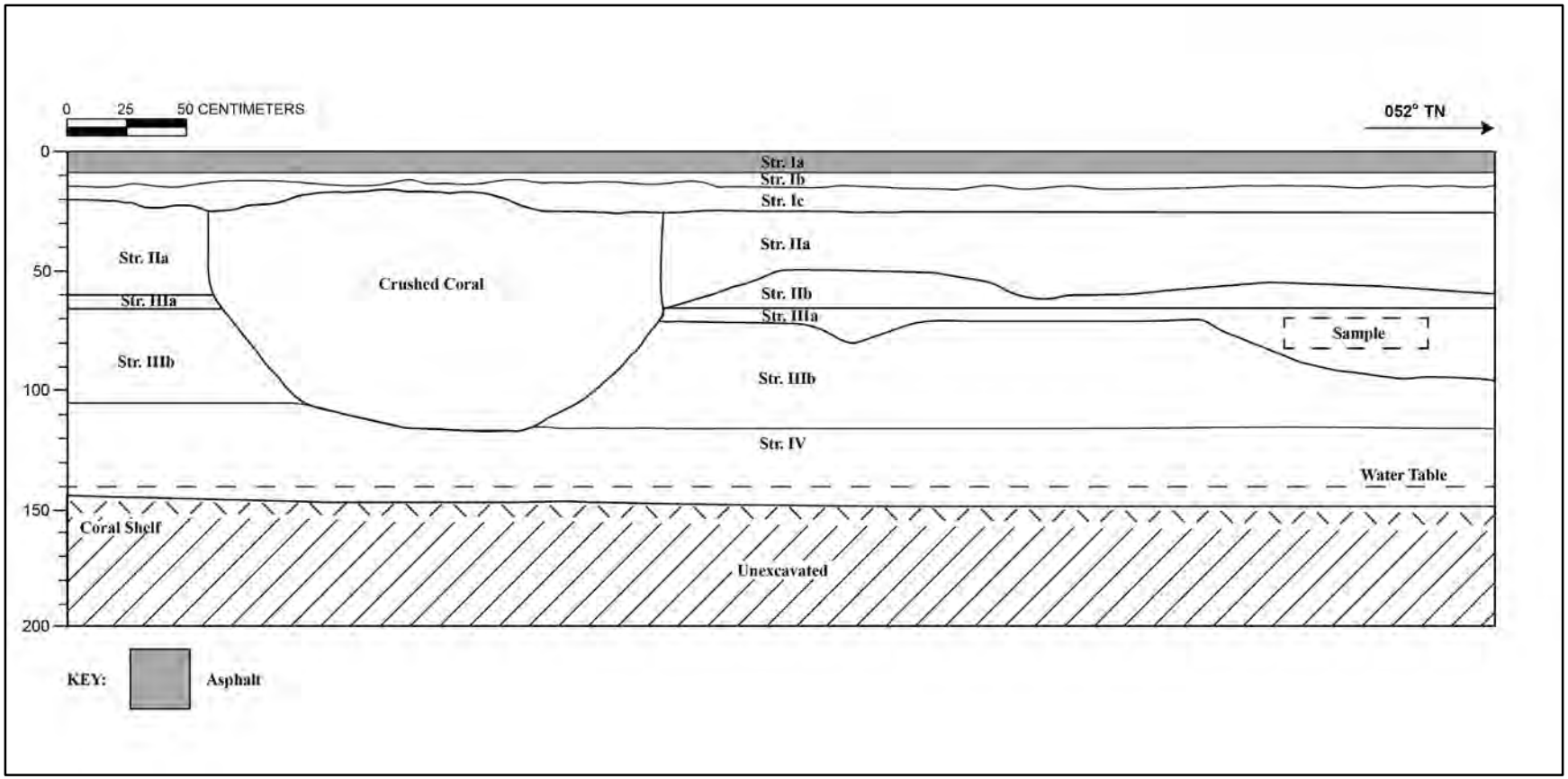

Figure 64. T-3 northwest profile

Table 6. T-3 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–9	Asphalt
Ib	9–15	Fill; 10YR 6/1, gray; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course consisting of mixed fill and coral cobbles
Ic	12–25	Fill; 10YR 4/3, brown; very gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, wavy lower boundary; base course
IIa	15–115	Fill; 2.5Y 7/2, light gray; cobbly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth, discontinuous lower boundary; crushed coral associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	50–65	Fill; 2.5Y 7/1, light gray; fine sand grading to sandy clay; structureless (single-grain); moist, loose consistence; non plastic; marine origin; clear, smooth, discontinuous lower boundary; coralline sand associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	60–95	Natural; 10YR 6/2, light brownish gray; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth, discontinuous lower boundary; few, very fine roots, A horizon; contained a ceramic shard and organic material
IIIb	65–115	Natural; 10YR 8/3, very pale brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand
IV	105–147 (BOE)	Natural; N 6/1 (GLEY 1), greenish gray; sandy clay; weak, fine, crumb structure; wet, slightly sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; wetland deposit; overlying coral shelf

4.2.4 Test Excavation 4 (T-4)

Test Excavation 4 (T-4), an exterior excavation located in the alleyway between the current Office Depot building and Warehouse Building 5, was oriented northeast-southwest and measured 6.15 m long by 0.74 m wide. The base of excavation was determined by the presence of the coral shelf at 1.50 mbs. The stratigraphy of T-4 consisted of asphalt surface (Stratum Ia) and associated base course (Stratum Ib) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) sandy clay (Stratum IIb), overlying a redeposited, locally procured loamy sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), and marine clay (Stratum V) (Figure 65 and Figure 67, and Table 7).

Stratum III consisted of a fine loamy sand that appeared to be comprised of reworked local soil (i.e., A horizon material) deposited over an in situ, loamy sand, A horizon (Stratum IVa) that was truncated during previous ground disturbance activities (Figure 66). Similar reworked loamy sand fill deposits were documented throughout the project area, overlying an in situ A horizon (Stratum IVa) and underlying the Kaka‘ako reclamation fill deposits (Strata IIa and IIb). This local fill material may have been deposited to level and/or build up the ground surface and may have served as a historic land surface for a period of time prior to reclamation activities.

The underlying A horizon (Stratum IVa) contained a small amount of cultural material and was considered a part of SIHP # -7429. In addition to a cluster of C*anis lupus familiaris* (dog) bone fragments, an 8-gallon field screen of the A horizon yielded charcoal flecks, *Tellina palatam* (3.1 g), and a lavender-colored glass fragment (1.8 g).

Figure 65. Photograph of T-4 northwest wall, view to north

Figure 66. Photograph of T-4 northwest wall, showing Stratum III (redeposited local loamy sand, indicated by the arrow) overlying the in situ loamy sand A horizon (Stratum IVa); interface indicated by the dashed white line, view to southwest

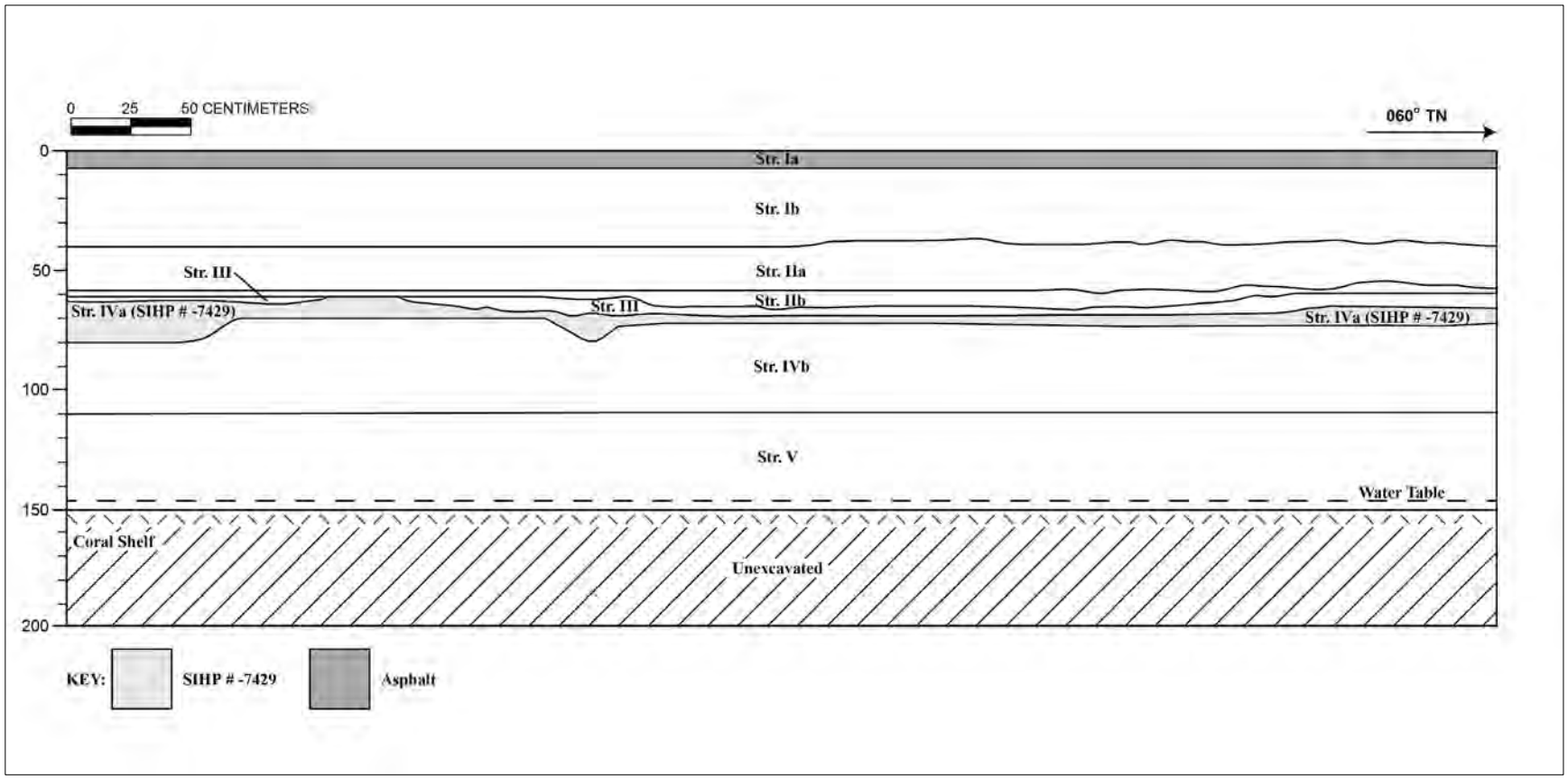

Figure 67. T-4 northwest profile

Table 7. T-4 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–40	Fill; 5YR 3/3 and 10YR 6/4, dark reddish brown and light yellowish brown; extremely gravelly sandy loam; moist consistence; mixed origin; basalt gravel base course with alternating layers of sandy clay and compact coral cobbles
IIa	38–59	Fill; 10YR 8/3, very pale brown; gravelly fine sand; weak, fine, granular structure; moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; fine sand with bands of coarser coral gravels; associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	56–67	Fill; 10YR 6/3, pale brown; fine sandy clay; structureless (massive); moist, friable consistence; non-plastic; marine origin; abrupt, broken/discontinuous lower boundary; hydraulic (dredge) material associated with Kaka‘ako land reclamation activities (1919–1927)
III	61–70	Fill; 10YR 3/2, very dark gray brown; loamy fine sand; weak, fine, crumb structure; moist, loose consistence; non plastic; marine origin; clear, wavy lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	63–80	SIHP # -7429; 10YR 2/2, very dark brown; loamy sand; moist, loose consistence; non-plastic; marine origin; diffuse, wavy lower boundary; few roots; A horizon; contained charcoal flecks, faunal bone, marine shell midden, and a glass fragment
IVb	70–120	Natural; 2.5Y 7/3, pale brown; fine sand; weak, fine, granular structure; moist, loose consistence; non-plastic; marine origin; few roots; Jaucas sand
V	120–150 (BOE)	Natural; 10Y 6/1 (GLEY 1), greenish gray; clay sand; wet, non-sticky consistence; non-plastic; marine deposit; overlying coral shelf

4.2.5 Test Excavation 5 (T-5)

Test Excavation 5 (T-5), an exterior excavation located near Queen Street at the northwest corner of the Office Depot building, was oriented northeast-southwest and measured 6.10 m long by 0.70 m wide. The base of excavation was determined by the presence of the coral shelf at 1.50 mbs. The stratigraphy of T-5 consisted of two layers of asphalt surface (Stratum Ia), associated base course (Stratum Ib), and crushed coralline sand (Stratum Ic), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic (dredge) clay (Stratum II), overlying redeposited, locally procured sandy loam containing historic trash (Strata IIIa and IIIb), overlying a natural sandy loam A horizon (Stratum IVa), Jaucas sand (Stratum IVb), and clay sand wetland sediment (Stratum V) (Figure 68 through Figure 70, and Table 8).

T-5 documented two redeposited, locally procured sandy loam fill deposits, containing historic trash (Strata IIIa and IIIb) and considered part of SIHP # -7429. Stratum IIIa was a discontinuous layer of very dark grayish brown sediment containing small glass and ceramic fragments, charcoal, rusted metal; portions of it appeared to have been partly removed prior to or during the deposition of hydraulic clay fill (Stratum II). The underlying Stratum IIIb was a somewhat lighter colored discontinuous loamy sand layer, similar to the locally procured sand fill documented within the surrounding test excavations and which likely served as a living surface for a period of time prior to Kaka‘ako land reclamation. Stratum IIIb contained small glass fragments, rusted metal, a ceramic utility pipe fragment, and faunal material (Figure 71 and Figure 72). Faunal material consisted of fish vertebra (7.3 g), *Canis lupus familiaris* (dog) vertebra fragments (0.1 g), *Bos taurus* (cow) rib and long bone fragments (cut with a metal saw blade—cut marks (kerf) and striations visible along the cross-section were consistent with blades used in commercial butcher shops) (17.6 g), and a cow molar (4.8 g). Faunal material was also identified within the overlying Stratum Ic fill consisting of cf. *Sus scrofa* (pig) irregular bone fragments (1.4 g) and a *Bos taurus* rib fragment and an unmodified foot bone (60.3 g); all but the cow foot bone, were cut with a metal saw blade. Cut marks (kerf) and striations visible along the cross-section were consistent with blades used in commercial butcher shops.

T-5 also documented undulating natural topography as evidenced by high sand deposits within the *makai* portion of the trench which sloped gently down in the *mauka* direction where the terrestrial loamy sand A horizon transitioned to a more clay sand wetland A horizon. The low lying *mauka* portion of T-5 likely sustained periodic inundations of water. The redeposited sand fill layers (Strata IIIa and IIIb) were located over top this low-lying area and may reflect historic efforts to level the low lying wetlands prior to Kaka‘ako land reclamation efforts. The natural A horizon was carefully inspected (100% hand troweled), however, no cultural material was identified.

Figure 68. Photograph of T-5 southeast wall, view to south

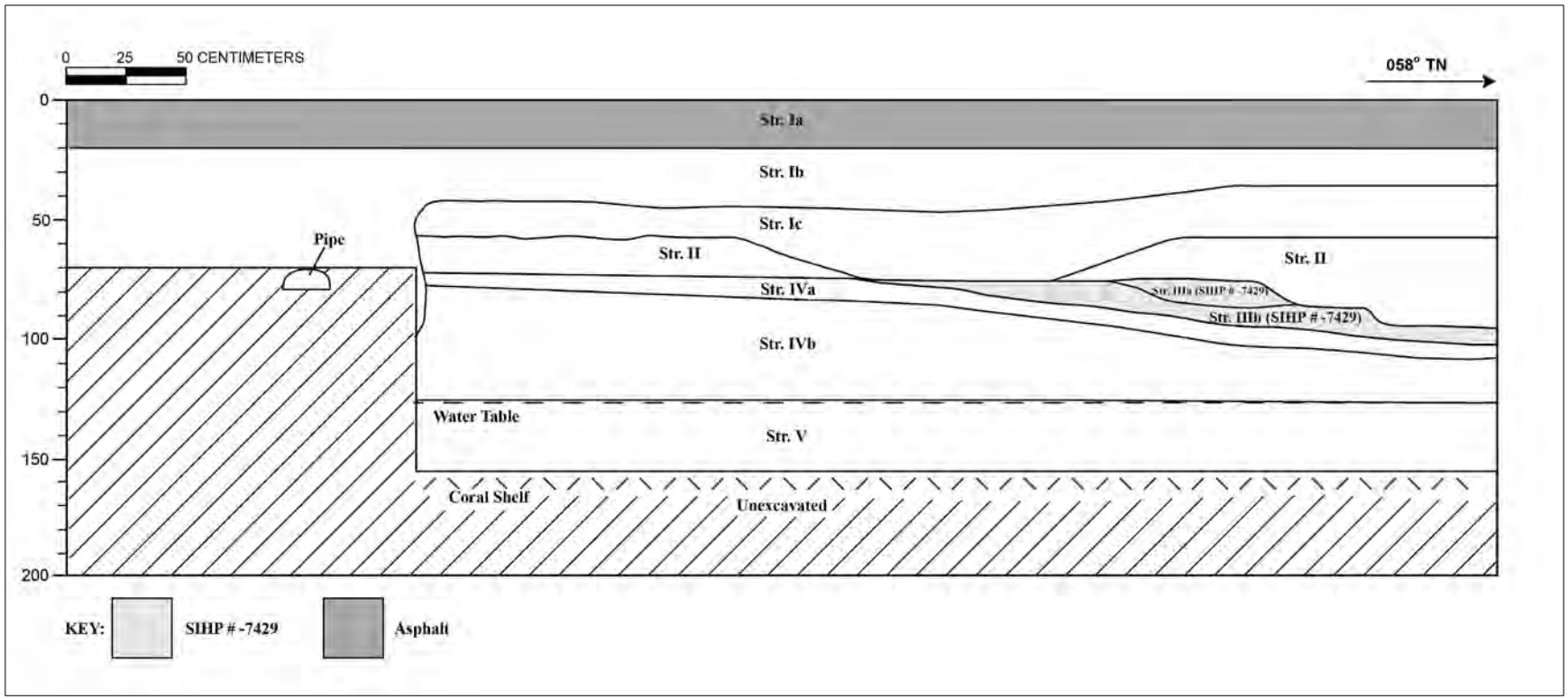

Figure 69. T-5 northwest profile

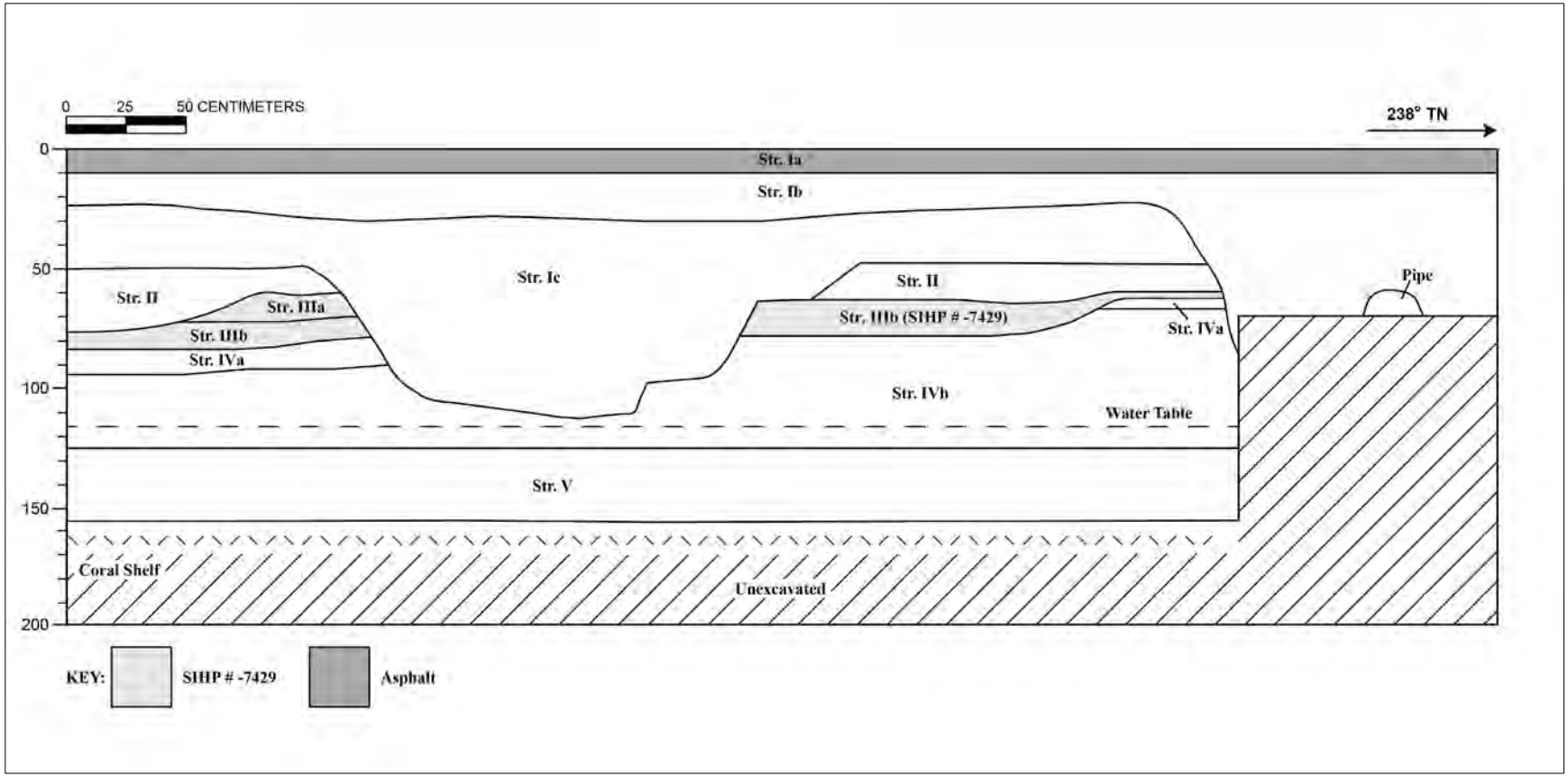

Figure 70. T-5 southeast profile

Table 8. T-5 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–10	Asphalt
Ib	10–30	Fill; 5YR 3/2, dark reddish brown; very gravelly loamy sand; moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary; mixed fill consisting of very compact base course and imported coral
Ic	20–115	Fill; 2.5Y 7/3, pale brown; gravelly coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; marine fill consisting of sand and shell fragments and about 5-10% coral gravels/small cobble inclusions; contained faunal bone
II	49–77	Fill; 10YR 7/2, light gray; clay; structureless (massive); moist, firm consistence; very plastic; marine origin; abrupt, smooth lower boundary; more sand content toward top of horizon; hydraulic (dredge) material associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	62–72	SIHP # -7429; 10YR 3/2, very dark grayish brown; sandy loam; weak, fine, granular structure; moist, loose consistence; non-plastic; marine origin; clear, smooth, and broken/discontinuous lower boundary; locally procured sand; contained small glass and ceramic fragments and charcoal flecks
IIIb	65–85	SIHP # -7429; 10YR 4/2, dark grayish brown; loamy sand; weak, medium, granular structure; moist, loose; clear, wavy lower boundary; locally procured sand; contained glass fragments, rusted metal, and faunal bone
IVa	64–95	Natural; 10YR 3/2–10YR 4/1, very dark grayish brown to dark gray; fine sandy loam; weak, fine crumb structure; moist, loose consistence; non-plastic; marine origin; diffuse, broken/discontinuous lower boundary; sand A horizon within the *makai* portion of the trench grading to a more clay sand A horizon in the *mauka* portion
IVb	90–125	Natural; 10YR 6/4, light yellow brown; fine sand; weak, fine, granular structure; moist, loose consistence; non-plastic, marine origin; common roots; Jaucas sand
V	125–155 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; clay sand; weak, granular structure; wet, slightly sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; overlying coral shelf

Figure 71. T-5 southeast wall, close-up of Stratum IIIb (sand fill) overlying Stratum IVa (natural A horizon), view to south

Figure 72. Photograph of T-5, *mauka* portion, showing redeposited sand fill layers (Strata IIIa and IIIb) overlying a clay sand A horizon (Stratum IVa), view to northeast

4.2.6 Test Excavation 6 (T 6)

Test Excavation 6 (T 6), an exterior excavation located near Queen Street at the northwest corner of the Office Depot building, was oriented northeast-southwest and measured 6.10 m long by 0.70 m wide. The base of excavation was determined by the presence of the coral shelf at 1.48 mbs. The stratigraphy of T 6 consisted of asphalt surface (Stratum Ia), associated base course mixed with asphalt (Stratum Ib), and crushed coral utility fill (Stratum Ic), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of coarse cobbly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) fine sandy clay (Stratum IIb), overlying a redeposited locally procured loamy sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), a clay sand marine deposit (Stratum V), and gravelly marine sand (Stratum VI) (Figure 73 and Figure 74, and Table 9).

T-6 documented multiple episodes of historic landscape alterations. Overlying and truncating the natural loamy sand A horizon (Stratum IVa) was a deposit of mixed loamy sand (Stratum III), likely locally procured and utilized to level and/or build up the ground surface. This alteration of the natural landscape occurred sometime prior to the 1919–1927 Kaka‘ako reclamation activities which deposited hydraulic dredge (Stratum IVb) and crushed coral (Stratum IVa) overtop Stratum III. A small amount of glass bottle fragments was identified in both the hydraulic dredge and the redeposited sand fills, substantiating a historic time period for these land modifications.

A 1-gallon field screen of the A horizon (Stratum IVa) yielded small amounts of charcoal flecking, natural marine shell, and brackish water snails. Careful troweling of the remaining material indicated a culturally sterile matrix.

Figure 73. Photograph of T-6 northwest wall, view to north

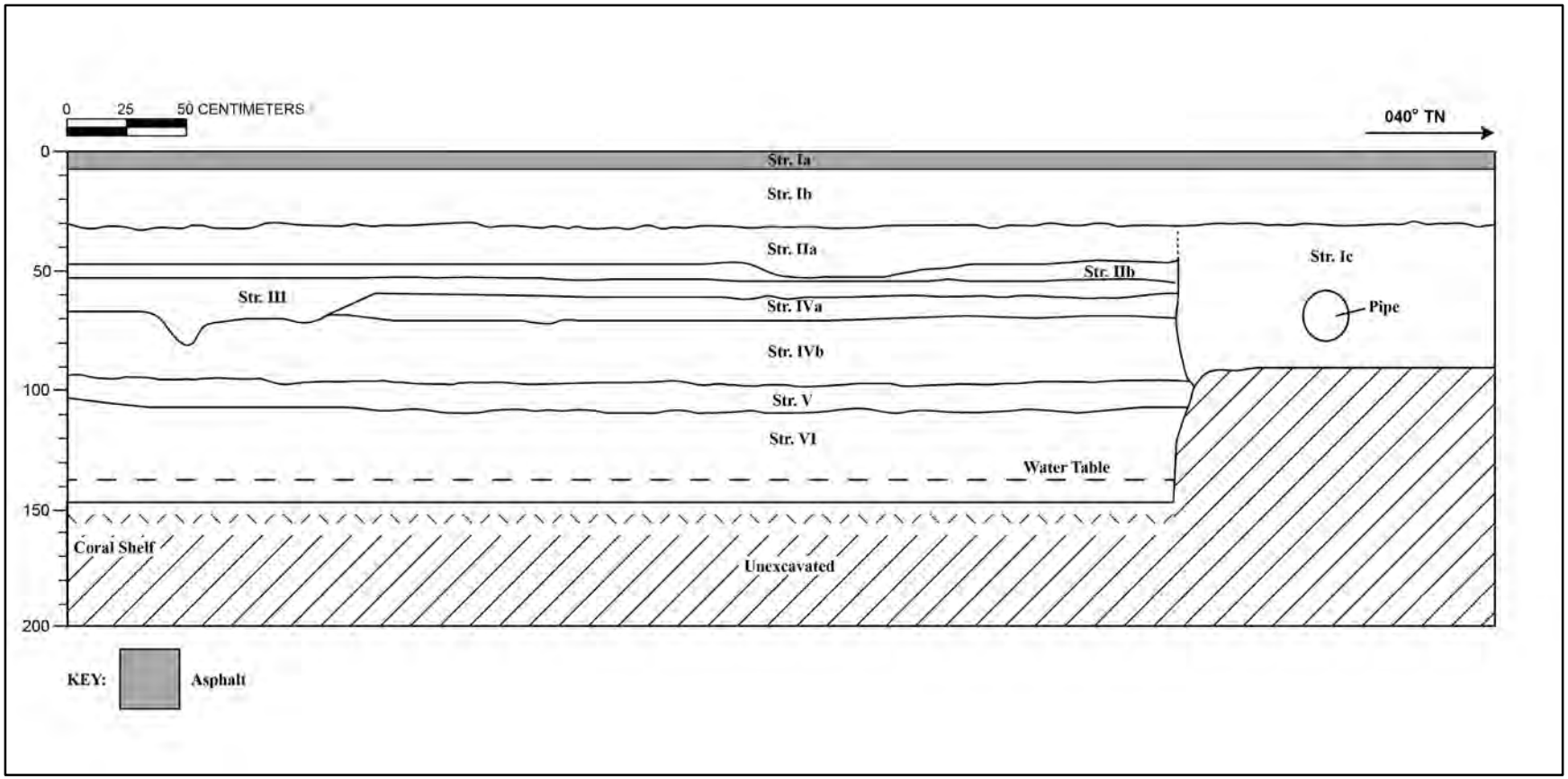

Figure 74. T-6 northwest profile

Table 9. T-6 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–33	Fill; 7.5YR 3/2, dark brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; mixed base course and asphalt fill layer
Ic	45–100	Fill; 10YR 5/3, brown; gravelly sandy loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; marine origin; lower boundary not visible; crushed coral fill containing a utility pipe
IIa	33–48	Fill; 10YR 8/2, very pale brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, discontinuous lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	47–55	Fill; 10Y 6/1 (GLEY 1), light greenish gray; fine sandy clay; moderate, fine, platy structure; moist, very friable; non-plastic; marine origin; clear, discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927); contained small glass fragments
III	55–83	Fill; 10YR 5/3, brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary; redeposited, likely locally procured sand utilized for land modification; contained small glass fragments
IVa	60–71	Natural; 10YR 3/2, very dark grayish brown; sandy loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; A horizon; contained small amounts of charcoal, natural marine shell, and brackish water snails
IVb	70–98	Natural; 10YR 5/4, yellowish brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand
V	98–110	Natural; 10YR 7/3, very pale brown; clay sand; moderate, coarse, crumb structure; slightly sticky; marine origin; clear, smooth lower boundary; marine clay sand
VI	110–148 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; gravelly sand; structureless (single-grain); wet, sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; overlying coral shelf

4.2.7 Test Excavation 7 (T-7)

Test Excavation 7 (T-7), an interior excavation located within the loading dock of the former Nordstrom Rack building in the southwest corner of the project area, was oriented southeast-northwest and measured 6.2 m long by 0.6 m wide. The base of excavation was initially determined by the presence of the water table; however, excavations continued for an additional 0.12 m to a maximum depth of 1.7 mbs. The stratigraphy of T-7 consisted of the concrete surface (Stratum Ia), a buried asphalt layer (Stratum Ib), and associated base course (Stratum Ic) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly coarse sand (crushed coral) (Stratum IIa) and hydraulic (dredge) sandy clay (Stratum IIb) overlying a possible disturbed natural loam A horizon (Stratum III) and natural marine sand (Stratum IV) (Figure 75 through Figure 77, and Table 10). A metal utility pipe with an associated utility pit was observed in the central portion of T-7 and a 1-m thick concrete slab was observed in the south (*makai*) end; as a result, portions of T-7 were left unexcavated.

T-7 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686. According to mid-twentieth century aerial photographs and maps, three rectangular warehouse structures were constructed within the project area sometime between 1939 and 1943. T-7 documented a concrete footing located immediately below the current concrete loading dock floor, which appeared to mark the edge of the northernmost warehouse. Identified just north of the concrete footing was a buried asphalt layer (Stratum Ib) and associated base course (Stratum Ic), also immediately below the concrete surface, which likely represented the asphalt alleyway alongside the warehouse and which was associated with the commercial complex.

Located beneath the warehouse and roadway remnants were Kaka‘ako reclamation fill deposits (Strata IIa and IIb) overlying natural wetland sediment (Stratum IV), including a disturbed wetland A horizon containing organics (Stratum III).

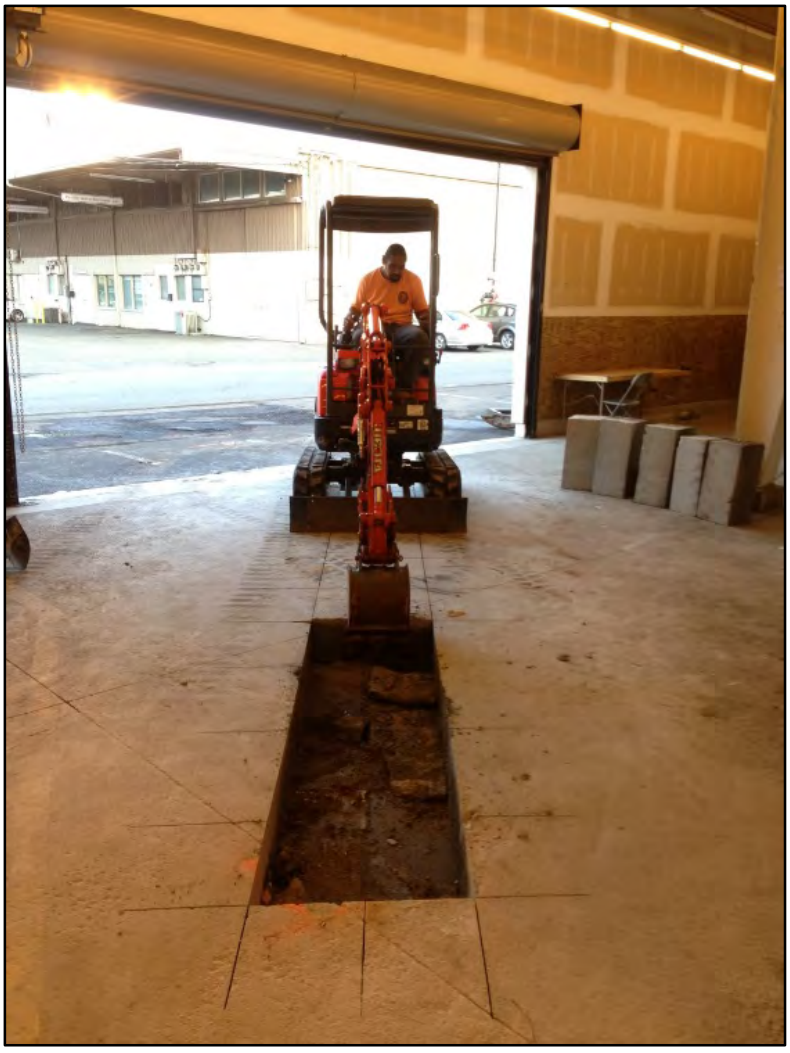

Figure 75. Location of T-7 within the loading dock of the former Nordstrom Rack building, showing removal of the thick concrete loading dock slab

Figure 76. Photograph of T-7 east wall, view to north

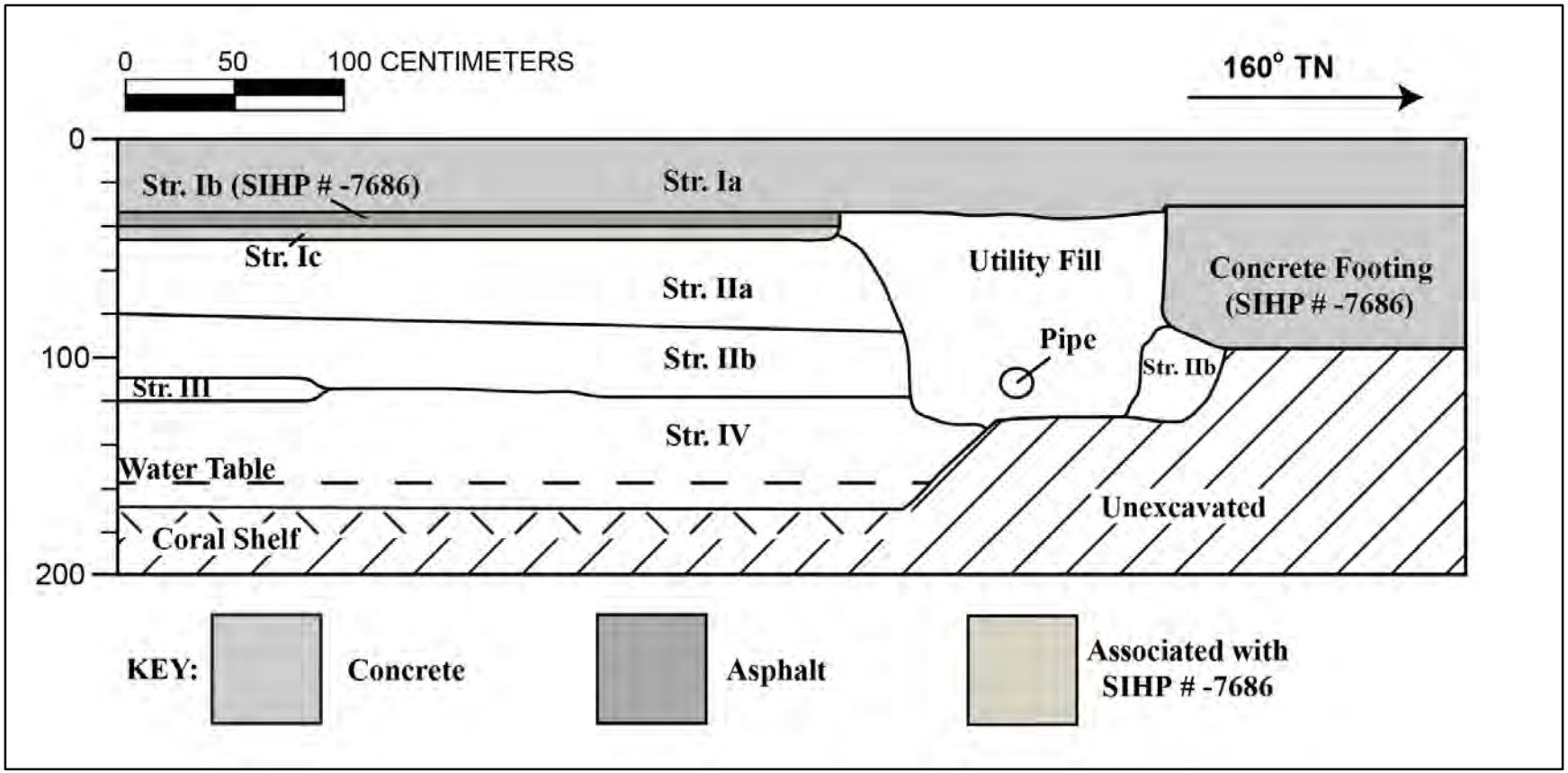

Figure 77. T-7 east profile

Table 10. T-7 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–35	Concrete; single slab
Ib	35–40	SIHP # -7686; buried asphalt roadway and concrete footing associated with commercial warehouse
Ic	40–47	Fill; 5YR 3/2, dark reddish brown; very gravelly silty loam; weak, fine, granular structure; dry, loose consistence; slightly plastic; mixed origin; abrupt, broken/discontinuous lower boundary; base course
IIa	47–85	Fill; 2.5Y 7/2, light gray; very gravelly coarse sand; structureless (single-grain); dry, loose consistence; non-plastic; marine origin; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	80–130	Fill; 10Y 8/1 (GLEY 1), light greenish gray with 10YR 8/2 striations; fine sandy clay; structureless (massive); moist, firm consistence; plastic; marine origin; abrupt, smooth lower boundary; few fine roots; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	110–121	Natural; 10YR 3/2, very dark grayish brown; loam; moderate, medium, platy structure; moist, friable consistence; slightly plastic; terrigenous origin; clear, broken/discontinuous lower boundary; many fine roots; possible disturbed A horizon
IV	115–170	Natural; 5G 6/1 (GLEY 1), greenish gray; sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; few fine roots at upper boundary; marine sediment

4.2.8 Test Excavation 8 (T-8)

Test Excavation 8 (T-8), an interior excavation located within the back storage space of the former Nordstrom Rack building, was oriented southwest-northeast and measured 6.2 m long by 0.6 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.92 mbs. The stratigraphy of T-8 consisted of the concrete surface (Stratum Ia), associated base course (Stratum Ib), a buried concrete surface (Stratum Ic), and associated base course (Stratum Id), 1919–1927 Kaka‘ako reclamation fill deposits consisting of cobbly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb) overlying a wetland loamy clay A horizon (Stratum IIIa) and wetland clay sand (Stratum IIIb). (Figure 78,

Figure 79, and Figure 81, and Table 11). Three utility fill deposits were also observed within the central portion of the trench overlying a utility line (Strata Ie–Ig).

Due to spatial limitations, excavation methods were altered slightly by excavating and backfilling the *mauka* and *makai* portions of the trench separately. The stratigraphy was consistent in both the *mauka* and *makai* halves, documenting natural wetland sediments beneath modern and historic fill deposits.

As with T-7, T-8 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686 (Figure 80). The warehouse remnants consisted of a buried concrete surface (Stratum Ic) and associated base course (Stratum Id), which extended across the length of the test excavation. The current commercial building surface (Stratum Ia), including the associated base course (Stratum Ib), was constructed directly over top this earlier commercial surface.

Located beneath the warehouse remnants were Kaka‘ako reclamation fill deposits (Strata IIa and IIb) overlying a natural wetland A horizon (Stratum IIIa) and wetland clay sand (Stratum IIIb).

Figure 78. Location of T-8 within the back storage area of commercial space

Figure 79. Photograph of T-8 southeast wall, view to east

Figure 80. T-8, historic concrete foundation (Stratum Ic, SIHP # -7686), view to east

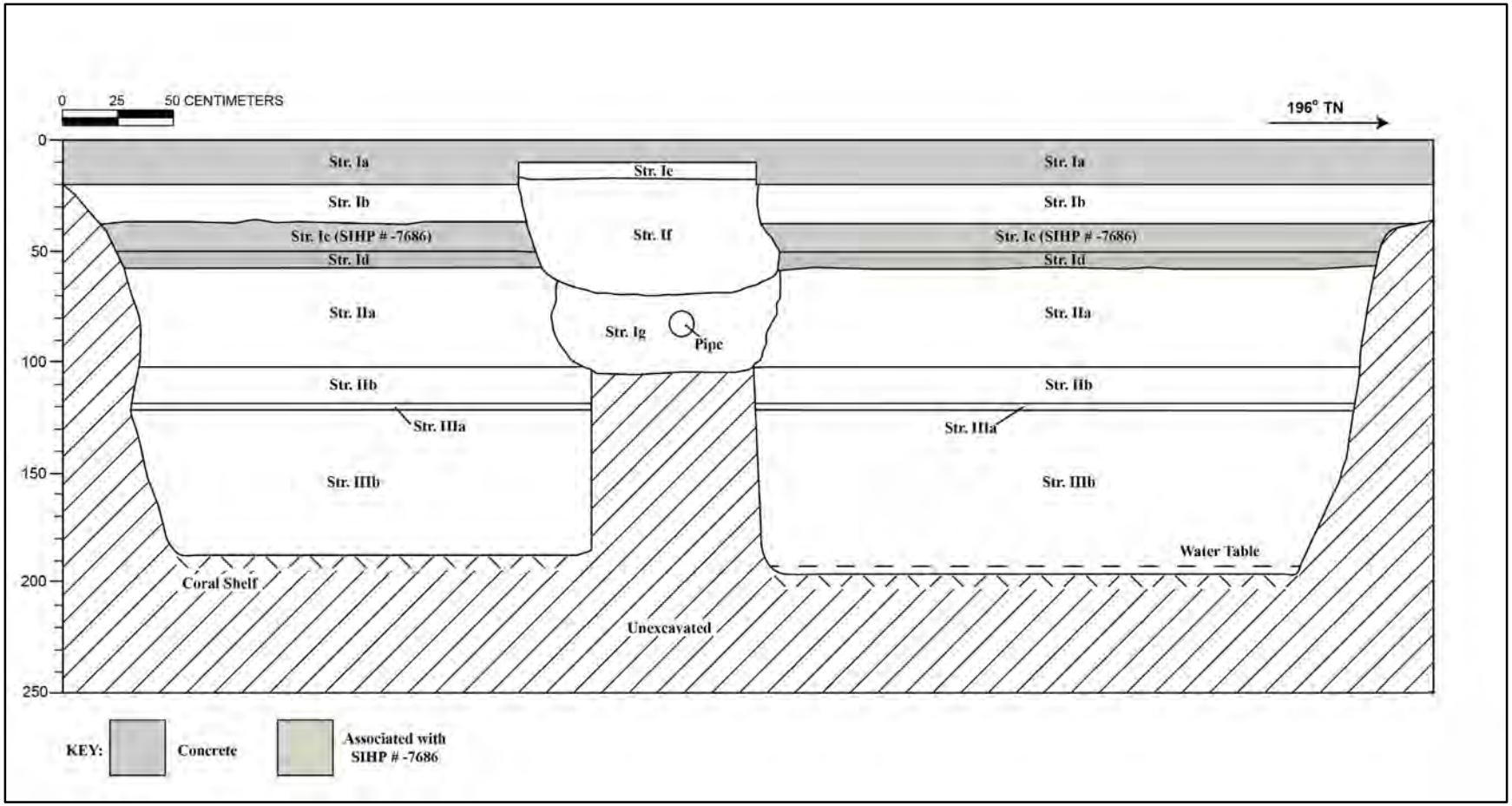

Figure 81. T-8 southeast profile

Table 11. T-8 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–20	Concrete
Ib	20–37	Fill; 10YR 3/6 dark yellowish brown; very gravelly silty loam; weak, very fine structure; moist, loose consistence; slightly plastic; terrigenous origin; abrupt, smooth lower boundary; base course
Ic	37–50	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Id	50–58	Fill; 10YR 2/2, very dark brown; gravelly clay loam; moderate, fine, crumb structure; moist, loose consistence; slightly plastic; terrigenous origin; abrupt, smooth lower boundary; base course
Ie	10–17	Fill; 10YR 3/3, dark brown; very gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; fill associated with utility
If	17–69	Fill; 10YR 5/2, grayish brown; gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; fill associated with utility
Ig	59–104	Fill; 10YR 3/2, very dark grayish brown with 3% small mottles of 2.5YR 4/6, red; sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; fill associated with utility
IIa	58–105	Fill; 10YR 8/2, very pale brown; cobbly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	105–119	Fill; 10YR 8/2, very pale brown; clay; structureless (massive); sticky consistence; very plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	119–122	Natural; 10YR 2/1, black; loamy clay; structureless (massive); wet, slightly sticky consistence; plastic; marine origin; common, very fine roots; diffuse, smooth lower boundary; humus O horizon; contains organics and few brackish water snails
IIIb	122–192 (BOE)	Natural; 5G 5/1 (GLEY 1), greenish gray; clay sand grading to coarse sand; structureless (massive); wet, slightly sticky consistence; plastic; common, very fine to fine roots; abrupt, smooth lower boundary; wetland sediment containing organics in the upper portion; overlying coral shelf

4.2.9 Test Excavation 9 (T-9)

Test Excavation 9 (T-9), an interior excavation located within the former Nordstrom Rack building, was oriented north-south and measured 6.1 m long by 0.6 m wide. The base of excavation was initially determined by the presence of the water table; however, excavations continued for an additional 0.15 m to a maximum depth of 1.65 mbs. The stratigraphy of T-9 consisted of a concrete and laminated tile surface (Stratum Ia) and associated base course (Stratum Ib) overlying a buried asphalt surface (Stratum Ic) and associated base course (Stratum Id) within the southern portion of the trench and a buried concrete surface (Stratum Ie) and associated base course (Stratum If) within the northern portion. These modern infrastructure layers overlay 1919–1927 Kaka‘ako reclamation fill deposits consisting of extremely gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb), a redeposited, locally procured loamy sand (Stratum III), a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), and marine clay sand sediment (Stratum V) (Figure 82 through Figure 84, Figure 86, and Table 12).

Due to spatial limitations, excavation methods were altered slightly by excavating and backfilling the *mauka* and *makai* portions of the trench separately. A concrete footing with a large concrete base was observed toward the southern (*makai*) end of T-9, running southeast-northwest.

Similar to T-7, T-9 documented remnants of a commercial warehouse along with remnants of the adjacent, contemporaneous asphalt alleyway (SIHP # -7686) (Figure 85). Within the southern portion of T-9, a concrete footing abutted remnants of a concrete surface (Stratum Ie) and associated base course (Stratum If), marking the edge of the commercial warehouse (Figure 83 and Figure 87). Within the northern portion of T-9, a buried asphalt surface (Stratum Ic) and associated base course (Stratum Id) likely represented the asphalt alleyway alongside the warehouse and was associated with the commercial complex.

Beneath the remnant commercial infrastructure, T-9 documented a culturally sterile loamy sand A horizon (Stratum IVa). A 5-gallon screen of the A horizon yielded no cultural content. A very shallow, linear discoloration of sediment matrix that measured approximately 1.8 m in length by 0.3 m wide by 3 cm deep extended from the A horizon into the underlying Jaucas sand. Given its ephemeral signature, the discoloration was interpreted as representative of natural erosion processes or an undulation within the A horizon (Figure 88). A 5-gallon screen of the sediment yielded no content.

Figure 82. Location of T-9 within the back room of the former Nordstrom Rack commercial store

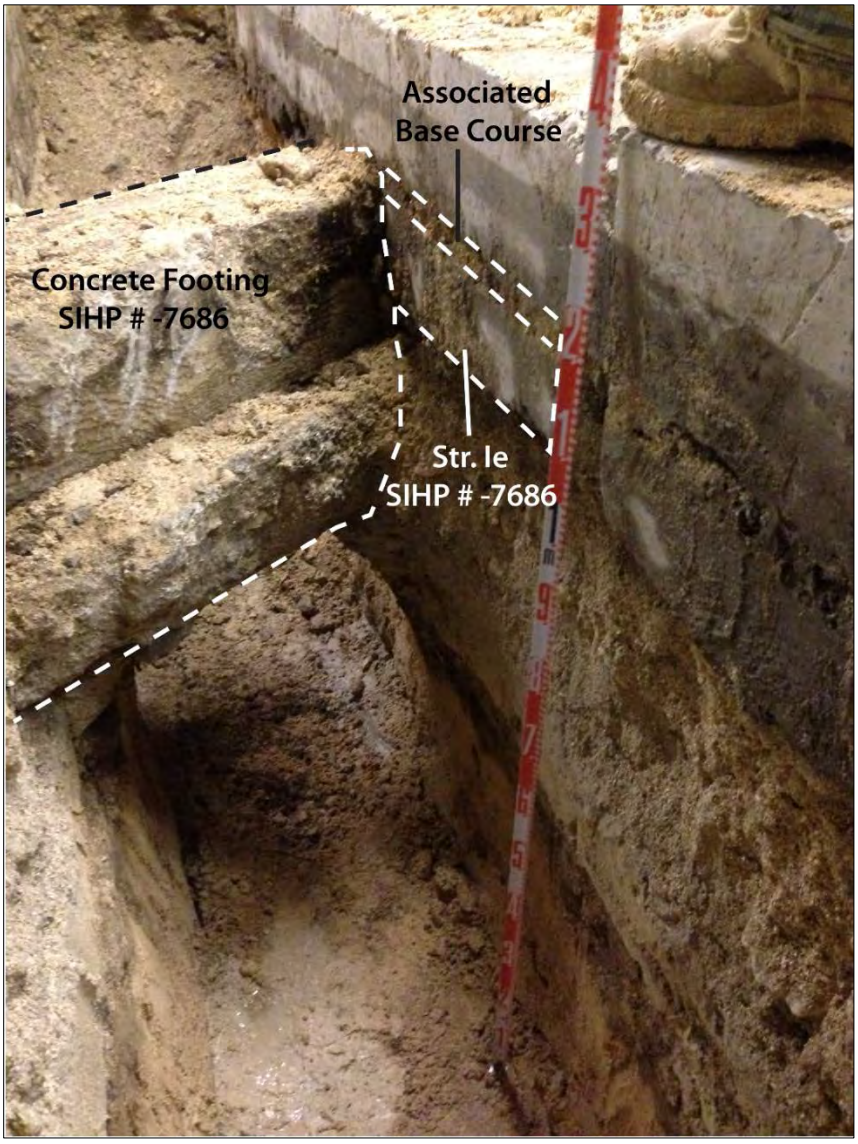

Figure 83. T-9 east sidewall, showing the current concrete surface overlying a thin layer of base course, a buried concrete surface (SIHP # -7686), and a concrete footing extending across the width of the test excavation, view to south

Figure 84. T-9, close-up photograph of crushed coral (Stratum IIa), hydraulic fill (Stratum IIb), and redeposited local sand fill (Stratum III) overlying a thin, dark-stained A horizon (Stratum IVa), and Jaucas sand (Stratum IVb)

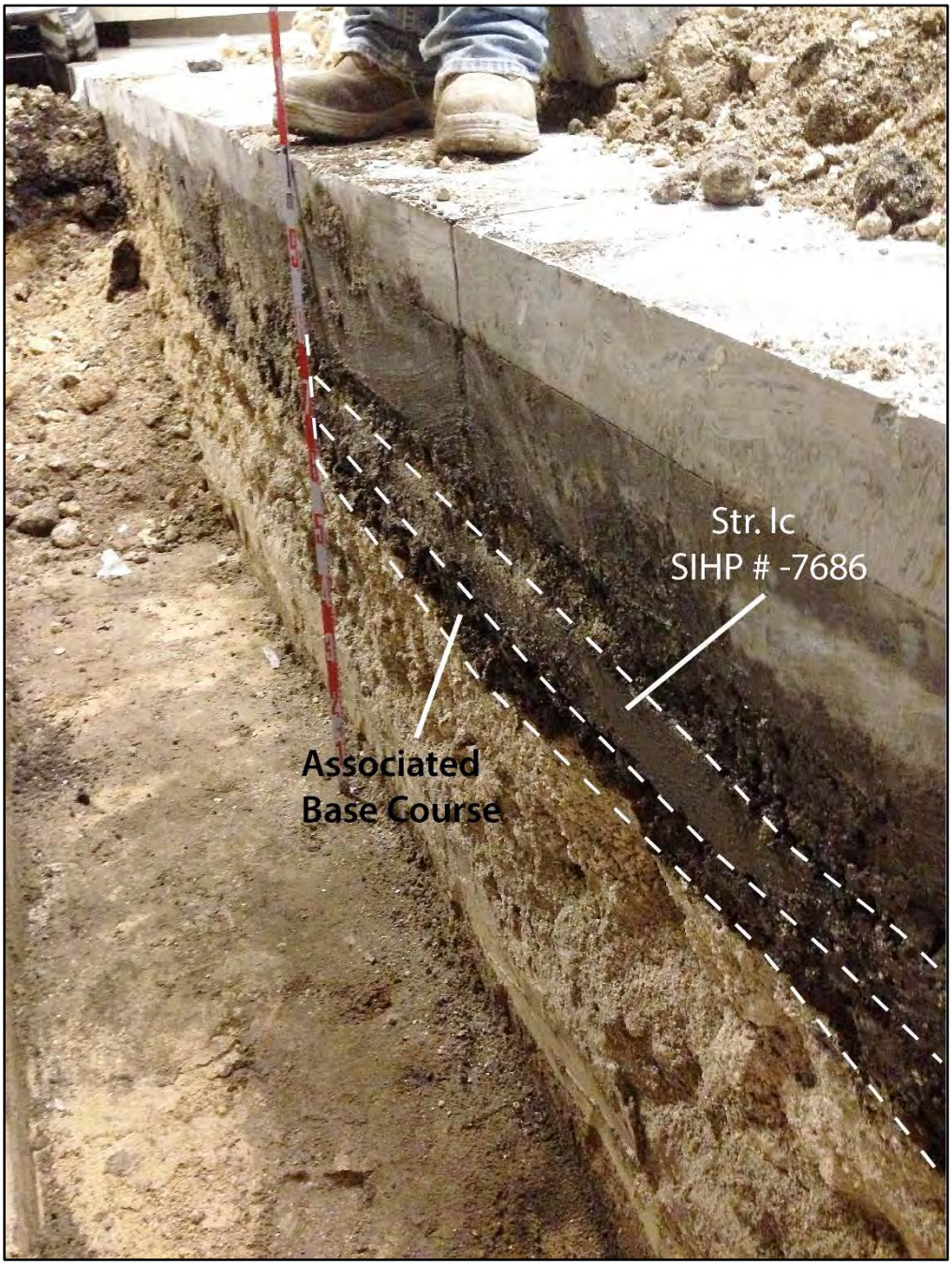

Figure 85. T-9 showing Stratum Ic (asphalt, SIHP # -7686) and associated base course, view to north

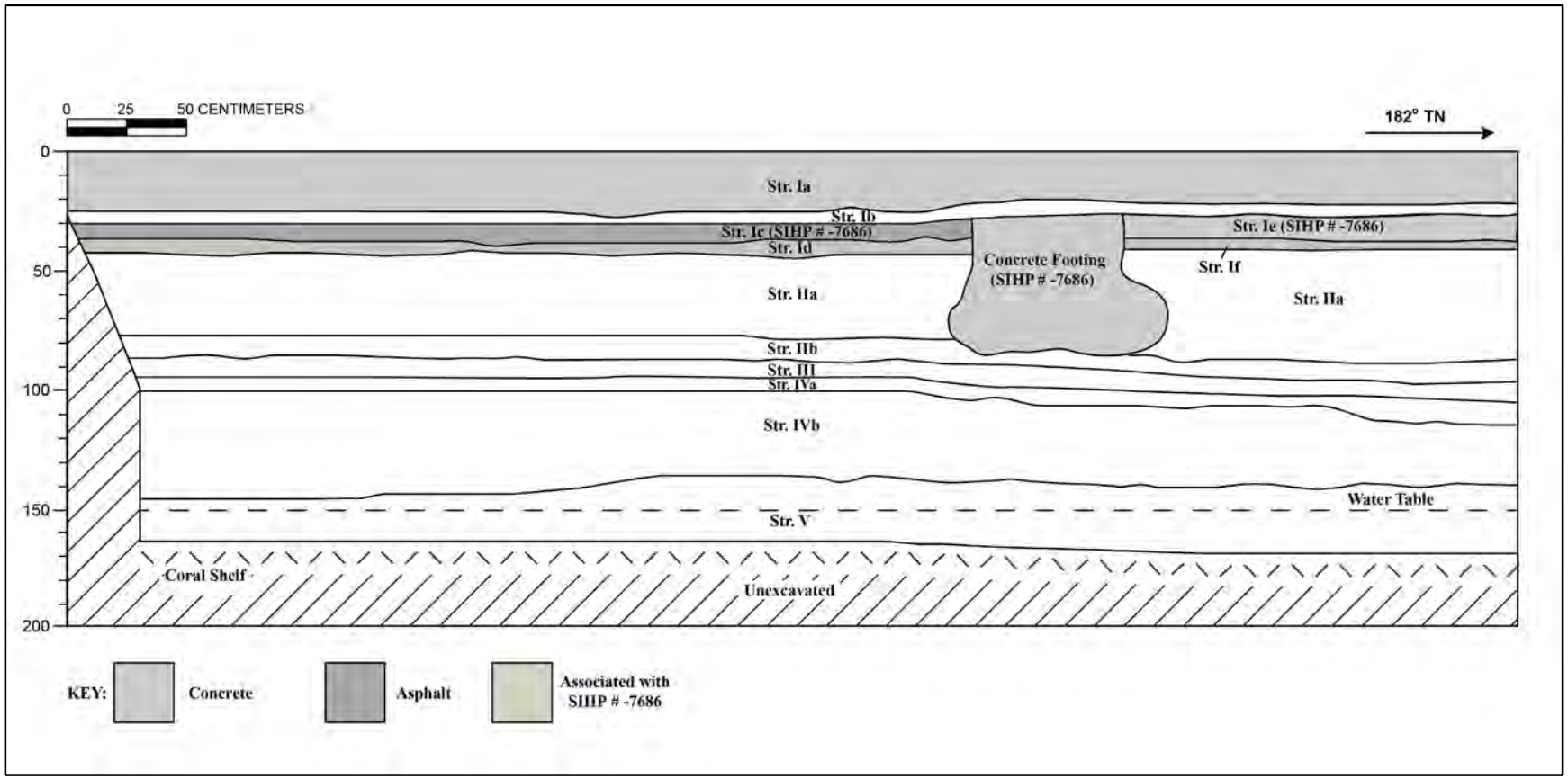

Figure 86. T-9 east profile

Table 12. T-9 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–25	Concrete/tile surface
Ib	21–30	Fill; 10YR 2/2, very dark brown; extremely gravelly sandy loam; structureless (single-grain); wet, non-sticky consistence; non-plastic; terrigenous origin; very abrupt, smooth lower boundary; base course
Ic	26–38	SIHP # -7686; buried asphalt roadway associated with commercial warehouse infrastructure
Id	35–43	Fill; 10YR 3/2, very dark grayish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
Ie	26–37	SIHP # -7686; concrete surface and concrete footing associated with commercial warehouse infrastructure
If	37–40	Fill; 10YR 3/2, very dark grayish brown; extremely gravelly sandy loam; weak, fine, crumb structure; moist, loose consistence; non-plastic, terrigenous origin; clear, smooth lower boundary; base course
IIa	40–86	Fill; 10YR 8/2, very pale brown; extremely gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, wavy lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	78–95	Fill; 10YR 7/3, very pale brown; clay; structureless (massive); moist, very friable consistence; very plastic; marine origin; very abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	86–100	Fill; 10YR 4/2, dark yellowish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	97–113	Natural; 10YR 3/2, very dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary; A horizon
IVb	100–145	Natural; 10YR 7/4, very pale brown; sand grading into clay sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand
V	135–170 (BOE)	Natural; 10Y 8/1 (GLEY 1), light greenish gray; clay sand; structureless (single-grain); wet, non-sticky consistence; slightly plastic; marine origin; few fine-medium decomposing roots; abrupt, smooth lower boundary; marine sediment; overlying coral shelf

Figure 87. Photograph of T-9 showing a concrete footing associated with SIHP # -7686, view to north

Figure 88. Photograph of shallow, linear discoloration extending from the A horizon into Jaucas sand, view to south

4.2.10 Test Excavation 10 (T-10)

Test Excavation 10 (T-10), an interior excavation located in the stockroom of the Office Depot building, was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide. The base of excavation was determined by the presence of the water table at 1.45 mbs. The stratigraphy of T-10 consisted of the current concrete surface (Stratum Ia), a buried concrete surface (Stratum Ib), associated base course (Stratum Ic), and gravelly sand utility fill material (Stratum Id), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of coarse sand (crushed coral) (Stratum IIa) and hydraulic (dredge) fine silty sand marine sandy clay (Stratum IV), and marine sand (Stratum V) (Figure 89 and Figure 90, and Table 13). Strata Ic, IIa, IIb, IIIa, and IIIb were truncated in the southwest (*makai*) end by previous ground disturbance activities, possibly related to a utility installation, then subsequently filled with crushed coralline sand mixed with oxidized metal fragments and broken glass (Stratum Id).

As with T-7 through T-9, T-10 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic) that extended across the length of the test excavation. The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial surface.

Beneath the remnant commercial infrastructure, T-10 documented a disturbed buried A horizon (Stratum IIIa) heavily striated with Jaucas sand, below the crushed coral and hydraulic fill material associated with land reclamation (1919–1927). Stratum IIIa had an abrupt to diffuse irregular, broken lower boundary (Figure 91). A bulk sample of the A horizon (11 gallons) was screened in the field; no cultural material was observed.

Figure 89. Photograph of T-10 northwest wall, view to southwest

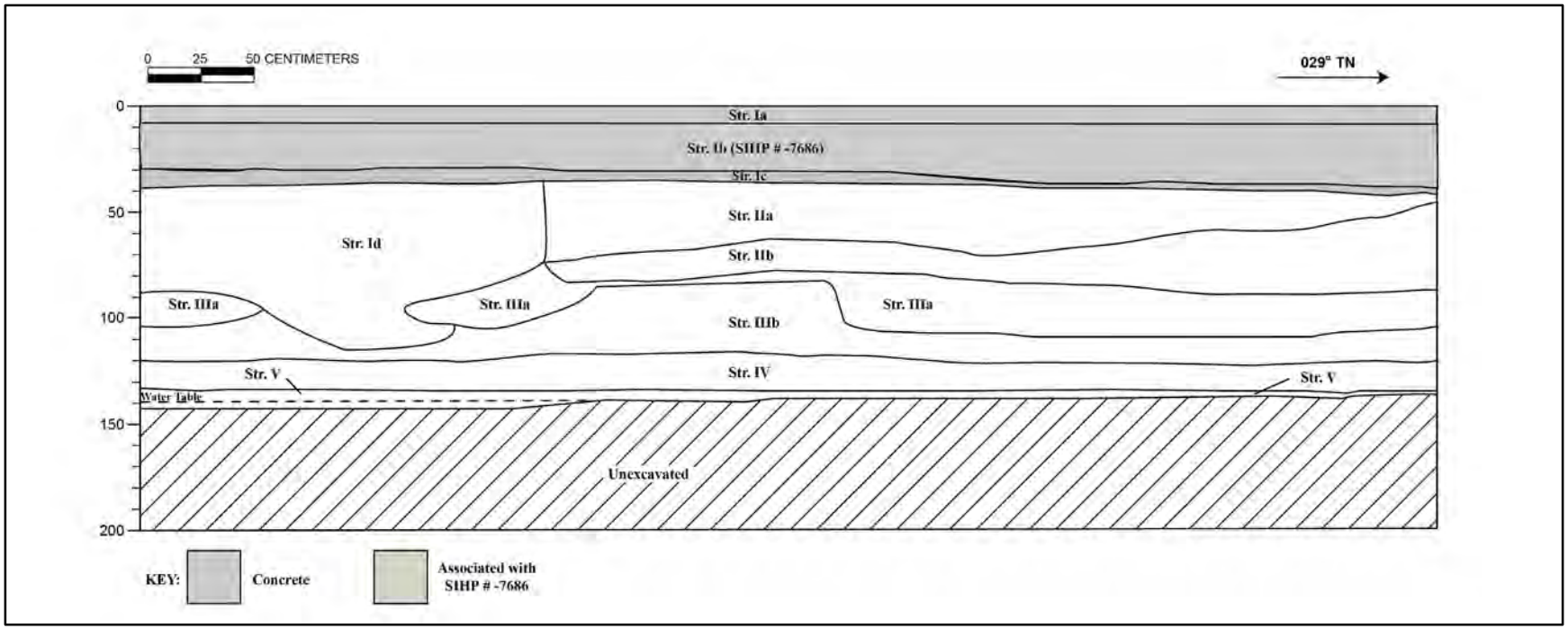

Figure 90. T-10 northwest profile

Table 13. T-10 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–7	Concrete; current commercial floor
Ib	7–40	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	32–42	Fill; 10YR 3/2, very dark grayish brown; gravel; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; no roots observed; gravel base course
Id	37–115	Fill; 10YR 7/6, yellow; gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; no roots observed; utility fill (contains oxidized crushed coral)
IIa	42–75	Fill; 10YR 6/2, light brownish gray; cobbly, gravelly coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken/ discontinuous lower boundary; no roots observed; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	49–88	Fill; 10YR 6/2, light brownish gray; silty fine sand; weak, fine, crumb structure; moist, very friable consistence; non-plastic; marine origin; clear, broken/ discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	75–110	Natural; 10YR 4/2, dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt to diffuse, wavy/broken lower boundary; disturbed A horizon
IIIb	83–132	Natural; 10YR 7/3, very pale brown; coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand
IV	121–135	Natural; 10YR 7/3, very pale brown; sandy clay; weak, fine, crumb structure; moist, very friable to friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; common fine roots; marine sediment
V	135–145 (BOE)	Natural; 5G 7/1 (GLEY 1), light greenish gray; coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; lower boundary not visible; few fine roots; marine sediment

Figure 91. Photograph of T-10 southeast sidewall, showing the Stratum IIIa undulating lower boundary, view to northeast

4.2.11 Test Excavation 11 (T-11)

Test Excavation 11 (T-11), an interior excavation located within the stockroom of the Office Depot building, was oriented southwest-northeast and measured 6.1 m long by 0.6 m wide. The base of excavation was determined by the presence of the water table at 1.48 mbs. The stratigraphy of T-11 consisted of the concrete surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of extremely gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) very fine sand (Stratum IIb) overlying a redeposited, locally procured fine sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), loamy sand wetland sediment (Stratum V), and marine sand (Stratum VI) (Figure 92 and Figure 93, and Table 14).

Similar to T-10, T-11 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) that extended across the length of the test excavation. The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial surface.

Beneath the remnant commercial infrastructure, T-11 documented a deposit of fine sand (Stratum III) that likely consisted of redeposited, locally procured sediment overlying an in situ, loamy sand A horizon (Stratum IVa). Similar reworked loamy sand or sand fill deposits were documented throughout the project area, overlying an in situ A horizon (Stratum IVa) and underlying the Kaka‘ako reclamation fill deposits (Strata IIa and IIb). This local fill material may have been deposited to level and/or build up the ground surface and may have served as a historic land surface for a period of time prior to reclamation activities.

The natural A horizon (Stratum IVa) evidenced a slightly scalloped, undulating lower boundary, while the upper boundary appeared to have been truncated by previous ground disturbance activities, leveled, and heavily compacted particularly in the northwest portion. A 5-gallon sample of the A horizon was screened in the field and yielded no cultural material. The underlying Jaucas sand (Stratum IVb) abruptly transitioned at its lower boundary to a thin indurate layer of coarse sand that either represents a different depositional environment or compaction from the weight of overlying deposits combined with water table fluctuations and calcification of the sediment grains (Figure 94).

Figure 92. Photograph of T-11, view to northwest

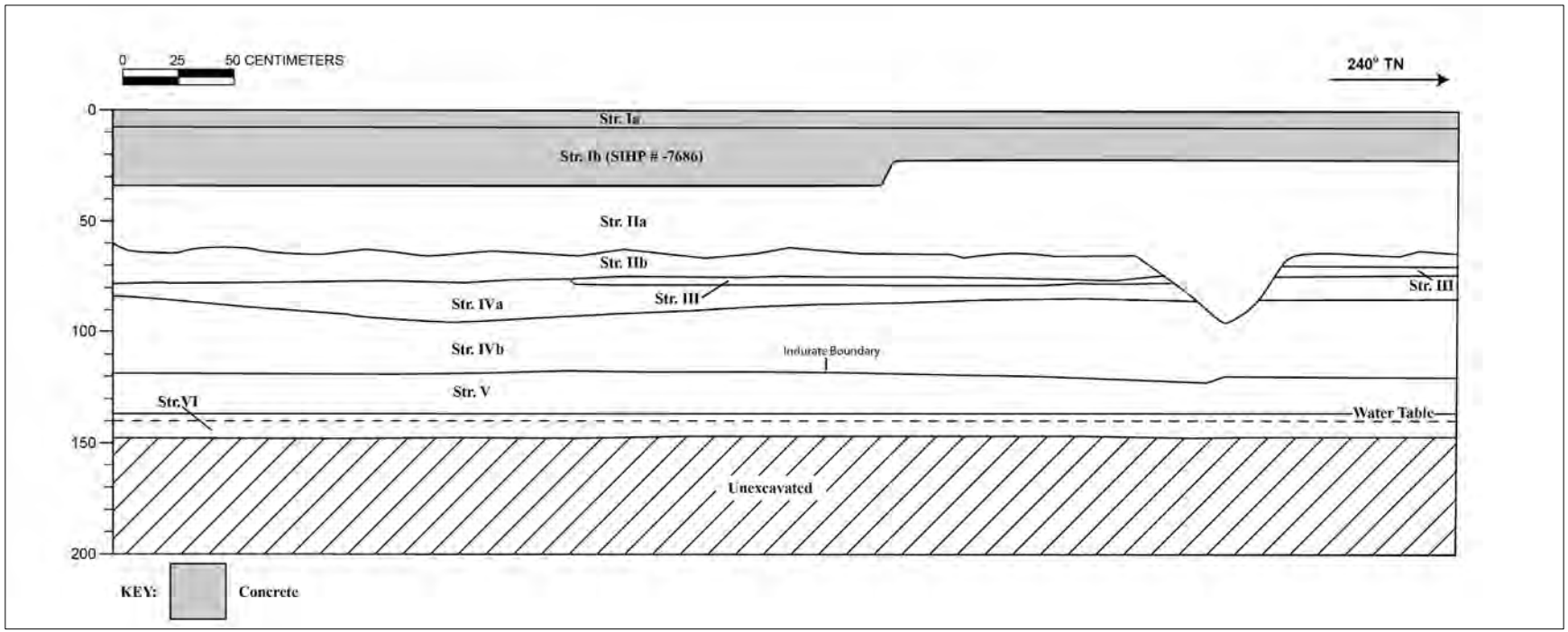

Figure 93. T-11 northwest profile

Table 14. T-11 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–7	Concrete; current commercial floor
Ib	7–35	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
IIa	22–95	Fill; 10YR 7/2, light gray; extremely gravelly coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, irregular lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	61–77	Fill; 10YR 6/2, light brownish gray; very fine sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, broken/discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	70–78	Fill; 10YR 4/2, dark grayish brown; fine sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	75–110	Natural; 10YR 2/2, very dark brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, wavy, and discontinuous lower boundary; A horizon
IVb	85–120	Natural; 10YR 7/4, very pale brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; no roots observed; Jaucas sand
V	118–135	Natural; 10YR 8/3, very pale brown; medium loamy sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; mixed origin; clear, smooth lower boundary; common medium roots; natural marine sediment
VI	135–148 (BOE)	Natural; 5Y 6/1, gray; medium sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; lower boundary not visible; natural marine sediment

Figure 94. Photograph of T-11 northwest (*mauka*) end, showing a thin indurate layer between Strata IVb and V, view to northwest

4.2.12 Test Excavation 12 (T-12)

Test Excavation 12 (T-12), an exterior excavation located within the alleyway between the Ward Theater parking garage and the former Nordstrom Rack building, was oriented southeast-northwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of a utility jacket at a maximum depth of 1.03 mbs. According to the project area utility maps, the location of T-12 provided the only potential gap within a network of utilities extending through the alleyway. The stratigraphy of T-12 consisted of asphalt and utility fill down to the level of the utility jacket within the majority of the test excavation. However, the northeast sidewall retained the previous stratigraphic sequence, which consisted of the asphalt road surface (Stratum Ia), associated base course (Stratum Ib), and extremely gravelly sandy silt (Stratum Ic) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) silty clay to a gravelly sandy loam (Stratum IIb) (Figure 95 through Figure 97 and Table 15).

Figure 95. Location of T-12 within the alleyway between the Ward Theaters and the former Nordstrom Rack building, view to southeast

Figure 96. Photograph of T-12 northeast wall, view to northwest

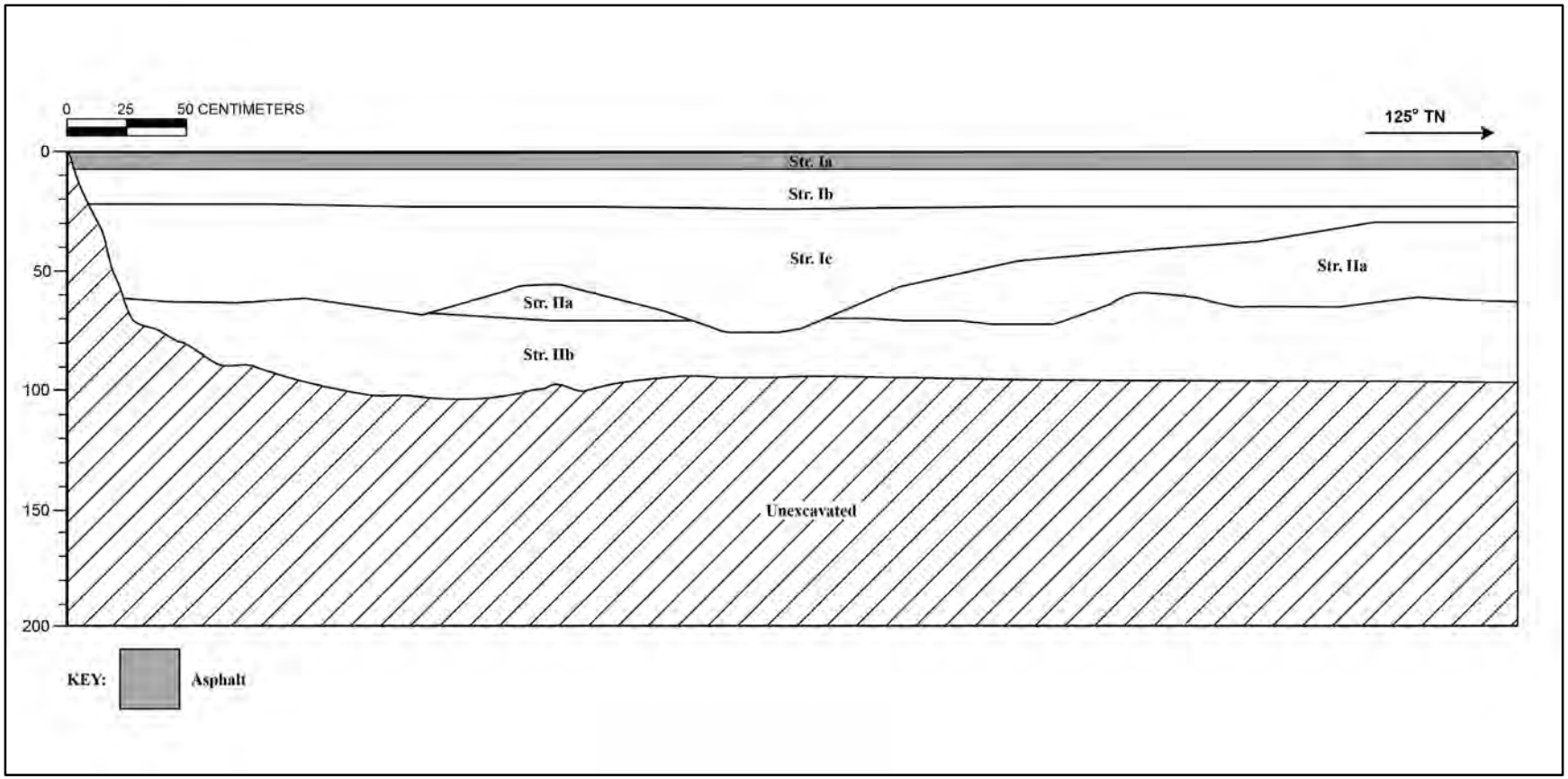

Figure 97. T-12 northeast profile

Table 15. T-12 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–23	Fill; 7.5YR 3/1, very dark gray; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	23–75	Fill; 2.5YR 6/2, light brownish gray; extremely gravelly sandy silt; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary
IIa	30–70	Fill; 2.5Y 7/2, light gray; structureless (single-grain); very gravelly sand; moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	59–103 (BOE)	Fill; 2.5Y 7/2- 7/3, light gray to pale brown; fine sand grading to silty clay; moderate, fine, blocky structure; moist, firm consistence; plastic; marine origin; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927). Mottled with 10YR 5/2, grayish brown; very gravelly sandy loam and 2.5Y 7/2, light gray; sandy clay

4.2.13 Test Excavation 13 (T-13)

Test Excavation 13 (T-13), an interior excavation located within the former Nordstrom Rack building, was oriented northwest-southeast and measured 6.2 m long by 0.45 m wide (Figure 98). The base of excavation was determined by the presence of the water table at a depth of 1.87 mbs. The stratigraphy of T-13 consisted of the current concrete surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic), overlying an additional layer of concrete (Stratum Id) and associated base course (Stratum Ie), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb), overlying a natural loamy clay A horizon (Stratum IIIa) and sandy clay wetland sediment (Stratum IIIb) (Figure 99 and Figure 100, and Table 16). T-13 was initially 0.6 m wide; however, due to the difficulty in cutting through the third concrete layer (Stratum Id), it was shortened slightly to 0.45 cm in width.

T-13 documented remnants of commercial warehouse infrastructure, considered part of SIHP # -7686. The warehouse remnants consisted of two buried concrete surfaces (Strata Ib and Id) and respective associated base courses (Strata Ic and Ie), which extended across the length of the test excavation. The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial infrastructure.

Beneath the remnant commercial infrastructure, T-13 documented natural wetland sediments consisting of a highly organic, peaty deposit (Stratum IIIa) overlying a wetland sandy clay containing brackish water snails and organics (Stratum IIIb). A column sample extracted from Strata IIIa and IIIb was sent for pollen analysis. The two samples show a strong contrast from one another as the lower sample from Stratum IIIb (136−139 cmbs) was primarily dominated by Cyperaceae pollen (79.7%) and Nama (12.4%). This reflects a wetland vegetation consisting of Wet Coastal Sedgeland surrounded by a sparse Nama Herbland on the sandy uplands. Conversely, the sediment in Stratum IIIa sample (130−133 cmbs) became a peat and the vegetation composition changed drastically. Within Stratum IIIa, Cyperaceae pollen percentage fell to 5.4% and Nama increased to 72.4%. Concurrently, Fabaceae pollen increased tenfold to 20.2% within Stratum IIIa. These changes indicate a great reduction in the presence of the wetland vegetation coupled with increased disturbance in the sparse upland Herbland. Total pollen concentration increased tenfold in Stratum IIIa and charcoal concentrations increased from 266,149 pieces/ml to 930,000 pieces/ml, suggesting increased disturbance by fire in the surroundings and possibly a transformation of the wetland by burning. Results from Stratum IIIa does not represent intact wetland vegetation, but, rather a highly disturbed plant community. See Section 5.3 for the full results of the pollen analysis.

Figure 98. Location of T-13 within the back storage area of a commercial establishment

Figure 99. T-13 northeast wall, view to north

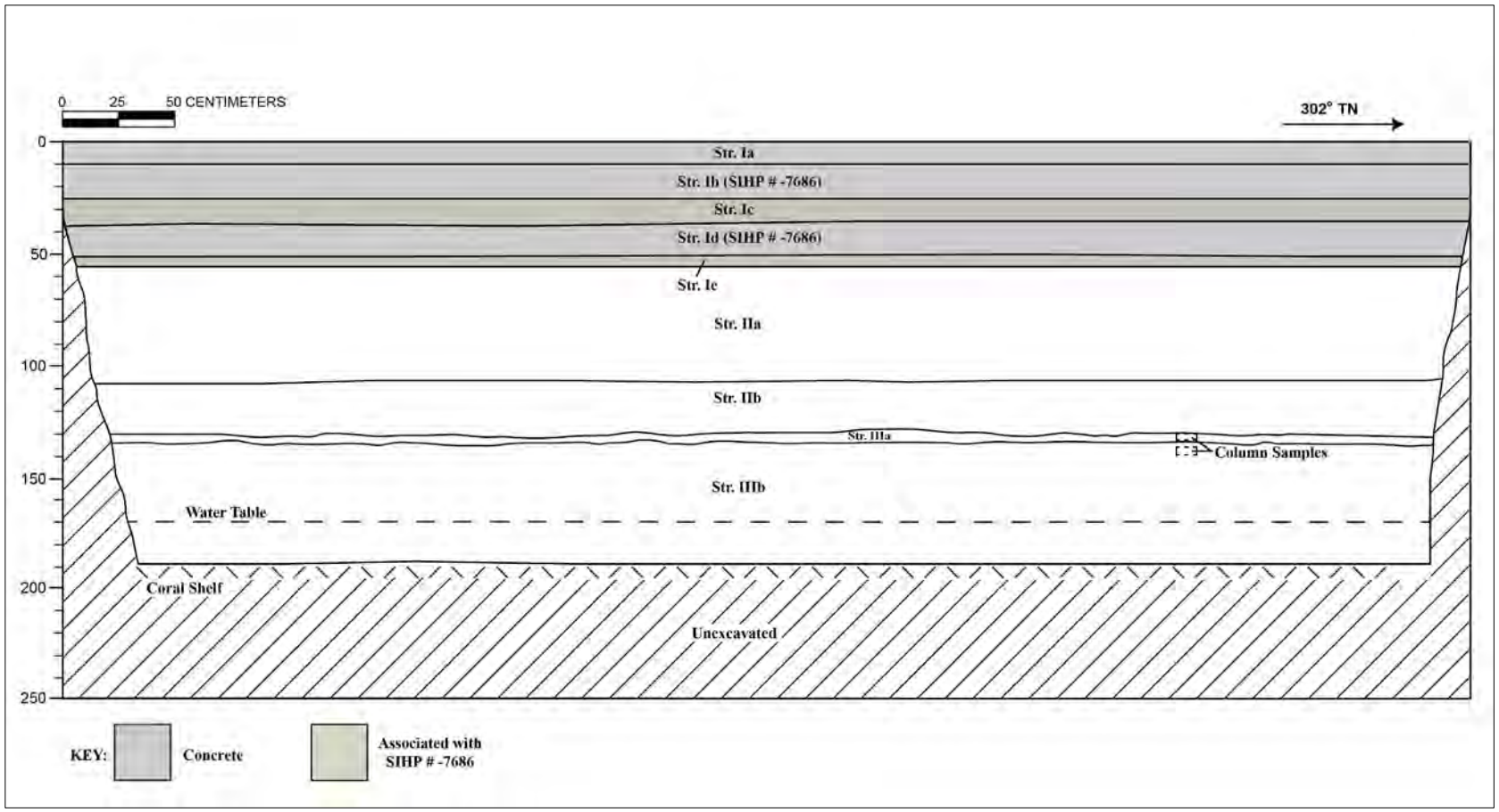

Figure 100. T-13 northeast profile

Table 16. T-13 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–10	Concrete; current commercial floor
Ib	10–27	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	27–37	Fill; 10YR 3/6, dark yellowish brown; very gravelly silty loam; weak, very fine, crumb structure; moist, loose consistence; slightly plastic; terrigenous origin; abrupt, smooth lower boundary; base course
Id	37–50	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure; contained metal wire
Ie	48–57	Fill; 10YR 2/2, very dark brown; gravelly clay loam; moderate, fine, crumb structure; moist, loose consistence; slightly plastic; terrigenous origin; abrupt, smooth lower boundary; base course
IIa	57–107	Fill; 10YR 8/2, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	107–130	Fill; 10YR 8/2, very pale brown grading to 10GY 6/1 (GLEY 1), greenish gray; clay; structureless (massive); wet, slightly sticky to sticky consistence; very plastic; marine origin; very abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	130–135	Natural; 10YR 2/1, black; loamy clay; structureless (massive); wet, non-sticky consistence; plastic; marine origin; diffuse, smooth lower boundary; many, very fine roots; contained abundant organic material
IIIb	132–187 (BOE)	Natural; 5G 5/1 (GLEY 1), greenish gray; sandy clay; structureless (massive); wet, slightly sticky consistence; plastic; marine origin; common, fine roots; marsh/wetland sediment; contained abundant organics and some fresh water snails)

4.2.14 Test Excavation 14 (T-14)

Test Excavation 14 (T-14), an interior excavation located within the former Nordstrom Rack building, was oriented southeast-northwest and measured 6.1 m long by 0.62 m wide (Figure 101). The base of excavation was determined by the presence of the hard coral shelf at 1.7 mbs. The stratigraphy of T-14 consisted of the current concrete surface (Stratum Ia) and gravely sand base course (Stratum Ib) overlying two buried concrete surfaces (Strata Ic–Id), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb) overlying an extremely gravelly silty sand fill with historic debris (Stratum III), over a marine sand deposit (Stratum IV) (Figure 102 and Figure 104, and Table 17).

T-14 documented remnants of commercial warehouse infrastructure, considered part of SIHP # -7686 (Figure 103). The warehouse remnants consisted of two buried concrete surfaces (Strata Ic and Id) (Figure 105). Stratum Ic extended only across the northern half of the test excavation. It was located directly over top another buried concrete surface, which contained abundant metal wire as well as rebar; in this configuration it showed similar characteristics to T-13. Stratum Ib, base course, appeared to have been deposited in the southern portion of T-13 in order to level the ground surface prior to the installation of the current floor.

Beneath the remnant commercial infrastructure, T-14 documented a layer of black cobbly fill that consisted of red and black stained fire-affected coral and rock as well as several fragments of burned and/or melted copper and a burned brick fragment (Stratum III). The natural wetland sediment (Stratum IV) was truncated by previous ground disturbance activities and later filled with mixed and historic trash (Stratum III).

Figure 101. Location of T-14 within interior commercial space, view to southeast

Figure 102. T-14 west wall, view to south

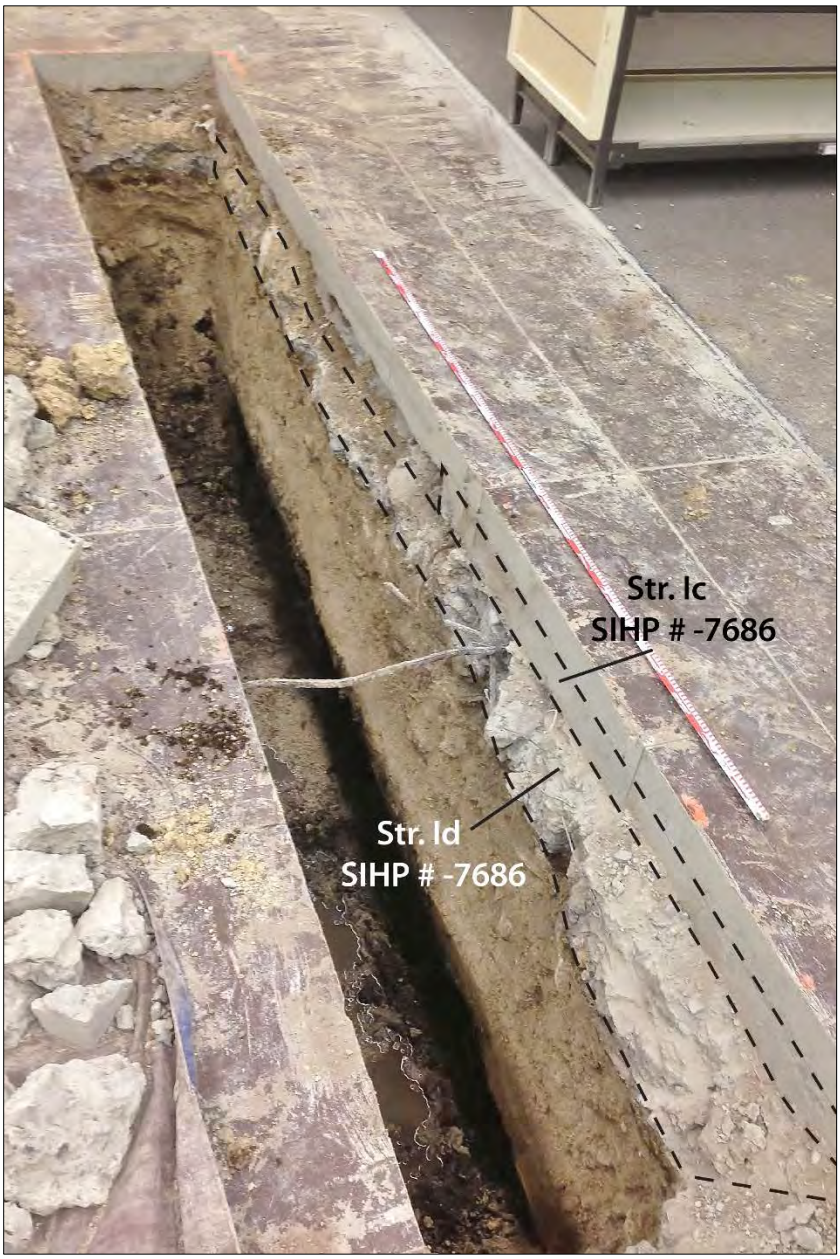

Figure 103. Photograph of T-14, showing SIHP # -7686, view to north

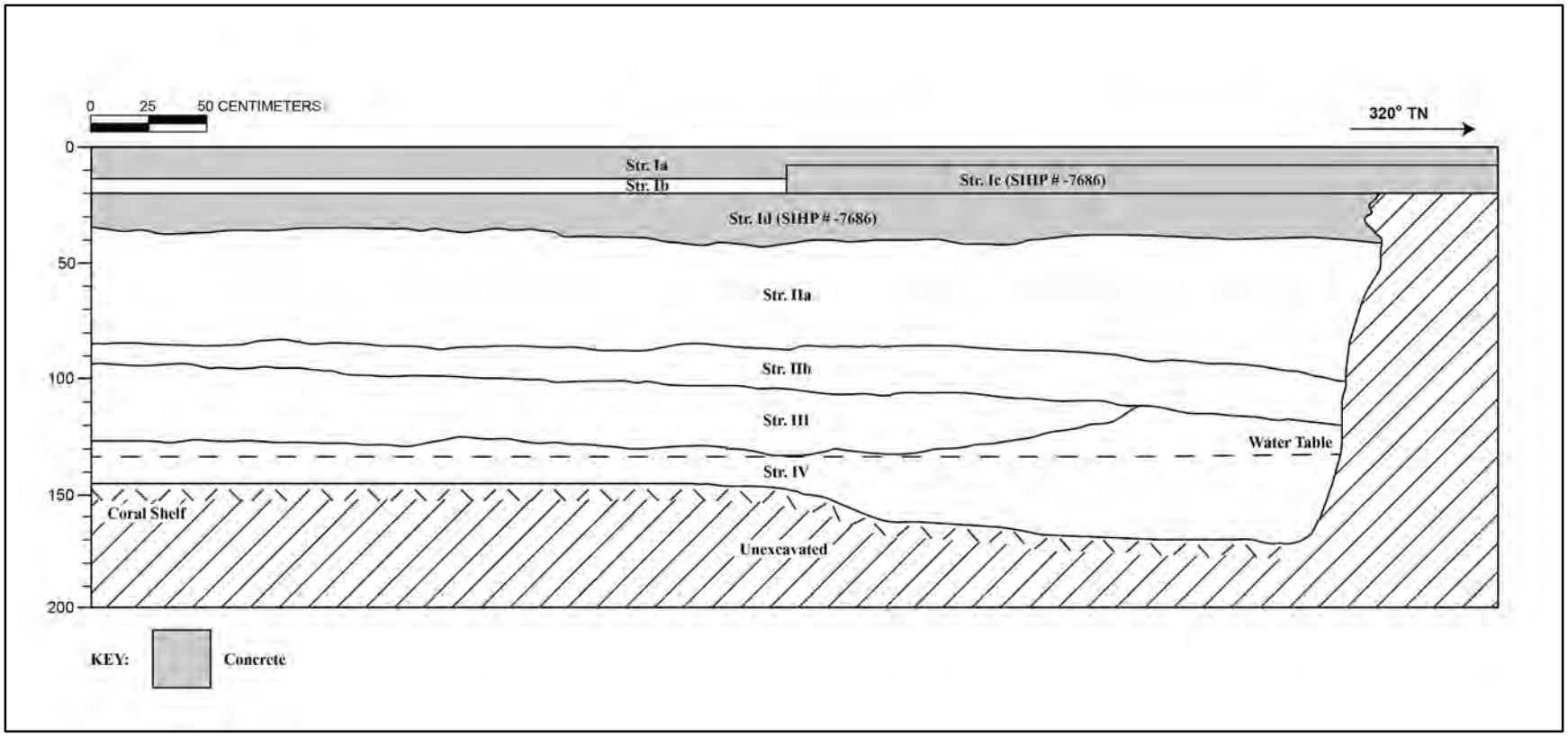

Figure 104. T-14 northeast profile

Table 17. T-14 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–12	Concrete; current commercial floor
Ib	12–19	Fill; gravelly sand; base course
Ic	7–19	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Id	19–42	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure; contained rebar and wire
IIa	35–100	Fill; 10YR 7/2, light gray; gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	85–120	Fill; 10YR 7/2, light gray; sandy clay; structureless (massive); moist, friable consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	100–130	Fill; 10YR 2/2, very dark brown; extremely gravelly silty sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; contained fire affected coral and rock, copper, and a brick fragment
IV	126–173 (BOE)	Natural; 10Y 7/1 (GLEY 1); medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, wavy lower boundary; overlying coral shelf

Figure 105. Photograph showing multiple concrete surfaces consisting of the current commercial floor (Stratum Ia) directly overlying an earlier concrete surface associated with SIHP # -7686 (Stratum Ic), overlying an additional buried concrete surface containing rebar and wire (Stratum Id) (SIHP # -7686)

4.2.15 Test Excavation 15 (T-15)

Test Excavation 15 (T-15), an interior excavation located within the former Nordstrom Rack building, was oriented northeast-southwest and measured 6.1 m long by 0.63 m wide (

Figure 106). The base of excavation was determined by the presence of the hard coral shelf at a depth of 1.65 mbs. The stratigraphy of T-15 consisted of the current concrete surface (Stratum Ia) overlying a second concrete layer (Stratum Ib) and associated base course (Stratum Ic), overlying an additional layer of concrete (Stratum Id) and associated base course (Stratum Ie), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of extremely gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb), overlying a loamy sand A horizon (Stratum IIIa), Jaucas sand (Stratum IIIb), and a clay sand marine deposit (Stratum IV) (Figure 107 and Figure 109, and Table 18).

T-15 documented remnants of commercial warehouse infrastructure, considered part of SIHP # -7686 (Figure 108). The warehouse remnants consisted of two buried concrete surfaces (Strata Ib and Id) (Figure 110). Stratum Ib and its associated base course (Stratum Ic) were located directly beneath the current commercial floor and over top an additional buried concrete surface (Stratum Id) and base course (Stratum Ie).

Beneath the concrete remnants, T-15 documented the presence of a natural loamy sand A horizon (Stratum IIa). The A horizon was significantly disturbed, as evidenced by heavy compaction and truncation. The compaction was most notable at the northeast and southwest ends (*mauka* and *makai*) which may have been a result of various uses of the former land surface. Within Stratum IIa, in the northeast (*mauka*) end, there was an anomalous culturally sterile ash lens that was compact and friable (Figure 111). This lens is most likely a disturbance of some sort. Bulk samples were screened from both Stratum IIa (5 gallons) and the ash lens (1 gallon); no cultural material was observed. A second anomalous pit was observed in the southwest (*makai*) end, located within Stratum IIb and terminating in Stratum III (Figure 112). The pit did not appear to have originated from Stratum IIa and the soil matrix of the pit contents was similar to Stratum III marine sand, but was slightly darker in color. A 5-gallon bulk sample of Stratum III was screened in the field; no cultural material was observed.

Figure 106. Location of T-15 within interior commercial space, view to southwest

Figure 107. T-15 northwest wall, view to north

Figure 108. Photograph of T-15, showing SIHP # -7686, view to southeast

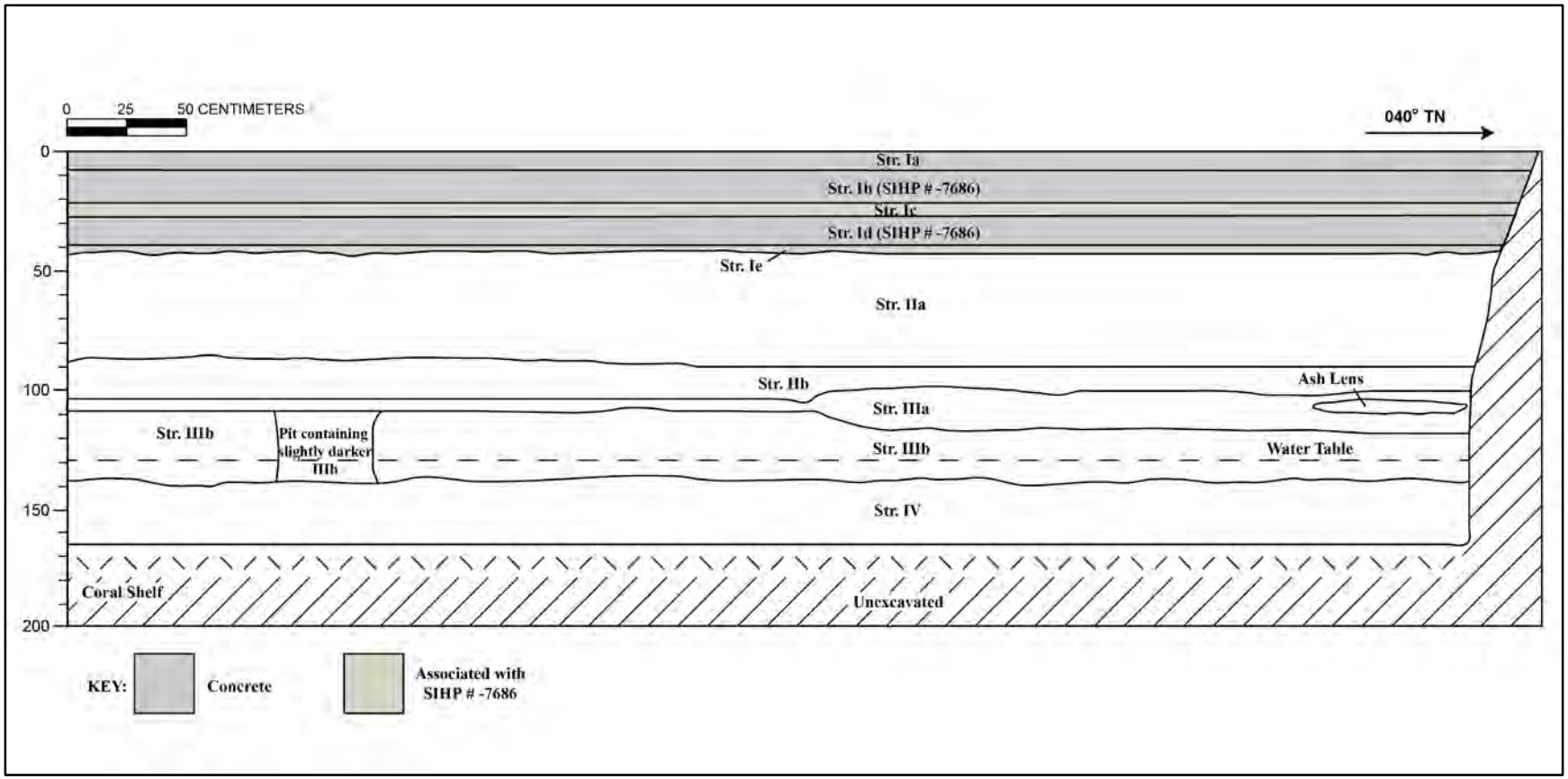

Figure 109. T-15 northwest profile

Table 18. T-15 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–7	Concrete; current commercial floor
Ib	7–23	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	23–28	Fill; gravelly sand; base course
Id	28–40	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ie	40–44	Fill; 7.5YR 2.5/1, black; extremely gravelly sandy loam; structureless (single-grain); dry, hard consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
IIa	44–90	Fill; 10YR 7/2; light gray; extremely gravelly sand; structureless (single-grain); dry, slightly hard consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	86–105	Fill; 10YR 8/2, very pale brown; clay; structureless (massive); wet, slightly sticky; very plastic; marine origin; very abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	100–118	Natural; 10YR 2/2, very dark brown; loamy sand; structureless (single-grain); moist, firm consistence; non-plastic; mixed origin; diffuse, wavy lower boundary; common, fine roots; A horizon; contained an ash lens
IIIb	110–140	Natural; 10YR 8/3, very pale brown; medium sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; clear, smooth lower boundary; common, fine roots; Jaucas sand
IV	110–165 (BOE)	Natural; 10YR 7/1, light gray; clay sand; structureless (single-grain); wet, non-sticky; slightly plastic; marine origin; abrupt, smooth lower boundary; marine sand; overlying coral shelf

Figure 110. Close-up of southeast wall, showing multiple concrete layers (Strata Ia, Ib, Id) overlying crushed coral and hydraulic dredge fill (Strata IIa–IIb) overlying a natural loamy sand A horizon (Stratum IIIa) and Jaucas sand (Stratum IIIb), view to east

Figure 111. Plan view of anomalous ash lens in the northeast (*mauka*) end of T-15, view to southwest

Figure 112. Anomalous pit within Strata IIb and III on the southwest (*makai*) end of T-15

4.2.16 Test Excavation 16 (T-16)

Test Excavation 16 (T-16), an interior excavation located within the Office Depot Building, was oriented southeast-northwest and measured 6.1 m long by 0.61 m wide (Figure 113). The base of excavation was determined by the presence of the decomposing coral shelf at 1.51 mbs. The stratigraphy of T-16 consisted of a concrete and laminated tile surface (Stratum Ia), associated gravelly sand with visqueen barrier (Stratum Ib), a buried concrete surface (Stratum Ic), compacted gravel fill (Stratum Id), very gravelly silty sand (Stratum Ie), and gravelly sandy loam (Stratum If), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly coarse sand (crushed coral) (Stratum IIa) and hydraulic (dredge) silty sand (Stratum IIb), overlying a redeposited, locally procured loamy sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), fine sand (Stratum V), and gravelly clay sand (Stratum VI) (Figure 114 and Figure 116, and Table 19). The lower boundary of Stratum IVb contained a thin indurate layer of cemented sand that separated the Jaucas sand from the sandy clay below. Utility conduits were observed at the northwest and southeast ends at approximately 0.2 mbs and as a result portions of the trench were left unexcavated.

T-16 documented the buried remnants of the central warehouse structure, considered part of SIHP # -7686. The northernmost edge of this central warehouse was identified at the northern end of T-16 and consisted of a buried concrete slab (Stratum Ic). The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial surface (Figure 115).

Beneath the current and remnant commercial infrastructure, T-16 documented a deposit of loamy sand (Stratum III) that likely consisted of redeposited, locally procured sediment overlying an in situ, loamy sand A horizon (Stratum IVa). Similar reworked loamy sand or sand fill deposits were documented throughout the project area, overlying an in situ A horizon (Stratum IVa) and underlying the Kaka‘ako reclamation fill deposits (Strata IIa and IIb). This local fill material was likely deposited to level and/or build up the ground surface and served as a historic land surface for a period of time prior to reclamation activities. The natural A horizon (Stratum IVa) appeared to have been truncated during previous ground disturbance activities. Ten gallons of combined material from Strata III and IVa were screened in the field and yielded no cultural material.

Figure 113. Photograph of T-16 within the interior Office Depot commercial space, view to southeast

Figure 114. T-16 southwest wall, view to southwest

Figure 115. Photograph of T-16, showing the modern surface overlying a historic concrete foundation (SIHP # -7686), view to north

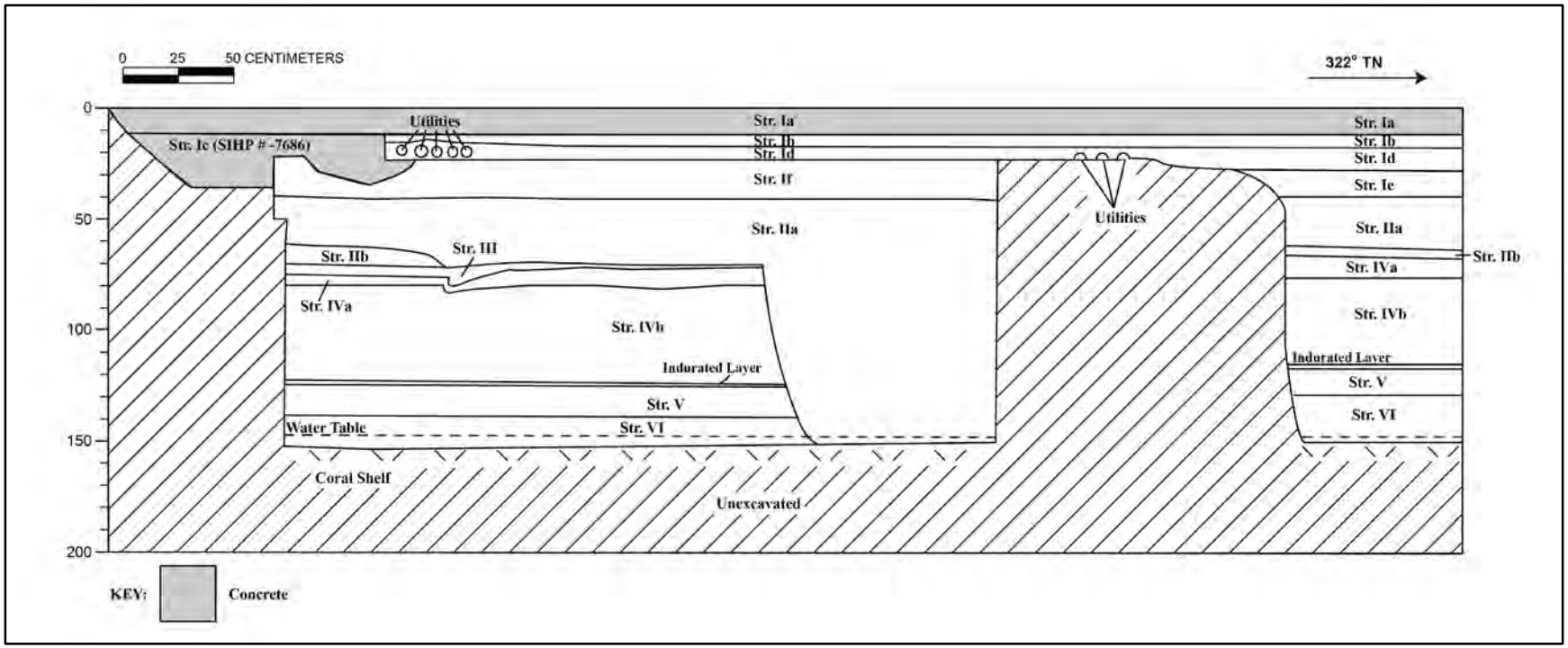

Figure 116. T-16 southwest profile

Table 19. T-16 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–13	Concrete; current commercial floor
Ib	13–18	Fill; 10YR 2/2, very dark brown; gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; small gravel sand used as a compaction material for cement; lower boundary defined by a visqueen plastic moisture barrier
Ic	13–35	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Id	18–28	Fill; 10YR 3/2, very dark grayish brown; gravel; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; lower layer of gravel as base for cement
Ie	28–40	Fill; 10YR 4/3, brown, mottled with 5YR 4/4 reddish brown; very gravelly silt sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, broken/discontinuous lower boundary
If	23–41	Fill; 10YR 3/2; very dark grayish brown; gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt, broken/discontinuous lower boundary
IIa	40–151	Fill; 10YR 6/2; light brownish gray; very gravelly coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, irregular lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	63–70	Fill; 10YR 6/1; gray; silty sand; weak, fine, crumb structure; moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	70–77	Fill; 10YR 4/2, dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	75–80	Natural; 10YR 3/2, very dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; diffuse, broken/discontinuous lower boundary; A horizon
IVb	76–124	Natural; 10YR 6/3; light yellowish brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic, marine origin; Jaucas sand
V	116–139	Natural; 10YR 7/3, very pale brown; fine sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; fine sand below indurated layer; discolored root staining but no roots present

Stratum	Depth (cmbs)	Description of Sediment
VI	191–151 (BOE)	Natural; 10Y 8/1 (GLEY 1), light greenish gray; gravelly clay sand; weak, medium, crumb structure; wet, non-sticky to slightly sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; overlying coral shelf

4.2.17 Test Excavation 17 (T-17)

Test Excavation 17 (T-17), an interior excavation located within the Office Depot building, was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.58 mbs. The stratigraphy of T-17 consisted of the concrete and laminated tile surface (Stratum Ia), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) silty clay (Stratum IIb) overlying a redeposited, locally procured loamy sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), sandy clay (Stratum V), and marine sand (Stratum VI) (Figure 117 and Figure 119, and Table 20). The lower boundary of Stratum IVb contained a thin indurate layer of cemented sand that separated the Jaucas sand from the sandy clay below (see Figure 117).

Similar to T-10, T-17 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686 (Figure 118). The warehouse remnants consisted of a buried concrete surface (Stratum Ib), which extended across the length of the test excavation. The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial surface.

Beneath the remnant commercial infrastructure, T-17 documented a deposit of loamy sand (Stratum III) that likely consisted of redeposited, locally procured sediment overlying an in situ, loamy sand A horizon (Stratum IVa). Similar reworked loamy sand or sand fill deposits were documented throughout the project area, overlying an in situ A horizon (Stratum IVa) and underlying the Kaka‘ako reclamation fill deposits (Strata IIa and IIb). This local fill material may have been deposited to level and/or build up the ground surface and may have served as a historic land surface for a period of time prior to reclamation activities. The natural A horizon (Stratum IVa) appeared to have been truncated during previous ground disturbance activities. A 10-gallon field screen of Stratum III and a 2-gallon field screen of Stratum IVa yielded no cultural material.

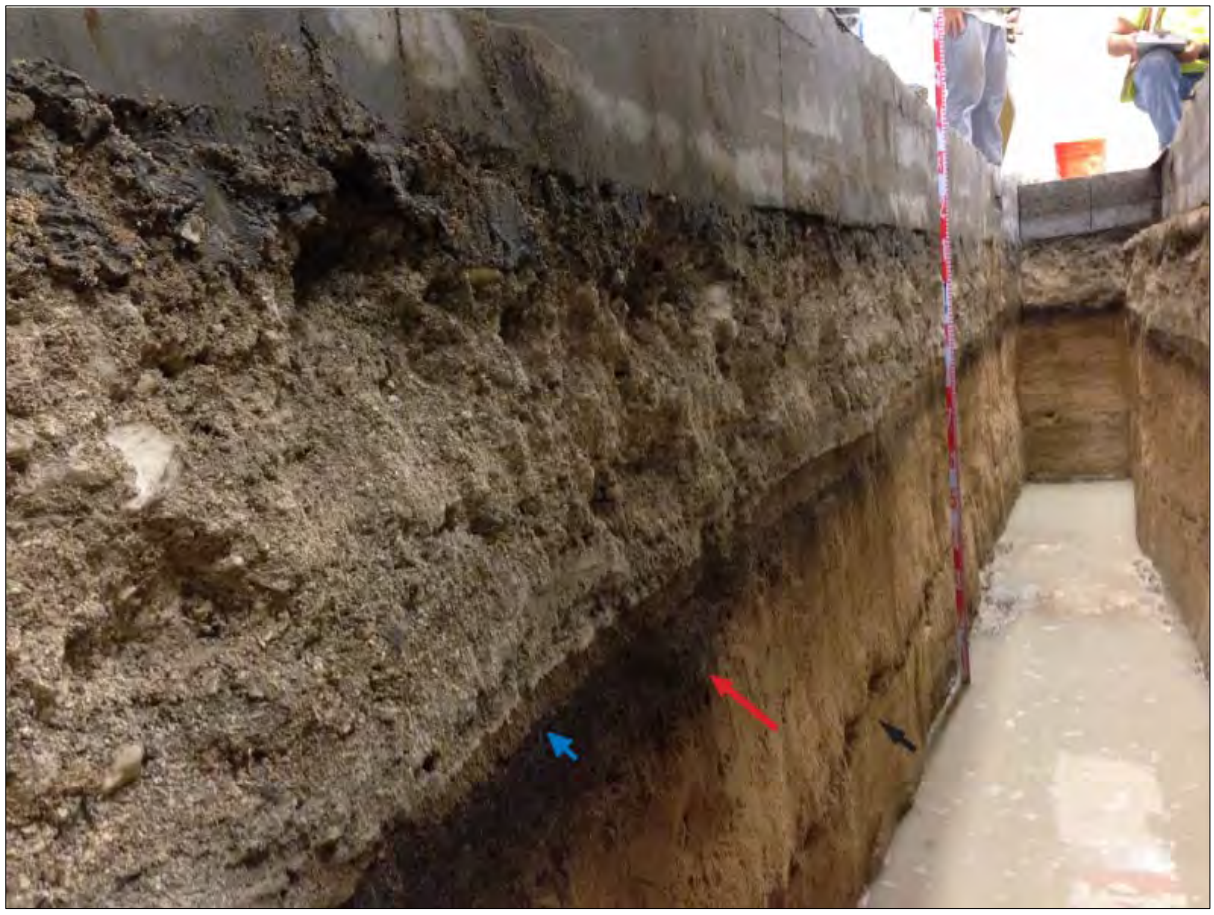

Figure 117. T-17 northwest wall, showing a layer of redeposited fill sand (Stratum III) (blue arrow) overlying the in situ A horizon (Stratum IVa) (red arrow), Jaucas sand (Stratum IVb), and the thin indurated lower boundary of the Jaucas sand (black arrow), view to north

Figure 118. Photograph of T-17, showing a historic concrete foundation (SIHP # -7686) underlying the Stratum Ia modern surface, view to northeast

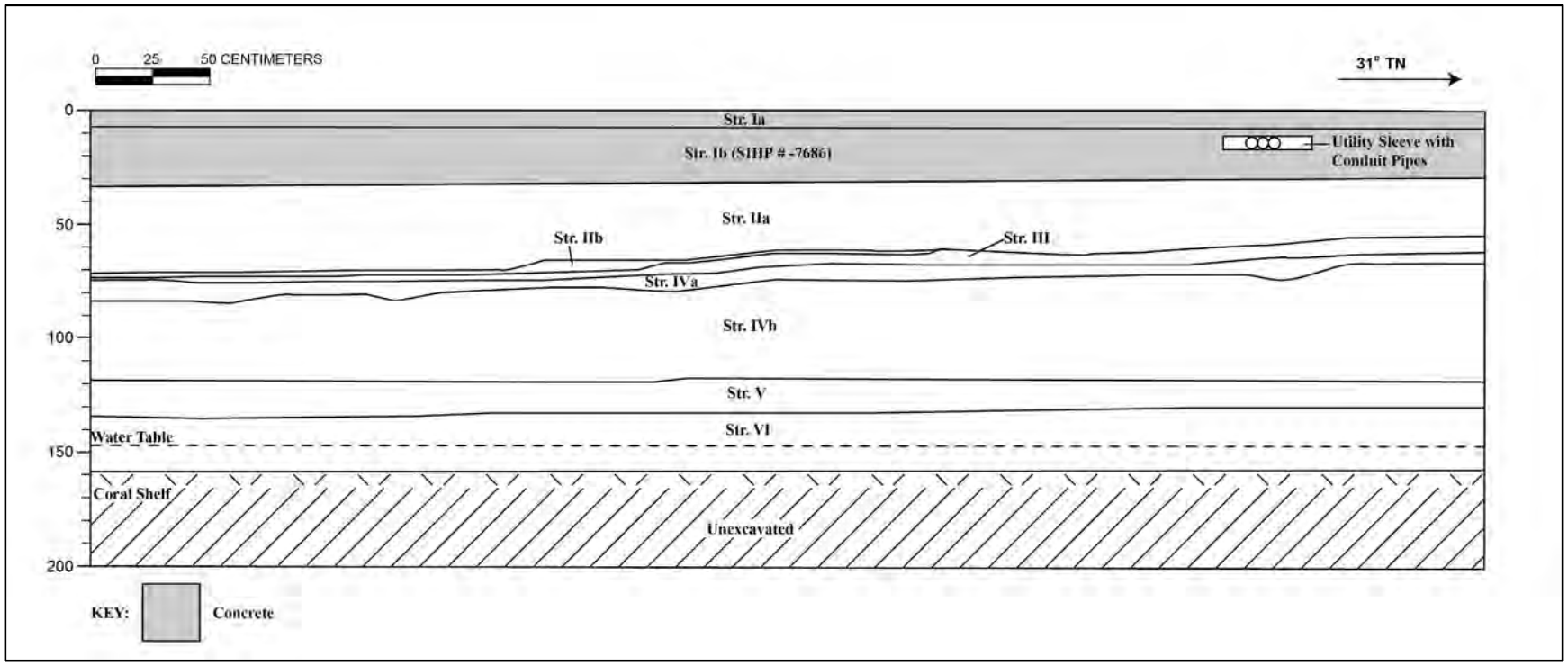

Figure 119. T-17 northwest profile

Table 20. T-17 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–7	Concrete; current commercial floor
Ib	7–34	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
IIa	29–71	Fill; 10YR 5/1, gray; very gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927); contained unidentified metal objects and a saw blade
IIb	61–73	Fill; 10YR 7/2, light gray; silty clay; structureless (massive); wet, slightly sticky consistence; plastic; marine origin; clear, broken/discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	55–75	Fill; 10YR 4/2, dark grayish brown; loamy sand; weak, fine to medium, granular structure; moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	61–85	Natural; 10YR 3/2, very dark grayish brown, loamy fine to medium sand; weak, fine to medium, granular structure; moist, loose consistence; non-plastic; mixed origin; diffuse, smooth lower boundary; A horizon
IVb	66–119	Natural; 10YR 7/3, very pale brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; Jaucas sand; contained a thin indurated layer at lower boundary, approximately 1-2 cm thickness
V	119–134	Natural; 10YR 7/2; light gray; sandy clay; moderate, fine, medium structure; wet, non-sticky consistence; slightly plastic, marine origin; diffuse, smooth lower boundary
VI	130–158 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; marine sediment; overlying coral shelf

4.2.18 Test Excavation 18 (T-18)

Test Excavation 18 (T-18), an exterior excavation located northeast (*mauka*) of the Office Depot building along Queen Street, was oriented northeast-southwest, and measured 1.95 m long by 1.0 m wide. The base of excavation was determined by spatial constraints and a seeping sewer pipe at a depth of 1.1 mbs. The size and location of T-18 was limited by the Office Depot building directly southwest (*makai*), utility lines extending parallel to the building, the property boundary, and a utility corridor to the northeast (*mauka*) (Figure 120). The stratigraphy of T-18 consisted of the asphalt surface (Stratum Ia) and associated base course (Stratum Ib) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of coarse sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay sand (Stratum IIb) overlying a disturbed natural loamy sand A horizon (Stratum IIIa) and Jaucas sand (Stratum IIIb) (Figure 121 and Figure 122, and Table 21). Two utility lines with associated utility fill were documented running perpendicular through T-18, which resulted in the truncation of both the imported fill and natural deposits (see Figure 121).

T-18 documented the remnant of a previously disturbed, culturally sterile A horizon (Stratum IIIa). The A horizon consisted of dark loamy sand which was heavily truncated most likely during the installation of a utility corridor. A 10-gallon screen of the A horizon yielded no cultural material.

Figure 120. Location of T-18 in relation to the spatial limitations, view to west

Figure 121. Photograph of T-18 northwest wall, view to north

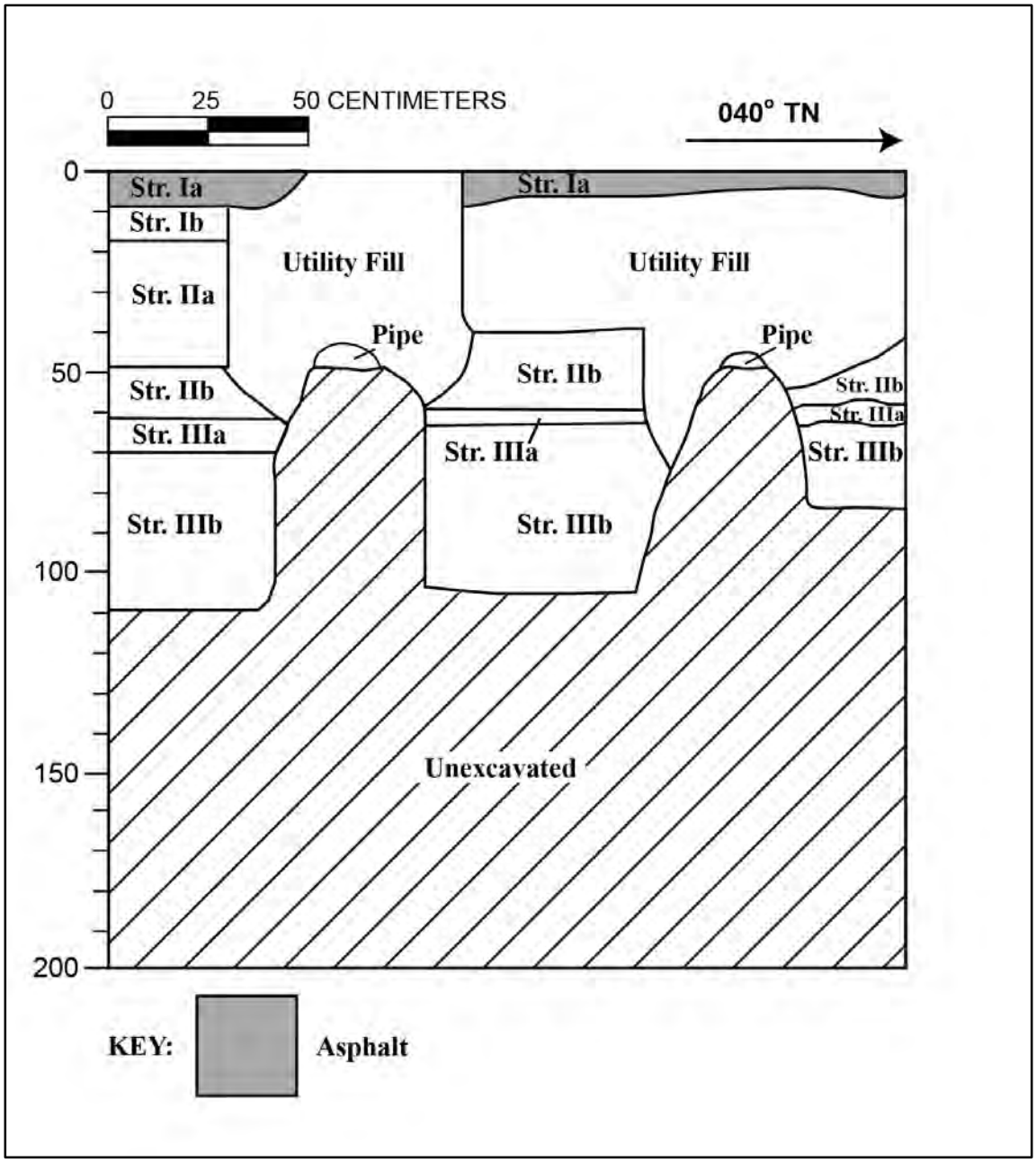

Figure 122. T-18 northwest profile

Table 21. T-18 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–18	Fill; 7.5YR 3/2, dark brown; base course
IIa	18–50	Fill; 10YR 5/1, gray; gravelly coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927); banding with coarser material toward the top and fine toward the bottom
IIb	40–60	Fill; 10YR 7/2, light gray; clay sand; moderate, fine, platy structure; moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	60–70	Natural; 10YR 3/2, very dark grayish brown; loamy sand; structureless (single-grain); moist, loose; non-plastic; marine origin; clear, broken/discontinuous lower boundary; A horizon; contained coral fragments and brackish water snails
IIIb	65–110 (BOE)	Natural; 10YR 7/3, very pale brown; sand; structureless (single-grain); moist, loose; non-plastic; marine origin; lower boundary not visible; Jaucas sand

4.2.19 Test Excavation 19 (T-19)

Test Excavation 19 (T-19), an interior excavation located within the former Nordstrom Rack building, was oriented southeast-northwest and measured 6.1 m long by 0.6 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.68 mbs. The stratigraphy of T-19 consisted of the current concrete surface (Stratum Ia) overlying gravelly sand with a visqueen barrier (Stratum Ib), associated base course (Stratum Ic), and sandy loam fill (Stratum Ie), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb), overlying a natural clay sand A horizon (Stratum IIIa) and two clay sand wetland deposits (Strata IIIb and IV) (Figure 123 through Figure 125, and Table 22). A concrete utility jacket overlain by extremely gravelly sandy loam utility fill (Stratum Id) was located at the southern end of the test excavation.

T-19 did not contain any buried commercial infrastructure remnants such as those seen in nearby interior test excavations. This is consistent with historic aerial photographs and maps which show a gap between two warehouses in this area. The general stratigraphy documented within T-19 was otherwise similar, consisting of 1919–1927 Kaka‘ako reclamation fill deposits (Strata IIa–IIb) overlying a natural, culturally sterile, peaty A horizon (Stratum IIIa) developed within wetland clay sand (Stratum IIIb).

Figure 123. T-19 southwest wall, view to south

Figure 124. Close-up of T-19 stratigraphy, southwest wall, view to southwest

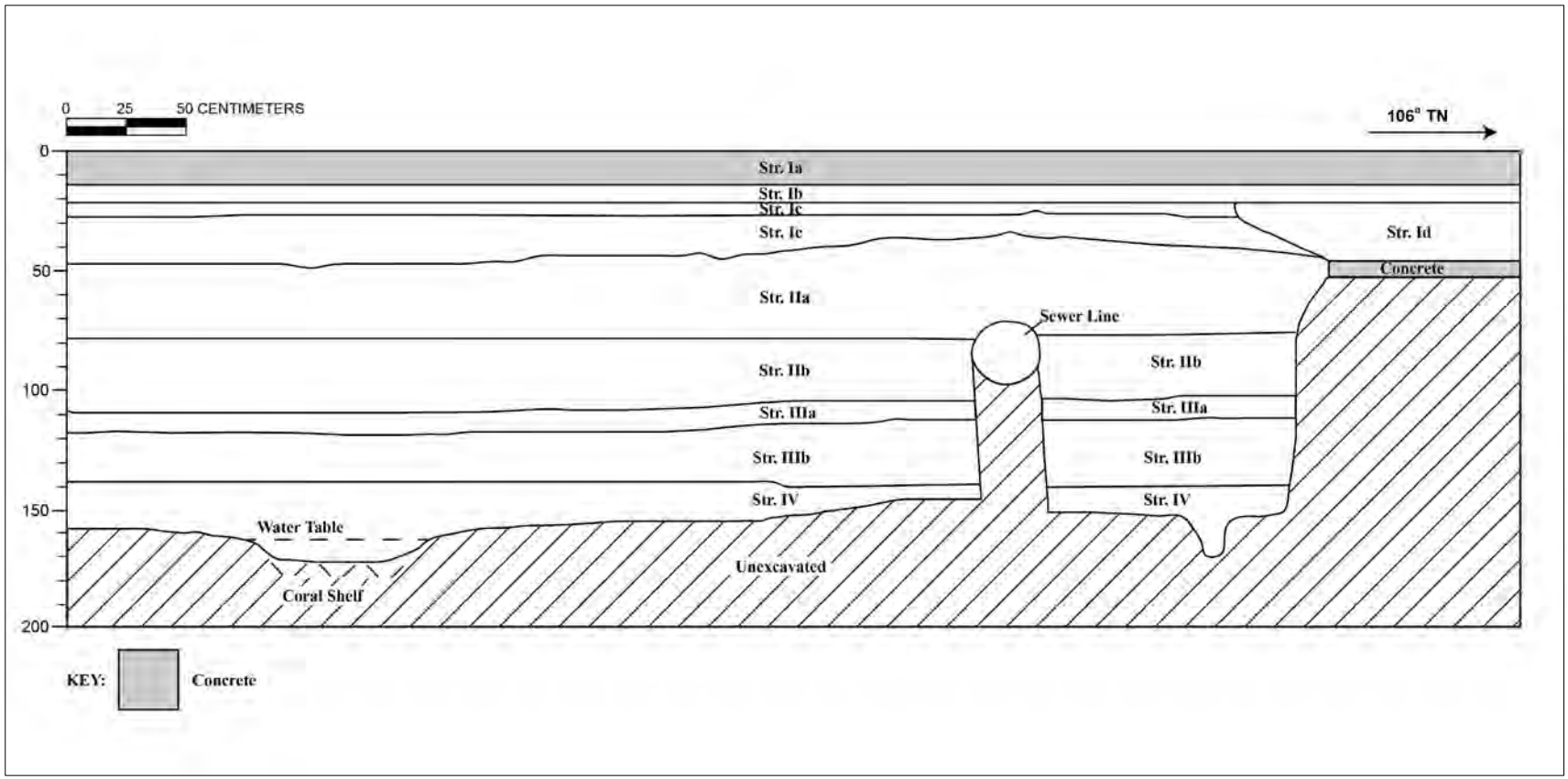

Figure 125. T-19 northeast profile

Table 22. T-19 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–15	Concrete; current commercial floor
Ib	15–22	Fill; 10YR 5/2, grayish brown; gravelly sand; structureless (single-grain); dry, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; fill associated with concrete slab; underlain by plastic sheeting
Ic	22–27	Fill; 10YR 4/1, dark gray; basalt gravel; structureless (single-grain); dry, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
Id	22–46	Fill; 10YR 4/1, dark gray; extremely gravelly sandy loam; structureless (single-grain); dry, loose consistence; non-plastic; terrigenous origin; abrupt, discontinuous lower boundary; fill associated with possible concrete utility jacket
Ie	25–48	Fill; 10YR 4/2; dark grayish brown with very pale brown mottles of crushed coral; gravelly sandy loam and sand; structureless (single-grain); dry, loose consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; intermixed fill
IIa	25–72	Fill; 10YR 8/2, very pale brown; very gravelly sand; structureless (single-grain); dry, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	72–109	Fill; 10YR 8/2, very pale brown; clay; structureless (massive); moist, firm consistence; plastic; marine origin; contained oxidized roots; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	104–118	Natural; 10YR 5/2, grayish brown; clay sand; weak, medium structure; moist, very friable consistence; slightly plastic; mixed origin; clear, smooth lower boundary; common, very fine-fine roots; A horizon; contained a 1-2 cm thick darker organic sediment at upper boundary; contained brackish water snails
IIIb	111–138	Natural; 10YR 7/2; light gray; clay sand; moderate, fine-medium, granular structure; moist, very friable consistence; plastic; marine origin; diffuse, smooth lower boundary; B horizon; natural marine deposit
IV	140–170 (BOE)	Natural; 10YR 5/1, gray; clay sand; moderate, fine-medium, granular structure; moist, very friable consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; natural wetland deposit; overlying coral shelf

4.2.20 Test Excavation 20 (T-20)

Test Excavation 20 (T-20), an interior excavation located within the former Nordstrom Rack building, was oriented northwest-southeast and measured 6.1 m long by 0.6 m wide (Figure 126). The base of excavation was determined by the presence of the hard coral shelf at 1.73 mbs. The stratigraphy of T-20 consisted of the current concrete surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb), overlying a natural sandy loam, wetland A horizon (Stratum IIIa), and a sandy clay wetland deposit (Stratum IIIb) (Figure 127 and Figure 128, and Table 23).

As with many of the surrounding interior test excavations, T-20 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic), which extended across the length of the test excavation. The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial surface. Additionally, a possible concrete tie-beam or footing likely associated with the buried concrete surface was located in the central portion of T-20.

Beneath the buried historic commercial remnants, T-20 documented fill deposits consisting of 1919–1927 Kaka‘ako land reclamation fill deposits. The underlying natural stratigraphic deposits consisted of a culturally sterile, peaty A horizon (Stratum IIIa) developed within a wetland environment (Stratum IIIa). The upper boundary of Stratum IIIa was truncated during previous ground disturbing activities; however, no other disturbances were observed.

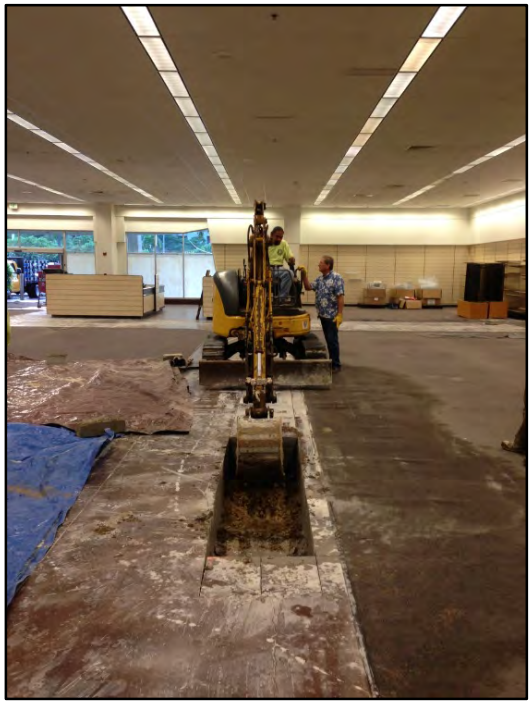

Figure 126. Location of T-20 within interior commercial space, view to southeast

Figure 127. T-20 southwest wall, view to south

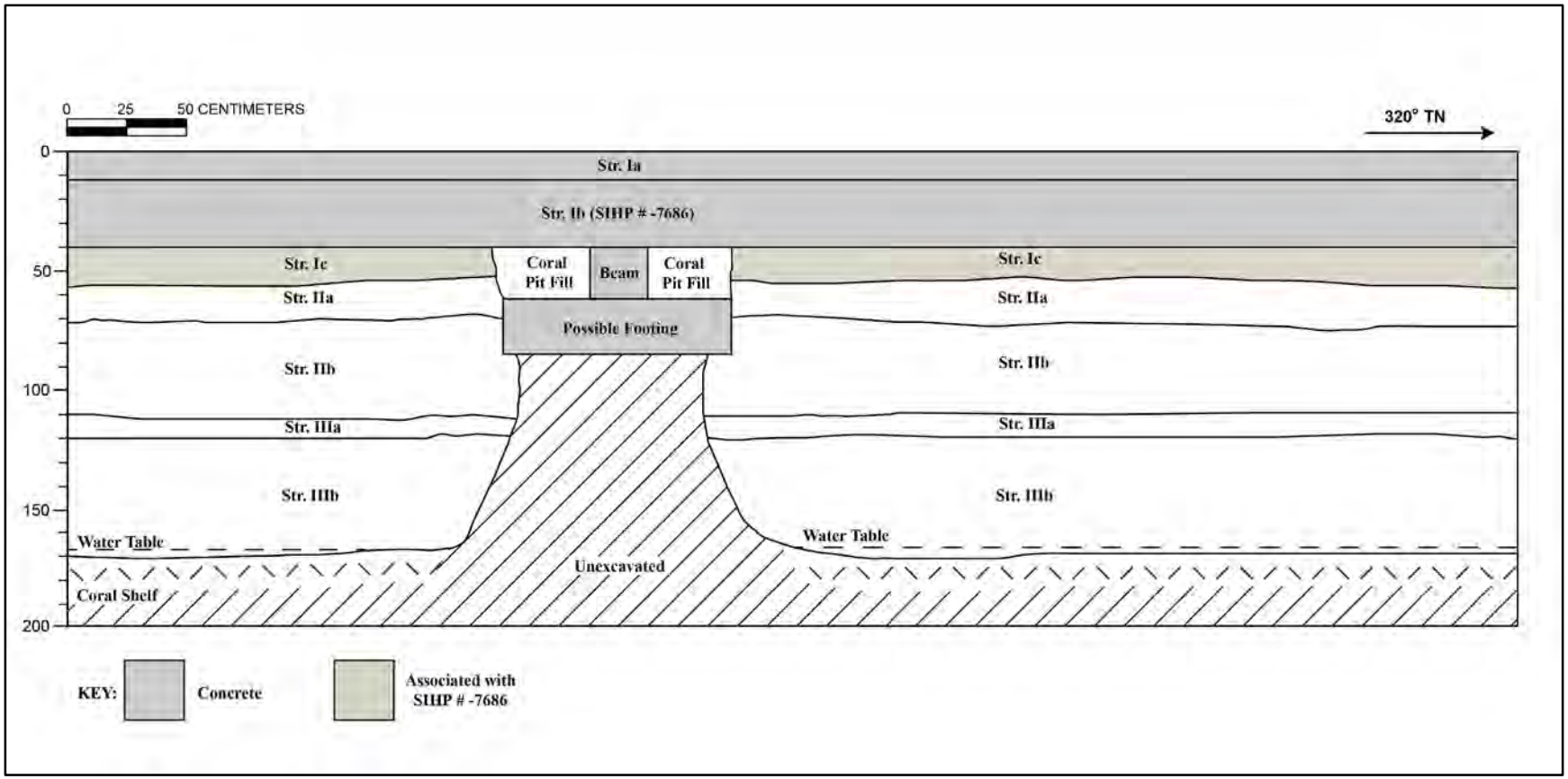

Figure 128. T-20 northeast profile

Table 23. T-20 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–13	Concrete; current commercial floor
Ib	13–41	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	41–57	Fill; 10YR 2/2, very dark brown; gravelly silty loam; moderate, medium, crumb structure; moist, loose consistence; slightly plastic; terrigenous origin; clear, broken/discontinuous lower boundary; base course
IIa	53–75	Fill; 10YR 7/2, light gray; gravelly sand; structureless (single-grain); moist, loose; non-plastic; marine; clear, broken/discontinuous lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	70–113	Fill; 10YR 7/2, light gray grading to 5G 7/1 (GLEY 1), light greenish gray; moist, friable to firm consistence; slightly to very plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	110–121	Natural; 10YR 3/3, dark brown; sandy loam; moderate, medium, crumb structure; moist, very friable; slightly plastic; marine origin; clear, smooth lower boundary; many very fine roots; A horizon; contained an appreciable amount of organic material; wetland sediment
IIIb	120–173 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; few, fine root at upper boundary; marine sand

4.2.21 Test Excavation 21 (T-21)

Test Excavation 21 (T-21), an interior excavation located within the former Nordstrom Rack building, was oriented northeast-southwest and measured 6.13 m long by 0.61 m wide (Figure 129). The base of excavation was determined by the presence of the hard coral shelf at 1.69 mbs. The stratigraphy of T-21 consisted of the current concrete surface (Stratum Ia) overlying gravelly sand fill with a visqueen barrier (Stratum Ib), associated base course (Stratum Ic), crushed coralline fill (Stratum Id), and extremely gravelly to cobbly loam fill (Stratum Ie) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb) overlying a gravelly loam fill (Stratum III), overlying a natural clay sand A horizon (Stratum IVa) developed within a clay sand wetland deposit (Stratum IVb) (Figure 130 and Figure 131, and Table 24).

T-21 documented a heavily mixed, dark black, culturally sterile fill layer (Stratum III) located above a culturally sterile A horizon (Stratum IVa). The A horizon was heavily mixed and appeared truncated during previous ground disturbing activities. Additionally, Stratum IVa contained a small anomalous organic rich lens at the upper boundary in the northeast (*mauka*) end, perhaps as a result of previous disturbance. The concrete surface (Stratum Ia) consisted of a single layer, rather a double layer previously observed in other interior test excavations, which indicates T-21 is located between the 1940s warehouse locations.

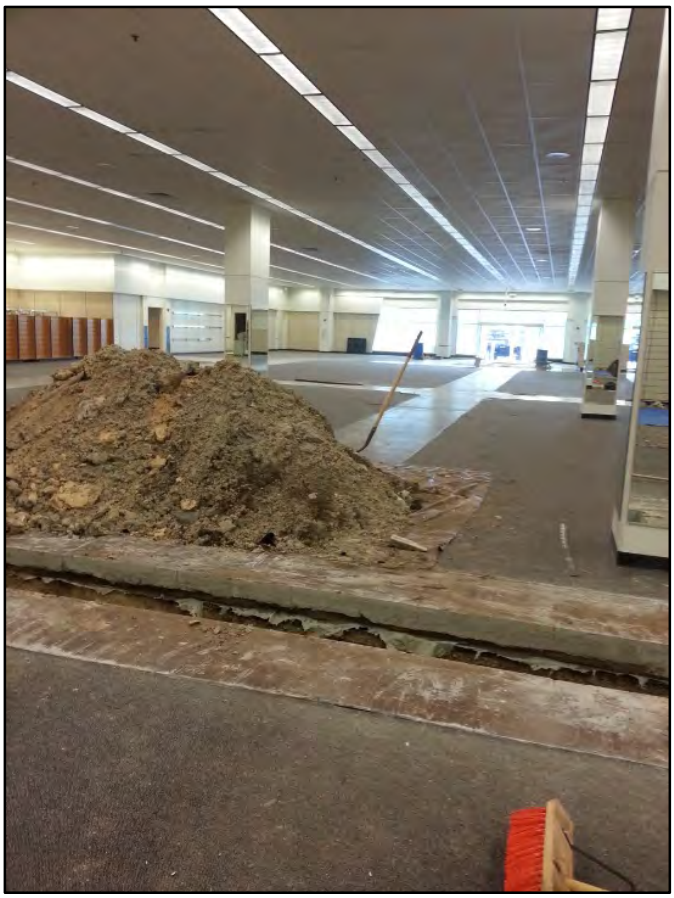

Figure 129. Location of T-21 within interior commercial space, view to southeast

Figure 130. T-21 north wall, view to north

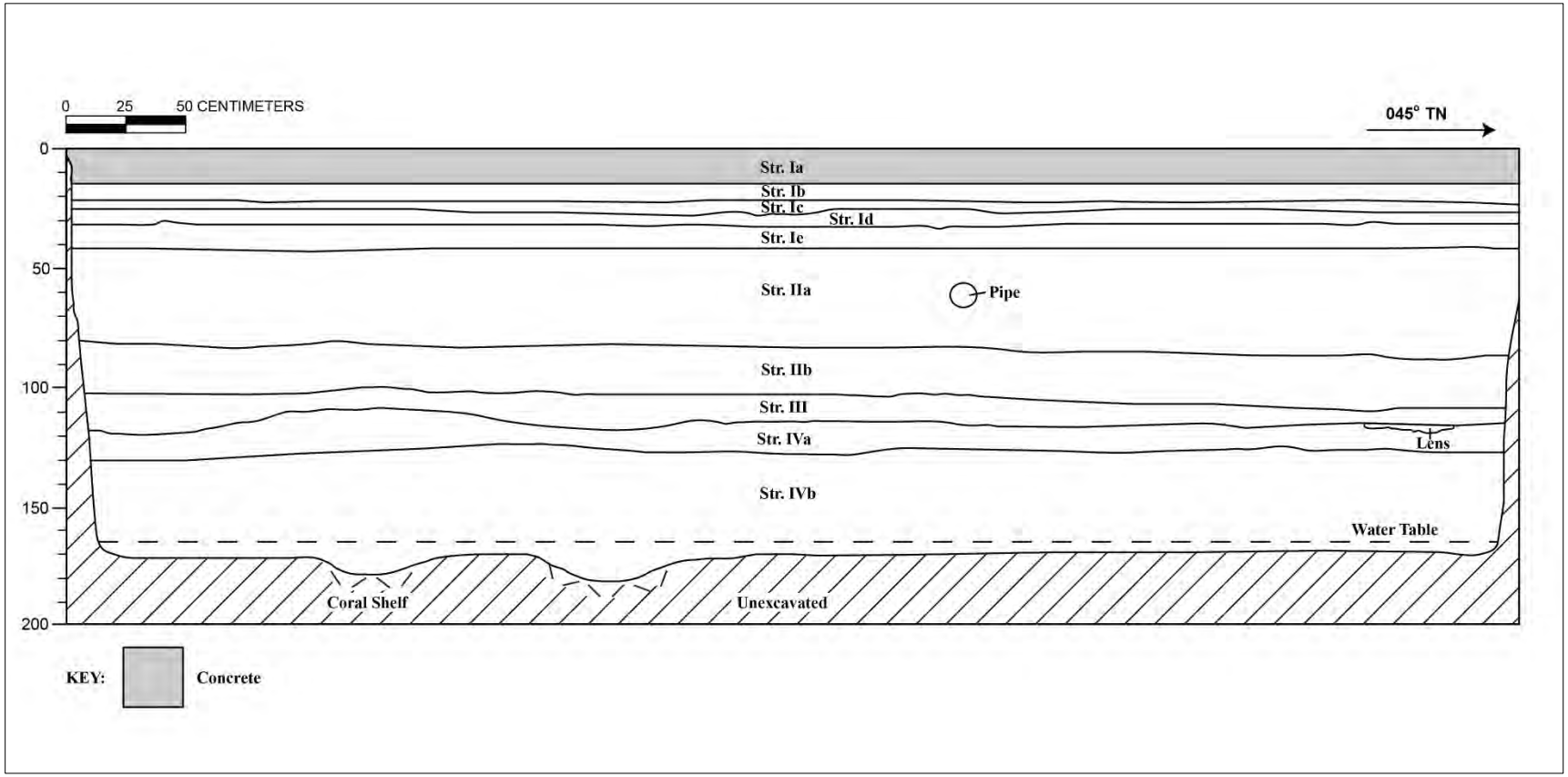

Figure 131. T-21 northwest profile

Table 24. T-21 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–15	Concrete; current commercial floor
Ib	15–22	Fill; 10YR 5/2, grayish brown; gravelly sand; structureless (single-grain); dry, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; associated with concrete slab; underlain by plastic sheeting
Ic	22–26	Fill; 10YR 4/1, dark gray; basalt gravel; structureless (single-grain); dry, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Id	26–33	Fill; 10YR 7/2, light gray; gravelly sand; structureless (single-grain); dry, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; crushed coral fill
Ie	33–42	Fill; 7.5YR 3/3, dark brown; extremely gravelly to cobbly loam; weak, medium, crumb structure; dry, loose consistence; non-plastic; terrigenous; abrupt, smooth lower boundary
IIa	42–88	Fill; 10YR 8/2, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	83–100	Fill; 10YR 8/2, very pale brown; clay; structureless (massive); moist, very friable; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	100–120	Fill; 10YR 2/1, black with 40% mottles of 10YR 3/6, dark yellowish brown; gravelly loam; weak, medium, crumb structure; moist, very friable; slightly plastic; abrupt, wavy lower boundary; imported fill
IVa	110–130	Natural; 10YR 7/2, light gray; clay sand; moderate, fine to medium, granular structure; moist, very friable consistence; plastic; marine origin; clear, smooth lower boundary; A horizon
IVb	125–175 (BOE)	Natural; 10YR 5/1, gray; clay sand; moderate, fine to medium, granular structure; moist, very friable consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; many very fine to fine roots; B horizon, wetland sediment; overlying coral shelf

4.2.22 Test Excavation 22 (T-22)

Test Excavation 22 (T-22), an interior excavation located within the former Nordstrom Rack building, was oriented northeast-southwest and measured 6.2 m long by 0.6 m wide (Figure 132). The base of excavation was determined by the presence of the hard coral shelf at 1.63 mbs. The stratigraphy of T-22 consisted of the current concrete surface (Stratum Ia) overlying a visqueen barrier and associated base course fill (Stratum Ib), extremely gravelly silty loam (Stratum Ic), and extremely gravelly silty loam fill (Stratum Id) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb), overlying a redeposited marine sandy clay (Stratum III), overlying a natural sandy clay A horizon (Stratum IVa), an organic rich gravelly sandy clay (Stratum IVb), and a marine sand deposit (Stratum V) (Figure 133 and Figure 134, and Table 25). Two utility pipes were observed in the northern end of the trench and as a result the surrounding material was not excavated.

T-22 did not contain any buried commercial infrastructure remnants such as those seen in nearby interior test excavations. This is consistent with historic aerial photographs and maps which show a gap between two warehouses in this area. A sandy clay deposit (Stratum III) was documented northwest of the utility pipes which contained an iron pipe fragment, shells, and roots, and may represent marine sand that was redeposited during utility installation. Strata IVa and IVb appeared to be a sandy clay to a gravelly sandy clay A horizon comprised of decomposing organics that developed within a wetland-marsh environment (Figure 135).

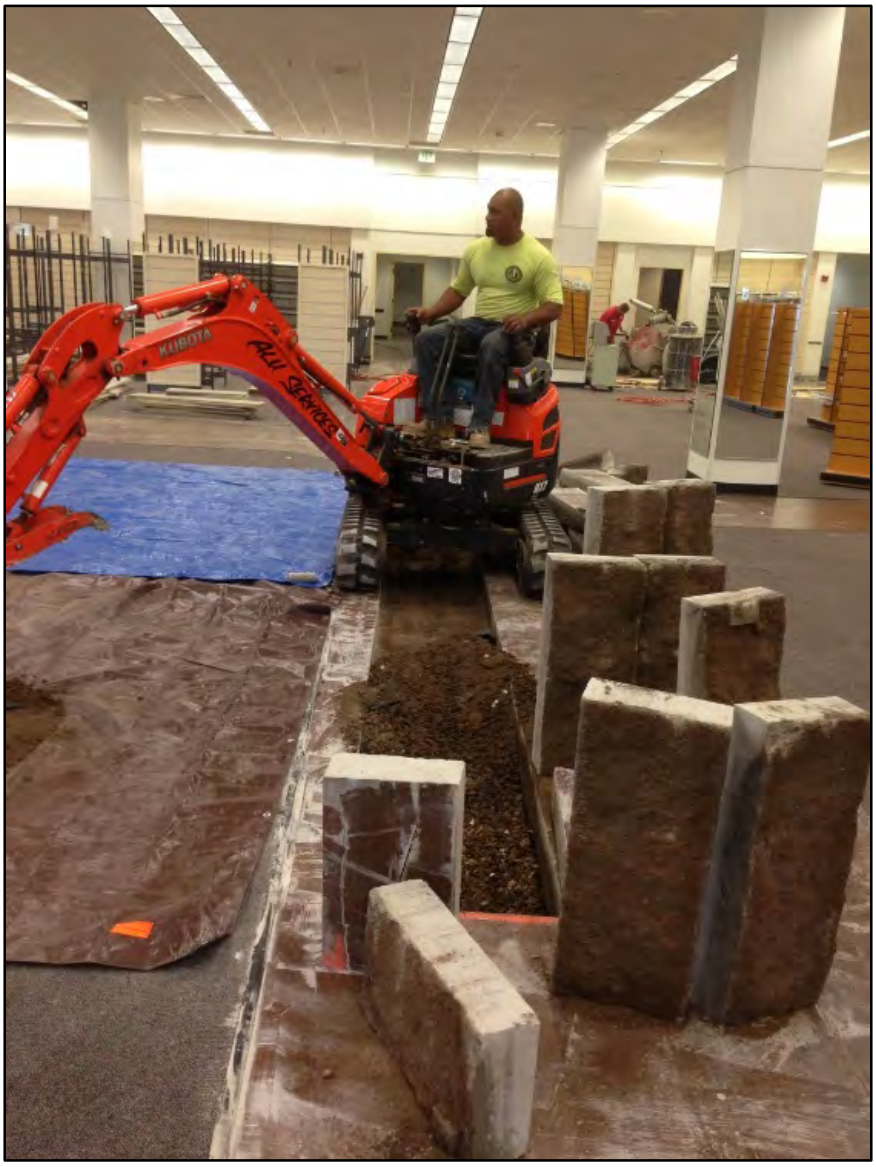

Figure 132. Location of T-22 within interior commercial space, view to northwest

Figure 133. T-22 northwest wall, view to northwest

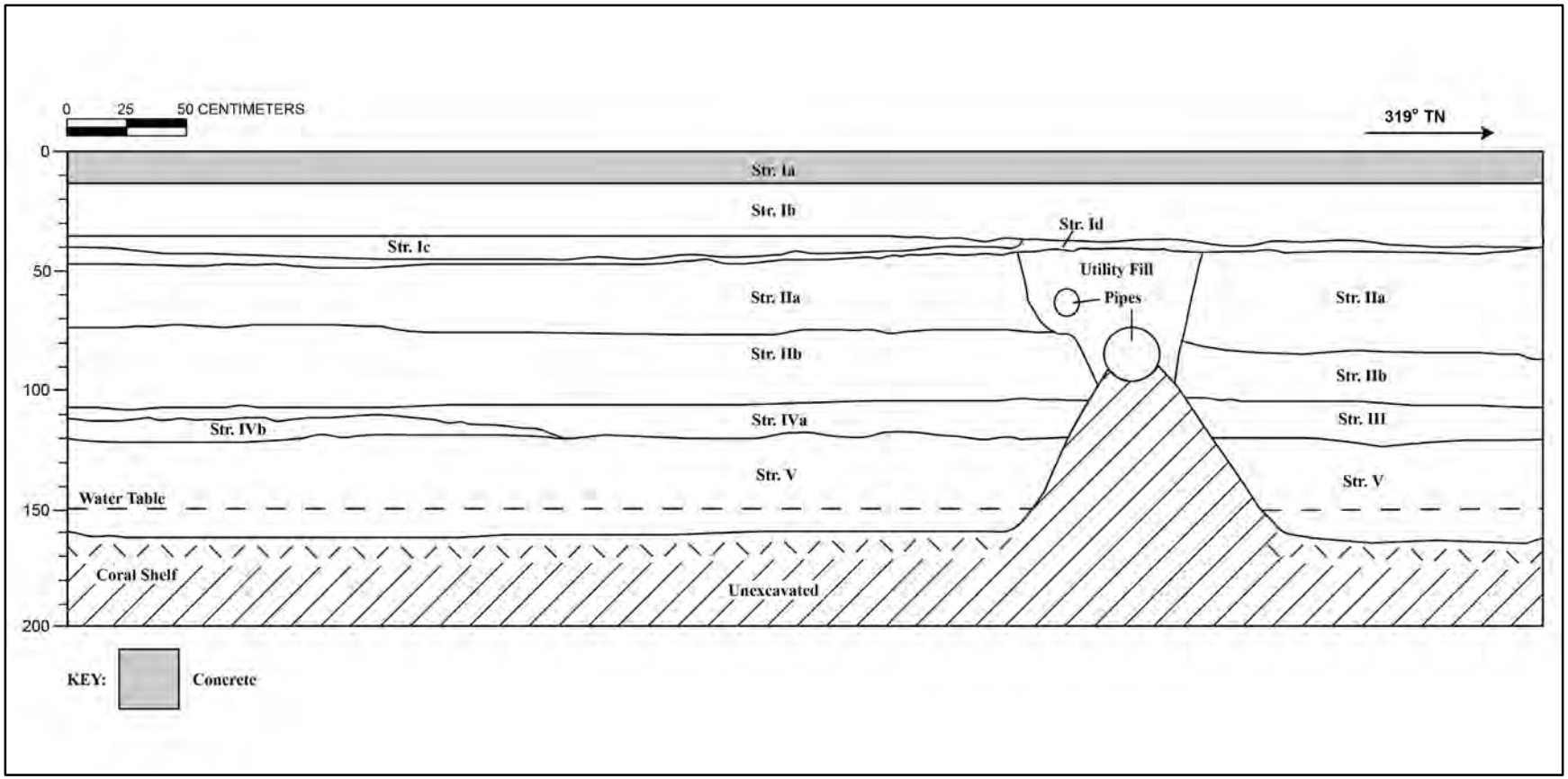

Figure 134. T-22 northeast profile

Table 25. T-22 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–14	Concrete; current commercial floor
Ib	14–40	Fill; extremely gravelly sandy loam; weak, very fine, crumb structure; moist, very friable consistence; non-plastic; terrigenous; abrupt, smooth lower boundary; base course
Ic	35–45	Fill; 7.5YR 6/6, reddish yellow; extremely gravelly silty loam; very fine, crumb structure; moist, very friable consistence; non-plastic; mixed origin; abrupt, smooth lower boundary
Id	40–48	Fill; 10YR 3/3, dark brown; extremely gravelly silty loam; very fine crumb structure; moist, loose consistence; slightly plastic; terrigenous; abrupt, smooth lower boundary
IIa	40–85	Fill; 10YR 8/2, very pale brown; gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	70–106	Fill; 10YR 8/2, very pale brown grading to 10GY 6/1 (GLEY 1), greenish gray; clay; structureless (massive); moist, very firm consistence; very plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	105–125	Fill; 10YR 6/3, pale brown; sandy clay; structureless (massive); moist, friable consistence; slightly plastic; marine origin; clear, broken/discontinuous lower boundary; few roots; iron pipe fragment present; redeposited marine sand containing some shells and rootlets; present only in northwest portion of test excavation
IVa	104–120	Natural; 5GY 5/1 (GLEY 1), greenish gray; sandy clay; structureless (massive); moist, firm consistence; plastic; marine origin; many fine roots; A horizon; wetland sediment with abundant of organics
IVb	112–123	Natural; 10YR 3/2, very dark grayish brown; gravelly sandy clay; structureless (massive); moist, firm consistence; plastic; marine origin; many, fine roots; peaty with lots of decomposing organics; likely a secondary A horizon
V	120–165 (BOE)	Natural; 5GY 5/1 (GLEY 1), greenish gray; medium sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; few fine roots; marine sand; abrupt, smooth lower boundary; overlying coral shelf

Figure 135. Close-up of Strata IVa and IVb underlying hydraulic dredge clay fill (Stratum IIb)

4.2.23 Test Excavation 23 (T-23)

Test Excavation 23 (T-23), an interior excavation located within the Office Depot building, was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide (Figure 136).The base of excavation was determined by the presence of the water table at 1.41 mbs. The stratigraphy of T-23 consisted of the current concrete with laminate tile surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) silty sand (Stratum IIb) overlying a redeposited, locally procured sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), indurated sand (Stratum V), sandy clay (Stratum VI), and marine sand clay (Stratum VII) (Figure 137 and Figure 139, and Table 26).

T-23 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686 (Figure 138). The warehouse remnants consisted of a buried concrete surface (Stratum Ib), which extended across the length of the test excavation. The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial surface.

Beneath the remnant commercial infrastructure, T-23 documented an appreciable amount of induration within natural deposits, indicative of historic disturbance associated with compaction of graded sediments. Stratum III consisted of redeposited, locally procured sediment that contained charcoal, a glass bottle fragment, ironstone ceramic fragments, a six-sided bone die, slag, and faunal material consisting of fish bone (1.9 g) and *Canis lupus familiaris* (dog) bone fragments (8.6 g) (Figure 140 and Figure 141). This local fill material was likely deposited to level and/or build up the ground surface and served as an historic land surface for a period of time prior to reclamation activities (Figure 142). Based on the concentration of historic artifacts and cultural material, Stratum III is considered part of SIHP # -7429. The underlying Stratum IVa is a former stable land surface (A horizon) with an undulating lower boundary. No cultural material was observed within the A horizon during excavation.

A glass bottle fragment and faunal remains were also identified within the crushed coral fill (Stratum IIa) (Figure 143). The faunal remains consisted of *Equus ferus caballus* (horse) proximal humerus that had been cut with a metal blade (276.2 g), *Canis lupus familiaris* vertebra fragment (8.6 g), and fish bone (0.5 g).

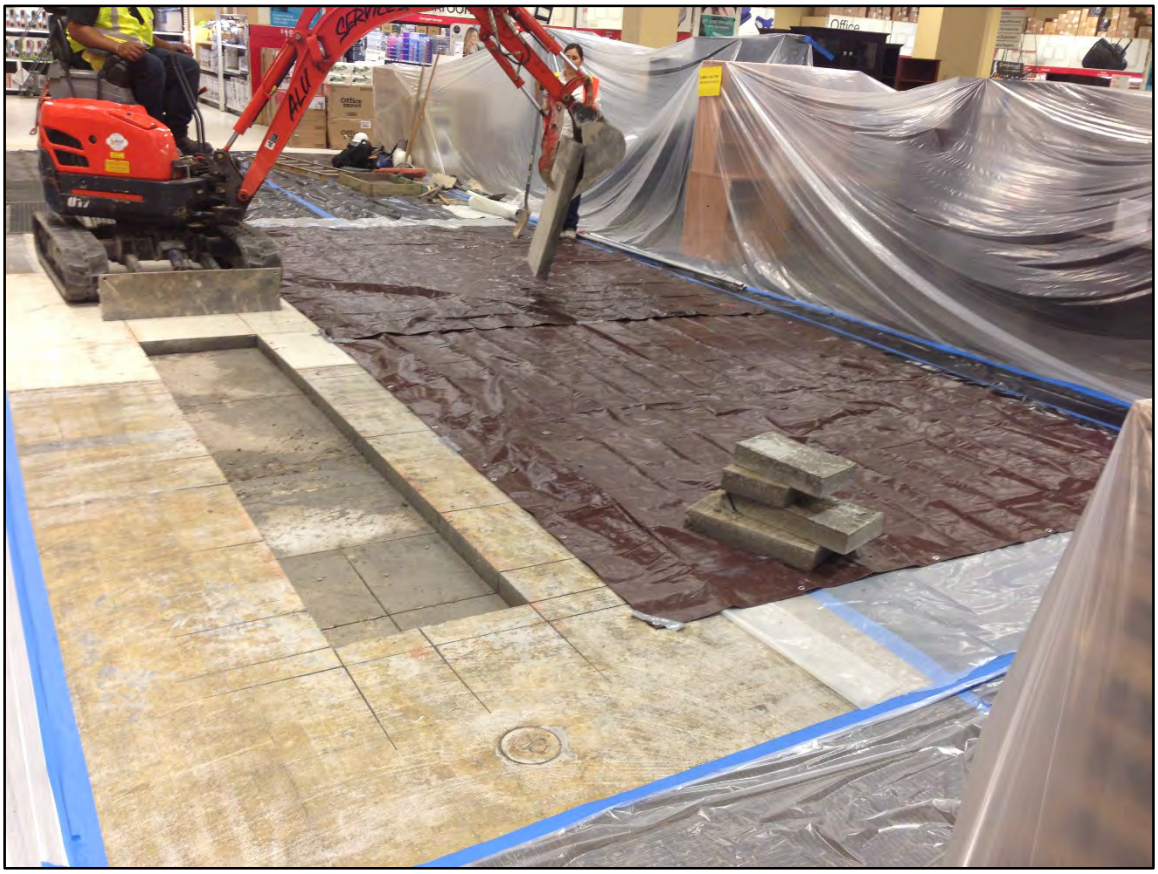

Figure 136. Location of T-23 within interior commercial space, showing removal of the current concrete surface and the thicker buried concrete surface (SIHP # -7686), view to southwest

Figure 137. Photograph of T-23 northwest wall, view to north

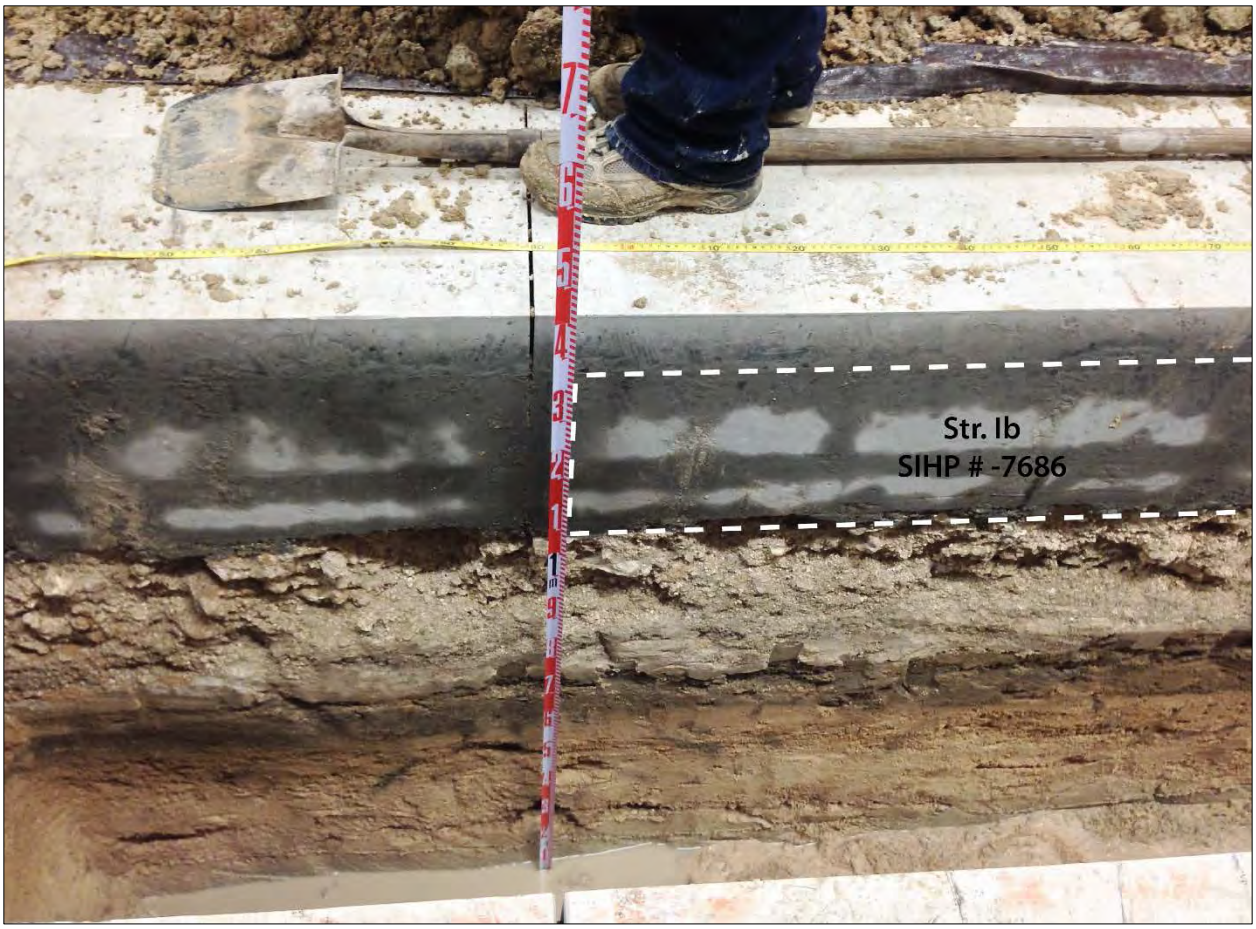

Figure 138. Photograph of T-23, showing Stratum Ib (SIHP # -7686), view to southeast

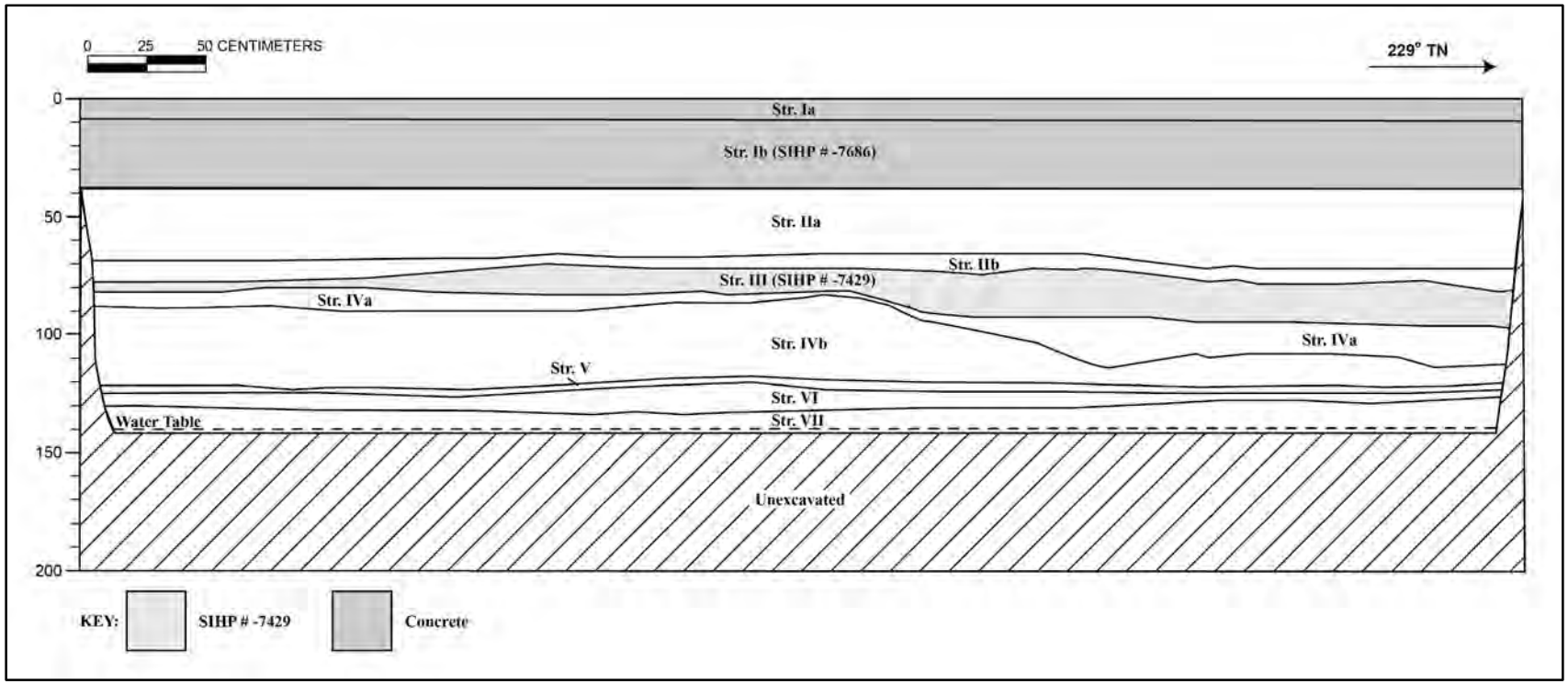

Figure 139. T-23 northwest profile

Table 26. T-23 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Concrete; current commercial floor
Ib	8–38	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
IIa	38–72	Fill; 10YR 6/2, light brownish gray; very gravelly coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927); contained a broken glass bottle and faunal bone
IIb	71–82	Fill; 10YR 7/1, light gray; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	70–96	SIHP # -7429; Fill; 10YR 6/3, pale brown, fine loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized for land modification; contained ceramics, faunal, slag, industrial slag, and a bone die
IVa	80–114	Natural; 10YR 4/2, dark grayish brown; loamy sand; weak, fine to medium, crumb structure; moist, loose consistence, non-plastic; mixed origin; diffuse, wavy lower boundary; A horizon contained charcoal, ceramic fragments, industrial slag, a six-sided wooden die and faunal material
IVb	84–121	Natural; 10YR 7/3; very pale brown; coarse sand; moderate, fine, medium structure; moist, loose consistence; non-plastic, marine origin; clear, smooth lower boundary; Jaucas sand
V	117–125	Natural; 10YR 5/3, brown; sand; strong, medium, crumb structure; indurated cementation; non-plastic; marine origin; clear, smooth lower boundary; indurated layer at bottom of Jaucas sand
VI	120–133	Natural; 10YR 7/3; very pale brown; fine sand clay; structureless (massive); wet, slightly sticky consistence; plastic; marine origin; common, fine roots observed; marine sediment
VII	128–141 (BOE)	Natural; 10Y 7/1 (GLEY 1); light greenish gray; sandy clay; moderate, medium, blocky structure; wet, slightly sticky consistence; plastic; marine origin; lower boundary not visible; common, fine roots observed; marine sediment

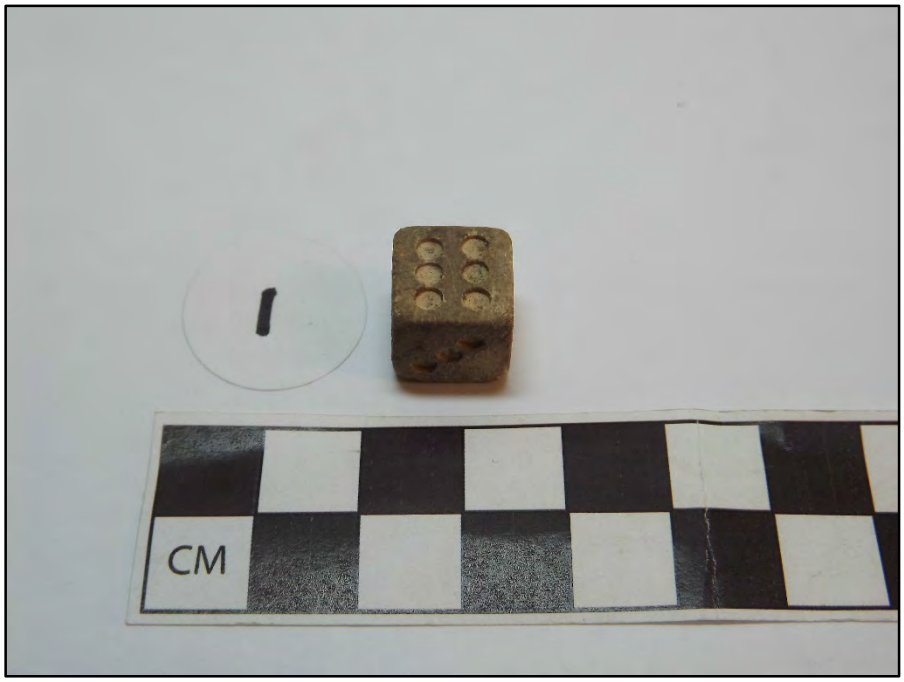

Figure 140. Photograph of six-sided bone die located within Stratum III, SIHP # -7429 (Acc. # 1)

Figure 141. Photograph of glass and ironstone fragments located within Stratum III, SIHP # -7429 (Acc. #s 2–4)

Figure 142. Close-up of T-23 southeast wall, showing the interface of Strata III (SIHP # -7429) (redeposited fine loamy sand), IVa (in situ A horizon), and IVb (Jaucas sand), view to southeast

Figure 143. Glass bottle fragment documented within Stratum IIa (crushed coral) (not collected)

4.2.24 Test Excavation 24 (T-24)

Test Excavation 24 (T-24), an interior excavation located within the Office Depot Building l, was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide (Figure 144). The base of excavation was determined by the presence of the water table at 1.43 mbs. The stratigraphy of T-24 consisted of concrete with laminated tile surface (Stratum Ia) and associated base course material with visqueen barrier (Stratum Ib) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) fine sand (Stratum IIb) overlying a redeposited, locally procured sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), and coarse sandy clay (Stratum V) (Figure 145 and Figure 146, and Table 27). Strata IIa-IVb were truncated on the southeast sidewall by previous ground disturbance activities that may have been related to the installation of a utility pipe (Figure 147).

Stratum III consisted of a layer of fine sand comprised of locally procured mixed sand and sediment deposited over an in situ A horizon (Stratum IVa) that was truncated during previous disturbance (Figure 148). Deposits similar to Stratum III were observed in other test excavations within the project area and are interpreted as local fill material utilized to level and/or build up the ground surface and may have served as a historic land surface for a period of time prior to reclamation activities. A 10-gallon sample of combined Strata III and IV material was field screened and yielded no cultural material.

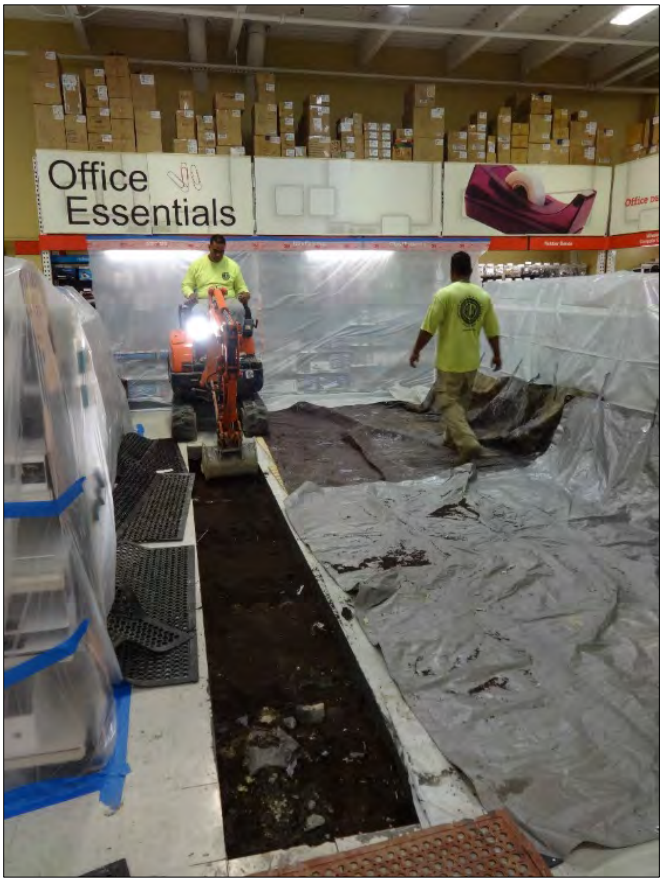

Figure 144. Location of T-24 within interior commercial space, view to northeast

Figure 145. Photograph of T-24 northwest wall, view to west

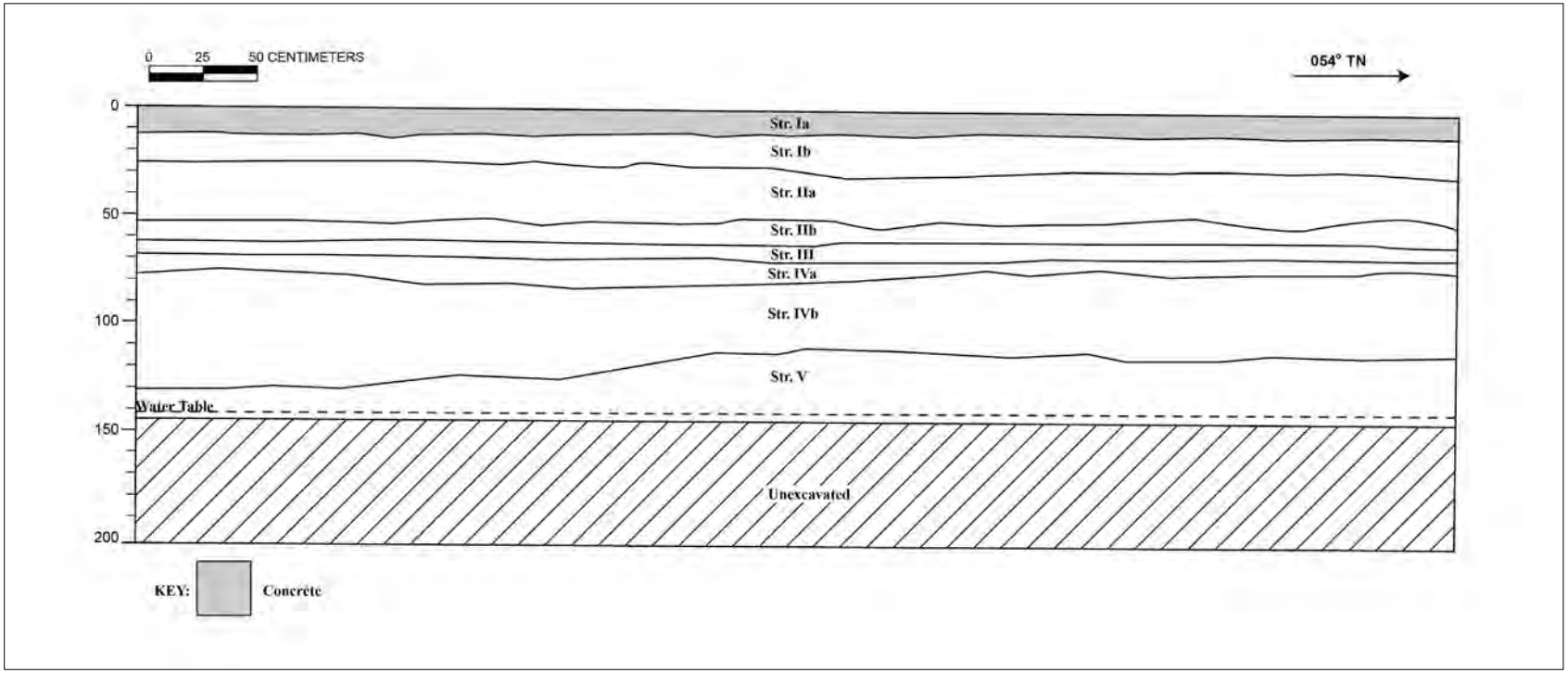

Figure 146. T-24 northwest profile

Table 27. T-24 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–12	Concrete, current store surface with laminate tile (VCT)
Ib	10–30	Fill; 10YR 2/2, very dark brown; extremely gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear lower boundary; contained a plastic sheet in center of stratum
IIa	24–54	Fill; 10YR 4/4, dark yellowish brown; very gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	49–62	Fill; 10YR 6/2, light brownish gray, fine sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; fine sand grading to clay; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	60–70	Fill; 10YR 5/2, grayish brown; fine sand; structureless (single-grain); moist, loose consistence, non-plastic; marine origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	68–82	Natural; 10YR 2/2; very dark brown; fine loamy sand; structureless (single-grain); moist, loose consistence; non-plastic, mixed origin; clear, smooth lower boundary; A horizon
IVb	75–130	Natural; 10YR 5/4, yellowish brown; medium sand; structureless (single-grain); non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand
V	110–143 (BOE)	Natural; 10YR 7/3; very pale brown; coarse sandy clay; structureless (massive); wet, slightly sticky consistence; non-plastic; mixed origin; lower boundary not visible; few, medium roots observed; wetland sediment

Figure 147. T-24 southwest wall showing a utility line extending along the southeast sidewall, view to southwest

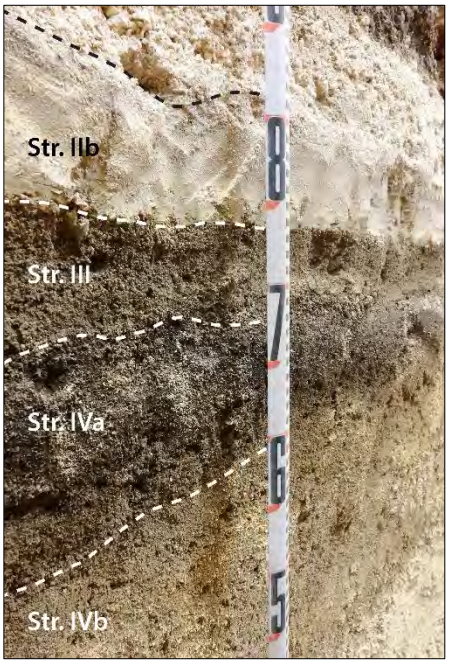

Figure 148. Close up of T-24 northwest (profile) wall showing a slightly lighter Stratum III overlying Stratum IVa, view to south

4.2.25 Test Excavation 25 (T-25)

Test Excavation 25 (T-25), an exterior excavation located northeast (*mauka*) of the Office Depot building along Queen Street, was oriented northeast-southwest and measured 3.0 m long by 1.0 m wide. The base of excavation was determined by the presence of the coral shelf at 1.30 mbs. The size and location of T-25 was limited by the Office Depot building directly southwest (*makai*), utility lines extending parallel to the building, the property boundary, and a utility corridor to the northeast (*mauka*) (Figure 149). The stratigraphy of T-25 consisted of the asphalt surface (Stratum Ia) and associated base course (Stratum Ib), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of coarse very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb) overlying a redeposited, locally procured loamy sand fill (Stratum III), overlying a natural A horizon (Stratum IVa), Jaucas sand (Stratum IVb), a wetland clay sediment (Stratum Va), and marine sand (Stratum Vb) (Figure 150 and Figure 151, and Table 28). Multiple utility lines with associated utility fill were documented running perpendicular through T-25, which resulted in the truncation of both the imported fill and natural deposits (see Figure 151).

T-25 is located approximately 20 m southeast of T-18 and documented a similar stratigraphic sequence. However, the natural A horizon (Stratum IVa) was thicker and exhibited less disturbance and transfiguration of the soil matrix than T-18. In addition, a redeposited locally procured loamy sand fill deposit (Stratum III) was located over top of the A horizon. This sand fill deposit was commonly found throughout the project area and is interpreted as historic leveling or building up of the ground surface prior to reclamation activities (Strata IIa and IIb).

One gallon of the A horizon was screened in the field, yielding no cultural material. Ten gallons of the underlying Jaucas sand were also screened due to the presence of cow bone (*Bos taurus* long bone fragments cut with a metal saw blade). Cut mark (kerf) and striations were visible on the cross-section consistent with blades used in commercial butcher shops. Heavily weathered non-human mammalian long bone fragments were also documented. No additional cultural or faunal material was identified.

Figure 149. Exterior location of T-25 in relation to spatial limitations.

Figure 150. T-25 northwest wall, view to west

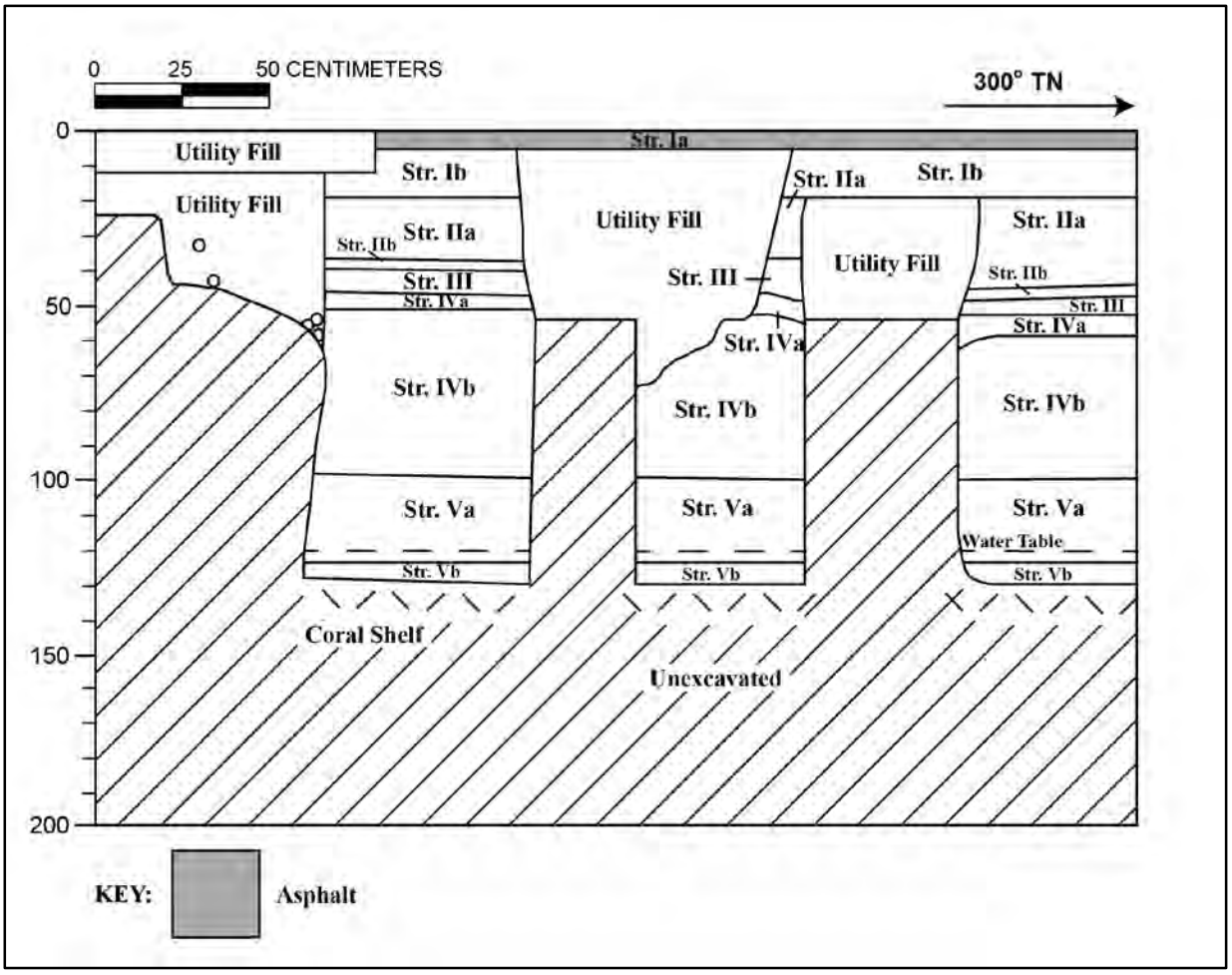

Figure 151. T-25 northwest profile

Table 28. T-25 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–20	Fill; 5YR 3/3, dark reddish brown; gravel base course
IIa	20–36	Fill; 2.5Y 7/2, light gray; very gravelly coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth, broken/discontinuous lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	36–40	Fill; 10YR 7/2, light gray; clay sand; moderate, fine, platy structure; moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	37–53	Fill; 10YR 4/2, dark grayish brown; loamy sand; weak, fine, crumb structure; moist, friable consistence; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	47–59	Natural; 10YR 3/2, very dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth, broken/discontinuous lower boundary; A horizon; contained brackish water shells
IVb	50–100	Natural; 2.5YR 7/3, pale brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; few, fine roots; Jaucas sand; faunal bones identified in interface between Jaucas sand and utility fill
Va	100–125	Natural; 2.5 8/3, pale brown; clay sand; weak, fine, crumb structure; wet, slightly sticky consistence; non-plastic; marine origin; clear, smooth lower boundary; wetland sediment
Vb	125–130 (BOE)	Natural; 10Y 6/1 (GLEY 1), greenish gray; sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; clear, smooth lower boundary; wetland deposit; overlying coral shelf

4.2.26 Test Excavation 26 (T-26)

Test Excavation 26 (T-26), an exterior excavation located within the alleyway behind the Office Depot building, was oriented northeast-southwest and measured 6.0 m long by .70 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.55 mbs. Due to stratigraphic differences between the northwest and southeast walls of T-26, two stratigraphic profiles were recorded for T-26.

The stratigraphy of the southeast wall consisted of the asphalt surface (Stratum Ia) and associated base course material (Stratum IIb) overlying a layer of subsurface asphalt (Stratum Id) and sandy loam fill (Stratum Ie), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of gravelly sand grading to sandy clay loam (Stratum II), overlying a redeposited, locally procured sandy loam (Stratum IIIa), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), and a gravelly clay sand wetland deposit (Stratum V) (Figure 152 through Figure 154, and Figure 157). This sequence is typical of the surrounding area.

The stratigraphy of the northwest wall differed from the southeast wall due to the natural downward slope of the A horizon and Jaucas sand, which descended approximately 50 cm from the southeast wall to the northwest wall (see Figure 152 and Figure 158). To in-fill this lower lying area, several additional layers of sandy loam fill were deposited below Stratum IIIa (Strata IIIb–IIIe) (Figure 158 and Figure 159, and Table 29).

T-26 documented at least two historic land modification episodes. The series of Strata IIIa–IIIe sandy loam deposits appeared to have been placed over top the natural A horizon (Stratum IVa) and Jaucas sand (Stratum IVb) in order to in-fill, or level, a significant dip in the natural sand topography. The uppermost sandy loam fill deposit, Stratum IIIa, was consistent with the reworked loamy sand fill deposits documented throughout the sandy portions of the project area, and served as a historic land surface for a period of time prior to the Kaka‘ako land reclamation program (Stratum II). Stratum III was observed to contain metal and glass bottle fragments.

The underlying in situ A horizon (Stratum IVa) appeared to have been truncated during previous ground disturbance activities. A 1-gallon screen and careful shovel scraping of the A horizon yielded no cultural material.

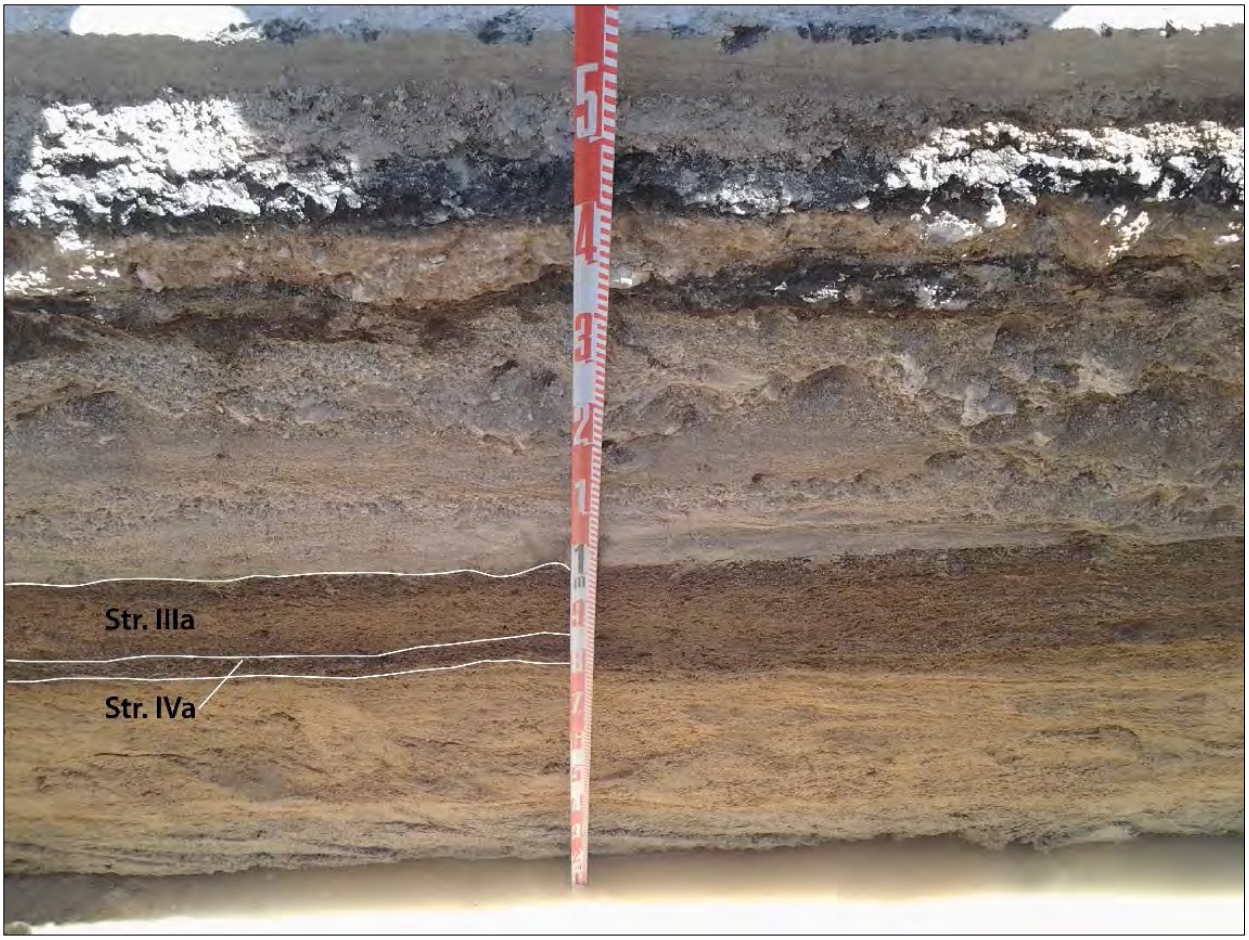

Figure 152. T-26 southeast wall, view to southeast

Figure 153. T-26 southeast and southwest walls, strata and disturbance fill on southeast wall, view to south

Figure 154. T-26 northeast and southeast walls, view to east

Figure 155. Close-up of southwest wall, showing a sloping sand dune (Stratum IVb) overlain by a dark, in situ A horizon (Stratum IVa) and several layers of lomy sand fill (Strata IIIa–IIIe), view to southwest

Figure 156. Close-up of northeast wall, showing similar stratigraphy to Figure 155, view to northeast

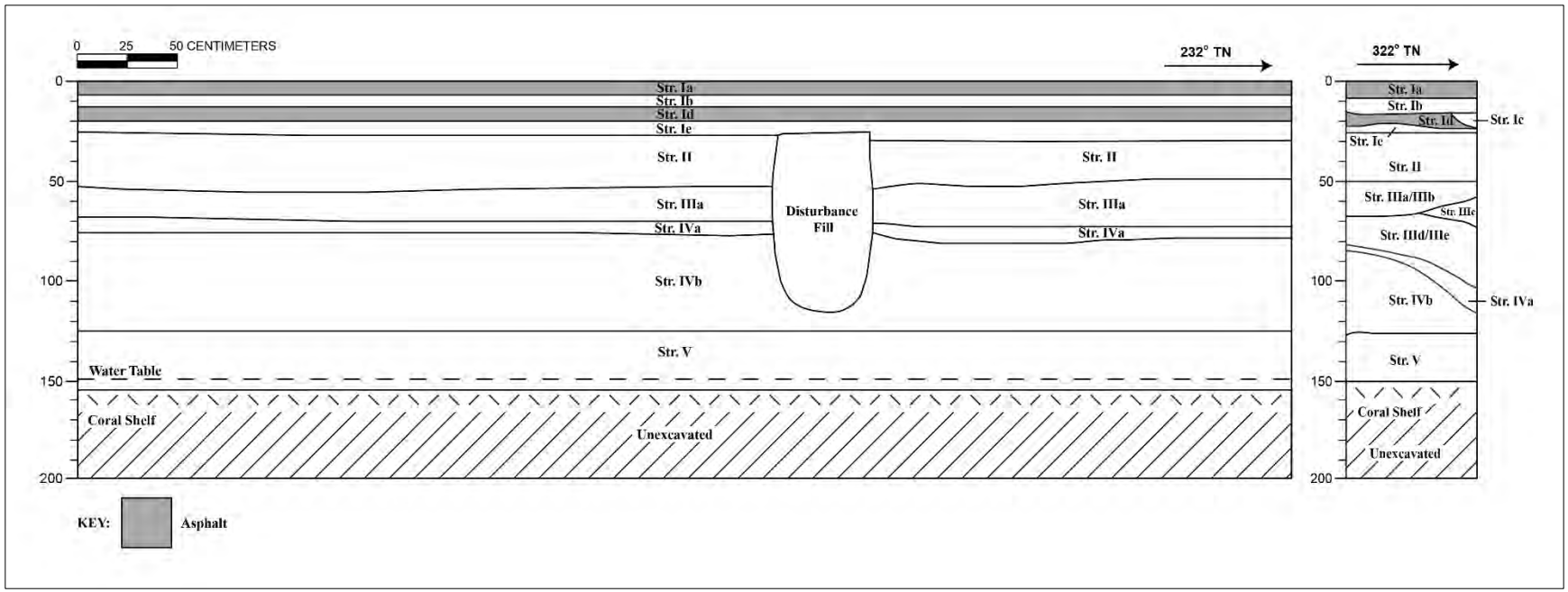

Figure 157. T-26 southeast (left) and southwest (right) profiles

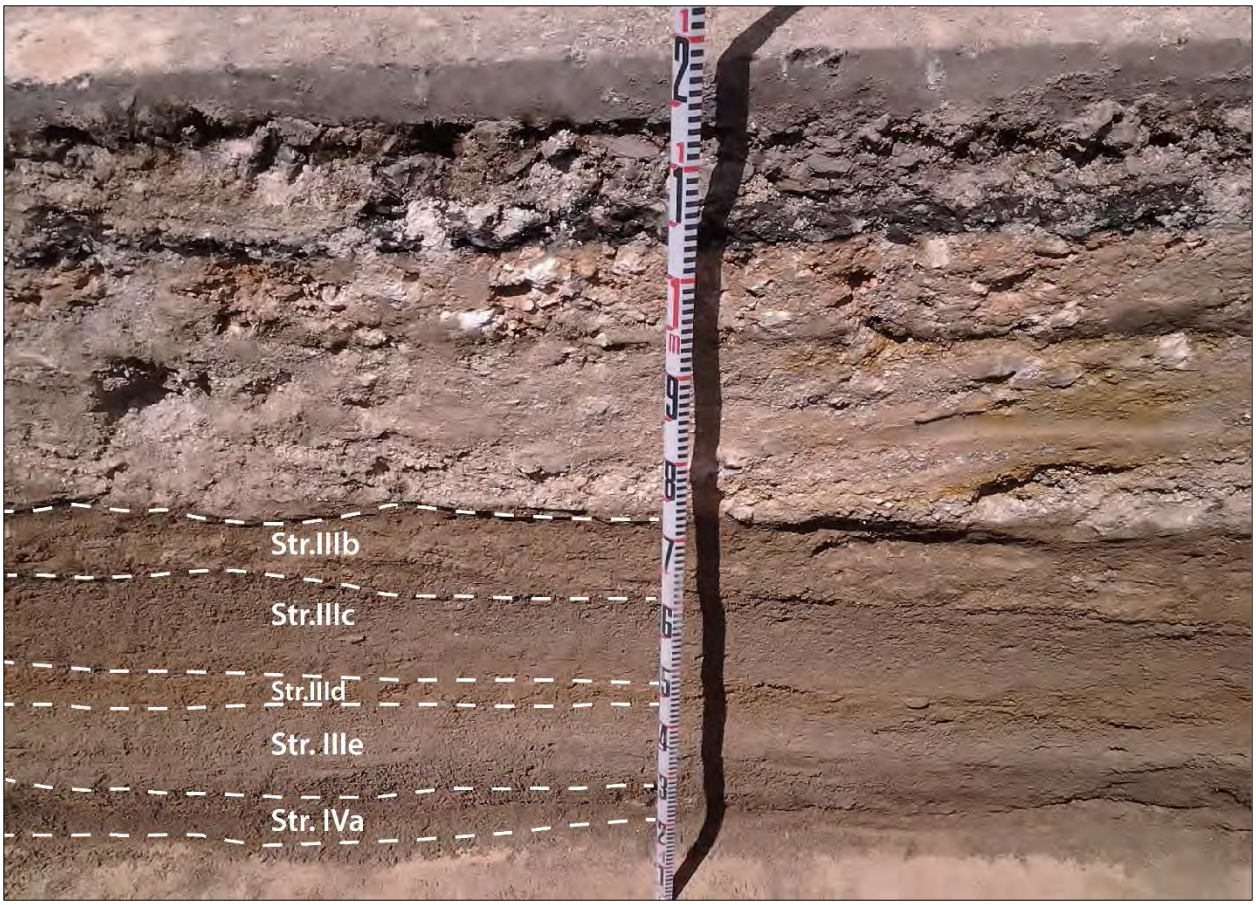

Figure 158. T-26 northwest wall, view to northwest

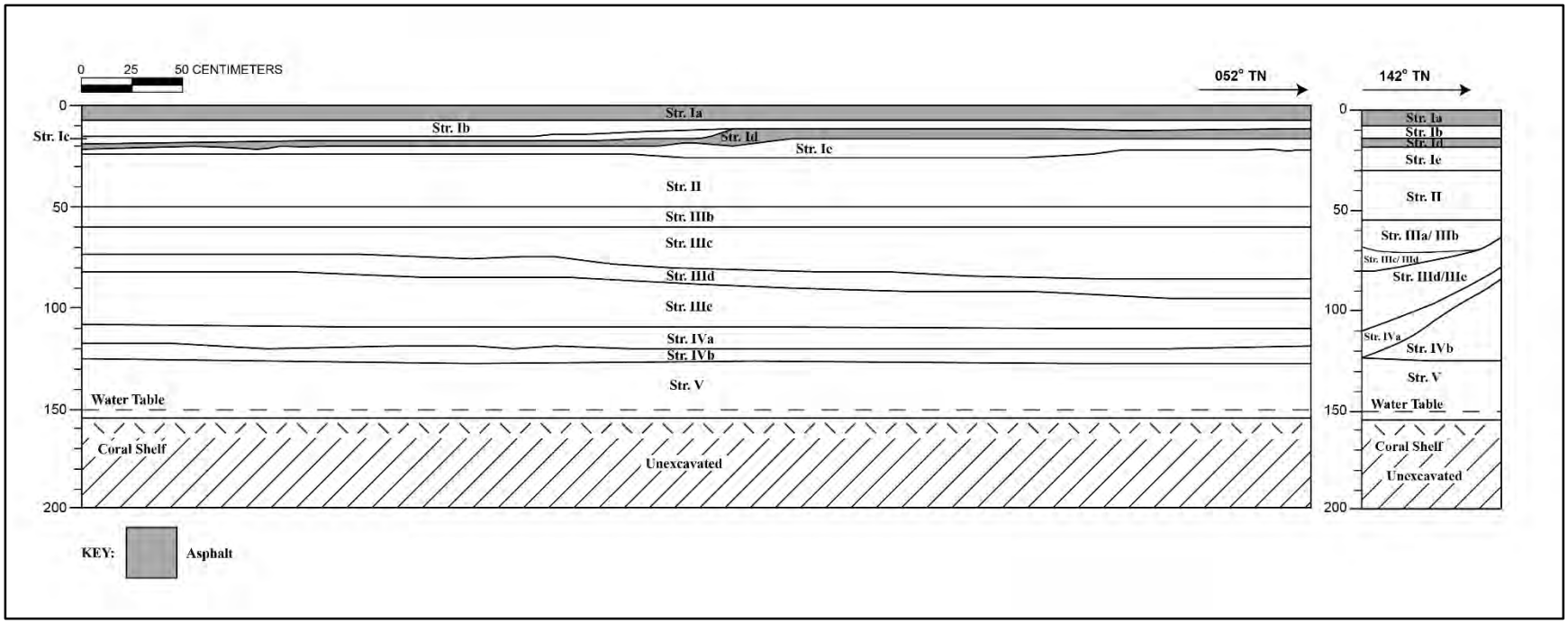

Figure 159. T-26 northwest (left) and northeast (right) profiles

Table 29. T-26 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–15	Fill; 5YR 3/2, dark reddish brown; extremely gravelly sandy loam; weak, fine to medium, granular structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	10–20	Fill; 7.5YR 3/2, dark brown; sandy loam; weak, fine to medium, granular structure; moist, loose consistence; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; compact fill, not continuous throughout profile
Id	10–20	Asphalt
Ie	20–25	Fill; 10YR 3/3, dark brown; slightly gravelly sandy loam; weak, fine, crumb structure; moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary; compact crushed coralline sand fill mottled with asphalt, slight amount of coral gravel inclusions and trace amounts of clay fill
II	25–55	Fill; 10YR 7/3, very pale brown; gravelly fine sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, wavy lower boundary; fine sand matrix containing large coral gravels and small coral cobbles; grading to fine sandy clay loam at lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	55–70	Fill; 10YR 4/3, brown; sandy loam; weak, fine to medium, crumb structure; moist, loose consistence; non-plastic, marine origin; diffuse, wavy lower boundary; re-deposited sandy A horizon used as fill, metal fragments observed but not collected
IIIb	50-60	Fill; 10YR 4/3, brown; sandy loam; weak, fine to medium, crumb structure; non-plastic; marine origin; diffuse, wavy lower boundary; glass bottle fragments observed; re-deposited sandy A horizon used as fill
IIIc	60-80	Fill; 10YR 6/2, light brownish gray; loamy sand; weak, fine, crumb structure; moist, loose consistence; non-plastic; clear, smooth lower boundary
IIId	75-95	Fill; 10YR 5/4, yellowish brown; loamy sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; diffuse lower boundary
IIIe	85-110	10YR 5/2, grayish brown; slightly gravelly loamy sand; weak, fine, crumb structure; moist, loose consistence; non-plastic; marine origin; clear lower boundary, small fragments of shell midden (urchin) observed but not collected
IVa	100–125	Natural; 10YR 4/2, dark grayish brown; loamy sand; weak, fine, crumb structure; moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; A horizon
IVb	100–125	Natural; 10YR 7/4, very pale brown; sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; marine origin; diffuse, smooth lower boundary; Jaucas sand

Stratum	Depth (cmbs)	Description of Sediment
V	125–155 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; gravelly clay sand; moderate, medium, crumb structure; wet, non-sticky consistence; non-plastic; marine origin; few, fine roots; wetland sediment; overlying coral shelf

4.2.27 Test Excavation 27 (T-27)

Test Excavation 27 (T-27), an interior excavation located within the former Nordstrom Rack building, was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide (Figure 160). The base of excavation was determined by the presence of the water table at 1.75 mbs. The stratigraphy of T-27 consisted of the current concrete surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb) overlying a natural sandy loam, wetland A horizon (Stratum IIIa), and a sandy clay wetland deposit (Stratum IIIb) (Figure 161 and Figure 162, and Table 30).

T-27 had a similar stratigraphic sequence as T-20. Directly beneath the current commercial floor, remnants of a commercial warehouse foundation were identified, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic). Located beneath the commercial warehouse remnants were 1917–1926 Kaka‘ako land reclamation fill deposits. The underlying natural stratigraphic deposits consisted of a culturally sterile, peaty A horizon (Stratum IIIa) developed within a wetland environment (Stratum IIIb) (Figure 163). The upper boundary of Stratum IIIa was truncated by previous ground disturbance activities; however, no other disturbances were observed.

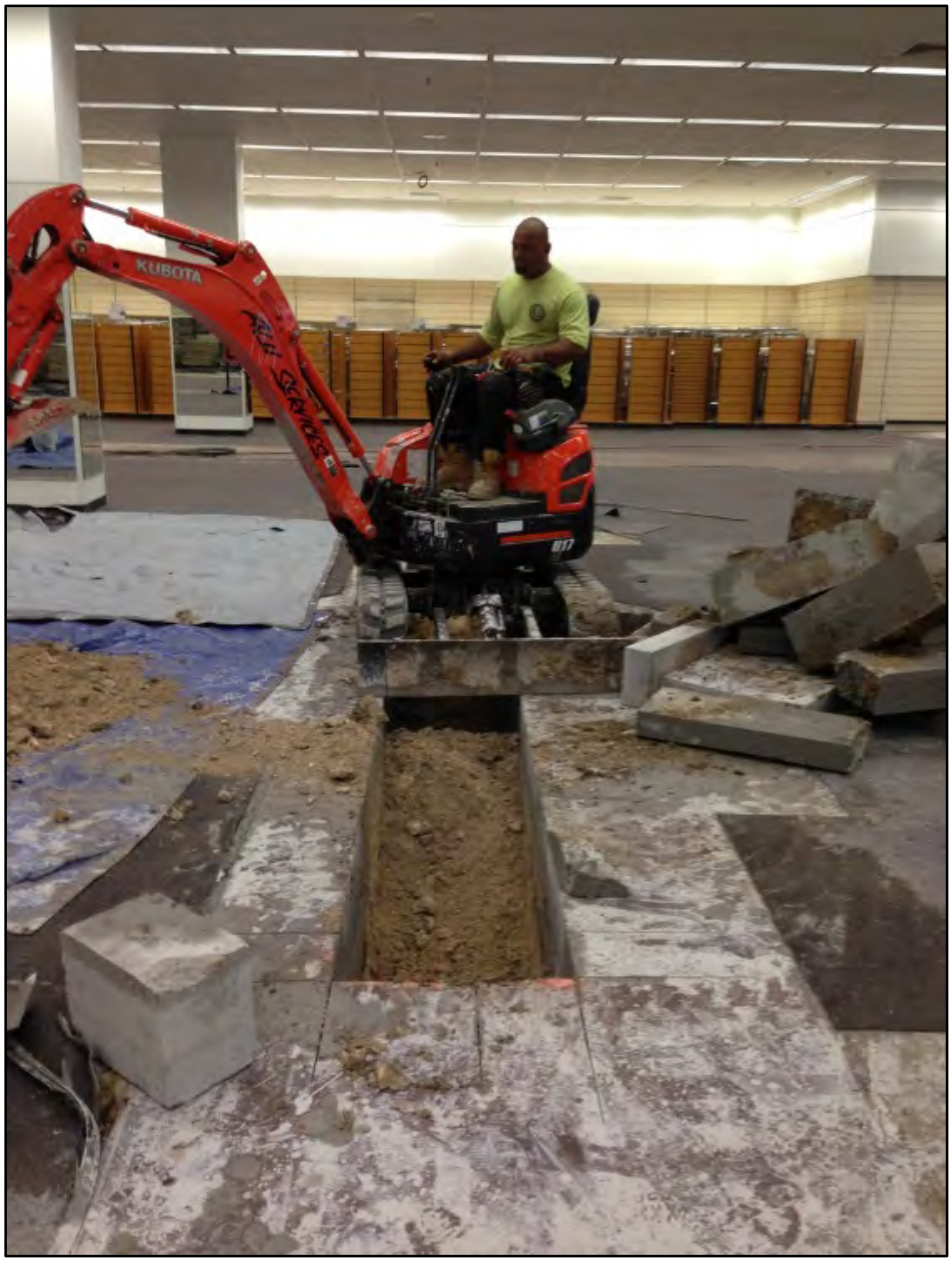

Figure 160. Location of T-27 within interior commercial space, showing removal of the current concrete surface and the thicker buried concrete surface (SIHP # -7686), view to southwest

Figure 161. T-27 north wall, showing SIHP # -7686, view to north

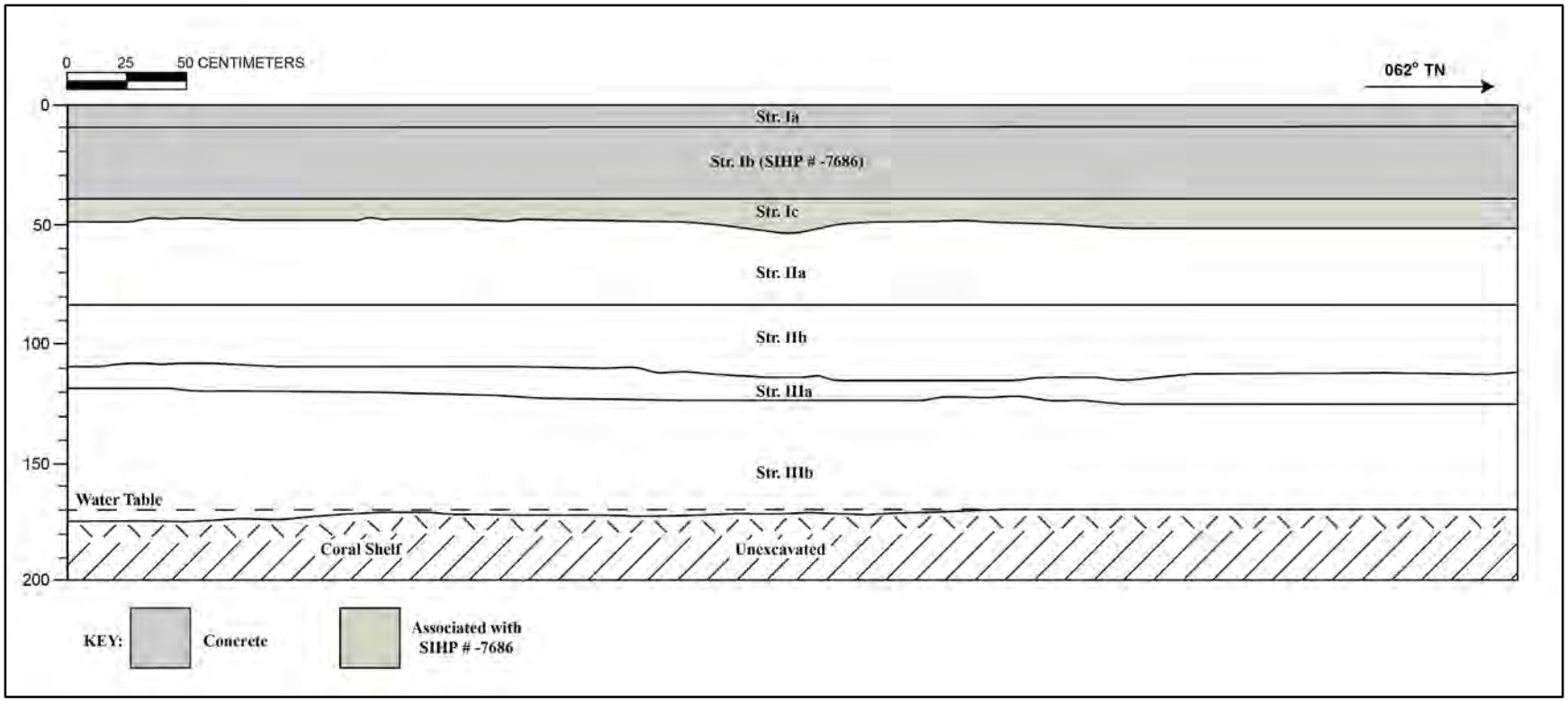

Figure 162. T-27 northwest profile

Table 30. T-27 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–10	Concrete; current commercial floor
Ib	10–40	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	40–52	Fill; 10YR 2/2, very dark brown; very gravelly silty loam; weak, fine, crumb structure; moist, loose consistence; slightly plastic; terrigenous; abrupt, smooth lower boundary; base course
IIa	45–84	Fill; 10YR 8/3, very pale brown; gravelly medium sand; structureless (single-grain); dry, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	84–115	Fill; 10YR 8/3 very pale brown grading to 10GY 6/1 (GLEY 1), greenish gray; clay; structureless (massive); moist, very firm consistence; very plastic; marine origin; clear, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	110–125	Natural; 10Y 3/1 (GLEY 1), very dark greenish gray; sandy loam; moderate, fine, crumb structure; moist, very friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; few very fine roots; natural wetland A horizon containing organics
IIIb	125–175 (BOE)	Natural; 5G 6/1 (GLEY 1), greenish gray; sandy clay; structureless (massive); wet, non-sticky consistence; plastic; marine origin; abrupt, smooth lower boundary; wetland deposit; overlying coral shelf

Figure 163. Close-up showing Stratum IIIa wetland A horizon developed within Stratum IIIb wetland sandy clay

4.2.28 Test Excavation 28 (T-28)

Test Excavation 28 (T-28), an interior excavation located within the former Nordstrom Rack building, was oriented southwest-northeast and measured 6.0 m long by 0.6 m wide (Figure 164). The base of excavation was determined by the hard coral shelf at 1.66 mbs. The stratigraphy of T-28 consisted of the current concrete laminated tile surface (Stratum Ia) over a buried concrete surface (Stratum Ib) and associated gravelly silty loam base course (Stratum Ic) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb) overlying a natural sandy loam, wetland A horizon (Stratum IIIa), and a sandy clay wetland deposit (Stratum IIIb) (Figure 165 and Figure 167, and Table 31).

Similar to T-20 and 27, T-28 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686 (Figure 166). The warehouse remnants consisted of a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic) that extended across the length of the test excavation. The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial surface. Located beneath the commercial warehouse remnants were 1917–1926 Kaka‘ako land reclamation fill deposits. The underlying natural stratigraphic deposits consisted of a culturally sterile, peaty A horizon (Stratum IIIa) within a wetland environment (Stratum IIIb). The upper boundary of Stratum IIIa was truncated during previous ground disturbance activities; however, no other disturbances were observed.

Figure 164. Location of T-28 within interior commercial space, view to southeast

Figure 165. T-28 southeast wall, view to south

Figure 166. Photograph of T-28, showing SIHP # -7686, view to south

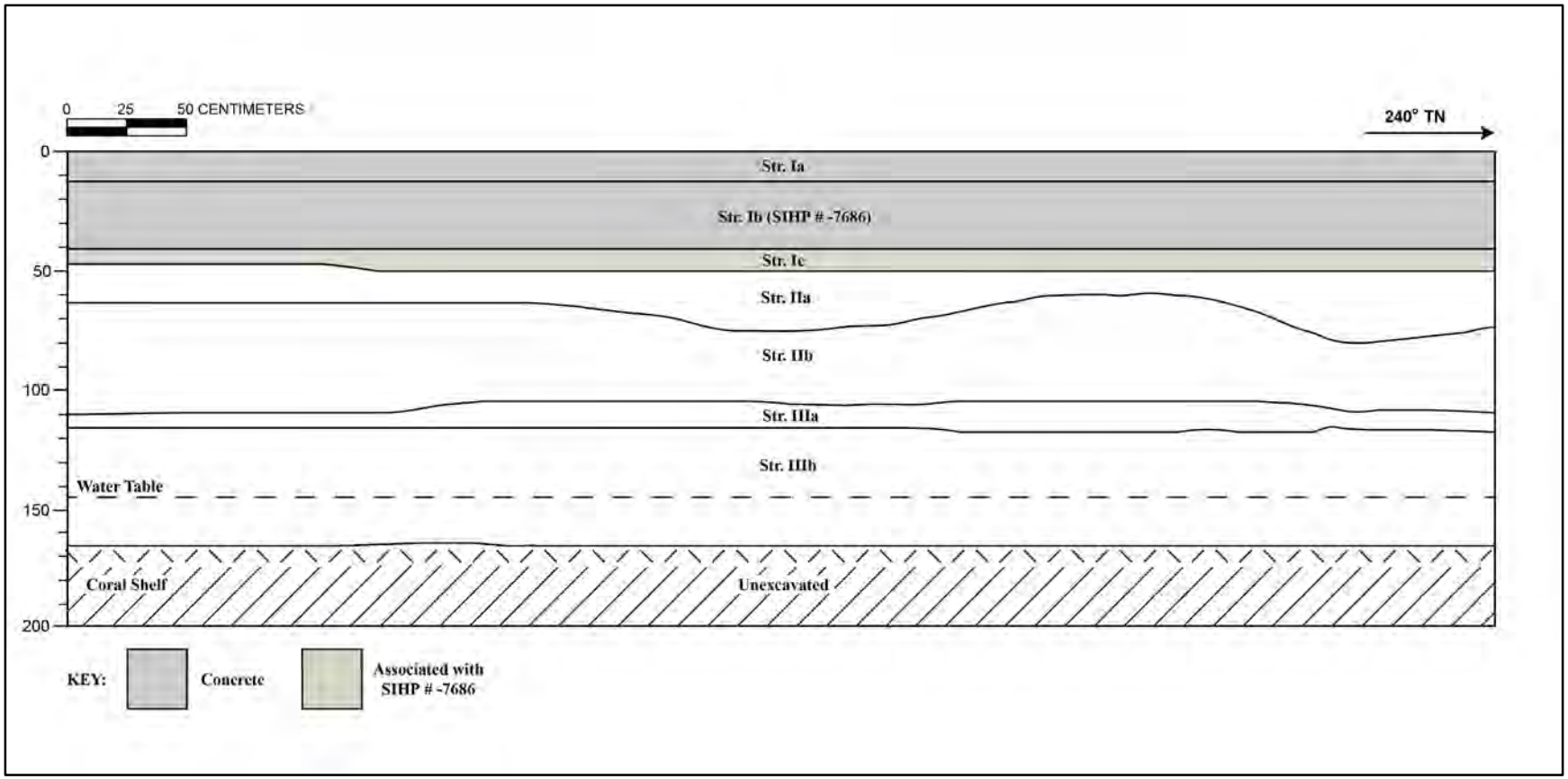

Figure 167. T-28 southeast profile

Table 31. T-28 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–13	Concrete; current commercial floor
Ib	13–41	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	41–50	Fill; 10YR 2/2, very dark brown; very gravelly silty loam; weak, fine, crumb structure; moist, loose consistence; slightly plastic; terrigenous origin; abrupt, smooth lower boundary; base course
IIa	47–80	Fill; 10YR 8/3, very pale brown; gravelly medium sand; structureless (single-grain); dry, loose consistence; non-plastic; marine origin; diffuse, wavy lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	60–109	Fill; 10YR 8/3, very pale brown grading to 10GY 6/1 (GLEY 1), greenish gray; clay; structureless (massive); moist, very firm consistence; very plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	104–117	Natural; 10Y 3/1 (GLEY 1), very dark greenish gray; sandy loam; moderate, fine, crumb structure; moist, friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; wetland A horizon containing organics
IIIb	117–166 (BOE)	Natural; 5G 6/1 (GLEY 1), greenish gray; sandy clay; structureless (massive); wet, non-sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; wetland deposit; overlying coral shelf

4.2.29 Test Excavation 29 (T-29)

Test Excavation 29 (T-29), an interior excavation located within the Office Depot building, was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide. The base of excavation was determined by the presence of the water table at 1.65 mbs. The stratigraphy of T-29 consisted of the concrete laminated tile surface (Stratum Ia) and an associated gravelly loamy sand base course (Stratum Ib) overlying a buried concrete surface (Stratum Ic) and associated cinder base course with a thin layer of asphalt gravel (Stratum Id), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb) overlying a possibly redeposited clay sand A horizon (Stratum III), Jaucas sand with clay inclusions (Stratum IV), and sandy clay (Stratum V) (Figure 168 and Figure 169, and Table 32).

T-29 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ic) and associated base course (Stratum Id), which extended across the length of the test excavation. The current commercial building surface (Stratum Ia), including the associated base course (Stratum Ib), was constructed directly over top this earlier commercial surface. The base course (Stratum Ib) was unevenly distributed, indicating the underlying concrete slab may not have been entirely level (to modern code).

Stratum III appeared to consist of redeposited A horizon material, including both sand and wetland clay, rather than the loamy sand A horizon material identified in the surrounding test excavations. Previous disturbance to and/or redeposition of this stratum may also be indicated by the inclusion of clay mottling within the upper boundary of the underlying Jaucas sand (Stratum IV) within the *makai* portion of T-29. Alternatively, the clay mottling may be the result of natural transformations related to change in the natural depositional environment (i.e., transition from wetland to terrestrial sand). No clear boundary was observed between the mottled clay and non-mottled sand. Aside from a glass bottle fragment found at the interface of Strata IIa and IIb (Figure 170), no diagnostic artifacts, features, or cultural material were observed.

Figure 168. T-29 southeast wall, SIHP # -7686, view to northeast

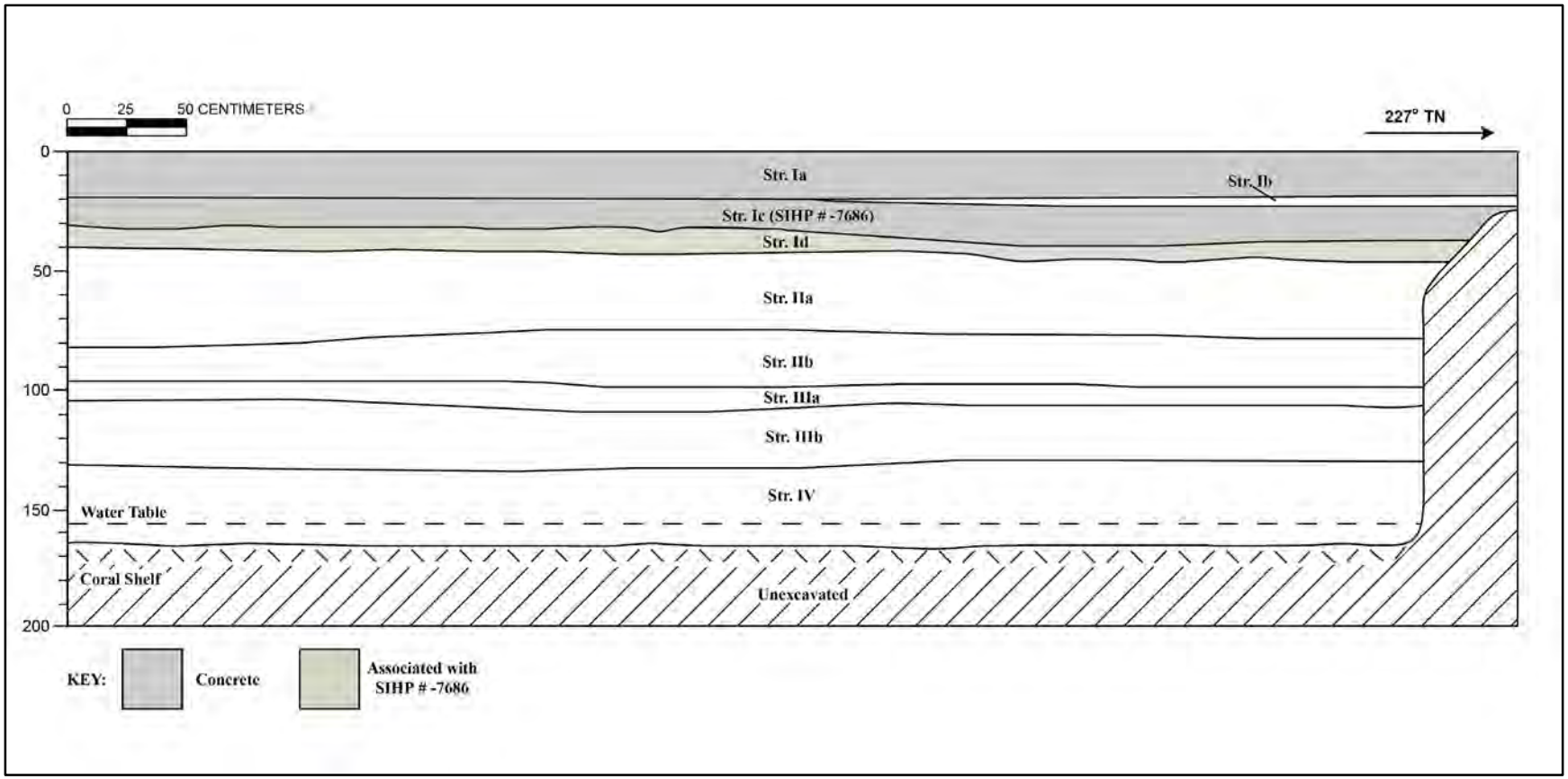

Figure 169. T-29 southeast profile

Table 32. T-29 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–40	Concrete, current commercial floor
Ib	19–23	Fill; gravelly loamy sand; base course
Ic	19–40	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Id	33–46	Fill; 10YR 3/2, very dark grayish brown; very gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; imported quarry gravel fill with asphalt gravel layer at lower boundary
IIa	42–83	Fill; 10YR 7/2, light gray; very gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927); contained a glass bottle bottom fragment at the lower boundary
IIb	75–109	Fill; 10YR 6/2, light brownish gray, clay; structureless (massive); wet, slightly sticky consistence; plastic; marine origin; clear, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	96–110	Disturbed natural; 10YR 5/2; grayish brown; clay sand; weak, fine, crumb structure; moist, very friable; non-plastic; mixed origin; diffuse–abrupt, wavy lower boundary; possible redeposited A horizon material
IIIb	105–135	Natural; 10YR 5/4; yellowish brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand containing clay mottles in the *makai* portion
IV	129–165 (BOE)	Natural; 5GY 6/1 (GLEY 1); greenish gray; sandy clay; moderate, fine to medium, granular structure; wet, slightly sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; common, fine roots observed; wetland sediment; overlying coral shelf

Figure 170. Glass bottle fragment found in T-29 at the interface of Strata IIa and IIb

4.2.30 Test Excavation 30 (T-30)

Test Excavation 30 (T-30), an interior excavation located within the Office Depot building, was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide (Figure 171). The base of excavation was determined by the presence of the water table at 1.36 mbs. The stratigraphy of T-30 consisted of concrete with laminated tile surface (Stratum Ia), associated base course with a lower visqueen barrier (Stratum Ib), and three strata of extremely gravelly sand (Strata Ic–Ie), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay silt (Stratum IIb), overlying a natural loamy sand A horizon (Stratum IIIa), Jaucas sand (Stratum IIIb), and coarse clay sand (Stratum IV) (Figure 172 and Figure 173, and Table 33). The lower boundary of Stratum IIIb contained a thin indurate layer of cemented sand that separated the Jaucas sand from the sandy clay, similar to that observed within T-16 and 17.

T-30 documented fill deposits ranging from modern urban development (Strata Ia–Ie) to Kaka‘ako land reclamation deposits (Strata IIa–IIb) overlying natural sand deposits (Strata IIIa, IIIb, IV). Stratum IV consisted of a buried A horizon that contained light charcoal staining and was truncated during previous ground disturbance activities. A 5-gallon screen of the A horizon yielded no cultural material.

A disturbance was documented in the southwest (*makai*) end of T-30 and was visible on the southeast, southwest, and northwest walls (Figure 174). This anomaly is characterized as contiguous pockets of extremely gravelly crushed coralline sand mixed with Strata Ie and IIa. A fragment of a *Bos taurus* (cow) long bone cut with a metal blade was identified within Stratum Ic.

Figure 171. Location of T-30 within interior commercial space, view to southwest

Figure 172. T-30 stratigraphic overview, view to northeast

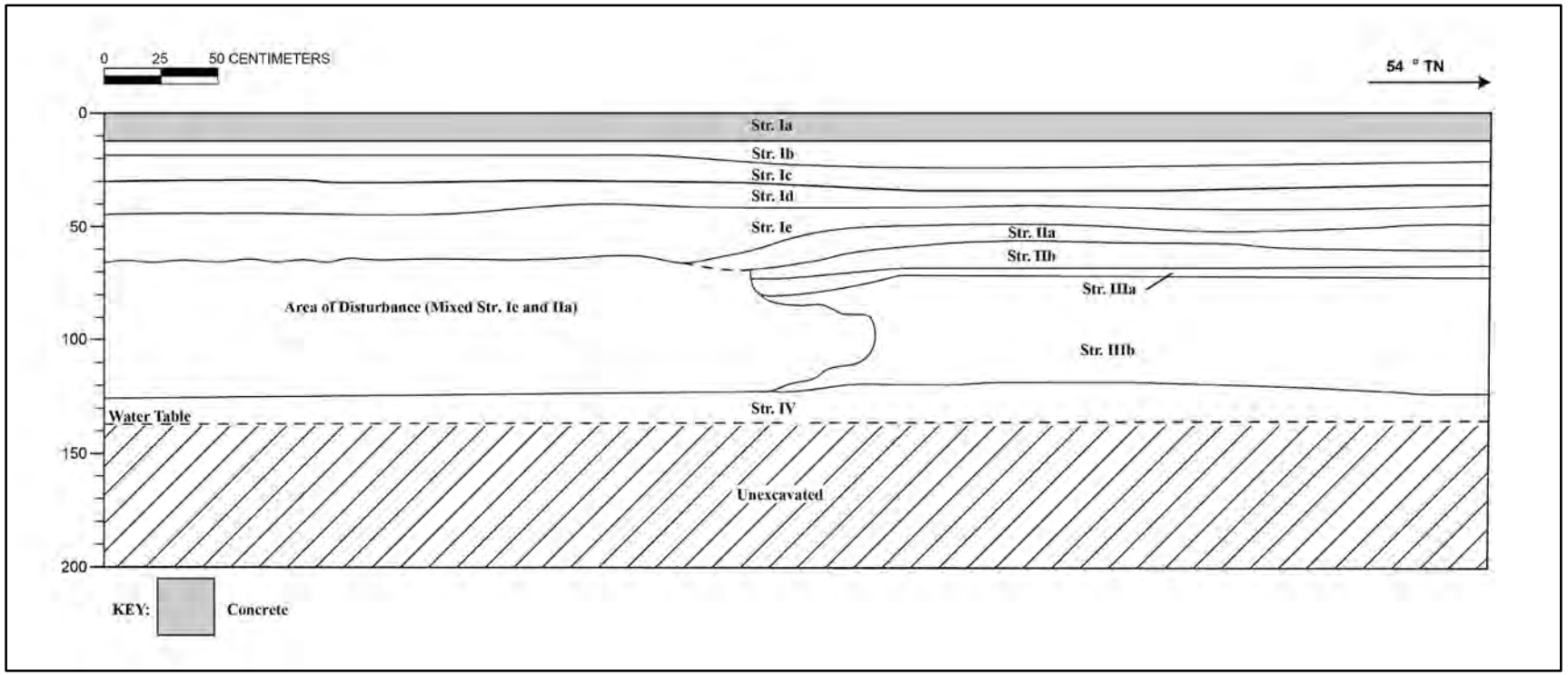

Figure 173. T-30 northwest profile

Table 33. T-30 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–13	Concrete, current surface with VCT flooring; very abrupt, smooth lower boundary
Ib	13–21	Fill; 10YR 2/2, very dark brown, mottled with N 6/1, gray; extremely gravelly, loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; contained PVC pipes and a visqueen barrier separating upper and lower halves
Ic	19–32	Fill; 7.5YR 4/4, brown; gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, abrupt lower boundary; lower boundary contained asphalt remnants; contained cf. *Bos taurus* (cow bone)
Id	30–45	Fill; 2.5Y 7/3, pale yellow; gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary
Ie	40–65	Fill; 7.5YR 4/1, dark gray; gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary; contained asphalt chunks
IIa	50–70	Fill; 10YR 8/3; very pale brown; extremely gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, wavy lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	56–73	Fill; 10YR 8/2; very pale brown; clay silt; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	67–80	Natural; 10YR 4/2; dark grayish brown; medium loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear to diffuse, broken/discontinuous lower boundary; A horizon; contained a concentration of charcoal flecking
IIIb	72–125	Natural; 10YR 8/4; very pale brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, broken/discontinuous lower boundary; Jaucas sand
IV	120–136 (BOE)	Natural; 10YR 8/4; very pale brown; coarse clay sand; structureless (single-grain); wet, slightly sticky consistence; non-plastic; marine origin; lower boundary not visible; marine sediment; contained marine shell and crab claw fragments

Figure 174. T-30 northwest wall, *mauka* end, view to northwest

4.2.31 Test Excavation 31 (T-31)

Test Excavation 31 (T-31), an interior excavation located within the Office Depot building, was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide (Figure 175). The base of excavation was determined by the presence of the water table at 1.38 mbs. The stratigraphy of T-31 consisted of concrete with laminated tile surface (Stratum Ia), overlying a buried concrete surface (Stratum Ib), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of extremely gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) very fine sand (Stratum IIb) overlying a redeposited, locally procured loamy sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), and a coarse sand marine deposit (Stratum V) (Figure 176 and Figure 177, and Table 34). A concrete jacket was encountered in the southwest (*makai*) end of T-31 at 0.48 mbs, and as a result the surrounding material was not excavated.

T-31 documented similar stratigraphy to the surrounding interior test excavations. Beneath the current concrete floor, remnants of a commercial warehouse foundation were identified, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) located directly below the current floor. Located beneath this historic surface was historic reclamation (Strata IIa and IIb) and land modification (Stratum III) fill deposits overlying natural beach sand deposits (Strata IVa, IVb, V). Stratum III is interpreted as a local fill material utilized to level and/or build up the ground surface and may have served as a historic land surface for a period of time prior to reclamation activities. The presence of a pit feature originating from Stratum III substantiates this interpretation. The feature, designated SIHP # -7429 Feature 12, was located in the northeast (*mauka*) end of T-31 and measured 0.31 m in length, 0.2 cm in width, and 0.12 cm thick. It consisted of a narrow pit of dark soil and sediment that surrounded a block of decomposing milled wood and was interpreted as an historic posthole (Figure 178 through Figure 180).

The underlying buried A horizon (Stratum IVa) appeared to have been truncated and leveled during previous ground disturbance activities. A 10-gallon sample of the A horizon was screened in the field and yielded no cultural material.

One glass bottle base fragment, butchered *Bos taurus* (cow) long bone fragments (76.5 g), and a *Fusinus sandvicensis* marine shell, approximately 9 cm in length and 2.5 cm thick, were found in the back dirt pile and of indeterminate provenience (Figure 181 and Figure 182).

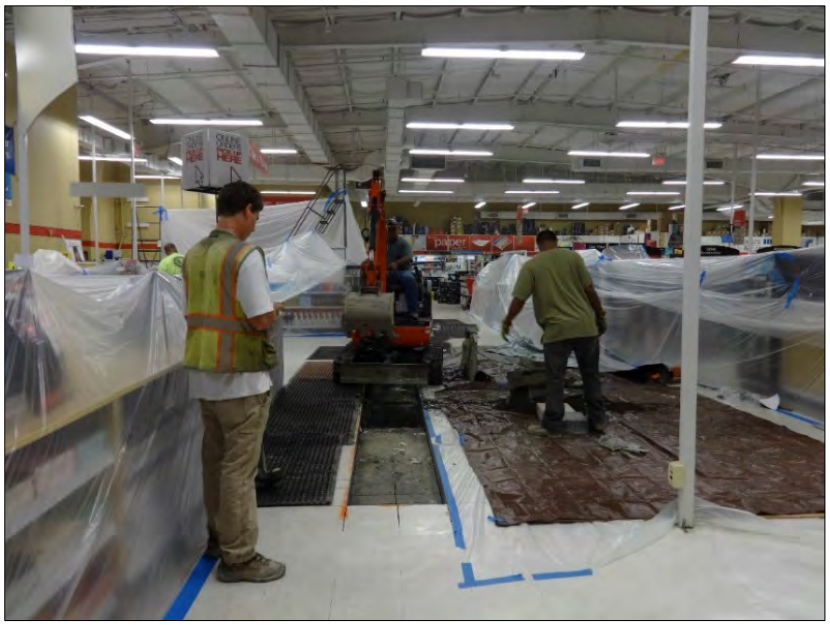

Figure 175. Location of T-31 within interior commercial space, view to southwest

Figure 176. T-31 northwest wall, view to north

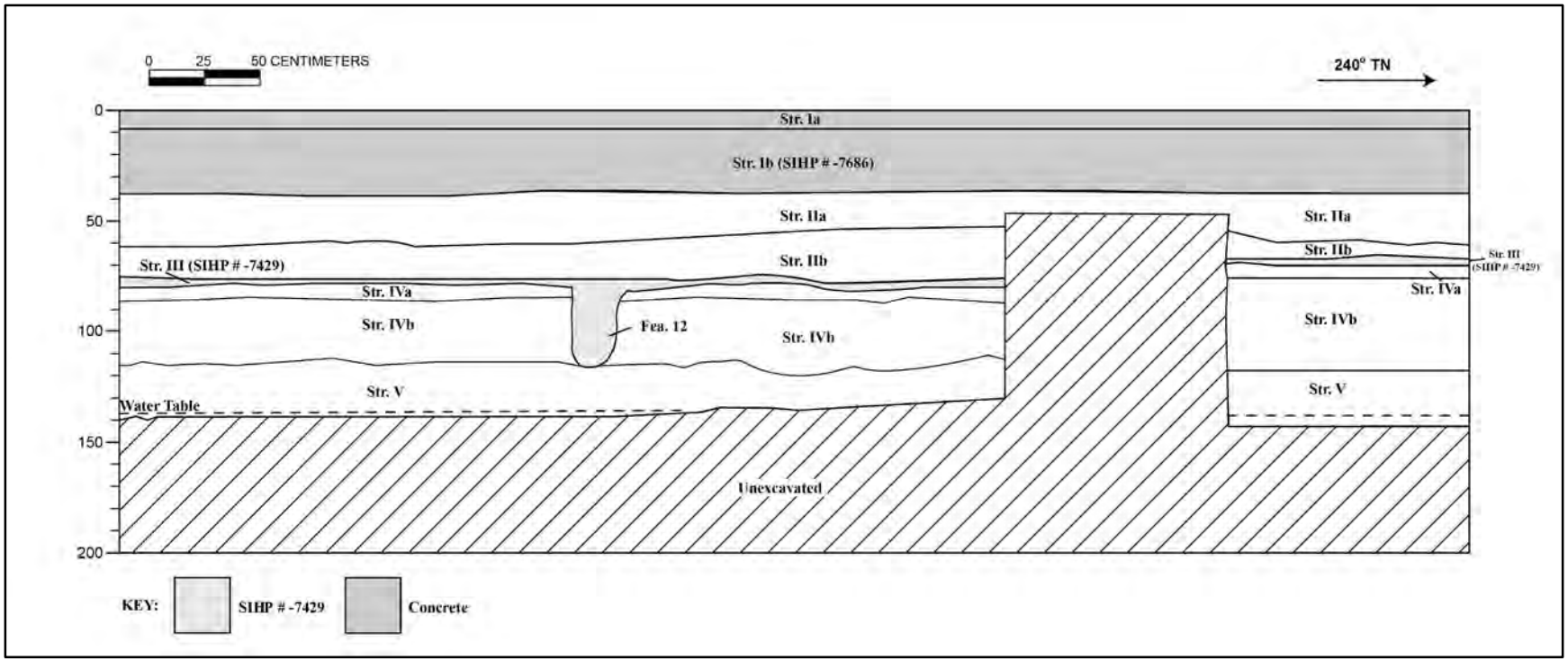

Figure 177. T-31 southeast profile

Table 34. T-31 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Concrete, current store surface with laminate tile
Ib	8–37	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
IIa	37–60	Fill; 10YR 5/2, grayish brown; extremely gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, broken/discontinuous lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	53–76	Fill; 2.5Y 7/3, pale yellow; very fine sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, broken/discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	67–70	SIHP # -7429; 10YR 4/2, dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; redeposited, likely locally procured sand utilized for land modification; contained SIHP # -7429 Feature 12 (historic posthole with decomposing milled wood)
IVa	70–76	Natural; 10YR 3/2, very dark grayish brown; fine sand; structureless (single-grain); moist, loose consistence, non-plastic; mixed origin; diffuse, broken/discontinuous lower boundary; A horizon
IVb	75–117	Natural; 10YR 8/4; very pale brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, broken/discontinuous lower boundary; Jaucas sand
V	115–143 (BOE)	Natural; 10YR 7/3; very pale brown; course sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; lower boundary not visible; marine sediment with shell fragments

Figure 178. T-31 southeast wall, SIHP # -7429 Feature 12, view to southeast

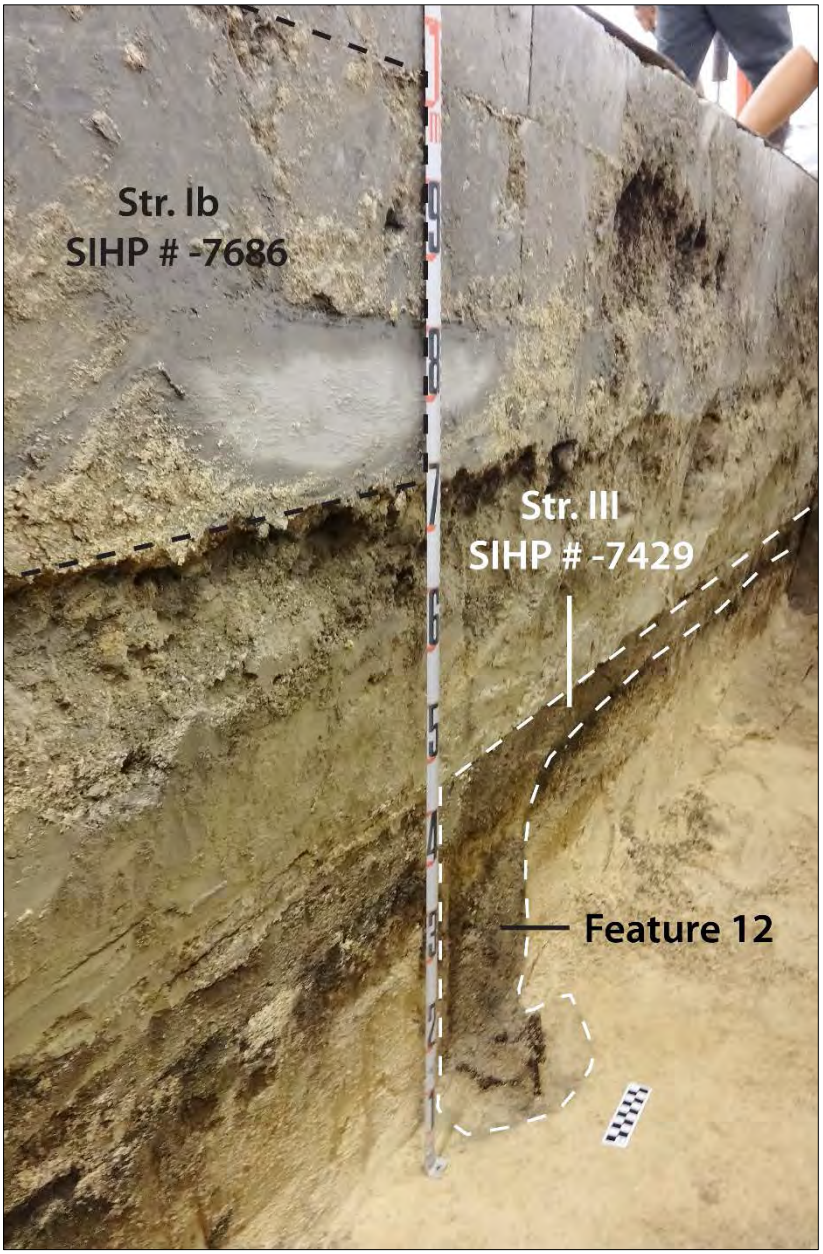

Figure 179. T-31 southeast wall, showing SIHP # -7686 overlying SIHP # -7429 Feature 12 originating from Stratum III and terminating in Stratum IVb, view to south

Figure 180. T-31, SIHP # 7429, Feature 12, decomposing milled wood post, view to south

Figure 181. Glass bottle base, found in back dirt pile

Figure 182. T-31, *Fusinus sandvicensis*, found in back dirt pile

4.2.32 Test Excavation 32 (T-32)

Test Excavation 32 (T-32), an interior excavation located within the former Nordstrom Rack building, was oriented southwest-northeast and measured 6.1 m long by 0.6 m wide (Figure 183). The base of excavation was determined by the presence of the hard coral shelf at 1.7 mbs. The stratigraphy of T-32 consisted of the current concrete and laminated tile surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic (dredge) very fine sand grading to clay (Stratum II), overlying a natural sandy clay wetland A horizon (Stratum IIIa), over a sand wetland deposit (Stratum IIIb) (Figure 184 and Figure 185, and Table 35).

Similar to many of the surrounding interior test excavations, T-32 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic), which extended across the length of the test excavation. The current commercial building surface (Stratum Ia) was constructed directly over top this earlier commercial surface. Beneath the commercial warehouse remnants was located a 1917–1926 Kaka‘ako land reclamation fill deposit. The underlying natural stratigraphic deposits consisted of a culturally sterile, peaty A horizon (Stratum IIIa) within a wetland environment (Stratum IIIb). The A horizon was discontinuous on the southwest (*makai*) where the underlying sand of Stratum IIIb sloped up 0.5 m to create a natural sand berm.

Figure 183. Location of T-32 within interior commercial space, view to southwest

Figure 184. T-32 southeast wall, view to northeast

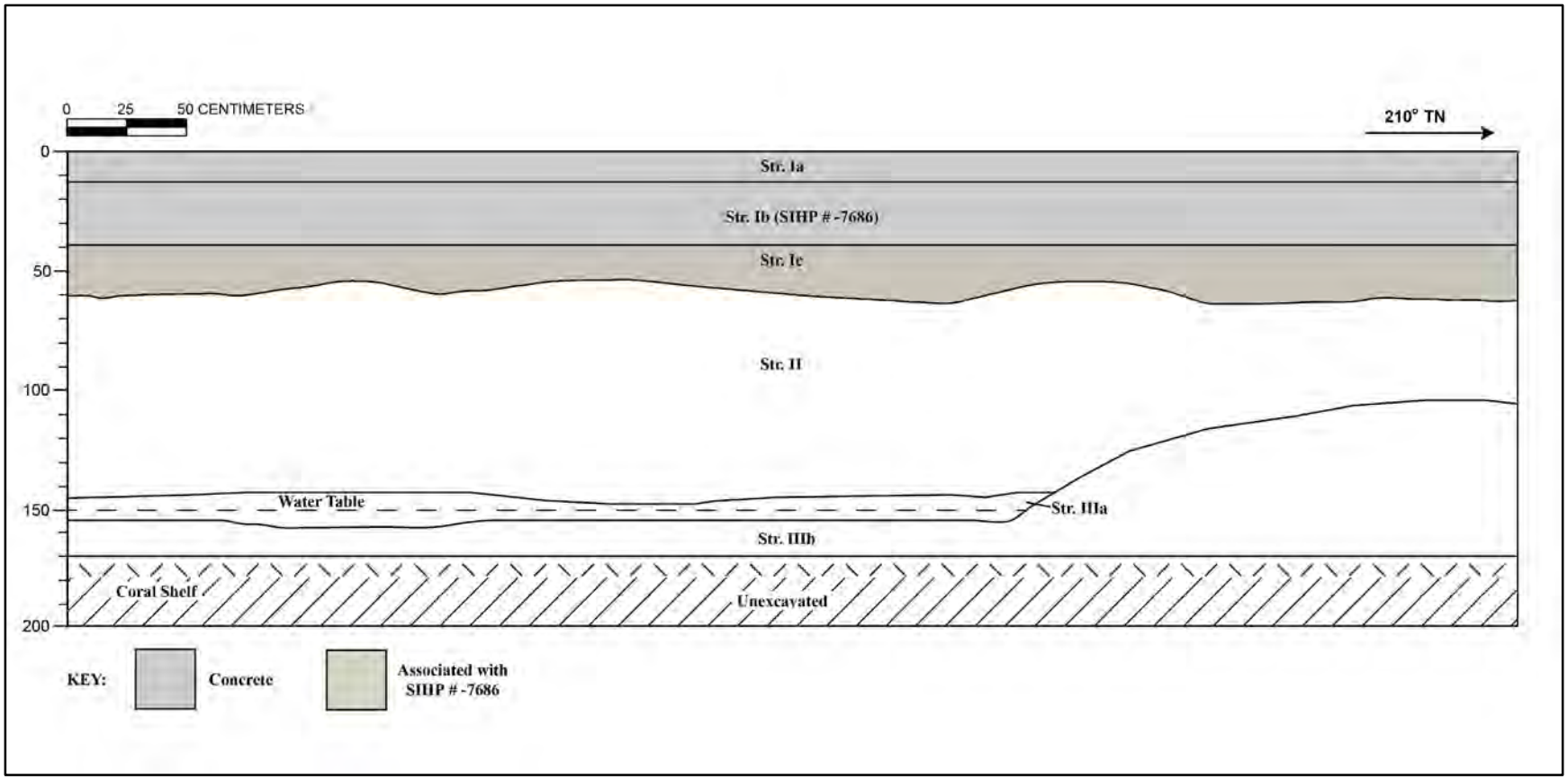

Figure 185. T-32 southeast profile

Table 35. T-32 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–13	Concrete; current commercial floor
Ib	13–40	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	40–53	Fill; 10YR 2/2, very dark brown; very gravelly silty loam; weak, fine, crumb structure; moist, loose consistence; slightly plastic; terrigenous origin; abrupt, smooth lower boundary; base course
II	54–148	Fill; 10YR 8/3, very pale brown grading to 10GY 6/1 (GLEY 1) greenish gray; very fine sand grading to clay; structureless (single-grain grading to massive); moist, very friable to firm consistence; non-plastic to very plastic; abrupt, wavy lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	143–159	Natural; 10Y 3/1 (GLEY 1), very dark greenish gray; sandy clay; structureless (massive); moist, firm consistence; plastic; mixed origin; discontinuous/clear, smooth lower boundary; few very fine roots; natural wetland sediment containing some organics
IIIb	105–170 (BOE)	Natural; 5G 6/1 (GLEY 1), greenish gray; medium sand; structureless (single-grain); wet, slightly sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; marine sand that forms a natural berm at southern end of the trench; overlying coral shelf

4.2.33 Test Excavation 33 (T-33)

Test Excavation 33 (T-33), an interior excavation located within the former Nordstrom Rack building, was oriented northeast-southwest and measured 6.0 m long by 0.61 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.7 mbs. The stratigraphy of T-33 consisted of the current concrete with laminated tile surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib) and associated mixed sandy loam base course (Stratum Ic), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) sandy clay (Stratum IIb), overlying a natural clay loam A horizon (Stratum IIIa) and wetland sand (Stratum IIIb) (Figure 186 through Figure 189, and Table 36). An asphalt slab which protruded from the southeast wall prevented complete excavation of the test excavation in the *mauka* portion.

Similar to T-32, T-33 documented remnants of a commercial warehouse foundation, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) and associated base course (Stratum Ic) directly underlying the current commercial floor. Located beneath the commercial warehouse remnants were a 1917–1926 Kaka‘ako land reclamation fill deposits (Strata IIa–IIb). The underlying natural stratigraphic deposits consisted of a culturally sterile, peaty A horizon (Stratum IIIa) developed within the upper boundary of a sandy wetland environment (Stratum IIIb) (see Figure 187).

Figure 186. T-33 southeast sidewall, view to east

Figure 187. Close-up of gray pump dredge fill (Stratum IIb) overlying a dark organic-rich A horizon (Stratum IIIa) and marine sand (Stratum IIIb)

Figure 188. T-33 post-excavation, view to northeast

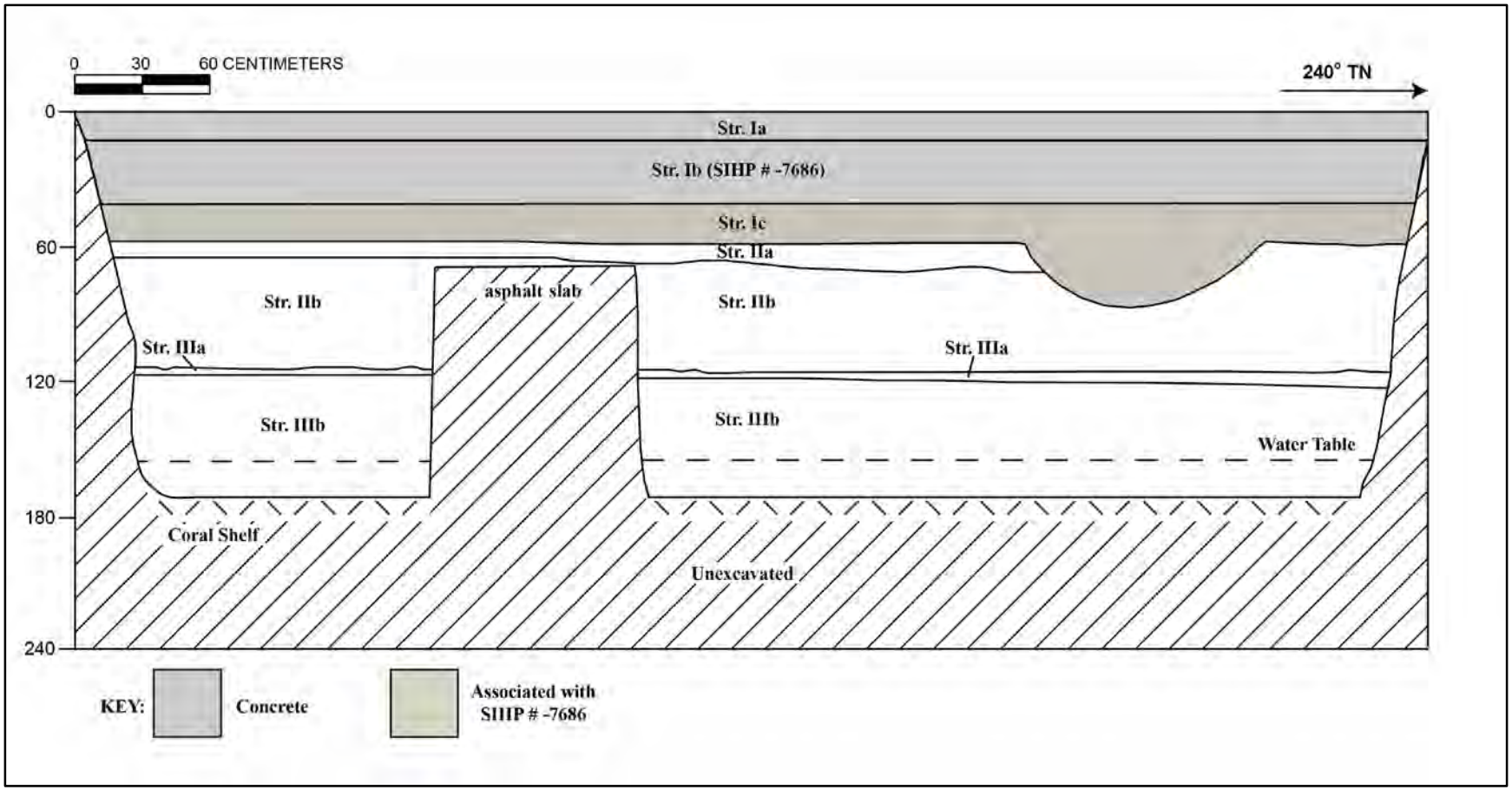

Figure 189. T-33 southeast profile

Table 36. T-33 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–13	Concrete; current commercial floor
Ib	13–42	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	42–85	Fill; 5YR 2.5/2, dark reddish brown; sandy loam; moderate, fine, crumb structure; dry, hard consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; grading material associated with concrete
IIa	58–72	Fill; 10YR 8/4, light yellowish brown; gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	65–115	Fill; 10YR 7/9, very pale brown grading to 5B 6/1, bluish gray; very fine sandy clay grading to clay; structureless (massive); wet, slightly sticky consistence; slightly plastic to plastic; marine origin; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	114–123	Natural; 2.5Y 3/2, very dark grayish brown; clay loam; medium, crumb structure; wet, slightly sticky consistence; slightly plastic; mixed origin; abrupt, smooth lower boundary; many very fine to medium roots; thin humic A horizon
IIIb	118–170 (BOE)	Natural; 10Y 7/1, light greenish gray; medium sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; few, fine to medium roots; marine sand; overlying coral shelf

4.2.34 Test Excavation 34 (T-34)

Test Excavation 34 (T-34), an interior excavation located within the Office Depot building was oriented northeast-southwest and measured 6.1 m long by 0.6 m wide (Figure 190). The base of excavation was determined by the presence of the water table at 1.63 mbs. The stratigraphy of T-34 consisted of concrete with laminated tile surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib), mixed loam and cinder (Stratum Ic), and base course fill (Stratum Id), overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) with pockets of clay (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb), overlying a redeposited, locally procured loamy sand (Stratum III), overlying an organic rich sandy clay A horizon (Stratum IVa) developed within a wetland sandy clay (Stratum IVb) (Figure 191 and Figure 192, and Table 37).

T-34 documented similar stratigraphy to the surrounding interior test excavations. Beneath the current concrete floor, remnants of a commercial warehouse foundation were identified, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) located directly below the current floor. Located beneath this historic surface were fill deposits from the Kaka‘ako land reclamation (Strata IIa–IIb), over pre-reclamation fill (Stratum III), resting on a disturbed wetland environment (Stratum IV). Stratum III was a very compact, culturally sterile fill that consisted of medium sand, mottled in color, and was likely composed of locally procured sand and soil. This local fill material may have been deposited to level and/or build up the ground surface and may have served as a historic land surface for a period of time prior to reclamation activities (Figure 193). Stratum IVa was a culturally sterile, sandy clay, A horizon that developed within the upper boundary of a sandy clay, wetland environment (Stratum IVb) and was truncated during previous ground disturbance activities. The lower boundary of Stratum IVa is very abrupt in the northeast (*mauka*) end and becomes very diffuse toward the southwest (*makai*) end (see Figure 191 and Figure 193). An abrupt contact between a developing soil horizon and its parent material is not a good indication of in situ development, therefore one of two things may have occurred. Stratum IVa may partially represent reworked local organic material in secondary deposition where some aspects of the lower boundary became integrated with the lower stratum, while other areas met resistance within the clay content in lower stratum and prohibited the downward translocation of solid particles and soluble constituents in the soil. Alternatively, Stratum IVa may represent a highly disturbed in situ soil horizon that experienced isolated truncation, reconstitution, and secondary deposition (i.e., northeast end) which resulted in the very abrupt to diffuse lower boundary seen in Stratum IVa.

Bulk samples were screened from Stratum III and Stratum IVa (2.5 gallons each); however, no cultural materials were identified.

Figure 190. Location of T-34 within interior commercial space, view to west

Figure 191. T-34 southeast profile, view to northeast

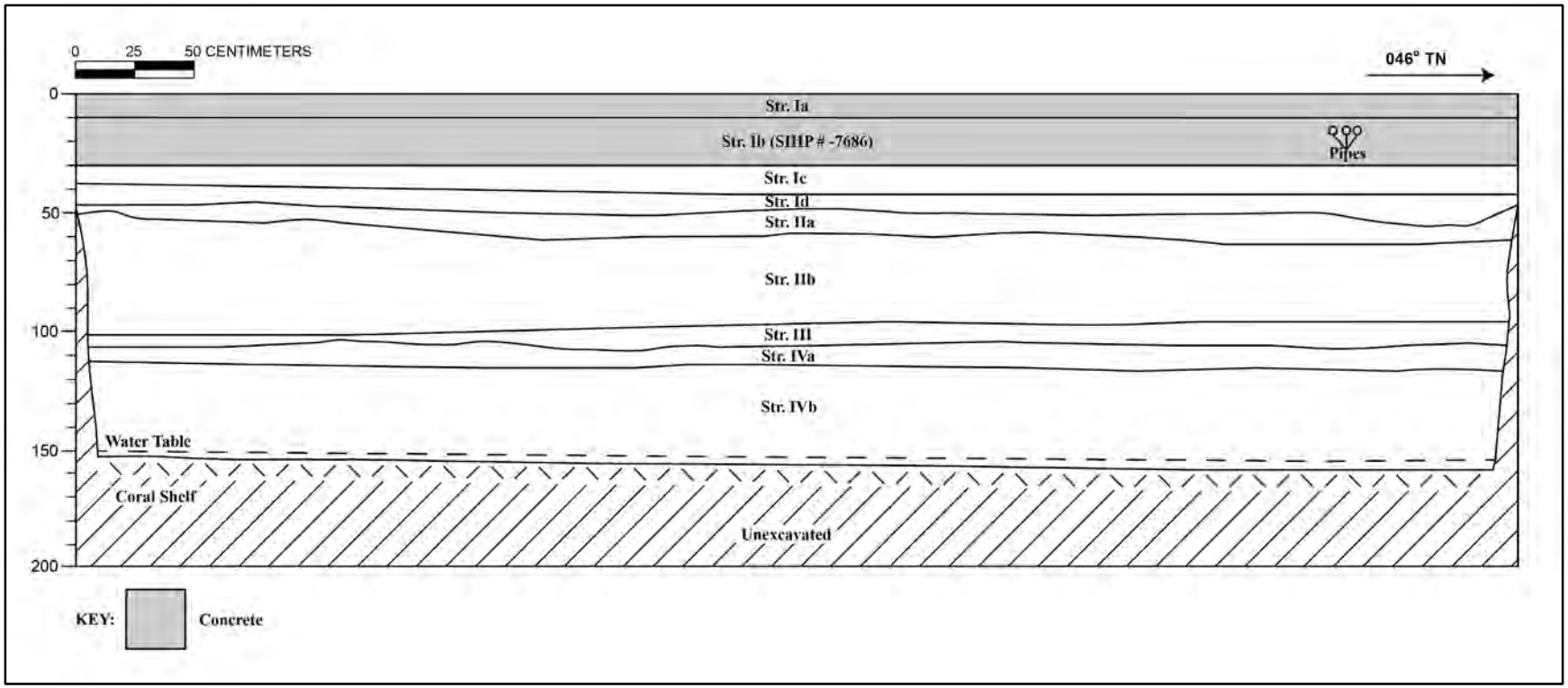

Figure 192. T-34 northwest profile

Table 37. T-34 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–10	Concrete, current store surface with laminate tile (VCT); very abrupt, smooth lower boundary
Ib	10–33	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	33–44	Fill; 7.5YR 2.5/2; very dark brown mottled with 10YR 2/1 50%, large; sandy loam; weak, fine, crumb structure; moist, very friable consistence; slightly plastic; mixed origin; abrupt, smooth lower boundary; imported loam fill with lighter hue on upper boundary and lower boundary composed of cinder in the *makai* end
Id	40–56	Fill; 7.5Y 3/3, dark brown; extra gravelly loam; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt, broken/discontinuous lower boundary; imported base course
IIa	50–65	Fill; 10YR 8/2, very pale brown, gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, wavy lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	50–104	Fill; 5Y 6/1, gray mottled with 10YR 6/3, clay; structureless (massive); moist, firm consistence; very plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927); graded from fine silt to clay; contained wood
III	97–110	Fill; 10YR 4/1, dark gray mottled with 10YR 3/3, dark brown; medium loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear to diffuse, wavy lower boundary; redeposited, likely locally procured sand utilized for land modification; contained wood observed
IVa	106–118	Natural; 10YR 4/2, dark grayish brown; sandy clay; structureless (massive); moist, friable consistence, slightly plastic; marine origin; very abrupt to diffuse, wavy lower boundary
IVb	116–163 (BOE)	Natural; 5Y 6/1; gray; sandy clay; medium, blocky structure; wet, slightly sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; common, medium roots; natural wetlands sediment with shell fragments and terrestrial snails

Figure 193. T-34 northeast wall, close-up of hydraulic clay (Stratum IIb) overlying fill sand (Stratum III) and an organic wetland A horizon (Stratum IVa) with a very abrupt contact with the underlying wetland clay sand (Stratum IVb), view to northeast

4.2.35 Test Excavation 35 (T-35)

Test Excavation 35 (T-35), an interior excavation located within the Office Depot building, was oriented northeast-southwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the water table at 1.44 mbs. The stratigraphy of T-35 consisted of concrete with laminated tile surface (Stratum Ia) overlying a buried concrete surface (Stratum Ib) and gravelly loamy sand fill (Stratum Ic), overlying 1917–1927 Kaka‘ako reclamation fill consisting of hydraulic very fine sand (Stratum II), overlying a natural loamy sand A horizon (Stratum IIIa), Jaucas sand (Stratum IIIb), a marine sand (Stratum IV), and loamy sand (Stratum V) (Figure 194 and Figure 195, and Table 38).

T-34 documented similar stratigraphy to the surrounding interior test excavations. Beneath the current concrete floor, remnants of a commercial warehouse foundation were identified, considered part of SIHP # -7686. The warehouse remnants consisted of a buried concrete surface (Stratum Ib) located directly below the current floor. Beneath this historic surface were located fill deposits from the Kaka‘ako land reclamation (Stratum II) resting over a buried A horizon and Jaucas sand (Strata IIIa and IIIb). The pre-reclamation, locally procured sand fill material observed in other test excavations was not present in T-35. The upper boundary of Stratum IIIa was highly compacted and truncated while the lower boundary consisted of loose, diffuse dark-stained sand. Two 5-gallon screens of the A horizon, taken from the upper and lower portions, yielded no cultural material.

Figure 194. T-35 southeast wall, view to north

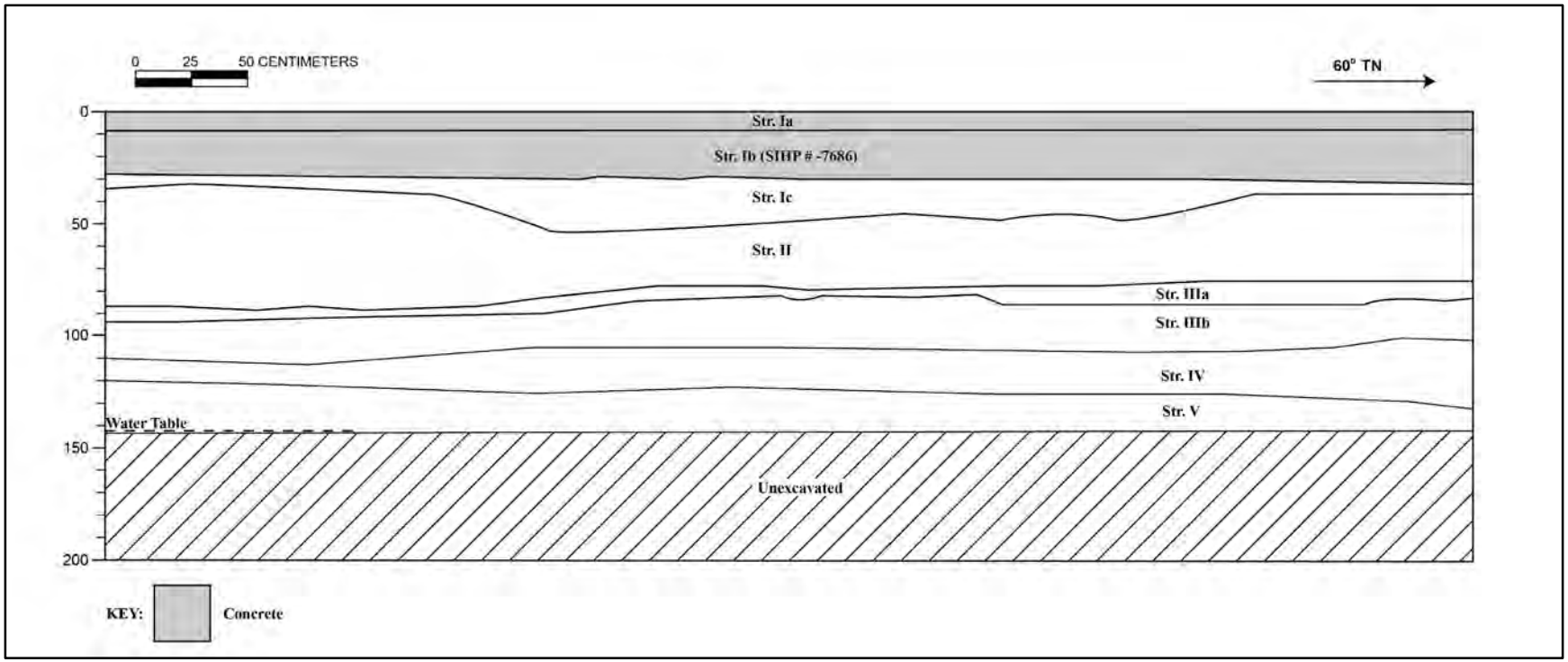

Figure 195. T-35 northwest profile

Table 38. T-35 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Concrete; current floor surface with VCT tile
Ib	8–27	SIHP # -7686; concrete surface associated with commercial warehouse infrastructure
Ic	27–54	Fill; 10YR 4/2; dark grayish brown; gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary
II	29–90	Fill; 10Y 7/6, yellow mottled with 10YR 5/2, grayish brown; very fine sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; contained a small discontinuous lens of crushed coral at *makai* end; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	75–95	Natural; 10YR 3/1, very dark gray; medium loamy sand; structureless (single-grain); moist, loose consistence, non-plastic; mixed origin; diffuse, smooth lower boundary; A horizon
IIIb	81–110	Natural; 10YR 10/4; very pale brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, smooth lower boundary; Jaucas sand
IV	100–132	Natural; 10YR 5/4; yellowish brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; natural marine deposit
V	120–143 (BOE)	Natural; 10YR 8/3; very pale brown; medium loamy sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; lower boundary not visible; common, very fine to fine roots; wetland sediment

4.2.36 Test Excavation 36 (T-36)

Test Excavation 36 (T-36), an exterior excavation located along Queen Street near the entrance to the Office Depot building, was oriented northwest-southeast and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.30 mbs. The stratigraphy of T-36 consisted of the asphalt surface (Stratum Ia) and associated base course (Stratum Ib), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic (dredge) very fine sandy clay (Stratum II), overlying a redeposited, locally procured loamy sand (Stratum III), a natural sandy loam A horizon (Stratum IVa), Jaucas sand (Stratum IVb), a clay sandy wetland deposit (Stratum V), and a sand wetland deposit (Stratum VI) (Figure 196, Figure 197, Figure 199, and Table 39). A utility line was encountered at 0.45 mbs running parallel with the south (*makai*) wall; as a result, the south wall was benched and the surrounding material was not excavated (Figure 198). Additionally, two utility pits were observed truncating Strata II–IVb on the northeast wall (see Figure 199).

T-36 documented historic fill deposits (Strata II, III) over a disturbed, natural A horizon developed within Jaucas sand. Stratum III consisted of loamy sand that likely consisted of redeposited, locally procured sediment deposited to level and/or build up the ground surface and which served as a historic land surface for a period of time prior to reclamation activities. The in situ A horizon (Stratum IVa) was a culturally sterile, truncated, sandy loam A horizon. The A horizon was absent within the southwest (*makai*) wall due to the installation of a utility pipe. Fine to medium-sized roots were observed in Stratum IIIa, however, more roots were observed within the utility fill on the north wall, most likely as a result of the nearby palm trees.

Figure 196. T-36 north wall, view to northwest

Figure 197. Close-up of T-36 stratigraphy

Figure 198. Photograph showing utility running parallel with the south wall, view to northwest

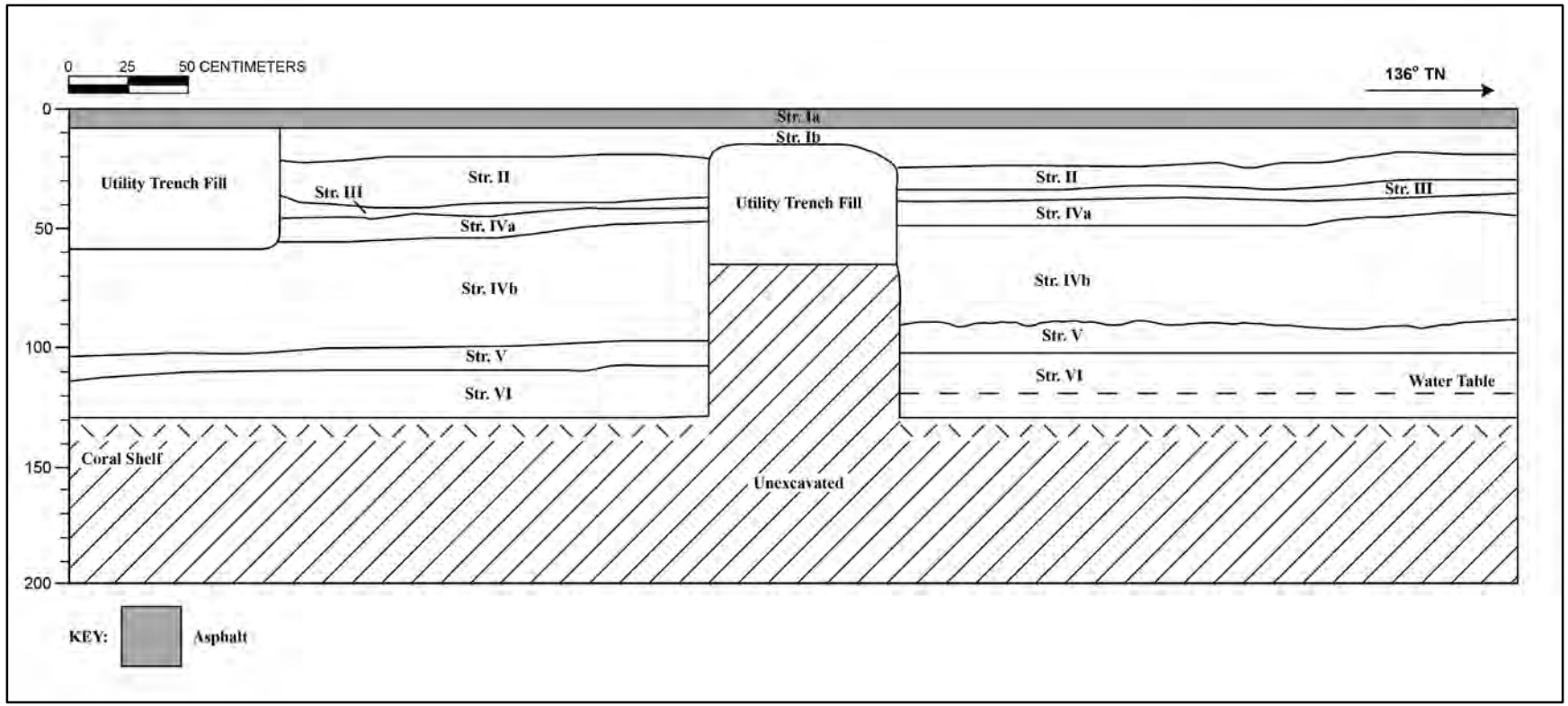

Figure 199. T-36 northeast profile

Table 39. T-36 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–25	Fill; 5YR 3/3, dark reddish brown; extremely gravelly sandy loam; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth boundary; base course
Utility Fill	13–65	Fill; 10YR 6/3, pale brown; gravelly loamy sand; weak, fine to medium, crumb structure; moist, loose consistence; non-plastic; mixed origin; common fine roots; mix of base course, dredge, and compacted coral gravels
II	20–35	Fill; 2.5Y 6/3, light yellowish brown; very fine sandy clay; structureless (massive); moist, very friable consistence; non-plastic; marine origin; abrupt, smooth lower boundary; many, fine roots; water or sewer pipe observed at 0.45 m; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	30–40	Fill; 10YR 5/3, brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary; one redeposited, likely locally procured sand utilized for land modification
IVa	35–50	Natural; 10YR 4/2, dark grayish brown; fine sandy loam; weak, fine, crumb structure; moist, loose consistence; non-plastic; diffuse, smooth lower boundary; common, fine roots
IVb	45–93	Natural; 10YR 7/3, very pale brown; sand; structureless (single-grain); moist, loose consistence; non-plastic, marine origin; clear, smooth lower boundary; Jaucas sand
V	93–103	Natural; 10YR 7/3, very pale brown; clay sand; structureless (massive); wet, non-sticky consistence; plastic; marine origin; clear, wavy lower boundary; marine sediment
VI	103–130 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; clay sand; structureless (massive); wet, non-sticky consistence; plastic; marine origin; marine sediment; overlying coral shelf

4.2.37 Test Excavation 37 (T-37)

Test Excavation 37 (T-37), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.0 m long by 0.75 m wide. The base of excavation was determined by the presence of very hard gravel associated with a possible concrete jacket at 0.39 mbs (Figure 200). The gravel layer was encountered at 0.22 mbs and excavations terminated after it was established that the impasse extended across the majority of the test excavation. No stratigraphy was recorded.

Figure 200. T-37, post excavation, view to northeast

4.2.38 Test Excavation 38 (T-38)

Test Excavation 38 (T-38), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northwest-southeast and measured 6.0 m long by 0.70 m wide. The base of the excavation was determined by the water table at 1.23 mbs. The stratigraphy of T-38 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), and very gravelly sandy loam (Stratum Ic), overlying a thick layer of gravel which extended to below the water table (Stratum Id) (Figure 201, Figure 202, and Table 40). No natural stratigraphy was observed; it appeared to have been removed during the deposition of the gravel fill. Based on the surrounding test excavations, however, the natural sediments likely consisted of wetland deposits.

Figure 201. T-38, post excavation, view to northwest

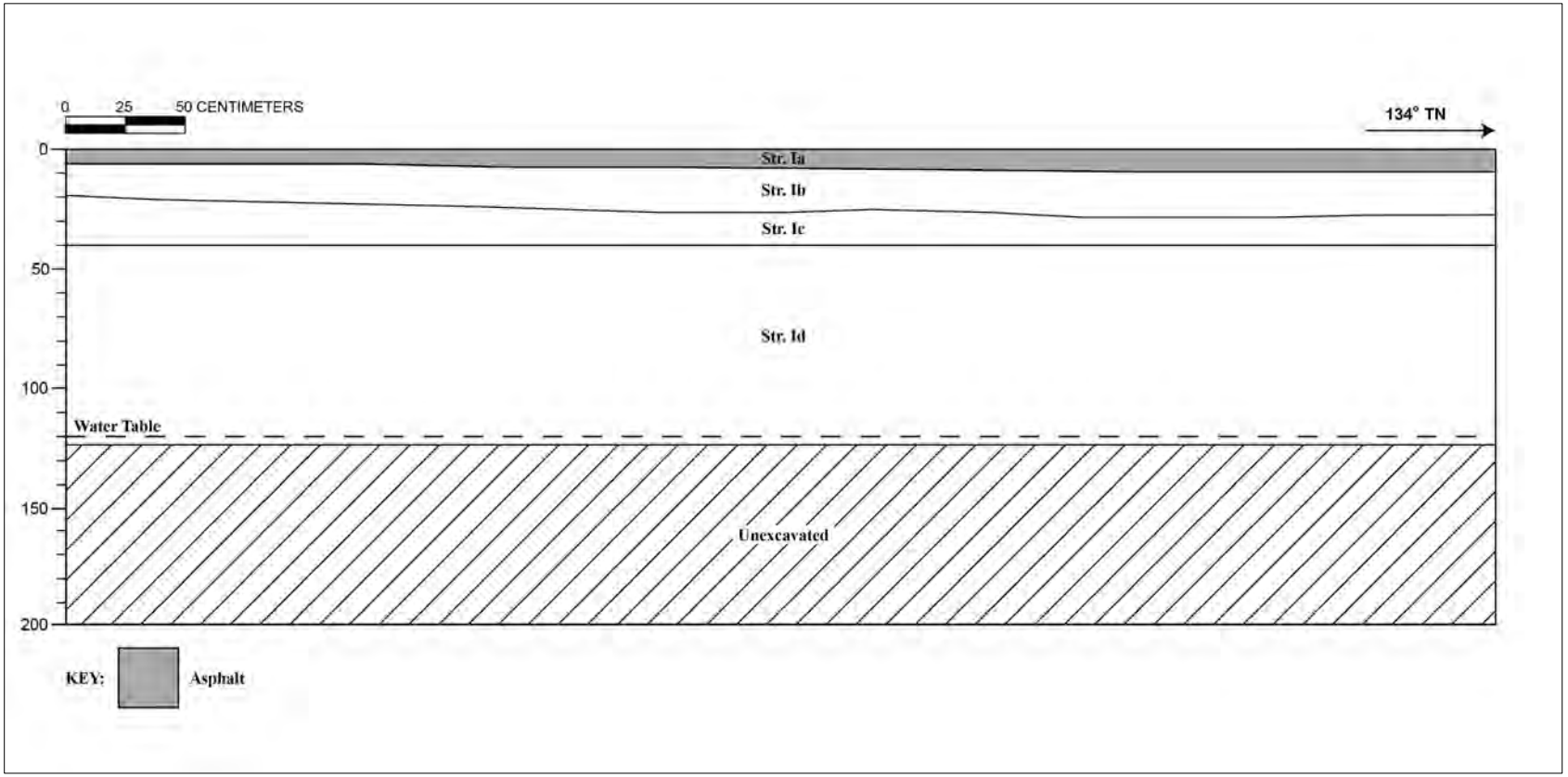

Figure 202. T-38 northeast profile

Table 40. T-38 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–27	Fill; 5YR 3/3, dark reddish brown; extremely gravelly sandy loam, structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	20–40	Fill; 10YR 4/4, dark yellowish brown; very gravelly sandy loam, structureless (single-grain); moist, loose consistence; mixed origin; clear, smooth lower boundary; imported fill
Id	40–123 (BOE)	Fill; 5YR 3/3, dark reddish brown; extremely gravelly sandy loam, structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; lower boundary not visible; gravel fill

4.2.39 Test Excavation 39 (T-39)

Test Excavation 39 (T-39), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.5 m long by 0.8 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.30 mbs. The stratigraphy of T-39 consisted of the asphalt surface (Stratum Ia) and two layers of associated base course material (Strata Ib–Ic), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of fine sandy clay (Stratum II), overlying natural loamy clay A horizon (Stratum IIIa), over a sandy clay A horizon (Stratum IIIb), developed within a fine sandy wetland deposit (Stratum IIIc) (Figure 203 through Figure 205, and Table 41).

T-39 documented fill deposits from the Kaka‘ako land reclamation period (Stratum II) overlying a natural, organically rich, wetland environment (Strata III). It is clear from the gleyed characteristics of the natural strata and the hydraulic dredge material (Stratum II) that this area experienced a prolonged state of reduced oxygen and increased water saturation. Stratum IIIa was a culturally sterile, loamy clay A horizon and former ground surface of a marshy wetland environment. Surface stability is evidenced by the diffused contact between Strata IIIa and IIIb, which suggests the downward translocation of solid particles and soluble constituents in the soil. The wetland deposits in T-39 are consistent with other test excavations within the project area.

Figure 203. T-39 northwest wall, view to west

Figure 204. T-39, close-up of Strata II (hydraulic fill) over Strata IIIa–IIIc (natural wetland environment deposits), view to northwest

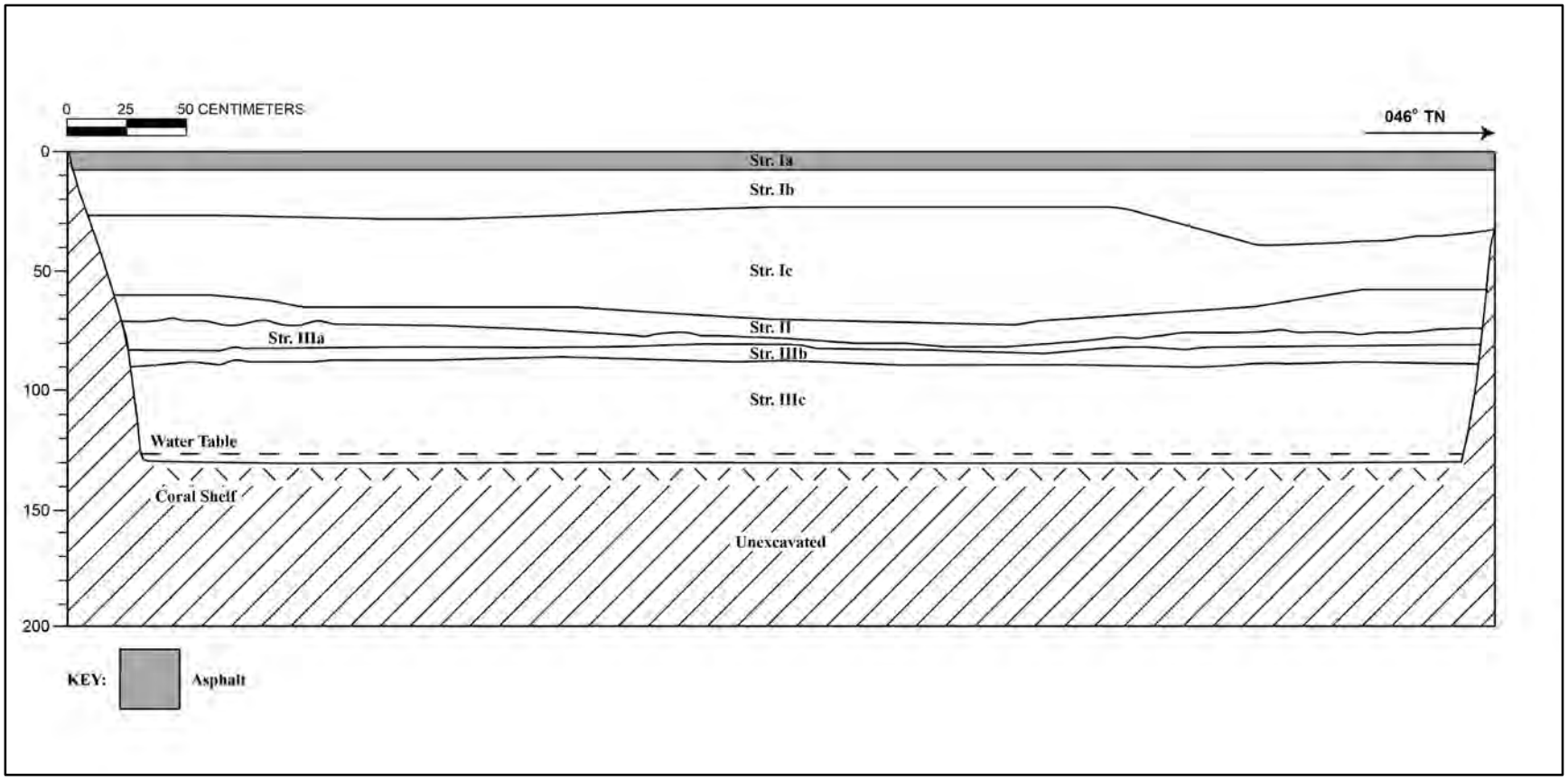

Figure 205. T-39 northwest profile

Table 41. T-39 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–40	Fill; 7.5YR 3/1 mottled with 10YR 4/3, very dark gray and brown; extremely gravelly sandy loam, structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	23–72	Fill; 10Y 4/1 (GLEY 1), dark greenish gray; extremely gravelly sandy loam, structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
II	46–80	Fill; 2.5Y 7/2, light gray grading to 5GY 6/1 (GLEY 1), greenish gray; fine sandy clay, structureless (massive); moist, friable consistence; slightly plastic to plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927); silt barrier (black filter material) at lower boundary
IIIa	74–84	Natural; 5Y 4/2, olive gray; loamy clay; moderate, medium, crumb structure; moist, friable consistence; slightly plastic; marine origin; diffuse, smooth lower boundary; few, fine roots; A horizon containing peat
IIIb	80–89	Natural; 10YR 4/3, brown; sandy clay; moderate, medium, crumb structure; moist, friable consistence, slightly plastic; marine origin; abrupt, smooth lower boundary; common, fine roots; wetland deposit; contained brackish water snails and peat
IIIc	83–130 (BOE)	Natural; 10Y 5/1 (GLEY 1), greenish gray; fine sand, structureless (single-grain); moist, loose consistence; non-plastic; marine origin; common, medium roots; marine sand with decomposing roots

4.2.40 Test Excavation 40 (T-40)

Test Excavation 40 (T-40), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northwest-southeast and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.3 mbs. The stratigraphy of T-40 consisted of the asphalt surface (Stratum Ia) and associated base course material (Stratum Ib) overlying additional base course material with a lower silt liner (Stratum Ic), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic (dredge) silty clay (Stratum II), overlying a clay loam O horizon (Stratum IIIa), sandy loamy clay (Stratum IIIb), and gravelly loamy sand (Stratum IIIc) (Figure 206 through Figure 209, and Table 42).

T-40 documented recent fill deposits (Strata Ia–Ic) overlying Kaka‘ako reclamation fill deposits (Strata IIa–IIb), resting on a natural, organically rich, wetland environment. Recent landscape modifications (Stratum Ic) truncated the Kaka‘ako reclamation fill (Stratum II) along the northwest and southeast walls (Figure 207). The interface of the natural wetland environment consisted of a layer of clay loam and the surface accumulation of partially decomposed organic matter (i.e., natural peat) (Stratum IIIa). This stratum has many fine roots, smells of sulfur, and is more characteristic of an O horizon than an A horizon. Strata IIIb and IIIc are grouped with the Stratum IIIa sequence as they appear to represent the same wetland depositional environment.

Stratum IIIb is sandy loamy clay that exhibited properties of a low energy environment evidenced by the accumulation of smaller, finer, particles near the upper boundary and a coarsening downward towards the lower boundary. This stratum may represent a transition zone from an A horizon, indicated by comingling of the soil constituents. Stratum IIIb appears to have once been a stable environment that experienced pedogensis followed by natural mixing, and natural aggradation. Additionally, the mottled greenish gray gley is most likely the result of a saturated anaerobic environment, possibly due to the deposition of the hydraulic clay fill (Stratum II). Stratum IIIc is a gravelly loamy sand wetland deposit that exhibited a diagentic history similar to Stratum IIIb. However, Stratum IIIc displayed an increase in gravel content due to the close proximity and geomorphological relationship with the underlying coral shelf.

Figure 206. T-40 northeast wall, view to northwest

Figure 207. T-40 southeast wall, showing Stratum II (hydraulic fill) truncated by Stratum Ic subsurface base course, view to southeast

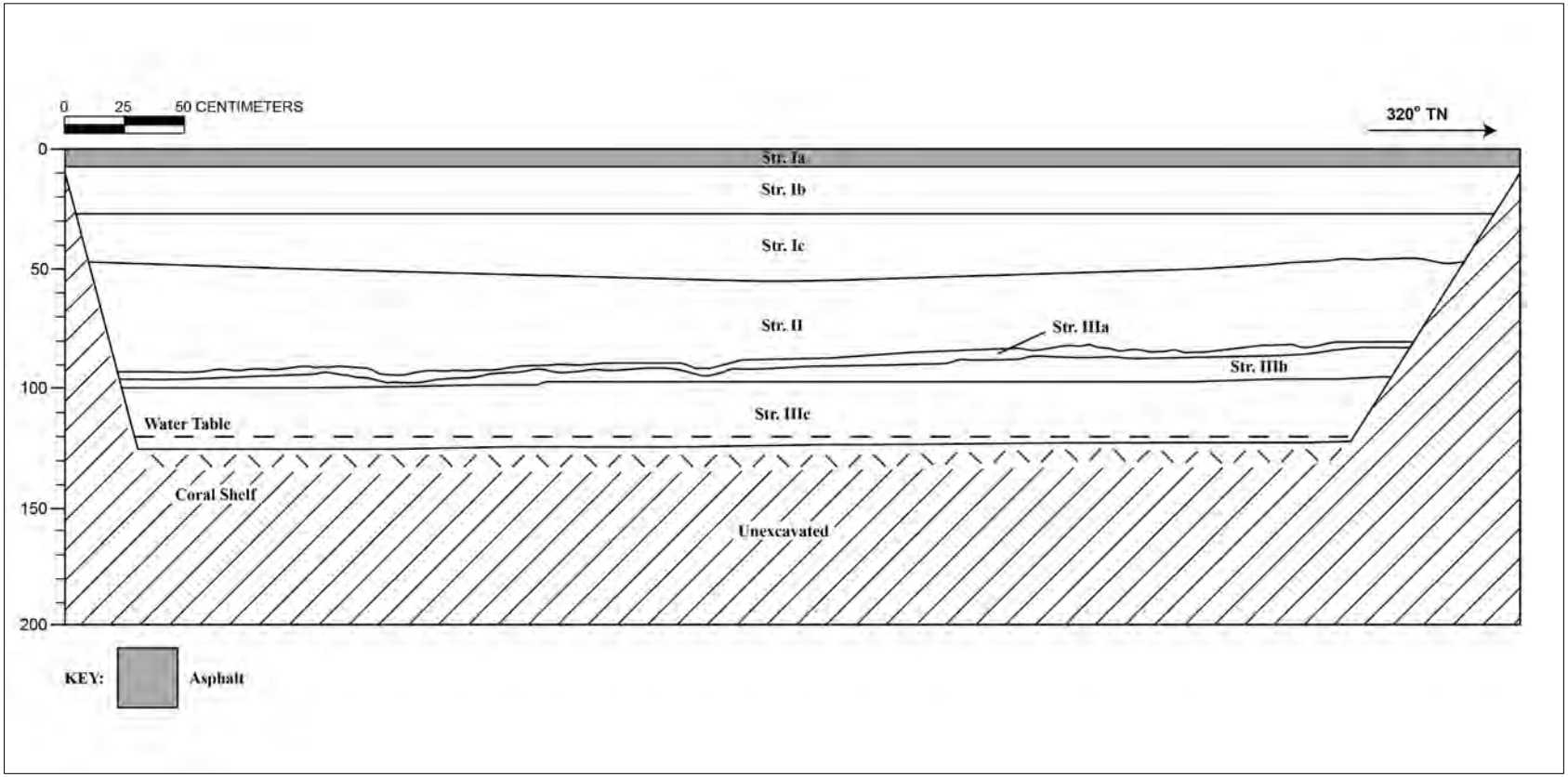

Figure 208. T-40 southwest profile

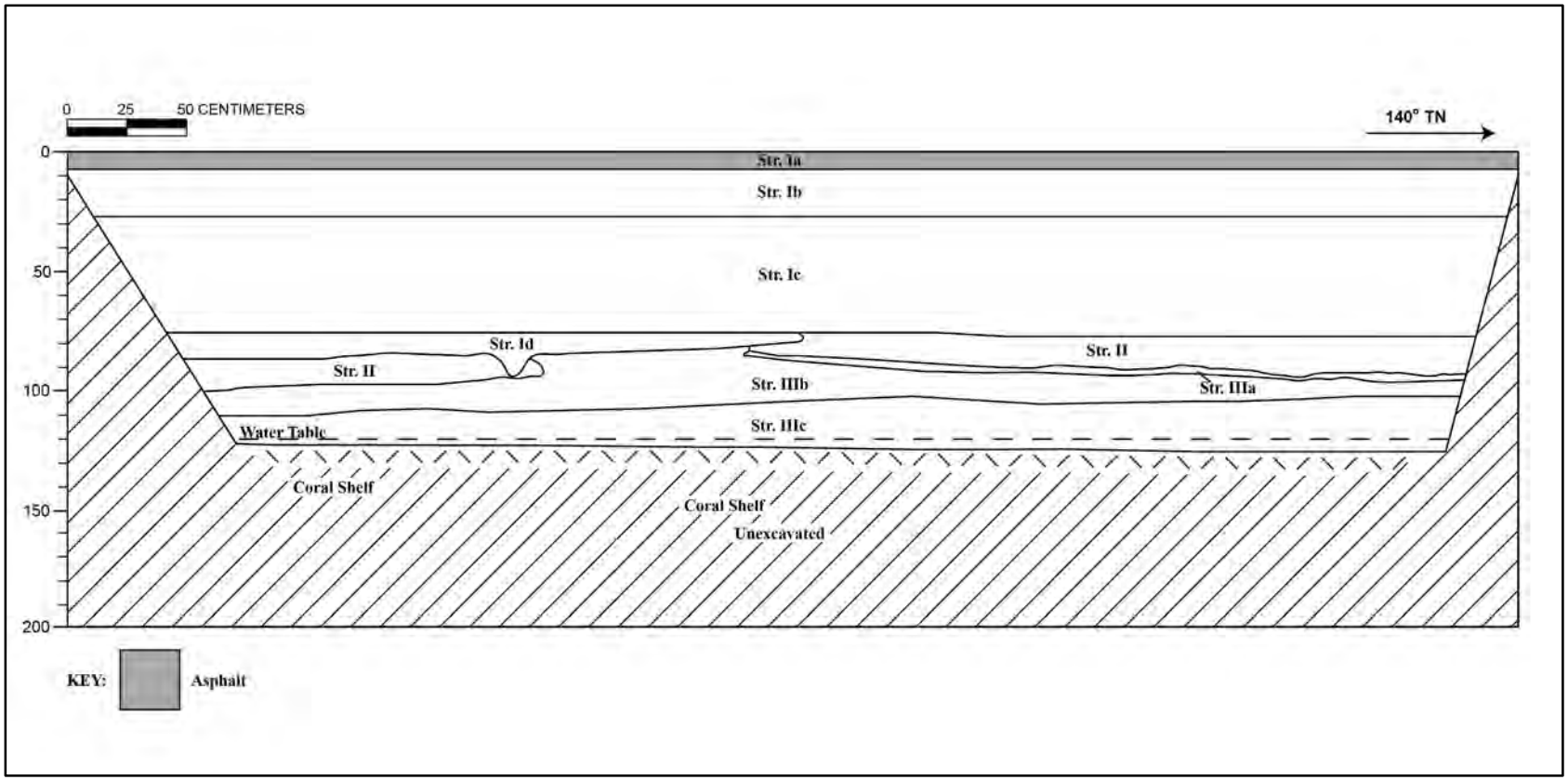

Figure 209. T-40 northeast profile

Table 42. T-40 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–6	Asphalt
Ib	6–24	Fill; 5YR 3/3, dark reddish brown; very gravelly loamy sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth boundary; base course
Ic	24–55	Fill; 10Y 4/1 (GLEY 1), dark greenish gray; very gravelly loamy sand; weak, medium structure; moist, loose consistence; non-plastic; terrigenous origin; abrupt, wavy lower boundary; contained a black matting at the lower boundary
Id	75–90	Fill; 2.5Y 7/4, pale yellow; gravelly loamy sand; weak, medium, crumb structure; moist, loose consistency; non-plastic; abrupt, smooth lower boundary; observed only within northeast wall in north portion of trench; truncated Stratum II
II	47–95	Fill; 5GY 6/1 (GLEY 1), greenish gray; silty clay; fine, platy structure; moist, firm consistence; plastic; marine origin; clear, smooth lower boundary; few, fine roots; grading from silty clay to clay; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	80–99	Natural; 2.5YR 3/2, very dark grayish brown; clay loam; structureless (massive); moist, friable consistence; terrigenous origin; clear, smooth lower boundary; common, fine roots; thin organic layer; O horizon
IIIb	82–97	Natural; 10Y 7/1 (GLEY 1) mottled with 10YR 7/4, light greenish gray and pale brown; sandy loamy clay; weak, fine, blocky structure; moist, firm consistence; plastic; marine origin; diffuse, wavy lower boundary; few, fine roots; possible mixed buried A horizon, representative of a stable/organic environment, gleying as a result of saturated anaerobic environment
IIIc	97–125 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; gravelly loamy sand; weak, medium, granular structure; moist, friable consistence; slightly plastic; marine origin; courser than Stratum IIb and containing saprolitic coral shelf particles; overlying coral shelf

4.2.41 Test Excavation 41 (T-41)

Test Excavation 41 (T-41), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.2 mbs. The stratigraphy of T-41 consisted of the asphalt surface (Stratum Ia) and two associated base course layers (Strata Ib–Ic) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic silty clay (Stratum II), overlying a redeposited, locally procured sandy loam (Stratum III), overlying a loamy sand remnant A horizon (Stratum IVa), developed within Jaucas sand (IVb), over a clay sand wetland deposit (Stratum V) (Figure 210, Figure 211, and, Figure 214, and Table 43).

T-41 documented recent fill deposits (Strata Ia–Ic) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II) and a historic sand fill deposit (Stratum III), resting on a natural wetland environment. Stratum III is a culturally sterile, very compact former ground surface that contained a mixture of partially decomposed organic material and brackish water sediment, evidenced by the inclusion of Quilted and Red-rimmed Melania (*Melanoides tuberculate* and *Tarebia granifera*) (Figure 212 and Figure 213). While a historic layer was consistently observed above an in situ A horizon throughout the project area, the sediment matrix of this fill deposit varied from terrestrial to wetland-brackish water constituents, and was most likely dependent on the natural environment from which the material was procured. Stratum IVa is culturally sterile, truncated, loamy sand remnant A horizon underlying pre-reclamation fill (Stratum III). This sequence of A horizon fill material overlying a truncated remnant A horizon is common throughout the project area. Stratum IVb is Jaucas sand A horizon parent material that increased in clay content toward the lower boundary.

Figure 210. T-41 northwest wall, view to north

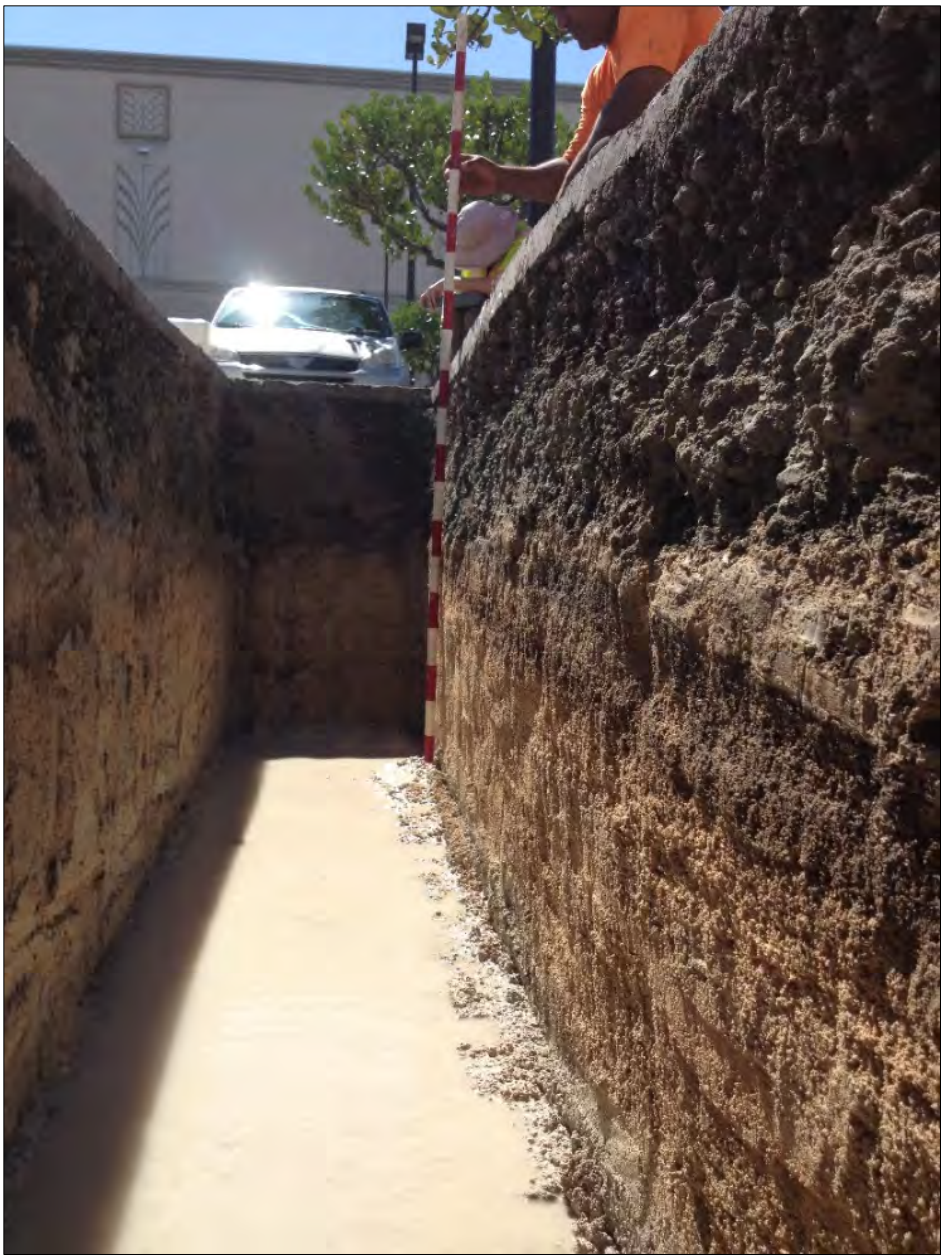

Figure 211. T-41, northwest and southeast walls, view to southwest

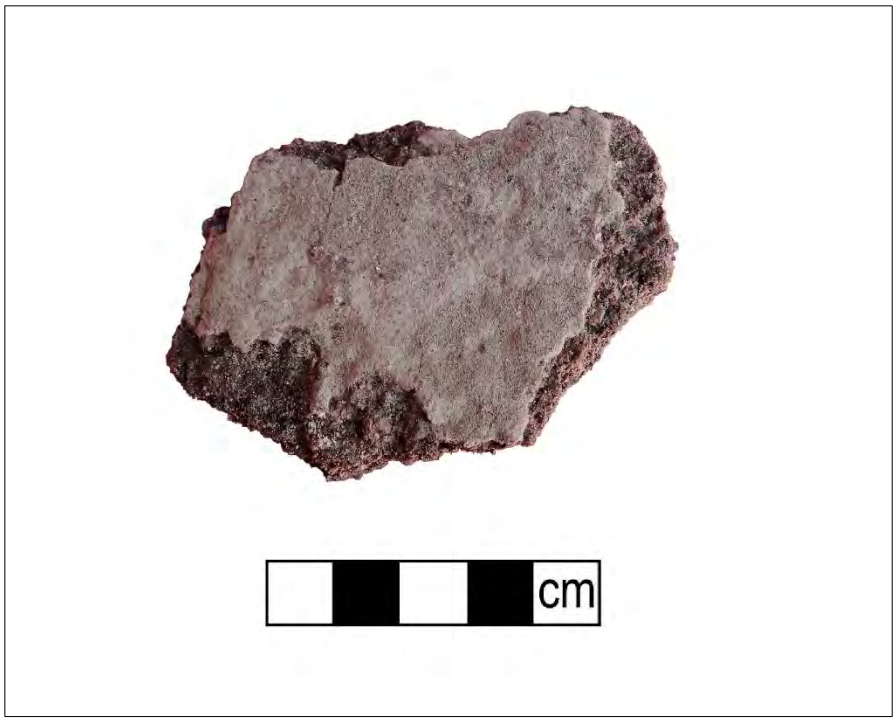

Figure 212. T-41 sediment sample from Stratum II, compacted locally procured fill, top view

Figure 213. T-41 Stratum II sample, side view

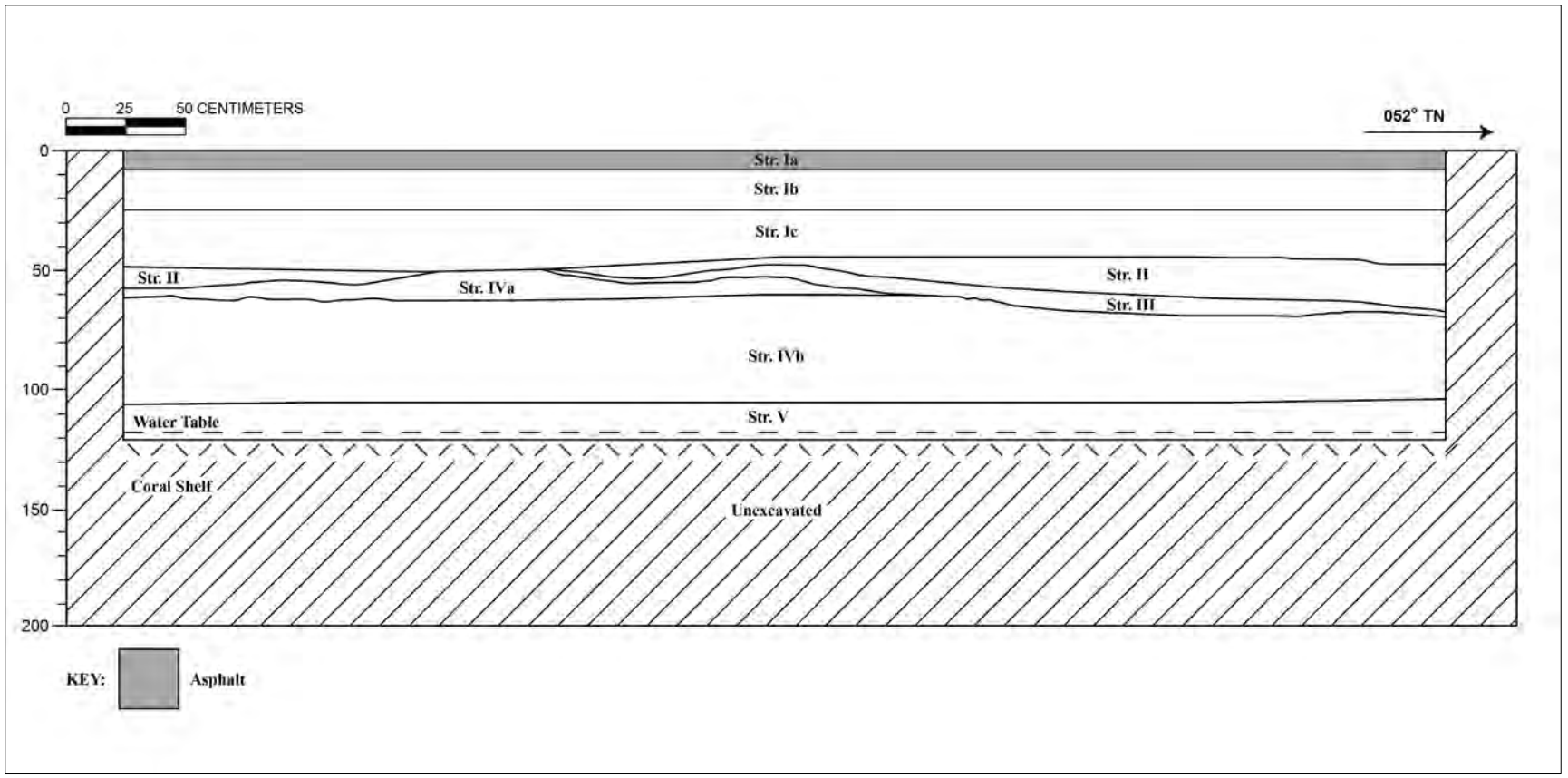

Figure 214. T-41 northwest profile

Table 43. T-41 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–6	Asphalt
Ib	6–25	Fill; 10YR 3/2, very dark grayish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth boundary; base course
Ic	25–50	Fill; 10Y 4/1 (GLEY 1), dark greenish gray; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
II	50–60	Fill; 2.5Y 7/4, pale yellow grading to 10Y 6/1 (GLEY 1), greenish gray; silty clay; moderate, fine, platy structure; moist, friable consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	60–68	Fill; 10YR 4/2, dark grayish brown; sandy loam; weak, medium, crumb structure; moist, friable consistence; non-plastic; mixed origin; clear, smooth lower boundary; very compact redeposited, likely locally procured sand utilized for land modification
IVa	50–65	Natural; 10YR 6/3, pale brown; loamy sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; mixed origin; clear, discontinuous lower boundary; disturbed and truncated remnant A horizon
IVb	60–105	Natural; 10YR 8/2, very pale brown; medium sand grading to sandy clay; weak, medium, crumb structure; moist, loose consistence; slightly plastic; marine origin; clear, smooth lower boundary; Jaucas Sand, intertidal sediment
V	105–220 (BOE)	Natural; N 7/ (GLEY 1), light gray; clay sand; moderate, medium, crumb structure; wet, slightly sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; gleyed wetland deposit; overlying coral shelf

4.2.42 Test Excavation 42 (T-42)

Test Excavation 42 (T-42), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.3 mbs. The stratigraphy of T-42 consisted of the asphalt surface (Stratum Ia), associated base course material (Stratum Ib), and overlying gravelly sandy loam fill (Stratum Ic), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic sandy clay (Stratum II), overlying a gravelly sandy loam, remnant A horizon (Stratum IIIa), overlying transitional deposits consisting of wetland sand (Stratum IIIb) and Jaucas sand (Stratum IIIc), a wetland clay sand with roots (Stratum IIId), and wetland sand with roots (Stratum IV) (Figure 215 through Figure 217, and Table 44).

T-42 documented recent fill deposits (Strata Ia–Ic), overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), resting on a natural transitional zone from terrestrial sand to an organically rich, wetland, marsh-like environment. Stratum IIIa was a highly compacted, remnant A horizon that was culturally sterile and contained brackish water snails, marine shells, and organic material. This horizon had been disturbed and truncated, and a thin black lens was observed at the upper stratum boundary in the southwest (*makai*) end. Stratum IIIa overlies both the wetland and Jaucas sands (Strata IIIb and IIIc), indicating pedogensis occurred evenly across the upper boundary of these transitional deposits. It is plausible that Strata IIIb and IIIc were truncated, graded, compacted, and then experienced stability resulting in soil formation. The interface between Strata IIIb and IIIc was a lateral-gradational termination of one lithostratagraphic unit against another (see Figure 216). Stratum IIIb was first deposited followed by the lateral aggradation of Stratum IIIc. Stratum IV is an oxygen depleted, water saturated, wetland sand that underlies Stratum III, and rests on top of the coral shelf.

Figure 215. T-42 southeast wall, view to south

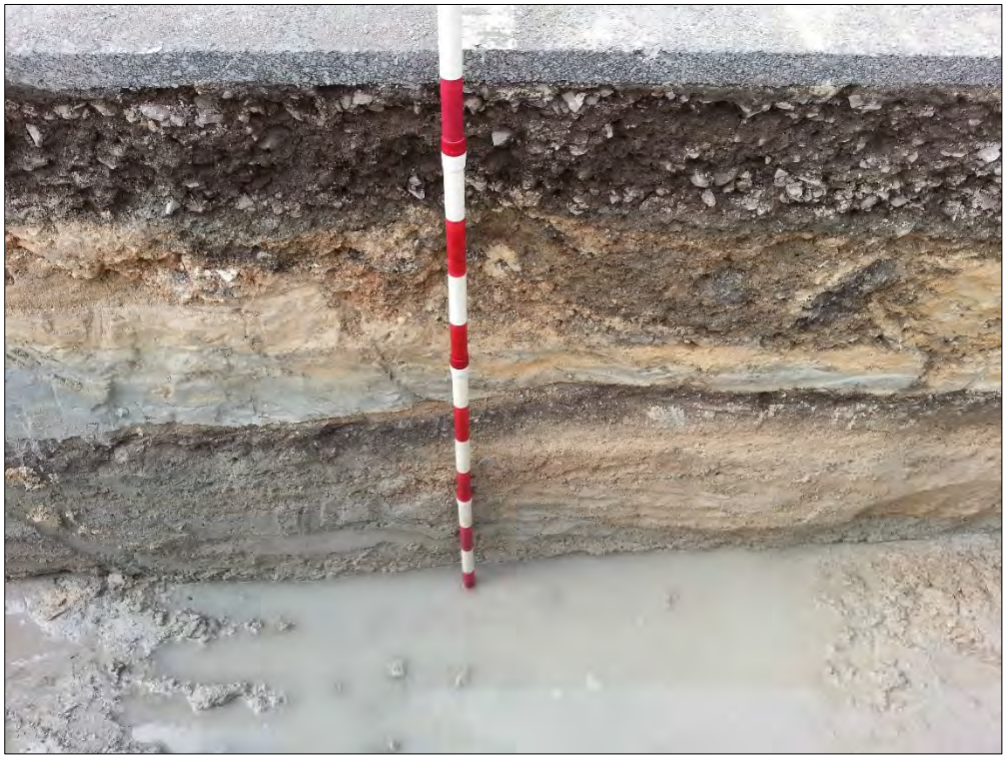

Figure 216. T-42 northwest wall, showing transitional interface, view to northwest

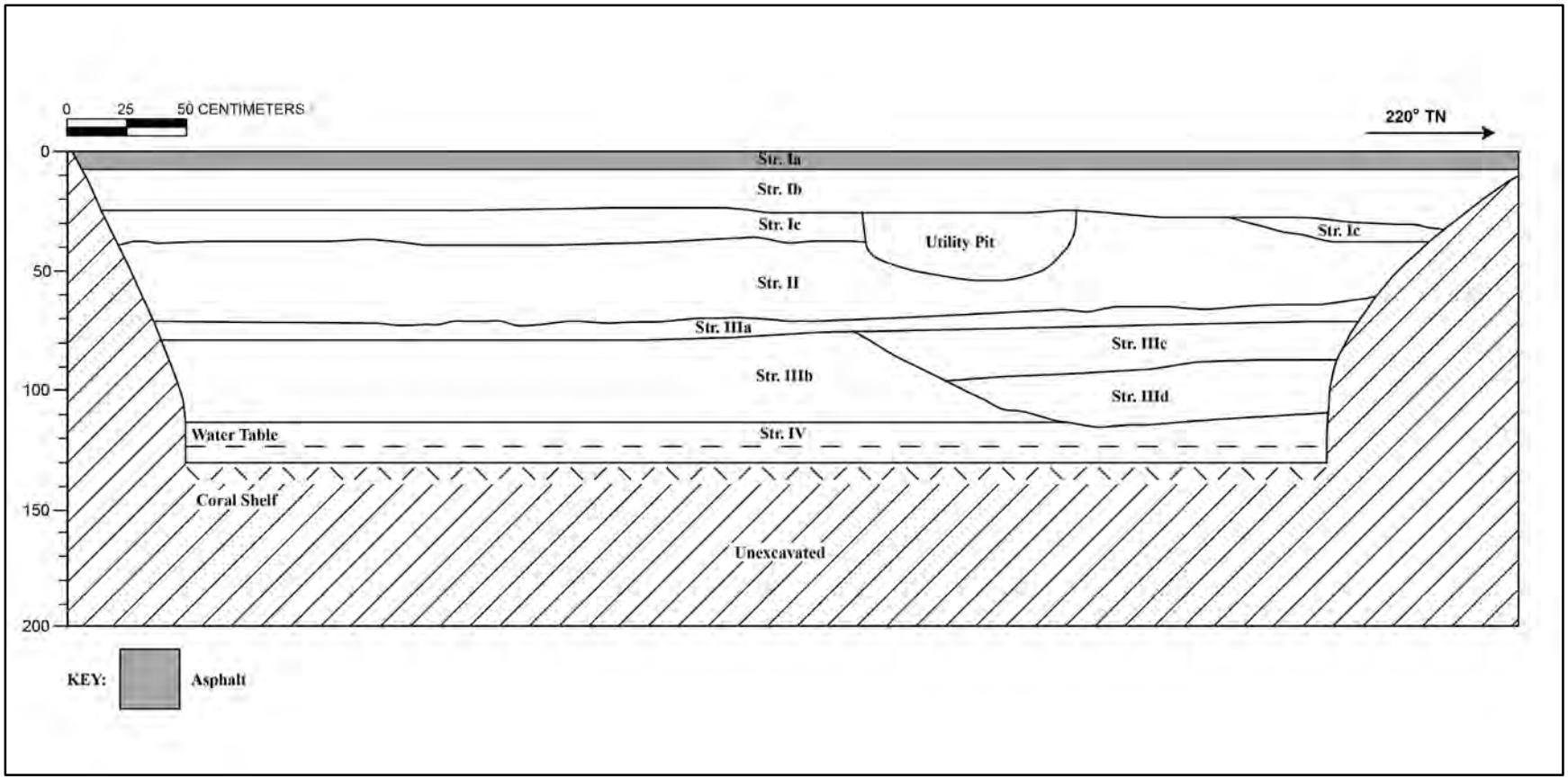

Figure 217. T-42 southeast profile

Table 44. T-42 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–30	Fill; 7.5YR 2.5/2, very dark brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth boundary; base course
Construction pit fill	25–55	Fill; 10YR 4/2, dark grayish brown; very gravelly loam; structureless (single-grain); moist, loose consistence; non-plastic; clear boundary; contains chunks of hydraulic dredge
Ic	24–38	Fill; 7.5YR 5/6, strong brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; crushed coral fill
II	25–71	Fill; 2.5Y 7/4, pale yellow grading to 10Y 6/1 (GLEY 1), greenish gray; fine sandy clay grading to clay; structureless (massive); moist, firm consistence; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	65–80	Natural; 2.5Y 4/1, dark gray; gravelly sandy loam; strong, medium, crumb structure; moist, firm consistence; non-plastic; mixed origin; clear, smooth lower boundary; common, fine roots; highly compacted A horizon which transitioned from terrestrial sand to wetland; contained a thin black lens on top boundary (south end); contained brackish snails, tiny marine shells, and humus in south end
IIIb	75–115	Natural; 5Y 6/1, gray; sand; weak, fine, crumb structure; moist, very friable consistence; non-plastic; marine origin; diffuse, smooth lower boundary; contained tiny marine shells
IIIc	73–86	Natural; 10YR 8/2, very pale brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; highly compacted Jaucas sand at edge of wetland
IIId	86–115	Natural; 2.5Y 7/2, light gray; clay sand; moderate, fine, blocky structure; moist, friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; contained decomposing roots
IV	115–131 (BOE)	Natural; 2.5Y 7/1, light gray; sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; contained marine shell (Tellinidae) and decomposing roots; overlying coral shelf

4.2.43 Test Excavation 43 (T-43)

Test Excavation 43 (T-43), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, approximately 10 m northeast of T-42, was oriented southwest-northeast, and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.36 mbs. The stratigraphy of T-43 consisted of the asphalt surface (Stratum Ia), associated base course material (Stratum Ib), and 1919–1927 Kaka‘ako land reclamation hydraulic sandy clay fill (Stratum II), overlying a sandy loam A horizon (Stratum IIIa), Jaucas sand (Stratum IIIb), a wetland clay sand with organics (Stratum IVa), and coarse wetland sand (Stratum IVb) (Figure 218 through Figure 220, and Table 45).

T-43 documented recent fill deposits (Strata Ia–Ib) overlying 1919–1927 Kaka‘ako reclamation fill (Stratum II), resting on a truncated, natural A horizon (Stratum IIIa) and sand deposits (Strata IIIb–IVb). The A horizon contained a light amount of cultural material and is considered part of SIHP # -7429. Fifteen gallons of Stratum IIIa was screened in the field, yielding charcoal, marine shell midden (*Nerita picea*) (5.6 g), rusted metal pieces (12.9 g), a small ceramic fragment (1.0 g), two small glass fragments (1.8 g), slag (1.3 g), a faunal bone fragment (0.2 g), and natural water-worn marine shell. Stratum IIIa displayed a gradual yet clear lower boundary that indicates in situ pedogenisis within the upper boundary of the Jaucas sand (Stratum IIIb) (see Figure 219). The lower boundary of Stratum IIIb becomes coarse and displayed evidence of bioturbation from roots extending up from the underling wetland clay sand (Stratum IVa).

Figure 218. T-43 southeast wall, view to south

Figure 219. Close-up of Stratum IIIa (A horizon), SIHP # -7429, view to east

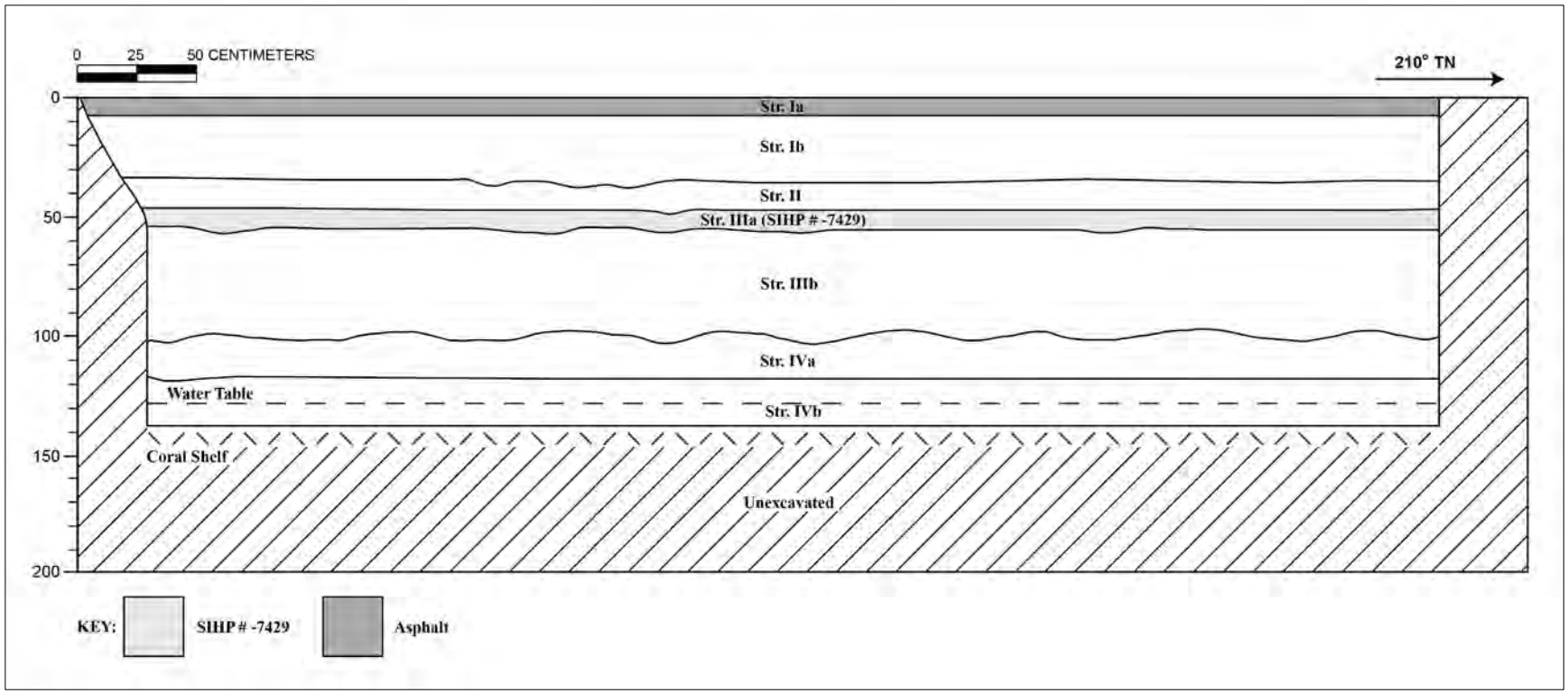

Figure 220. T-43 southeast profile

Table 45. T-43 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–35	Fill; 5YR 3/1, very dark gray; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth boundary; base course
II	35–47	Fill; 10YR 7/3, very pale brown; fine sandy clay; moderate, fine, platy structure; moist, friable consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	47–56	SIHP # -7429; 10YR 4/4, dark yellowish brown; sandy loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; A horizon; contained charcoal, marine shell midden, rusted metal, faunal bone, and small ceramic and glass fragments
IIIb	56–103	Natural; 10Y 6/4, light yellowish brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, smooth lower boundary; Jaucas sand; bioturbation from roots, lower boundary becomes course sand
IVa	101–119	Natural; 2.5Y 7/3, pale brown; clay sand; weak, fine, blocky structure; moist, friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; few, very fine roots; organically rich wetland clay sand
IVb	119–136 (BOE)	Natural; 5Y 7/1, light gray; course sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; wetland deposit above coral shelf

4.2.44 Test Excavation 44 (T-44)

Test Excavation 44 (T-44), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northwest-southeast and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.3 mbs. The stratigraphy of T-44 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), utility fill (Stratum Ic), and a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic (dredge) sandy clay to clay (Stratum II) overlying a natural wetland silty clay containing organics (Stratum IIIa), a wetland sandy clay A horizon (Stratum IIIb), silty clay (Stratum IIIc), silty sand with decomposing organics (Stratum IIId), and clay sand with decomposing organics (Stratum IV) (Figure 221 through Figure 223, and Table 46). T-44 was extended approximately 0.7 m southwest of the original layout due to encountering a telecom utility line (0.9 mbs). The telecom utility line cut diagonally through the western end of T-44, and as a result, the surrounding material was not removed.

T-44 documented recent fill deposits (Strata Ia–Ic) overlying a Kaka‘ako reclamation fill deposit (Stratum II), overlying a natural former ground surface and several strata of organically rich, wetland sands (Strata IIIa–IV). Stratum IIIa was a culturally sterile, organically rich silty clay, which may have been either locally procured, wetland A horizon material that was deposited as surface leveling fill, or may be part of the natural wetland depositional sequence. It appeared to have been truncated prior to the deposition of Stratum II. Stratum IIIb was a culturally sterile, buried wetland A horizon that consisted of an organically rich sandy clay and contained brackish water snails (e.g., *Melampus* sp.). Below is a culturally sterile, organically rich, silty clay wetland deposit with roots (Stratum IIIc). Collectively, Stratum III appeared to represent alternating sequences of deposition, stability, pedogenisis, and accumulation of organics within a wetland environment, similar to a salt marsh or mud flat (see Figure 222). Stratum IV was wetland clayey sand located above the slowly decomposing coral shelf.

Figure 221. T-44 southwest wall, view to west

Figure 222. T-44, view of natural deposits (Strata IIIa–IV) underlying gleyed hydraulic clay fill (Stratum II), view to southwest

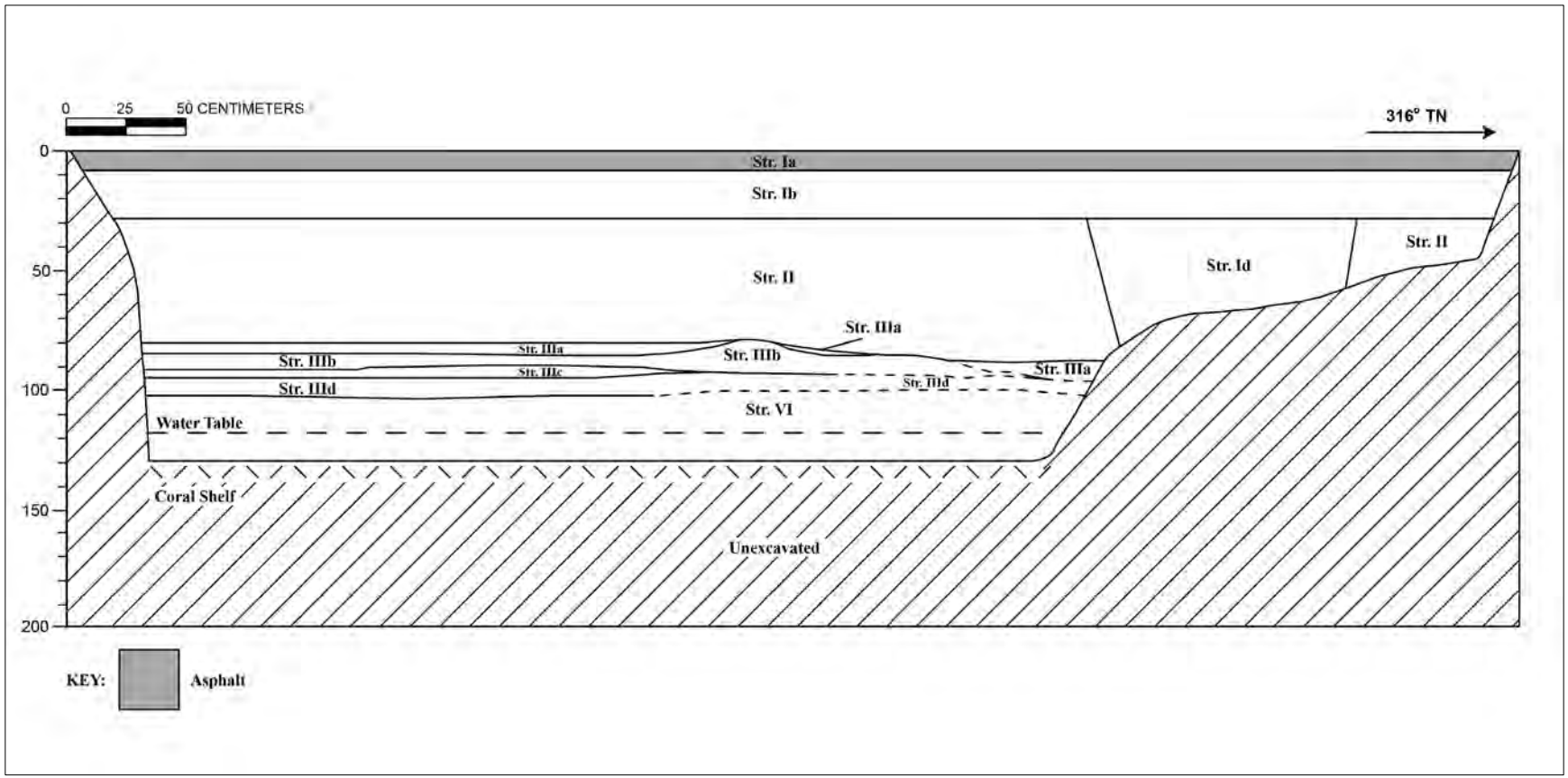

Figure 223. T-44 southwest profile

Table 46. T-44 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–27	Fill; 7.5YR 2.5/2, very dark brown; extremely gravelly sandy loam; weak, fine to medium, crumb structure; moist, loose consistence; slightly plastic; mixed origin; clear, smooth boundary; likely locally procured sediment mixed with imported gravel
Ic	27–54	Fill; 5YR 3/2; extremely gravelly sandy clay; weak, fine structure; moist, loose consistence; slightly plastic; terrigenous origin; smooth lower boundary; fill related to installation of drain line
II	27–79	Fill; 2.5Y 7/3 grading to 10Y 6/1 (GLEY 1), pale yellow to greenish gray; sandy clay grading to clay; structureless (massive); moist, firm consistence; plastic; mixed origin; abrupt and smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	77–91	Natural; 5GY 6/1 (GLEY 1), greenish gray; silty clay; moderate, very fine, blocky structure; moist, firm consistence; slightly plastic; marine origin; diffuse, smooth lower boundary; common, very fine to fine roots; contained organics; part of a organic wetland sequence
IIIb	85–90	Natural; 10YR 5/3, brown; sandy clay; moderate, fine, blocky structure; moist, firm consistence; slightly plastic; marine origin; clear, smooth lower boundary; contained humus material and brackish water snails (*Melampus* sp.); wetland A horizon
IIIc	90–93	Natural; 10YR 6/1, gray; silty clay; moist, firm consistence; plastic; marine origin; clear, smooth lower boundary; contained humus material; bioturbation from roots extending from lower horizon
IIId	93–101	Natural; 5Y 6/2, light olive gray; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; contained decomposing roots
IV	101–130 (BOE)	Natural; 5Y 7/1, light gray; clay sand; weak, fine, crumb structure; wet, non-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; marine sand grading to coarse sand at lower boundary; contained decomposing roots; overlying coral shelf

4.2.45 Test Excavation 45 (T-45)

Test Excavation 45 (T-45), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented southwest-northeast and measured 6.0 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.4 mbs. The stratigraphy of T-45 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), and gravelly sandy loam fill (Stratum Ic) overlying a thick layer of gravel that extended to below the coral shelf (Stratum Id) (Figure 224 and Table 47). No natural stratigraphy was observed; it appeared to have been removed during the deposition of the gravel fill. Based on the surrounding test excavations, however, the natural sediments likely consisted of wetland deposits. A utility line was encountered in the mid-section of T-45 at 0.7 mbs, and as a result, the surrounding material was not excavated.

Table 47. T-45 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–25	Fill; 5YR 3/3, dark reddish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	22–48	Fill; 10YR 4/4, dark yellowish brown; very gravelly sandy loam; structureless (single-grain); moist, loose consistence; clear, smooth lower boundary; imported fill
Id	45–140 (BOE)	Fill; 5YR 3/3, dark reddish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; overlying coral shelf

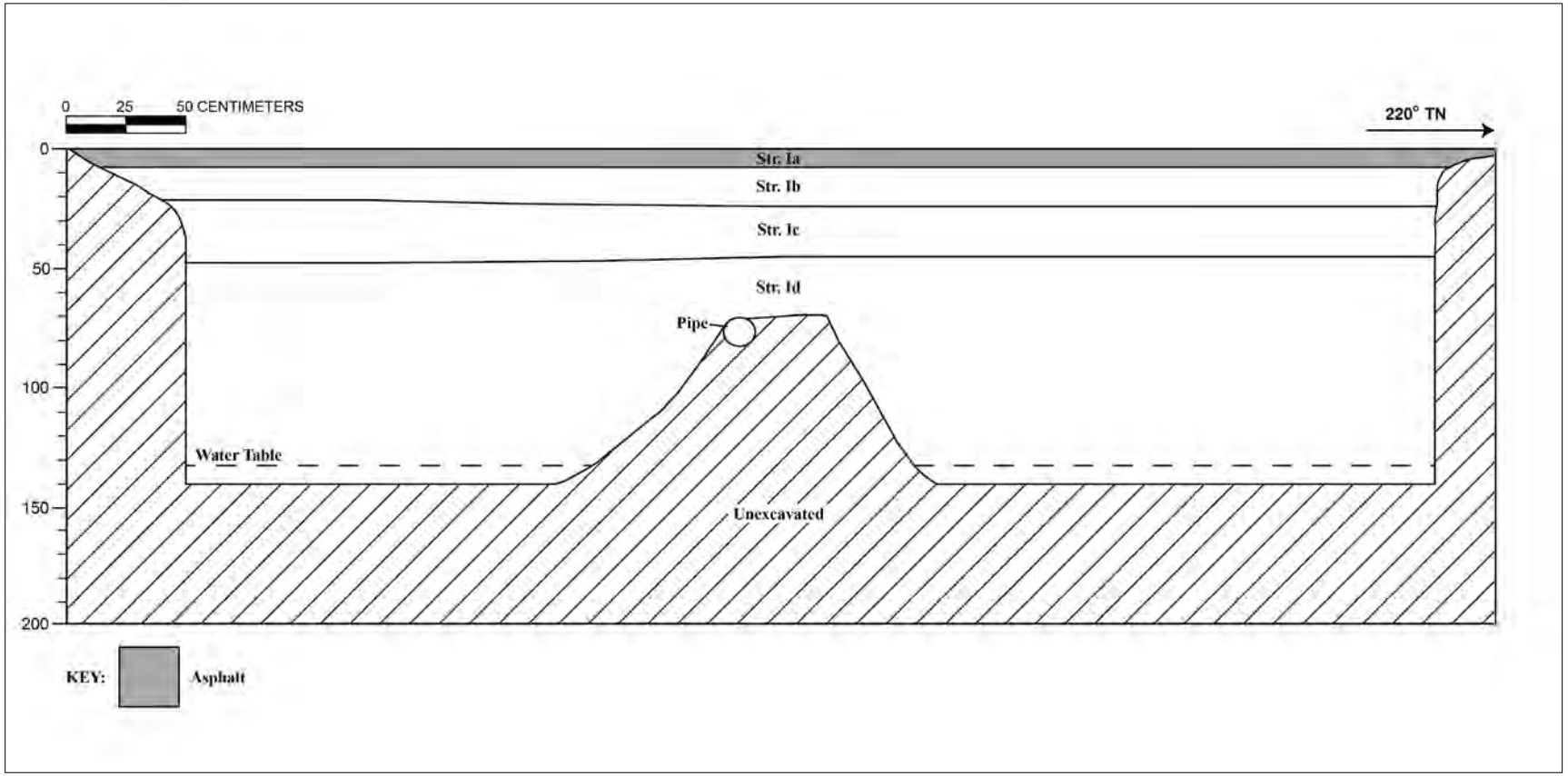

Figure 224. T-45 southeast profile

4.2.46 Test Excavation 46 (T-46)

Test Excavation 46 (T-46), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented southwest-northeast, and measured 6.0 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.3 mbs. The stratigraphy of T-46 consisted of the asphalt surface (Stratum Ia) and associated base course material (Stratum Ib) over additional base course material with a lower silt lining (Stratum Ic), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic silty clay (Stratum II), overlying a humicy clay O horizon (Stratum IIIa), an organically rich, loamy clay (Stratum IIIb), and sand (Stratum IV) (Figure 225 and Figure 226, and Table 48).

T-46 documented recent fill deposits (Strata Ia–Ic), overlying a Kaka‘ako reclamation fill deposit (Stratum II), resting on a natural, organically rich, wetland environment. Stratum IIIa consisted of clay and decomposing organics (i.e., humus). The accumulation of humus at the upper boundary of Stratum IIIa is more characteristic of an O horizon than an A horizon. Small roots extended from Stratum IIIa into the subsurface horizon below (Stratum IIIb), which is characterized as culturally sterile, loamy clay with few, fine roots. Brownish mottling was observed at the interface of Strata IIIb and IV and may be attributed to bioturbation from roots and the translocation of minerals near the fluctuating water table. Stratum IV is a wetland sand resting above the coral shelf that displayed a decrease in clay content and an increase in coral gravel compared to the overlying stratum, most likely the result of the close proximity to the decomposing coral shelf.

Figure 225. T-46 southeast wall, view to south

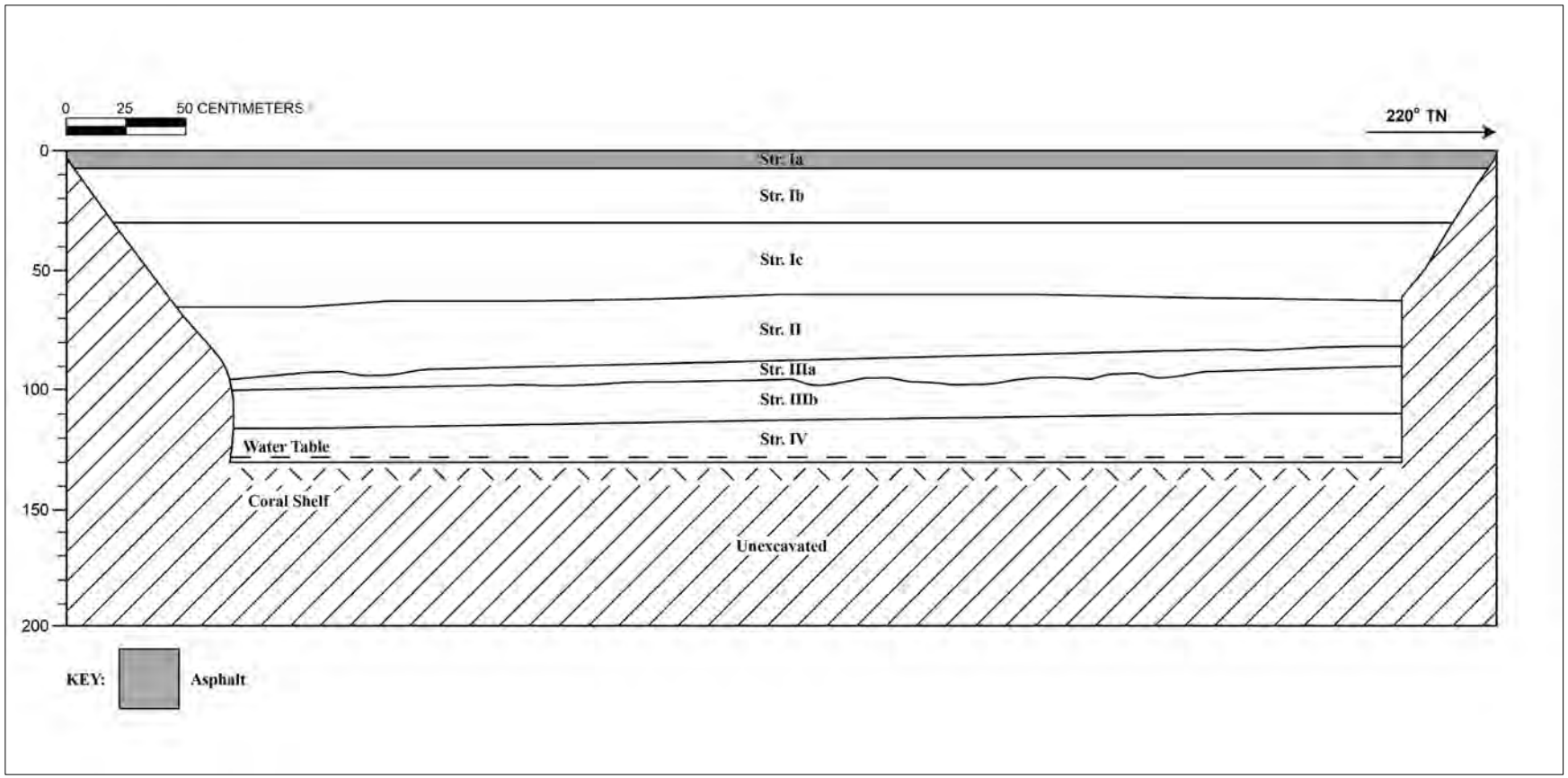

Figure 226. T-46 southeast profile

Table 48. T-46 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–30	Fill; 5YR 3/3, dark reddish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; clear, smooth lower boundary; base course
Ic	30–65	Fill; 5Y 5/1, gray; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; abrupt, smooth lower boundary; silt lining observed at lower boundary; base course
II	60–95	Fill; 2.5Y 7/3, pale yellow grading to 10Y 6/1 (GLEY 1), greenish gray; silty clay; structureless (massive); moist, firm consistence; slightly plastic; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	80–100	Natural; 2.5Y 3/3, dark olive brown; humicy clay; structureless (massive); moist, firm consistence; plastic; terrigenous origin; abrupt, smooth lower boundary; many, fine roots; extremely humicy O horizon; contained brackish water snails
IIIb	90–115	Natural; 2.5Y 6/1, gray; loamy clay; moderate, fine, crumb structure; moist, firm consistence; slightly plastic; marine origin; diffuse, smooth lower boundary; few, fine roots; marine clay
IV	110–130 (BOE)	Natural; 2.5Y 7/1, light gray; sand; structureless (single-grain); wet, slightly sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; sand overlying coral shelf

4.2.47 Test Excavation 47 (T-47)

Test Excavation 47 (T-47), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northwest-southeast and measured 6.2 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.43 mbs. The stratigraphy of T-47 consisted of the asphalt surface (Stratum Ia), associated base course material (Stratum Ib), an additional base course with a lower silt liner (Stratum Ic), and silty clay mixed with base course material (Stratum Id) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic (dredge) silty clay (Stratum II), overlying a very gravelly sandy loam containing slag and thermally altered metal (Stratum III), overlying natural loamy sand (Stratum IVa), sandy clay (Stratum IVb), a silty clay A horizon (Stratum IVc), and a loamy sand with roots (Stratum IVd) (Figure 227 through Figure 230, and Table 49).

T-47 documented recent fill deposits (Strata Ia–Id) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), overlying a localized fill deposit, resting on a series of natural wetland deposits (Strata Iva–IVd). Stratum III was a compact layer of slag and thermally altered and oxidized metal fragments (Figure 228). It appeared to be a thin layer of incinerator fill material from early the 1900s method of garbage disposal in Kaka‘ako. Below Stratum III was a truncated, culturally sterile wetland-marsh environment (Stratum IV) that displayed two sequences of deposition, stability, and pedogenisis, similar to that of T-44. Strata IVa and IVb appear to have been a wetland sub-stratum that likely supported an A horizon prior to the removal of the upper boundary of Stratum IVa. Strata IVa and IVb most likely represent the second, more recent, observed depositional sequence. Stratum IVb displayed some mineral leaching, most likely due to the translocation of ions and oxides from the subsurface matrix into the dissolved ground water. Stratum IVc was an A horizon that developed within the loamy sand above the coral shelf (Stratum IVd). Stratum IVc represents a period of stability that was eventually buried under Strata IVa and IVb due to a change in the depositional conditions, resulting in an increase in sediment load and aggradation.

Four column samples were taken from T-47: Strata IVa (97–98 cmbs), IVb (108–109 cmbs), IVc (114–115 cmbs), and IVd (126–127 cmbs) (Figure 229). Results from the four sampled strata indicate that T-47 was consistently a natural wetland. Cyperaceae pollen percentages were high through the sequence indicating a Wet Coastal Sedgeland vegetation dominated the site. Strata IVc and IVd column samples had higher percentages of aquatic Foraminifera shells, suggesting the wetland may have been more frequently or deeply inundated during the earlier depositional periods. Charcoal concentrations increased from the lower to the upper samples (Strata IVd–IVa), demonstrating an increase in burning activities in the surrounding uplands in the more recent sediments.

Figure 227. T-47 southwest wall, view to northwest

Figure 228. T-47 southwest wall, close-up of incinerated material within Stratum III, view to southwest

Figure 229. T-47 southwest wall column sample location, view to west

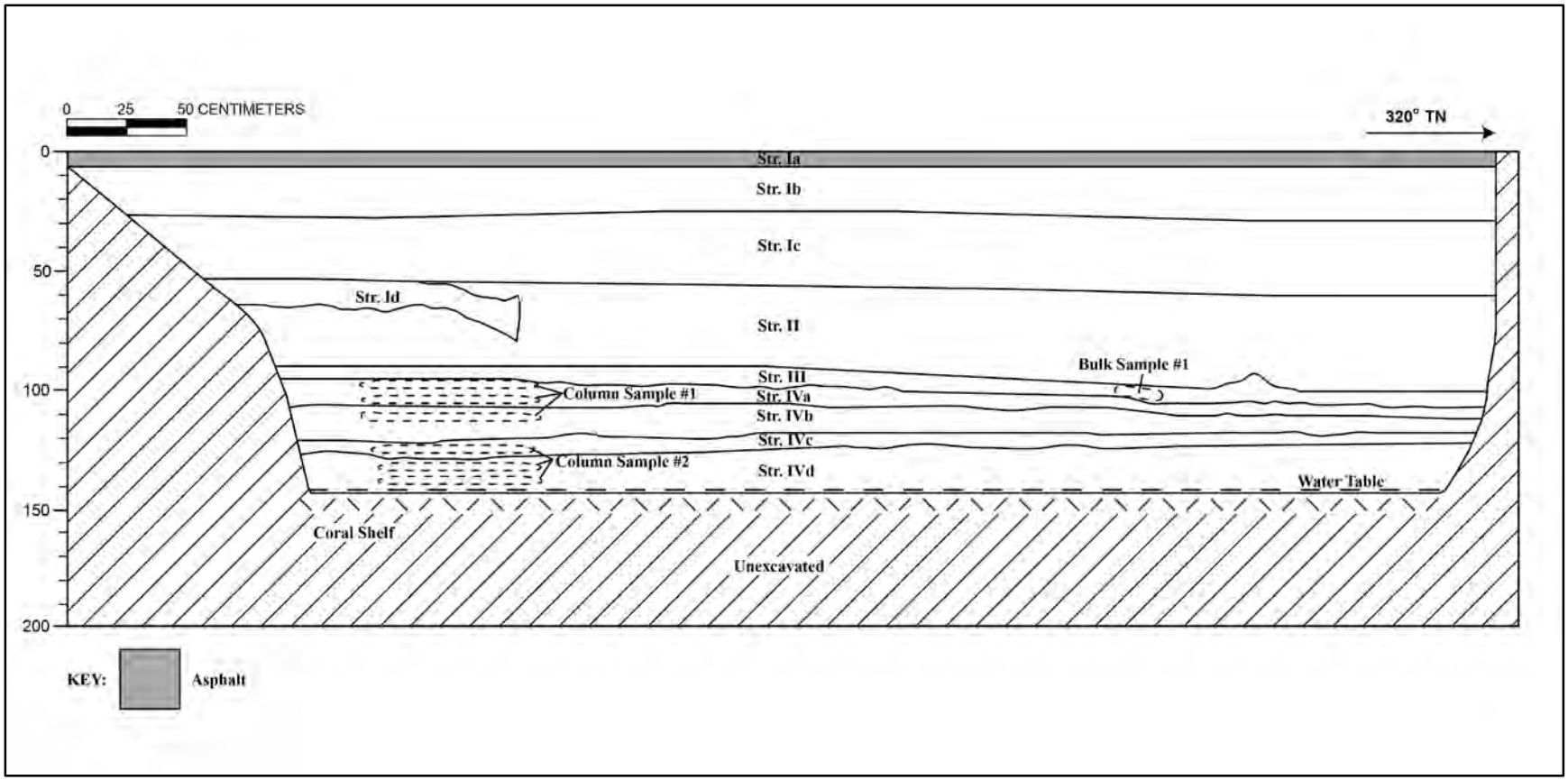

Figure 230. T-47 southwest profile

Table 49. T-47 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–6	Asphalt
Ib	6–27	Fill; 5YR 3/3, dark reddish brown; very gravelly loamy sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth boundary; base course
Ic	25–60	Fill; 10Y 4/1 (GLEY 1), dark greenish gray; very gravelly loamy sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course with black matting material near lower boundary
Id	55–85	Fill; 2.5YR 6/4, light yellowish brown mottled with 10YR 4/3, brown; very gravelly silty clay; moderate, fine, platy structure; moist, friable, firm consistence; slightly plastic; mixed origin; clear, broken/discontinuous lower boundary; hydraulic dredge (Stratum II) mixed with base course
II	54–100	Fill; 10YR 7/4, very pale brown grading to 5GY 6/1 (GLEY 1), greenish gray; silty clay; weak, medium, crumb structure; moist, firm consistency; slightly plastic; marine origin; clear, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	90–106	Fill; 10YR 4/1, dark gray; very gravelly sandy loam; weak, fine, crumb structure; moist, friable consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; contained slag and thermally altered metal observed; possible incinerator fill
IVa	95–110	Natural; 10YR 7/1, light gray; loamy sand; weak, fine, crumb structure; moist, friable consistence; non-plastic; marine origin; clear, smooth lower boundary; possible intertidal sand deposit
IVb	105–125	Natural; 5G 6/1 (GLEY 1), greenish gray; sandy clay; weak, medium, crumb structure; moist, firm consistency; plastic; marine origin; diffuse, smooth lower boundary; possible intertidal deposit
IVc	116–127	Natural; 2.5Y 5/2, grayish brown; silty clay; weak, medium, crumb structure; moist, friable consistency; slightly plastic; few, small root stains; marine origin; clear, smooth lower boundary; intertidal sediment organic horizon
IVd	122–143 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; loamy sand; structureless (single-grain); moist, friable consistence; slightly plastic; common, medium roots; marine origin; abrupt, smooth lower boundary; possible intertidal deposit

4.2.48 Test Excavation 48 (T-48)

Test Excavation 48 (T-48), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented southwest-northeast and measured 6.1 m long by 0.7 m. The base of excavation was determined by the presence of the hard coral shelf at 1.33 mbs. The stratigraphy of T-48 consisted of the asphalt surface (Stratum Ia) and two associated base course deposits (Strata Ib–Ic), overlying 1919–1927 Kaka‘ako reclamation hydraulic silty clay fill (Stratum II), overlying a locally procured wetland loamy sand (Stratum III), overlying a natural sandy loam wetland A horizon (Stratum IVa), developed within a sand deposit (Stratum IVb) (Figure 231 and Figure 233, and Table 50).

T-48 documented recent fill deposits (Strata Ia–Ic) overlying a Kaka‘ako land reclamation fill deposit (Stratum II), overlying a culturally enriched historic horizon (Stratum III) (SIHP # -7429), resting on a disturbed wetland, marsh-like environment. Stratum III consisted of a locally procured wetland loamy sand likely utilized to level and/or build up the ground surface. A milled wood post was observed to originate from Stratum III and terminate in Stratum IVb (Figure 232). The exterior of the milled wood exhibited a minimal amount of decomposition and retained an odorous smell, most likely as a result of anaerobic digestion which produces an odorous biogas consisting of methane, carbon dioxide, and other contaminant gases. The presence of the wood post indicates stability of the land surface for a period of time. Based on the similarity of stratigraphic provenience and feature type to Test Excavations 31 and 65, the wood post was considered associated with SIHP # -7429 and was designated SIHP # -7429 Feature 13. Stratum IVa is a culturally sterile, sandy loam wetland A horizon, developed within a wetland sand deposit (Stratum IVb).

Figure 231. T-48 southeast wall, view to northeast

Figure 232. T-48 southeast wall, close-up of SIHP # -7429 Feature 13 milled wood post and posthole (Stratum III), view to south

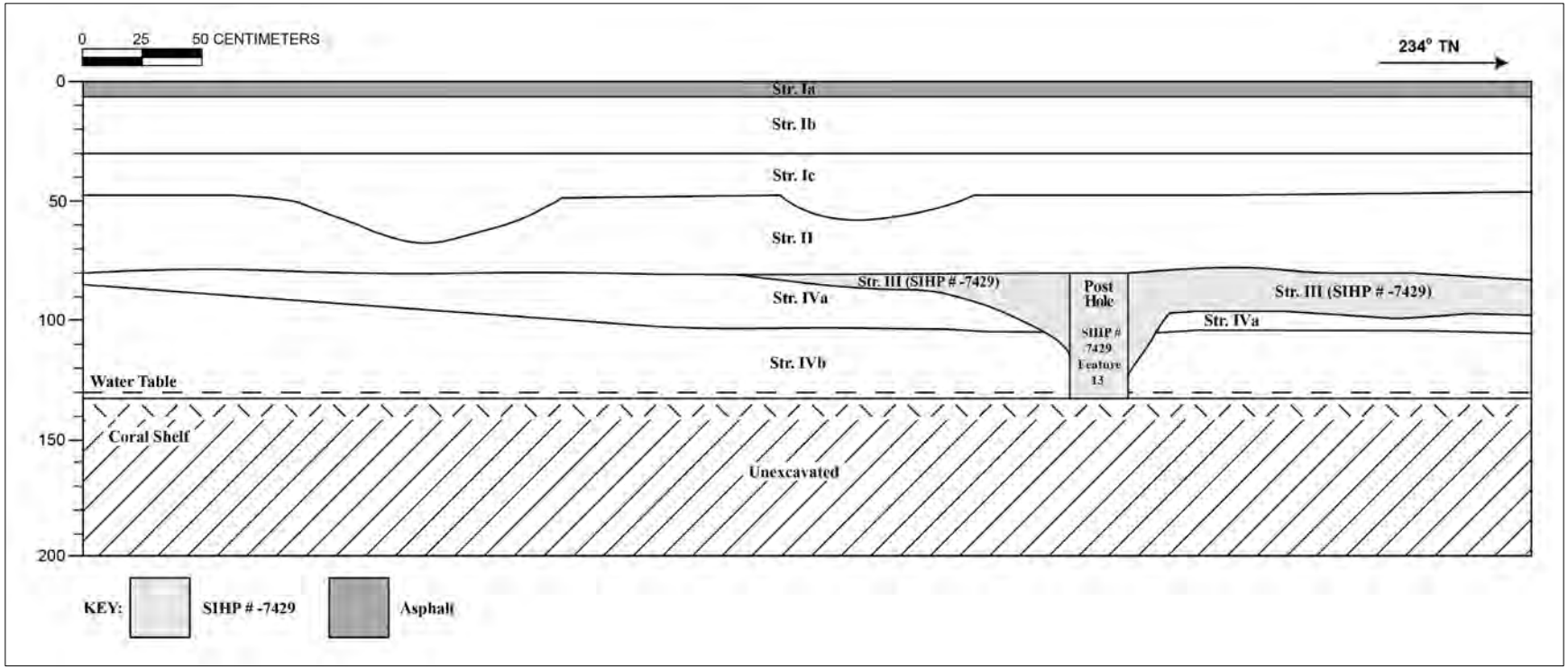

Figure 233. T-48 southeast profile

Table 50. T-48 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–6	Asphalt
Ib	6–30	Fill; 10YR 3/2, very dark grayish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth boundary; few, medium roots; base course
Ic	30–68	Fill; 10Y 4/1 (GLEY 1), dark greenish gray; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
II	48–80	Fill; 2.5Y 7/4, pale yellow grading to 10Y 6/1 (GLEY 1), greenish gray; silty clay; moderate, fine, platy structure; moist, friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	80–100	SIHP # -7429; 2.5Y 7/2 mottled with 2.5Y 4/3, light gray and olive brown; loamy sand; weak, medium, crumb structure; moist, loose consistency; slightly plastic; marine origin; clear, broken/discontinuous lower boundary; contained SIHP # -7429 Feature 13 posthole and milled wooden post
IVa	70–105	Natural; 10YR 4/2, dark grayish brown; sandy loam; weak, medium, crumb structure; moist, very friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; wetland A horizon
IVb	85–133 (BOE)	Natural; 2.5Y 6/2, light brownish gray; sand; structureless (single-grain); wet, slightly sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; wetland deposit

4.2.49 Test Excavation 49 (T-49)

Test Excavation 49 (T-49), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northwest-southeast and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.4 mbs. The stratigraphy of T-49 consisted of the asphalt surface (Stratum Ia) and two layers of associated base course material (Strata Ib–Ic) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic silty clay (Stratum II), overlying a natural loamy sand A horizon (Stratum IIIa), developed within Jaucas sand (Stratum IIIb), over a wetland sandy clay (Stratum IVa), and wetland sand (Stratum IVb) (Figure 234 through Figure 236, and Table 51).

T-49 documented recent fill deposits (Strata Ia–Ic) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), overlying a natural soil horizon developed within beach sand, and two wetland deposits, resting on top of the coral shelf. Stratum IIIa was a culturally sterile, truncated, and buried A horizon. Stratum IIIb consisted of Jaucas sand and had a highly undulated and diffuse lower boundary that transitioned into a gleyed, wetland clay sand (Stratum IVa), which was most likely the result of post depositional processes in an anaerobic environment (see Figure 235).

Figure 234. T-49 southwest wall, view to west

Figure 235. T-49 southwest wall, close-up of natural deposits (Strata III–IV), view to west

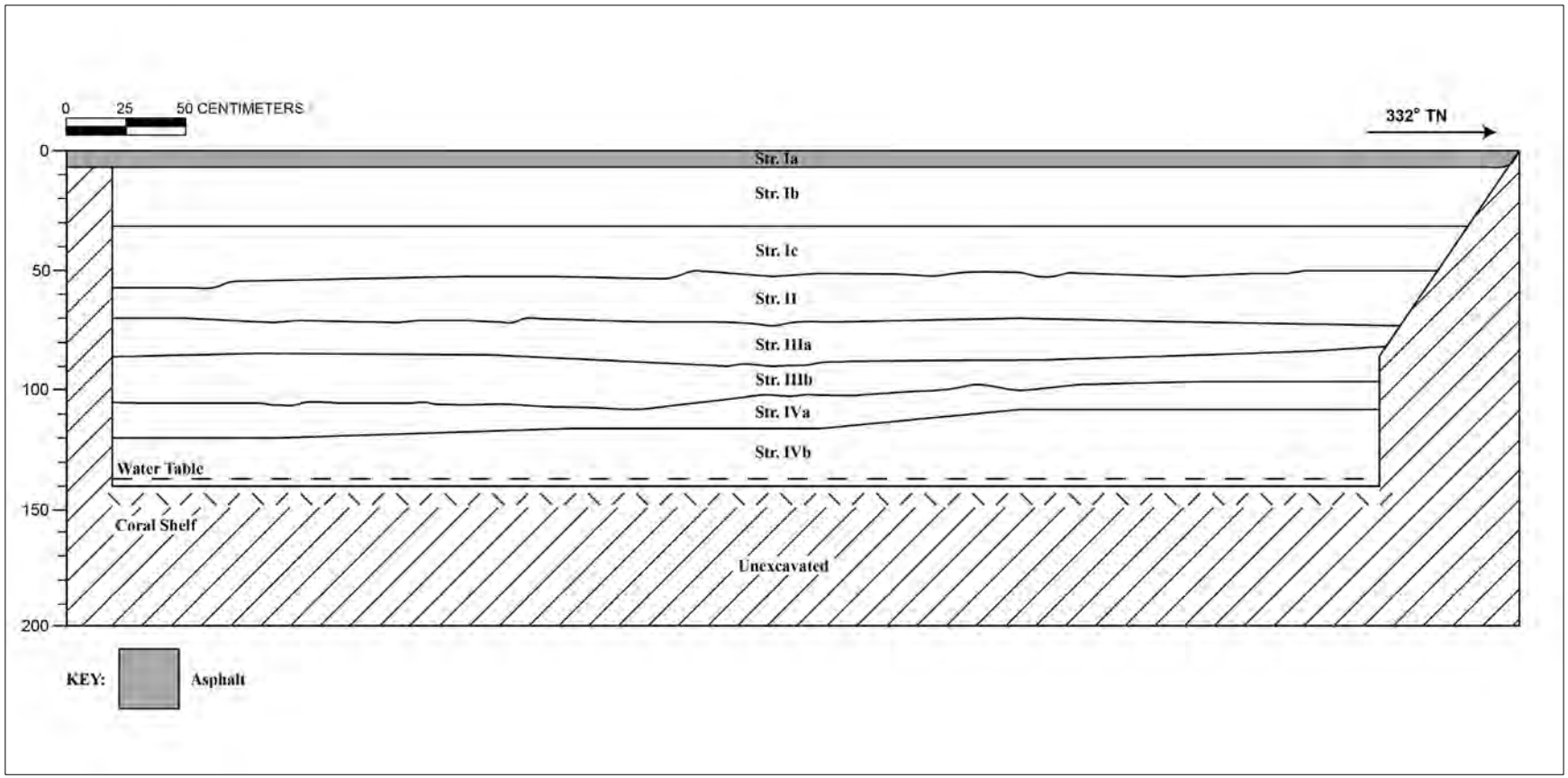

Figure 236. T-49 southwest profile

Table 51. T-49 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–7	Asphalt
Ib	7–32	Fill; 10YR 4/2, dark grayish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth boundary; base course
Ic	32–57	Fill; 10Y 5/1 (GLEY 1), greenish gray; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
II	50–73	Fill; 2.5Y 7/3, pale yellow grading to 5GY 7/1 (GLEY 1), light greenish gray; silty clay; moderate, fine, platy structure; moist, friable consistence; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	70–87	Natural; 2.5Y 4/2, dark grayish brown; loamy sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; A horizon
IIIb	82–107	Natural; 2.5Y 7/4, pale yellow; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand
IVa	95–120	Natural; 2.5Y 7/4, pale yellow; sandy clay; moderate, medium, crumb structure; moist, friable consistence; non-plastic; marine origin; diffuse, wavy lower boundary; wetland deposit
IVb	107–140 (BOE)	Natural; 10Y 6/1 (GLEY 1), greenish gray; coarse sand; structureless (single-grain); wet, slightly sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; wetland sand; overlying coral shelf

4.2.50 Test Excavation 50 (T-50)

Test Excavation 50 (T-50), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.38 mbs. The stratigraphy of T-50 consisted of the asphalt surface (Stratum Ia) and two associated base course layers (Strata Ib–Ic) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic silty clay (Stratum II), overlying a redeposited, locally procured loamy sand (Stratum III), overlying a wetland loamy clay A horizon (Stratum IVa) and wetland sand (Stratum IVb) (Figure 237 through Figure 239, and Table 52).

T-50 documented recent fill deposits (Strata Ia–Ic) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II) and a historic sand fill deposit (Stratum III), overlying a disturbed, natural wetland deposit resting on top of the coral shelf. Stratum III most likely consists of locally procured sand deposited to level and/or build up the ground surface and that served as a historic land surface for a period of time prior to reclamation activities. Below the mixed local sand was a culturally sterile, buried wetland A horizon (Stratum IVa) that developed within a natural wetland clay that inclined to the southwest (*makai*) (Stratum IVb) (see Figure 238). The Stratum IVa matrix contained minimal organics and appeared to be disturbed, with a truncated upper boundary; portions of the stratum were removed in the southwest end, possibly as a result of the deposition of Stratum III.

Figure 237. T-50 northwest wall, view to north

Figure 238. T-50 close-up of northwest wall, showing locally procured sand fill (Stratum III) over a wetland A horizon (Stratum IVa), view to northwest

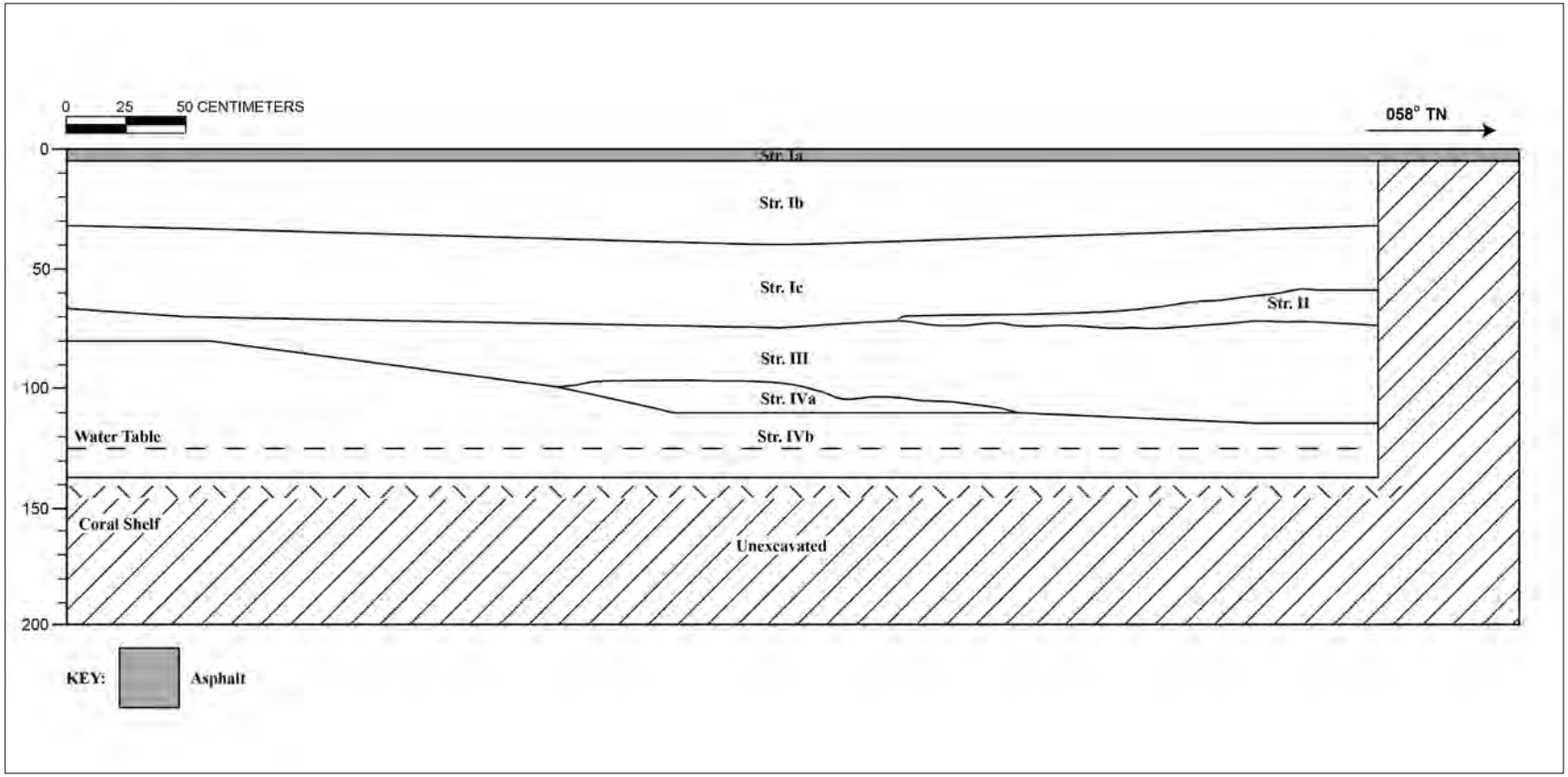

Figure 239. T-50 northwest profile

Table 52. T-50 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–5	Asphalt
Ib	5–40	Fill; 10YR 4/2, dark grayish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth boundary; base course
Ic	33–70	Fill; 10Y 5/1 (GLEY 1), greenish gray; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
II	60–75	Fill; 5Y 7/2, light gray; silty clay; moderate, fine, platy structure; moist, firm consistence; slightly plastic; marine origin; clear, irregular lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	67–115	Fill; 5Y 4/1, dark gray; sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	95–105	Natural; 10YR 3/2, very dark grayish brown; loamy clay; moderate, medium, crumb structure; moist, friable consistence; slightly plastic; marine origin; clear, irregular, discontinuous lower boundary; contained some organics; wetland sediment
IVb	80–138 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; lower boundary not visible; wetland sand; overlying coral shelf

4.2.51 Test Excavation 51 (T-51)

Test Excavation 51 (T-51), an exterior excavation located the Office Depot parking lot near the Queen Street entrance, was oriented northeast-southwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.4 mbs. The stratigraphy of T-51 consisted of the asphalt surface (Stratum Ia), associated base course material (Stratum Ib), and gravelly silty loam with hydraulic silty clay and asphalt inclusions (Stratum II), overlying a redeposited, locally procured loamy sand (Stratum III), overlying a natural silty sand A horizon (Stratum IVa), developed within Jaucas sand (Stratum IVb), over gravelly sand (Stratum IVc) and wetland clay loam (Stratum V) (Figure 240 through Figure 242, and Table 53).

T-51 documented recent fill deposits (Strata Ia–II) overlying a historic sand fill (Stratum III), overlying a disturbed, natural A horizon developed within Jaucas sand. Stratum II was a heavily mixed layer that consisted of hydraulic pump dredge material and crushed coralline sand from the Kaka‘ako land reclamation period incorporated with asphalt inclusions. Below this was a broken and discontinuous layer of early twentieth century fill, likely composed of locally procured sand and soil (Stratum III). This local fill material may have been deposited to level and/or build up the ground surface and may have served as a historic land surface for a period of time prior to reclamation activities. Stratum III was deposited over an in situ, culturally sterile, silty sand A horizon (Stratum IVa) (Figure 241).

Figure 240. T-51 southeast wall, view to south

Figure 241. T-51 southwest wall, close-up of disturbed A horizon (Stratum IVa), view to north

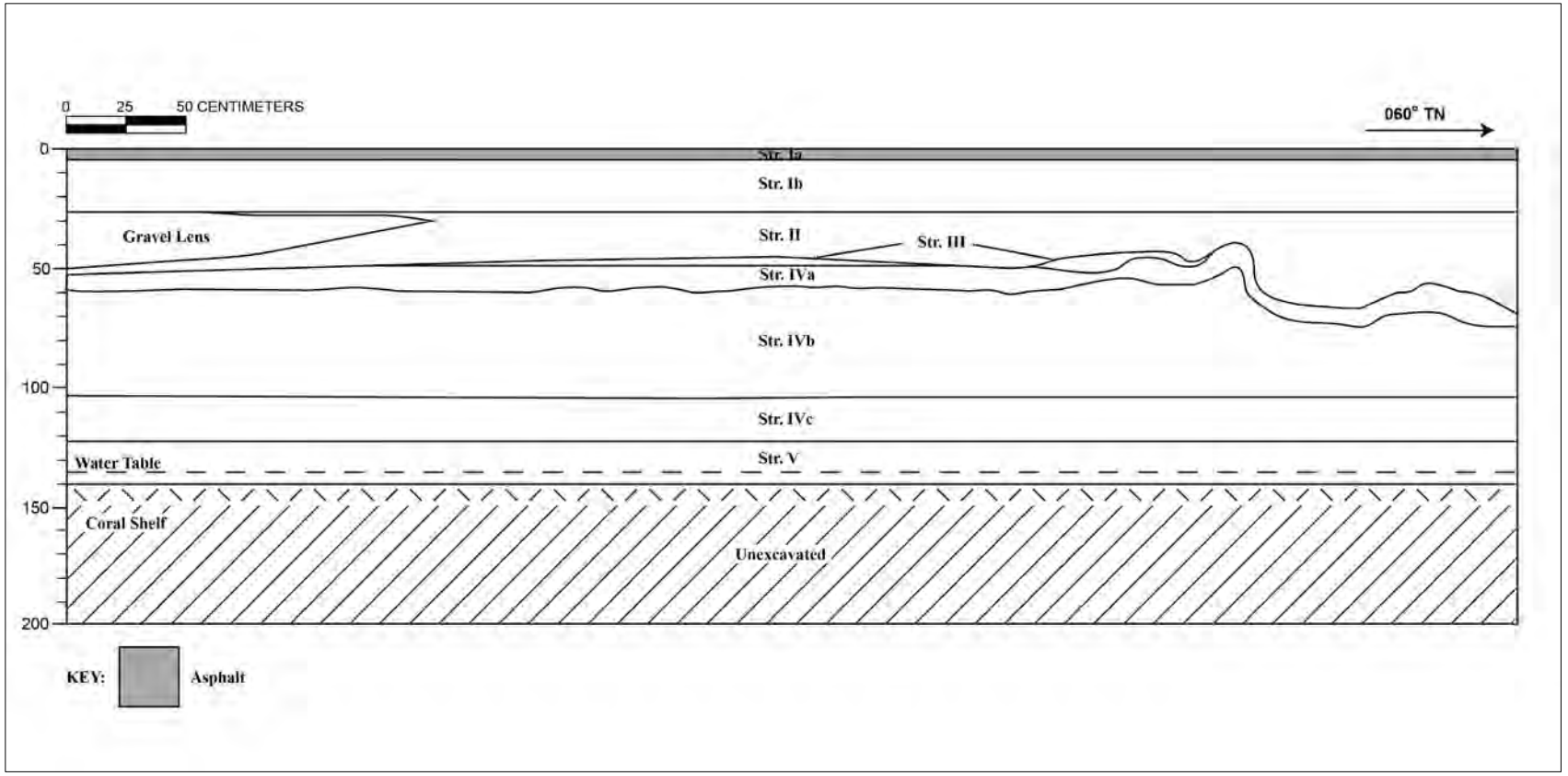

Figure 242. T-51 northwest profile

Table 53. T-51 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–5	Asphalt
Ib	5–27	Fill; 5YR 3/2, dark reddish brown; very gravelly sandy loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth boundary; base course
II	27–60	Fill; 2.5Y 5/4, light olive brown grading to 10YR 5/3, brown; very gravelly silty loam; weak, fine, crumb structure; moist, loose consistence; non-plastic; mixed origin; clear, wavy lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927); highly disturbed upper portion with coral and asphalt
III	43–50	Fill; 10 YR 6/1, gray; silty sand; weak, fine, crumb structure; moist, loose consistency; non-plastic; mixed origin; irregular, broken, and discontinuous lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	48–70	Natural; 2.5Y 4/3, olive brown; silty sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; A horizon
IVb	55–105	Natural; 2.5Y 7/4, pale yellow; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand
IVc	105–123	Natural; gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; clear, smooth lower boundary; lower, coarser section of Jaucas sand
V	123–140 (BOE)	Natural; 2.5Y 7/4, pale yellow; clay loam; weak, fine, crumb structure; wet, non-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; overlying coral shelf

4.2.52 Test Excavation 52 (T-52)

Test Excavation 52 (T-52), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.1 m long by 0.72 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.48 mbs. The stratigraphy of T-52 consisted of asphalt surface (Stratum Ia), associated base course material (Stratum Ib), gravelly loamy sand (Stratum Ic), mixed crushed coralline sand and hydraulic silty clay (Stratum Id), and gravelly sandy silt fill (Stratum Ie), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic silty clay (Stratum II), overlying three deposits of locally procured loamy sand fill (Strata IIIa–IIIc), overlying a lateral transition from Jaucas sand (Stratum IVa), gravelly silty Jaucas sand (Stratum IVb), and sandy clay (Stratum IVc), to an in situ, loamy sand wetland A horizon (Stratum V), developed within slightly clayey wetland sand deposit (Stratum VI), overlying a coarse wetland sand (Stratum VII) (Figure 243 through Figure 246, and Table 54).

T-52 documented recent fill deposits (Strata Ia–Ie) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), overlying several strata of redeposited, locally procured sand (Strata IIIa–IIIc), overlying a natural transition from a wetland marsh-like setting to a sandy dune setting. Strata IIIa–IIIc were most likely deposited as local grading fill, possibly in an effort to level out the natural wetland prior to the large-scale land reclamation efforts in the early 1900s, and may have served as a former land surface. Stratum III slopes from the northeast to the southwest, congruent with the lower-lying strata, and was thinner on the *mauka* end than on the *makai* end (see Figure 244). Below Stratum III on the northeast (*mauka*) end was a sand berm (Strata Iva–IVc) that sloped down to the southwest (*makai*) (see Figure 245). The upper boundary of Stratum IVa was mottled with pockets of Stratum IIIb, indicating some truncation or disturbance had impacted the sand dune berm. Stratum V was a culturally sterile, natural wetland A horizon with humus and brackish water snails (i.e., Melampus). At the lateral interface of Stratum IV and Stratum V, faces converged in a “washed zone” of intermixed brackish water-wetland sediments that contained humus and other organics, with various sand dune deposits. Previous AIS investigations within Queen Street, immediately adjacent to T-52 (Hammatt 2013), documented sand overlaid by an A horizon with very slight cultural content. Stratum V was discontinuous, laterally associated with Strata IVa on the southwest (*makai*) side, and was buried below Stratum II. Below both Strata III and V was wetland sand with organic material (Strata VI and VII), resting over the coral shelf.

Figure 243. T-52 northwest wall, view to north

Figure 244. T-52 southeast side wall, close-up of Stratum III (multiple layers of A horizon fill) overlying Stratum V (A horizon), view to east

Figure 245. T-52 plan view of Stratum IVa (sand berm) and Stratum III (local A horizon fill) upper boundaries, view to northeast

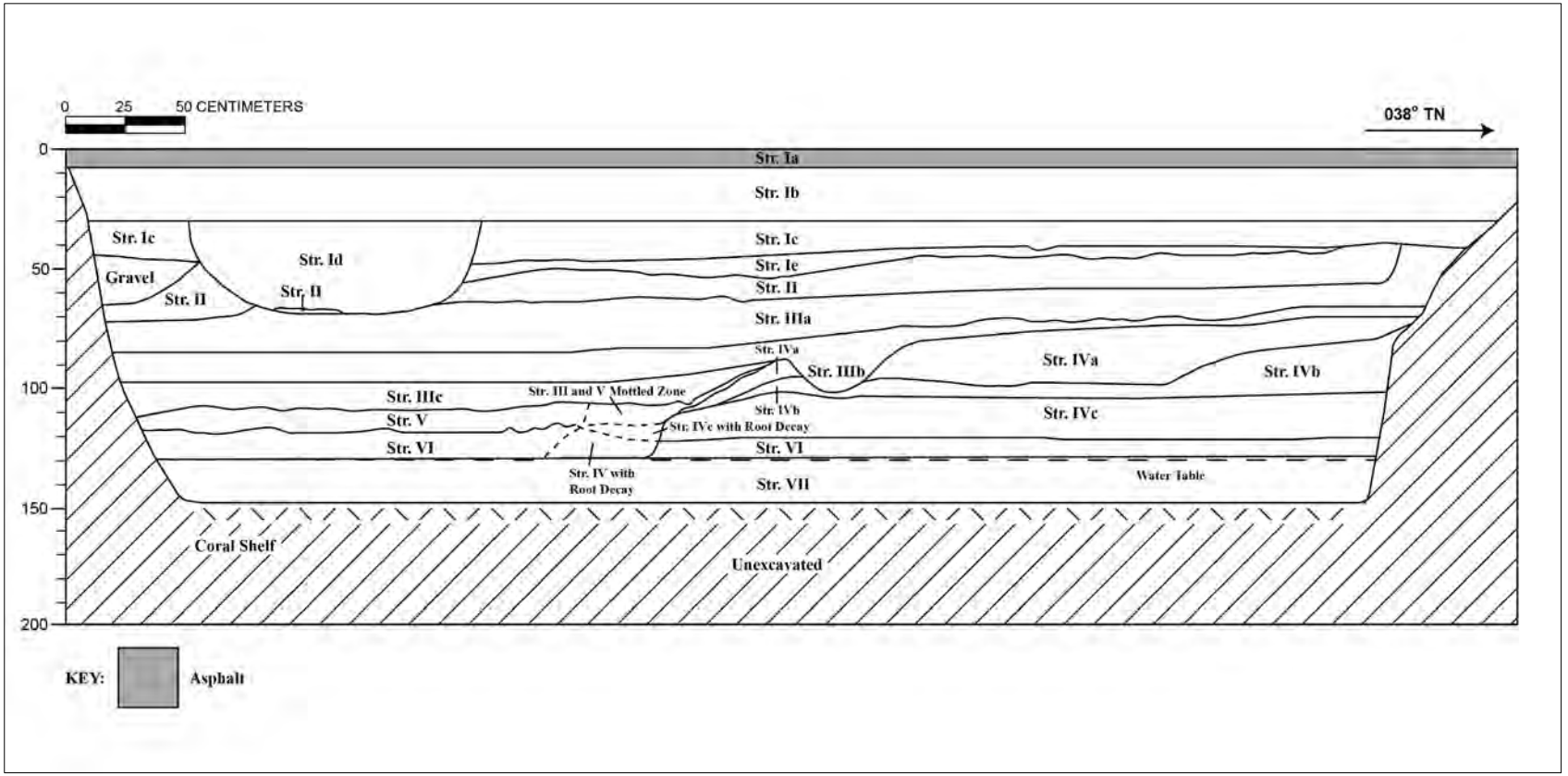

Figure 246. T-52 northwest profile

Table 54. T-52 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–30	Fill; 10YR 4/2, dark grayish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	30–48	Fill; 2.5YR 6/3, light yellowish brown; very gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; crushed coral
Id	30–70	Fill; 10YR 4/3, brown; very gravelly sandy loam; weak, fine, crumb structure; moist, very friable consistence; non-plastic; mixed origin; clear, discontinuous lower boundary; mixed fill containing Strata Ic and II
Ie	40–56	Fill; 5YR 4/4, reddish brown; extremely gravelly sandy silt; weak, fine, blocky structure; moist, very friable consistence; non-plastic; terrigenous origin; clear, smooth, and discontinuous lower boundary
II	40–75	Fill; 5Y 7/2, light gray mottled with 7.5YR 4/6, strong brown; silty clay; structureless (massive); moist, firm consistence; slightly plastic; marine origin; clear, smooth lower boundary; micro-striations of ferrous manganese; mottled with organics; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	40–85	Fill; 10YR 5/3, brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized as fill to grade the wetland and sand dune transition
IIIb	75–103	Fill; 10YR 5/2, grayish brown; gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized as fill to grade the wetland and sand dune transition
IIIc	97–112	Fill; 10YR 6/2, light brownish gray; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; likely local sand used as fill to grade the wetland and sand dune transition
IVa	70–108	Natural; 10YR 7/3, very pale brown; coarse sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; Jaucas sand; natural sand berm
IVb	75–103	Natural; 10YR 8/3, very pale brown; gravelly silty sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken/discontinuous lower boundary; coarser sand (some indurated)

Stratum	Depth (cmbs)	Description of Sediment
IVc	102–122	Natural; 10YR 8/2, very pale brown; sandy clay; moderate, fine, crumb structure; moist, firm consistence; slightly plastic; marine origin; clear, broken/discontinuous boundary; grading to clay sand as nears water table
V	107–129	Natural; 10YR 4/2, dark grayish brown; loamy sand; weak, fine, crumb structure; moist, very friable consistence; non-plastic; mixed origin; clear, smooth, and discontinuous lower boundary; contains fine humus, brackish snails, shell frags, *Melampus* sp.; A horizon
VI	115–130	Natural; 2.5Y 6/2, light brownish gray; sand (slight clay); moderate, fine to medium, crumb structure; moist to wet, firm consistence; non-plastic; marine origin; contained organics (decayed roots) at the “wash zone” where wetland meets berm
VII	130–148 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; coarse sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; wetland sand; overlying coral shelf

4.2.53 Test Excavation 53 (T-53)

Test Excavation 53 (T-53), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northwest-southeast and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.3 mbs. The stratigraphy of T-53 consisted of the asphalt surface (Stratum Ia) and associated gravel base course material (Stratum Ib) resting over the coral shelf (Figure 247 and Table 55). No natural stratigraphy was observed; it appeared to have been removed during the deposition of the gravel fill. Based on the surrounding test excavations, however, the natural sediments likely consisted of wetland deposits.

Table 55. T-53 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–130 (BOE)	Fill; 2.5YR 6/1, reddish gray; extremely gravelly sandy loam; structureless (single-grain); dry, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported fill; overlying coral shelf

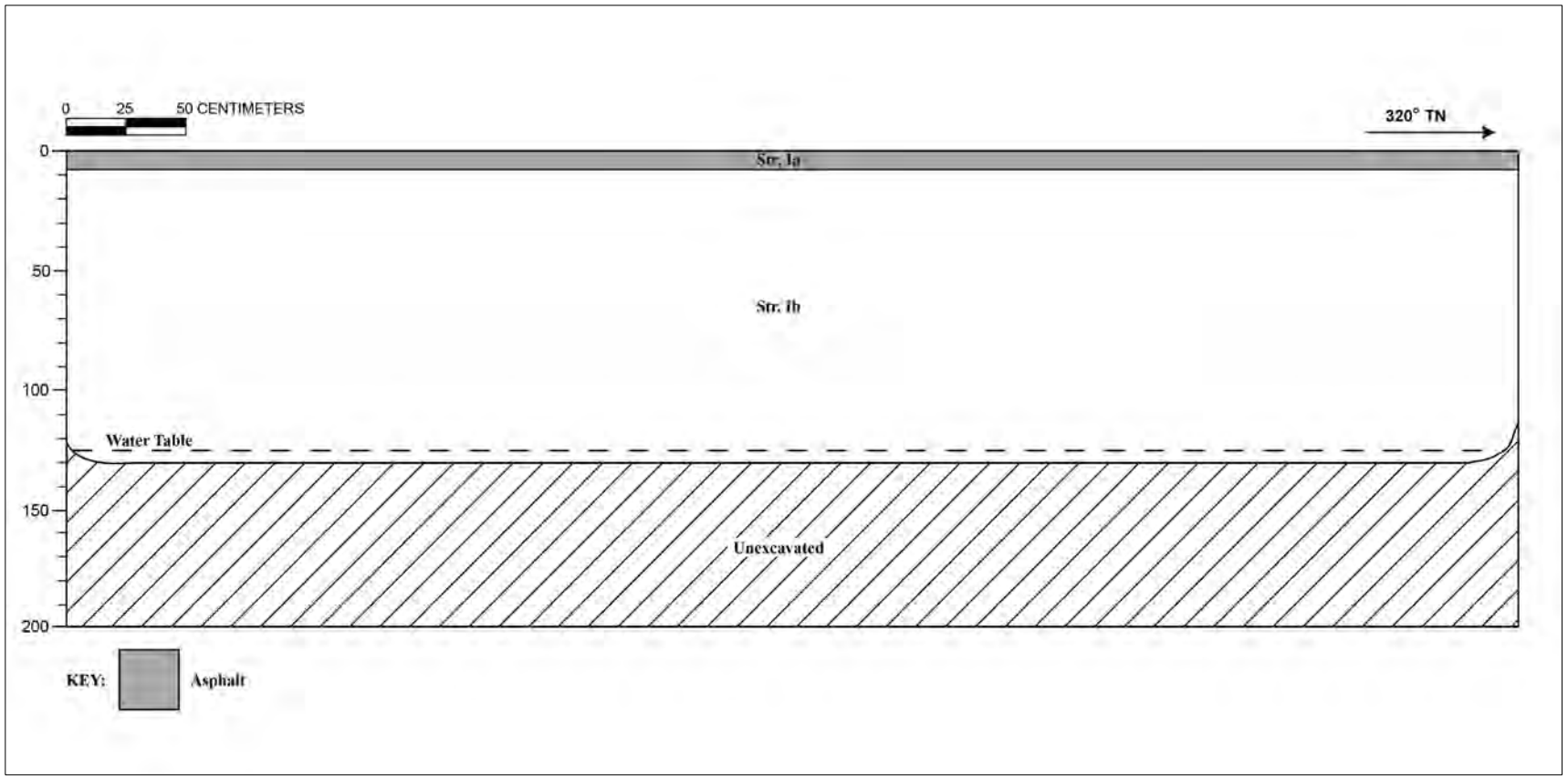

Figure 247. T-53 southwest profile

4.2.54 Test Excavation 54 (T-54)

Test Excavation 54 (T-54), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.12 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.41 mbs. The stratigraphy of T-54 consisted of the asphalt surface (Stratum Ia), associated base course material (Stratum Ib), additional base course material (Stratum Ic), extremely gravelly sand utility fill (Stratum Id), and very gravelly sandy loam fill (Stratum Ie), overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of clay (Stratum II), overlying a possibly redeposited silty sand A horizon (Stratum III), overlying a wetland clay sand (Stratum IVa), a clay sand A horizon (Stratum IVb), and slightly clayey sand with organics (Stratum IVc) (Figure 248, Figure 249, and Figure 251, and Table 56). A storm drain was documented in Stratum Id and as a result, the surrounding material was not excavated.

T-54 documented recent fill deposits (Strata Ia–Ie) overlying a Kaka‘ako reclamation fill deposit (Stratum II), overlying wetland sediments resting on the coral shelf. Underlying the Kaka‘ako reclamation fill was a culturally sterile, greenish black, silty sand with an abrupt and discontinuous lower boundary (Stratum III). Judging from the nature of the lower boundary, which also displayed minute undulations, it is difficult to determine if Stratum III was an in situ A horizon, or a redeposited A horizon fill material. Stratum III may have developed in place but was later truncated and disturbed, or it may have been leveling fill comprised of mixed local wetland soil. Below Stratum III was a culturally sterile wetland environment consisting of a sandy clay (Stratum IVa) over a wetland A horizon (Stratum IVb), which developed within a slightly clayey sand with roots (Stratum IVc) (Figure 250).

Figure 248. T-54 southeast wall, view to east

Figure 249. T-54 southeast wall, view to south

Figure 250. T-54 southeast wall, close-up of possible A horizon fill (Stratum III) over a natural wetland environment (Stratum IV), view to east

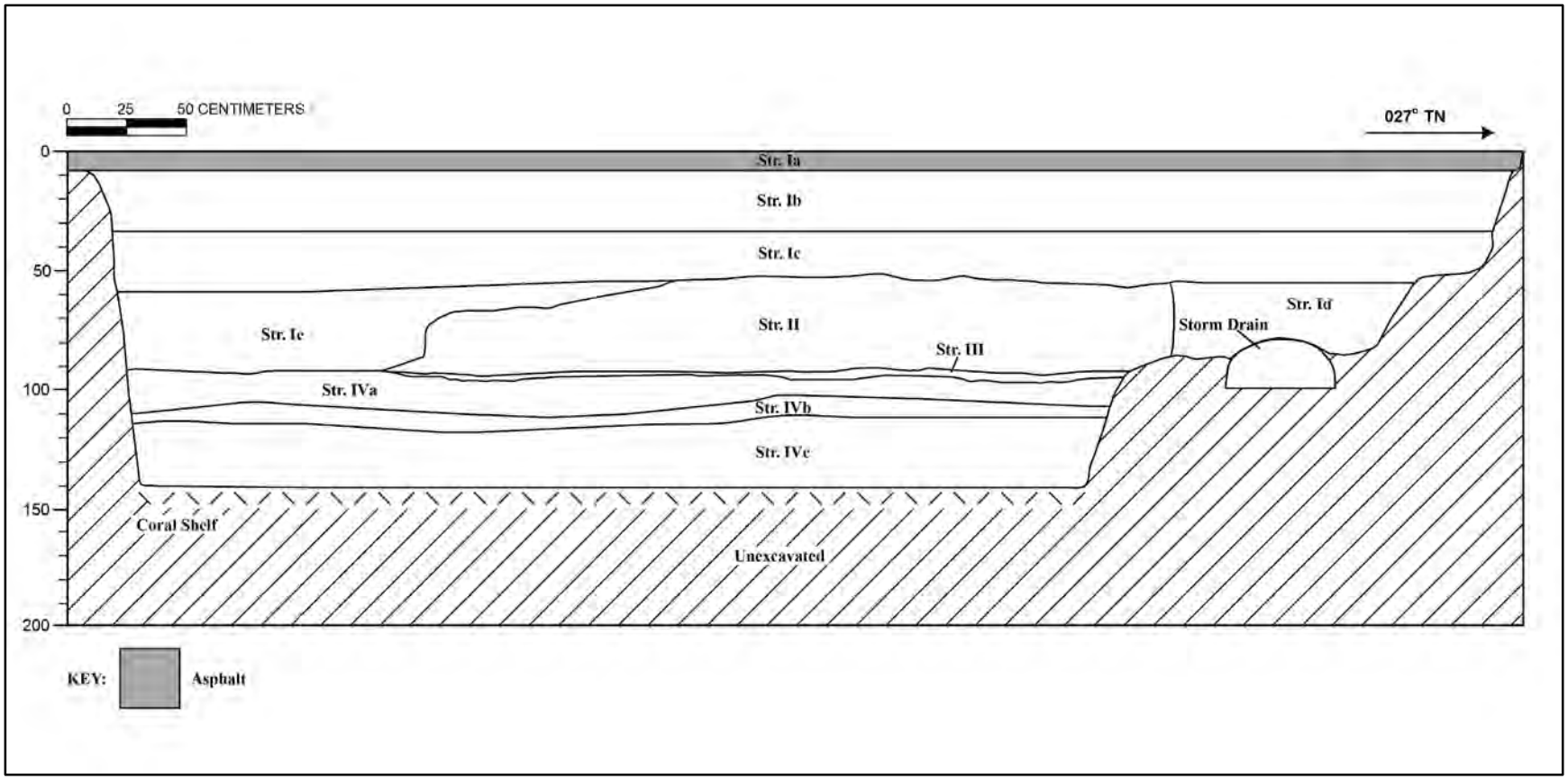

Figure 251. T-54 northwest profile

Table 56. T-54 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–34	Fill; 10YR 3/1, very dark gray; extremely gravelly silty sand; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; basalt base course
Ic	34–59	Fill; 10YR 5/1, gray; extremely gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
Id	55–87	Fill; 2.5YR 6/1, gray; extremely gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; lower boundary not visible; drain line fill, mottled with asphalt, dredged clay, and coral
Ie	55–98	Fill; 10YR 5/1 mottled with 10YR 3/2, gray; very gravelly sandy loam; weak, fine, crumb structure; moist, friable consistence; non-plastic; terrigenous origin; abrupt, broken-discontinuous lower boundary
II	53–95	Fill; 2.5Y 7/3, pale yellow grading to 10Y 6/1 (GLEY 1), greenish gray; clay; structureless (massive); moist, firm consistence; very plastic; marine origin; very abrupt, broken/discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	92–98	Possible Natural; 5Y 2.5/1, greenish black; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt, smooth, discontinuous lower boundary; dark stained A horizon material; possible in situ A horizon or redeposited A horizon material
IVa	95–112	Natural; 10Y 6/1 (GLEY 1), greenish gray; clay sand; moderate, fine, crumb structure; moist, friable consistence; slightly plastic; marine origin; diffuse, smooth lower boundary; wetland deposit
IVb	102–117	Natural; 10YR 5/2, grayish brown; clay sand; strong, fine, blocky structure; moist, firm consistence; plastic; marine origin; clear, smooth lower boundary; wetland A horizon
IVc	112–141 (BOE)	Natural; 10YR 7/1, light gray; sand with slight clay content; moderate, fine, blocky structure; moist, firm consistence; non-plastic; marine origin; abrupt, smooth lower boundary; few, very fine roots; organic horizon with many decayed roots; overlying coral shelf

4.2.55 Test Excavation 55 (T-55)

Test Excavation 55 (T-55), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.0 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.41 mbs. The stratigraphy of T-55 consisted of the asphalt surface (Stratum Ia), associated base course material (Stratum Ib), and very gravelly loamy sand utility fill (Stratum Ic) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of silty clay (Stratum II), overlying a wetland clayey loam O horizon (Stratum IIIa), developed over sandy, clay loam with organics (Stratum IIIb), and a wetland gravelly, sandy, loam (Stratum IIIc) (Figure 252 through Figure 254, and Table 57). Two utility lines were documented in T-55. The first was a 5-cm thick pipe observed running parallel along the northwest wall while the second utility was observed traveling perpendicular through the northeast (*mauka*) end of T-55. Due to the presence of the utility in the northeast portion of T-55, the material surrounding the pipe was not excavated.

T-55 documented recent fill deposits (Strata Ia–Ic), overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), overlying a natural wetland environment resting on the coral shelf (Strata IIIa–IIIc). Stratum IIIa consisted of a thin layer of very dark grayish brown, clayey loam humus (Stratum IIIa) that developed in an organically rich, loamy-sandy wetland sediment (Strata IIIb and IIIc). Strata IIIb and IIIc exhibited a mixed appearance of brown, organically rich soil constituents, with gleyed sandy clay loam. This mottled presentation may reflect natural intermingling of the wetland deposits, possibly as a result of tidal fluctuations and/or changes in the overall depositional environment.

Figure 252. T-55 northwest wall, view to north

Figure 253. T-55, bulk sample from Stratum IIIa, showing a humus O horizon

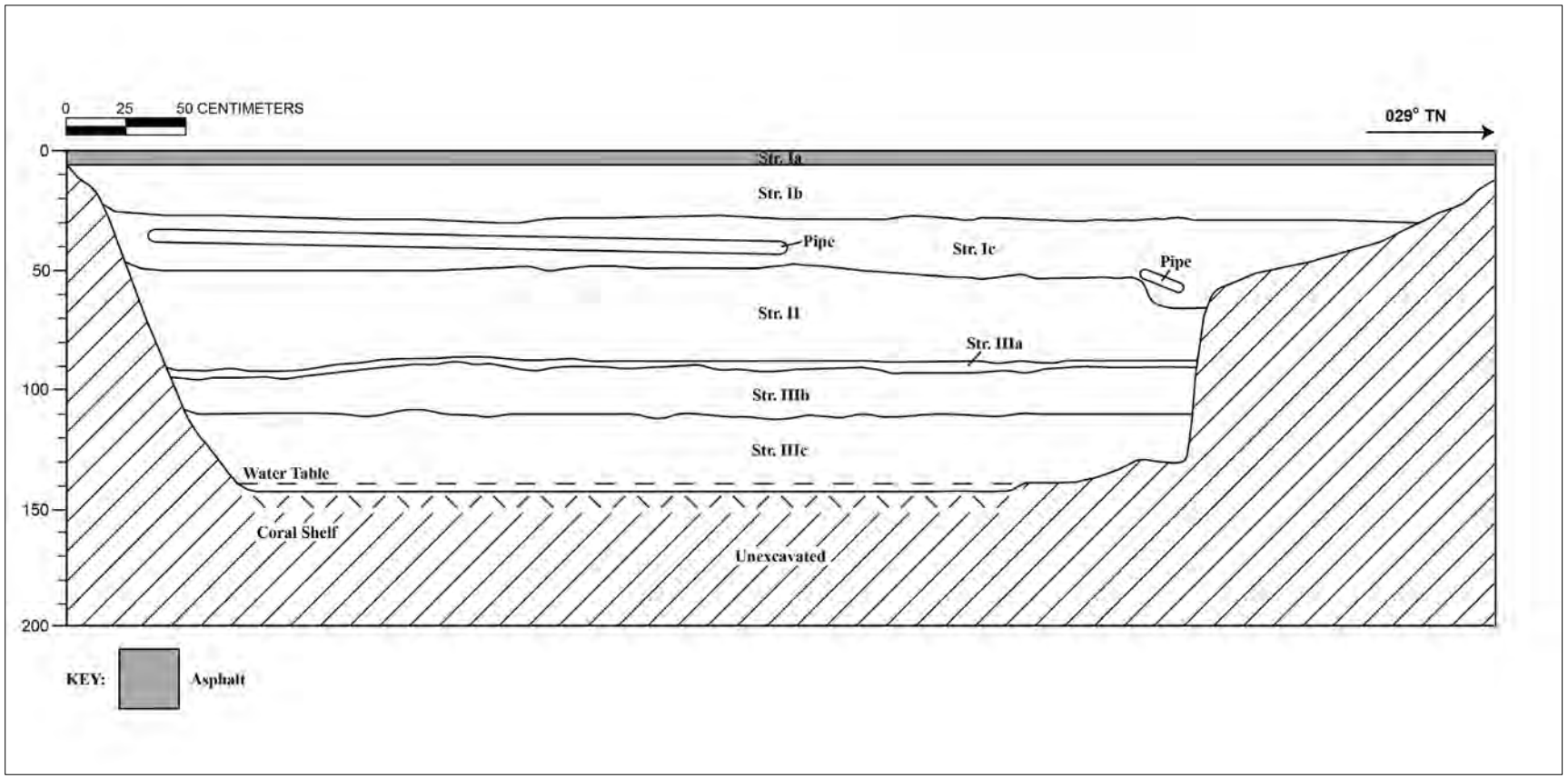

Figure 254. T-55 northwest profile

Table 57. T-55 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–6	Asphalt
Ib	5–30	Fill; 5YR 3/3, dark reddish brown; very gravelly loamy sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	26–65	Fill; 5YR 3/2, dark reddish brown mottled with 10YR (15%), pale brown; very gravelly loamy sand; weak, fine, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; abrupt; smooth lower boundary; contained a utility pipe in northwest wall
II	48–92	Fill; brownish yellow grading to 10Y 6/1 (GLEY 1), greenish gray; silty clay grading to clay; strong, very fine, platy structure; moist, firm consistence; plastic; marine origin; very abrupt, smooth lower boundary; common, fine roots; grass inclusions at lower boundary, originating from Stratum IIIa; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919-1927)
IIIa	80–95	Natural; 2.5Y 3/2, very dark grayish brown; clay loam; structureless (massive); moist, friable consistence; plastic; terrigenous origin; abrupt, smooth lower boundary; common, fine roots; O horizon; roots from IIIa extend into lower horizon
IIIb	88–110	Natural; 10Y 7/1 (GLEY 1), light greenish gray mottled with 10YR (30%), very pale brown; sandy clay loam; weak, fine, blocky structure; moist, firm consistence; plastic; mixed origin; diffuse, wavy lower boundary; common, fine roots; pale brown mottling most likely as a result of pedogenisis from Stratum II
IIIc	109–141 (BOE)	Natural; gravelly loamy sand; weak, medium, granular structure; moist, very friable consistence; slightly plastic; mixed origin; abrupt, smooth lower boundary; overlying coral shelf

4.2.56 Test Excavation 56 (T-56)

Test Excavation 56 (T-56), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.1 m long by 0.78 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.5 mbs. The stratigraphy of T-56 consisted of the asphalt surface (Stratum Ia), associated base course material (Stratum Ib), two layers of gravelly sandy loam (Strata Ic–Id), and a redeposited wetland sandy loam utilized as fill (Stratum Ie) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic silty clay (Stratum II), over a natural sandy loam humus deposit (Stratum IIIa), and a wetland loamy sand (Stratum IIIb) (Figure 255 through Figure 258, and Table 58). Two utility lines were observed in the *mauka* portion of T-56 within upper fill levels (Strata Ie–II), and as a result, the surrounding material was not excavated.

T-56 documented recent fill deposits (Strata Ia–Ie) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), overlying a wetland environment (Strata IIIa–IIIb) resting on the coral shelf. Stratum IIIa is an undulating layer of dark gray, sandy loam humus (A horizon), developed on the surface of a wetland marsh-like environment. It appears that Stratum IIIa experienced a moderate amount of disturbance, evidenced by the irregular lower boundary that ranged from clear to abrupt (see Figure 257). Some organics were observed within the upper boundary of Stratum IIIb as it most likely underwent at least one of the four general processes of soil formation. Additionally, the gleyed deposits observed within the fill (Stratum II) and natural sediments (Stratum IIIb) are indicative of prolonged saturation in an anaerobic environment.

Figure 255. T-56 southeast wall, view to east

Figure 256. T-56, close-up of northwest wall, view to west

Figure 257. T-56 southeast wall (*makai* end), close-up of the Stratum IIIa abrupt and irregular lower boundary, view to south

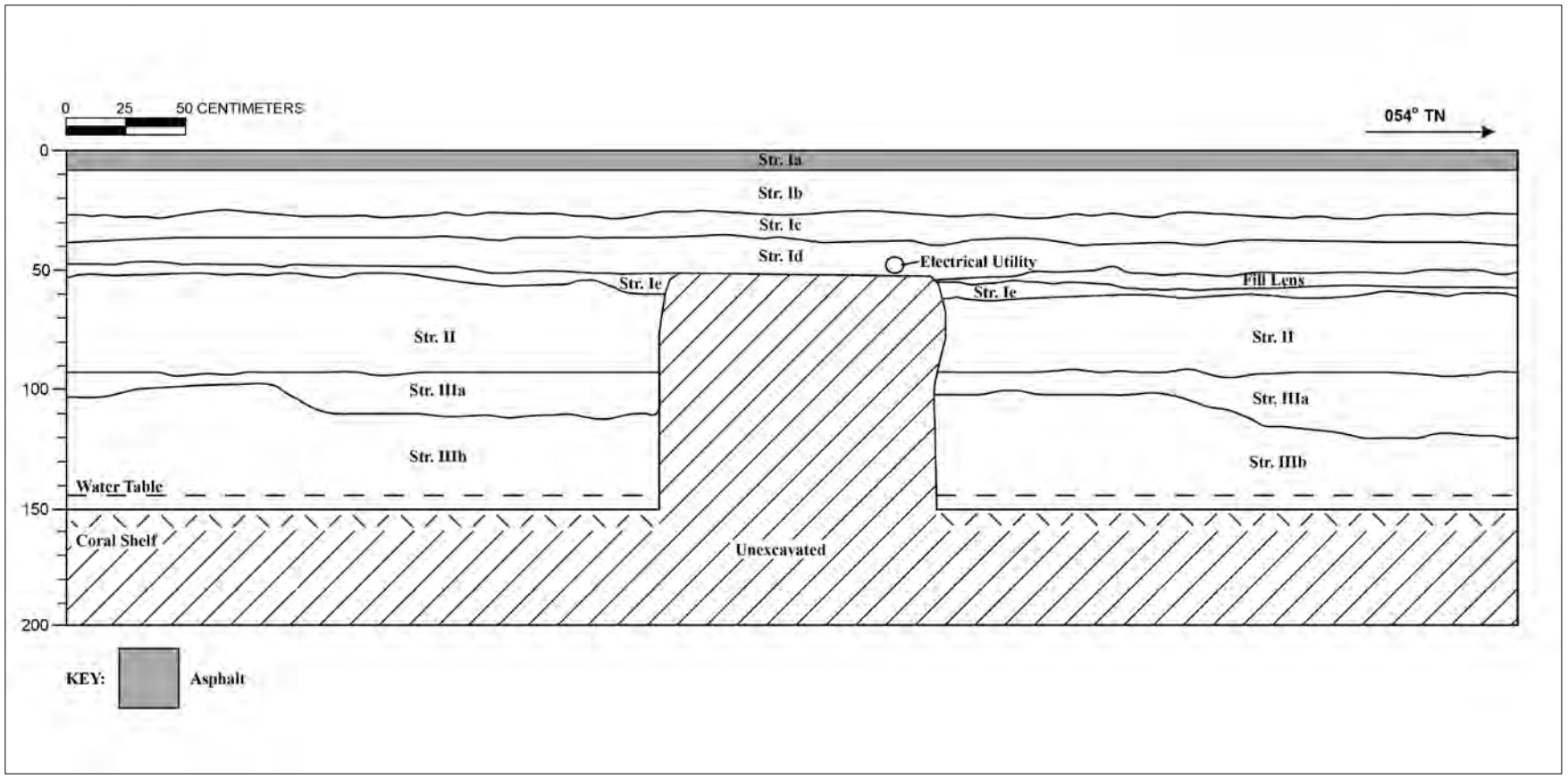

Figure 258. T-56 northwest profile

Table 58. T-56 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–28	Fill; 5YR 3/2, dark reddish brown; very gravelly loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear lower boundary; base course
Ic	25–39	Fill; 10YR 3/2, very dark grayish brown; very gravelly sandy loam; weak, medium, crumb structure; moist, very friable consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; crushed coral fill
Id	35–52	Fill; 10YR 5/4, yellowish brown; very gravelly sandy loam; weak, medium, crumb structure; moist, very friable consistence; non-plastic; mixed origin; clear, smooth lower boundary; electrical utility observed; crushed coral fill
Ie	47–55	Fill; 2.5Y 6/3, light yellowish brown; sandy loam; weak, fine, crumb structure; moist, very friable consistence; non-plastic; mixed origin; clear, smooth lower boundary; crushed coral fill with a redeposited marshland soil lens overtop in northeast portion (10YR 2/1, black)
II	53–98	Fill; 5Y 7/3, pale yellow grading to 5GY 6/1 (GLEY 1), greenish gray; silty clay; structureless (massive); moist, firm consistence; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	98–130	Natural; 10YR 4/1, dark gray; sandy loam; moderate, medium, crumb structure; moist, very friable consistence; slightly plastic; mixed origin; clear to abrupt, irregular lower boundary; upper boundary contained a thick humus layer (1-3 cm); A horizon
IIIb	98–150 (BOE)	Natural; 10Y 6/1 (GLEY 1), greenish gray; loamy sand; weak, medium, crumb structure; moist, very friable consistence; slightly plastic; mixed origin; some organics observed; wetland sediment overlying coral shelf

4.2.57 Test Excavation 57 (T-57)

Test Excavation 57 (T-57), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.1 m long by 0.9 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.5 mbs. The stratigraphy of T-57 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), gravelly sand with base course inclusions (Stratum Ic), very gravelly sandy loam utility fill (Stratum Id), and very gravelly sand fill (Stratum Ie) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic silty clay (Stratum II), overlying a redeposited, locally procured loamy sand fill (Stratum IIIa) and clay fill with organic residue (Stratum IIIb), overlying a natural sandy loam A horizon (Stratum IVa), a sandy clay loam A horizon (Stratum IVb), a transitional clay sand (Stratum V), and a wetland sandy clay loam (Stratum VI) (Figure 259 through Figure 262, and Table 59).

T-57 documented recent fill deposits (Strata Ia–Ie) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), overlying a redeposited, likely locally procured sand and clay utilized for land modification (Strata IIIa–IIIb), resting on a transitional environment from a wetland marsh-like setting to a sandy terrestrial dune setting. Strata IIIa and IIIb may reflect historic endeavors to level the low-lying wetlands prior to Kaka‘ako land reclamation efforts and likely served as a former land surface. Below Strata IIIa and IIIb were natural deposits that displayed a shift in the depositional environment (see Figure 260). Collectively, Stratum IV was a culturally sterile soil horizon that gradually transitioned from a dark gray sandy loam, wetland A horizon (Stratum IVa) in the southwest (*makai*) to a light gray, sandy clay loam A horizon (Stratum IVb) in the northeast (*mauka*) (Figure 261). The change in color and texture from Stratum IVa to Stratum IVb was most likely due to both cultural and natural transformations such as intentional intermingling of the soil matrix (i.e., cultural transformation) evidenced by the generally abrupt to diffused lower boundary, and through wind and water (i.e., natural transformations) moving things about. Strata V and VI subsurface deposits also displayed a gradational-lateral shift that corresponded with the Strata IVa-IVb transition above. Stratum VI, located below Stratum IVa, was a culturally sterile sandy clay loam that turned to a culturally sterile clay sand (Stratum V) indicative of a sandier terrestrial environment.

Figure 259. T-57 southeast wall, view to south

Figure 260. T-57 northwest wall, close-up of natural deposits (Strata III–VI), view to northwest

Figure 261. T-57 northwest wall, close-up of Stratum IVa, view to northwest

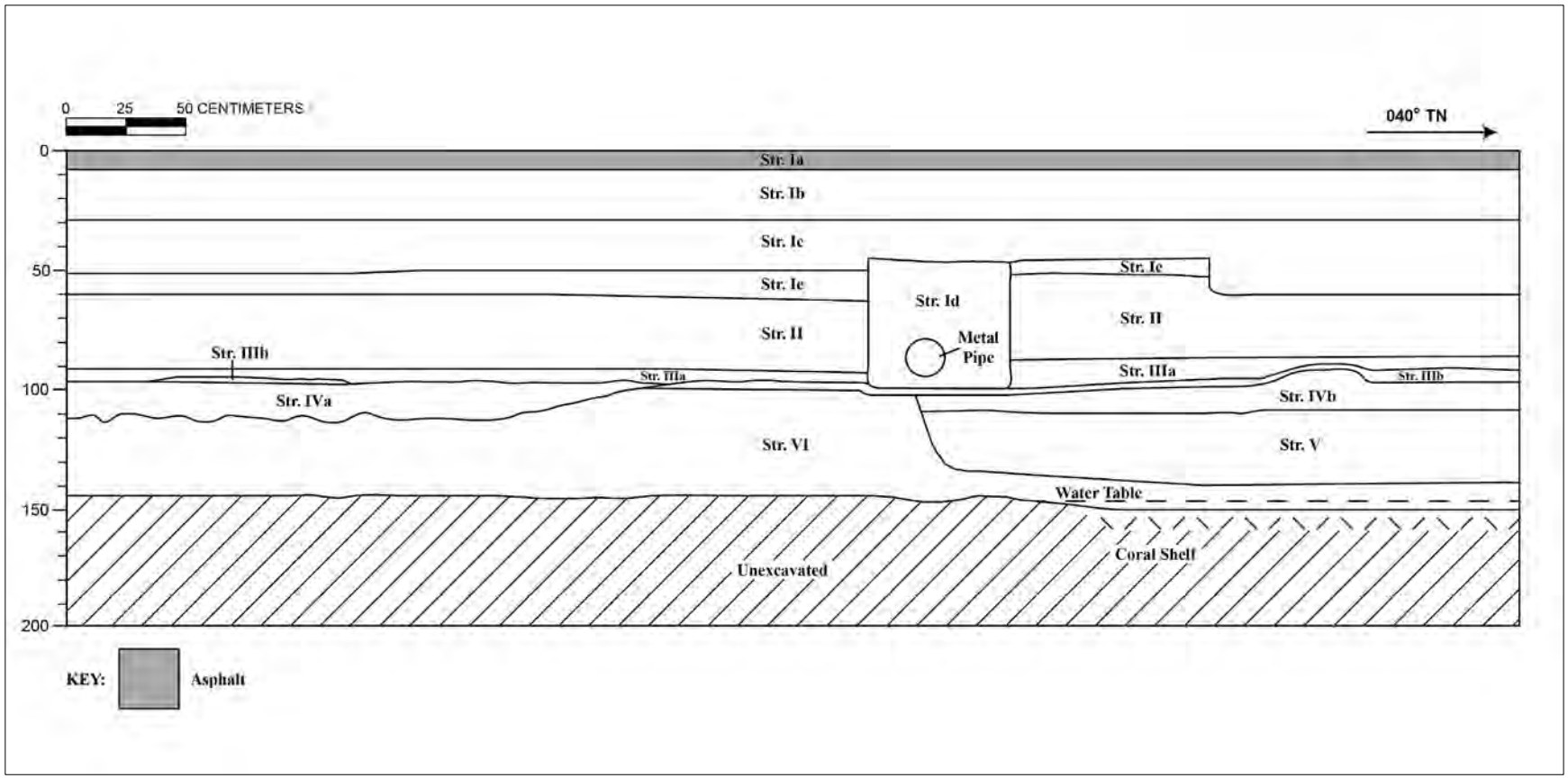

Figure 262. T-57 northwest profile

Table 59. T-57 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–29	Fill; 5YR 3/2, dark reddish brown; very gravelly loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	29–60	Fill; 10YR 4/4, dark yellowish brown; gravelly loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; crushed coral fill
Id	45–103	Fill; 10YR 6/3, pale brown; very gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, discontinuous lower boundary; utility trench fill; mix of Strata Ic and If
Ie	45–62	Fill; 5YR 4/3, reddish brown; very gravelly sandy loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; smooth, discontinuous lower boundary; mixed crushed coral fill
II	60–92	Fill; 5GY 6/1 (GLEY 1), greenish gray; silty clay; structureless (massive); moist, firm consistence; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	86–113	Fill; 10YR 5/3, brown; loamy sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized for land modification
IIIb	98–150	Fill; 10Y 7/1 (GLEY 1), light greenish gray; clay; structureless (massive); moist, firm consistence; plastic; marine origin; clear, smooth lower boundary; thin band of clay fill with some organic residue
IVa	97–113	Natural; 10YR 4/1, dark gray; sandy loam; weak, fine, crumb structure; moist, very friable consistence; non-plastic; mixed origin; clear to abrupt, wavy lower boundary; wetland A horizon (undulating lower boundary)
IVb	92–110	Natural; 2.5YR 7/1, light gray; sandy clay loam; medium, crumb structure; moist, loose consistence; slightly plastic; terrigenous origin; abrupt to diffuse, smooth lower boundary; sandier than—possible transition to drier, higher sand terrain
V	110–140	Natural; 10YR 8/3, very pale brown; clay sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; marine origin
VI	100–150 (BOE)	Natural; 10YR 6/1, gray; sandy clay loam; weak, medium, crumb structure; moist, friable consistence; plastic; very abrupt lower boundary; wetland sediment overlying coral shelf; some organics (decayed roots) observed in upper portion

4.2.58 Test Excavation 58 (T-58)

Test Excavation 58 (T-58), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented southeast-northwest and measured 6.1 m long by 0.75 m wide. The base of excavation was determined by the presence of a Telecom utility pipe at 1.0 mbs. The stratigraphy of T-58 consisted of the asphalt surface (Stratum Ia) over an extremely gravelly mixed loam with coral and asphalt inclusions (Stratum Ib) and base course material (Stratum Ic) (Figure 263 and Figure 264, and Table 60).

Figure 263. T-58 northeast wall with base course fill material and utility pipes, view to north

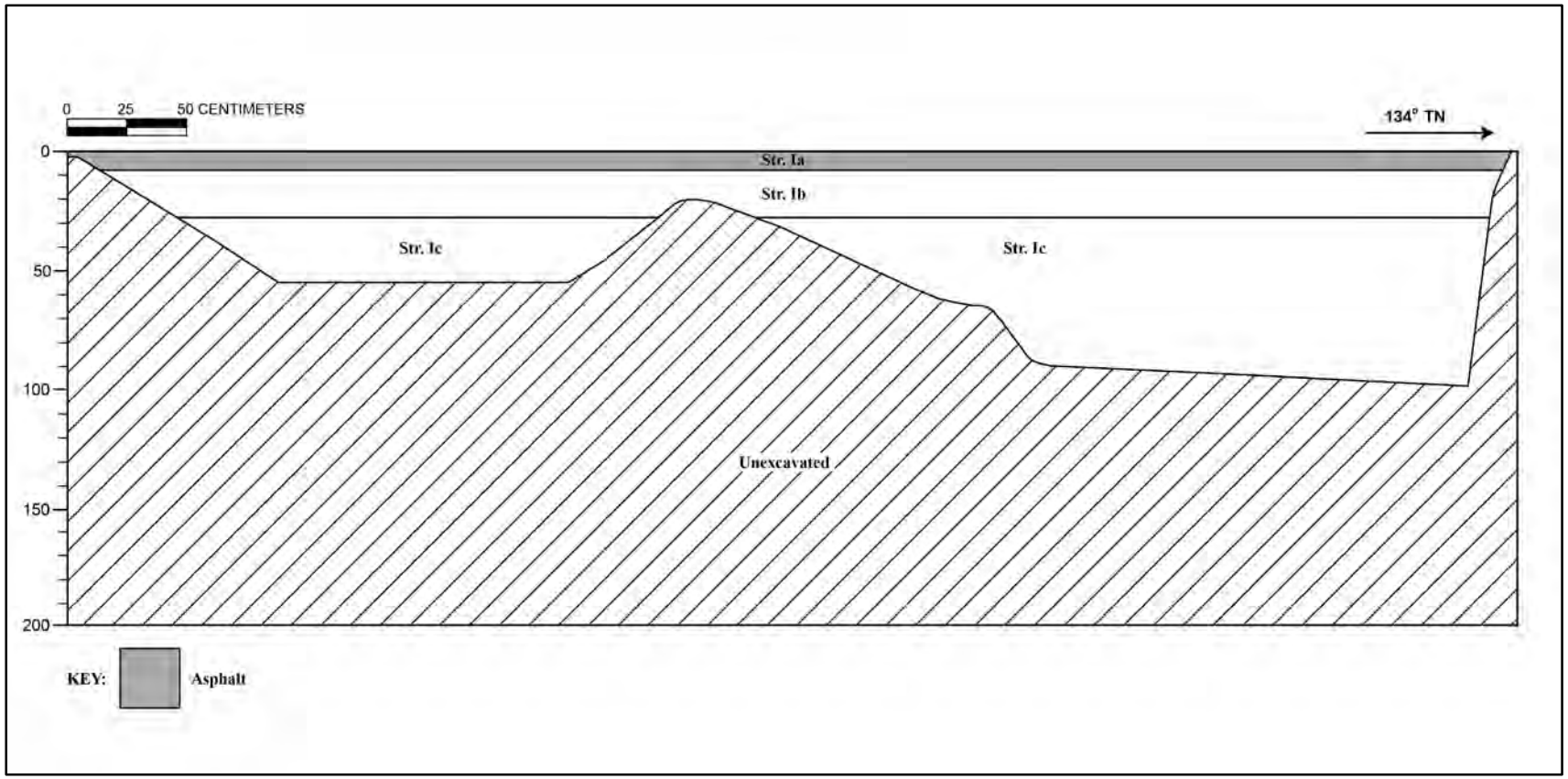

Figure 264. T-58 northeast profile

Table 60. T-58 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–28	Fill; 7.5YR 3/4, dark brown; extremely gravelly loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; mixed loam fill with gravel, asphalt, and coral cobbles
Ic	28–100 (BOE)	Fill; 7.5YR 3/1, dark brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; lower boundary not visible; base course containing a Telecom utility pipe at 1.0 mbs and a concrete jacket in the south side wall

4.2.59 Test Excavation 59 (T-59)

Test Excavation 59 (T-59), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented southeast-northwest and measured 6.1 m long by 0.86 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.45 mbs. The stratigraphy of T-59 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), extremely gravelly sandy loam (Stratum Ic), and a thick layer of gravel material (Stratum Id) over a very thin remnant of wetland clay sand (Stratum II) (Figure 265 and Figure 266, and Table 61). During excavation the sidewalls became very unstable and in an effort to avoid the potential collapse of the side walls and the parking lot surface, only half of T-59 was excavated.

T-59 documented extensive modern disturbance as the historic reclamation fill deposits and underlying natural sediment had been removed and replaced with base course material (Strata Ib–Id). The only remaining portion of the natural environment was approximately 6 cm of culturally sterile, clayey wetland sand (Stratum II) resting over the coral shelf.

Figure 265. T-59 northeast wall, view to north

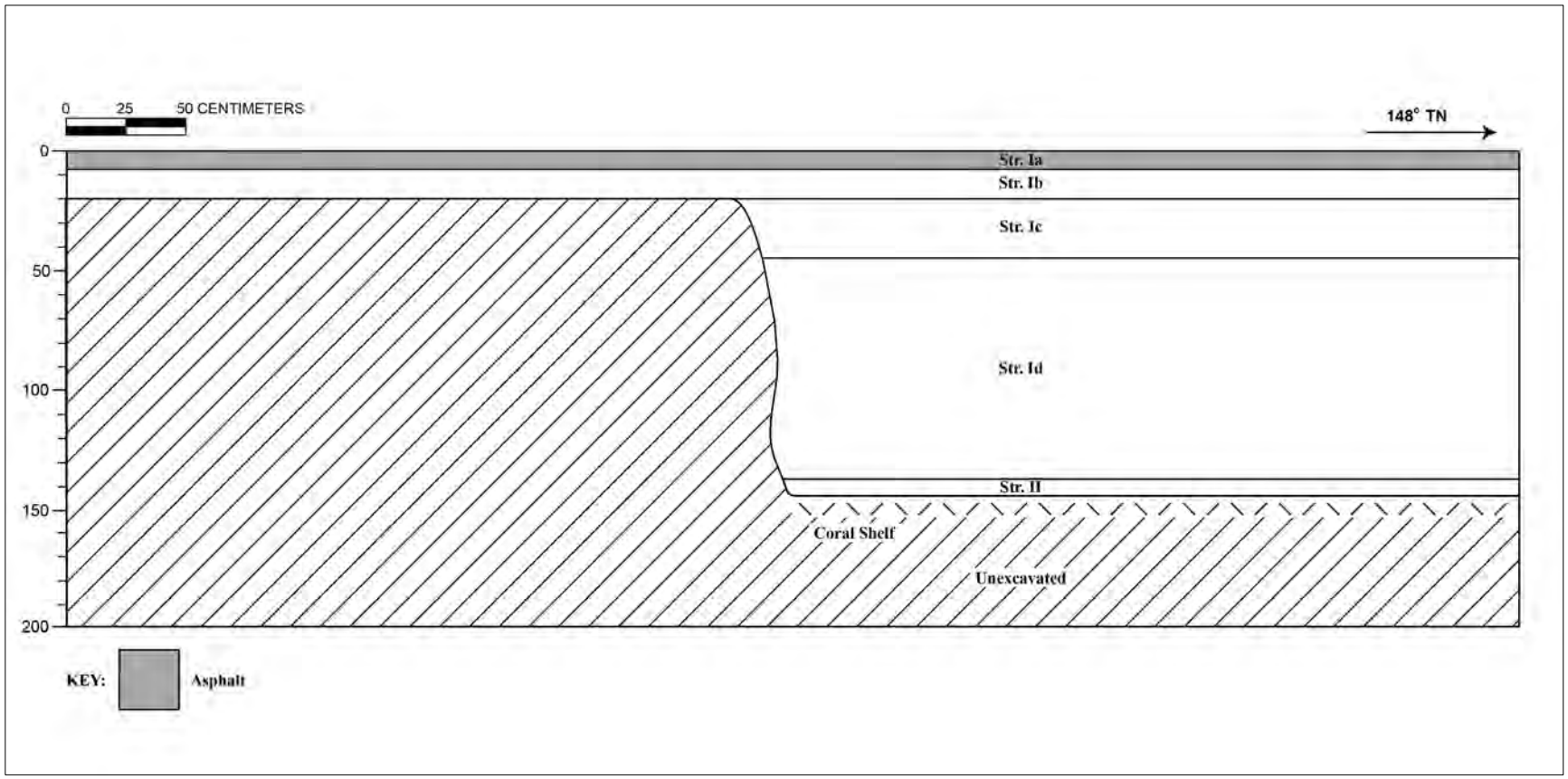

Figure 266. T-59 northeast profile

Table 61. T-59 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–20	Fill; gray; gravel; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt lower boundary; base course
Ic	20–45	Fill; 10YR 3/3, dark brown; extremely gravelly sandy loam; weak, fine, crumb structure; moist, loose consistence; slightly plastic; mixed origin; abrupt, smooth lower boundary
Id	45–138	Fill; gray; gravel; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
II	138–145 (BOE)	Natural; 10Y 6/1 (GLEY 1), greenish gray; course clay sand; strong, fine to medium, blocky structure; moist, firm consistence; slightly plastic; marine origin; lower boundary not visible; wetland sediment containing decomposing coral shelf

4.2.60 Test Excavation 60 (T-60)

Test Excavation 60 (T-60), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented southeast-northwest and measured 6.0 m long by 1.03 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.4 mbs. The stratigraphy of T-60 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), gravelly clay loam (Stratum Ic), and fine sandy clay fill (Stratum Id) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of fine sandy clay (Stratum II), overlying a humus and clay wetland O horizon (Stratum IIIa), a wetland clay with organics (Stratum IIIb), and coarse sand (Stratum IV) (Figure 267 through Figure 269, and Table 62). The northeast sidewall was undermined and collapsed due to the combination of a pit disturbance in the north portion of the trench and a PVC line that ran parallel with the northeast wall (see Figure 268).

T-60 documented recent fill deposits (Strata Ia–Id) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), resting on a natural, organically rich, wetland environment. Stratum IIIa consisted of clay and decomposing organics (i.e., humus). The accumulation of humus at the upper boundary of Stratum IIIa is more characteristic of an O horizon than an A horizon. Stratum IIIb was a stable organic wetland clay horizon that experienced the accumulation of humus at the upper boundary. Collectively, Stratum III represents a culturally sterile wetland soil horizon resting over coarse sand (Stratum IV) and the coral shelf.

Figure 267. T-60 southwest wall, view to southwest

Figure 268. T-60 southwest wall, showing collapse of the northeast wall, view to west

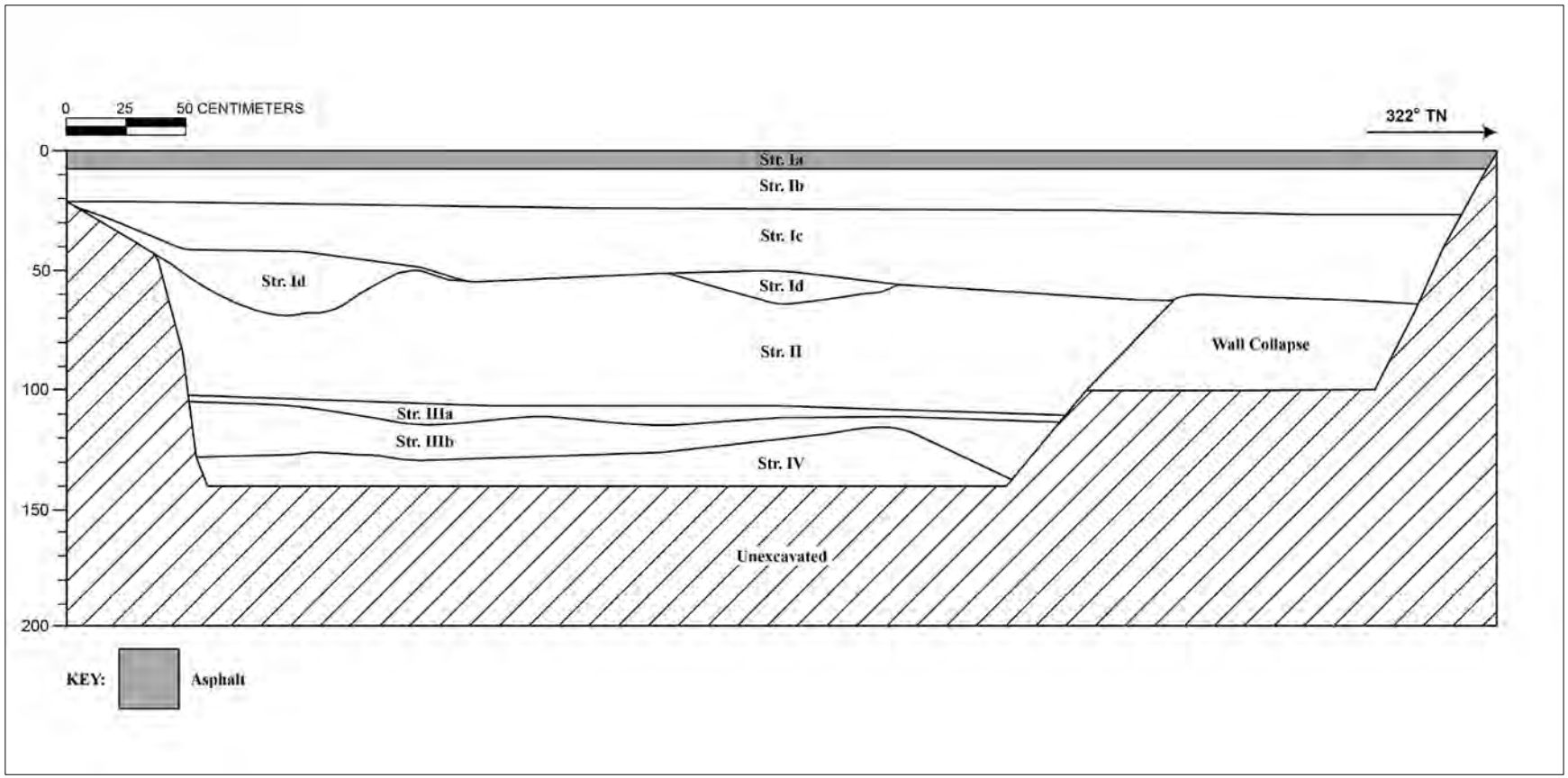

Figure 269. T-60 southwest profile

Table 62. T-60 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–7	Asphalt
Ib	7–26	Fill; 5YR 3/2, dark reddish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
Ic	26–56	Fill; 2.5Y 3/3, dark olive brown; gravelly clay loam; weak, medium, crumb structure; moist, very friable consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; contained a mixed fill lens on top (7.5YR 5/4, brown, fine sand)
Id	23–68	Fill; 10YR 7/3, very pale brown; fine sandy clay with coral cobbles; moderate, fine, crumb structure; moist, very friable consistence; non-plastic; mixed origin; clear, smooth lower boundary
II	51–110	Fill; 10YR 7/3, very pale brown grading to 10Y 6/1 (GLEY 1), greenish gray; fine sandy clay; structureless (massive); moist, firm consistence; very plastic; mixed origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	103–115	Natural; 10Y 2.5/1 (GLEY 1), greenish black; clay; structureless (massive); moist, firm consistence; plastic; marine origin; abrupt, smooth lower boundary; common, medium roots; humus A horizon at upper boundary (2-3 cm); contained organics, rootlets, and brackish water snails
IIIb	110–136	Natural; 10Y 5/1 (GLEY 1), greenish gray; clay; structureless (massive); moist, firm consistence; plastic; marine origin; clear, smooth lower boundary; few, fine roots; organic horizon
IV	115–140 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; course sand; structureless (massive); wet, slightly-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; sand

4.2.61 Test Excavation 61 (T-61)

Test Excavation 61 (T-61), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northeast-southwest and measured 6.1 m long by 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.4 mbs. The stratigraphy of T-61 consisted of the asphalt surface (Stratum Ia), associated base course material (Stratum Ib), gravelly sandy loam (Stratum Ic), extremely gravelly sand (Stratum Id), very gravelly silty clay (Stratum Ie), and very gravelly sandy loam fill (Stratum If) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of silty clay (Stratum II), overlying a natural clay and humus wetland O horizon (Stratum IIIa), three sandy clay wetland soil horizons with humus (Strata IIIb–IIId), over wetland sandy clay with organics (Stratum IV) (Figure 270 and Figure 271, and Table 63).

T-61 documented recent fill deposits (Strata Ia–If) overlying 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), resting on a natural, organically rich, wetland environment (Strata IIIa–IV). Stratum III was a wetland-marsh environment that appeared to display more than one sequence of deposition, stability, and pedogenisis, similar to that of T-44 and T-47. Specifically, Stratum IIIa was the upper boundary of a wetland, marsh-like soil horizon that experienced a period of geomorphological stability that resulted in the surface accumulation of humus. Below Stratum IIIa were three thin soil layers rich with humus, overlying a wetland, sub-soil horizon, with visible roots and humus (Stratum IV).

Figure 270. T-61 southeast wall, view to east

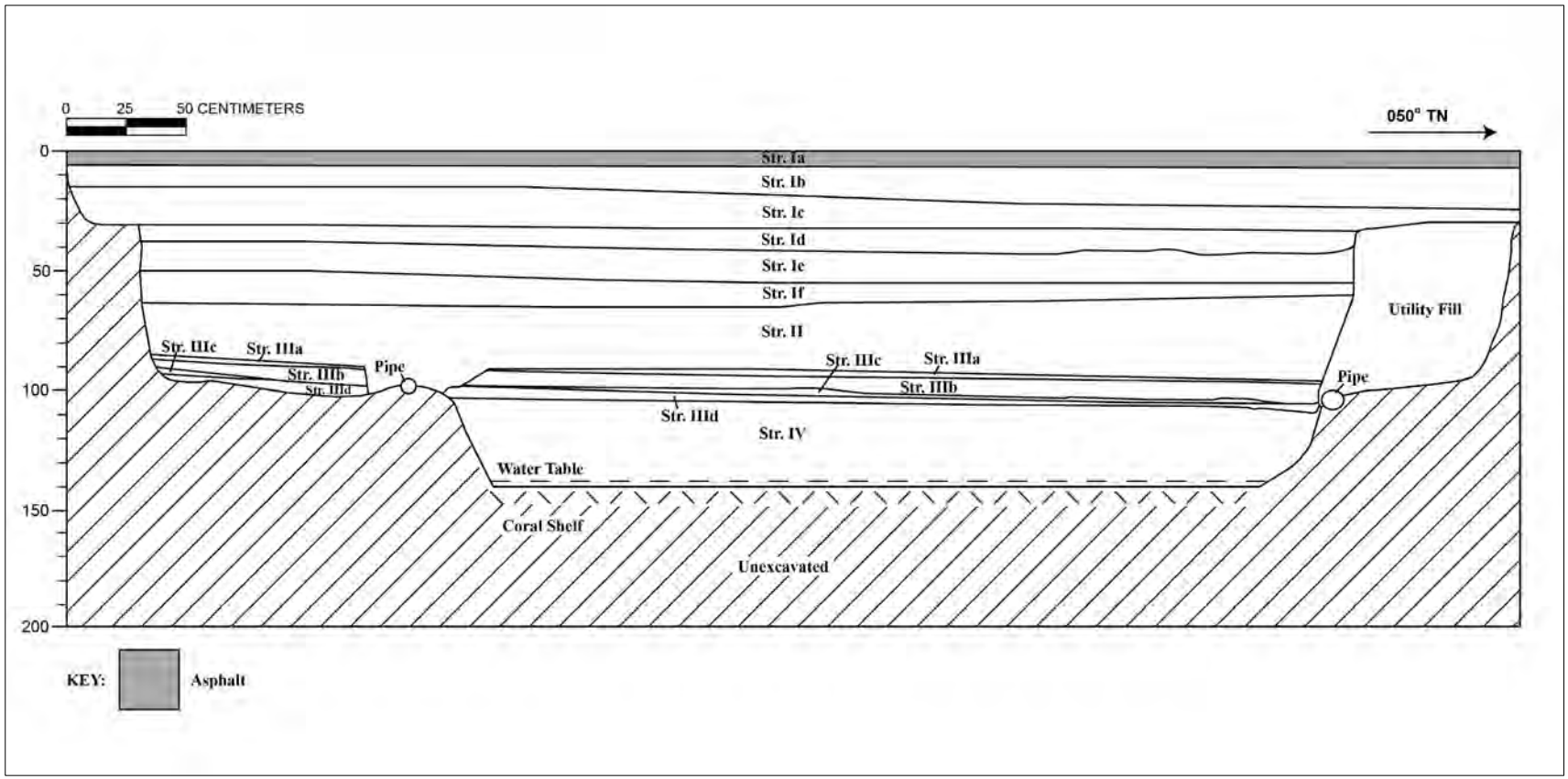

Figure 271. T-61 northwest profile

Table 63. T-61 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–6	Asphalt
Ib	5–24	Fill; 10YR 3/2, very dark brown; extremely gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course
Ic	15–33	Fill; 2.5Y 7/4, pale yellow; very gravelly fine sandy loam; weak, fine, crumb structure; moist, very friable consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; mixed crushed coral fill
Id	30–42	Fill; 2.5YR 4/4, reddish brown; extremely gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary
Ie	38–55	Fill; 2.5Y 6/4, olive brown; very gravelly silty clay; moderate, fine, crumb structure; moist, friable consistence; slightly plastic; mixed origin; abrupt, smooth lower boundary; mixed crushed coral fill; contained a brick fragment (not collected)
If	50–62	Fill; 2.5Y 4/4, olive brown; very gravelly sandy loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; mixed crushed coral fill; contained a brick fragment (not collected)
II	62–100	Fill; 2.5Y 7/2, light gray grading to 10Y 6/1, greenish gray; silty clay; strong, fine, platy structure; moist, friable consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	85–96	Natural; 10YR 3/3, dark brown; clay with humus; structureless (massive); moist, firm consistence; plastic; terrigenous origin; clear, smooth lower boundary; common, fine roots; thin O horizon with accumulated humus
IIIb	88–105	Natural; 5Y 4/2, olive gray; sandy peaty clay; moderate, medium, crumb structure; moist, very friable consistence; slightly plastic; marine origin; diffuse, smooth lower boundary; common, medium roots; wetland soil horizon with humus
IIIc	90–106	Natural; 5Y 4/1, dark gray; sandy clay; moderate, medium, crumb structure; moist, very friable consistence; slightly plastic; marine origin; diffuse, smooth lower boundary; wetland soil horizon with humus
IIId	105–110	Natural; 5Y 5/2, olive gray; fine sandy peaty clay; moderate, fine, crumb structure; moist, very friable consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; common, medium roots; mineral accumulation; wetland soil horizon with humus

Stratum	Depth (cmbs)	Description of Sediment
IV	103–140 (BOE)	Natural; 10Y 6/1, greenish gray; sandy clay; moderate, fine, crumb structure; moist, friable consistence; slightly plastic; marine origin; few, fine roots; wetland soil horizon with humus; overlying coral shelf

4.2.62 Test Excavation 62 (T-62)

Test Excavation 62 (T-62), an exterior excavation located in the Office Depot parking lot on the corner of Queen and Kamake‘e streets, was oriented northwest-southeast and measured 6.1 m long by 0.85 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.4 mbs. The stratigraphy of T-62 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), additional base course (Stratum Ic), very gravelly sandy loam (Stratum Id), and highly mottled clay fill (Stratum Ie) overlying a 1919–1927 Kaka‘ako reclamation fill deposit consisting of hydraulic silty clay (Stratum II), overlying a redeposited, locally procured loamy sand (Stratum IIIa) and a thin layer of clay fill with organics (Stratum IIIb), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), and a wetland clay sand (Stratum V) (Figure 272 through Figure 274, and Table 64).

T-62 documented recent fill deposits (Strata Ia–Id) overlying a 1919–1927 Kaka‘ako reclamation fill deposit (Stratum II), overlying redeposited, likely locally procured sand utilized for land modification (Stratum IIIa), resting on a natural terrestrial sand surface. The upper boundary of the terrestrial sand displayed a soil horizon while the lower boundary transitioned to a wetland deposit above the coral shelf. The lower boundary of Stratum IIIb ranged from abrupt to clear (see Figure 273), which indicated the underlying A horizon (Stratum IVa) was truncated prior to the deposition of Stratum IIIb, and that enough time and compaction occurred for Stratum IIIb to permeate Stratum IVa. Judging from the clay and organics within Stratum IIIb, it is possible it was composed of locally procured wetland material and used as leveling fill prior to the deposition of Stratum IIIa. Stratum IVa was a culturally sterile, natural soil horizon, developed within Jaucas sand (Stratum IVb). The stratigraphic results of T-62 are consistent with previous archaeological investigations along Kamake‘e Street, which documented an A horizon over Jaucas sand in areas not impacted by major disturbance events.

Figure 272. T-62 northeast wall, view to east

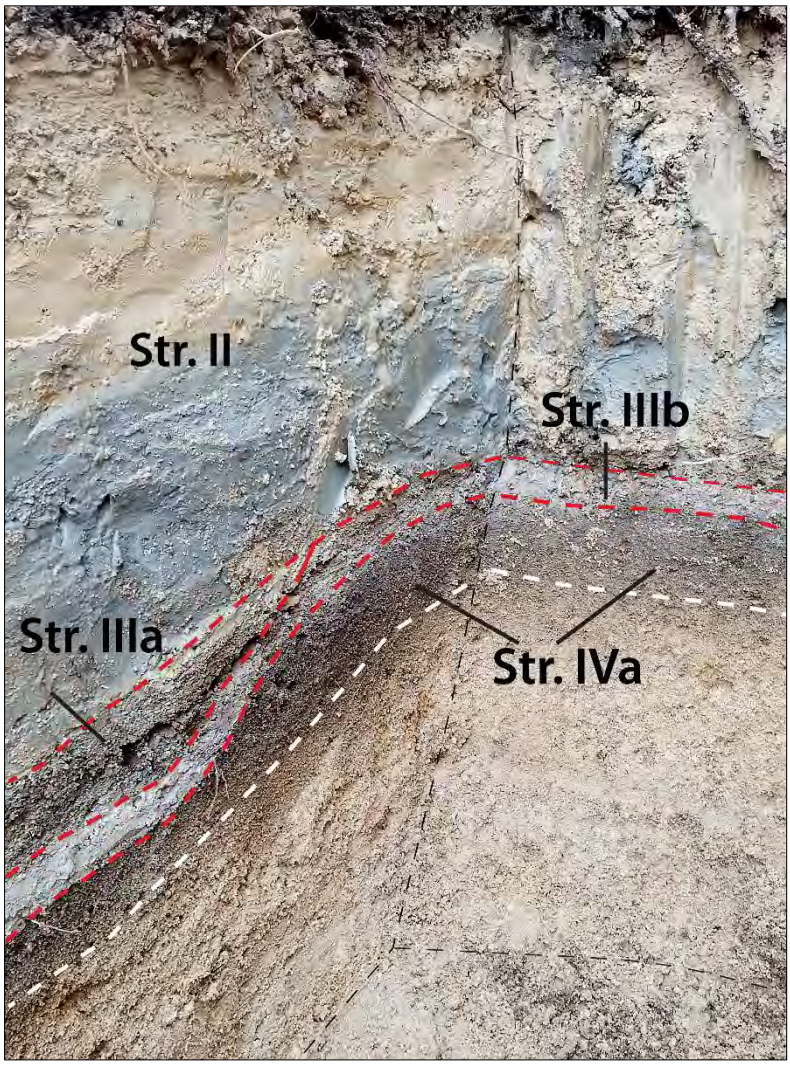

Figure 273. T-62 southeast end, close-up of Stratum IIIb truncating Stratum IVa, view to east

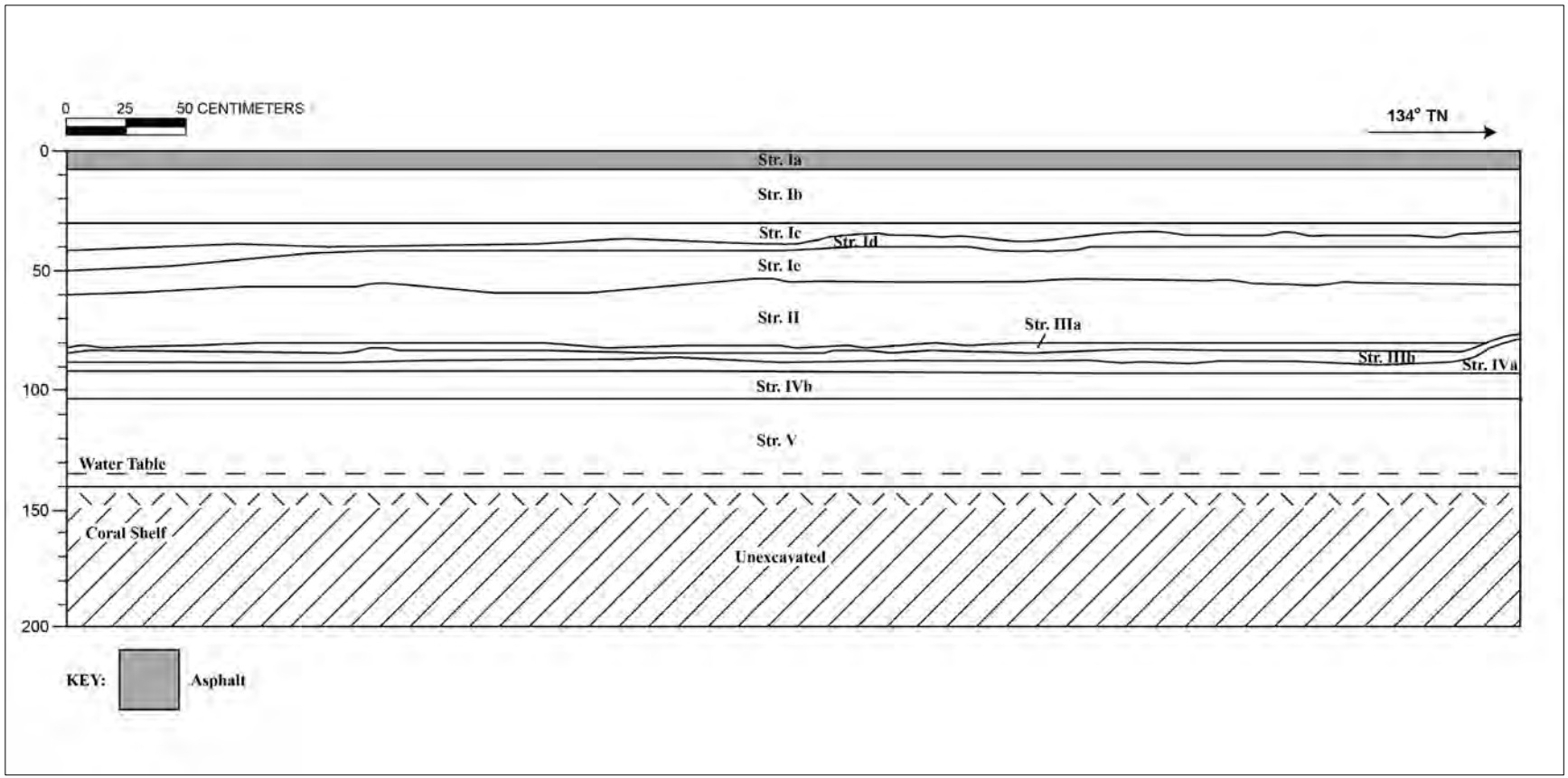

Figure 274. T-62 northeast profile

Table 64. T-62 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–30	Fill; 5YR 3/2, dark reddish brown; very gravelly loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; common, medium roots; base course
Ic	30–43	Fill; 5YR 4/3, reddish brown; very gravelly loam; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; common, medium roots; base course
Id	35–50	Fill; 10YR 5/4, yellowish brown; very gravelly sandy loam; weak, medium, crumb structure; moist, very friable consistence; non-plastic; terrigenous origin; many, medium roots; crushed coral fill
Ie	40–60	Fill; N 2.5/ (GLEY 1), black mottled with N 8/ (GLEY 1), white; clay; strong, fine, platy structure; moist, very friable consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; many, medium roots; highly mottled clay fill layer
II	55–80	Fill; 5Y 7/3, pale yellow grading to 5GY 6/1 (GLEY 1), greenish gray; silty clay; structureless (massive); moist, firm consistence; plastic; marine origin; clear, abrupt lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	80–84	Fill; 10YR 5/3, brown; loamy sand; weak, medium, crumb structure; moist, friable consistence; non-plastic; mixed origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized for land modification
IIIb	84–87	Fill; 10Y 7/1 (GLEY 1), light greenish gray; clay; structureless (massive); moist, firm consistence; plastic; mixed origin; abrupt to clear, smooth lower boundary; clay band with organics
IVa	87–93	Natural; 10YR 5/2, grayish brown; loamy sand; weak, medium structure; moist, loose consistence; non-plastic; mixed origin; truncated, in situ A horizon
IVb	93–104	Natural; 10YR 7/2, light gray; very gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; Jaucas sand with organics
V	93–140 (BEO)	Natural; 10YR 8/2, very pale brown; clay sand; weak, medium, crumb structure; wet, slightly sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; overlying coral shelf

4.2.63 Test Excavation 63 (T-63)

Test Excavation 63 (T-63), an exterior excavation located in the parking lot northwest (‘Ewa) of the Office Depot building along Queen Street, was oriented northeast-southwest and measured 6.1 m long and 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.53 mbs. The stratigraphy of T-63 consisted of the asphalt surface (Stratum Ia), extremely gravelly, loamy sand base course (Stratum Ib), gravelly sand fill (Stratum Ic), and loamy sand fill containing historic trash (Stratum Ie) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) silty clay (Stratum IIb), overlying a redeposited, locally procured silty sand (Stratum III), overlying a natural silty sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), loamy sand wetland sediment (Stratum Va), and two silty sand deposits (Strata Vb–Vc) (Figure 275 and Figure 276, Table 65).

T-63 documented recent fill deposits (Strata Ia–Ic) overlying several historic fill deposits (Strata IIa, IIb, III), over a natural transition from a wetland marsh-like environment (*mauka*) to a sandy dune setting (*makai*). Strata Ia–Ic consisted of modern deposits while Strata IIa and IIb consisted of crushed coral and hydraulic dredge material associated with 1919–1927 Kaka‘ako land reclamation efforts. A disturbance pocket (Stratum Ie) was observed on the northwest wall in the northeast (*mauka*) end of T-63, which intruded into Stratum IIa. It consisted of very dark gray, loamy sand with coral gravels and contained burned trash, possibly related to the nearby nineteenth and twentieth century residential houses along Queen Street. Trash inclusions consisting of glass bottle and ceramic fragments, three clay or glass marbles, wood, faunal remains, metal, fire-altered basalt cobbles, and large marine shell fragments (Figure 277 through Figure 280). A representative sample was collected for analysis in the laboratory. Faunal remains consisted of *Sus scrofa* (pig) burned long bone fragments and rib fragments and a *Bos taurus* (cow) lumbar vertebra fragment. The cow and pig bones were cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops). Marine shell consisted of Cypraeidae (*Cypraea* sp.) (37.1 g) and Conidae (*Conus* sp.) (14.2 g).

Below the early 1900s land reclamation fill (Strata IIa–IIb) was an earlier fill deposit (Stratum III), likely composed of locally procured sand and soil utilized to raise and level the former ground surface. Stratum III contained a discontinuous lens with increased sand content in the central portion of the trench. Strata IIa, IIb, and III all contained faunal material, consisting of *Canis lupus familiaris* (dog) metacarpal, ulna, and phalanx fragments (Stratum IIa), dog ulna and rib fragments (Strata IIa–IIb interface), a *Equus ferus caballus* (horse) patella (Stratum IIb), and dog cranial and rib fragments and dog teeth (Stratum III).

Underlying Stratum III, a natural, truncated A horizon (Stratum IVa) was documented. Careful troweling of the A horizon material yielded no cultural material. Stratum IVa developed within Stratum IVb (Jaucas sand); however, there appeared to be a lateral, gradational transition from the terrestrial dominated sand in the southwest (*makai*) to a wetland sand (Stratum V) in the northeast (*mauka*).

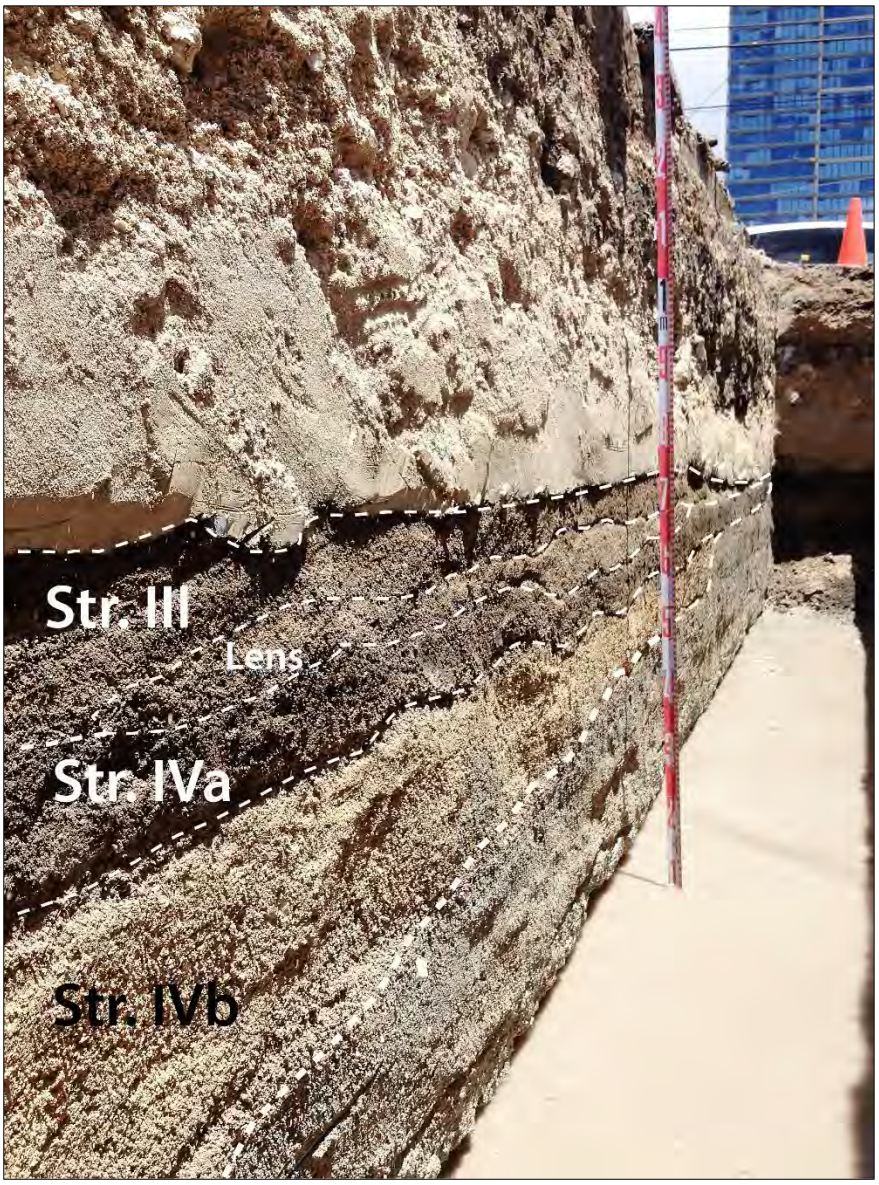

Figure 275. T-63 northwest wall, view to north

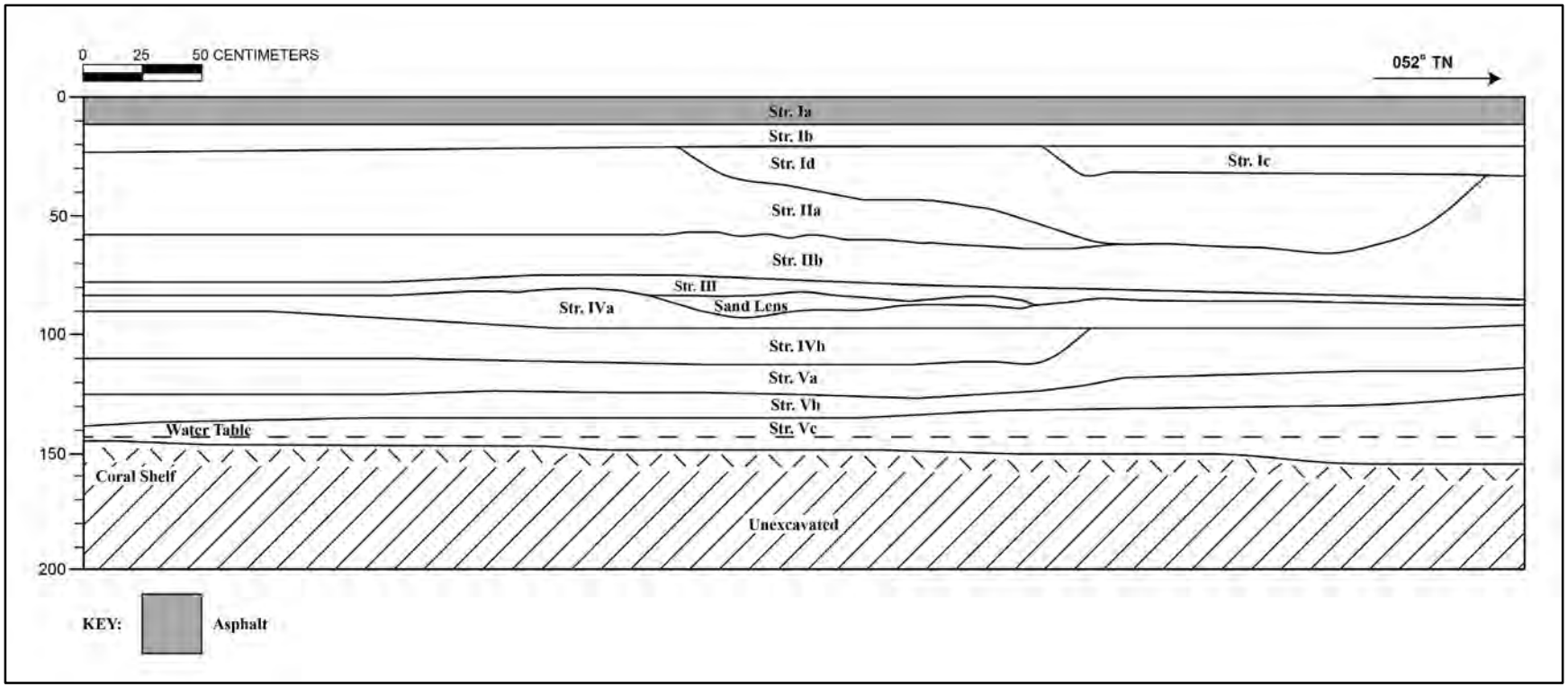

Figure 276. T-63 northwest profile

Table 65. T-63 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–13	Asphalt
Ib	10–24	Fill; 10YR 4/2, dark grayish brown; extremely gravelly loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; base course material; contained *Bos taurus* (cow) bone, glass fragments, metal, nails, porcelain, wood, a metal door stop, and wood
Ic	20–32	Fill; 2.5Y 7/3, pale yellow; gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine sediment; clear, discontinuous lower boundary
Id	20–65	Fill; 10YR 3/1, very dark gray; gravelly loamy sand; weak, medium, crumb structure; moist, very friable consistence; non-plastic; mixed origin; abrupt, discontinuous lower boundary; highly compacted mixed fill disturbance pocket; contained fire-altered basalt cobbles, glass and ceramic fragments, marbles, faunal bone, and charcoal (representative sample collected: Acc. #s 24–34)
IIa	24–61	Fill; 2.5Y 8/3, pale yellow; very gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927); contained faunal bone
IIb	33–84	Fill; 10YR 7/3, very pale brown grading to 10YR 8/1, light greenish gray; silty clay; moderate, fine, platy structure; moist, firm consistence; slightly plastic; mixed origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927); contained faunal remains
III	75–85	Fill; 2.5Y 4/3, olive brown; silty sandy; moderate, fine, crumb structure; very friable consistence; non-plastic; mixed origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized for land modification; contained faunal remains
IVa	72–97	Natural; 2.5Y 4/1, dark gray; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, smooth lower boundary; A horizon
IVb	90–112	Natural; 2.5Y 6/4, light yellowish brown; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, discontinuous lower boundary; Jaucas sand
Va	95–126	Natural; 10Y 7/1 (GLEY 1), light greenish grey; loamy sand; weak, medium, crumb structure; very friable consistence; non-plastic; marine origin; diffuse, smooth lower boundary; wetland sediment contained natural marine shell

Stratum	Depth (cmbs)	Description of Sediment
Vb	113–138	Natural; 5Y 5/2, olive gray; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, smooth lower boundary
Vc	125–147 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; coarse silty sand; structureless (single-grain); wet, sticky consistence; non-plastic; marine origin; lower boundary not visible; wetland sediment; overlying coral shelf

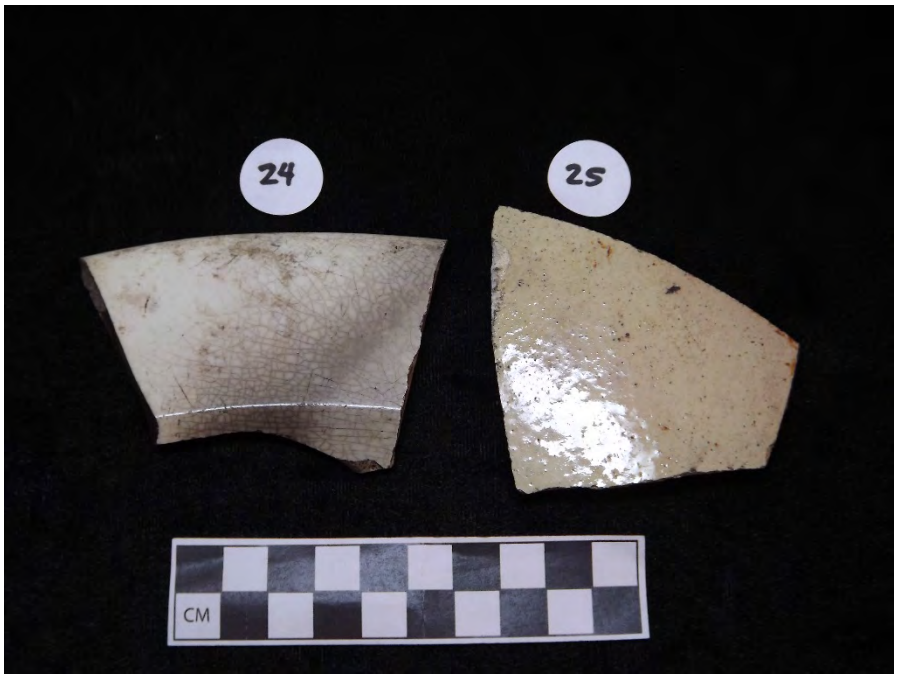

Figure 277. Stoneware and ironstone fragments identified within modern mixed fill (Acc. #s 24, 25)

Figure 278. Glass and clay marbles identified within modern mixed fill (Acc. #s 26–28)

Figure 279. Glass bottle fragments identified within modern mixed fill (Acc. #s 29–32)

Figure 280. A porcelain bowl fragment and a portion of a screw top metal container identified within modern mixed fill (Acc. #s 33, 34)

4.2.64 Test Excavation 64 (T-64)

Test Excavation 64 (T-64), an exterior excavation located in the parking lot northwest (‘Ewa) of the Office Depot building along Queen Street, was oriented northwest-southeast and measured 6.1 m long and 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.6 mbs. The stratigraphy of T-64 consisted of the asphalt surface (Stratum Ia) and various layers of fill consisting of extremely gravelly loamy sand (Stratum Ib), gravelly sandy loam (Stratum Ic), silty sand (Stratum Id), and (Stratum Ie) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (Stratum IIa) and hydraulic (dredge) silty clay (Stratum IIb), overlying redeposited, likely locally procured silty sand utilized for land modification (Stratum III), overlying a natural silty sand A horizon (Stratum IV) and Jaucas sand (Stratum V), overlying a series of wetland deposits consisting of an organically rich, loamy sand (Stratum VIa), organically rich, silty sand (Stratum VIb), and coarse silty sand (Stratum VIc) (Figure 281 and Figure 282, and Table 66).

T-64 documented recent fill deposits (Strata Ia–Id), over historic fill deposits (Strata IIa, IIb, III), over a natural, transitional environment from a wetland, marsh-like setting (‘Ewa end) to a sandy terrestrial dune setting (southeast end). Historic trash was found incorporated within Stratum Ib (recent fill), possibly related to the nearby nineteenth and twentieth century residential houses along Queen Street, consisted of fishbone, a clay marble, glass fragments, oxidized metal, broken utility pipe fragments, wood, brick fragments, rusted nails, marine shell, a 1918 U.S. penny, and butchered *Bos taurus* (cow) bone (Figure 283). Additionally, a sandy loam fill containing historic trash (Stratum Ie) was encountered in the northwest (‘Ewa) end that originated from below Stratum Ic and truncated Strata Id and IIa. This deposit consisted of gravelly, coarse sandy loam, with an appreciable amount of historic refuse. Materials included glass bottle fragments, metal fragments, wire, nails, ceramic fragments, wood, tile fragments, decorated shell (non-traditional Hawaiian), ceramic and bone buttons, marine shell (*Nerita picea*), charcoal, fire-altered cobbles, and possible shoe rubber (Figure 284 and Figure 285). A similar concentration was found within T-63, cutting into the upper crushed coralline sand fill. However; the trash concentration within T-64 appeared to have been graded in with the fill, rather than deposited after the crushed coralline sand fill.

Strata IIa and IIb consisted of 1919–1927 Kaka‘ako reclamation fill deposits deposited over a thick layer of pre-reclamation sand fill (Stratum III). Stratum III consisted of locally procured sand and soil, which contained historic artifacts consisting of a brick fragment and slag material. This local fill material appeared to have been deposited to level and/or build up the ground surface and served as a historic land surface for a period of time prior to reclamation activities. Below Stratum III was located the natural A horizon (Stratum IV) that developed over a relatively thin layer of Jaucas beach sand (Stratum V) (southeast end) and natural wetland deposits (Strata Via–VIc) (‘Ewa end). A modified, wedge-shaped polished stone which may have functioned as a metal sharpener was documented within Stratum IV (Figure 286). Based on the presence of cultural material, Strata III and IV are considered part of SIHP # -7429.

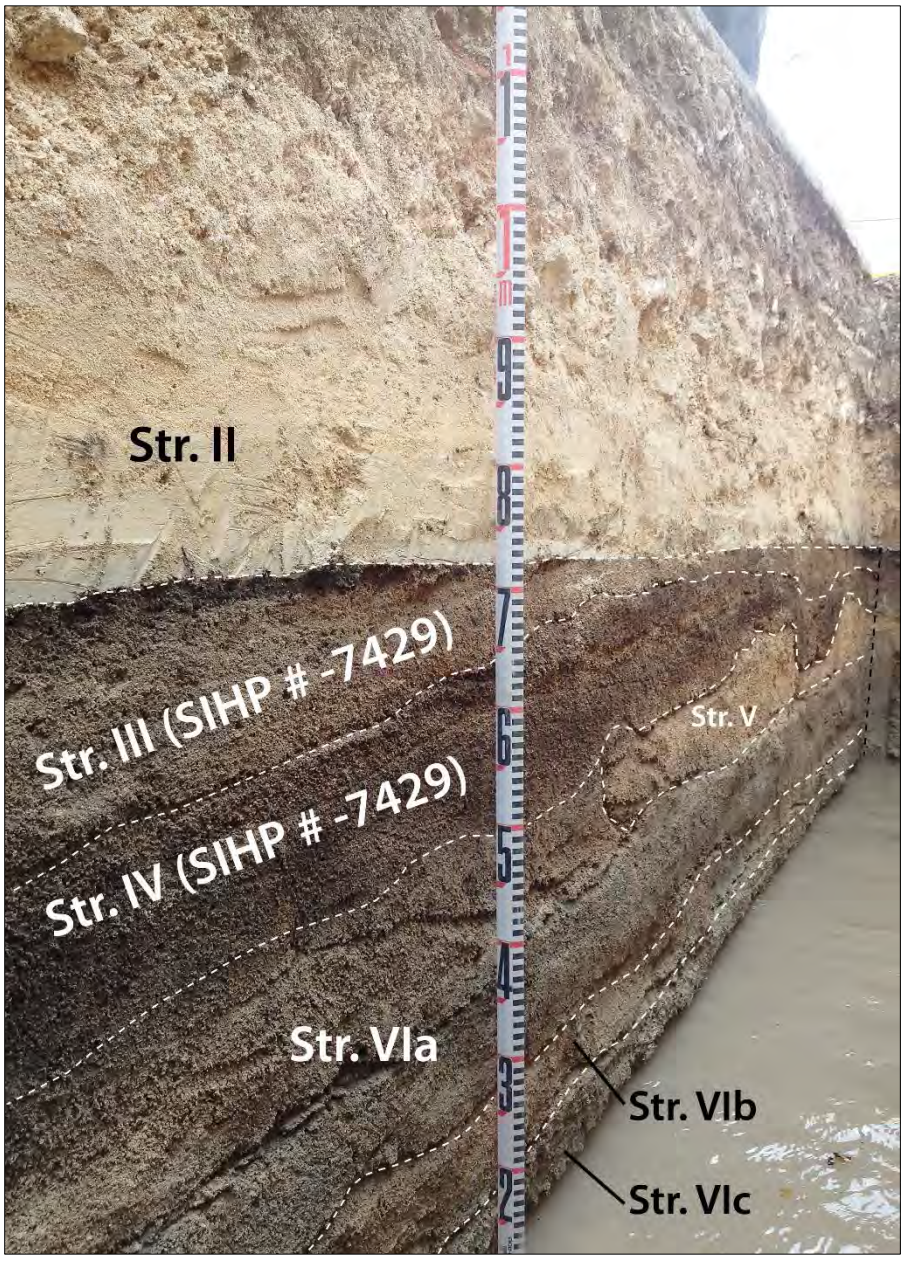

Figure 281. T-64 northeast wall, showing reclamation fill deposits (Stratum II) overlying fill sand likely utilized as a living surface (Stratum III), overlying an in situ A horizon (Stratum IV), Jaucas sand dune deposits (Stratum V), and a series of wetland deposits (Strata VIa–c), view to east

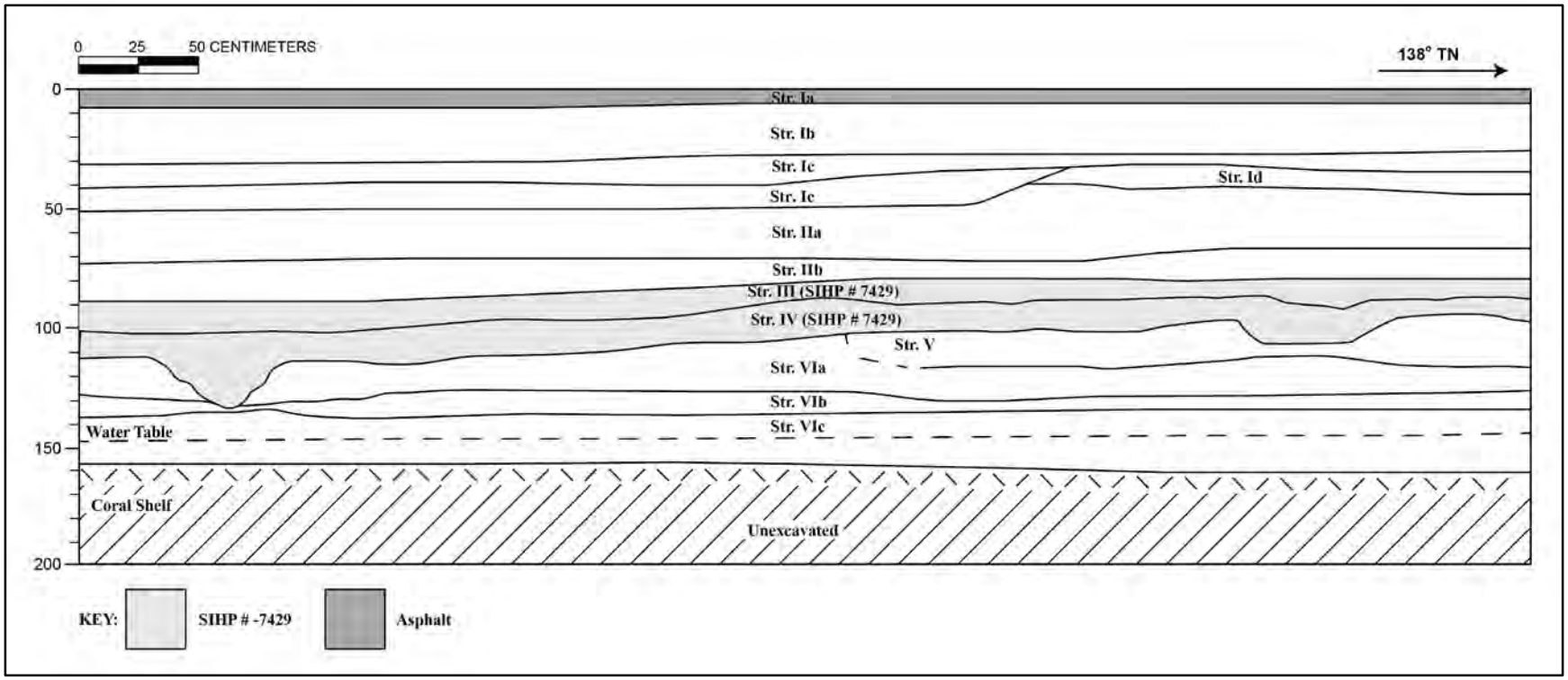

Figure 282. T-64 northeast profile

Table 66. T-64 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	6–30	Fill; 10YR 4/3, brown; extremely gravelly loamy sand; weak, coarse, crumb structure; moist, loose consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; mixed fill with coral cobbles and asphalt chunks; contained fishbone, a clay marble, glass fragments, oxidized metal, broken utility pipe fragments, wood, brick fragments, nails, marine shell, a 1918 U.S. penny, ceramic, porcelain, and cow remains cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops) (representative sample collected: Acc. #s 6–10)
Ic	26–40	Fill; 2.5Y 5/2, loamy clay; gravelly sandy loam; weak, medium, crumb structure; moist, very friable consistence; non-plastic; mixed origin; abrupt, smooth lower boundary
Id	32–45	Fill; 2.5YR 4/1; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, broken, discontinuous lower boundary
Ie	32–50	Fill; 10YR 2/1, black; gravelly sandy; weak, medium, coarse, crumb structure; very friable consistence; slightly plastic; mixed origin; very abrupt, discontinuous lower boundary; contained glass bottle fragments, metal fragments, wire, nails, ceramic fragments, wood, tile fragments, decorated shell (non-traditional Hawaiian), ceramic and bone buttons, marine shell (*Nerita picea*), charcoal, and fire-altered cobbles (representative sample collected: Acc. #s 11–19)
IIa	40–72	Fill; 2.5Y 8/3, pale yellow; very gravelly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927); contained glass fragments, an insulator, a broken cosmetic container, and *Bos taurus* (cow) remains cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops) (Acc. #s 21–23)
IIb	66–87	Fill; 10YR 7/3, very pale brown grading to 10Y 8/1, greenish gray; silty clay; moderate, fine, platy structure; moist, firm consistence; slightly plastic; mixed origin; very abrupt, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	80–101	SIHP # -7429; 10YR 4/4, dark yellowish brown; silty sand; weak, medium, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; redeposited, likely locally procured sand utilized for land modification; contained a brick fragment and slag material

Stratum	Depth (cmbs)	Description of Sediment
IV	80–113	SIHP # -7429; 2.5YR 4/1, dark gray; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, wavy, lower boundary; A horizon; contained a modified wedge-shaped stone (possible metal sharpener) (Acc. # 20)
V	93–115	Natural; 2.5Y 6/4, light yellowish brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, discontinuous lower boundary; Jaucas sand
VIa	100–125	Natural; 10Y 7/1 (GLEY 1), light greenish gray; loamy sand; weak, medium, crumb structure; moist, very friable consistence; non-plastic; marine origin; diffuse, smooth lower boundary; common, fine roots; wetland sediment with natural shell and rootlets, diffuse lower boundary becoming olive gray may be due to increased organics or changing depositional environments
VIb	120–135	Natural; 5Y 5/2, olive gray; silty sand; structureless (single-grain); moist, loose, slightly sticky consistence; non-plastic; marine origin; diffuse, smooth lower boundary; few, fine roots; wetland sediment; contained *Sus scrofa* (pig) remains cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops)
VIc	135–160 (BOE)	Natural; 10Y 7/1 (GLEY 1), light greenish gray; coarse silty sand; structureless (single-grain); wet, sticky consistence; non-plastic; marine origin; smooth lower boundary; wetland sediment containing marine shell; overlying the coral shelf

Figure 283. 1918 U.S. penny, a glass handle fragment, a blue-fired clay marble, and glass bottle fragments identified within Stratum Ib (Acc. #s 6–10)

Figure 284. Ceramic and bone buttons and ceramic fragments identified within Stratum Ie (Acc. #s 11–16)

Figure 285. Glass fragments and a decorated scallop shell identified within a trash concentration (Acc. #s 17–19)

Figure 286. A wedge-shaped polished stone identified within Stratum IV, SIHP # -7429 (Acc. # 20)

4.2.65 Test Excavation 65 (T-65)

Test Excavation 65 (T-65), an exterior excavation located in the parking lot northwest (‘Ewa) of the Office Depot building, was oriented northwest-southeast and measured 6.1 m in long and 0.7 m in wide. The base of excavation was determined by the presence of the hard coral shelf at 1.45 m. T-65 consisted of the asphalt surface (Stratum Ia) and associated base course (Stratum Ib), a gravelly asphalt layer (Stratum Ic) and coarse gravelly loam fill (Stratum Id), 1919–1927 Kaka‘ako reclamation fill deposits consisting of very gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) fine clay sand (Stratum IIb), overlying a redeposited, locally procured loamy sand (Stratum III), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), and a coarse silty sand wetland deposit (Stratum V) (Figure 287, Figure 288 through Figure 290, and Table 67).

T-65 documented recent fill deposits (Strata Ia–Id), over historic fill deposit (Strata IIa, IIb, III), over a disturbed, natural A horizon developed within Jaucas sand. Stratum Id fill (Stratum Id) contained historic trash, possibly related to the nearby nineteenth and twentieth century residential houses along Queen Street. Incorporated trash within Stratum Id consisted of porcelain ceramic fragments, rusted nails, and glass fragments (Figure 291 and Figure 292). The underlying historic fill deposits consisted of Kaka‘ako reclamation fill deposits (crushed coral and hydraulic dredge–Strata IIa and IIb), and a thin, discontinuous layer of loamy sand that likely consisted of redeposited, locally procured sediment deposited to level and/or build up the ground surface and that served as a historic land surface for a period of time prior to reclamation activities. These fill deposits overlay a truncated natural A horizon (Stratum IVa) developed within the upper boundary of a Jaucas sand deposit (Stratum IVb). A modified dog ulna fragment (*Canis lupis familiaris*) was found at the interface of Strata III and the A horizon at approximately 70 cmbs on the northeast wall. It is unclear whether the faunal bone was intentionally modified or modified as a result of use (see Figure 288). Additionally, the bottom of a square milled wood post was documented in Stratum IVb, from 95–105 cmbs, in the northwest (‘Ewa) end (Figure 289). Its provenience stratum was unable to be determined; however, based on the presence of a similar wood post within T-31 that originated from Stratum III, the wood post feature in T-65 may have originated from Stratum III. Based on the presence of modified faunal bone and the milled wood post, Strata III and IVa are considered part of SIHP # -7429. Stratum IVb, Jaucas sand, transitioned to a wetland deposit (Stratum V) overlying the coral shelf.

Figure 287. T-65 northeast profile, view to southeast

Figure 288. T-65 northeast wall, showing a modified faunal bone located at the interface of Strata III and IVa (SIHP # -7429), view to north

Figure 289. T-65, milled wood terminating in Stratum IVb (Jaucas sand), view to northwest

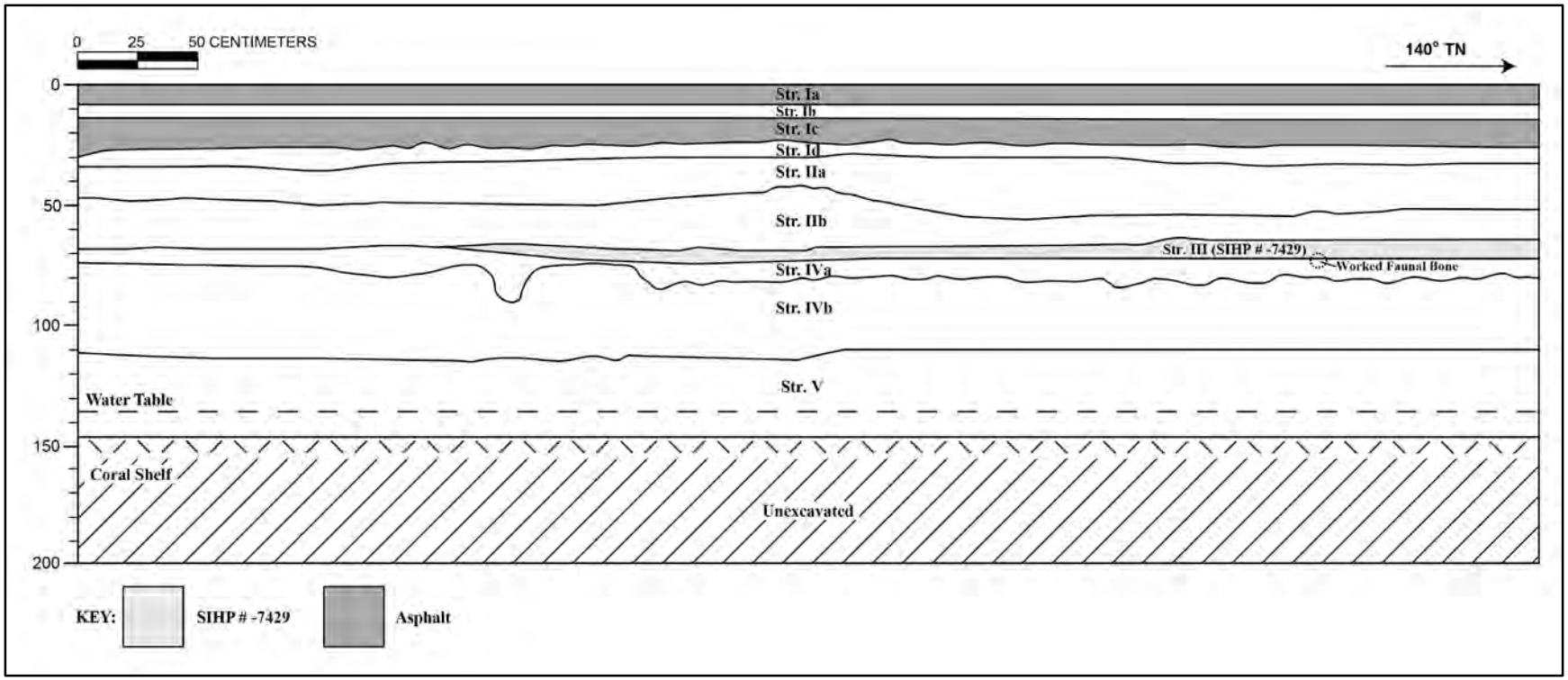

Figure 290. T-65 northeast profile

Table 67. T-65 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–8	Asphalt
Ib	8–15	Fill; very gravelly loamy sand; weak, fine, crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; base course
Ic	15–30	Buried asphalt
Id	30–41	Fill; 10YR 6/4, light yellowish brown; coarse gravelly loam; crumb structure; moist, loose consistence; non-plastic; terrigenous origin; clear, smooth lower boundary; contained historic trash consisting of porcelain ceramic fragments, rusted nails, and glass fragments (Acc. #s 5, 36)
IIa	30–51	Fill; 2.5Y 8/3, pale yellow; gravelly sand; single-grain structure; moist, loose consistence; non-plastic; marine origin; clear, wavy lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	48–68	Fill; 10YR 7/4, very pale brown; fine clay sand; massive structure; moist, very friable consistence; slightly plastic; marine origin; clear, smooth lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	64–72	SIHP # -7429; 10YR 4/2, dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, smooth, discontinuous lower boundary; redeposited, likely locally procured sand utilized for land modification
IVa	61–90	Natural; 10YR 3/2, very dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; diffuse, wavy lower boundary; A horizon; contained a modified dog long bone at the upper boundary
IVb	75–114	Natural; 2.5Y 6/4, light yellowish brown; silty sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; diffuse, smooth lower boundary; Jaucas sand; contained remnant milled wood at 95–105 cmbs on the northwest end
V	110–145 (BOE)	Natural; 6Y 7/1 (GLEY 1), light greenish gray, coarse silty sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; marine sand; overlying coral shelf

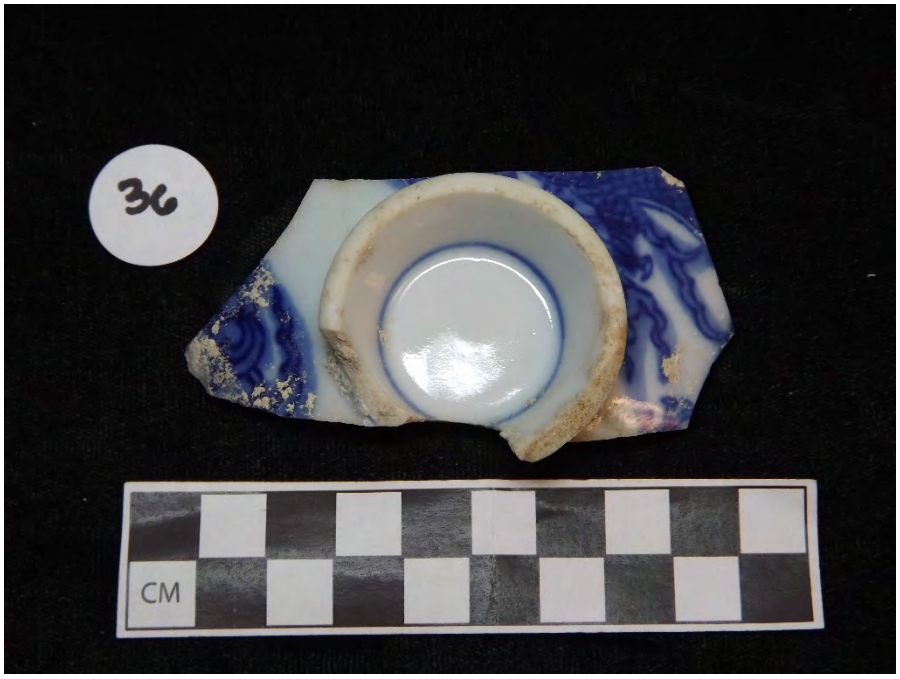

Figure 291. A porcelain bowl base identified within Stratum Id fill (Acc. # 36)

Figure 292. Oxidized round top nails identified within Stratum Id fill (Acc. # 5)

4.2.66 Test Excavation 66 (T-66)

Test Excavation 66 (T-66), an exterior excavation located in the parking lot northwest (‘Ewa) of the Office Depot building, was oriented northwest-southeast and measured 6.1 m long and 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.48 mbs. T-66 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), and extremely gravelly sandy loam (Stratum Ic) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of extremely gravelly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) sandy clay (Stratum IIb), overlying in the ‘Ewa portion of the test excavation a redeposited, locally procured loamy sand (Stratum V), a natural sandy loam A horizon (Stratum VIa) developed within Jaucas sand (Stratum VIb), and wetland sandy clay (Stratum VII). Within the southern portion of T-66 the Kaka‘ako reclamation fill deposits overlay a man-made *‘auwai* (SIHP # -7429 Feature 14) (Stratum III) with an associated loamy sand A horizon forming along the embankments (Stratum IV) and that intruded into Stratum VII (Figure 293 through Figure 297, and Table 68).

T-66 documented similar stratigraphy to T-65, including recent fill deposits (Strata Ia–Ic), over historic fill deposits (Strata IIa, IIb, and V), overlying a disturbed, natural A horizon (Stratum VIa) developed within Jaucas sand (Stratum VIb). The A horizon appeared to have been disturbed and truncated by the overlying local sand fill and included coral gravels. A 20-gallon screen of the A horizon material yielded no cultural material. However, a shallow, dark-stained circular feature, measuring 35 cm in diameter and 10 cm deep, was observed originating from the A horizon and was designated SIHP # -7429 Feature 15 (Figure 298 and Figure 299). While screening of feature sediment yielded no cultural material, the distinct morphology and dark staining of the feature indicated it did not represent a natural undulation in the A horizon. *Bos taurus* (cow) long bone fragments cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops) were identified within Stratum Ic.

Within the southern portion of the test excavation a man-made *‘auwai* was identified, designated SIHP # -7429 Feature 14. The *‘auwai* extended in a *mauka-makai* orientation and was relatively narrow and shallow, measuring 48 cm deep with a maximum width of 1.0 m. The *‘auwai* sediment (Stratum III) consisted of a dark sandy clay containing freshwater snails and a layer of peat at the upper boundary (Figure 300). The embankments of the *‘auwai* sloped gently up and contained a developing, light-stained A horizon (Stratum IV) indicating land surface stability for a period of time. The *‘auwai* and associated embankments appeared to have cut through the natural A horizon (Stratum VIa), indicating a historic date for the construction of the *‘auwai*. Historic artifacts consisting of a clay marble and an ironstone vessel fragment were also identified within Stratum IV (Figure 301). It is less clear whether the *‘auwai* also cut through the overlying sand fill layer (Stratum V), although the fact that both Strata V and VIa end at the same point along the test excavation sidewalls indicates the *‘auwai* may have been constructed when the fill sand living surface had already been emplaced. As the *‘auwai* was not observed within the test excavations *makai* of T-66 (T-67 and T-68), it appears that Feature 14 is a localized water feature unrelated to the historic salt pan remnants (SIHP # -7655) located immediately *makai* of the project area.

Figure 293. T-66 northeast (*mauka*) wall, showing fill deposits over a dark-stained A horizon and Jaucas sand, which transitions towards the south into a man-made *‘auwai* (SIHP # -7429 Feature 14), view to northwest

Figure 294. T-66 southwest wall, showing the man-made *‘auwai* (SIHP # -7429 Feature 14) running *mauka-makai*, view to southeast

Figure 295. T-66, close-up photograph of the *‘auwai* (SIHP # -7686 Feature 14), view to northeast

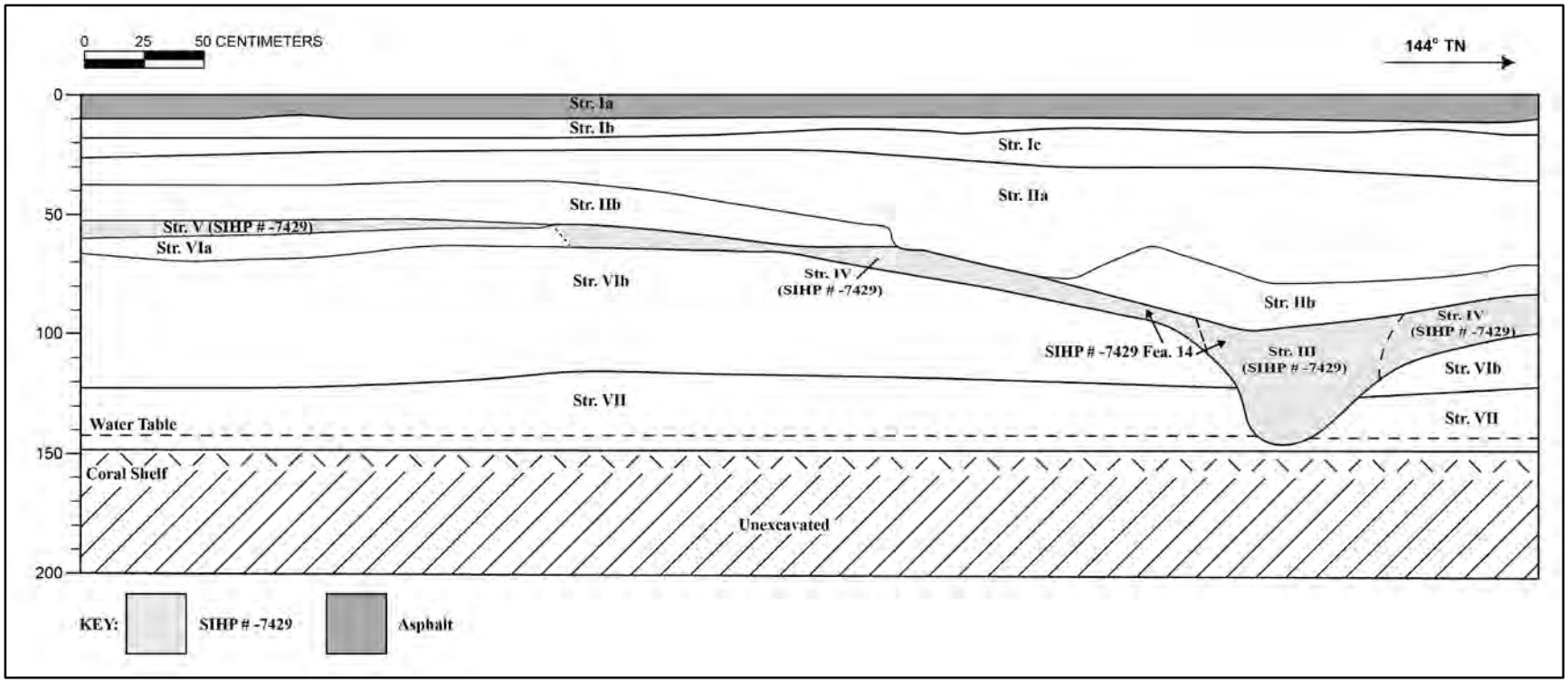

Figure 296. T-66 northeast profile

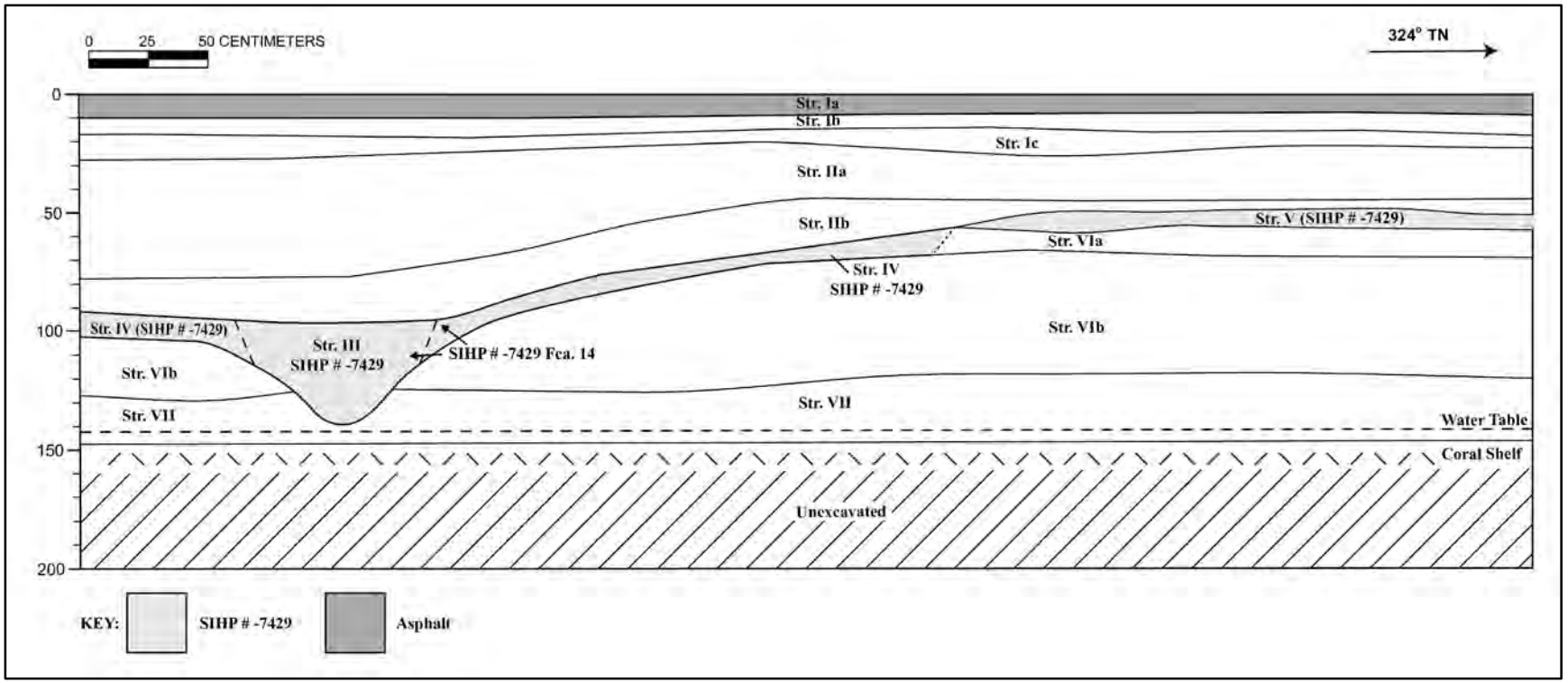

Figure 297. T-66 southwest profile

Table 68. T-66 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–10	Asphalt
Ib	10–19	Fill; basalt gravel base course material
Ic	15–30	Fill; 10YR 6/2, light brownish gray; extremely gravelly sandy loam; structureless (single-grain); dry, loose consistence; non-plastic; mixed origin; abrupt, smooth lower boundary; contained a clay marble, an earthenware fragment, and a nondiagnostic bottle glass fragment (not collected), and *Bos taurus* (cow) long bone fragments
IIa	23–76	Fill; 10YR 7/6, yellow; extremely gravelly sand; structureless (single-grain) dry, loose consistence; non-plastic; marine origin; abrupt, wavy lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	35–97	Fill; 10YR 8/2, very pale brown; sandy clay; massive structure; moist, firm consistence; plastic; marine origin; abrupt, wavy lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	93–145	SIHP # -7429; 10YR 4/2, dark grayish brown; sandy clay; moderate, blocky structure; wet, sticky consistence; plastic; terrigenous origin; irregular lower boundary; *‘auwai* (SIHP # -7429 Feature X); contained freshwater snail and peat along upper boundary
IV	55–115	SIHP # -7429; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, discontinuous lower boundary; forming A horizon atop *‘auwai* embankments
V	51–60	SIHP # -7429; 10YR 6/4, light yellowish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, broken, discontinuous lower boundary; redeposited, likely locally procured sand utilized for land modification; likely provenience of SIHP # 7429 Feature 14
VIa	55–111	SIHP # -7429; 10YR 5/2, grayish brown; sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; diffuse, wavy, broken lower boundary; A horizon; contained SIHP # -7429 Feature 15
VIb	67–124	Natural; 10YR 7/4, very pale brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, broken lower boundary; Jaucas sand
VII	124–148 (BOE)	Natural; 5G 7/1 (GLEY 1), light greenish gray; sandy clay; massive, blocky structure; wet, slightly sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; marine sand; overlying coral shelf

Figure 298. T-66, SIHP # -7429 Feature 15, view to northeast

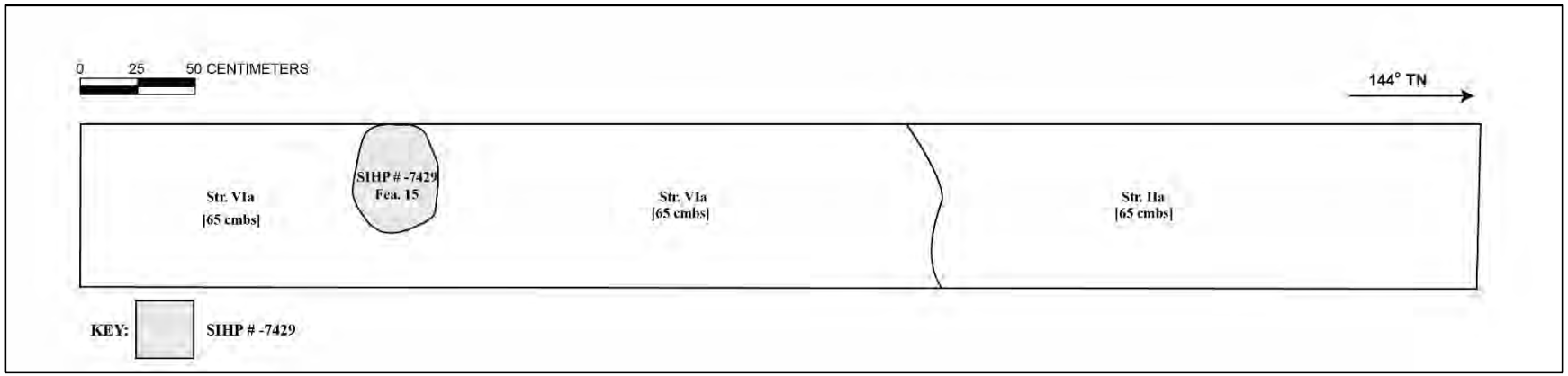

Figure 299. T-66 plan view, showing SIHP # -7429 Feature 15

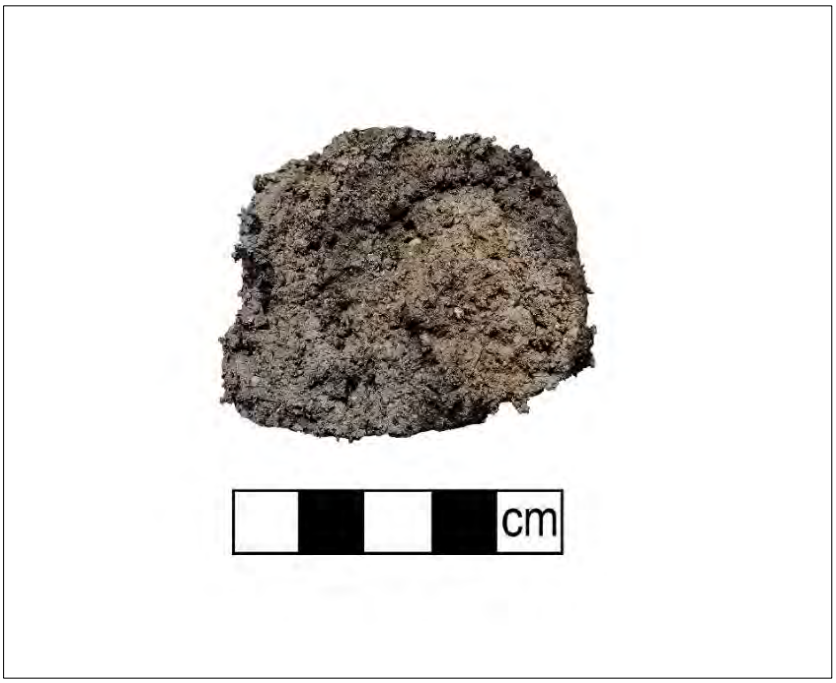

Figure 300. T-65, close-up bulk sediment sample from SIHP # -7429 Feature 14

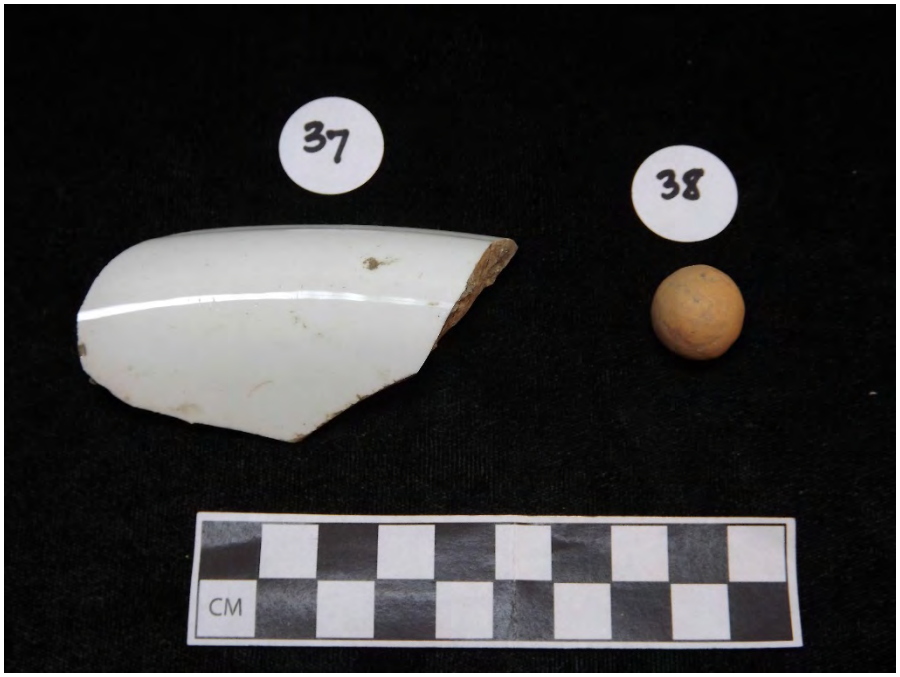

Figure 301. Portion of an ironstone vessel and a clay marble identified within Stratum IV, SIHP # -7429 Feature 14 (Acc. #s 37, 38)

4.2.67 Test Excavation 67 (T-67)

Test Excavation 67 (T-67), an exterior excavation located in the warehouse alleyway in the western corner of the project area, was oriented northwest-southeast and measured 6.1 m long and 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.42 mbs. T-67 consisted of the asphalt surface (Stratum Ia) and associated base course (Stratum Ib) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of very cobbly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) clay (Stratum IIb), overlying disturbed and redeposited natural A horizon material intermixed with sand and clay (Stratum III), overlying natural Jaucas sand (Stratum IV),a sandy clay wetland deposit with organics (Stratum Va), and silty sand (Stratum Vb) (Figure 302 through Figure 304, and Table 69).

T-67 documented recent fill deposits (Strata Ia–Ib) over historic fill deposits (Strata IIa–IIb), over a disturbed A horizon (Stratum III) marbled with the underlying Jaucas sand (Stratum IV) and wetland clay (Strata Va–Vb). Five gallons of the disturbed A horizon (Stratum III) was screened in the field and yielded no cultural material. Heavy disturbance of this layer is indicated by the irregular, abrupt to diffused lower boundary, as well as the heavily marbled soil matrix that was incorporated with Jaucas sand, charcoal, and clay (see Figure 303). The boundary between Stratum IV (Jaucas sand) and Stratum V (wetland deposit) contained a thin indurate layer of coarse sand that either represents a different depositional environment or compaction from the weight of overlying deposits combined with water table fluctuations and calcification of the sediment grains (see Figure 302).

Figure 302. T-67 southwest wall, black arrows point to thin indurate lens

Figure 303. T-67 showing a disturbed and redeposited A horizon intermixed with Jaucas sand and clay (Stratum Ie)

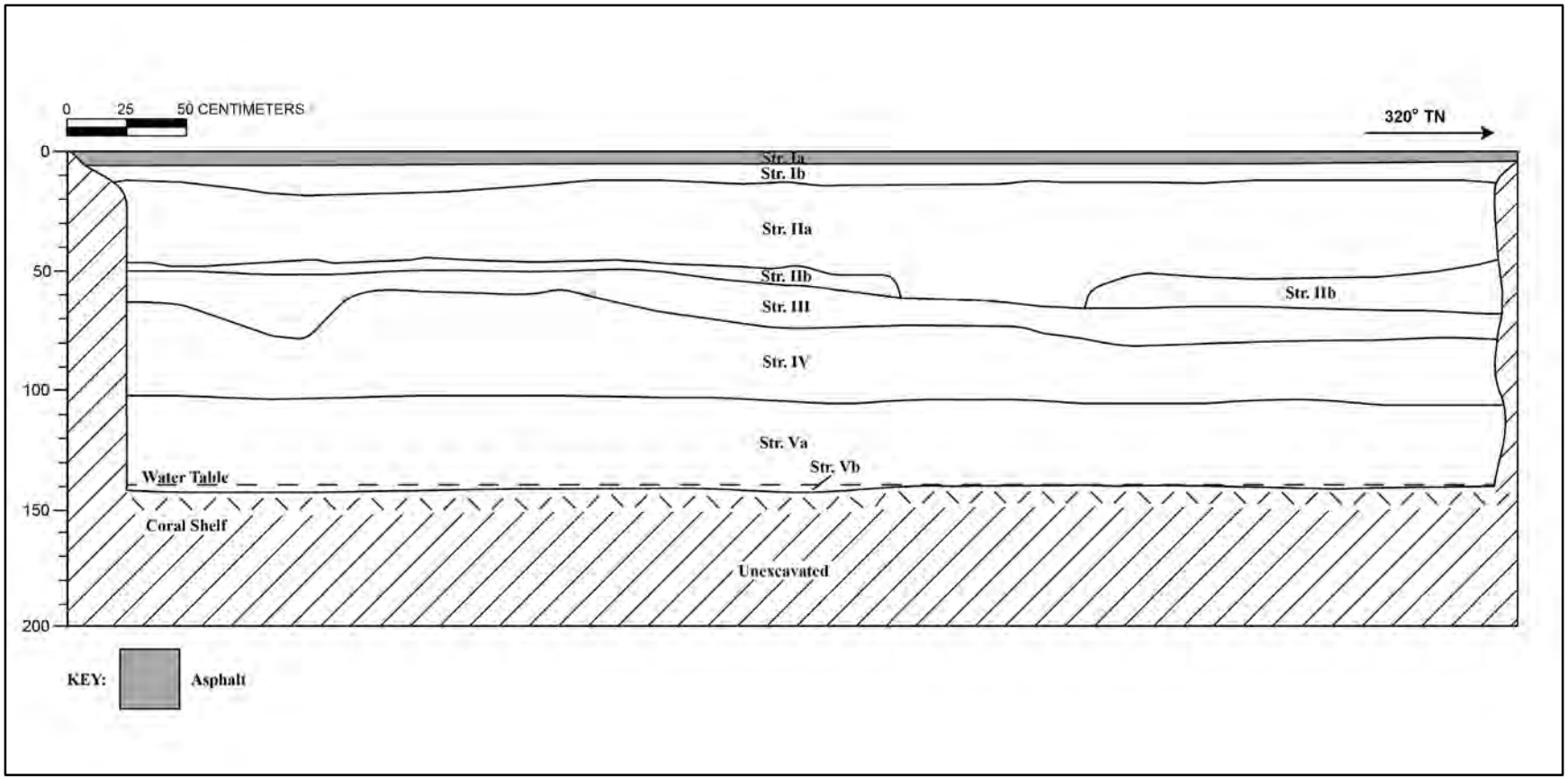

Figure 304. T-67 northeast profile

Table 69. T-67 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–6	Asphalt
Ib	6–20	Fill; 10YR 3/2, very dark grayish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistence; non-plastic; terrigenous origin; abrupt, smooth lower boundary; base course for road surface
IIa	12–166	Fill; 10YR 7/3, very pale brown; cobbly sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; clear, wavy lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	146–164	Fill; 10YR 7/2, light gray; fine sand grading to clay; weak, fine, platy structure; moist, very friable consistence; non-plastic; marine origin; clear, broken, discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
III	50–83	Fill; 10YR 4/2, dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; abrupt, wavy lower boundary; highly marbled (swirled) mixture of redeposited A horizon, Jaucas sand, and clay; contained a glass bottle base fragment at the lower boundary (not collected)
IV	55–105	Natural; 10YR 7/4, very pale brown; medium sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, smooth lower boundary; Jaucas sand: lower boundary consisted of an indurated layer of sand
Va	103–140	Natural; 10YR 7/2, light gray grading to 5 GY 7/1 (GLEY 1), light greenish gray; sand grading to clay; massive structure; moist, friable to firm consistence; non-plastic to plastic; marine origin; clear, smooth lower boundary; common, fine roots; marine sand grading to marine clay
Vb	140–142 (BOE)	Natural; 5 GY 7/1 (GLEY 1), light greenish gray; silty sand; structureless (single-grain); wet, non-sticky consistence; non-plastic; marine origin; abrupt, smooth lower boundary; natural marine sand; contained natural marine shell (Tellinidae); overlying coral shelf

4.2.68 Test Excavation 68 (T-68)

Test Excavation 68 (T-68), an exterior excavation located in the warehouse alleyway in the western corner of the project area, was oriented northwest-southeast and measured 6.1 m long and 0.7 m wide. The base of excavation was determined by the presence of the hard coral shelf at 1.37 mbs. T-68 consisted of the asphalt surface (Stratum I) overlying 1919–1927 Kaka‘ako reclamation fill deposits consisting of extremely cobbly sand (crushed coral) (Stratum IIa) and hydraulic (dredge) sandy clay (Stratum IIb), overlying a redeposited, locally procured loamy sand (Stratum IIIa), overlying a natural loamy sand A horizon (Stratum IVa), Jaucas sand (Stratum IVb), a clay sand wetland deposit (Stratum Va), and sandy clay (Stratum Vb) (Figure 305 through Figure 309, and Table 70).

T-68 differed from the surrounding test excavations in that the current asphalt surface (Stratum I) directly overlay the 1919–1927 Kaka‘ako reclamation fill deposits (Strata IIa–IIb) and appeared to have truncated three modern pit features (labeled as Pits 1–3 in Figure 309). The pit features were identical in shape and fill content and were uniformly spaced, indicating a potential structural function such as fence holes. Aside from oxidized metal fragments, no cultural material was observed in the clay pits. Due to truncation, the provenience of these pit features is unclear.

Within the southern portion of T-68, a rectangular clay-lined feature was observed extending diagonally (north-south) across the test excavation floor, measuring 1.2 m wide by 0.24 m deep (see Figure 306 and Figure 307). The feature, designated SIHP # -7429 Feature 16, appeared to be laterally associated with Stratum IIIa, a redeposited locally procured sand fill layer utilized to level or build up the land surface and which served as a living surface for a period of time prior to reclamation activities. The feature cut down through the earlier, natural A horizon (Stratum IVa) and intruded into the underlying Jaucas sand (Stratum IVb). Based on the presence of clay lining, the feature functioned as either a water containment or water channel feature. Feature 16 was in-filled with a loamy sand (Stratum IIIb), interpreted as secondary fill material.

Figure 305. T-68 southwest wall, view to west

Figure 306. Close-up of SIHP # -7429 Feature 16, a clay-lined rectangular feature likely utilized to contain or channel water, southwest sidewall of T-68

Figure 307. T-68 southwest wall, showing a historic fill layer utilized as a living surface (Stratum IIIa) overlying a natural A horizon (Stratum IVa) and Jaucas sand (Stratum IVb); a clay-lined feature, SIHP # -7429 Feature 16, cuts through the A horizon and appears to be laterally associated with Stratum IIIa

Figure 308. Close-up of the southwest sidewall of T-68 (northern end), showing uniform pit features truncated by the modern asphalt road and extending into Strata III (historic sand fill) and IVa (in situ A horizon)

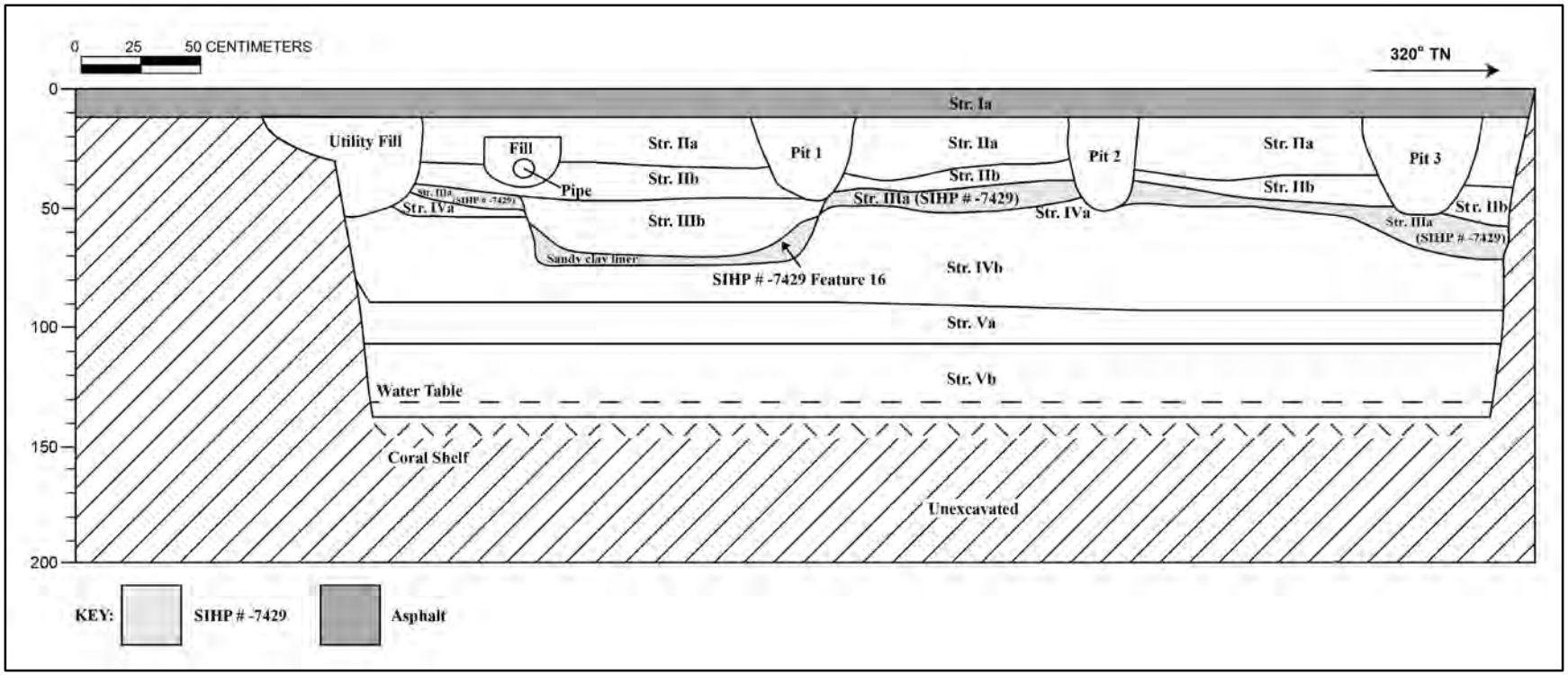

Figure 309. T-68 southwest wall

Table 70. T-68 Stratigraphic Description

Stratum	Depth (cmbs)	Description of Sediment
Ia	0–12	Asphalt
Pit fill	12–51	Fill; 10YR 3/6, dark yellowish brown; clay loam; moderate, medium, blocky structure; firm consistence; non-plastic; terrigenous origin; abrupt, discontinuous lower boundary; consisted of three uniform pits truncated by the overlying asphalt road; contained rusted metal pieces
IIa	12–42	Fill; 10YR 7/3, very pale brown; extremely cobbly sand; structureless (single-grain); dry, loose consistence; non-plastic; marine origin; clear, broken lower boundary; crushed coral fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIb	31–58	Fill; 2.5Y 7/3 and 2.5Y 7/1, pale yellow grading to light gray; clay sand grading to sand clay; structureless (single-grain grading to massive); moist, loose to firm consistence; slightly plastic to plastic; marine origin; very abrupt, wavy, discontinuous lower boundary; hydraulic (dredge) fill associated with Kaka‘ako land reclamation activities (1919–1927)
IIIa	39–56	SIHP # -7429; 10YR 4/2, dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, wavy, discontinuous lower boundary; redeposited, likely locally procured sand fill utilized for land modification; contained SIHP # -7429 Feature 16, a clay-lined water containment or channel feature
IIIb	40–74	Fill; 10YR 4/2, dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; clear, irregular lower boundary; sand utilized to infill SIHP # -7429 Feature 16; very similar texture and color to Stratum IIIa but contained more (coarse) sand; contained rusted metal pieces
IVa	46–59	Natural; 10YR 3/2, very dark grayish brown; loamy sand; structureless (single-grain); moist, loose consistence; non-plastic; mixed origin; diffuse, smooth, broken lower boundary; A horizon
IVb	55–98	Natural; 10YR 7/4, very pale brown; sand; structureless (single-grain); moist, loose consistence; non-plastic; marine origin; abrupt, wavy lower boundary; Jaucas sand; lower boundary consisted of an indurated layer of sand
Va	90–107	Natural; 10YR 7/3, , very pale brown; clay sand; moderate, coarse, crumb structure; moist, friable consistence; slightly plastic; marine origin; diffuse, smooth lower boundary; common, fine decomposed roots observed; marine sediment
Vb	106–137 (BOE)	Natural; 10YR 7/1, light gray, sandy clay; structureless (single-grain); wet, sticky consistence; slightly plastic; marine origin; abrupt, smooth lower boundary; few roots observed; overlying coral shelf

Section 5 Results of Laboratory Analysis

5.1 Artifact Analysis

Artifacts identified and collected from the Block M project area consisted exclusively of historic period artifacts. The majority of the historic artifacts are discussed within the following Section 1.1.1 (Historic Artifacts). Additionally, a modified dog (*Canis lupus famliaris*) long bone, which evidenced historic butcher marks, is discussed in Section 1.2 (Faunal Analysis).

5.1.1 Historic Artifacts

Forty-three historic artifacts were collected from the Block M excavations: eight glass bottles, one glass jar, one glass bottle stopper, two glass vessels, one basalt whetstone, one bone die, five marbles (four fired clay and one glass), three buttons (one ceramic and two bone), ten ceramic tablewares, one ceramic household insulator, one copper penny, five nails, one metal lid, one shell ornament, and two slate pencils. These are summarized in Table 71 and illustrated in Figure 310 through Figure 324.

5.1.1.1 Historic Bottle Glass

All terminology used to describe bottle traits and all bottle dating information in this report section is based on information from the U.S. Department of Interior, Bureau of Land Management (BLM)/Society of Historic Archaeology (SHA) “Historic Glass Bottle Identification and Information Website” (BLM/SHA 2014), unless otherwise noted. Research on historic bottles focused on the function and manufacturing dates of the items, using reference texts (i.e., Elliott 1971, Elliott and Gould 1988, Fike 1987, Toulouse 1971, and Whitten 2014) and online resources to identify glass manufacturers’ marks on bottles and company histories of the brands.

There are three stages in the evolution of glass bottle manufacture. Since antiquity, bottles have been free-blown with a blow-pipe. These types of bottles are usually asymmetrical, crudely made and often have a pontil mark where a rod was used to hold the bottle during the last stages of manufacture, with the lip of the bottle finished by hand. In the United States, these types of bottles usually pre-date ca. 1865 (BLM/SHA 2014_Glassmaking). The Block M collection contained no free-blown bottles.

Circa 1800, glassworkers began to blow bottles into some type of mold, usually a metal mold. Mold-blown bottles usually leave seam marks which indicate the edges of the metal mold sections. The most common mold used was a two-piece mold with a separate cup-bottom plate. These types of bottles have a mold seam around the base of the bottle and two side seams that run vertically up the sides of the bottle. The side mold seams usually terminate on the neck, as the lip on mold-blown bottles was still finished by hand. The Block M collection contained no definite mold-blown bottles.

In 1903, Micheal Owens invented a machine that no longer required the human glassblower. The machine was used to blow wide-mouth bottles as early as 1905 and narrow-necked bottles (such as beverage bottles) as early as 1908. The Automatic Bottle Machine blew a bottle from base

Table 71. Summary of Historic Artifacts

Acc. #	Test Excavation #	L/H (cm)	Dia. (cm)	Material	Type	Origin/Age	Description/Identification
1	T-23, Str III, SIHP # -7429, 87 cmbs	1.2	1.6	Bone	Die	Pre-1900	Six-sided bone die
2	T-23, Str IIa			Glass	Bottle		Olive green bottle glass fragments (two)
3	T-23, Str III, SIHP # -7429		11.0	Ceramic	Plate	Euro-American; post-1880s	Ironstone Hotelware plate, white, no decoration, base portion (date from Lebo 1997:G-3)
4	T-23, Str III, SIHP # -7429		5.5	Ceramic	Cup/mug	Euro-American; post-1880s	Ironstone Hotelware cup/mug, white, no decoration, base to body portion of cup/mug (date from Lebo 1997:G-3)
5	T-65, Str Id	3.34–5.57		Metal	Nails		Five oxidized/rusted round iron top (ferrous) top
6	T-64, back pile material associated with Str Ib, ~15 cmbs		1.9	Copper	Penny	American; 1918	U.S. 1918 penny (one cent)
7	T-64, back pile material associated with Str Ib			Glass	Vessel	Euro-American	Handle fragment of a colorless glass vessel, possibly a pitcher

Acc. #	Test Excavation #	L/H (cm)	Dia. (cm)	Material	Type	Origin/Age	Description/Identification
8	T-64, back pile material associated with Str Ib			Fired Clay	Marble	German; 1870–1910	Blue handmade fired clay glazed marble; “Benningtons are readily identifiable by both their coloring and the little eye ‘eyes’ that they have on them. These are spots where the marbles were touching each other while they were being fired, resulting in those spots being uncolored and unglazed” (Block 1999:67); peak manufacture in 1880s and 1890s (Carskadden et al. 1985:90)
9	T-64, back pile material associated with Str Ib			Glass	Bottle	Euro-American; 1910–1920	Amber lip and neck portion of bottle, reinforced extract finish, two-piece old, machine-made (BLM/SHA 2014)
10	T-64, back pile material associated with Str Ib			Glass	Bottle	American; 1908–1917	Aqua blue base and body portion, “HO . . . /ME . . . /460 . . ./NE . . ./BREW . . .” Embossed on the base, stippling on body portion; labelling not similar to any mold-blown bottles for the Honolulu Brewing Company in Elliott and Gould (1988:188-189), which had mold-blown bottles up to 1917; this is probably a machine-made bottle, post-dating 1917
11	T-64, Str Ie, mixed trash layer, ~39 cmbs		1.4	Ceramic	Button	Euro-American; 1840–1920	Four-hole Prosser button, white
12	T-64, Str Ie, mixed trash layer, ~39 cmbs		1.4	Bone	Button	1850–1900	Four-hole bone button, machine-drilled holes
13	T-64, Str Ie, mixed trash layer, ~39 cmbs		1.4	Bone	Button	1850–1900	Four-hole bone button, machine-drilled holes

Acc. #	Test Excavation #	L/H (cm)	Dia. (cm)	Material	Type	Origin/Age	Description/Identification
14	T-64, Str Ie, mixed trash layer, ~39 cmbs			Ceramic	Tableware	1880–1950s	Blue decalomania leaf design on white background, rim fragment of tableware, hand-painted blue floral decoration underglaze
15	T-64, Str Ie, mixed trash layer, ~39 cmbs			Ceramic	Flatware	Asian; post-1850	White, porcelain dish rim fragment with serrated edge, hand-painted floral design
16	T-64, Str Ie, mixed trash layer, ~39 cmbs			Ceramic	Tableware	Euro-American; post-1830	Refined earthenware (whiteware) tableware rim fragment; white, pink, and gray vines and leaves, gilt trim; hand-painted underglaze; small flower design
17	T-64, Str Ie, mixed trash layer, ~39 cmbs			Glass	Vessel	Post-1820	Colorless pressed glass fragments, which include handle and body portions; fragments have geometric designs with triangle and circle patterns, and a visible mold seam on the handle
18	T-64, Str Ie, mixed trash layer, ~39 cmbs		2.5	Glass	Bottle	Euro-American; post-1910	Colorless lip to neck fragment with a small mouth external thread finish, machine-made (BLM/SHA 2014)
19	T-64, Str Ie, mixed trash layer, ~39 cmbs			Shell	Ornament		Fragment of an etched/carved red scallop shell with leaf and floral designs
20	T-64, Str IV, ~90 cmbs	9.0	2.8 x 2.1	Basalt	Whetstone		Stone wedge, a possible tool sharpener/whetstone
21	T-64, Str IIa, 60 cmbs			Glass	Bottle	American; 1902–1920s	Colorless bottle glass, base fragment with the “IPGCO” (Illinois Pacific Glass Company emblem) and “5” on base
22	T-64, Str IIa, 60 cmbs	3.5	2.8	Ceramic	Insulator	1890–1930	Broken household porcelain insulator, white, solid knob design (Myers 2010)

Acc. #	Test Excavation #	L/H (cm)	Dia. (cm)	Material	Type	Origin/Age	Description/Identification
23	T-64, Str IIa, 60 cmbs	5.5	4.5	Glass	Jar	Euro-American; late nineteenth to early twentieth century	Broken cylindrical white milk glass cosmetic jar, machine-made, external continuous thread finish (six fragments)
24	T-63, Str Id, mixed trash layer, ~34 cmbs		39.0	Ceramic	Plate	Euro-American; post-1880s	Rim fragment of a ironstone Hotelware plate
25	T-63, Str Id, mixed trash layer,~34 cmbs			Ceramic	Tableware	Euro-American	Salt glazed pale yellow stoneware fragment
26	T-63, Str Id, mixed trash layer,~34 cmbs		2.0	Glass	Marble	American; post-1903	Red (ox-blood) and white swirl, machine-made glass marble
27	T-63, Str Id, mixed trash layer,~34 cmbs		1.4	Fired clay	Marble	Euro-American; 1800 to 1900	Gray fired clay marble
28	T-63, Str Id, mixed trash layer,~34 cmbs		1.3	Fired clay	Marble	Euro-American; 1800–1900	Light orange fired-clay marble
29	T-63, Str Id, mixed trash layer,~34 cmbs		5.0	Glass	Bottle	American; 1900–1930s	Heel fragment of a light aqua green glass soda bottle; heel reads “PROPERTY O . . ./HONOLULU”; configuration and labelling matches machine-made bottle of City Soda Works, Honolulu; bottles shown in Millar (1988:Oahu_Pictures 39-42) have an IPC (Illinois-Pacific) mark on heel and embossed “TRADE MARK REG OCT 1923” on base, indicating embossed bottles date from 1920s–1930s

Acc. #	Test Excavation #	L/H (cm)	Dia. (cm)	Material	Type	Origin/Age	Description/Identification
30	T-63, Str Id, mixed trash layer,~34 cmbs		6.0	Glass	Bottle	American; 1920–1930s	Base fragment of a colorless glass soda bottle' reads "Rycroft" in cursive; lip type on ginger ale bottles with paper labels date from 1920s–1930s ((Millar 1988:Oahu_Picture 227–280, 373–374)
31	T-63, Str Id, mixed trash layer,~34 cmbs		2.6	Glass	Bottle	American; 1920–1930s	Colorless glass soda bottle; lip and partial neck portion machine made; possible portion of Rycroft bottle, artifact No. 30; similar to Rycroft bottles for ginger ale made in the 1920s and 1930s (Millar 1988:Oahu_Picture 227–280, 373–374)
32	T-63, Str Id, mixed trash layer,~34 cmbs	2.7	2.5	Glass	Bottle stopper	Euro-American; 1850–1950s	Colorless glass flat-head bottle stopper, typical for condiment bottles; stoppers used for bottles until 1950s (Zumwalt 1980:269)
33	T-63, Str Id, mixed trash layer,~34 cmbs			Ceramic	Bowl	Euro-American	Rim fragment of a porcelain bowl, dark green glaze on interior and exterior
34	T-63, Str Id, mixed trash layer,~~34 cmbs	5.8	2.2	Metal	Lid		Cap and shoulder portion of possible screw top metal container
35	T-64, back pile	5.4–5.6	0.6–0.8	Slate	Pencil		Two slate pencils
36	T-65, Str Id, upper fill		Base 4.2	Ceramic	Bowl		Base portion of a porcelain bowl, blue hand-painted Asian design on white background with animal figure on interior
37	T-66, Str IV, SIHP # -7429, 101 cmbs			Ceramic	Tableware	Euro-American; post-1880s	Rim fragment of a large ironstone Hotelware tableware

Acc. #	Test Excavation #	L/H (cm)	Dia. (cm)	Material	Type	Origin/Age	Description/Identification
38	T-66, Str IV, SIHP # -7429, 101 cmbs		1.6	Fired clay	Marble	Euro-American; 1800–1901	Fired-clay marble, light orange

Acc. # = Accession Number; T-# = Text Excavation Number; L/H (cm) = Length or Height in cm; Dia (cm) = Diameter in cm

Figure 310. Bone die, pre-1900 (Acc. # 1)

Figure 311. Olive glass bottle fragments (Acc. # 2), Hotelware ironstone plate, post-1880 (Acc. # 3), and Hotelware ironstone cup/mug, post-1880 (Acc. # 4)

Figure 312. 1918 copper penny (Acc. # 6), pressed glass vessel (Acc. # 7), 1870–1910 Bennington clay marble (Acc. # 8), 1910–1920 amber bottle lip and neck (Acc. # 9), and post-1917 colorless beer or soda bottle base (Acc. # 10)

Figure 313. 1840–1920 Prosser moulded button (Acc. # 11), post-1850 bone button (Acc. #s 12–13), 1880–1950s porcelain fragment with decalcomania and hand-painted leaves (Acc. # 14), porcelain dish with Asian design (Acc. # 15), and post-1830 Euro-American whiteware with painted design (Acc. # 16)

Figure 314. Glass fragments and a decorated scallop shell identified within a trash concentration (Acc #s 17–19)

Figure 315. Wedge-shaped whetstone, sharpening scars on ventral side (right photograph) (Acc. # 20)

Figure 316. Colorless bottle glass, base fragment with the “IPGCO” (Illinois Pacific Glass Company) emblem and “5” on base (Acc. # 21)

Figure 317. Ceramic household insulator, used between 1890-1930 (Acc. # 22), and fragments of milk glass cosmetic jar (Acc. # 23)

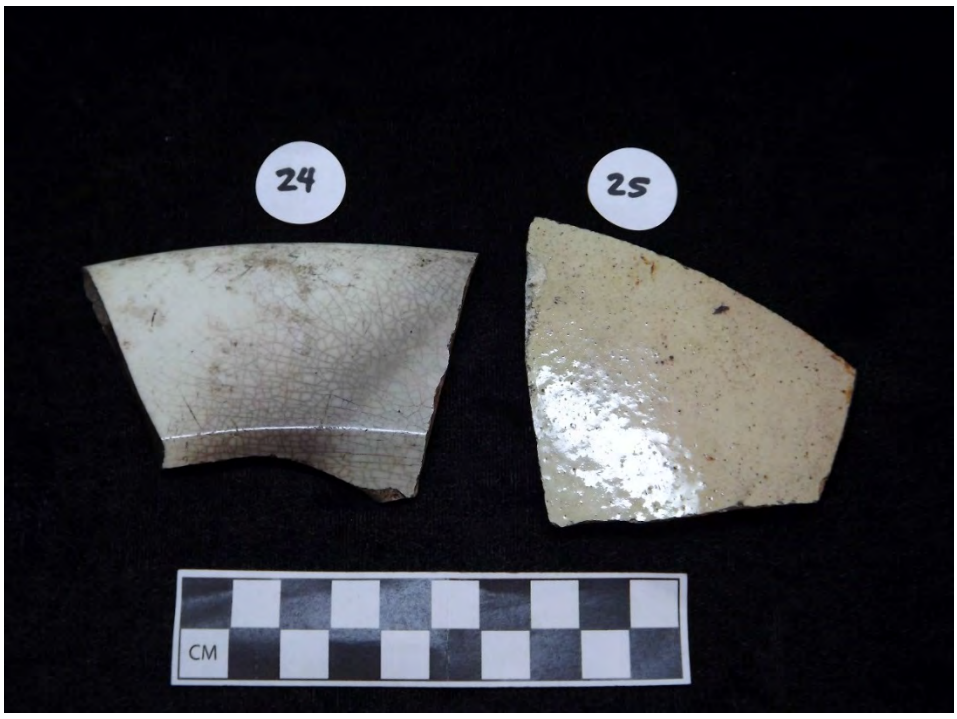

Figure 318. Hotelware ironstone plate rim fragment made after 1880 (Acc. # 24) and salt-glazed stoneware fragment (Acc. # 25)

Figure 319. Machine-made glass marble made after 1902 (Acc. # 26) and two clay marbles, probably made from 1800–1920 (Acc. # 27–28)

Figure 320. Bottle heel, probably from City Soda Works, Honolulu, made 1900–1930 (Acc. # 29); bottle heel fragment for Rycroft soda company, 1920–1930s (Acc. # 30), soda bottle lip (Acc. # 31) and stopper (Acc. # 32)

Figure 321. Dark green glazed porcelain tableware fragment and metal lid (Acc. #s 33 and 34)

Figure 322. Slate pencil fragments (Acc. # 35)

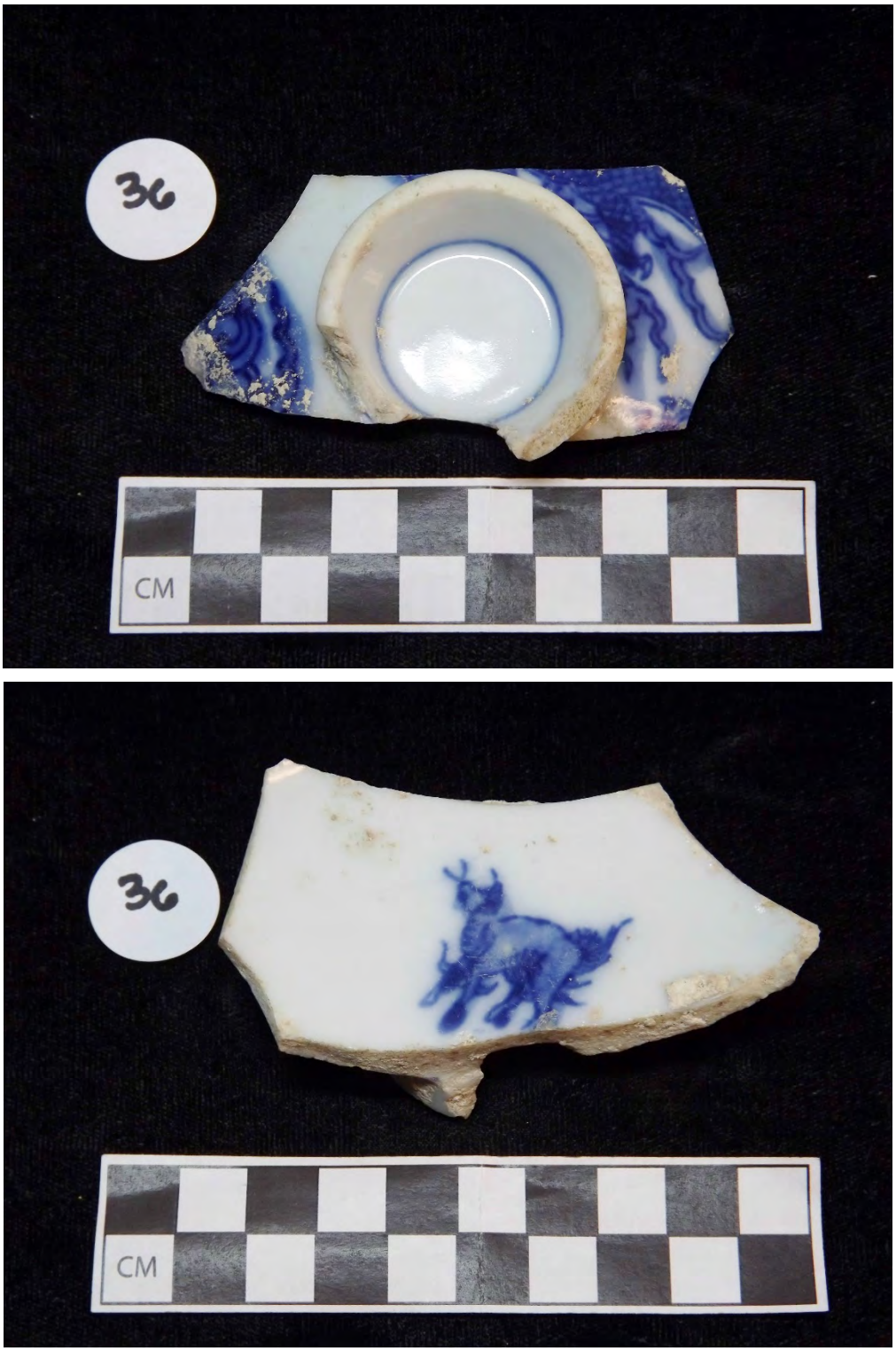

Figure 323. Asian porcelain bowl, exterior (upper photograph) and interior (lower photograph) (Acc. # 36)

Figure 324. Ironstone Hotelware rim fragment made after 1880 (Acc. # 37) and clay marble, probably made between 1800-1920

to lip, usually using a two-piece cup mold. The two side seams extend up to and over the lip of the bottle; however, the lip seams could later be erased by fire-polishing (BLM/SHA 2014_Bottle Dating_Machine-Made Bottles).

Seven of the glass bottles found were definitely machine-made and thus post-date 1905. Four of these artifacts are fragments of soda bottles with some embossed labeling suggesting they were distributed by O‘ahu bottlers. None of the bottle fragments match any of the pictures in Elliott and Gould’s comprehensive book on Hawaiian mold-blown bottles. Nevertheless, the embossed labeled fragments do match several bottles in Jim Millar’s book on machine-made soda bottles, although the latter book is not as well researched or as comprehensive. One heel fragment with the embossing “Property of Honolulu” matches several bottles shown in Millar’s description (Millar 1988:Oahu_Pictures 39-42) for the City Soda Works of Honolulu, which used machine-made embossed soda bottles from at least 1927 into the 1930s. One base fragment is embossed “Rycroft.” Walter Rycroft established the Fountain Mineral and Soda Works in 1900 and absorbed other businesses (the Arctic Soda Works and the Consolidated Soda Works) in the 1910s (Nellist 1925). The company used mold-blown bottles until at least 1917 (Elliott and Gould 1988:94-95), and then machine-made embossed bottles into the 1930s. One lip fragment and one heel fragment are similar to bottles used by Rycroft for Canada Dry Ginger Ale with paper labels dating from the 1920s and 1930s (Millar 1988:Oahu_Pictures # 227, 280, 373–374). One aqua heel fragment was embossed with letters used by the Honolulu Brewing Company, which sold beer bottles but also sold some soda bottles (Elliott and Gould 198:188-189). This bottle fragment is probably from a post-1908 machine-made bottle as the labeling does not match the mold-blown bottles shown in Elliott and Gould (1988:188−189). One additional probable soda bottle does not have the name of the bottler but does have the embossed name of the glass manufacturer. On the base the letters “IPGCO” are embossed for the Illinois Pacific Glass Company, which used this mark from 1902–1920 (BLM/SHA 2014_Glassmaking_Maker’s Marks). Thus all of the dated bottles indicate a ca. 1910-1940 time period for the deposit.

5.1.1.2 Historic Ceramics

Ceramic vessels were analyzed for basic qualities such as shape, paste, color, and designs. Shapes are designated as “flatware” (e.g., plates, shallow saucers) or “hollowware” (e.g., bowls, cups). When the fragment was too small to determine the general shape, the item was listed as “tableware” or “unknown.” The Florida Museum of Natural History (2014) maintains an Internet site with a visual guide to historic ceramics. The website was used as the basis for attribute descriptions for paste, ware, background color, glaze, decoration, design motif, and rim motif. Their ceramic identification site divides paste type into “earthenwares,” “stonewares,” and “porcelains.”

The majority of the Euro-American ceramics found are ironstone fragments, a type of refined earthenware introduced in 1820. A durable type of ironstone called Hotelware became popular after 1880 in Europe and American (Lebo 1997:Appendix G:3), and four of the tablewares (Acc. # 3, # 4, # 24, and # 37) from Block M are composed of this type of ceramic. These wares are sometimes molded but have little other decoration. Other Euro-American artifacts consisted of a dark green glazed bowl rim, a salt-glazed stoneware fragment, and a small whiteware rim with a painted floral design.

Two of the small porcelain fragments have an “Asian” design (Acc. # 14 and # 15) of painted leaves. Although the decorations are “Asian” they may have been made in Europe or America. One Asian design was made by a decal (decalcomania), a floral design that was common from the 1880s to the 1950s (Lebo 1997:G-7). The third porcelain tableware is a large bowl with blue painted designs of animals on both the interior and exterior sides (Acc. # 36; see Figure 323). It has a high footring typical for Asian dishes and was probably exported from Japan or China. The Block M collection did not contain any of the Chinese hand-painted rice bowls in such designs called “Bamboo” and “Sweet Pea” and “Four Flowers,” common in nineteenth century overseas Chinese sites. The Block M collection also did not include any Japanese “Dashed Line” transfer print ceramics (Costello and Maniery 1988; Lister and Lister 1989), which were exported to the United States from Japan from 1870 to the 1920s (Ross 2012:5).

5.1.1.3 Marbles

Five marbles were collected from the Block M excavations. Three are small fired-clay marbles, one is a larger fired-clay marble called a Bennington, and one is a machine-made glass marble with a dark red (ox-blood) swirl design.

Clay marbles were made in Germany and the United States, however, the Germans dominated the marble business in the nineteenth century. They exported fired clay, china, and crockery marbles mainly from 1800 to 1920. One large marble from Block B is a Bennington clay marble, a type of fired clay marble with a salt glaze imported from Germany. These marbles often have small spots that are unglazed where one marble was touching another during the firing process (Block 1999:67). The peak for Bennington marbles began in the 1880s to 1890s (Carskadden et al. 1985:90). The Germans also made glass marbles blown with a blow pipe. These marbles had one or more flat pontil scars on the round surface of the marble where the blowpipe had been removed. In 1846, a German invented marble scissors with a blade to cut off a section from a glass rod and a cup to help shape the glass into a ball (Block 1999:13). These led to much cheaper glass marbles and the domination of Germany in their production.

Certain innovations in the marble business led to the decline of imported marbles and the dominance of U.S. manufacturers in marble making. Although clay marbles had been made since antiquity, they became inexpensive in 1884 when Samuel C. Dyke of Akron, Ohio invented a machine to mass-produce clay marbles (American Toy Marble Museum 2014). The first automatic glass marble-making machine was patented by M.F. Christenson of Akron, Ohio in 1903 (Block 1999:82). The marbles were cheaper and perfectly round, without the flat pontil scar of handmade marbles. Other U.S. manufacturers also began to produce machine-made marbles. From the beginning of World War I, the U.S. supplanted the Germans as the premier marble makers due to their mass-production innovations, the cut-off of German imports during World War II, and higher tariffs placed on all imported goods in the 1920s (Block 1999:13).

Clay marbles were made in both the United States and in Germany from 1800 onwards, so the origin and date of the three small plain clay marbles from Block M cannot be determined. The Bennington clay marble was imported from Germany, probably between 1840 and 1920. The machine-made glass marble was made sometime after 1903.

5.1.1.4 Miscellaneous Artifacts

Three buttons, two bone and one ceramic, were collected (see Figure 313). The bone buttons had four regularly spaced drilled holes and appear to be machine-made. Bone buttons were common artifacts of the historic period. Four-holed bone buttons with drilled holes were common after 1790 (Hinks 1995:67-68; Prosser 1970:58). Bone buttons before 1850 were made by hand; after 1850 they were machine made. All bone buttons generally declined in popularity after 1850 due to the availability of other materials such as horn, ivory, glass, and ceramics and by the end of the nineteenth century they were rare. Porcelain buttons were first made in the eighteenth century. In 1840 Richard Prosser patented the dry porcelain mold where clays, flint, and feldspar are ground into a powder and compressed in a mold to form a button. These buttons have small indentations near the center that are marks made by the molds. These “Prosser Buttons” were made into the 1950s but were most popular before the 1920s (Scanlan and Redmond 2012:12; Venovcevs 2013:2-5).

One large wedge-shaped stone artifact is probably an historic whetstone for sharpening metal tools (see Figure 315). It has thin striations running parallel to the length of the blade, from sharpening large tools such as ax heads, and some smaller diagonal striations, scars left from sharpening smaller tools such as knives. Although there are some traditional Hawaiian stones for sharpening and polishing stone tools, these are usually irregular-shaped to oval and often of a rough scoriaceious basalt (Brigham 1902:Plate XXXV), not wedge-shaped with a smooth surface such as the Block M stone.

One bone die was collected from Block M (see Figure 310). Dice made of bone were generally supplanted by resin or plastic dice by the late nineteenth century (Spude 202). A ceramic knob-type insulator for household use was collected from Block M (see Figure 317). Porcelain knob and tube wiring in households was generally used between 1890 and 1930 (Myers 2010:33). A 1918 copper penny, a metal can lid, five rusted nails, a shell ornament, and two slate pencil fragments were also collected from the Block M excavations (see Figure 312 and Figure 322). The introduction of slate pencils to the Hawaiian Islands is usually accredited to the Protestant missionaries, who began to set up schools around the Islands in 1825 (Kirch 1992:181)

5.1.1.5 Summary of Historic Artifacts

The Block M collection generally consists of small fragments, with few complete bottles, ceramic dishes, or other large historic artifacts. There are no definite free-blown bottles (pre-1850) or mold-blown (pre-1920) bottles. All of the datable bottles are machine-made and date from the 1910s to the 1930s or 1940s. The ceramics are also typical for the early to mid-twentieth century. Most of the Euro-American wares are Hotelware ironstones, made after the 1880s. There are none of the Chinese painted ware and Japanese transfer print wares typical for nineteenth century deposits in overseas Asian settlements. Some of the artifacts are not common twentieth century artifacts, such as the bone die, bone buttons, clay marbles, and slate pencils. Although not common, these were still manufactured and used into the twentieth century. Other artifacts firmly place the deposit in the early twentieth century, such as the 1918 penny, the ceramic knob insulator (1890–1930), and several soda bottles. In all, the material probably represents household trash transported to Kaka‘ako for disposal.

5.2 Faunal Analysis

Vertebrate remains were documented within ten test excavations—T-4, T-5, T-23, T-25, T-26, T-63, T-64, T-65, and T-66 (Table 72). Test Excavation 64 contained the most varied species.

Within T-4, isolated irregular bone fragments of *Canis lupus familiaris* (dog) were identified within the buried A horizon (Stratum IVa) (SIHP # -7429). There was no evidence of butchering. A glass fragment and marine mollusk shells were also documented within Stratum IVa, which indicate an historic context for the faunal remains.

Within T-5, a *Bos taurus* (cow) foot bone and cf. *Sus scrofa* (pig) irregular bone fragments were identified within fill material (Stratum Ic). The cow and pig bones were cut with a metal saw blade. Cut marks (kerf) and striations visible along the cross-section were consistent with blades used in commercial butcher shops. Within the same test excavation, *Bos taurus*, *Canis lupus familiaris*, and Osteichthyes (fish) remains were also documented within Stratum IIIb (SIHP # -7429), a historic sand fill sediment. An unmodified cow molar and foot bone, and rib and long bone fragments were identified. The cow rib and long bone fragments were cut with a metal saw blade. Cut marks (kerf) and striations visible along the cross-section were consistent with blades used in commercial butcher shops. The dog and fish vertebrae fragments did not exhibit evidence of butchering. Based on the presence of historically introduced cow and the cut marks produced by a metal saw blade used in a commercial butcher shop, all faunal remains were deposited in the historic period.

Within T-23, a proximal *Equus ferus caballus* (horse) humerus cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops) along with a *Canis lupus familiaris* atlas vertebra fragment, and Osteichthyes (fish) remains were documented within Stratum IIa, crushed coral fill material associated with land reclamation. The horse humerus was the only modified bone within Stratum IIa. Also within T-23, a single *Canis lupus familiaris* long bone condyle and phalanx fragment and Osteichthyes remains were documented within Stratum III (SIHP # -7429), historic sand fill sediment. The faunal remains within Stratum III did not exhibit evidence of butchering. Based on the presence of historically introduced horse and the cut marks produced by a metal saw blade used in a commercial butcher shop, all faunal remains were deposited in the historic period.

Within T-25, *Bos taurus* long bone fragments cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops) were identified within Jaucus sand (Stratum IVb). Heavily weathered non-human mammalian long bone fragments were also documented at the interface of Stratum IVa (buried A horizon) and Stratum IVb (Jaucus sand layer). Based on the presence of historically introduced cow and the cut marks produced by a metal saw blade used in a commercial butcher shop, all faunal remains were deposited in the historic period.

Within T-26, isolated irregular bone and phalanx fragments of *Canis lupus familiaris* were identified within a historic fill used prior to land reclamation efforts (Stratum III). The dog bones do not exhibit evidence of butchering. Based on the presence of historic introduced fill, the dog remains were deposited in the historic period.

Table 72. Block M Vertebrate Faunal Remains

Test Excavation	Stratum	Scientific name	Common name	Weight (g)	Comments
T-4	IVa	*Canis lupus familiaris*	Dog	0.1	Irregular bone fragments
T-5	Utility fill	cf. *Sus scrofa*	Pig	1.4	Long bone fragments cut with a metal saw blade
T-5	Ic	*Bos taurus*	Cow	60.3	Foot bone; rib fragment cut with a metal saw blade
T-5	IIIb	Osteichthyes	Fish	7.3	Irregular fragmens
T-5	IIIb	*Canis lupus familiaris*	Dog	0.1	Lumbar vertebra
T-5	IIIb	*Bos taurus*	Cow	17.6	Rib and long bone fragments cut with a metal saw blade
T-5	IIIb	*Bos taurus*	Cow	4.8	Molar
T-23	IIa	Osteichthyes	Fish	0.5	Irregular fragments
T-23	IIa	*Canis lupus familiaris*	Dog	8.6	Atlas vertebra fragment
T-23	IIa	*Equus ferus caballus*	Horse	276.2	Proximal humerus cut with a metal saw blade
T-23	III	Osteichthyes	Fish	1.9	Irregular fragments
T-23	III	*Canis lupus familiaris*	Dog	8.6	Condyle and phalanx fragments
T-25	Spoil pile/IVb	*Bos taurus*	Cow	7.1	Long bone fragments cut with a metal saw blade
T-25	Iva/IVb	*Bos taurus*	Cow	1.9	Heavily weathered; cut with a metal saw blade
T-26	III	*Canis lupus familiaris*	Dog	0.8	Irregular bone and phalanx fragment
T-63	Ib	*Bos taurus*	Cow	4.2	Rib fragment cut with a metal saw blade
T-63	Mixed trash fill	*Sus scrofa*	Pig	48.6	Burned tibiotarsal fragments; ribs cut with a metal saw blade
T-63	Mixed trash fill	*Bos taurus*	Cow	0.1	Lumbar vertebra
T-63	IIa/IIb	*Canis lupus familiaris*	Dog	10.7	Right proximal ulna fragment and rib fragment
T-63	IIa	*Canis lupus familiaris*	Dog	6.2	Metacarpal fragments and ulna
T-63	IIb	*Equus ferus caballus*	Horse	33.9	Left patella
T-63	Spoil pile/ Ib	*Canis lupus familiaris*	Dog	0.1	Phalanx
T-63	Spoil pile/ Ib	*Canis lupus familiaris*	Dog	6.9	Long bone fragments
T-63	Spoil pile/ Ib	*Sus scrofa*	Pig	1.1	Rib fragment cut with a metal saw blade
T-63	Spoil pile/ III	*Canis lupus familiaris*	Dog	22.9	Left mandible fragment, maxilla fragment, cranial fragment, molars, premolars, and proximal rib fragment
T-64	Ib	*Bos taurus*	Cow	58.2	Rib fragments; long bone and lumbar vertebra cut with a metal saw blade

Test Excavation	Stratum	Scientific name	Common name	Weight (g)	Comments
T-64	IIa	*Bos taurus*	Cow	21.1	Rib fragment cut with a metal saw blade
T-64	IVb	cf. *Sus scrofa*	Pig	2.1	Rib fragment cut with a metal saw blade
T-64	Trash pit	*Bos taurus*	Cow	72	Irregular bone fragments; rib fragment cut with a metal saw blade
T-65	Spoil pile	*Bos taurus*	Cow	70.9	Long bone fragment cut with a metal saw blade
T-65	Spoil pile	*Aves*	Bird	0.8	Long bone fragment
T-65	Spoil pile	*Bos taurus*	Cow	5.6	Long bone fragment cut with a metal saw blade
T-65	III/IVa	*Canis lupus familiaris*	Dog	1.7	Modified ulna shaft; butcher cut marks on cortical bone surface; butcher marks made with a sharp implement
T-66	Ic	*Bos taurus*	Cow	23.5	Long bone fragment cut with a metal saw blade

Within T-63, *Bos taurus* long bone fragments cut with a metal saw blade (kerf and striations visible on the cross-section consistent with blades used in commercial butcher shops) were documented within recent fill (Stratum Ib) just below the asphalt. Burned tibiotarsal fragments and rib fragments cut with a metal saw blade (kerf and striations visible on the cross-section consistent with blades used in commercial butcher shops) were identified as *Sus scrofa* (pig) within a mixed fill below Stratum Ic. A *Bos taurus* lumbar vertebra fragment was also documented within the same mixed fill layer. Remains of *Canis lupus familiaris* (right proximal ulna and rib fragment) were identified between Stratum IIa, a crushed coral fill, and Stratum IIb, hydraulic fill material associated with land reclamation. The dog ulna and rib fragment were very weathered and brittle. Additionally within Stratum IIa, more *Canis lupus familiaris* remains were identified; weathered and brittle metacarpal fragments, a phalanx, and ulna fragment were documented. An isolated *Equus ferus caballus* left patella was identified within Stratum IIb as well. During excavation of T-63, unmodified *Canis lupus familiaris* remains (left manible fragment, maxilla fragment, a proximal rib fragment, cranial fragments, molars, and premolars) were documented within the spoil pile sediment associated with Stratum III, a redeposited, likely locally procured sand utilized for land modification. *Canis lupus familiaris* (phalanx and an unmodified long bone fragment) and *Sus scrofa* rib fragment cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops) were also documented within the spoil pile sediment associated with Stratum Ib. Based on the presence of historically introduced cow and the cut marks produced by a metal saw blade used in a commercial butcher shop, all faunal remains were deposited in the historic period.

Within T-64, *Bos taurus* rib fragment (unmodified), lumbar vertebra, and long bone fragments cut with a metal saw blade (kerf and striations visible on the cross-section consistent with blades used in commercial butcher shops) were documented within a recent fill (Stratum Ib) sediment. *Bos taurus* unmodified irregular bone fragments and a rib fragment cut with a metal saw blade (kerf and striations visible on the cross-section consistent with blades used in commercial butcher shops) were also identified in a historic trash layer (Stratum Ie) located beneath recent fill sediments. Within (Stratum IIa), a crushed coral/coralline sand fill associated with land

reclamation, a single *Bos taurus* rib fragment cut with a metal saw blade (kerf and striations visible on the cross-section consistent with blades used in commercial butcher shops) was identified. Stratum IVb, a natural silty sand, was the only stratum that contained cf. *Sus scrofa*. A single rib fragment cut with a metal saw blade (kerf and striations visible on the cross-section consistent with blades used in commercial butcher shops) was documented. Based on the presence of historically introduced cow and the cut marks produced by a metal saw blade used in a commercial butcher shop, all faunal remains were deposited in the historic period.

Within T-65, *Bos taurus* long bone fragments cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops) were documented and collected, along with unmodified Aves (bird) long bone fragment, from the excavation spoil pile. Additionally, a modified *Canis lupus familiaris* ulna shaft that also displayed kerf cut marks made with a sharp implement when the dog was butchered. The dog ulna was documented and collected from the interface of the pre-land reclamation historic sand fill (Stratum III, SIHP # -7429) and the buried A horizon (Stratum IVa). Based on the presence of historically introduced cow and the cut marks produced by a metal saw blade used in a commercial butcher shop, all faunal remains were deposited in the historic period.

Within T-66, *Bos taurus* long bone fragment cut with a metal saw blade (kerf and striations visible on the cross-section were consistent with blades used in commercial butcher shops) was identified within an extremely sandy loam (Stratum Ic). Cow is a historically introduced species.

5.3 Pollen Analysis

Six pollen and microcharcoal samples, believed to all represent natural wetland sediments, were taken from T-13 and T-47; two samples from T-13 and four samples from T-47 (Table 73). Sediment texture varied among samples with textures including peat, silty clay, sandy clay, and loamy sand. The goal of this analysis was to characterize the community composition of the natural wetland contemporary with each sampling stratum and to assess the role of fire at the time of sediment deposition. The six pollen and microcharcoal samples were submitted to Dr. Michael Tweiten of SkyCedar Research of Port Townsend, Washington for analysis. SkyCedar Research prepared a report, presented in Appendix B (Tweiten 2014). Portions of the report analysis are provided below.

Table 73. Pollen Sample Location and Provenience

Test Excavation #	Sample	Stratum	Depth (cmbs)
13	1	IIIa	130−133
13	2	IIIb	139–139
47	3	IVa	97–97
47	4	IVb	108−109
47	5	IVc	114 –115
47	6	IVd	126−127

5.3.1 Results

The following discussion is taken directly from Tweiten 2014:4–5:

Trench 13 [T-13]

Overall, 13 pollen types (including spores and wetland microfossils) were found in the Trench 13 and 47 sediments [Table 74 and Table 75]. The two samples from Trench 13 show a strong contrast. The lower sample (136-139 cm in [Stratum IIIb]), was dominated by Cyperaceae pollen (79.7%). The second most abundant type was Nama at 12.4% [Figure 325 and Figure 326]. This reflects a wetland vegetation consisting of Wet Coastal Sedgeland surrounded by a sparse Nama Herbland on the sandy uplands. In the upper sample (130-133 cm in [Stratum IIIa]) the sediment became a peat and the vegetation composition changed drastically. Cyperaceae pollen percentage fell to 5.4% and Nama increased to 72.4%. At the same time Fabaceae pollen increased tenfold to 20.2% [Figure 327]. These changes indicate a great reduction in the presence of the wetland vegetation coupled with increased disturbance in the sparse upland Herbland. Total pollen concentration increased tenfold in the upper sample [Stratum IIIa]. Charcoal concentrations also increased from 266,149 pieces/ml to 930,000 pieces/ml suggesting increased disturbance by fire in the surroundings and possibly a transformation of the wetland by burning. The same pattern of Cyperaceae dominance in underlying wetland samples giving way to reduced Cyperaceae pollen, increased Charcoal, increased Total Pollen concentration and increased Fabaceae pollen was observed in [adjacent] Block I of Kaka‘ako in the transformation of wetland to historical salt production pans [Block I AIS report in progress—Sroat et al. 2014]. The Trench 13 [Stratum IIIa] does not represent intact wetland vegetation but rather a highly disturbed plant community. The similarities in pollen and charcoal concentrations in the Trench 13 [Stratum IIIa] sample to the historical salt pan samples in Block I suggest that this location may have had a relationship with the historical salt production activities.

Trench 47 [T-47]

Trench 47 was consistently a natural wetland through all four sampled strata. Cyperaceae pollen percentages were high through the sequence indicating a Wet Coastal Sedgeland vegetation dominated the site. The lower two samples [Strata IVc and IVd] had higher percentages of aquatic Foraminifera shells suggesting the wetland may have been more frequently or deeply inundated during the earlier depositional periods. Charcoal concentrations increased from the lower [Strata IVc and IVd] to the upper samples [Stratum IVa and IVb] demonstrating increasing burning in the surrounding uplands in more recent sediments.

Summary & Conclusion

The most abundant types in all samples were from Herbaceous species indicating the vegetation was a matrix of herb, grass or sedge dominated community types. In all samples except Trench 13 [Strata IIIa], Cyperaceae was the dominant type indicating natural wetlands of the Wet Coastal Sedgeland vegetation type surrounded by a sparse Nama Herbland on the sandy uplands. In Trench 13 [Strata

Table 74. Pollen Types Identified from the Block M Project Area

Pollen Type	*Group*	*Common Name*	*Most Proximate Community Types*
FORAMINIFERA	Aquatic	Forams	Wetlands, pools, water
ASTERACEAE-High Spine	Herb	Sunflower family, Helianthus-type	disturbed habitats
ASTERACEAE-Low spine	Herb	Sunflower family, Ambrosia-type	disturbed habitats
CYPERACEAE	Herb	Sedge family, Kaluha, and Makaloa	Coastal Wet Sedgelands
FABACEAE	Herb	Bean family, Beach pea, nanea, Bur clover, slender mimosa	Coastal Dry Grassland, Coastal Dry Shrublands
LAMIACEAE	Herb	Mint family	naturalized species in disturbed habitats
Nama	Herb	Hinahina kahakai	Coastal Dry Herbland
POACEAE	Herb	Grass family, 'aki'aki, seashore rushgrass	Coastal Dry Grasslands, Coastal Wet Sedgelands, Coastal Dry Mixed Communities, Coastal Dry Shrublands
CHENO-AM	Shrub	`Aweoweo	Coastal Dry Shrubland
Aleurites	Tree	Kukui	Coastal Mesic Forests
Cocos nucifera	Tree	Niu, coconut	Coastal Mesic Forests
Cibotium	Spore	Hapu`u, tree ferns	Lowland Mesic Forests
Monolete-psilate	Spore	Ferns	Coastal Mesic Forests, Lowland Mesic Forests

Table 75. Numerical Values for Pollen Types within Each Sample Collected from Block M

ID	Trench	Depth	Stratum	Sediment type	FORAMINIFERA	ASTERACEAE -High spine	ASTERACEAE- Low spine	CYPERACEAE	FABACEAE	Nama	POACEAE	Chenopodiaceae-Amaranthaceae	Monolete-psilate	Other Types- < 2 grains per slide	UNIDENTIFIED	TotalSUM	TotalCONC	CHARCOAL
1	13	130-133	IIIa	peat	0	0	1.5	5.4	20.2	72.4	0	0.5	0		0.5	203	507500	930000
2	13	136-139	IIIb	sandy clay	0	0.5	1.5	79.7	2	12.4	0.5	0.5	2.5	Cocos nucifera	0	202	62733	266149
3	47	97-98	IVa	loamy sand	4.5	1.3	0	71.8	1.9	10.3	4.5	3.8	0.6	LAMIACEAE, Aleurites	1.3	149	24833	109000
4	47	108-109	IVb	sandy clay	1	0	0	94.5	0.5	0	0	1.5	1	Cocos nucifera, Cibotium	2	198	16555	139047
5	47	114-115	IVc	silty clay	45.5	1	0	45	0.5	1	4	2	1		2.8	109	55612	60204
6	47	126-127	IVd	loamy sand	18.7	0	0	68.7	0	6.3	0	6.3	0		0	13	14130	6522

Numerical values for pollen types are percent of the total sum (%). Higher values are darker gray. Total sum is the total count of identified microfossils and pollen types.

Unidentified percent is relative to the sum but not included in the sum.

Total concentration and Charcoal are shown as pieces or grains /ml.

Figure 325. *Makaloa* (Cyperaceae) found within Coastal Wet Sedgelands

Figure 326. *Hinahina kahakai* (Nama) found within Coastal Dry Herbland

Figure 327. *Nanea* (Fabaceae) found within Coastal Dry Grassland and Coastal Dry Shrublands

> IIIa] the occurrence of reduced Cyperaceae pollen, increased Charcoal, increased Total Pollen concentration and increased Fabaceae pollen indicate a highly disturbed plant community which may have had a relationship with the historical salt production activities in the area. Charcoal concentrations increased in the upper strata of both Trenches showing the increased role of burning in the area surrounding the wetlands in more recent times. [Tweiten 2014:4–5]

5.4 Wood Taxa Analysis

One charcoal sample was obtained from T-2, SIHP # -7429 Feature 8—a fire pit feature originating from the natural sandy loam A horizon—and submitted to IARII for taxa identification. Four taxa were identified within the sample, consisting of *Aleurites moluccana* (*kukui*), *Chenopodium oahuense* (*ʻĀheahea, ʻāweoweo*), *Nototrichium* sp. (*Kuluʻī*), and *Osteomeles anthyllidifolia* (*ʻŪlei*) (Table 76) (see Appendix C for full report). The four taxa identified consisted of three native Hawaiian plants (endemic and indigenous) and one Polynesian introduced species; notably, historically introduced species were not present. Based on the absence of historic species, a sample of the short-lived *kukui* nutshell was sent for radiocarbon dating.

Table 76. Charcoal Taxa Identification from T-2, SIHP # -7429 Feature 8, Stratum IIIa, 76−83 cmbs

WIDL #	Taxa	Common /Hawaiian Name	Origin/Habit	Part	Count	Weight (g)
1405-1	*Chenopodium oahuense*	*‘Āheahea*	Endemic/shrub	Wood	5	0.90
1405-2	cf.* *Nototrichium* sp.	*Kulu‘ī*	Endemic/shrub-tree	Wood	1	0.06
1405-3	*Aleuritus moluccana*	*Kukui*	Polynesian introduction/ tree	Nutshell	1	0.10
1405-4	cf. *Osteomeles anthyllidifolia*	*‘Ūlei*	Indigenous/ shrub	Wood	1	0.05
1405-5	cf. *Aleuritus moluccana*	*Kukui*	Polynesian introduction /tree	Wood	1	0.02

* “cf.” indicates the charcoal resembles the taxon specified but its exact identity is uncertain at this time

5.5 Radiocarbon Analysis

One charcoal sample (Beta -384715) collected from SIHP # -7429 Feature 8 was sent to Beta Analytic, Inc. for radiocarbon dating using the accelerator mass spectrometry (AMS) method, and subsequently calibrated to calendar ages using the OxCal calibration program, Version 4.2, in order to better establish the age range of occupation at the subsurface cultural layer (SIHP # -7429) (see Appendix D).

Beta -384715 was collected from a fire-altered rock and charcoal concentration in Stratum IIIa (76−83 cmbs) of T-2, designated as SIHP # -7429 Feature 8, and consisted of charred *kukui* nutshell (*Aleuritus moluccana*). This sample yielded two possible date ranges, 2-sigma calibrated results (95.4 % probability), of AD 1333−1337 (0.7%) and AD 1398−1449 (94.7%) (Figure 328 and Figure 329). This date range indicates pre-Contact activity, and evidences traditional Hawaiian use of the low lying, wetland Kaka‘ako area as early as the fourteenth or early fifteenth centuries.

Sample Data	Measured Radiocarbon Age	13C / 12C Ratio	Conventional Radiocarbon Age(*)
Beta - 384715	490 +/- 30 BP	-24.3 o/oo	500 +/- 30 BP

SAMPLE : K122-T02Fe1
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1405 to 1445 (Cal BP 545 to 505)

Figure 328. Radiocarbon dating results from T-2, Stratum IIIa, SIHP # -7429, Feature 8 fire pit (Beta -384715) (Beta Analytic Inc.)

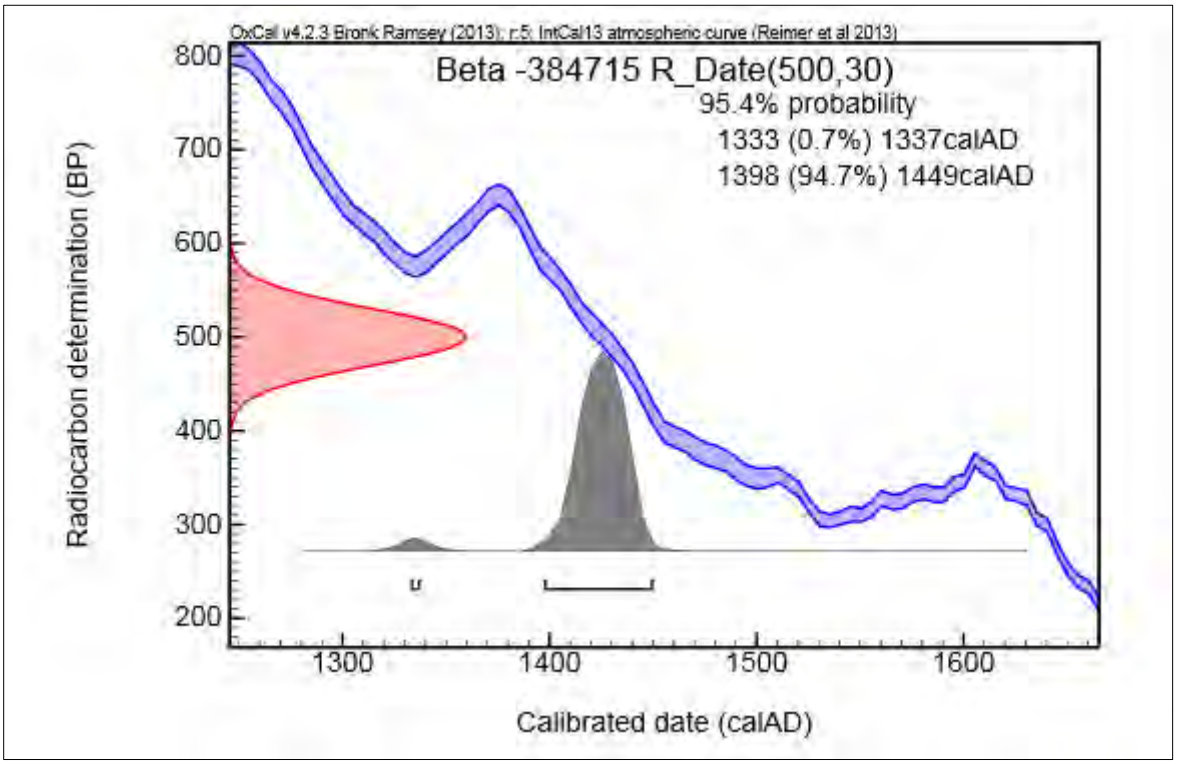

Figure 329. Calibrated (2σ) radiocarbon dating results from T-2, SIHP # -7429, Feature 8, charcoal from fire pit (Beta -384715) (OxCal 4.2)

Section 6 Historic Property Descriptions

Two historic properties were identified within the Block M project area during this AIS (Figure 330). They are summarized in Table 77 and described below in Sections 6.1 and 6.2. SIHP # 50-80-14-7429 was initially identified during previous archaeological investigations in the area (Hammatt 2013). One newly identified historic property was documented during the Block M AIS, SIHP # 50-80-14-7686.

Table 77. Sites Identified Within the Current Project Area

SIHP # 50-80-14-	Formal Type	Function
7429	Two subsurface cultural deposits	Habitation, agriculture/domestic
7686	Historic buried surfaces	Commercial infrastructure

6.1 SIHP # 50-80-14-7429

FORMAL TYPE:	Subsurface cultural deposits, human skeletal element
FUNCTION:	Habitation, agriculture/domestic
NUMBER OF FEATURES:	16 total; nine newly identified and seven previously documented
AGE:	Pre- and post-Contact
TEST EXCAVATIONS:	T-2, 4, 5, 23, 31, 43, 48, 64, 65, and 66 (current project); T-167, 168, 168A, 168B, 169, 170, and 170A (Hammatt 2013)
TAX MAP KEY:	Located between the corner of Ward Avenue and Queen Street and the corner of Queen and Kamake‘e Streets
LAND JURISDICTION:	Victoria Ward Ltd.
PREVIOUS DOCUMENTATION:	Hammatt 2013:639−654

SIHP # -7429 is a previously identified subsurface cultural deposit consisting of two discrete strata, and including 16 features. SIHP # -7429 extends from the corner of Ward Avenue and Queen Street to the corner of Queen and Kamake‘e streets (Figure 331).

SIHP # -7429 was initially identified during a previous AIS (Hammatt 2013:639−654) in the Ross Dress for Less store parking lot, near the intersection of Ward Avenue and Queen Street, approximately 200 m northwest of Block M. A buried loamy sand/silty sand A horizon, developed within Jaucas sand, was documented beneath historic fill deposits, containing both traditional Hawaiian and post-Contact cultural material, vertebrate and invertebrate faunal material, and charcoal. Historic cultural material identified within the culturally enriched A horizon (Stratum II)

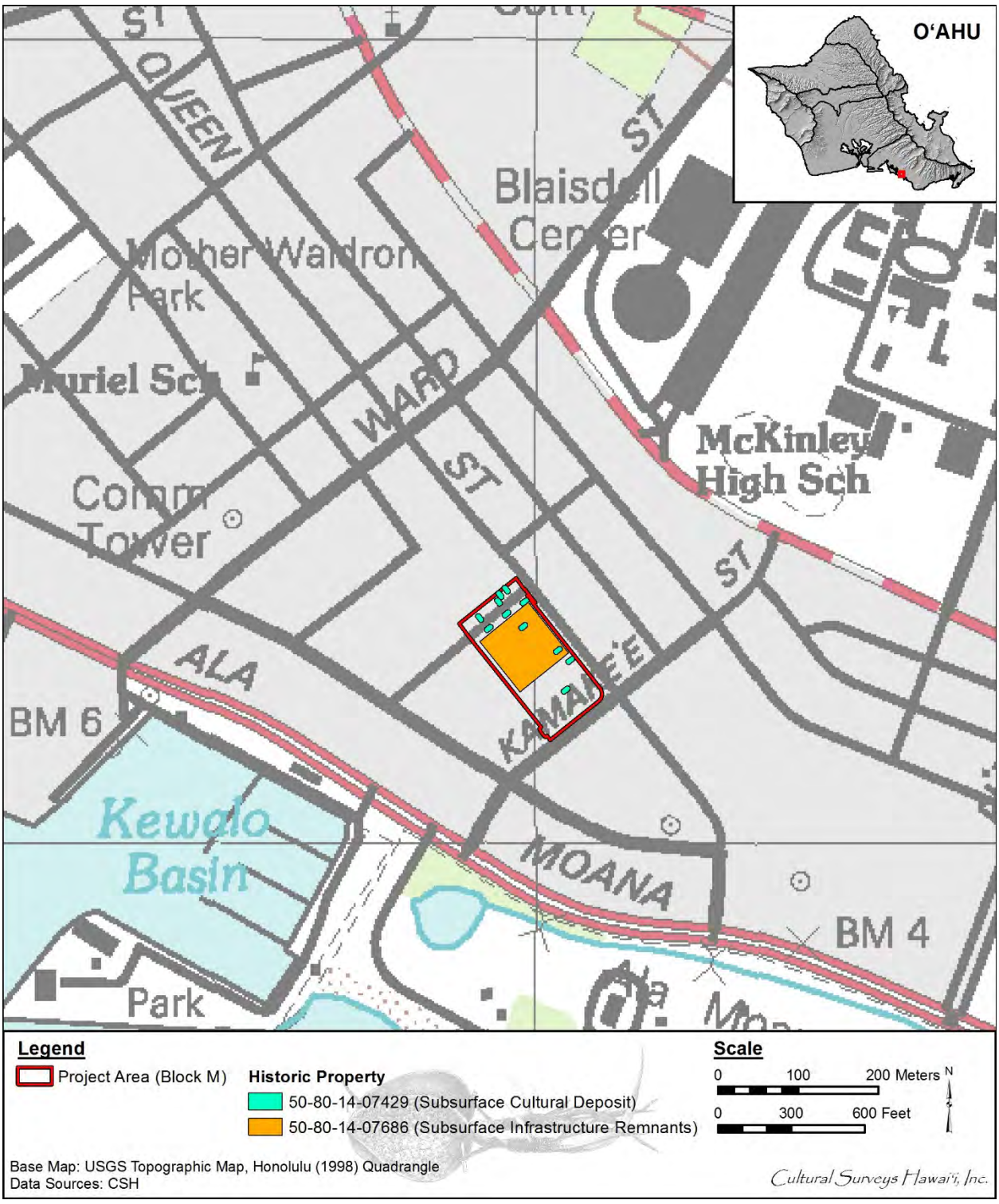

Figure 330. 1998 Honolulu USGS 7.5-minute topographic quadrangle showing the location of the two historic properties identified within the Block M project area: SIHP # 50-80-14-7429 and SIHP # 50-80-14-7686

Figure 331. Aerial photograph showing the current, extrapolated extent of SIHP # -7429 documented within the Block M project areas (Google Earth 2013)

included bottle glass, metal fragments, nails, glass and clay marbles, a blue glass bead, and earthenware fragments. Vertebrate faunal remains included both historically introduced species—*Bos taurus* (cow) and possibly *Ovis aries* (sheep) or *Felis catus* (cat)—and Polynesian introduced species—*Sus scrofa* (pig), *Canis lupus familiaris* (dog), and *Rattus* sp. (rat), as well as unidentified fish remains. Invertebrate faunal remains identified as marine midden included *Nerita picea* (the most prevalent species identified), *Tellina palatam*, *Turbo sandwicensis*, *Strombus* sp., *Isognomon* sp., *Trochus* sp., *Brachidontes crebristriatus*, *Cypraea caputserpentis*, *Cellana sandwicensis*, crustacean, and echinoidea (sea urchin).

Seven features associated with the culturally enriched A horizon were also identified in four test excavations (T-167, 168B, 170, and 170A), exhibiting both pre- and post-Contact land use (Figure 332 and Table 78). SIHP # -7429 Features 1–7 are detailed in the following section.

6.1.1 Previously Identified Features of SIHP # -7429 (Hammatt 2013)

SIHP # -7429 Feature 1 was an irregularly shaped pit identified within T-167, observed in the northwest end of the excavation, and extending beyond the excavation sidewalls. The feature was recorded at or near the base of Stratum II at 1.40 mbs, measured over 94 cm long and 87 cm wide, and terminated in Stratum III at 1.45mbs. The feature sediment matrix within the pit was silty sand with similar characteristics to Stratum II. An osseous fragment from a medium mammal was collected from during excavation. A 4-gallon bulk sediment sample collected from within the pit was screened and yielded charcoal (0.2 g), *Nerita picea* (1.9 g), possibly burned crustacean (0.7 g), naturally occurring, water-rounded marine shell (non-midden) (0.8 g), and a metal fragment (0.4 g). SIHP # -7429 Feature 1 was interpreted as a pit of indeterminate function.

SIHP # -7429 Feature 2 was an ovoid pit identified within T-167 at or near the base of Stratum II at 1.41 mbs and was intrusive into Stratum III where it terminated at 1.49 mbs. The feature measured 32 cm long and over 15 cm wide, and extended into the south sidewall. The feature sediment matrix was silty sand with similar characteristics to Stratum II. Burned osseous fragments from an unidentified medium mammal were collected during excavation. A 1.5-gallon screened bulk sediment sample was collected from SIHP #-7429 Feature 2. It contained charcoal (0.3 g), naturally occurring, water-rounded marine shell (2.8 g), rusted metal fragments (4.1 g), and fish bone (0.1 g). SIHP #-7429 Feature 2 was interpreted as a possible post mold.

SIHP # -7429 Feature 3 was a roughly rectangular pit identified within T-167 at or near the base of Stratum II at 1.32 mbs and was intrusive into Stratum III, where it terminated at 1.48 mbs. The feature measured over 95 cm long and over 64 cm wide and extended into the south and southeast sidewalls. The feature sediment matrix was silty sand with similar characteristics to Stratum II. Burned osseous fragments from an unidentified medium mammal and *Sus scrofa* (pig) were collected from the upper portion of SIHP #-7429 Feature 3 during excavation. One pig rib fragment exhibited cut marks characteristic of butchering. Two glass insulator fragments also were collected from the upper portion of the pit feature during excavation. The insulator was embossed with a “B” referring to Bushwick/Brookfield Glass Works, which was in operation from 1864-1921 (Whitten 2013). A canine tooth from a *Canis lupus familiaris* with a drilled hole through the end of the root (Acc. # 167-H-1) was discovered near the faunal remains and glass fragments. The drilled tooth is considered a traditional Hawaiian artifact and may have been part of a dog tooth necklace (*lei ‘ilio*) or leg ornament (*kupe‘e niho ‘ilio*). A 12-gallon screened bulk sediment sample

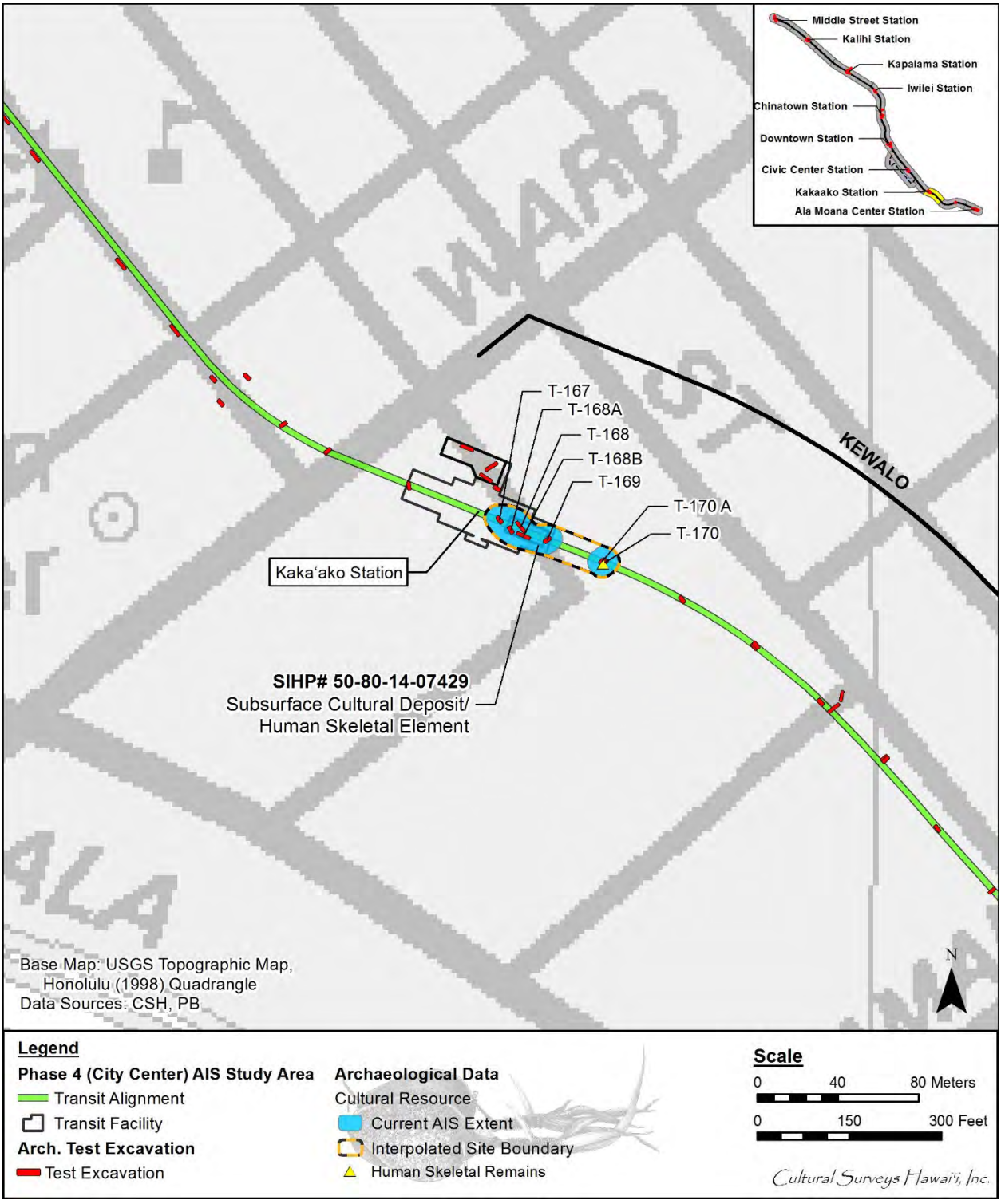

Figure 332. Figure from the Hammatt 2013 AIS investigation, showing the location and boundaries of SIHP # -7429, as defined during this initial identification and documentation (USGS 1998)

Table 78. Archaeological Features of SIHP # -7429 Identified by Hammatt 2013:639−654

Feature	Test Excavation	Depths (cmbs)	Type	Function	Contents
1	T-167	140–145	Pit	Indeterminate	*Nerita picea* shell, burned crustacean, non-cultural shell, a metal fragment, a single fragmentary medium mammal skeletal element
2	T-167	141–149	Pit	Possible posthole	Burned osseous fragments from an unidentified medium mammal, naturally occurring, water-rounded marine shell, rusted metal fragments, and fish bone
3	T-167	140–148	Pit	Indeterminate	Drilled *Canis lupus familiaris* tooth, burned osseous fragments from an unidentified medium mammal and a *Sus scrofa*, also a butchered pig rib, Bushwick/Brookfield Glass Works glass insulator (1864–1921), charcoal (native *‘ōhi‘a lehua* and conifer), shell midden, rusted metal fragments, and an unidentified fish bone
4	T-167	140–166	Pit	Possible post mold	Possible post mold
5	T-168B	150–165	Pit	Indeterminate	Charcoal (native *‘ōhi‘a lehua* and conifer), shell midden, non-cultural shell, rusted metal, *Rattus* sp., and fire-cracked rock
6	T-170	65–71	Isolated human remains	Burial	Isolated human cranial fragment identified as a left temporal portion including the mastoid process and root of the zygomatic arch; gracile mastoid process indicates possible female or young adult; no pit outline
7	T-170A	56–60	Pit	Indeterminate	Shell midden, bottle glass fragments, a fish spine, fire-cracked rock, and faunal remains from a *Canis lupus familiaris*, *Rattus* sp., and unknown medium mammal

collected from within the pit yielded charcoal (0.2 g), rusted metal fragments (4.1g), an unidentified fish bone (0.1 g), unidentified medium mammal bone (0.3 g), and marine shell midden consisting of *Nerita picea* (4.7 g), Isognomidae (1.2 g), *Isognomon* sp. (0.3 g), burned *Conus* sp. (0.9 g), *Strombus* sp. (0.3 g), Mitridae (0.3 g), crustacean (2.2 g), Echinoidea spp. (1.7 g), and *Brachidontes crebristriatus* (1.3 g). The charcoal collected from Feature 3 was submitted for wood taxa analysis that identified cf. Conifer (pine, fir), a historically introduced tree, as well as cf. *Metrosideros polymorpha* (*‘ōhi‘a lehua*), a native tree, and four unidentified species. The contents of Feature 3 indicate post-Contact influence. SIHP #-7429 Feature 3 was interpreted as a pit of indeterminate function.

SIHP # -7429 Feature 4 was a circular pit identified within the central portion of T-167, originating from the base of Stratum II at 1.54 mbs and terminating at 1.66 mbs within Stratum III. This feature measured 31 cm long and 28 cm wide and the sediment matrix was silty sand with characteristics similar to Stratum II. No bulk sample was collected and no artifacts or faunal remains were observed during the excavation of the feature. SIHP # -7429 Feature 4 was interpreted as a possible post mold.

SIHP # -7429 Feature 5 was an ovoid pit identified in the western portion of T-168B, originating from the base of Stratum II at 1.50 mbs and terminating at 1.65 mbs within Stratum III. The feature measured over 60 cm long and 30 cm wide, and extended into the south sidewall. The feature sediment matrix was loamy sand with characteristics similar to Stratum II. SIHP # -7429 Feature 5 contained a noticeable deposit of charcoal flecking. A 4-liter bulk sediment sample and a 3-gallon screened sediment sample collected from SIHP # -7429 yielded charcoal (43.2 g), various shell midden (5.4 g), various non-cultural shell (2.5 g), rusted metal (3.0 g), *Rattus* sp. bone (0.1 g), fire-cracked rock (43.1 g), and possible marine shell midden. The possible marine shell midden included crustacean (1.6 g), *Nerita picea* (1.5 g), *Isognomon* sp. (1.4 g), Echinoidea (0.2 g), *Ctena bella* (0.1 g), *Brachidontes crebristriatus* (0.1 g), and *Strombus* sp. (0.5 g). A sample of charcoal (4.2 g) was submitted for wood taxa analysis and identified as cf. *Metrosideros polymorpha* (*‘ōhi‘a lehua*) and conifer (i.e., pine, fir, or other cone-bearing variety). SIHP # -7429 Feature 5 was interpreted as a pit of indeterminate function.

SIHP # -7429 Feature 6 was a previously disturbed, isolated human cranial fragment identified in T-170 that consisted of a left temporal bone portion, including the mastoid process and the root of the zygomatic arch. The previously disturbed human cranial fragment was discovered in situ within the buried A horizon (Stratum II) near the southern end of the southeast sidewall and at 65 cmbs. A limited investigation was performed by an osteologist to identify the remains. The fracture margins of the fragment were similar in color to the adjacent bone, which indicates the temporal portion was not fractured recently. The mastoid process was notably gracile, suggesting a possible female or young adult individual. An assessment of ancestry was indeterminate due to the lack of supporting traits. SIHP # -7429 Feature 6 is interpreted as a human skeletal fragment. No additional human remains were observed.

SIHP # -7429 Feature 7 was a square-shaped stain identified in T-170A, originating within Stratum II at 0.56 mbs and terminating at 0.60 mbs near the base of Stratum II. The feature measured 0.35 m long and 0.25 m wide. The feature sediment matrix was silty sand with characteristics similar to Stratum II. A 2-liter screened bulk sediment sample yielded various shell midden (13.5 g), bottle glass fragments (0.3 g), a fish spine (0.1 g), and fire-cracked rock (25.8 g).

The shell midden was identified as *Strombus* sp. (8.5 g), *Nerita picea* (2.6 g), burned *Natica* sp. (2.0 g), burned crustacean (0.3 g), and *Isognomon* sp. (0.1 g). Faunal remains from the screened bulk sediment sample were identified as *Canis lupus familiaris*, *Rattus* sp., and an unknown medium mammal, not consistent with human. The presence of historic material indicated post-Contact components of Feature 7. SIHP # -7429 Feature 7 is interpreted as a pit of indeterminate function.

6.1.2 Block M Documentation of SIHP # 50-80-14-7429

The cultural deposits identified in the Block M project area are similar in soil color, texture, and material content to the characteristics of SIHP # -7429 documented by Hammatt (2013). While Block M is located approximately 200 m northeast from the location of SIHP # -7429 as identified by Hammatt (2013), the cultural deposits documented within Block M are in fact contiguous with SIHP # -7429 when viewed in conjunction with the AIS results from the intervening Block I project area (CSH report in progress). Both Block M and Block I documented cultural deposits and associated features similar to SIHP # -7429 and are similarly geographically and spatially located along the *makai* edge of a continuous sand dune deposit abutting the Kaka‘ako coastal wetlands. Based on cultural content, spatial contiguity, and geographical similarity, the cultural deposits of Block M and Block I are considered part of SIHP # -7429.

The Block M AIS documented SIHP # -7429 within 11 test excavations (T-2, 4, 5, 23, 31, 43, 48, and 64–66). Within Block M, two discrete cultural deposits were identified, consisting of a buried sandy loam A horizon overlain by a very thin, culturally enriched, historic sand and soil fill deposit. The overlying historic deposit was not originally identified by Hammatt (2013); however, reinspection of the field documents (i.e., photographs) from the previous AIS indicate this very thin layer was indeed present, represented as a slightly lighter colored loamy sand layer (Component 1) atop the buried A horizon (Component 2). Of the 11 Block M test excavations containing SIHP # -7429, five were exclusively associated with Component 1 (culturally enriched, historic fill), four were exclusively associated with Component 2 (culturally enriched, buried A horizon), and two test excavations were associated with both components of SIHP # -7429 (Table 79). Five test excavations also contained associated features, SIHP # -7429 Features 8–16 (Table 80 and Table 81).

SIHP # -7429 Component 1 consisted of a layer of mixed sand and soil that contained historic debris, faunal material (including a modified dog bone), shell midden, charcoal, milled wooden posts, and irrigation features. Based on its location directly below Kaka‘ako land reclamation fill deposits (crushed coral and hydraulic clay), this layer was deposited prior to the 1919–1927 Kaka‘ako land reclamation efforts. It appeared to be composed of locally procured sand and sediment, including redistributed A horizon material, most likely utilized to modify, or level, the natural topography. This sand fill layer directly overlay, and in most cases, truncated the buried natural A horizon. The soil color and texture varied from dark grayish brown to olive brown and from sandy loam to loamy sand or silty sand. Within stratigraphic descriptions, it was primarily designated as Stratum III. Component 1 of SIHP #-7429 was recorded in seven test excavations (T-5, 31, 48, 64, 65, 66, and 68) and contained four features (SIHP # -7429 Features 12, 13, 14, and 16). This layer was also observed within 16 additional test excavations within Block M; however, due to the absence of any cultural content or features in these locations, it was not considered part of the historic property.

Table 79. Test Excavations within Block M Associated with SIHP # -7429

Test Excavation	Stratum	SIHP Component	SIHP Feature #
T-2	IIIa	2	8–11
T-4	IVa	2	-
T-5	IIIa and IIIb	1	-
T-23	IVa	2	-
T-31	III	1	12
T-43	IIIa	2	-
T-48	III	1	13
T-64	III and IV	1 and 2	-
T-65	III	1	-
T-66	II, IV, V	1 and 2	14–15
T-68	IIIa	1	16

Table 80. SIHP # -7429 Culturally Enriched Strata Identified within Block M

Test Excavation	Stratum	Depth (cmbs)	Content
T-4	IVa	63−80	Charcoal flecks, faunal bone (*Canis lupus familiaris*), marine shell midden (*Tellina palatam*), and a glass fragment
T-5	IIIa−IIIb	62−85	Str IIIa: glass and ceramic fragments, and charcoal flecks; Str IIIb: glass fragments, rusted metal, and faunal bone
T-23	IVa	80−114	Charcoal, ceramic fragments, industrial slag, a six-sided wooden die, and faunal material consisting of fish and *Canis lupus familiaris* bone fragments
T-43	IIIa	47−56	Shell midden material, glass fragments, a rusted nail, and charcoal
T-64	III−IV	80−113	Str III: brick and slag; Str IV: modified wedge-shaped polished stone and faunal remains
T-65	III−IVb	64−105	Str III: modified long bone (*Canis lupus familiaris*); Str IVb: termination of milled wood post
T-66	IV	55−115	Embankments associated with SIHP # -7429 Feature 14 (*‘auwai)*

Table 81. SIHP # -7429 Archaeological Features Identified within Block M

Feature	Test Excavation	Depths (cmbs)	Type	Function	Age	Contents
8	T-2	67–95	Fire pit	Food preparation and consumption	*Cal AD 1333-1337 (0.7%); 1398−1449 (94.7%)	Charcoal, fire-altered basalt and coral cobbles, and marine midden: *Echinothrix diadema* sp. (*wana*, or sea urchin) (1.8 g), *Tellina palatam* (19.0 g), and *Turbo sandwicensis* (13.1 g)
9	T-2	65–110	Fire pit	Food preparation and consumption	-	Charcoal, fire-altered basalt and coral cobbles, and marine midden: *Tellina palatam* (1.0 g) and crustacean (0.1 g)
10	T-2	80–96	Pit	Indeterminate	-	Isognomidae
11	T-2	75–90	Pit	Indeterminate	-	None
12	T-31	75–85	Posthole	Possible fence or structural component	-	Decomposing milled wood
13	T-48	80–133	Posthole	Possible fence or structural component	-	Decomposing milled wood
14	T-66	95–138	*‘Auwai* (irrigation channel)	Possible agriculture/ domestic function	-	Dark sandy clay with freshwater snails and a layer of humus at the upper boundary
15	T-66	58–70	Pit	Indeterminate	-	None
16	T-68	50–75	*‘Auwai* (irrigation channel)	Possible agriculture/ domestic function	-	Sandy clay

* Beta -384715

SIHP # -7429 Component 2 consisted of a buried natural A horizon developed within calcareous Jaucus sand that contained both traditional Hawaiian and historic cultural deposits consisting of marine midden, charcoal, faunal material, glass and ceramic fragments, a wooden die, and miscellaneous historic debris. The cultural signature within the general A horizon was very light, but notably present. The culturally enriched A horizon (SIHP # -7429) was consistently documented below reclamation fill, locally procured historic fill, or culturally enriched, locally procured, historic fill (SIHP # -7429). The soil color and texture varied from very dark brown to dark gray or dark yellowish brown, and from sandy loam to loamy sand or silty sand. Within stratigraphic descriptions, it was primarily designated as Stratum III or IV. Component 2 of SIHP #-7429 was observed in five test excavations (T-2, 4, 23, 43, 64, and 66) and contained five features (SIHP # -7429 Features 8, 9, 10, 11, and 15). Test Excavations 64, 65, and 66 contained both components of SIHP # -7429. Nine features were associated with SIHP # -7429, originating from both component cultural deposits. SIHP # -7429 Features 9–16 consisted of the following:

SIHP # -7429 Feature 8 was a concentration of charcoal and fire-affected rock and coral identified within T-2, originating within the buried natural A horizon and extending into the underlying Jaucas sand (Figure 333 through Figure 337). The feature extended diagonally through the test excavation and was documented between 67 and 95 cmbs. It measured 86 cm long, 75 cm wide, and 15 cm thick. In addition to fire-altered material, Feature 8 contained marine midden consisting of E*chinothrix diadema* sp. (*wana*, or sea urchin) (1.8 g), *Tellina palatam* (19.0 g), and *Turbo sandwicensis* (13.1 g). A charcoal sample was collected for radiocarbon dating and yielded a date of Cal AD 1405 to 1445 (2σ) (Beta -384715), which establishes the use of this area as early as the fifteenth century. SIHP # -7429 Feature 8 is interpreted as a fire pit for the preparation and consumption of food.

SIHP # -7429 Feature 9 was a concentration of charcoal and fire-affected rock and coral identified in T-2, originating within the buried natural A horizon and extending into the underlying Jaucas sand (see Figure 334 through Figure 336). Feature 9 was documented between 65−110 cmbs and measured 40 cm in diameter and 19 cm thick. In addition to fire-altered material, Feature 9 contained marine midden consisting of *Tellina palatam* (1.0 g) and crustacean (0.1 g). SIHP # -7429 Feature 9 is interpreted as a fire pit for the preparation and consumption of food.

SIHP # -7429 Feature 10 was a circular stained pit identified in T-2, originating within the buried natural A horizon and extending into the underlying Jaucas sand (see Figure 337). Feature 10 was documented between 80–97 cmbs and measured 14 cm long, 10 cm wide, and 17 cm thick. It contained a small amount of marine midden (Isognomidae). SIHP # -7429 Feature 10 is interpreted as a pit of indeterminate function.

SIHP # -7429 Feature 11 was a stained pit identified in T-2, originating within the buried natural A horizon and extending into the underlying Jaucas sand (see Figure 335, Figure 336). Feature 11 was documented between 75−90 cmbs and measured 14 cm wide and 12 cm thick. No cultural material was observed. SIHP # -7429 Feature 11 is interpreted as a pit of indeterminate function.

SIHP # -7429 Feature 12 was a posthole that contained decomposing milled wood, identified in T-31 (Figure 338 and Figure 339). Feature 12 originated from Stratum III (historic sand fill) and terminated at the interface of Strata IVb (Jaucas sand) and V (marine sand). The feature was documented between 82−117 cmbs and measured 31 cm long, 20 cm wide, and 12 cm thick. SIHP

Figure 333. Close-up of SIHP # -7429 Feature 8, prior to excavation

Figure 334. Photograph of T-2 (*mauka* portion), showing SIHP # -7429 Features 8 (rear) and 9 (fore)

Figure 335. T-2 northwest wall, showing SIHP # -7429 Features 11, 9, and 8 (from front to back)

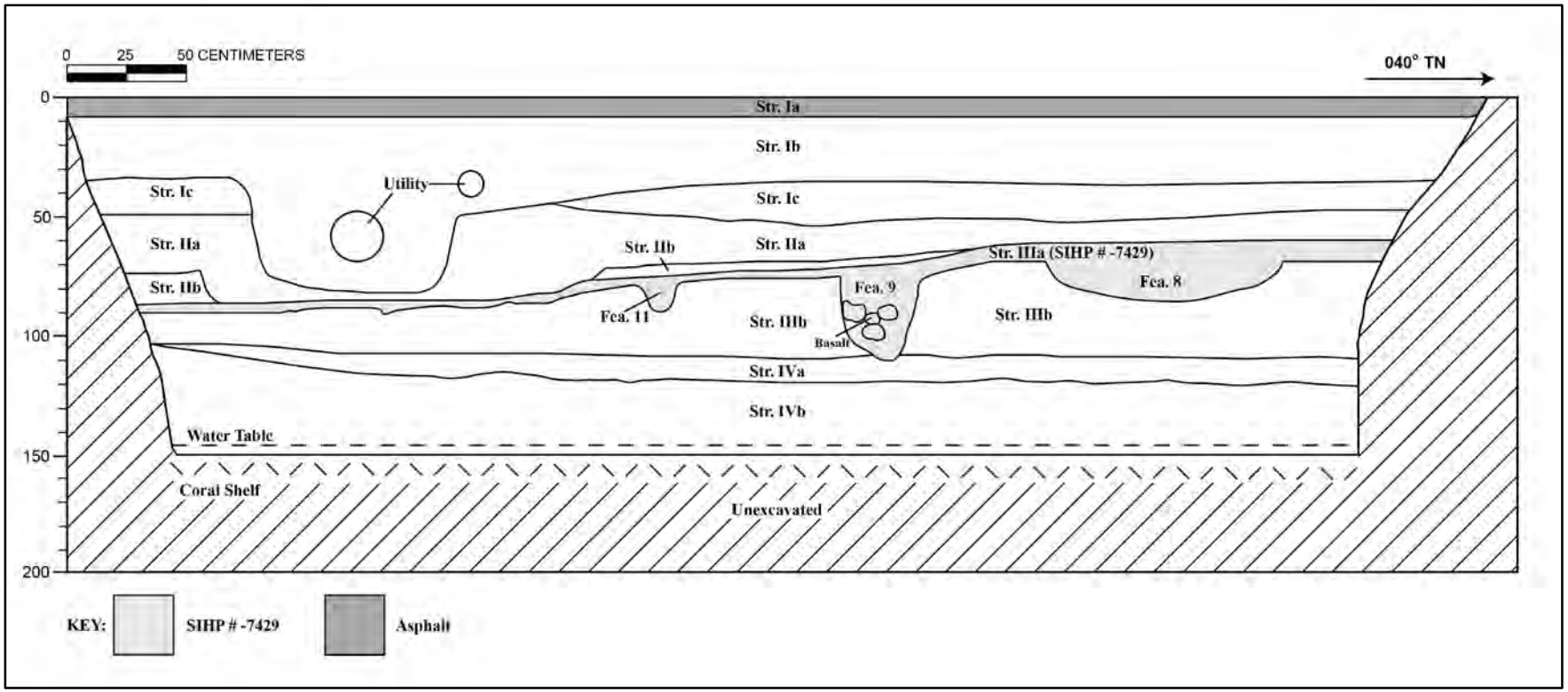

Figure 336. T-2 northwest profile, showing SIHP # -7429 Features 8, 9, and 11

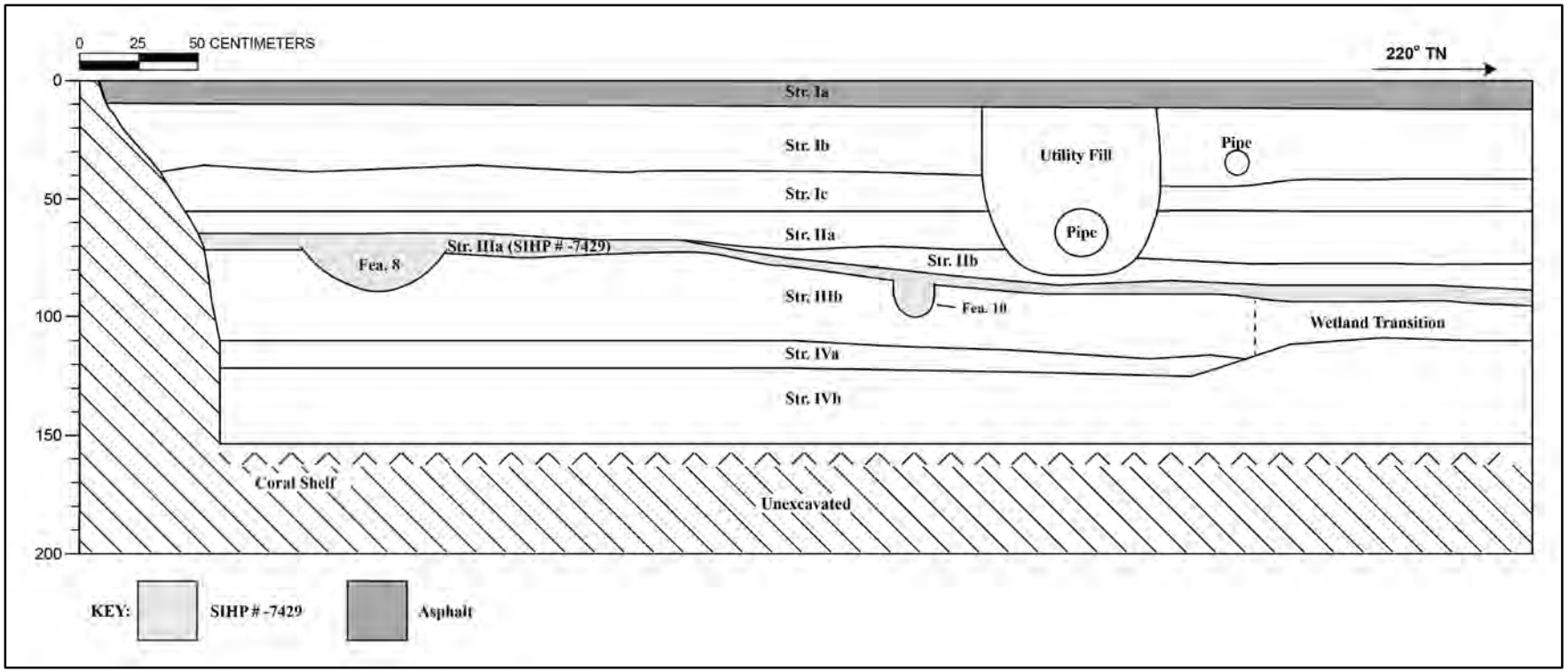

Figure 337. T-2 southeast profile, showing SIHP # -7429 Features 8 and 10

Figure 338. Photograph of T-31 southeast wall, showing SIHP # -7429 Feature 12, a posthole containing a historic milled wood post, originating from Stratum III (SIHP # -7429)

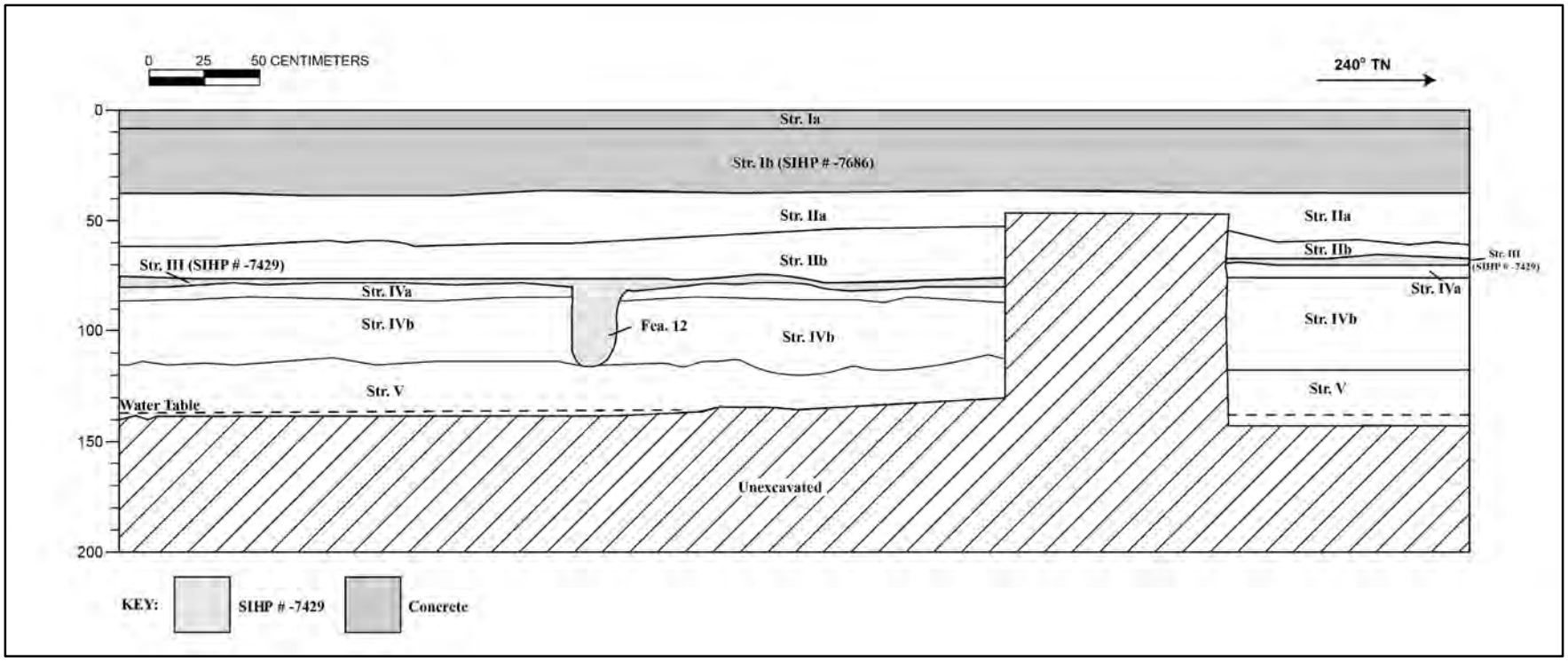

Figure 339. T-31 southeast profile, showing SIHP # -7429 Feature 12

-7429 Feature 12 is interpreted as a historic posthole that may have been part of a fence line or some structural component.

SIHP # -7429 Feature 13 was a posthole that contained decomposing milled wood, identified in T-48 (Figure 340). Feature 13 originated from Stratum III (historic sand fill) and terminated at the coral shelf. The feature was documented between 80−133 cmbs and measured 50 cm long and 25 cm wide. SIHP # -7429 Feature 13 is interpreted as a historic posthole that may have been part of a fence line or some structural component.

SIHP # -7429 Feature 14 was a deep, narrow channel identified in T-66, associated with the locally procured, historic sand fill layer (Figure 341 through Figure 343). Feature 14 extended *mauka-makai* through TE 66, truncated the buried natural A horizon (Stratum VIa), and terminated in Stratum VII. The feature was documented between 95−138 cmbs and measured 100 cm long by 48 cm wide. Feature 14 contained dark sandy clay and freshwater snails with a layer of humus at the upper boundary. SIHP # -7429 Feature 14 is interpreted as a man-made irrigation feature (*‘auwai*) which may have been used for either agricultural or domestic purposes. No cultural materials were observed within the feature contents.

SIHP # -7429 Feature 15 was a shallow circular pit stain identified in T-66, originating within the buried natural A horizon and extending into the underlying Jaucas sand (Figure 344). Feature 15 was documented between 58−70 and measured 35 cm wide and 10 cm thick. No cultural material was observed. SIHP # -7429 Feature 15 is interpreted as a pit of indeterminate function.

SIHP # -7429 Feature 16 was a shallow, rectangular pit identified in T-68, associated with the locally procured, historic sand fill layer (Figure 345). Feature 16 truncated the locally procured, historic fill layer (Stratum IIIa) and the buried, natural A horizon (Stratum IVa) and terminated in Jaucas sand (Stratum IVb). It was documented between 50−75 cmbs. This feature measured 120 cm long and 30 cm deep with a 5−8 cm layer of sandy clay lining the base of the channel. SIHP # -7429 Feature 16 is interpreted as a man-made irrigation feature (*‘auwai*) which may have been used for either agricultural or domestic purposes. No cultural materials were observed within the feature contents.

In summary, SIHP # -7429 consists of two buried, culturally enriched layers and 16 associated features. These cultural deposits document cultural activity along the *makai* edge of a sand dune deposit which abuts the Kaka‘ako coastal wetlands. The Block M AIS results have extended the boundaries of SIHP # -7429, originally documented by Hammatt (2013) at the corner of Ward and Queen streets, to the corner of Queen and Kamake‘e streets. The intervening area between Block M and Ward Avenue consists of the Block I project area, the AIS results of which also documented continuous cultural deposits associated with SIHP # -7429 along this sand dune-wetland edge (CSH report in progress). The two cultural deposits consist of a historic fill deposit, comprised of locally procured sand and soil, and the underlying natural sandy loam A horizon. Cultural content within the A horizon cultural layer and associated features indicate a prolonged period of usage, or at least periodic habitation, ranging from as early as the fourteenth to fifteenth centuries to the historic period. Cultural content within the overlying historic fill layer and associated features indicate this land modification layer served as a stable living surface for a period of time, as evidenced by an accumulation of historic debris and the presence of posthole and water channel features.

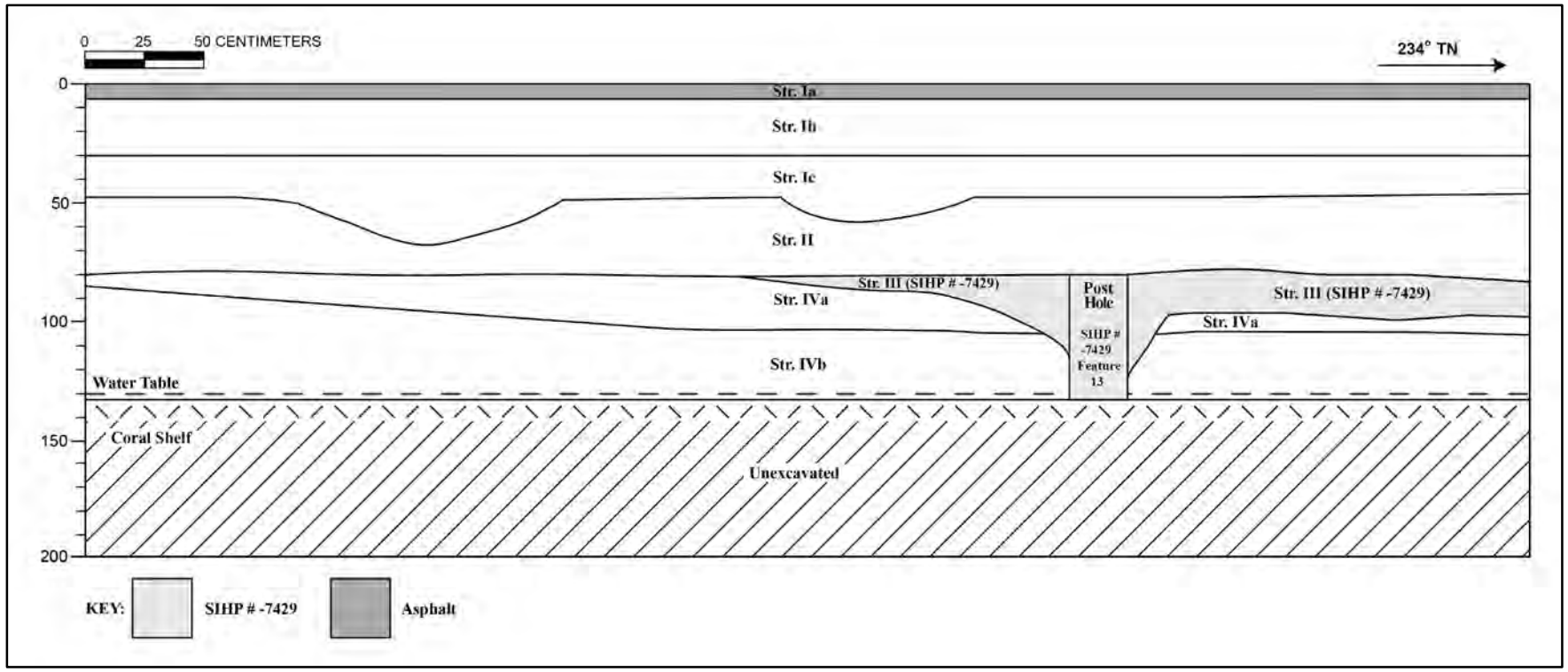

Figure 340. T-48 southwest profile, showing SIHP # -7429 Feature 13

Figure 341. T-66 northeast wall, showing SIHP # -7429 Feature 14 (*‘auwai*) at the south end

Figure 342. Close-up of SIHP # -7429 Feature 14

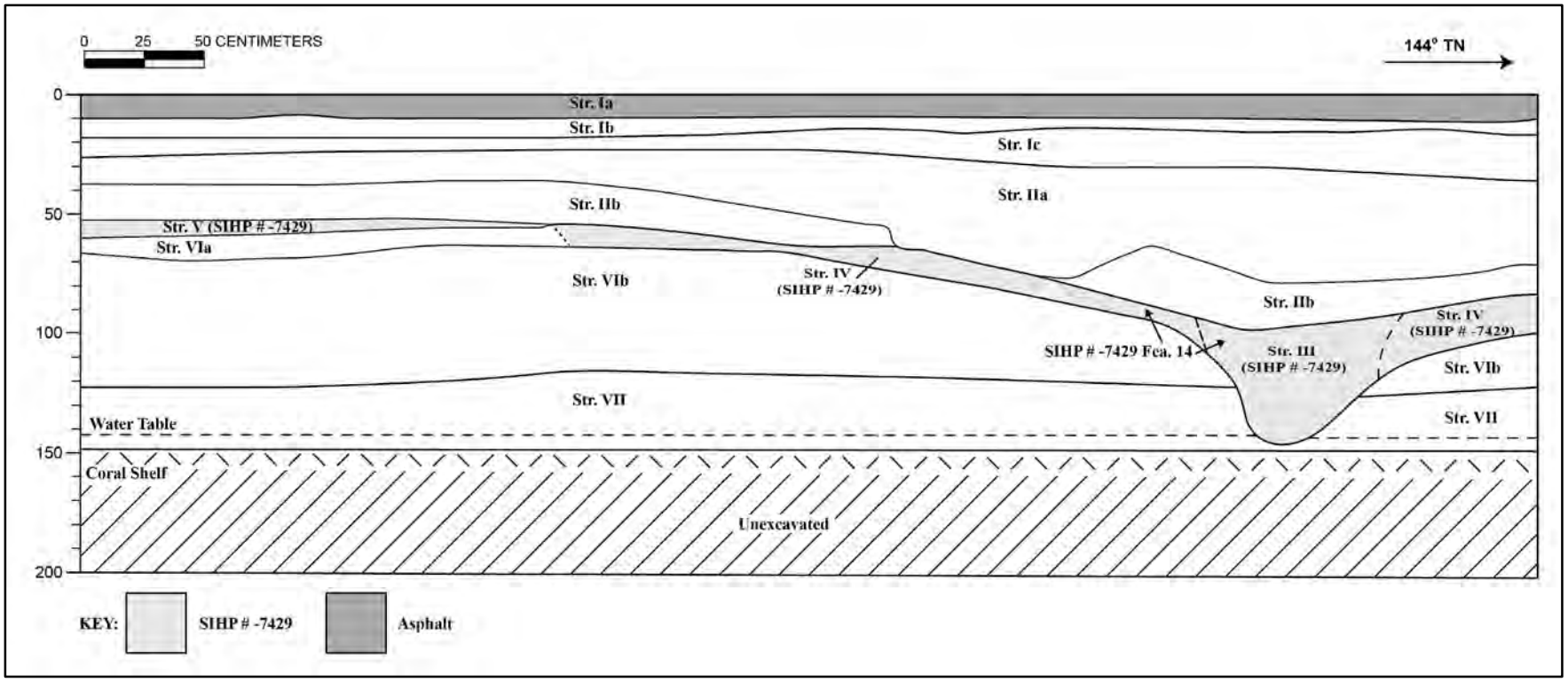

Figure 343. T-66 northeast profile, showing SIHP # -7429 Feature 14, *‘auwai*

Figure 344. Close-up of SIHP # -7429 Feature 15, pit feature

Figure 345. Close-up of SIHP # -7429 Feature 16, man-made irrigation feature

SIHP # -7429 was previously assessed by Hammatt (2013) as significant under Hawai‘i state historic property significance criterion “d” (have yielded, or may be likely to yield information important in prehistory or history) and “e” (historic property has cultural significance to an ethic group, including, but not limited to, religious structures, burials, and traditional cultural properties), pursuant to HAR §13-284-6. The results of this investigation support this previous significance assessment. SIHP # 50-80-14-7429 has provided, and can potentially provide, additional information on late pre- to early post-Contact habitation, historic land use, and pre- and post-Contact burial practices and distribution within Kaka‘ako. Based on the potential for SIHP # -7429 to provide further additional information, an archaeological monitoring program is believed to be warranted.

6.2 SIHP # 50-80-14-7686

FORMAL TYPE:	Historic buried surfaces
FUNCTION:	Commercial infrastructure
NUMBER OF FEATURES:	N/A
AGE:	Mid-twentieth century
TEST EXCAVATIONS:	T-7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 23, 27, 28, 29, 31, 32, 33, 34, and 35
TAX MAP KEY:	[1] 2-3-002:001 (portion)
LAND JURISDICTION:	Private, Victoria Ward, Limited (VWL)
PREVIOUS DOCUMENTATION:	None

SIHP # -7686 consists of buried historic commercial infrastructure remnants associated with development during the mid- to late twentieth century. This historic property is distributed beneath the current commercial building within the central portion of the Block M project area. These structural remnants are all located immediately beneath the current commercial building concrete floor and associated base course layer. SIHP # -7686 includes 26 component buried surfaces that consist of two concrete footings, two buried asphalt surfaces with associated base course layers, and 22 concrete surfaces, 13 of which have associated base course layers (Figure 346 and Table 82). Based on photographic and stratigraphic data, potential continuity among several subsurface layers was observed; and while some apparent contiguous historic surfaces have an associated base course, others do not. The buried concrete surfaces (both with and without associated base course layers) were all observed overlying crushed coral fill and hydraulic fill associated with the 1919–1927 Kaka‘ako land reclamation.

From the late nineteenth through the late twentieth centuries, the Block M project area underwent several landscape changes including the modification and leveling of the area with locally procured sand and soil (see Section 2.1), the later infilling of the wetland areas with material dredged from the nearby Kewalo Basin—the Kaka’ako land reclamation (1919–1927), and mid- to late twentieth century urban development. These buried historic structures are likely remnants of commercial infrastructure built following the historic land reclamation events. Use of aerial

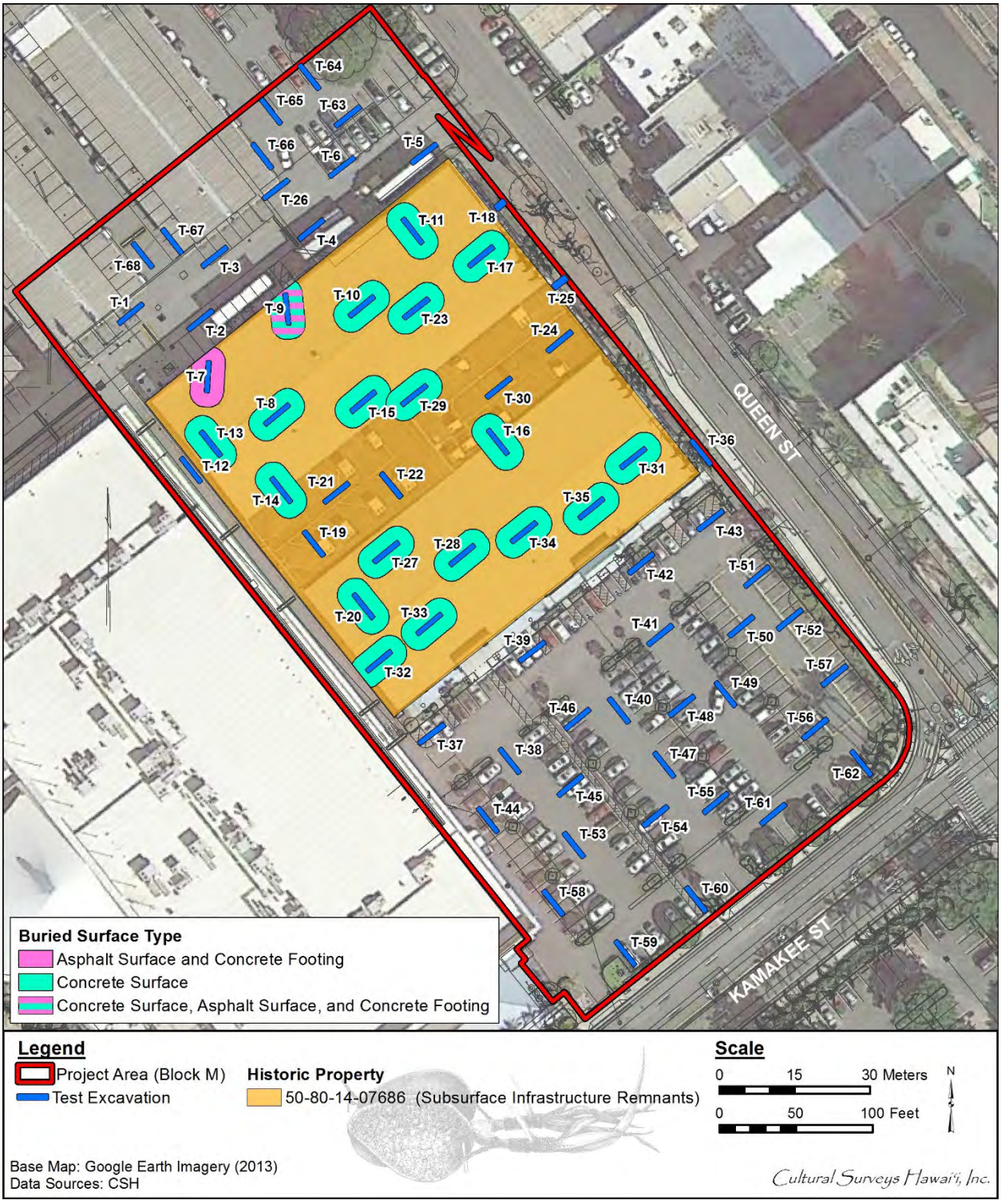

Figure 346. Aerial photograph showing the extent of the historic buried surfaces (SIHP # -7686) documented within the Block M project area (Google Earth 2013)

Table 82. SIHP # -7686 Subsurface Structures Identified in Block M

Test Excavation	Depth (cmbs)	Stratum	Description/Type	Associated Base Course (Y/N)	Base Course Depth (cmbs)
7	30–100	--	Concrete footing	No	--
7	35–40	Ib	Asphalt	Yes	40–47
8	37–50	Ic	Concrete surface	Yes	50–58
9	25–85	--	Concrete footing	No	--
9	26–37	Ic	Asphalt	Yes	37–40
9	26–37	Ie	Concrete surface	Yes	37–40
10	7–40	Ib	Concrete surface	Yes	32–42
11	7–35	Ib	Concrete surface	No	--
13	10–27	Ib	Concrete surface	Yes	27–37
13	37–50	Id	Concrete surface	Yes	48–57
14	7–19	Ic	Concrete surface	No	--
14	19–42	Id	Concrete surface	No	--
15	7–23	Ib	Concrete surface	Yes	23–28
15	28–40	Id	Concrete surface	Yes	40–44
16	13–35	Ic	Concrete surface	No	--
17	7–34	Ib	Concrete surface	No	--
20	13–41	Ib	Concrete surface	Yes	41–57
23	8–38	Ib	Concrete surface	No	--
27	10–40	Ib	Concrete surface	Yes	40–52
28	13–41	Ib	Concrete surface	Yes	41–50
29	19–40	Ic	Concrete surface	Yes	33–46
31	8–37	Ib	Concrete surface	No	--
32	13–40	Ib	Concrete surface	Yes	40–53
33	13–42	Ib	Concrete surface	Yes	42–85
34	10–33	Ib	Concrete surface	No	--
35	8–27	Ib	Concrete surface	No	--

photos support estimation of a relative date range for the subsurface structures; however, due to the time span between each of the aerial photos and historic maps, only approximate dates could be determined. According to a 1927 aerial photograph (Figure 347), the project area is mostly barren with the exception of some trees. The area continued to lack commercial infrastructure on a 1939–1941 aerial photograph (Figure 348). On a subsequent 1943 U.S. Army War Department terrain map and a 1952 aerial photograph (Figure 349 and Figure 350), it is clear that three parallel commercial warehouses were constructed in the Block M project area, indicating these subsurface structures date to sometime between 1939 and 1943. A 1993 aerial photograph continues to show the three warehouses in Block M (Figure 351). By the time a 2000 NOAA aerial photograph (Figure 352) was taken, the three warehouses have been replaced by a new commercial structure. The new and currently standing commercial structure took the place of portions of the northeastern two-thirds of the two northernmost warehouses, and a parking lot took the place of the third warehouse. The Block M interior trenches likely identified the structural remnants from two of these warehouses. The potential structural remnants of the third warehouse, if present, would have most likely been identified in the southeastern portion of the Block M project area. However, no structural remnants were recovered in this area, suggesting they were removed sometime between 1993 and 2000, when the parallel warehouse structures were removed from the area and the current commercial building was constructed.

Of the 22 historic concrete subsurfaces identified within Block M (SIHP # -7686), the nine subsurfaces without associated base course layers were predominantly located beneath the northeastern half of the current commercial building, while the 13 buried concrete surfaces with associated base course layers were located predominantly beneath the southwestern half of the current commercial building (Figure 353). Among all of the buried concrete surfaces, there appear to be five instances of consistency among test excavations based on relative depths of the structures, suggesting potential continuity of those subsurface structures (Table 83).

Buried concrete surfaces without associated base course layers were observed in eight test excavations (T-11, 14, 16, 17, 23, 31, 34, and 35) (Figure 354 through Figure 357). Continuity between these historic concrete layers is seen within seven test excavations (T-11, 17, 23, 31, 34, 35, and possibly T-16 (see Table 83). These surfaces range between approximately 7–37 cmbs, with an average thickness of 25 cm, and are directly underlying the current commercial building surface. Of note, T-14 presented a slightly different configuration, with two buried concrete surfaces that more closely resembled the buried historic surfaces with associated base course layers.

Thirteen buried concrete surfaces with associated base course layers were observed and documented in 11 test excavations (T-8, 9, 10, 13, 15, 20, 27, 28, 29, 32, and 33 (Figure 358 through Figure 361). The majority of these test excavations contained a single historic, subsurface concrete layer (see Figure 358 and Figure 359); however, T-13 and T-15 contained two historic subsurface concrete layers (see Figure 360 and Figure 361). The upper boundary of the concrete surfaces ranged from 7 to 37 cmbs with an average thickness of 21 cm.

Potential continuity of many of these concrete surfaces is seen within ten test excavations: T-8, 9, 13, 15, 20, 27, 28, 29, 32, and 33. The concrete surfaces located beneath the central-northwestern portion of the current building (T-9, 15, and 29) ranged between approximately 19–40 cmbs with an average thickness of 14.7 cm. The concrete surfaces located beneath the southern corner of the current building (T-20, 27, 28, 32, and 33) ranged between 10–42 cmbs with an average thickness

Figure 347. 1927 UH SOEST aerial photograph showing the absence of any commercial infrastructure within the Block M project area

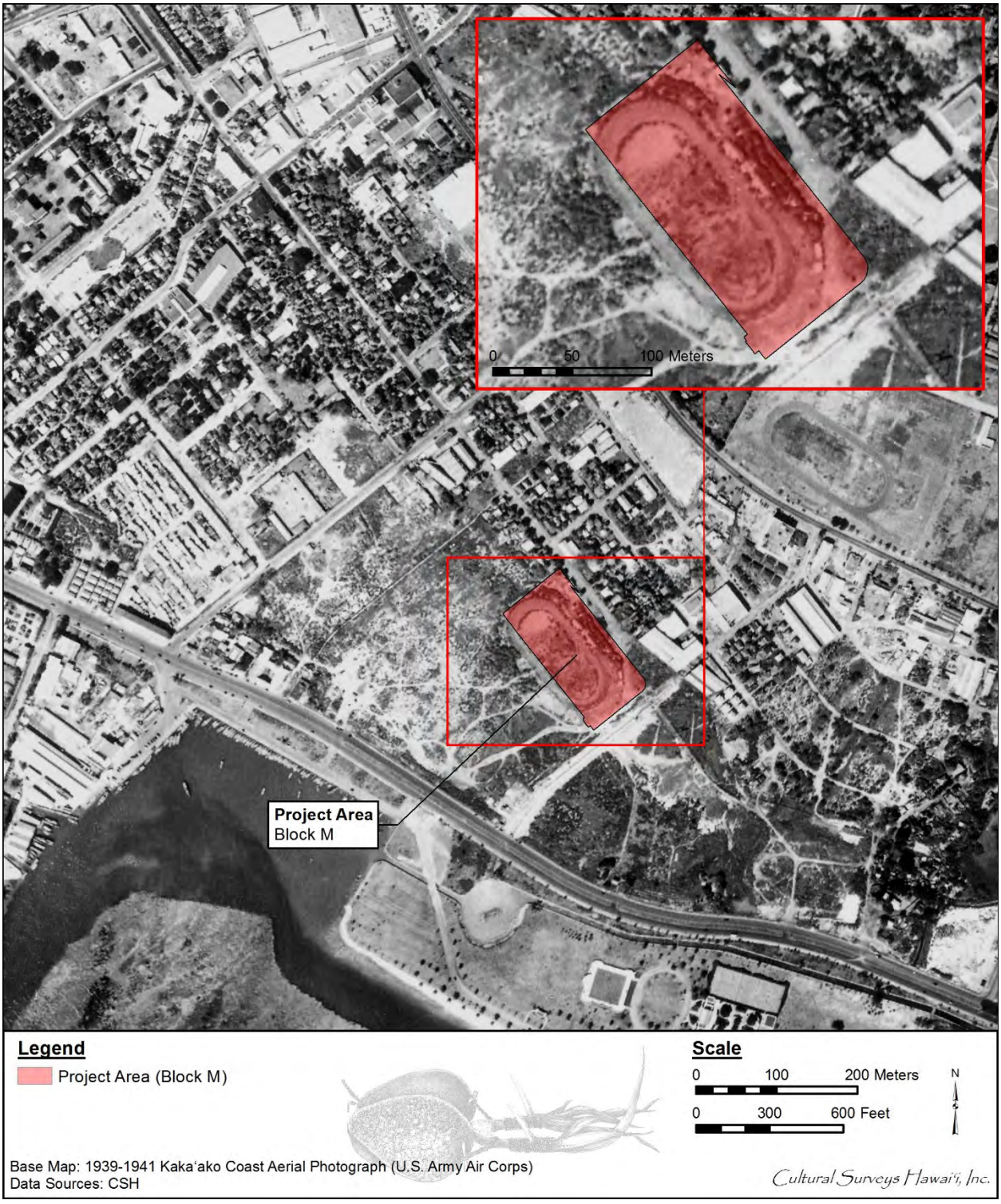

Figure 348. 1939-1941 aerial photograph (U.S. Army Air Corps) of Kaka‘ako showing a circular track in the location of the Block M project area and the absence of any large commercial structures

Figure 349. 1943 U.S. Army War Department terrain map showing a series of three parallel warehouse commercial structures located within the Block M project area

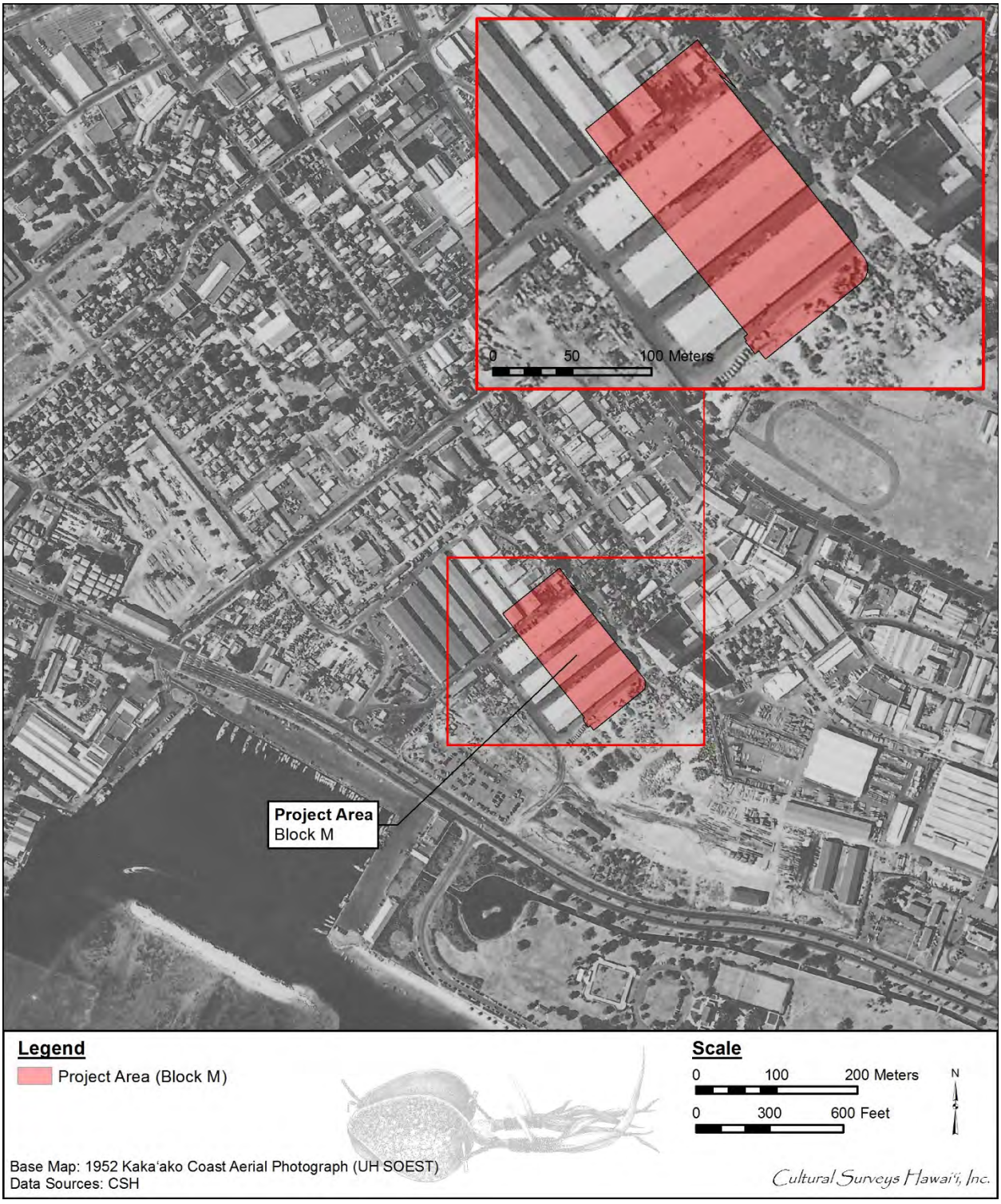

Figure 350. 1952 aerial photograph showing asphalted roadways and parking areas within the commercial warehouse complex

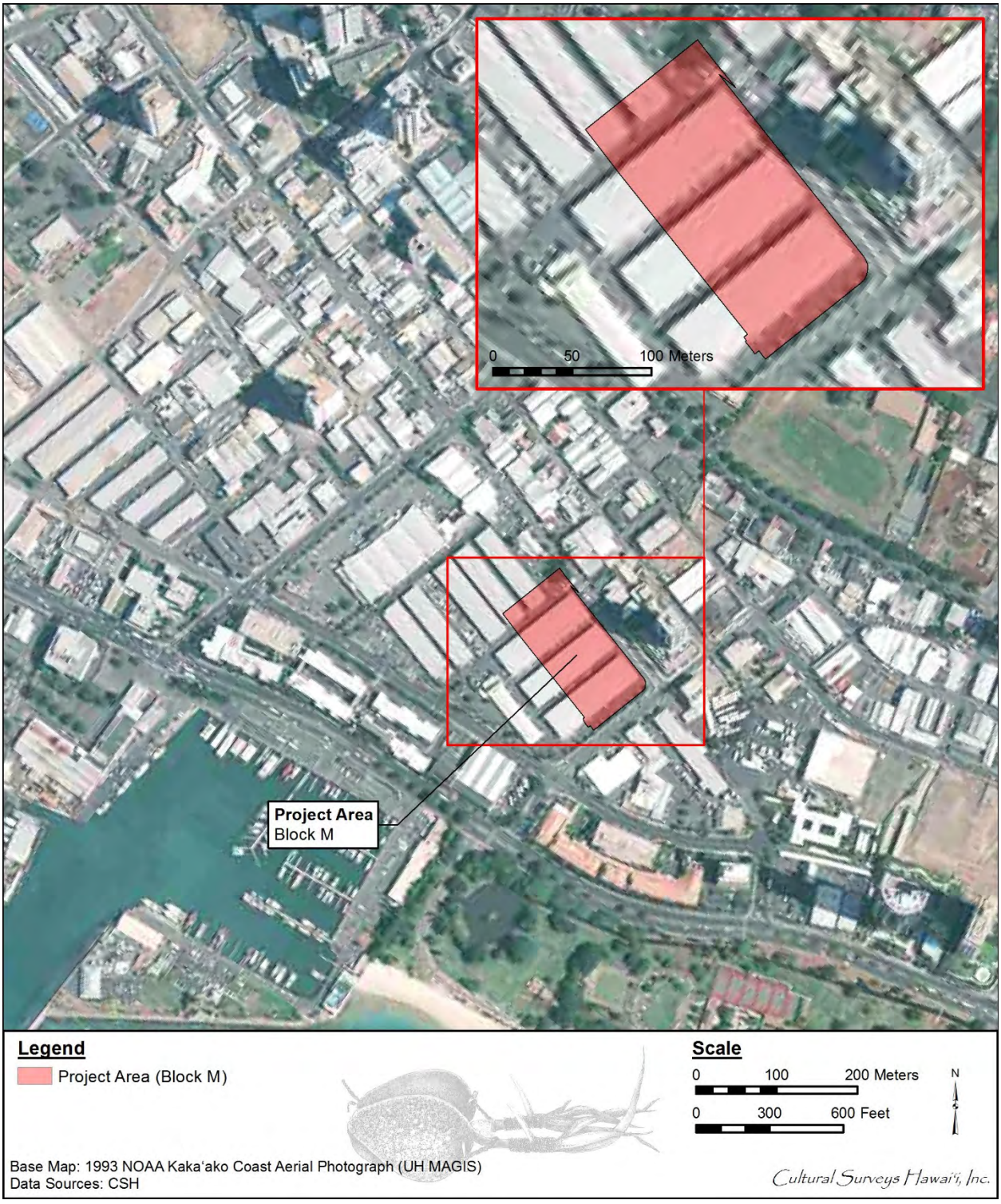

Figure 351. 1993 NOAA aerial photograph showing asphalted roadways and parking areas along with the commercial warehouse complex in the Block M project area

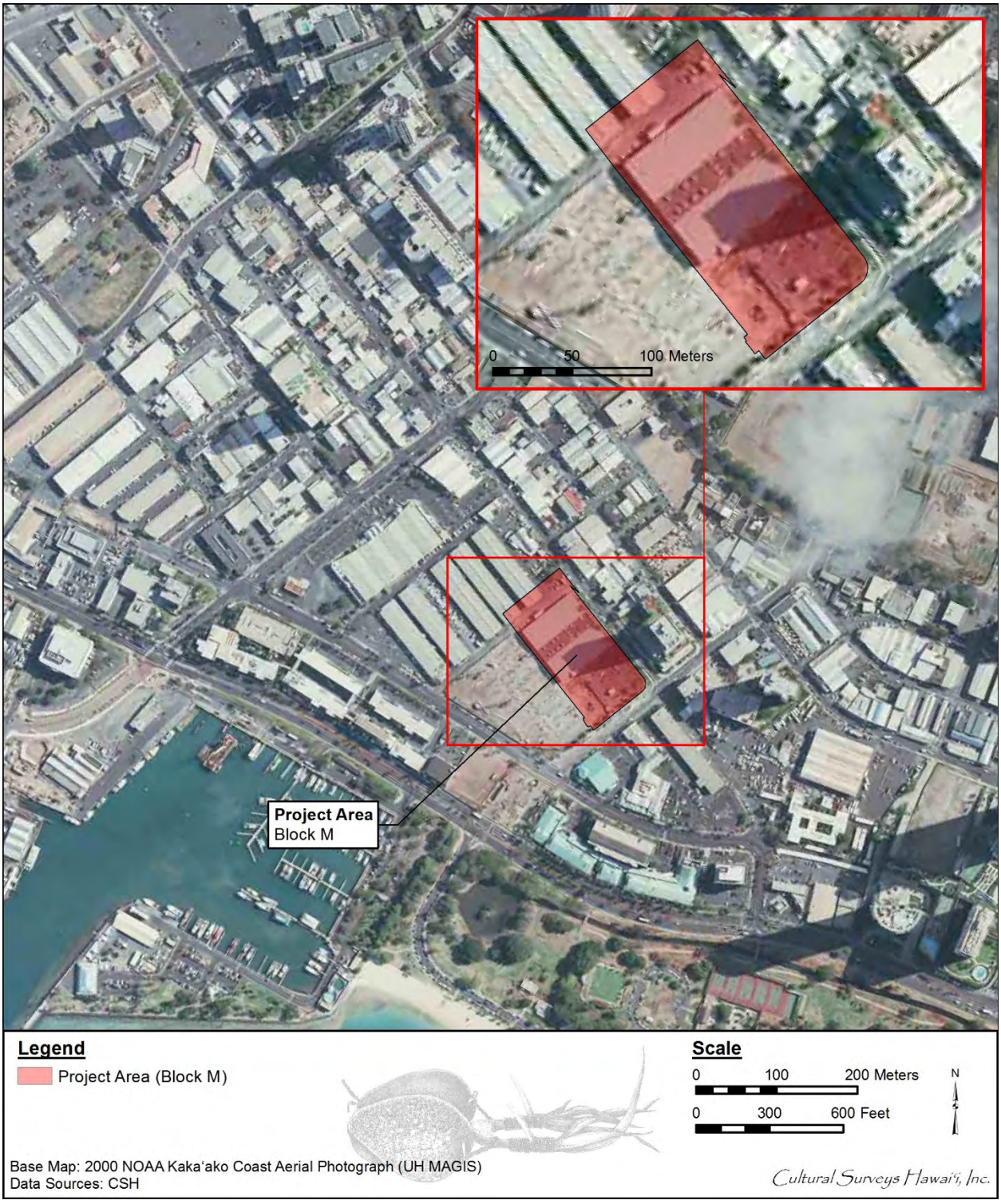

Figure 352. 2000 NOAA aerial photograph showing the absence of the warehouse complex, now replaced by the current commercial building in the Block M project area

Figure 353. Aerial photo showing the locations of buried concrete surfaces with associated base course layers and concrete surfaces without associated base course layers (SIHP # -7686) in the Block M project area

Table 83. SIHP # -7686 Potentially Associated Subsurface Concrete Surfaces

Test Excavation	Depth (cmbs)	Stratum	Description
1. Potentially associated surfaces, 7– 40 cmbs, average thickness 25.3 cm			
11	7–35	Ib	Concrete surface
16	13–35	Ic	Concrete surface
17	7–34	Ib	Concrete surface
23	8–38	Ib	Concrete surface
31	8–37	Ib	Concrete surface
34	10–33	Ib	Concrete surface
35	8–27	Ib	Concrete surface
10	7–40	Ib	Concrete surface (associated base course 32–42 cmbs)
13	10–27	Ib	Concrete surface (associated base course 27–37 cmbs)
2. Potentially associated surfaces, 19–40 cmbs, average thickness 14.7 cm			
9	26–37	Ie	Concrete surface (associated base course 37–40 cmbs)
15	28–40	Id	Concrete surface (associated base course 40–44 cmbs)
29	19–40	Ic	Concrete surface (associated base course 33–46 cmbs)
3. Potentially associated surfaces, 10–42 cmbs, average thickness 28 cm			
20	13–41	Ib	Concrete surface (associated base course 41–57 cmbs)
27	10–40	Ib	Concrete surface (associated base course 40–52 cmbs)
28	13–41	Ib	Concrete surface (associated base course 41–50 cmbs)
32	13–40	Ib	Concrete surface (associated base course 40–53 cmbs)
33	13–42	Ib	Concrete surface (associated base course 42–85 cmbs)
4. Potentially associated surfaces, 19–50 cmbs, average thickness 16.3 cm			
8	37–50	Ic	Concrete surface (associated base course 50–58 cmbs)
13	37–50	Id	Concrete surface (associated base course 48–57 cmbs)
14	19–42	Id	Concrete surface
5. Potentially associated surfaces, 7–27 cmbs, average thickness 15 cm			
14	7–19	Ic	Concrete surface
15	7–23	Ib	Concrete surface (associated base course 23–28 cmbs)
13	10–27	Ib	Concrete surface (associated base course 27–37 cmbs)

*T-13 appears to correlate with two separate assemblages of associated surfaces

Figure 354. Photograph of a buried concrete surface (SIHP # -7686) without an associated base course layer within T-17 southeast wall

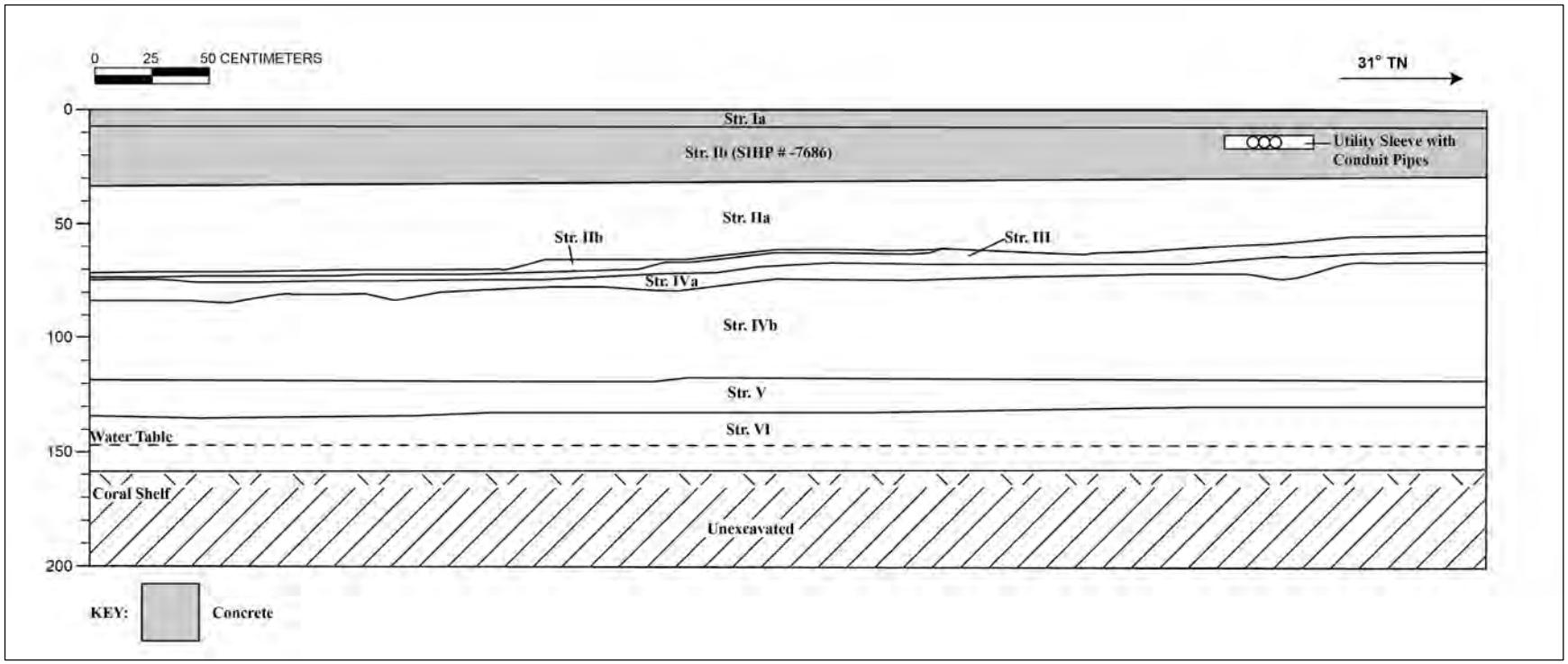

Figure 355. Profile of T-17, showing a buried concrete surface (SIHP # -7686) (without an associated base course layer) within the northwest wall

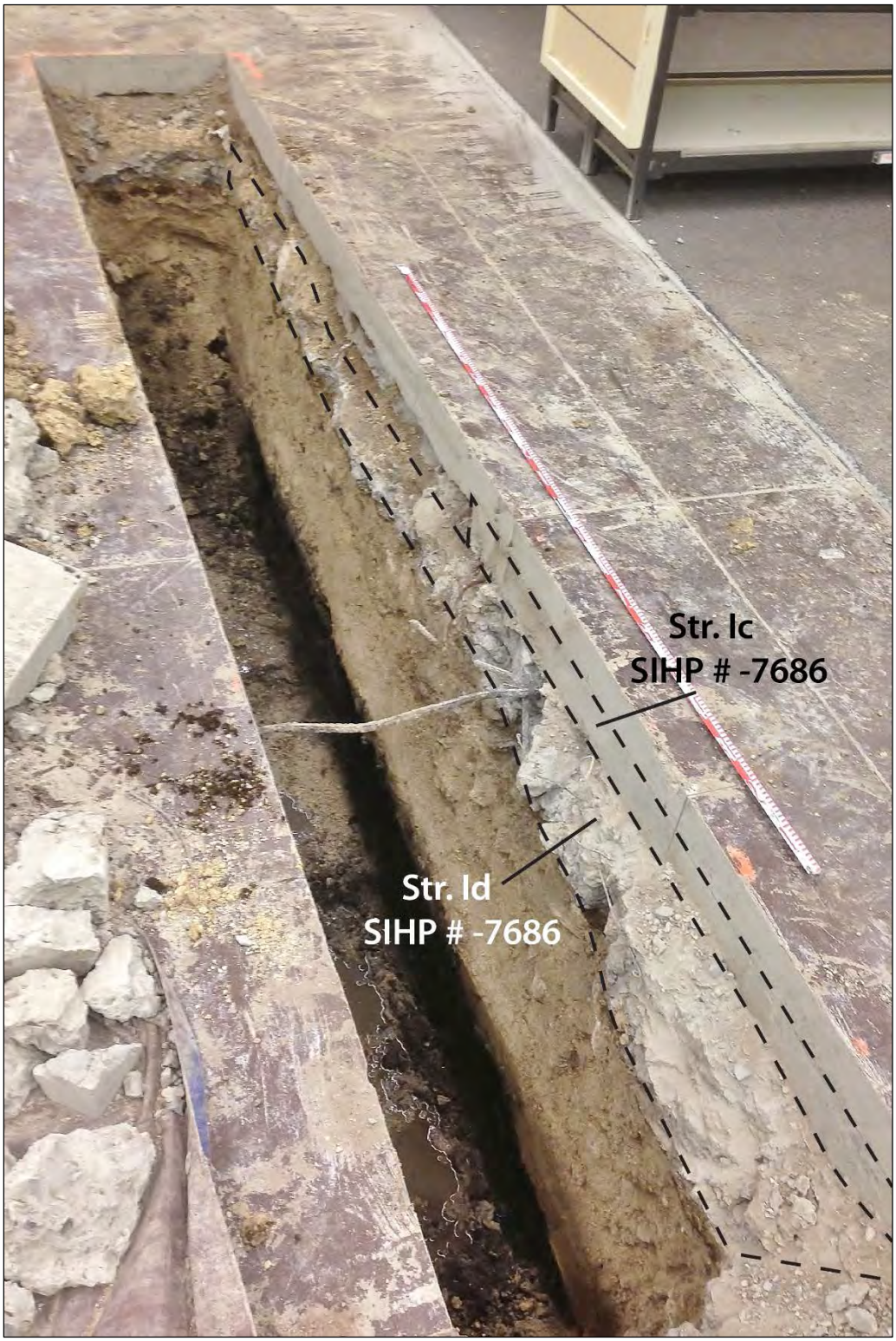

Figure 356. Photograph of the buried concrete surfaces (SIHP # -7686) within the T-14 northeast wall

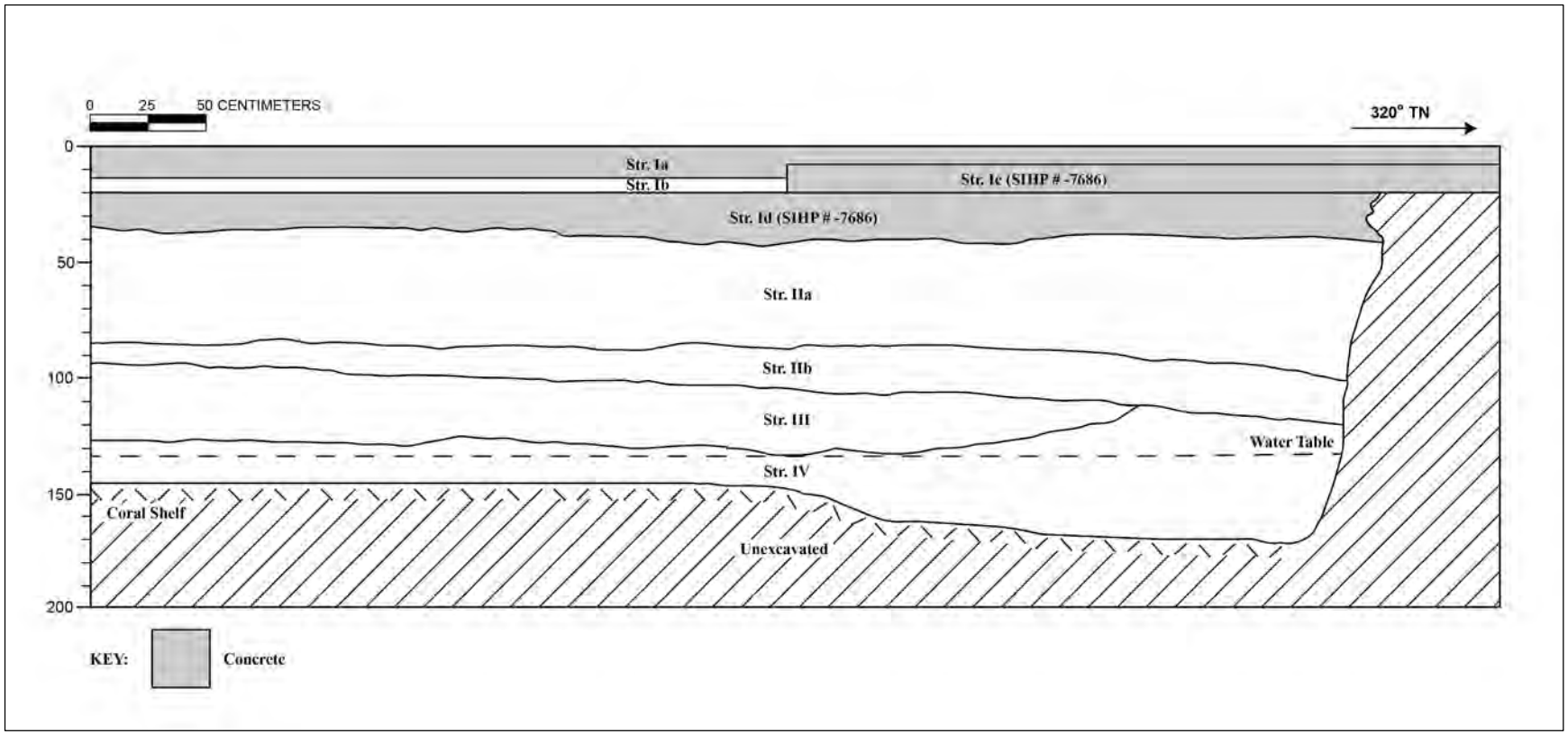

Figure 357. Profile of T-14, showing the multiple layers of buried concrete surfaces (SIHP # -7686) within the northeast wall

Figure 358. Photograph of the buried concrete surface (SIHP # -7686) with its associated base course layer within T-27 northwest sidewall

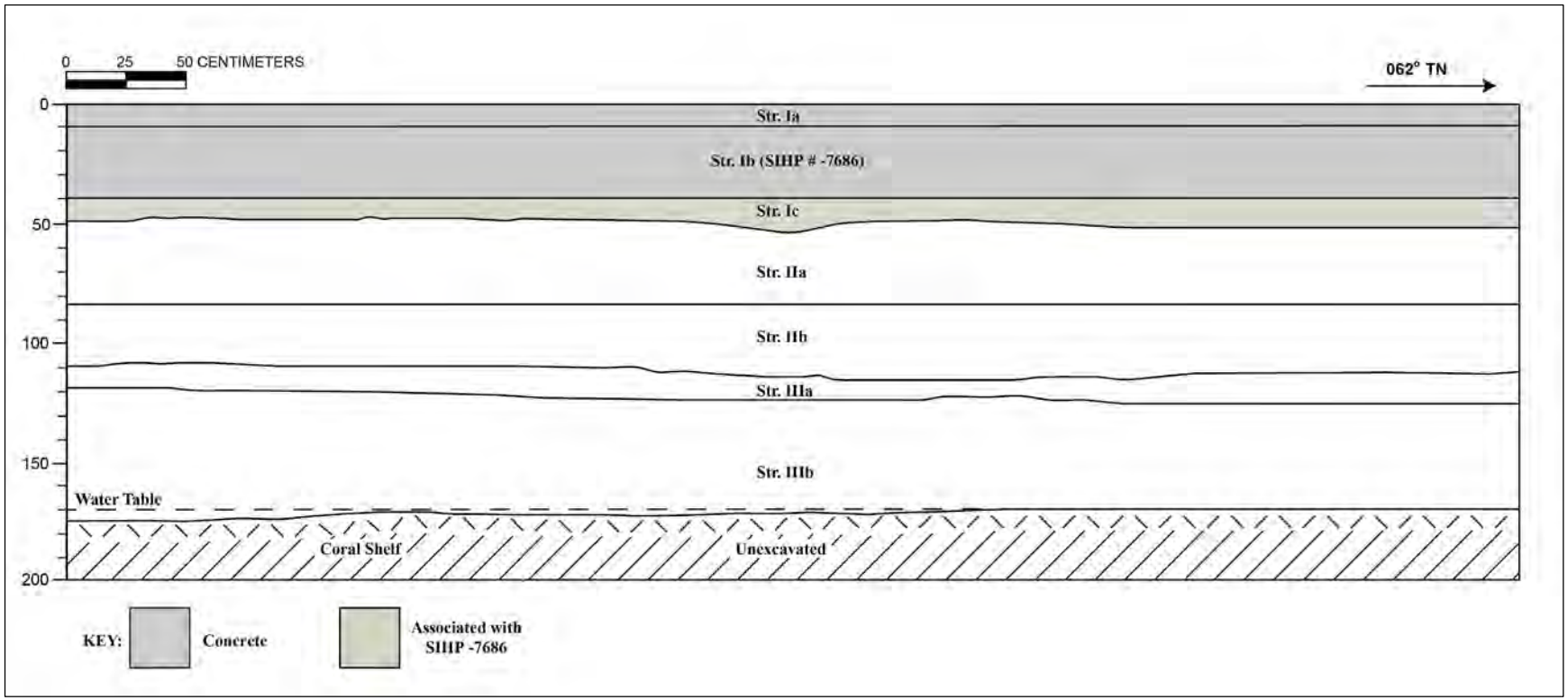

Figure 359. Profile of T-27, showing a buried concrete surface (SIHP # -7686) with associated base course layer within the northwest wall

Figure 360. Photograph of the multiple buried concrete surfaces (SIHP # -7686) with associated base courses within the T-15 southeast wall

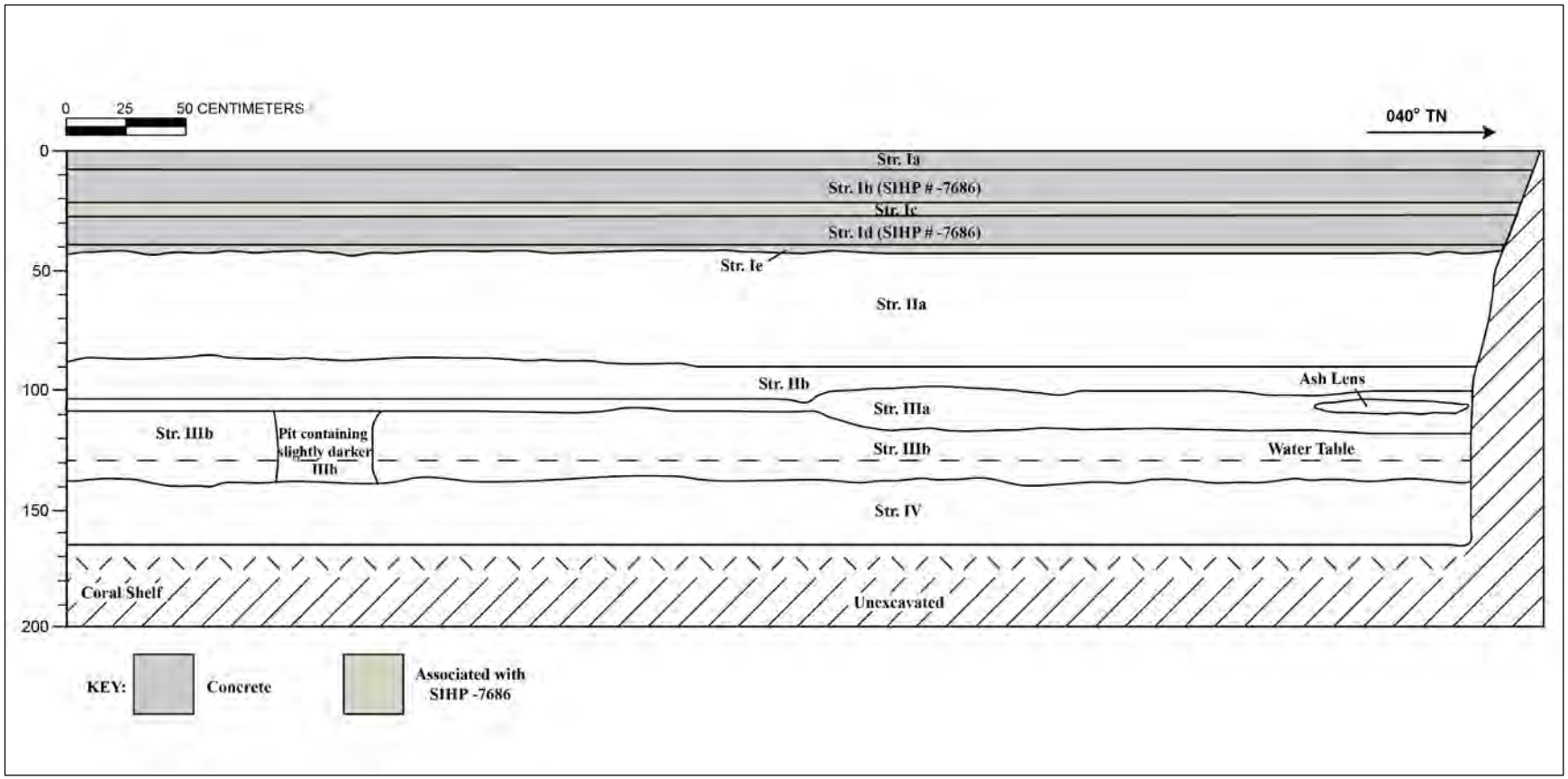

Figure 361. Profile of T-15, showing multiple buried concrete surfaces (SIHP # -7686) with associated base course layers within the northwest sidewall

of 28 cm. The concrete surface within T-8 and one of the surfaces within T-13 were located beneath the west corner of the current commercial building, and ranged from 37–50 cmbs, with a thickness of 13 cm each. TE 14 appears to have a concrete surface that is potentially consistent with T-8 and T-13 (see Table 83). One concrete surface within T-14 also appears to have continuity with one concrete surface within T-15. These test excavations were located beneath the central-southwestern portion of the current building, and had a range of 7–23 cmbs and an average thickness of 14 cm. T-10 presented a buried concrete surface that appeared to be consistent with the set of associated concrete surfaces without associated base course layers (see Table 83). One of the concrete surfaces within T-13 had potential continuity with two sets of associated surfaces (see Table 83).

SIHP # -7686 contains two concrete footings within two test excavations in the northwest portion of Block M (Figure 362, Figure 363). One concrete footing was identified in T-7, at 30 cmbs with a thickness of 70 cm. While excavation of this footing ceased in the south end of the test trench, the footing is believed to have intersected a buried asphalt surface (Stratum Ib, SIHP # -7686) prior to a more recent disturbance and utility installation. One subsurface concrete footing was observed and documented in T-9, at 25 cmbs, with a thickness of 60 cm (see Figure 362 and Figure 363). The concrete footing in T-9 intersected a buried asphalt surface (Stratum Ic, SIHP # - 7686) (Figure 364, see also Figure 363) and a buried concrete surface (Stratum Ie, SIHP # - 7686) (see Figure 362 and Figure 363) which demonstrated continuity among all three types of subsurface structures included with SIHP # -7686. The concrete footings in T-7 and T-9 were observed at similar location and depth within the excavation trenches and were of comparable thickness. These observations suggest consistency in construction and function of the buried historic surfaces as well as indicates a related purpose and contemporaneous use of said surfaces. The concrete footing in T-9 was observed overlying hydraulic fill associated with the 1919-1927 Kaka’ako land reclamation. The location of the concrete footings in the southern end of both T-7 and T-9, along with their relationship to the other types of subsurface structures associated with SIHP # -7686 within the trenches, suggests this area was the boundary of the ʻEwa (northwestern) most concrete commercial structure and the asphalt alleyway and parking area (see Figure 346, Figure 353).

SHIP # -7686 contains two buried asphalt surfaces with associated base course layers, also located within T-7 and T-9, in the northwest portion of Block M project area (see Figure 346, Table 82). The buried asphalt surface in T-7 was observed and documented at 35 cmbs with a thickness of 5 cm, overlying an associated base course layer 7 cm thick (Figure 365). The buried asphalt surface in T-9 was documented at 26 cmbs with a thickness of 12 cm, overlying an associated base course layer 8 cm thick (see Figure 364, Figure 363). Both asphalt surfaces were associated with the other types of subsurface structures associated with SIHP # -7686, and were observed overlying crushed coralline sand fill and hydraulic fill associated with the 1919-1927 Kakaʻako land reclamation.

Asphalt parking areas are not visible on 1927 and 1939 – 1941 aerial photos (see Figure 347 and Figure 348). The asphalt alleyway and parking area ʻEwa (northwest) of the northernmost former commercial structure was visible in the 1952 aerial photo (see Figure 350) and presumably existed in the early 1940s, based on the 1943 terrain map (see Figure 349). This photographic evidence indicates that the historic buried asphalt surfaces associated with SIHP # -7686 were likely related to the former commercial structures in existence from approximately the early 1940s through the 1990s. Aerial photos taken in 1993 confirm the continued existence of the three

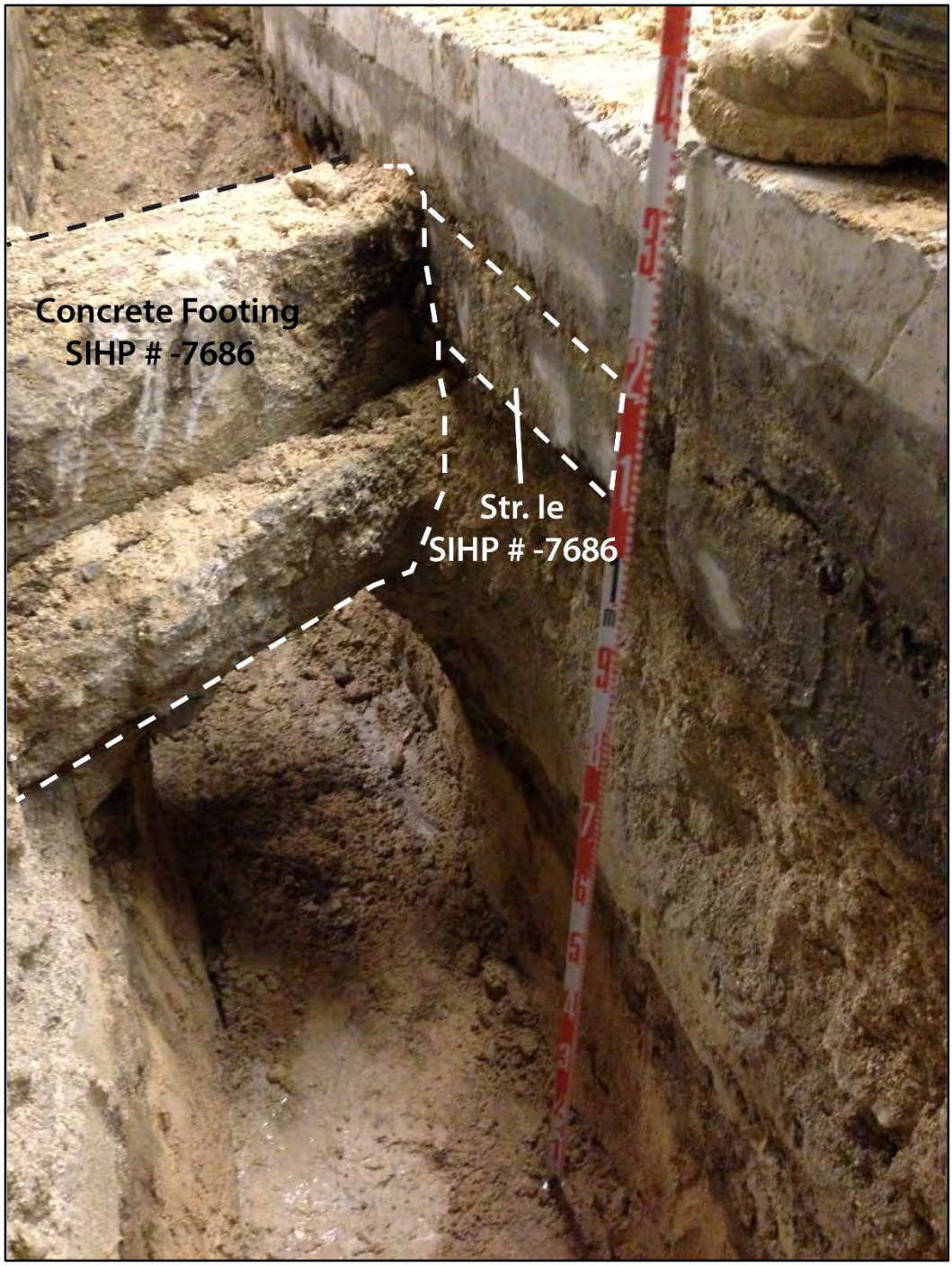

Figure 362. Photograph of concrete footing intersecting with buried concrete surface (SIHP # -7686) identified in T-9 east sidewall

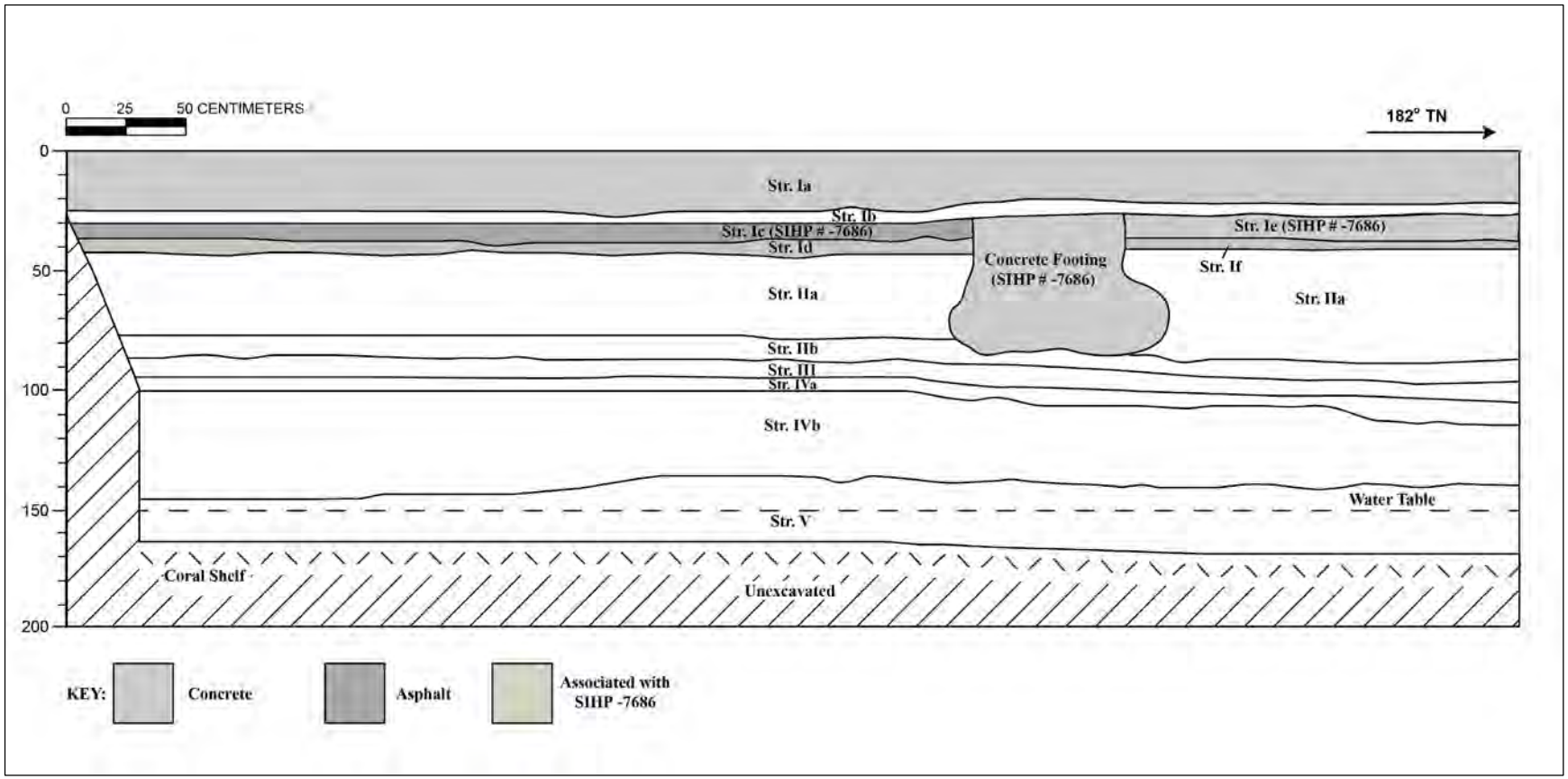

Figure 363. T-9 east profile, showing the commercial infrastructure remnants beneath the modern commercial building surface (Strata Ia–Ib), consisting of a buried concrete footing and concrete surface (Stratum Ie) contiguous with a buried asphalt layer (Stratum Ic) (SIHP # -7686); Kaka‘ako reclamation fill deposits (Strata IIa–IIb) and natural wetland sediments (Strata IVa–V) lie beneath SIHP # -7686

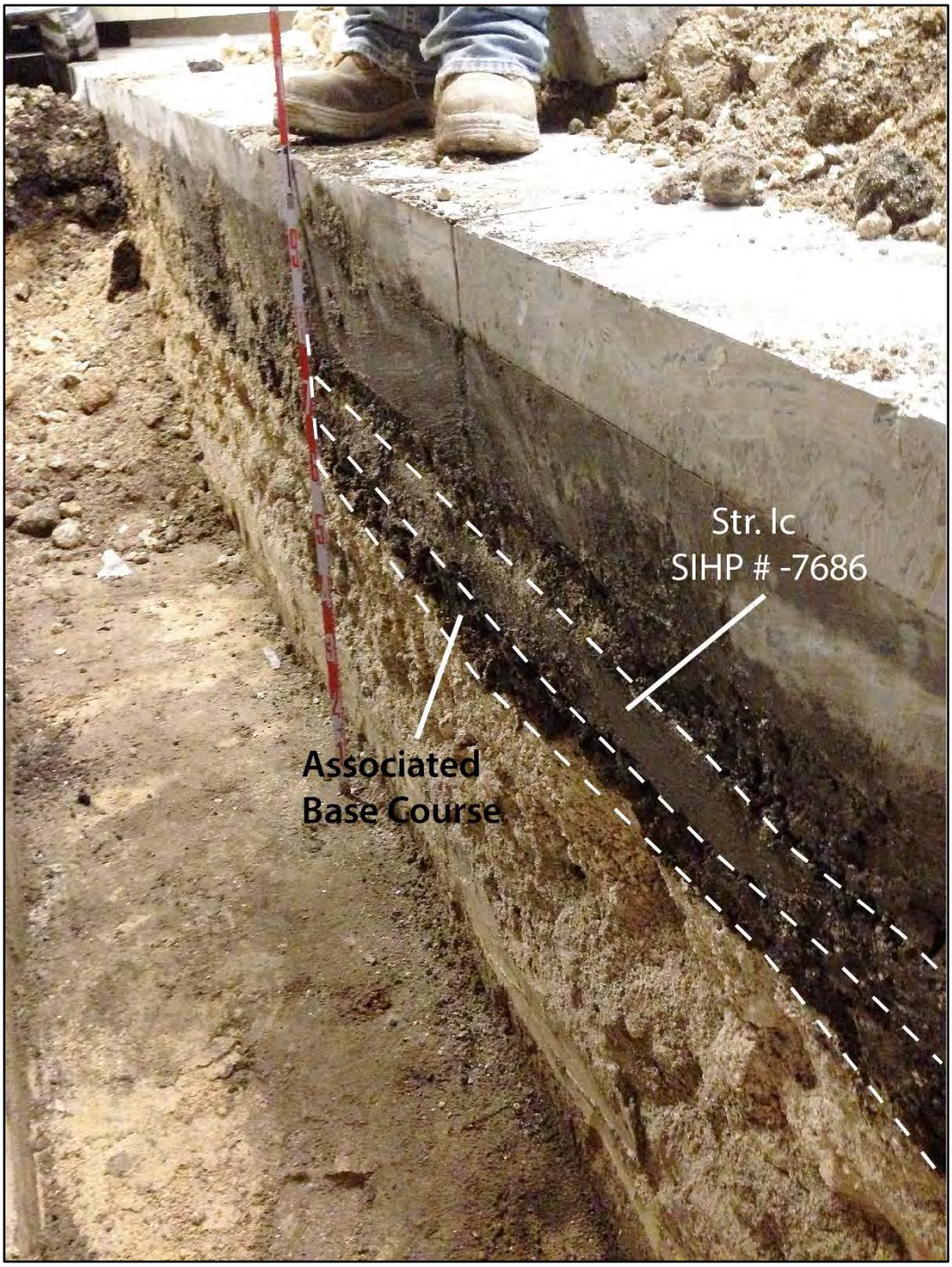

Figure 364. Photograph of asphalt surface (Stratum Ic, SIHP # -7686) identified in T-9 west wall; the asphalt surface intersects with concrete footing (not visible) in the top left corner of photo

Figure 365. Photograph of the asphalt (SIHP # -7686) and associated base course within T-7 east wall

warehouse structures (see Figure 351); however, a 2000 aerial photograph reveals that these warehouses were replaced by the current commercial building on the site (see Figure 352). These asphalt surfaces were likely in use contemporaneously with the commercial infrastructure visible in the photos, as asphalt alleyways or parking areas. The asphalt surfaces are located primarily in the north end of T-7 and T-9, indicating the likely boundary of the parking surfaces against the warehouses.

In summary, SIHP # -7686 contains 26 buried historic commercial infrastructure remnants associated with development and urbanization during the mid- to late twentieth century. These remnants consist of subsurface concrete layers, subsurface asphalt layers, and subsurface concrete footings and appear to have served as foundational slabs and former floor surfaces associated with commercial warehouse land use spanning approximately 50 to 60 years. SIHP # -7686 overlies crushed coralline sand and hydraulic dredge fill associated with the 1919–1927 Kaka‘ako land reclamation. Additional fill overlying SIHP # -7686, when present, is associated with the grading and construction of the current commercial structure. Urban development within the Block M project area has changed significantly between the 1927 and 2000 aerial photographs, indicating that urban development within the project area was on-going and changing. It is possible additional structures and surfaces were present within the project areas that are not pictured on any maps or aerial photos. SIHP # -7686 is assessed as significant under Hawai‘i state historic property significance criterion “d” (have yielded, or is likely to yield information important for research on prehistory or history) pursuant to HAR §13-284-6.

Section 7 Research Objectives

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

7.1 Research Question 1

Previous archaeology within and immediately adjacent to the Block M project area (Hammatt 2013; Medina et al. 2013; Winieski and Hammatt 2001) documented a buried A horizon and Jaucus sand beneath overlying fill deposits. How continuous are these natural deposits within the project area? In addition, two test excavations for the HHCTCP City Center AIS (Hammatt 2013) contained possible traditional Hawaiian cultural material within the buried A horizon. Does the Block M project area contain cultural deposits in the form of traditional Hawaiian and/or historic material and features? If so, how can we characterize the function, spatial distribution, and chronology of these deposits? What do these cultural deposits tell us about pre- and post-Contact usage of Kaka‘ako and its environment?

The natural deposits in Block M were observed to be largely continuous throughout the project area and were documented in 58 of the 68 trenches excavated. The stratigraphy within Block M displayed a buried A horizon and a natural environmental transition from beach sand to a marsh-like, wetland habitat. This transition extended diagonally through the project area from the southwest corner to the northeast corner; the *mauka* portion was dominated by calcareous Jaucus sand and the *makai* portion was dominated by clayey sand, wetland deposits. The A horizon contained a moderate amount of isolated historic trash, historic cultural deposits, and traditional Hawaiian cultural deposits. The natural deposits in the southeast corner of Block M had been removed during previous construction activities.

Both historic and traditional Hawaiian cultural deposits were observed below the hydraulic land reclamation fill, and are considered an extension of SIHP # -7429 (Hammatt 2013:639−654). SIHP # -7429 is a subsurface cultural deposit consisting of a culturally enriched buried A horizon, identified in the Ross Dress for Less store parking lot, approximately 200 m northwest of Block M. Seven features, potentially traditional Hawaiian and historic in age, were originally documented within this historic property.

Historic cultural deposits in Block M consisted of a layer of locally procured soil and sand that contained a small amount of historic trash and faunal remains (SIHP # -7429). This layer, which represents nineteenth and twentieth century landscape management activities, was observed in 23 of the 68 test trenches excavated, and appeared to be spatially associated with natural sand berms and possible irrigation channels. Additionally, three milled wooden posts were observed, two in profile originating from the historic fill layer. Within the northwest corner of Block M, the pre-reclamation fill layer appeared to be darker and thicker than the rest of the project area, and may be due in part to debris from the former residential area that once existed.

In situ traditional Hawaiian cultural deposits were observed in the northwest corner of Block M and consisted of a natural, loamy sand A horizon that contained light cultural content composed of fire-altered basalt cobbles, charcoal, and four features. Two of the four features (SIHP # 7429 Feature 8 and 9) were determined to be a fire pit for food consumption; charcoal collected from

one fire pit yielded a date of AD 1398−1449 (94.7%) (Beta - 348715). Judging from the lack of material culture and the relatively sparse evidence of human activity, the fire pit features did not appear to belong to a permanent habitation site.

Previous research suggests that due to the high water table and extensive wetland-marsh environment, the Kewalo area was sparsely populated during the pre- and early post-Contact time periods compared to Waikīkī to the southeast. Results from the Block M AIS documented light evidence of traditional Hawaiian activities isolated in the northwest corner of the project area. Evidence of historic activities were primarily observed in the *mauka* sandy deposits and less frequently observed in the *makai* wetland deposits. Traditional Hawaiian cultural deposits (SIHP # -7429 Features 8−11) suggest the area was used for food preparation and consumption. However, it is unclear at this time if the occupation and use of the area was continual, rather than sporadic, from the fourteenth century through the twentieth century. Nonetheless, it is evident that there were substantial landscape management activities in operation prior to 1919. These activities reflect the need for dry, level ground surface for what appeared to be residential and commercial use. Block I, located west of Block M, contained remnant salt pans, modified berms, and a thick culturally enriched historic stratum with burials. While these features do not extend into the current project area, it is conceivable that historic modifications in both project areas are contemporaneous and may be related.

7.2 Research Question 2

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

Land reclamation fill deposits from the early 1900s were observed overlying historic and natural sediments within 62 of the 68 test trenches (91%) excavated in Block M project area. Of those, 62 trenches contained both crushed coralline sand and hydraulic pump dredge while 38 trenches contained hydraulic dredge exclusively (Figure 366). A clear geographic distribution was observed as both crushed coralline sand and hydraulic dredge were documented in the northwest portion of the project area, primarily within the subsurface deposits underlying the current commercial space. Conversely, the crushed coralline sand in the southeast portion of the project area was removed, leaving only the truncated hydraulic pump dredge. Six test excavations, also located in the southeast portion of the project area, did not reveal any land reclamation fill as it was removed during prior construction activities.

The hydraulic dredge was derived from a combination of hydraulic pumping and truck dumping of sediment from the ocean floor and consisted of lenses of sandy or silty clay ranging from gleyed gray to pale yellow in color. The clearest observable characteristic of the hydraulic fill was the presence of fine, alternating laminea. While previous archaeological investigations interpreted the non-gleyed and gleyed hydraulic dredge as separate depositional events (Winieski and Hammatt 2001:8), current understanding is that the hydraulic clay was one depositional event that subsequently experienced prolonged durations of water saturation in an anaerobic environment, thus resulting in the gleyed sediments along the lower hydraulic dredge boundary. The hydraulic material was capped by gravelly, crushed coralline fill material, similarly associated with 1900s land reclamation. This layer differed from the hydraulic material below as it provided a dry, permeable, and stable land surface.

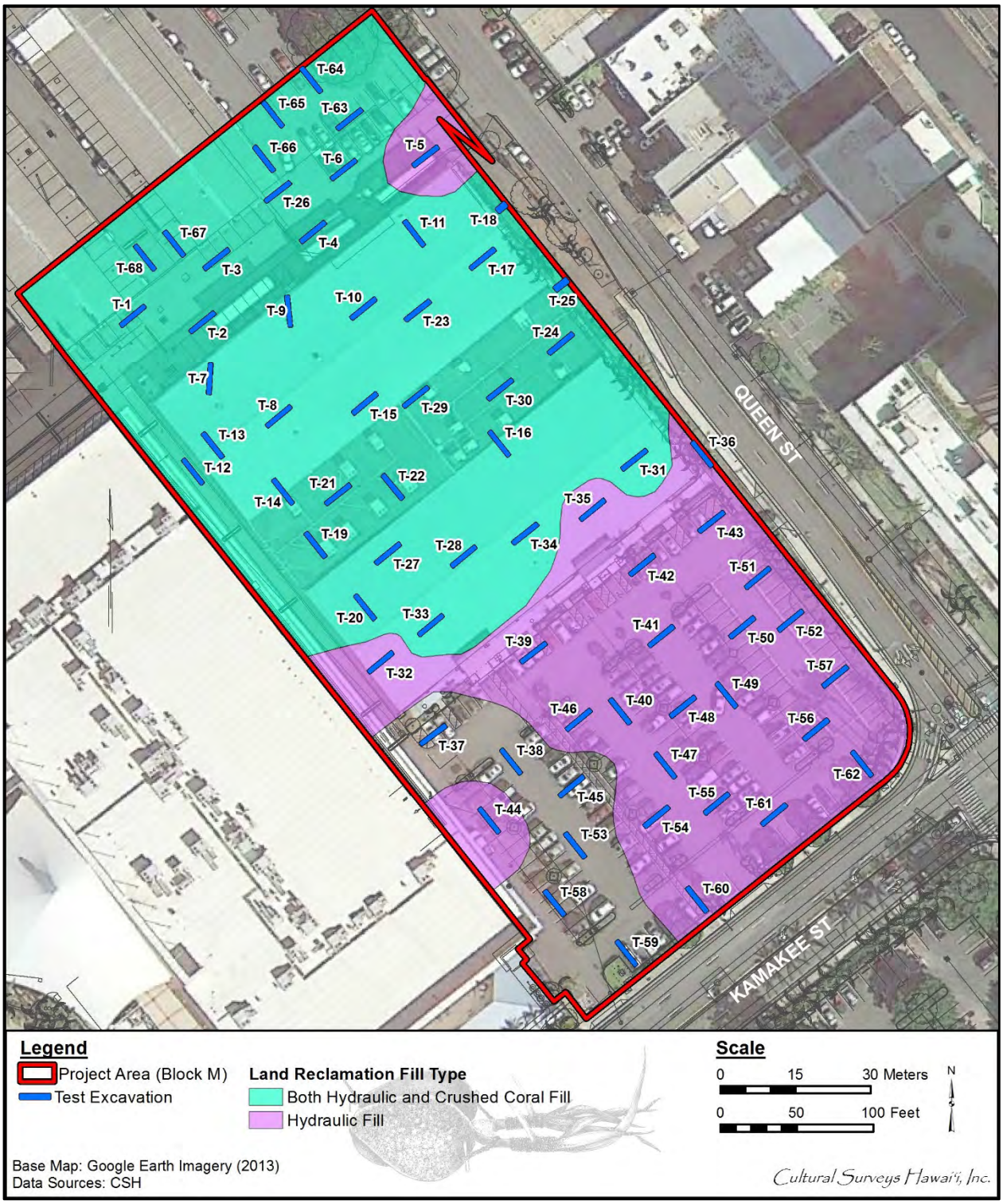

Figure 366. Aerial photograph showing the location of Kaka‘ako land reclamation fill deposits within the Block M project area (Base map: Google Earth Imagery 2013)

Background research indicates that while land reclamation had begun in Kewalo prior to 1913, Block M remained fallow until dredging of the Kewalo Basin, which took place from 1919–1927. As the project area is located *mauka* of the Kewalo Basin, Block M may have been among the first pieces of land to be filled with this dredged material. A 1920 report by the Department of the Interior notes the following:

> 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 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. . . .
>
> 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 Block M 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 preceeding the crushed coral in an effort to first “drain off” the marshy water.

A 1927 aerial photograph depicts the filled and leveled Block M project area, relatively barren in terms of structures (Figure 367). Vegetation extended diagonally through the project area from southeast to northwest, with small structures in the northeast corner along Queen Street. 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.

Figure 367. 1927 aerial photograph showing the Block M project area infilled with light colored crushed coral reclamation fill, with thick vegetation already growing along the *mauka* portion

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 indicator. The strata and deposits overlying the hydraulic fill post-date the 1919–1927 land reclamation events, most likely completed within the project areas by the end of 1920. Therefore, the strata underlying the hydraulic fill, consisting of the culturally enriched historic fill and buried A horizon (SIHP # -7429) 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, concrete within the interior commercial spaces, and was universally designated Stratum Ia. Based on a review of aerial imagery, the white dredge fill material is visible as the Block M project area land surface within the 1927 aerial photo (see Figure 367); however, by 1939 a large track was constructed and occupied a large majority of the project area (see Figure 348). By the early 1950s the landscape had undergone considerable changes due to an increase in urban development within the area. A 1952 photograph indicates the surface layer of crushed coralline sand fill was no longer visible, and three warehouse buildings existed within the Block M project area. These buildings are still visible in a 1993 photo and are replaced with the current commercial space by 2000 (see Figure 350 through Figure 352).

Section 8 Summary and Interpretation

The fieldwork component of this archaeological inventory survey was conducted between 13 January 2014 and 1 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., Veronica Morris, M.A., Doug Inglis, B.A., Nifae Hunkin, B.A., Pablo Rivera, B.A., Andrea Kay, M.A., Andrew Soltz, B.A., Scott Belluomini, B.A., Malina Reveal, M.Sc., Kimi Matsushima, B.A., Amanda Eggers, B.A., Timothy Zapor, B.A., Jessica Leger, M.A., Tyler Turran, B.A., Pua Guanzon, B.A., Laura Ortiz, M.A., Leandra Medina, B.A., Jim Thain, B.A., Tara del Fierro, B.A., Karl Van Ryzin, B.A., Fred LaChance, B.A., Nigel Kingsbury, B.A., Abbey Mierzejewski, B.A., Brittany Enanoria, B.A., and Tom Martel, B.A.

Fieldwork consisted of an initial 100% coverage pedestrian survey followed by a subsurface testing program. The pedestrian survey concluded that no surface historic properties were present and that the entire surface of the project area had previously been modified as a result of development of the Ward commercial complex. Based on results from the pedestrian survey, the archaeological inventory survey focused on a schedule of 68 test excavations to locate subsurface archaeological deposits. According to the project's predictive model for archaeological potential (see O'Hare et al. 2012 and Sroat et al. 2014) and recent archaeological investigations, there was reason to conceive that majority of the project area lies within an area of high archaeological potential, with the exception of a very small portion of medium potential in the southern corner (Figure 368). Anticipated archaeological resources within the project area included culturally enriched A horizon deposits, human burials, remnants/artifacts from the Rifle Association firing range, artifacts/debris associated with twentieth century commercial and residential use, and reclamation fill deposits, including historic trash layers or incinerated fill.

A total of 68 backhoe-assisted test excavations were completed, including both exterior (parking lot and alleyway) and interior (current commercial space) locations. On average, each test excavation measured 6.1 m (20 ft) long by 0.7 m (2.3 ft) wide and terminated at either the water table or coral shelf, depending on which was encountered first.

Findings of the inventory survey included the identification of two historic properties: 1) 26 buried historic surfaces considered to be structural remnants associated with mid- to late twentieth century urban development consisting of two concrete footings, two buried asphalt surfaces, 22 concrete surfaces, and various associated base course layers (SIHP # -7686); and, 2) a previously identified subsurface cultural deposit consisting of 16 features within two discrete strata characterized as a buried sandy loam A horizon overlain by a very thin, culturally enriched, historic sand and soil fill deposit (SIHP # -7429).

The general stratigraphic sequence within Block M from the present land surface to the coral shelf included the modern developed land surface, overlying buried historic surfaces (SIHP # -7686), variable layers of imported fill occasionally mixed with historic trash, overlying crushed coral and hydraulic (dredge) reclamation fill, overlying early twentieth century fill, over subsurface cultural deposits (SIHP # -7429), and either calcareous Jaucas sand, marsh-like wetland horizons, or a combination thereof.

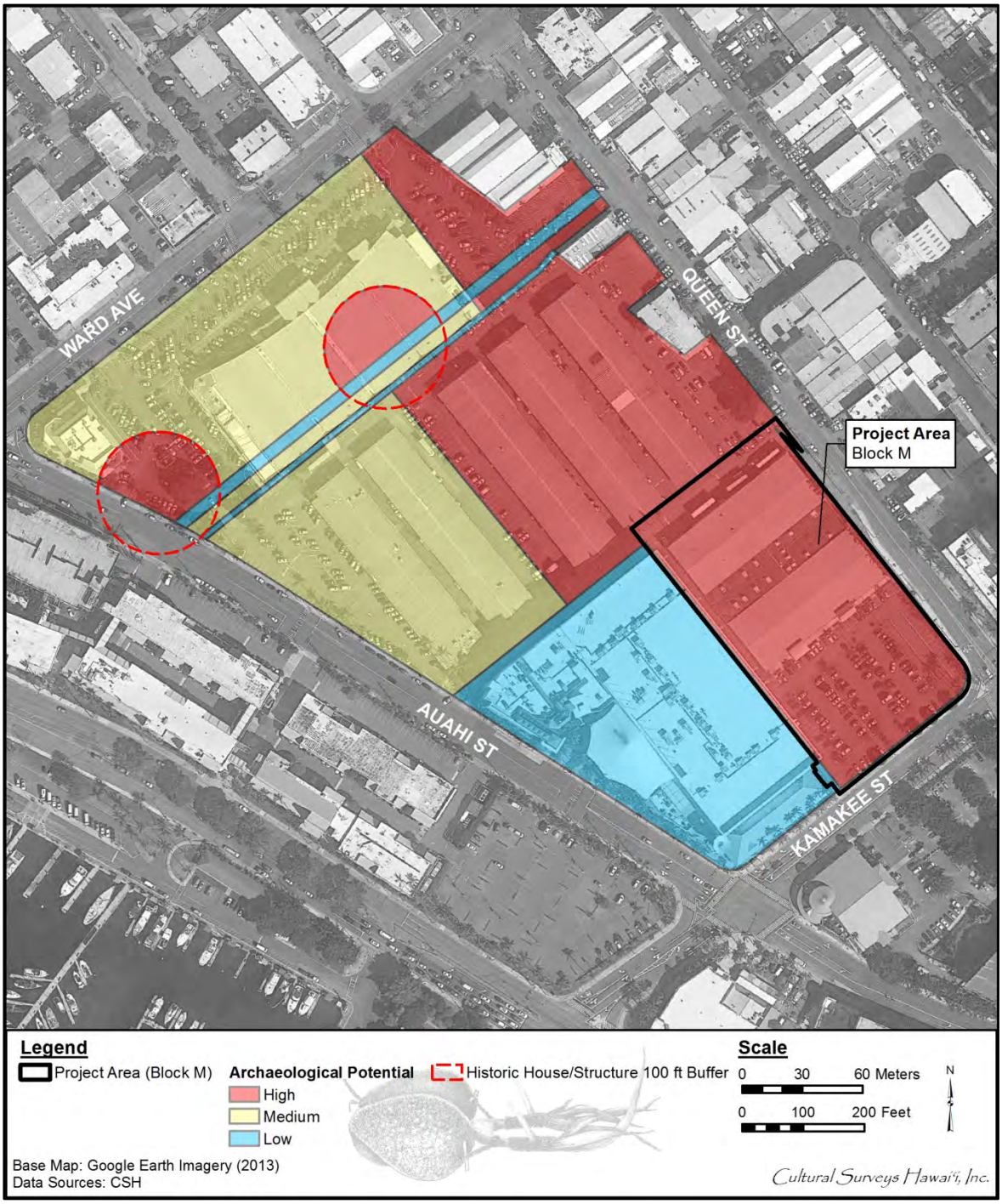

Figure 368. Aerial photograph overlain with predictive model of archaeological potential for Land Block 1, including Block M project area

Background research indicates the Block M project area was filled during dredging of the Kewalo Basin, which took place from 1919–1927. 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. The hydraulic dredge was from a combination of hydraulic pumping and truck dumping of sediment from the ocean floor. 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 fill deposits observed in Block M consisted of structureless, crushed coralline sand and hydraulic-dredged marine clays, which were predominantly massive but occasionally single-grained depending on the sand content. The hydraulic dredge ranged in color from a pale brown to a greenish grey gley. When present, the gleyed material was located at the lower boundary of the hydraulic dredge fill and is indicative of prolonged saturation in an anaerobic environment. The gleyed characteristics were the result of natural, post depositional processes, which occur in low lying wetland environments with a shallow water table. Additionally, the hydraulic dredge material consisted of sandy or silty clay laminae, displayed alternate banding and downward grading from coarse to fine material, as well as post-depositional ferrous manganese stains. 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 of crushed coralline sand and hydraulic (dredge) fill within Block M project area. Both the crushed coral and hydraulic (dredge) was documented below the current commercial space and extended to the northwest boundary (ʻEwa) of the project area. Conversely, crushed coral fill was not documented within the parking lot in the southeast end (Diamond Head) of Block M, along the corner of Queen and Kamakeʻe Streets, as it was ostensibly removed during previous ground disturbing activities, leaving a layer of truncated hydraulic (dredge) fill (Figure 369).

Based on background research and current available data, the buried historic structural remnants associated with SIHP # -7686 were constructed directly over the crushed coral reclamation surface sometime between 1941 and 1943. Quadrangle maps and aerial photos reveal three rectangular warehouses that occupied the majority of the project area, were oriented northeast-southwest, and extended beyond the southwest boundary of Block M (see Figure 349 and Figure 350). These structures remained in existence for approximately 50 years, were subsequently decommissioned sometime after 1993, and the current commercial space was established by the year 2000 (see Figure 351 and Figure 352).

SIHP # -7429 was initially identified during a previous AIS, near the intersection of Ward Avenue and Queen Street, approximately 200 m northwest of Block M (see Hammatt 2013). At that time, this historic property was characterized as a buried loamy sand/silty sand A horizon, developed within Jaucas sand, documented beneath historic fill deposits, and contained seven features with both traditional Hawaiian and post-Contact cultural material. The cultural deposits identified in the Block M project area are similar in soil color, texture, and material content to the characteristics of SIHP # -7429 documented by Hammatt (2013). Ongoing excavations have revealed that SIHP # -7429 is contiguous in both Block M and I (CSH report in progress) and are similarly geographically and spatially located along the *makai* edge of a continuous sand dune deposit that abutted the former Kakaʻako coastal wetlands (Figure 370). Therefore, based on

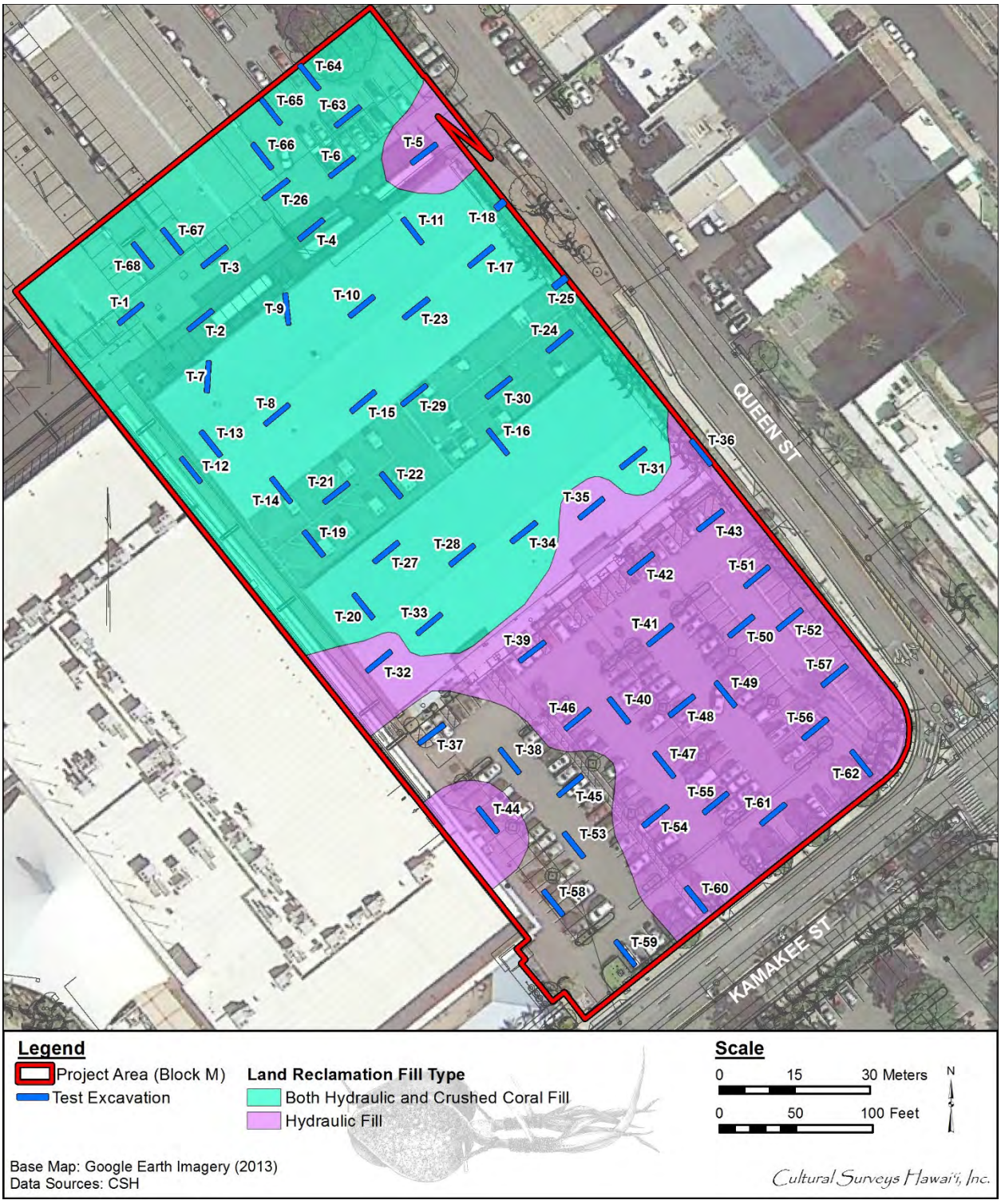

Figure 369. Distribution of crushed coralline sand and hydraulic (dredge) fill within Block M project area

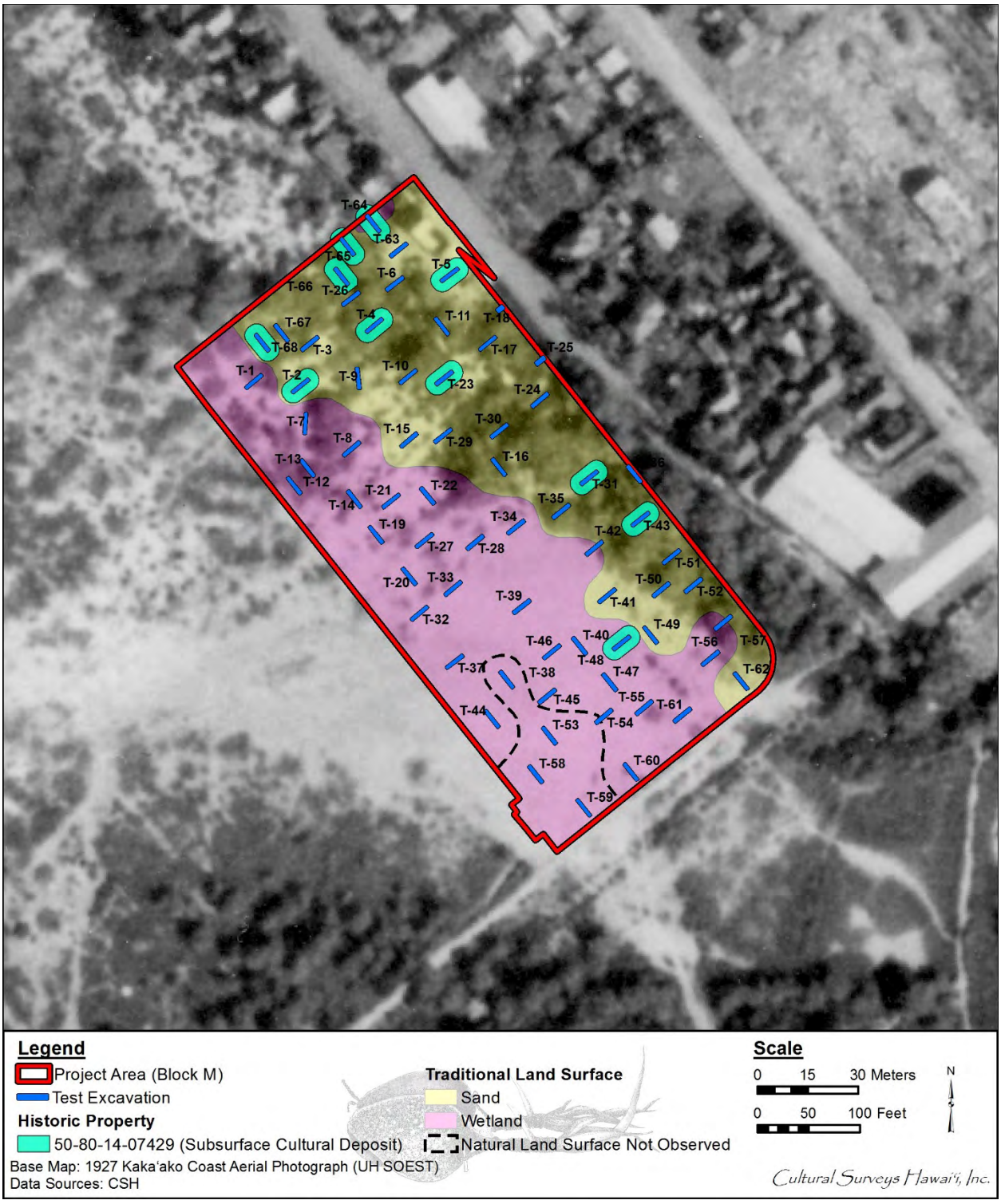

Figure 370. Geographic distribution of Jaucus sand and wetland environment with an overlay of Block M test excavations

cultural content, spatial contiguity, and geographical similarity, the cultural deposits of Block M and Block I are considered part of SIHP # -7429.

The Block M AIS documented SIHP # -7429 within 11 test excavations (T-2, 4, 5, 23, 31, 43, 48, and 64–66). Two discrete cultural deposits were identified, consisting of a buried sandy loam A horizon overlain by a very thin, culturally enriched, historic sand and soil fill deposit. The overlying historic deposit was not originally identified by Hammatt (2013); however, reinspection of the field documents (i.e., photographs) from the previous AIS indicate this very thin layer was indeed present, represented as a slightly lighter colored loamy sand layer (Component 1) atop the buried A horizon (Component 2). Of the 11 Block M test excavations containing SIHP # -7429, five were exclusively associated with Component 1 (culturally enriched, historic fill), four were exclusively associated with Component 2 (culturally enriched, buried A horizon), and two test excavations were associated with both components of SIHP # -7429. Five test excavations also contained associated features, SIHP # -7429 Features 8–16. Additionally, one radiocarbon date (Beta -384715) from SIHP # -7429 Feature 8 indicates that the area was used, in some capacity, by humans as early as thirteenth century.

It is possible that Block M AIS may have documented the boundary of SIHP # -7429 as the cultural material content becomes noticeably more scant as the historic property extends from the Ross Dress for Less parking lot on the corner of Ward Avenue and Queen Street to the Block M parking lot on the corner of Queen and Kamake‘e Streets. Additionally, based on an overlay of a 1927 aerial photograph (see Figure 347), SIHP# -7429 appears to be primarily associated with the above mentioned continuous sand dune that extended from the northeast corner of Block M, near the corner of Queen and Kamake‘e Streets, to the southwest corner, near the current Ward Theater parking garage. Said former sand dune may have served as a natural berm that was later modified by humans, and while correlation does not imply causation, it is possible that this landscape feature may be associated with SIHP # -7429.

While remnant salt pans were not observed in Block M project area, modified sand dunes, irrigation ditches (‘*auwai*), and thick deposits of prereclamation fill were observed and documented, primarily in the northwest end of the project area, along the ʻEwa boundary. The modified sand dunes seemingly served as a berm, and in one occurrence appeared to be spatially and stratigraphically related to a ‘*auwai* documented within close proximity (see T-26 and 65). A total of two berms were documented in Block M (T 26 and 52) and are located along the sand dune that previously paralleled Queen Street. Thick layers of pre-reclamation fill (T-5, 26, 63, and 64), some of which exhibited light cultural content (SIHP# -7429), were also observed in the northwest corner of Block M. These fill layers contained much darker sediment than other pre-reclamation fill deposits observed, and may be due to the incorporation of incinerated material, such as ash and refuse, within the fill deposits. This is plausible as ash and burnt material, produced from both open-air trash burning and the Kewalo Incinerators, were used as fill to created additional land surfaces in the area (see Section 3). Two test excavations (T-63 and 64) in the northwest corner of Block M also contained a discontinuous layer of burnt trash mixed with crushed coralline sand fill within the upper fill layers. The land reclamation fill was previously truncated and later intercalated with the mixed fill and historic trash. These layers appeared to incorporate historic trash most likely related to nineteenth-twentieth century residential houses along Queen Street, but did not appear to have served as a living surface or discrete trash deposit.

In summary, Block M AIS has further defined and expanded upon SIHP # -7429 to include additional surfaces, additional features, and potentially associated, culturally sterile, components not currently designated as a historic property. A newly identified historic property was documented and contains historic structural remnants from mid twentieth century urbanization efforts. Based on background research and the radiocarbon date obtained from SIHP # -7429 Feature 8, it is clear that the in situ A horizon experienced human activity as early as Cal AD 1398-1449 (Beta -384715), through the early twentieth century, prior to the in-filling of low lying wetland areas. Land reclamation fill was pervasive throughout Block M, with the majority of the crushed coral previously removed from the southeast portion of the project area. Post depositional gleying and ferrous manganese stains were observed within the hydraulic (dredge) fill. Pre-reclamation deposits were observed throughout the project area and consisted of locally procured material that was often easily confused for an in situ A horizon. When cultural material was present, the pre-reclamation fill was designated as Component 1 of SIHP # -7429. An in situ, buried A horizon was observed within the upper boundary of either Jaucas sand or a wetland horizon. When cultural material was present, the pre-reclamation fill was designated as Component 2 of SIHP # -7429. Additionally, a natural transition between the terrestrial Jaucas series and the Kaka‘ako coastal wetland zone was documented within Block M.

Section 9 Significance Assessments

The two historic properties observed within the current study area were evaluated for significance according to the broad criteria established by HAR § 13-284-6. The five criteria are as follows:

a. Be associated with events that have made an important contribution to the broad patterns of our history;
b. Be associated with the lives of persons important in our past;
c. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, or possess high artistic value;
d. Have yielded, or is likely to yield information important for research on prehistory or history;
e. Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

Table 84 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 # -7429 consists of subsurface cultural deposits within two discrete strata, including associated traditional-type and historic features and an isolated human skeletal element. The boundaries of SIHP # -7429 extend from the vicinity of Ward Avenue just *makai* of the intersection with Queen Street (as documented by Hammatt 2013) to the corner of Queen and Kamake‘e streets (as documented by the current Block M project AIS and the intervening Block I project AIS). SIHP # -7429 was previously assessed as significant under Hawai‘i state historic property significance criterion "d" (have yielded, or may be likely to yield information important in prehistory or history) and "e" (historic property has cultural significance to an ethic group, including, but not limited to, religious structures, burials, and traditional cultural properties), pursuant to HAR §13-284-6. The historic property is related to traditional Hawaiian and historic land use and has the potential to offer insight into traditional Hawaiian and subsequent historic activities in the Kaka‘ako area.

SIHP # -7686 consists of buried, historic commercial infrastructure remnants, including asphalt layers, concrete surfaces and concrete footings. SIHP # -7686 is assessed as significant under Hawai‘i 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.

Table 84. Archaeological Historic Property Significance and Mitigation Recommendations

SIHP #	Test Excavation #s	Formal Type/ Description	Significance per HAR §13-284-6	Mitigation Recommendation
-7429	2, 4, 5, 23, 31, 43, 48, and 64-66 (current project area); 167, 168B, 170, and 170A (Hammatt 2013)	Subsurface cultural deposits	“d” and “e”	Archaeological monitoring
-7686	7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 23, 27, 28, 29, 31, 32, 33, 34, and 35	Subsurface historic commercial infrastructure 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 -7429 and -7686) 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 M project area contains: 1) subsurface cultural deposits within two discrete strata, including associated traditional-type and historic features, within sand deposits located within the northern and northeastern portions of the project area (SIHP # -7429); and 2) buried mid-twentieth century commercial infrastructure remnants, including asphalt layers, concrete surfaces and concrete footings (SIHP # -7686), observed within the central-western portion of the project area. 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.

Based on the results of the Block M AIS, and in consultation with the SHPD, an archaeological monitoring program was determined to be warranted. While two historic properties were identified within the project area, sufficient data concerning the location, function, morphology, and age of SIHP # -7686 is believed to have been gathered during the project AIS; therefore, the primary focus of the monitoring plan is to mitigate construction impact on SIHP # -7429 and to facilitate the identification and proper treatment of any potential historic properties that might be newly encountered during project construction activities.

10.2.1 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 the documented historic properties, in particular SIHP # -7429, or any as yet unidentified cultural resources within the project area, it is recommended that project construction proceed under an archaeological monitoring program. A dual program of on-site and on-call archaeological monitoring is recommended for all project construction activities below 2 ft (60 cm) below the current ground surface within the Block M project area.

The archaeological monitoring program will consist of the following dual approach:

1. On-site monitoring of all project related ground disturbance activities below 24 inches (2 feet) (from the current ground surface) within the zone of natural sand deposits (the *mauka*, or northeastern diagonal half of the project area); and

2. On-call monitoring with weekly spot-checks within the zone of natural wetland deposits (the *makai*, or southwestern diagonal half of the project area).

In addition, on-site monitoring shall include targeted monitoring of specified features associated with SIHP # -7429. The details of the monitoring program will be included in the project's archaeological monitoring plan to be reviewed and approved by the SHPD.

10.2.2 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 historic fill deposits and natural soil layers. 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.

Section 11 References Cited

Abbott, R. Tucker and S. Peter Dance
1990 *Compendium of Seashells*. American Malacologists, Melbourne, Florida.

Adams, Bradley and Pam Crabtree
2011 *Comparative Osteology.* Academic Press, Reed Elsevier, New York.

American Toy Marble Museum
2014 History of toy marbles website. Online at http://americantoymarbles.com

Armstrong, R. Warwick (editor)
1983 *Atlas of Hawai‘i*. University of Hawaii Press, Honolulu.

Andrews, Lorrin
2003 *A Dictionary of the Hawaiian Language.* Island Heritage Publishing, Waipahu, Hawai‘i.

Athens, J. Stephen and Jerome V. Ward
1997 *Liliha Paleoenvironmental Study, Honolulu, Hawai‘i, Appendix A in Archaeological Excavations At Kuwili Fishpond, Site of the Proposed Liliha Civic Center, Kalihi-Pālama, O‘ahu, Hawai‘i (TMK: 1-5-7:1, 14, 15, 18, 57, 58, 60-78).* International Archaeological Research Institute, Inc., Honolulu.

Baldwin, E.D.
1883 Honolulu Water Works System. Registered Map 1087. Archived at Hawai‘i Land Survey Division, Department of Accounting and General Services, 1151 Punchbowl Street, Room 210, Honolulu, Hawai‘i.

Barrera, W.M., Jr. and P.V. Kirch
1973 Basaltic-Glass Artifacts from Hawaii: Their Dating and Prehistoric Uses. *Journal of the Polynesian Society*, 82:176-87. University of Auckland, Auckland, New Zealand.

Bell, Matt, Matt McDermott, and Owen O’Leary
2006 *Archaeological Inventory Survey Report for the Victoria Ward Village Shops Project, Waikiki Ahupua‘a, Honolulu (Kona) District, O‘ahu Island, TMK: [1] 2-3-5: 013-017, 022, & 023.* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Bingham, Hiram
1847 *A Residence of Twenty-One Years in the Sandwich Islands.* Huntington, Hartford, Connecticut and Convers, New York.

Bishop, S.E.
1884 Map of Honolulu, Kewalo Section. Registered Map 1090. Archived at Hawai‘i Land Survey Division, Department of Accounting and General Services, 1151 Punchbowl Street, Room 210, Honolulu, Hawai‘i.

BLM/SHA
2014 Bureau of Land Management and the Society for Historical Archaeology Historic Glass Bottle Identification Website. Electronic document, http:// www.sha.org/bottle/index.htm.

Block, Robert

1999 *Marbles. Identification and Price Guide.* Revised third edition. Schiffer Publishing Ltd., Atglen, Pennsylvania.

Boelen, Jacobus

1988 *A Merchant's Perspective: Captain Jacobus Boelen's Narrative of his Visit to Hawai‘i in 1828.* Hawaiian Historical Society, Honolulu, Hawai‘i.

Borget, Auguste

2000 Honolulu Salt Pan, near Kakaako. Original sketch at Peabody Essex Museum, Salem, Massachusetts. Reprinted in *Hawai‘i Looking Back. An Illustrated History of the Islands* by Glen Grant. Mutual Publishing, Honolulu, Hawai‘i.

Brigham, William T.

1902 *Stone Implements and Stone Work of the Ancient Hawaiians*. Memoirs of the Bernice Pauahi Bishop Museum Vol. 1, No. 4. Bernice Pauahi Bishop Museum, Honolulu.

1974 *Stone Implements and Stone Work of the Ancient Hawaiians.* Memoirs of the Bernice Pauahi Bishop Museum, Vol I, No. 4. Kraus Reprint Company, Millwood, New York.

Buck, Peter H. (Te Rangi Hiroa)

2003 *Arts and Crafts of Hawaii.* Bishop Museum Special Publication 45. Bishop Museum Press, Honolulu.

Carskadden, Jeff, Richard Gartley, and Elizabeth Reeb

1985 Marble Making and Marble Playing in Eastern Ohio: The Significance of Ceramic, Stone, and Glass Marbles in Historic Archaeology. *Proceedings of the Symposium on Ohio Valley Urban and Historic Archaeology*, pp. 86-97. Edited by Donald B. Ball and Philip J. Diblasi. Ohio Historical Society, Columbus, Ohio.

Chinen, Jon J.

1958 *The Great Māhele, Hawaii's Land Division of 1848.* University of Hawai‘i Press, Honolulu, Hawai‘i.

Chong, Douglas Dai Lunn

1998 *Ancestral Reflections: Hawaii’s Early Chinese of Waipahu, an Ethnic Community Experience, 1885-1935.* Waipahu Tsoong Nyee Society, Waipahu, Hawai‘i.

Clark, John R.K.

1977 *The Beaches of O‘ahu.* University of Hawai‘i Press, Honolulu, Hawai‘i.

Corney, Peter

1896 *Voyages in the Northern Pacific. Narrative of Several Trading Voyages From 1813 1818, Between the Northwest Coast of America, the Hawaiian Islands and China, with a Description of the Russian Establishments on the Northwest Coast.* Thos. G. Thrum, Honolulu, Hawai‘i.

Costello, Julia G. and Mary L. Maniery

1988 *Rice Bowls in the Delta. Artifacts Recovered from the 1915 Asian Community of Walnut Grove, California.* Occasional Paper 16, Institute of Archaeology, University of California, Los Angeles.

Cruz, Brian, Haven Giannasio and Hallett H. Hammatt
2012 *Cultural Impact Assessment for the Ward Neighborhood Master Plan Project, Kaka‘ako Ahupua‘a, Honolulu (Kona) District, Island of O‘ahu, TMK : [1] 2-1-049:063, 080; 2-1-050:001, 061, 062; 2-1-052:011, 012, 016, 017, 020, 022, 024, 027, 028, 031 to 036, 038, 039, 040, 042, 043, 045, 046, 051, 052, 053, 2-1-053:001, 030; 2-1-056:001; 2-3-001:001, 004, 005; 2-3-002:001, 002, 059, 067, 086, 087, 104; 2-3-003:022, 065, 093, 094; 2-3-005:004, 005, 006, 012 to 017, 019, 022*. Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Davis, Bertell
1989 *Subsurface Archeological Reconnaissance Survey and Historical Research at Fort DeRussy, Waikiki, Island of O‘ahu, Hawai‘i.* International Archaeological Research Institute, Inc., Honolulu.

Daysong, Rick
1997 Kakaako Mall to cost $200 Million. The 915,000 square-foot retain and entertainment center would replace Ward Warehouse. *Honolulu Star-Bulletin* 22 January 22.

Deenik, J. and A.T. McClellan
2007 Soils of Hawai‘i. *Soil and Crop Management*. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai‘i at Mānoa.

DeLeon, David
1978 *A Short History of Manoa Valley from 1800 to Present.* University of Hawai‘i at Mānoa, Hamilton Library, Honolulu, Hawai‘i.

Dye, Tom and J. Stephen Athens
2000 Part A: Introduction. In *Ancient Hawaiian Fishponds of Pearl Harbor: Archaeological Studies on U.S. Navy Lands, Hawai‘i*. J. Stephen Athens, editor. International Archeological Research Institute, Inc., Honolulu.

Eisenberg, Jerome M.
1981 *A Collector’s Guide to Seashells of the World.* Crescent Books, New York.

Elliott, Rex R.
1971 *Hawaiian Bottles of Long Ago.* Hawaiian Service, Inc., Honolulu.

Elliott, Rex R. and Stephen C. Gould
1988 *Hawaiian Bottles of Long Ago*. Revised edition. Hawaiian Service, Inc., Honolulu.

Emory, Kenneth Pike, William J. Bonk, and Yoshihiko H. Sinoto
1968 *Fishhooks.* Bishop Museum Special Publication Volume 47. Bishop Museum Press, Honolulu.

Ernest K. Hirata & Associates, Inc.
1992 *Soils Investigation Kakaako Community Development District Mauka Area-Phase 4 Infrastructure System Design Project for Engineers Surveyors Hawaii, Inc.* Ernest K. Hirata & Associates, Aiea, Hawai‘i.

Ferrall, Charles C., Jr.
1976 *Subsurface Geology of Waikiki, Moiliili and Kakaako with Engineering Application.* University of Hawai‘i Geology and Geophysics manuscript. University of Hawai‘i at Mānoa, Honolulu, Hawai‘i.

Fike, R.E.
1987 *The Bottle Book: A Comprehensive Guide to Historic, Embossed Medicine Bottles.* Peregrine Smith Books, Salt Land City, Idaho.

Fitzpatrick, Gary L.
1985 *The Early Mapping of Hawai‘i.* Editions Limited, Honolulu, Hawai‘i.

Fletcher, Charles H., III and Anthony T. Jones
1996 Sea-level highstand recorded in Holocene shoreline deposits on O‘ahu, Hawaii. *Journal of Sedimentary Research* 66(3):632-641.

Florida Museum of Natural History
2014 Historical Archaeology at the Florida Museum of Natural History. Introduction to Ceramic Identification. Electronic document, http://www.flmnh.ufl.edu/histarch/gallery_types/ceramics_intro.asp.

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens
1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the University of Hawai‘i Agricultural Experiment Station. U.S. Government Printing Office, Washington, D.C.

Forbes, David
1992 *Encounters with Paradise: Views of Hawaii and its People 1778-1941*. Honolulu Academy of Arts, Honolulu, Hawai‘i.

Fornander, Abraham
1916-1920 Fornander Collection of Hawaiian Antiquities and Folk-Lore. *Memoirs of the Bernice Pauahi Bishop Museum* Vol. IV-VI. Bishop Museum Press, Honolulu, Hawai‘i.

Gessler, Clifford
1938 *Hawaii. Isles of Enchantment.* D. Appleton-Century Company, New York and London.

Giambelluca T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte
2013 Online Rainfall Atlas of Hawai‘i. *Bulletin of the American Meteorological Society volume 94, pp. 313-316, doi: 10.1175/BAMS-D-11-00228.1.* Electronic document. <http://rainfall.geography.hawaii.edu> (accessed 27 September 2013).

Gilman, Gorman D.
1903 Streets of Honolulu in the Early Forties. In *Hawaiian Almanac and Annual for 1904.* Thos. G. Thrum, Honolulu, Hawai‘i.

Google Earth
2013 Aerial photographs of Hawai‘i. Google Inc., Mountain View, California. Available online at www.google.com/earth.html.

Grant, Glen
2000 *Hawai‘i Looking Back. An Illustrated History of the Islands.* Mutual Publishing, Honolulu, Hawai‘i.

Greer, Richard A.
1994 Grog Shops and Hotels. Bending the Elbow in Old Honolulu. *The Hawaiian Journal of History* 28:35-67.

Griffin, P. Bion, D.T.P. Keene, and Joseph Kennedy
1987 *Kaka‘ako: Prediction of Sub-Surface Archaeological Resources, Kaka‘ako Community Development District, Archaeological Reconnaissance Survey.* University of Hawai‘i at Mānoa, Honolulu, Hawai‘i.

Grossman, E.E. and C.H. Fletcher
1998 Sea level higher than present 3500 years ago on the northern main Hawaiian Islands. *Geology* 26(4):363-366.

Grossman, E.E., C.H. Fletcher, and B.M. Richmond
1998 The Holocene sea-level highstand in the equatorial Pacific: analysis of the insular paleosea-level database. *Coral Reefs* 17: 309-327.

Hammatt, Hallett, H.
2013 *Archaeological Inventory Survey Report for City Center (Section 4) of the Honolulu-High Capacity Transit Corridor Project, Kalihi, Kapālama, Honolulu, and Waikīkī Ahupua'a, Honolulu (Kona) District, Island of O'ahu TMK [1] 1-2, 1-5, 1-7, 2-1, 2-3 (Various Plates and Parcels),* Volume I. Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Handy, E.S., Craighill and Elizabeth G. Handy
1972 *Native Planters in Old Hawaii: Their Life, Lore, and Environment.* Bishop Museum Bulletin 23. Bishop Museum, Honolulu, Hawai‘i.

Hanley, Sister M.L., and O.A. Bushnell
1980 *A Song of Pilgrimage and Exile: the Life and Spirit of Mother Marianne of Molokai.* Franciscan Herald Press, Chicago.

Harney, J.N., E.E. Grossman, B.M. Richmond, and C.H. Fletcher III.
2000 Age and composition of carbonate shoreface sediments, Kailua Bay, Hawaii. *Coral Reefs* 19:141-154.

Hawaii Board of Health
1902 *Report of the President of the Board of Health of the Territory of Hawaii.* Bulletin Publishing Company, Honolulu.
1903 *Annual Report of the Board of Health of the Territory of Hawaii.* Bulletin Publishing Company, Honolulu.
1908 *Annual Report of the Board of Health of the Territory of Hawaii*. Bulletin Publishing Company, Honolulu.

Hawaii Department of Public Works
1904 *Annual report of the Superintendent of Public Works to the Governor of the Territory of Hawaii.* Bulletin Publishing Company, Honolulu.

1914 *Annual report of the Superintendent of Public Works to the Governor of the Territory of Hawaii.* Bulletin Publishing Company, Honolulu.

Hawai‘i Department of Transportation, Harbors Division

2007 *History of O‘ahu’s Harbors*. Electronic document, http://www.hawaii.gov/dot/harbors/oahu/history.htm (accessed 29 June 2011).

Hawaii First Legislative Assembly

1901 *First Legislative Assembly of the Territory of Hawaii, 1901, in Extra Session.* Grieve Publishing Company, Honolulu.

Hawaii Governor

1905 *Report of the Governor of the Territory of Hawaii to the Secretary of the Interior.* Government Printing Office, Washington, D. C.

Hawaii Reports

1914 *Cases Decided in the Supreme Court of the Territory of Hawaii*. Honolulu Star-Bulletin, Honolulu.

1915 *Cases Decided in the Supreme Court of the Territory of Hawaii.* Honolulu Star-Bulletin, Honolulu.

Hawai‘i State Archives

1933 Aerial photograph of Honolulu to Waikiki. Photograph PP-40-5-009. Hawai‘i State Archives, Honolulu.

Hawai‘i TMK Service

2012 Tax Map Key [1] 2-3-002. Hawai‘i TMK Service, Honolulu.

Hinks, Stephen

1995 A Structural and Functional Analysis of Eighteenth Century Buttons. *Volumes in Historical Archaeology* XXXII, edited by Stanley South. South Carolina Institute of Archaeology and Anthropology. University of South Carolina, Columbia, South Carolina.

Honolulu Advertiser

1928 Article on the Ala Wai Canal. Honolulu Advertiser, October 17, 1928, Page 2:16.

Hustace, Frank Ward, III

2000 *Victoria Ward and Her Family: Memories of Old Plantation.* Victoria Ward, Ltd., Honolulu, Hawai‘i.

Ī‘ī John Papa

1959 *Fragments of Hawaiian History as Recorded by John Papa ‘Ī‘ī.* Bishop Museum Press, Honolulu, Hawai‘i.

Kamakau, Samuel M.

1961 *Ruling Chiefs of Hawaii*. Kamehameha Schools Press, Honolulu, Hawai‘i.

1991 *Tales and Traditions of the People of Old: Nā Mo‘olelo a ka Po‘e Kahiko*. Bishop Museum Press, Honolulu, Hawai‘i.

Kay, E. Allison

1979 *Hawaiian Marine Shells.* Section 4. Bishop Museum Press, Honolulu.

Kekahuna, Henry E. P.
1958 *Hawaiian Place Names of O‘ahu*. Box M-445, Item # 81, Hawai‘i State Archives, Honolulu, Hawai‘i.

Kewalo Basin Harbor
2013 *Harbor History*. Electronic document, https://sites.google.com/site/kewalobasinharbor/home (accessed November 2013).

Kirch, Patrick V.
1992 *Anahulu. The Anthropology of History in the Kingdom of Hawaii. Volume Two: The Archaeology of History.* University of Chicago Press, Chicago.

Kotzebue, Otto von
1817 South O‘ahu [map]. In *The Early Mapping of Hawai‘i,* by Gary L. Fitzpatrick. Editions Limited, Honolulu, Hawai‘i.

Kovel, Ralph and Terry Kovel
1986 *Kovels’ New Dictionary of Marks: Pottery & Porcelain 1850 to the Present.* Crown Publishers, Inc., New York.

Larrison, G.
1917 Honolulu’s Future Water Supply. *Hawaiian Almanac and Annual for 1917*. Thomas G. Thrum, Honolulu.

Lebo, Susan A.
1997 *Native Hawaiian and Euro-American Culture Change in Early Honolulu, Archaeological Data Recovery, Harbor Court Property, Site No. 50-80-14-2456, Honolulu, Hawai‘i.* Susan A. Lebo, editor. Anthropology Department, Bishop Museum, Honolulu.

Lehner, Lois
1988 *Lehner’s Encyclopedia of U.S. Marks on Pottery, Porcelain & Clay.* Collector Books, Paducah, Kentucky.

Lindsey, Bill
2010 Historic Glass Bottle Identification & Information Website. Online at http://www.sha.org/bottle.

Lister, Florence C. and Robert H. Lister
1989 The Chinese of Early Tucson. Historic Archaeology from the Tucson Urban Renewal Project. *Anthropological Papers of the University of Arizona Number* 52. University of Arizona Press, Tucson, Arizona.

Lockhart, Bill
2004-2010 *The Dating Game. Bottles and Extras.* Electronic document, www.sha.org/bottlesandmore.htm.

Macdonald, Gordon A., Agatin T. Abbott, and Frank L. Peterson
1983 *Volcanoes in the Sea*. Second edition. University of Hawaii Press, Honolulu.

1989 The Chinese of Early Tucson. Historic Archaeology from the Tucson Urban Renewal Project. *Anthropological Papers of the University of Arizona Number* 52. The University of Arizona Press, Tucson.

Little, Elbert L. and Roger G. Skolmen
1989 Common Forest Trees of Hawaii (Native and Introduced). U.S. Department of Agriculture, Forest Service, Washington D.C.

Lockhart, Bill
2004 The Dating Game. Owens-Illinois Glass Co. *Bottles and Extras* Summer 2004:24-27.

2004-2010 *The Dating Game. Bottles and Extras.* Electronic document, www.sha.org/bottles.andmore.htm.

2010 *The History and Bottles of the Soft Drink Industry in El Paso, Texas, 1881-2000.* Townsend Library, New Mexico State University, Alamogordo, New Mexico.

Lockhart, Bill, Michael R. Miller, Bill Lindsey, Carol Serr, and David Whitten
2005 The Dating Game. Illinois Pacific- A Division of the Illinois Glass Co. *Bottles and Extras* Fall 2005:73-80)

Malo, David
1951 *Hawaiian Antiquities (Moolelo Hawaii)*, Translated from the Hawaiian by Nathaniel B. Emerson, 1898, Bernice P. Bishop Museum Special Publication, 2nd edition. Bishop P. Bishop Museum, Honolulu.

McAllister, J. Gilbert
1933 *Archaeology of Oahu.* Bishop Museum Bulletin 104. Bishop Museum Press, Honolulu.

Macdonald, Gordon A., Agatin T. Abbott, and Frank L. Peterson
1983 *Volcanoes in the Sea: The Geology of Hawaii*. University of Hawai‘i Press, Honolulu.

Mason Architects, Inc.
2002 *Incinerator Number One (Old Kewalo Incinerator)*. HAER No. HI-64. Historic American Buildings Survey (HAER), Pacific Great Bain System Support Office, National Park Service, Oakland, California.

Medina et al.
2013 *Archaeological Monitoring Report for the Traffic Control Signal Improvements along Dillingham Boulevard (Federal Aid Project No. STP-0001[36]), Honolulu Ahupua‘a, Kona District, O‘ahu Island TMKs: (1) 1-5-017, 020, and 022 por*. Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Millar, Jim
1988 *The Handbook of Hawaiian Machine Made Soda Bottles*. Soda Mart, Goodletsville, Tennessee.

Mitsch, William J., and James G. Gosselink
2007 *Wetlands*. John Wiley & Son, Inc. Hoboken, New Jersey.

Monsarrat, M.D.
1897 Map of Honolulu, Hawaiian Islands. Registered Map 1910. Archived at Hawai‘i Land Survey Division, Department of Accounting and General Services, 1151 Punchbowl Street, Room 210, Honolulu.

Myers, Adrian T.
2010 Telling Time for the Electrified: An Introduction to Porcelain Insulators and the Electrification of the American Home. *Technical Briefs in Historical Archaeology* 2010:31-42. Society for Historical Archaeology, Germantown, Maryland.

Nakamura, Barry S.
1979 The Story of Waikiki and the "Reclamation" Project. Master's thesis, History Department, University of Hawai‘i, Honolulu.

Nellist, George F., editor
1925 *The Story of Hawaii and Its Builders*. Honolulu Star Bulletin, Ltd., Honolulu.

NOAA (National Oceanic and Atmospheric Administration)
1993 NOAA Kaka‘ako Coast Aerial Photograph. UH MAGIS (University of Hawaii Maps, Aerial Photographs, and Geographic Information Systems), online at http://guides.library.manoa.hawaii.edu/magis.
2000 NOAA Kaka‘ako Coast Aerial Photograph. UH MAGIS (University of Hawaii Maps, Aerial Photographs, and Geographic Information Systems), online at http://guides.library.manoa.hawaii.edu/magis.

Odysseys Virtual Museum
2014 Lea & Perrins Worcestershire Sauce. Electronic document, http://odysseysvirtualmuseum.com/products/Lea-%26-Perrin%27s-Worcestershire-Sauce-Bottle-and-Stopper.html.

O'Hare, Constance R., Anthony Bush, and Hallett H. Hammatt
2006 *Archaeological Monitoring Report Kaka‘ako Community Improvement District 10, Honolulu Ahupua‘a, Kona District, O‘ahu (TMK [1] 2-3-04, 05, 06, & 07).* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

O'Hare, Constance R., Douglas F. Borthwick, and Hallett H. Hammatt
2012 *Archaeological Literature Review and Predictive Model Development for the Ward Neighborhood Master Plan Project, Kaka‘ako, Honolulu Ahupua‘a, Honolulu District, O‘ahu Island TMK: [1] 2-1-049:063, 080; 2-1-050:001, 061, 062; 2-1-052:011, 012, 016, 017, 020, 022, 024, 027, 028, 031 to 036, 038, 039, 040, 042, 043, 045, 046, 051, 052, 053, 2-1-053:001, 030; 2-1-056:001; 2-3-001:001, 004, 005; 2-3-002:001, 002, 059, 067, 086, 087, 104; 2-3-003:022, 065, 093, 094; 2-3-005:004, 005, 006, 012 to 017, 019, 022.* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Olsen, Stanley J.
1964 *Mammal Remains from Archaeological Sites: Part 1—Southeastern and Southwestern United States.* Peabody Museum Press, Cambridge, Massachusetts.

Pacific Commercial Advertiser
1875 Article on the Ward Estate. *Pacific Commercial Advertiser*, September 4, 1875.

Paradise of the Pacific
1950 Kakaako, A Growing Business District. *Paradise of the Pacific* November:21.

Prosser, Richard B.
1970 *Birmingham Inventors and Inventions, Being a Contribution to the Industrial History of Birmingham.* Originally published 1881. S.R. Publishers, n.p, Birmingham, Great Britain.

Pukui, Mary Kawena, E.W. Haertig, and Catherine A. Lee
1972 *Nānā I Ke Kumu (Look to the Source).* Hui Hānai, Honolulu, Hawai‘i.

Pukui, Mary Kawena, Samuel H. Elbert, and Esther T. Mookini
1974 *Place Names of Hawaii.* University of Hawai‘i Press, Honolulu, Hawai‘i.

Punahou School and Oahu College
1866 *Catalogue of the Teachers and Pupils of Punahou School and Oahu College for Twenty-five Years Ending 1866 with an Account of The Quarter Century Celebration Held at Punahou June 15th, 1866.* Printed by Henry M. Whitney, Honolulu, Hawai‘i.

Reineck, H. E., and I. B. Singh
1973 *Depositional Sedimentary Environments*. Springer-Verlag Berlin.

R.M. Towill Company
1970 High-altitude aerial photographic series for O‘ahu, 1970, 5063.2 and 5063.4. Copies available at the Hawai‘i State Archives, Aerial Photographs, File PPA 50-10.002 and 10.004, Kekāuluohi Building, 364 S. King Street, Honolulu, Hawai‘i.

Ross, Douglas
2012 Late Nineteenth- and Early Twentieth-Century Japanese Domestic Wares from British Columbia. In *Ceramics in America*, edited by Robert Hunter, pp. 2-29. Chipstone Publications, Yorktown, Virginia.

Scanlan, Brian L. and Brian G. Redmond
2012 *A Report of Archaeological Test Excavations at the Burrell Homestead August 2012.* Firelands Archaeological Research Center Occasional Papers No. 3. Sheffield, Ohio.

Schmid, Elisabeth
1972 *Atlas of Animal Bones for Prehistorians, Archaeologists and Quaternary Geologists.* Elsevier Publishing Company, Amterdam-London-New York.

Scott, Edward B.
1968 *The Saga of the Sandwich Islands, Volume 1.* Sierra-Tahoe Publishing Company, Crystal Bay, Lake Tahoe, Nevada.

Selling, Olof H.
1946a *Studies in Hawaiian Pollen Statistics: Part I, The Spores of the Hawaiian Pteridophytes.* Bishop Museum Special Publication 37. Bernice Pauahi Bishop Museum, Honolulu.

1946b *Studies in Hawaiian Pollen Statistics: Part 2, The Pollens of the Hawaiian Phanerograms.* Bishop Museum Special Publication 38. Bernice Pauahi Bishop Museum, Honolulu.

Sisson, Septimus
1953 *The Anatomy of the Domestic Animals*. W.B. Saunders Company, Philadelphia.

Soil Survey

2014 Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed 08 September 2014

Souza, Kehaulani E., Mary Perzinski, and Hallett H. Hammatt

2002 *An Archaeological Monitoring Report for the Kaka‘ako Improvement District 7 Project (TMK: 2-1-58, 2-3-01 thru-05).* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Spude, Cathy

2002 *Common 20th Century Artifacts—A Guide to Dating.* Society for Historic Archaeology. Electronic document, http://www.sha.org/research/20thCent_artifacts.cfm.

Sroat, Ena and Matt McDermott

2012 *Supplemental Archaeological Inventory Survey Report for the Ward Village Shops Phase 2 Project, Waikīkī Ahupua‘a, Honolulu (Kona) District, O‘ahu Island TMK: [1] 2-3-005:013-017, 022 & 023*. Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Sroat, Ena M., Constance R. O’Hare, and Matthew McDermott

2014 *Archaeological Inventory Survey Plan for the Block M Project, Kaka‘ako Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK: [1] 2-3-002:001 (portion).* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Stearns, H.T.

1978 *Quaternary Shorelines in the Hawaiian Islands*. Bishop Museum Bulletin 237. Bishop Museum Press, Honolulu.

Stewart, C.S.

1970 *Journal of a Residence in the Sandwich Islands, During the Years 1823, 1824, and 1825.* University of Hawai‘i Press for the Friends of the Library of Hawai‘i, Honolulu.

Stone, Scott C.S.

1983 *Honolulu, Heart of Hawai‘i.* Continental Heritage Press, Inc., Tulsa, Oklahoma.

Thrum, Thomas

1901 Retrospect for 1900. *Hawaiian Almanac and Annual for 1901.* Thomas G. Thrum, Honolulu.

1902 Retrospect for 1901. *Hawaiian Almanac and Annual for 1902*. Thomas G. Thrum, Honolulu.

1905 The Sandalwood Trade of Early Hawaii, As Told by the Pioneer Traders, Voyagers and Others, compiled by Thos. G. Thrum. *Hawaiian Almanac and Annual for 1905,* Thomas G. Thrum, Honolulu.

1906 Retrospect for 1905. *Hawaiian Almanac and Annual for 1906*. Thomas G. Thrum, Honolulu.

1907 Retrospect for 1906. *Hawaiian Almanac and Annual for 1907.* Thomas G. Thrum, Honolulu.

1916 Retrospect for 1915. *Hawaiian Almanac and Annual for 1916*. Thomas G. Thrum, Honolulu.

1920 Retrospect for 1919. *Hawaiian Almanac and Annual for 1920*. Thomas G. Thrum, Honolulu.

1924 Hawaiian Salt Making. *Hawaiian Almanac and Annual for 1924*. Thomas G. Thrum, Honolulu.

Titcomb, Margaret

1979 *Native Use of Marine Invertebrates in Old Hawaii.* University of Hawaii Press, Honolulu.

Toulouse, Julian Harrison

1971 *Bottle Makers and their Marks*. Thomas Nelson, Inc., Nashville, Tennessee and New York.

Tweiten, Michael Alan

2014 *Pollen and Charcoal Analysis of Samples from Kaka‘ako Block M, Honolulu (Kona) District, O‘ahu Island*. SkyCedar Research, Port Townsend, Washington.

UH SOEST

1927 Kaka‘ako Coast aerial photograph. University of Hawai‘i at Mānoa School of Ocean and Earth Science and Technology–Coastal Geology Group.

1952 Kaka‘ako Coast aerial photograph. University of Hawai‘i at Mānoa School of Ocean and Earth Science and Technology–Coastal Geology Group.

University of Hawai‘i

1978 *Remembering Kakaako: 1910-1950.* Ethnic Studies Oral History Project, Ethnic Studies Program, University of Hawai‘i at Mānoa, Honolulu.

U.S. Army Air Corps

1939-1941 High-altitude aerial photographic series for Oahu, 1939-1941, M [Mission] 56.57 and M. 56.59. Copies available at the Hawai‘i State Archives, Aerial Photographs, File PPA 44 1.001 and 1.006, Kekāuluohi Building, 364 S. King Street, Honolulu.

1952 High-altitude aerial photographic series for Oahu, 1952. Mosaic of aerial photographs of coastal area from the Hawai‘i Coastal Geology Group online at http://www.soest.hawaii.edu/coasts/erosion/oahu/mosaics.php (accessed 10 June 2011).

U.S. Army Mapping Service

1953 Map of Oahu, Honolulu Quadrangle. Available at USGS Information Services, Box 25286, Denver, Colorado.

U.S. Army War Department

1919 U.S. Army War Department Fire Control map, Honolulu Quadrangle. Available at USGS Information Services, Box 25286, Denver, Colorado.

1933 U.S. Army War Department Fire Control map, Honolulu Quadrangle. Survey conducted 1927-1928. Available at USGS Information Services, Box 25286, Denver, Colorado.

1943 U.S. Army War Department terrain map, Honolulu Quad. USGS Information Services, Denver, Colorado.

U.S. Department of Agriculture

2001 Soil Survey Geographic (SSURGO) database. U.S. Department of Agriculture, Natural Resources Conservation Service. Fort Worth, Texas. http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/.

U.S. Department of the Interior

1920 *Reports of the Department of the Interior for the Fiscal Year Ended June 30 1920.* Government Printing Office, Washington D. C.

U.S. Engineers

1917 Map of Oahu, from surveys conducted between 1903 and 1909. U. S. Army Corps of Engineers, Washington, D.C.

USGS (U.S. Geological Survey)

1927-28 Honolulu USGS 7.5-minute topographic quadrangle. Available at USGS Information Services, Box 25286, Denver, Colorado.

1982 USGS Orthophoto, Honolulu Quadrangle (Aerial photograph). Available at USGS Information Services, Box 25286, Denver, Colorado.

1998 Honolulu USGS 7.5-minute topographic quadrangle. USGS Information Services, Denver, Colorado.

Venovcevs, Anatolijs

2013 Dress for Life and Death: The Archaeology of Common Nineteenth Century Buttons. Paper presented at the 23rth annual Forward into the Past Conference, April 6, 2013, Wilfrid Laurier University, Waterloo, Ontario. Copy online at http://www.fitp.ca/articles/FITPXXIII/Dress_for_Life_and_Death_Paper.pdf.

Wagner, Warren L., Derral R. Herbst, and S. H. Sohmer

1990 *Manual of the Flowering Plants of Hawaii 1 and 2.* Bishop Museum Special Publication 83. Bernice Pauahi Bishop Museum, Honolulu.

Waihona ‘Aina

2000 *The Māhele Database*. Electronic document, http://www.waihona.com (accessed 1August 2010).

Wall, W.A.

1887 Map of Honolulu and Vicinity, Oahu Island, Kona District. Archived at Hawai‘i Land Survey Division, Department of Accounting and General Services, 1151 Punchbowl Street, Room 210, Honolulu.

Waters, Michael

1992 *Principles of Geoarchaeology: a North American Perspective*. The University of Arizona Press.

Whitten, David

2009 *Glass Factory Marks on Bottles.* Electronic document, http://www.myinsulators.om/glass-factories/bottlemarks.html

Wilson Okamoto & Associates, Inc.
1998 *Final Environmental Impact Statement for the Block J Redevelopment Project Honolulu, O‘ahu, Hawai‘i.* City and County of Honolulu Department of Community Services, Honolulu.

Winieski, John and Hallett H. Hammatt
2000 *An Archaeological Monitoring Report for Kaka’ako Improvement District 4 Honolulu, Hawaii (TMK 2-3-02 thru 05).* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Winieski, John and Hallett H. Hammatt
2001 *Archaeological Monitoring Report for Ward Village Phase II, (Ward Theaters) Kaka‘ako, Honolulu, O’ahu, Hawai’i (TMK 2-3-02:1).* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Young, Robert
2005 *Garbage in Paradise: A History of Honolulu’s Refuse Division*. City and County of Honolulu’s Department of Environmental Services, Division of Refuse Collection and Disposal, Honolulu.

Yucha, Trevor M., Josephine M. Yucha, and Matt McDermott
2013 *Draft. Archaeological Inventory Survey Report for the Ward Block C Project Area, Honolulu Ahupua‘a, Honolulu (Kona) District, O‘ahu Island, TMK: [1] 2-3-001:001 and 004.* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Zumwalt, Betty
1980 *Ketchup, Pickles, Sauces: 19th Century Food in Glass*. M. West Publishers, Fulton, California.

Appendix A SHPD Acceptance Letter

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

ESTHER KIA'AINA
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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
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January 10, 2014

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

LOG NO: 2013.6926
DOC NO: 1401SL10
Archaeology

Dear Ms. Sroat:

SUBJECT: Chapter 6E-42 Historic Preservation Review –
Draft Archaeological Inventory Survey Plan for the Block M Project
Kaka'ako Ahupua'a, Honolulu (Kona) District, O'ahu
TMK (1) 2-3-002:001 por.

Thank you for the opportunity to review this draft report titled *Draft Archaeological Inventory Survey Plan for the Block M Project, Kaka'ako Ahupua'a, Honolulu (Kona) District, O'ahu TMK (1) 2-3-002:001* (Sroat et al., December 2013). We received this submittal on December 10, 2013. The 3.6-acre Block M project area is owned by Victoria Ward, Limited (VWL) and is part of the VWL's 60.5-acre Ward Neighborhood Master Plan.

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 M. The field methods involve excavation of about 62 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. Fire-affected rocks will be documented in the field.

Please revise the following:
(1) Revise Table 2 to insert missing SIHP#s and Fig 36 to include SIHP #6378.
(2) Revise (page 83) to remove any mention of a supplemental AIS.

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 this correction 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 Pollen Analysis Report

Pollen and Charcoal Analysis of Samples from Kaka‘ako Block M, Honolulu (Kona) District, O‘ahu Island

By

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SkyCedar Research

Port Townsend, Washington

SkyCedar Research Report 14-002

Prepared for

Cultural Surveys Hawai`i, Inc.

Waimanalo, Hawai`i

Introduction

Sampling Purpose

Pollen and microcharcoal samples were taken from two excavation trenches currently below paved parking areas and the interior of existing commercial buildings in the Kaka‘ako Project Block M, Honolulu (Kona) District, O‘ahu Island. The 6 samples were thought to all represent natural wetland sediments. Sediment texture varied among samples with sediment textures including peat, silty clay, sandy clay and loamy sand. The goal was to characterize the community composition of the natural wetland contemporary with each sampling stratum and to assess the role of fire at the time of sediment deposition.

Ecological Review

The site is located in Kaka`ako with T- 13 at approximately 21°17' 42.47"N latitude and 157°51' 11.94"W longitude and T- 47 at 21°17' 40.34"N latitude and 157°51' 08.91"W longitude. Currently the site is in highly urbanized surroundings devoid of vegetation except for street trees. The site is at approximately 1 - 2 meter elevation and trench locations are currently 275 - 325 meters from open salt water. Annual rainfall in the area is 667mm per year (1). The potential non-wetland vegetation of the site is characterized as Dry Coastal because elevation is less than 15 meters and rainfall is less than 1200 mm per year (2).

The potential wetland vegetation is limited to a few Coastal Wet Communities (2). The most likely community is the Coastal Wet Sedgeland dominated by members of the Cyperaceae family that tolerate brackish water such as Kaluha (Bolboschoenus maritimus), and Makaloa (Cyperus laevigatus). The `Akulikuli (Sesuvium portulacastrum) Herbland is possible as an intermittent wetland type if the locality consisted of intermittently flooded, muddy shorelines adjacent to brackish lagoon and marshes. It is unlikely that Coastal Wet Shrublands dominated by hau (Hibiscus tilaceus) occurred in Kaka`ako since these communities mainly occur in windward

environments with more rainfall. Other archaeological investigations in the area found natural wetlands and fish pond sites dominated by the Cyperaceae family (3,4,5). The Coastal Wet Sedgelands is thus the most likely wetland community in the local area. These wetlands also had higher concentrations of non-pollen microfossils that indicate perpetually wet conditions such as Foraminifera and sclerodont fossils from wetland invertebrates. These wetland indicator microfossils were also recorded in the analysis of this report to help collaborate the interpretation from the pollen and spores.

Previous investigation of historical salt production pans and natural wetlands at Kaka`ako (6) found that the original vegetation before historic salt pan production was a matrix of two vegetation types. The first was Wet Coastal Sedgeland, likely dominated by the Cyperaceae species such as Kaluha (Bolboschoenus maritimus), and Makaloa (Cyperus laevigatus) and wetland Poaceae species like `Aki`aki (Sporobolus virginatus). The second was a sparse Dry Coastal Herbland vegetation on the surrounding sandy uplands and dunes with Hinahina kahakai (Nama sandwicensis) being the principle species. Historic development of salt pans and holding pools drastically reduced the abundance of the Wet Sedgeland with Cyperaceae and Poaceae possibly persisting on the fringe of the pools and pans. The sparse upland Nama Herbland vegetation persisted on the dunes, embankments and shores of the salt pan operations but increases in disturbance favored species in the Fabaceae family, possibly Nanea (Vigna marina).Natural wetlands had low levels of charcoal concentrations reflecting burning in the general area. Areas converted to pans for salt production showed increased charcoal concentrations both during the salt production and during subsequent fallow periods.

Pollen signatures found in the sediments represent a mixture of the pollen from the immediate site of sediment deposition as well as pollen-types from the surrounding vegetation which may consist of a different vegetation type. The pollen signatures in this analysis were interpreted as representing the wetland community composition combined with the composition of the upland matrix surrounding each excavation site. Typically the upland pollen signature become stronger when the wetland vegetation is reduced or eliminated by disturbance.

Methods

Pollen and microcharcoal samples were prepared with standard methods. Sediment samples from each sampling site were sub-sampled into 1 cc sub-samples. A 2-cc sub-sample size was used for the four samples with high sand content from T- 47. At the beginning of the pollen prep a spike of polystyrene microspheres of known concentration (50, 0000 spheres/ ml ± 8%) was added to the samples. Samples were boiled for 30 minutes in potassium hydroxide to disperse particles and remove humic acids. Then samples were filtered with 180 u and 6 u mesh screens to remove particles outside the size range of pollen types. Samples were then boiled in hydrochloric acid for 20 minutes to dissolve and remove carbonates. Following that samples were boiled in hydrofluoric acid for 20 minutes to remove silicates. The hydrofluoric acid treatment was neutralized with an additional three minute hydrochloric acid treatment. The residue was washed with glacial acetic acid then subjected to acetolysis with 9:1 a mixture of acetic anhydride and sulfuric acid to further disintegrate organic matter. For the four samples from T- 47 low pollen recovery led to the addition of a heavy liquid extraction procedure. Lithium heteropolytungstates (LST, density of 1.96 g/ml) was added to the samples and they were centrifuged to float pollen out of the silicate matrix and

further concentrate the pollen sample. Samples were dehydrated in 100% ethanol, then again in tert-butyl alcohol and suspended in silicone oil for slide preparation.

Pollen types were identified on a light microscope under kohler illumination with 400X magnification. Pollen type identification followed Selling (7,8) and species names follow Wagner (9). Additional assistance with pollen type identification was made using a personal collection of prepared reference pollen slides, and a collection of Hawaiian pollen type digital imagery. In addition to pollen and spores other microfossils such Foraminifera shells were also recorded. All pieces of microcharcoal, 6 to 180 u size class, were tallied on each slide. During each analysis the number of polystyrene microspheres were tallied along with the pollen, microfossils and charcoal. Counts of identified pollen types were made for each slide up to a total sum of 200 if possible. When counts of microspheres exceeded 150 microspheres further slide analysis was discontinued due to low pollen concentrations. In sample 6, the bottom-most loamy sand sample in T- 47, pollen recovery was quite low. After completely scanning multiple slides the count was stopped at a Total Sum of 13 due to time constraints. Unidentified pollen grains that are damaged or degraded so much that identification was impossible were counted but not included in the total sum. They represent a measure of the relative preservation quality of each sample.

Pollen type percentages were calculated for each pollen type by dividing the number of counted grains by the total sum and multiplying by 100%. Total concentration of pollen and concentration of charcoal were calculated in a similar manner using the formula:

$$C = ((P/M) * 50{,}000 \text{ spheres/ml})/V$$

where C is the concentration, P is the Total Pollen Sum or Charcoal Sum, M is the total count of microspheres and V is the sub-sampling volume (1cc or 2 cc).

Results & Discussion

Trench 13 (T- 13)

Overall, 13 pollen types (including spores and wetland microfossils) were found in the T- 13 and 47 sediments (Table 85 and Table 86). The two samples from T- 13 show a strong contrast. The lower sample (136-139 cm in stratum IIIb) was dominated by Cyperaceae pollen (79.7%). The second most abundant type was Nama at 12.4%. This reflects a wetland vegetation consisting of Wet Coastal Sedgeland surrounded by a sparse Nama Herbland on the sandy uplands. In the upper sample (130-133 cm in stratum IIIa) the sediment became a peat and the vegetation composition changed drastically. Cyperaceae pollen percentage fell to 5.4% and Nama increased to 72.4%. At the same time Fabaceae pollen increased tenfold to 20.2%. These changes indicate a great reduction in the presence of the wetland vegetation coupled with increased disturbance in the sparse upland Herbland. Total pollen concentration increased tenfold in the upper sample. Charcoal concentrations also increased from 266,149 pieces/ml to 930,000 pieces/ml suggesting increased disturbance by fire in the surroundings and possibly a transformation of the wetland by burning. The same pattern of Cyperaceae dominance in underlying wetland samples giving way to reduced Cyperaceae pollen, increased Charcoal, increased Total Pollen concentration and increased Fabaceae pollen was observed in Block I of Kaka`ako in the transformation of wetland to historical salt production pans (6). The T- 13 Stratum IIIa does not represent intact wetland vegetation but rather a highly disturbed plant community. The similarities in pollen and charcoal

concentrations in the T- 13 stratum IIIa sample to the historical salt pan samples in Block I suggest that this location may have had a relationship with the historical salt production activities.

Trench 47 (T- 47)

T- 47 was consistently a natural wetland through all four sampled strata. Cyperaceae pollen percentages were high through the sequence indicating a Wet Coastal Sedgeland vegetation dominated the site. The lower two samples had higher percentages of aquatic Foraminifera shells suggesting the wetland may have been more frequently or deeply inundated during the earlier depositional periods. Charcoal concentrations increased from the lower to the upper samples demonstrating increasing burning in the surrounding uplands in more recent sediments.

Summary & Conclusion

The most abundant types in all samples were from Herbaceous species indicating the vegetation was a matrix of herb, grass or sedge dominated community types. In all samples except T- 13 Strata IIIa, Cyperaceae was the dominant type indicating natural wetlands of the Wet Coastal Sedgeland vegetation type surrounded by a sparse Nama Herbland on the sandy uplands. In T- 13 Strata IIIa the occurrence of reduced Cyperaceae pollen, increased Charcoal, increased Total Pollen concentration and increased Fabaceae pollen indicate a highly disturbed plant community which may have had a relationship with the historical salt production activities in the area. Charcoal concentrations increased in the upper strata of both Trenches showing the increased role of burning in the area surrounding the wetlands in more recent times.

Wet Coastal Sedgelands are widespread globally but in Hawai`i have been greatly impacted by human land use and urbanization. Most examples of this community on the island of O`ahu have been replaced by urban development. The Kaka`ako Block M and Block I studies are an important record of what vegetation occurred in Honolulu before urbanization.

References

1. Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte, 2013: Online Rainfall Atlas of Hawai‘i. Bull. Amer. Meteor. Soc. 94, 313-316, doi: 10.1175/BAMS-D-11-00228.1.

2. Gagne, Wayne C. and Linda W, Cuddihy. 1990. "Vegetation" In Wagner, Warren L., Derral R. Herbst, and S. H. Sohmer 1990 Manual of the Flowering Plants of Hawaii 1 and 2. Bishop Museum Special Publication 83, Honolulu, Hawaii.

3. Cummings, Linda S. 1995. POLLEN ANALYSIS OF STRATIGRAPHIC SAMPLES FROM THE KAPI'OLANI BUSINESS DISTRICT, HONOLULU, ISLAND OF O'AHU http://core.tdar.org/document/375571 DOI: doi:10.6067/XCV8MG7NQ

4. Cummings, Linda S. 2006.POLLEN ANALYSIS OF SEDIMENTS FROM KOWILI FISHPOND, SIHP# 50-80-14-5368, NEAR THE HONOLULU HARBOR, HAWAII Stable URL: http://core.tdar.org/document/379415 DOI: doi:10.6067/XCV8348JVW

5. Cummings, Linda S . 2012. POLLEN ANALYSIS OF SAMPLES FROM THE HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT, HONOLULU, HAWAI'I. Stable URL: http://core.tdar.org/document/380417 DOI: doi:10.6067/XCV8V40TSG

6. Tweiten, M.A. 2014. Pollen and Charcoal Analysis of Samples from the Howard Hughes Corporation Kaka‘ako Block I, Honolulu (Kona) District, O‘ahu Island. Sky Cedar Research Report 14-001.

7. Selling, Olof H. 1946 Studies in Hawaiian Pollen Statistics: Part I, The Spores of the Hawaiian Pteridophytes. Bernice P. Bishop Museum Special Publication 37. Bishop Museum, Honolulu, Hawaii.

8. Selling, Olof H. 1946 Studies in Hawaiian Pollen Statistics: Part 2, The Pollens of the Hawaiian Phanerograms. Bernice P. Bishop Museum Special Publication 38. Bishop Museum, Honolulu, Hawaii.

9. Wagner, Warren L., Derral R. Herbst, and S. H. Sohmer 1990 Manual of the Flowering Plants of Hawaii 1 and 2. Bishop Museum Special Publication 83, Honolulu, Hawaii.

Table 85. Kaka’ako Pollen Types

Pollen Type	*Group*	*Common Name*	*Most Proximate Community Types*
FORAMINIFERA	Aquatic	Forams	Wetlands, pools, water
ASTERACEAE-High Spine	Herb	Sunflower family, Helianthus-type	disturbed habitats
ASTERACEAE-Low spine	Herb	Sunflower family, Ambrosia-type	disturbed habitats
CYPERACEAE	Herb	Sedge family, Kaluha, and Makaloa	Coastal Wet Sedgelands
FABACEAE	Herb	Bean family, Beach pea, nanea, Bur clover, slender mimosa	Coastal Dry Grassland, Coastal Dry Shrublands
LAMIACEAE	Herb	Mint family	naturalized species in disturbed habitats
Nama	Herb	Hinahina kahakai	Coastal Dry Herbland
POACEAE	Herb	Grass family, 'aki'aki, seashore rushgrass	Coastal Dry Grasslands, Coastal Wet Sedgelands, Coastal Dry Mixed Communities, Coastal Dry Shrublands
CHENO-AM	Shrub	`Aweoweo	Coastal Dry Shrubland
Aleurites	Tree	Kukui	Coastal Mesic Forests
Cocos nucifera	Tree	Niu, coconut	Coastal Mesic Forests
Cibotium	Spore	Hapu`u, tree ferns	Lowland Mesic Forests
Monolete-psilate	Spore	Ferns	Coastal Mesic Forests, Lowland Mesic Forests

Table 86. Numerical values for pollen types within each sample collected from Block M

ID	Trench	Depth	Stratum	Sediment type	FORAMINIFERA	ASTERACEAE -High spine	ASTERACEAE- Low spine	CYPERACEAE	FABACEAE	Nama	POACEAE	Chenopodiaceae-Amaranthaceae	Monolete-psilate	Other Types- < 2 grains per slide	UNIDENTIFIED	TotalSUM	TotalCONC	CHARCOAL
1	13	130-133	IIIa	peat	0	0	1.5	5.4	20.2	72.4	0	0.5	0		0.5	203	507500	930000
2	13	136-139	IIIb	sandy clay	0	0.5	1.5	79.7	2	12.4	0.5	0.5	2.5	Cocos nucifera	0	202	62733	266149
3	47	97-98	IVa	loamy sand	4.5	1.3	0	71.8	1.9	10.3	4.5	3.8	0.6	LAMIACEAE, Aleurites	1.3	149	24833	109000
4	47	108-109	IVb	sandy clay	1	0	0	94.5	0.5	0	0	1.5	1	Cocos nucifera, Cibotium	2	198	16555	139047
5	47	114-115	IVc	silty clay	45.5	1	0	45	0.5	1	4	2	1		2.8	109	55612	60204
6	47	126-127	IVd	loamy sand	18.7	0	0	68.7	0	6.3	0	6.3	0		0	13	14130	6522

Numerical values for pollen types are percent of the total sum (%). Higher values are darker gray. Total sum is the total count of identified microfossils and pollen types.

Unidentified percent is relative to the sum but not included in the sum.

Total concentration and Charcoal are shown as pieces or grains /ml.

Appendix C Taxa Analysis Report

RADIOCARBON SAMPLE SCREENING FOR
KAKAAKO 122 PROJECT, KAKA‘AKO, O‘AHU ISLAND

Gail M. Murakami

June 13, 2014

Introduction

This report presents the results of taxa identification in a single charcoal sample from the Cultural Surveys Hawaii Kakaako 122 Project in Kaka‘ako, O‘ahu. The identification of charcoal found in archaeological context can give insight into the vegetation of the surrounding area at the time the woods were burned. This information can then be used to interpret the environment as well as possible cultural use of specific plants. In addition, the screening of charcoal samples for the absence of historically introduced plants gives some assurance that the sample does not represent the remains of modern activities. The selection of native short-lived plants and plant parts for radiocarbon dating lessens the effect of in-built age.

Methods

One charcoal sample from the Kakaako 122 Project was examined for taxa identification. The freshly fractured transverse and tangential facets of each charcoal piece were viewed under magnification of a dissecting microscope. Taxa identifications were made by comparing the anatomical characteristics seen during examination against those of known woods in the Pacific Islands Wood Collection at the Department of Botany, University of Hawai‘i, and published descriptions.

Results

Four taxa were identified from the single sample. A description of the identified taxa is presented below. The summary of results is presented in Table 87. In Table 87, “cf.” indicates that the charcoal resembles the taxon specified but its exact identity is uncertain at this time.

Taxa Review

Aleurites moluccana (L.) Willd. *(Kukui)*

Once cultivated, this Polynesian introduction has escaped into the native forest, where the palefoliage of the 10 to 20 m trees (Wagner et al. 1990:598) can be seen in abundance in moist gulches and valleys. Dyes were once extracted from the bark and roots (Buck 1957:187), the oily kernel was burned for light (Buck 1957:107) or eaten as a relish after baking (Buck 1957:48), and net floats and dugout canoes were made from the soft wood (Buck 1957:297).

Chenopodium oahuense (Meyen) Aellen *(‘Āheahea, ‘āweoweo)*

This endemic species is usually a shrub in the coastal lowlands but may become arborescent at higher elevations (Hillebrand 1981:380). Its known distribution in the main Hawaiian Islands

includes coastal, dry forest, and subalpine shrubland at 0 to 2,520 meters elevation (Wagner et al. 1990:538). The soft wood was probably not used by the ancient Hawaiians but the leaves were cooked and eaten as greens (Hillebrand 1981:380; Malo 1951:23).

Nototrichium sp. (*Kulu‘ī*)

Two species of these native shrubs, endemic to the Hawaiian Islands, are found on O‘ahu. Nototrichium humile is rare in open dry remnant forest and sometimes found on cliff faces, in gulches or on steep slopes of O‘ahu and East Maui. N. sandwicense may be found scattered to sometime common in open dry forest, on exposed ridges, and lava fields on all the main Hawaiian Islands (Wagner et al. 1990:193-194).

Osteomeles anthyllidifolia Lindl. (*‘ūlei)*

This indigenous plant can often be found sprawling among the rocks along the coasts but may become an erect shrub up to 3 m tall in other environments. Osteomeles is found on all the main islands except Ni‘ihau and Kaho‘olawe and ranges in distribution from sea level to 2300 m in elevation (Wagner et al. 1990:1104-1105). In the past, the hard wood was used to make digging sticks (‘ō‘ō, fishing spears, carrying poles (‘auamo), and a musical bow (‘ukeke) (Buck 1957:12, 357, 14, 388). The flexible smaller branches were bent into hoops for fishnets (Neal 1965:387).

Table 87. Charcoal Taxa Identification in A Sample from the Kakaako 122 Project, O‘ahu.

WIDL No.	Taxa	Common/Hawaiian Name	Origin/Habit	Part	Count	Weight (g)
1405-1	*Chenopodium oahuense*	*‘Āheahea*	Native/shrub	Wood	5	0.90
1405-2	cf. *Nototrichium* sp.	*Kulu‘ī*	Native/shrub-tree	Wood	1	0.06
1405-3	*Aleuritus moluccana*	*Kukui*	Polynesian Introduction/tree	Nutshell	1	0.10
1405-4	cf. *Osteomeles anthyllidifolia*	*‘Ūlie*		Wood	1	0.05
1405-5	cf. *Aleuritus moluccana*	*Kukui*	Polynesian Introduction/tree	Wood	1	0.02

References Cited

Buck, Peter H. (Te Rangi Hiroa)
1957 Arts and Crafts of Hawaii. Bishop Museum Special Publication 45, Honolulu.

Hillebrand, William
1981 Flora of the Hawaiian Islands: A Description of their Phanerograms and Vascular Cryptogams. Lubrecht & Cramer, New York. Originally published in 1888.

Neal, Marie C.
1965 In Gardens of Hawaii. Bernice P. Bishop Museum Special Publication 50. Bishop Museum Press, Honolulu.

Wagner, Warren L., Derral R. Herbst, and S. H. Sohmer
1990 Manual of the Flowering Plants of Hawai‘i. University of Hawaii and Bishop Museum Presses, Honolulu.

Appendix D Radiocarbon Dating Results

Report of Radiocarbon Dating Analysis

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REPORT OF RADIOCARBON DATING ANALYSES

Dr. Hallett H. Hammatt/Megan Hawkins — Report Date: 7/23/2014

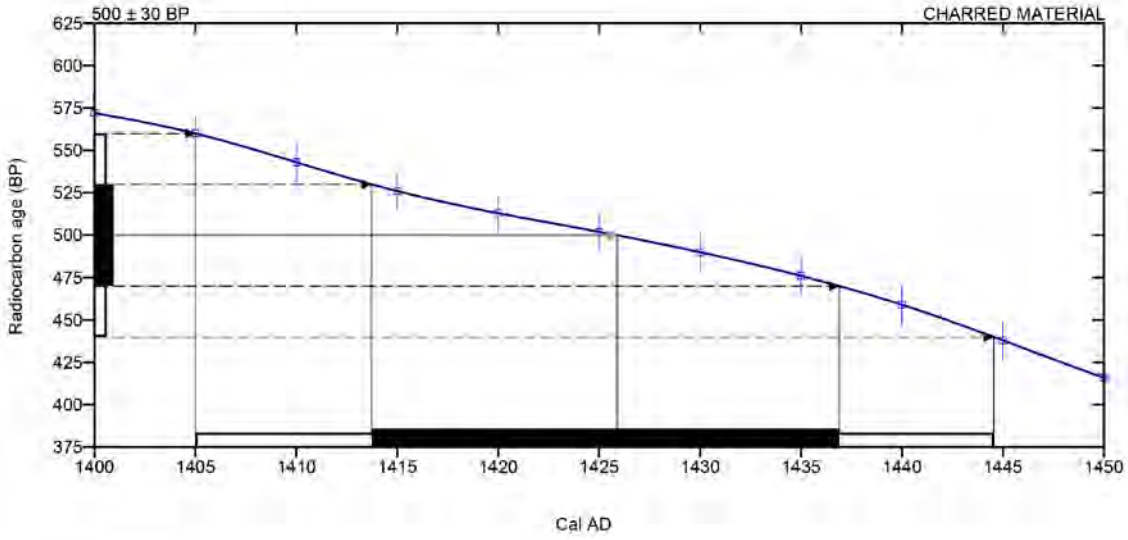
Cultural Surveys Hawaii — Material Received: 7/7/2014

Sample Data	Measured Radiocarbon Age	13C / 12C Ratio	Conventional Radiocarbon Age(*)
Beta - 384715	490 +/- 30 BP	-24.3 o/oo	500 +/- 30 BP
SAMPLE : K122-T02Fe1			
ANALYSIS : AMS-Standard delivery			
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid			
2 SIGMA CALIBRATION : Cal AD 1405 to 1445 (Cal BP 545 to 505)			

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -24.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-384715**
Conventional radiocarbon age	**500 ± 30 BP**
2 Sigma calibrated result 95% probability	**Cal AD 1405 to 1445 (Cal BP 545 to 505)**
Intercept of radiocarbon age with calibration curve	Cal AD 1425 (Cal BP 525)
1 Sigma calibrated results 68% probability	Cal AD 1415 to 1435 (Cal BP 535 to 515)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869–1887.

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