



Honolulu District
US Army Corps
of Engineers

Public Notice of Application for Permit

Regulatory Office
Building 230
Fort Shafter, Hawaii 96858-5440

Public Notice Date: December 4, 2013
Expiration Date: January 3, 2014
File Number: POH-2010-00248

Interested parties are hereby notified that an application has been received by the U.S. Army Corps of Engineers (Corps) for a Department of the Army (DA) permit for certain work in waters of the United States as described below and shown on the attached drawings.

APPLICANT: Mr. Clifford Lau, City & County of Honolulu, Department of Design & Construction (DDC), 650 South King Street, Honolulu, Hawaii 96813

AGENT: Dr. Dayananda Vithanage, Oceanit, 828 Fort Street Mall, Suite 600, Honolulu, Hawaii 96813

LOCATION: Shoreline fronting Mauna Lahilahi Beach Park and the Makaha Surfside Apartments, Makaha, Island of Oahu, Hawaii. TMK: 185017005.
Coordinate location: 21.45809°N, -158.20351°W.

PURPOSE: Stabilize the eroding coastline.

AUTHORITY: This permit application will be reviewed under the following authorities:

(X) Perform work in or affecting navigable waters of the United States – Section 10 Rivers and Harbors Act 1899 (33 U.S.C. 403).

(X) Discharge dredged or fill material into waters of the United States – Section 404 Clean Water Act (33 U.S.C. 1344). The Corps' public interest review will consider the guidelines set forth under Section 404(b) of the Clean Water Act (40 CFR 230).

() Transport dredged material for the purpose of dumping it into ocean waters - Section 103 Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1413). The Corps' public interest review will consider the criteria established under authority of Section 102(a) of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (40 CFR Parts 220 to 229), as appropriate.

PROPOSED ACTIVITY: The DDC proposes to discharge a total of approximately 800 cubic yards of armor stone, 190 cy of bedding stone, 65 cy of sand and 200 cy of gravel fill material into waters of the U.S. to construct a 300-foot long, 30-40-foot wide, 15-foot high rock revetment along the eroded shoreline fronting the Makaha Surfside Apartments. The proposed rock revetment would replace the existing temporary sandbag revetment constructed in 1990 that is currently failing even after several attempts to repair it. The construction sequence would involve installation of temporary Best Management Practices (BMP) and erosion control measures both in water and on land, removal of the existing sandbags with placement of the bag material along the adjacent beach, excavation of the existing shoreline to prepare the site for the rock revetment, laying of geotextile fabric within the footprint of the rock revetment, and construction of the permanent rock revetment. During construction, the applicant is proposing to use a temporary wave barrier constructed of sandbags and toe rocks to surround and isolate the active construction area from surrounding marine waters to minimize construction runoff into the ocean as well as protect the work area from wave action. All heavy machinery associated with the construction of the revetment, including a clamshell excavator, front loader, and a backhoe would be staged along the shoreline and not in waters of the U.S. All excavated materials would either be used as backfill for the revetment or would be removed from the project site using dump trucks. If authorized, construction is expected to begin in October 2014 and last no more than 3-4 months.

The project plans and site-specific BMP plan are provided as an attachment (Enclosure 1) to this notice.

MITIGATION: There exist no alternative sites for the proposed action as the need for the rock revetment is to treat site-specific erosion of the coastal slope fronting the Makaha Surfside Apartments. The following alternative methods to protect the shoreline in the area were considered by the DDC: construction of an additional breakwater to block the wave surge coming through the gap between the existing breakwater and the reef rock shoreline to the North, building a concrete or CRM seawall along the shoreline, or extending the existing breakwater across the mouth to the northern shoreline. The DDC's application states that the proposed action is the most acceptable alternative for protecting inland property and that the design for the preferred alternative is the minimum necessary to be effective in reducing the erosion threat. Because the revetment will be placed in a highly eroded area, the DDC proposes that the preferred alternative will not cause additional adverse environmental effects. The DDC's site-specific measures are included in the attached BMP plan.

WATER QUALITY CERTIFICATION: The proposed action would result in a discharge of dredged or fill material into waters of the U.S. and would require authorization from the Corps under Section 404 of the Clean Water Act of 1972 (33 U.S.C. 1344) (CWA). Under Section 401 of the CWA, the Corps may not issue a permit for the described work until the applicant obtains a certification, or a waiver of certification, from the State of Hawaii, Department of Health, Clean Water Branch.

COASTAL ZONE MANAGEMENT ACT CERTIFICATION: The proposed action will affect land or water uses in the Coastal Zone. Under Section 307(c)(3) of the Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1456(c)(3)) (CZMA), the Corps may not issue a permit for the described work until the applicant obtains a CZM Consistency Concurrence from the State of Hawaii, Department of Business, Economic Development, and Tourism, Office of Planning, CZM Program.

CULTURAL AND HISTORIC RESOURCES: The DDC provided an Archaeological Monitoring Report for the subject project dated January 2009 (Enclosure 2). The report identifies two historic sites within parcels adjoining the project area (TMKs 184001001, 185017001-007 & 002, and 185018001-003) identified as State inventory of Historic Places (SIHP) Site #50-80-07-6704 and SIHP #50-80-07-6705. Accordingly, a determination of eligibility and, if needed, a determination of effect will be made in consultation with the State Historic Preservation Division (SHPD). This application is being coordinated with SHPD. Any comments SHPD may have concerning presently unknown archeological or historic data that may be lost or destroyed by work under the requested permit will be considered in our final assessment of the proposed work.

ENDANGERED SPECIES: Section 7 of the Endangered Species Act of 1973 (16 U.S. C. 1531 *et seq.*) (ESA) requires federal agencies to consult with the National Marine Fisheries Service (NMFS) and/or U.S. Fish and Wildlife Service (USFWS) on any action that may affect a species listed (or proposed for listing) under the ESA as threatened or endangered or any designated critical habitat.

Surveys conducted by the DDC indicate sea turtles are known to occur within the project area (Enclosure 3). The following ESA-listed marine species have the potential to occur within the project area: Hawksbill sea turtle (*Eretmochelys imbricate*), Green sea turtle (*Chelonia mydas*), and Hawaiian monk seals (*Monachus schauinslandi*). Concurrently with the issuance of this notice, the Corps will evaluate the potential project-related impacts to protected species and their designated critical habitat and, if required, initiate consultation with the local NMFS office.

ESSENTIAL FISH HABITAT: The proposed work is being evaluated for possible effects to Essential Fish Habitat (EFH) pursuant to Section 305(b) the Magnuson Stevens Fishery Conservation and Management Act of 1996 (16 U.S.C. 1855(b)) (MSFCMA) and associated federal regulations found at 50 CFR Part 600 Subpart K. The Honolulu District area of responsibility includes areas of EFH as Fishery Management Plans. We have reviewed the January 20, 1999, Western Pacific Fishery Management Council's Environmental Assessment to locate EFH areas as identified by NMFS.

The DDC surveyed the project area and determined the surrounding waters are absent of coral. However, the project area encompasses EFH identified for the following Management Unit Species: Bottomfish (all life stages), Pelagics (all life stages), Coral Reef Ecosystem and Crustaceans (lobster and crab, all life stages). Concurrently with the issuance of this notice, the Corps will evaluate the potential project-related impacts to EFH and, if required, initiate consultation with the local NMFS office.

EVALUATION: The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits, which reasonably may be expected to accrue from the proposal, must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people.

The Corps is soliciting comments from the public; Federal, State, and local agencies and officials; and other interested parties in order to consider and evaluate the impacts of this activity. Any comments received will be considered by the Corps to determine whether to issue, modify, condition, or deny a permit for the work. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the activity.

PUBLIC HEARING: Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for public hearings must state clearly and concisely, the reasons and rationale for holding a public hearing.

COMMENT AND REVIEW PERIOD: Conventional mail or e-mail comments on this public notice will be accepted and made part of the record and will be considered in determining whether it would be in the public interest to authorize this proposed work. In order to be accepted, e-mail comments must originate from the author's e-mail account and must include on the subject line of the e-mail message the permit applicant's name and the Corps file number **POH-2010-00248**.

All e-mail comments should be sent to:

jessie.k.paahana@usace.army.mil

Conventional mail comments should be sent to:

U.S. Army Corps of Engineers, Honolulu District
Regulatory Office, Building 230
Attention: Jessie Paahana
Fort Shafter, Hawaii 96858-5440

Both conventional mail or e-mail comments must reach this office no later than the expiration date of this public notice to become part of the record and be considered in the decision. Please contact Ms. Jessie Paahana at (808) 835-4107 if further information is desired concerning this notice. This public notice is issued by the Chief, Regulatory Office.

Attachments

- Enclosure 1: DA Permit Application, Supplemental Questionnaire and BMP Plan
- Enclosure 2: Archaeological Monitoring Report
- Enclosure 3: Marine Biological Survey

Department of the Army Permit Application ENG FORM 4345 and Supplemental Questionnaire

Mauna Lahilahi Rock Revetment Wai`anae, Hawaii

Prepared for:

Department of Design and Construction
City and County of Honolulu



Prepared by:



828 Fort Street Mall
Suite 600
Honolulu, HI 96813

June 2013

TABLE OF CONTENTS

ENG FORM 4345 iv

SUPPLEMENTAL QUESTIONNAIRE

A. Location 1

B. Proposed Action 1

 1. Scope of Work..... 1

 a. Construction Methods..... 1

 b. Machinery/Equipment..... 1

 c. Staging/Access Requirements 1

 d. Construction Sequence 3

 e. Construction Scheduling..... 3

 f. Stockpiling..... 3

 2. Borrow and Upland Disposal Sites 3

 3. Best Management Practices..... 3

C. Discharge of Dredged and/or Fill Material..... 4

 1. Source of Dredged or Fill Material 4

 2. Method of Discharge 4

 3. Location of Discharge..... 4

 4. Structures/Facilities Constructed on Fill Area 4

D. Dredging Projects..... 4

 1. Project Plans 4

 2. Composition of Dredged Material 5

 3. Construction Window 5

 4. Volume and Surface Area of Project Area 5

 5. Dredging Methods 5

 6. Dredged Material Dewatering Area 5

 7. Disposition of Dredged Materials Once Excavated..... 5

 a. Disposal Location of Dredged Materials 5

 b. Proposed Disposal Volume 5

 c. Type and Composition of Material 5

 d. Length of Disposal Period..... 5

 e. Means of Transportation of Material to Ocean Disposal Site 5

E. Structures in Navigable Waters.....	6
1. Structures Constructed and Machinery/Equipment Used.....	6
2. Water Work Required.....	6
3. Structure Use	6
4. Support or Anchoring System.....	6
F. Existing Environment	7
1. Physical Environment.....	7
a. Project and Surrounding Area.....	7
b. Site Substrate.....	10
c. Range of Water Levels	10
d. Water Currents and Circulation.....	10
e. Salinity of Waters.....	12
f. Water Quality.....	12
g. Groundwater Recharge Area.....	12
h. History or Possibility of Contamination in Fill Area	12
i. Erosion Problems	12
j. Drainage Way or Floodplains.....	12
k. Air Quality.....	12
l. Noise Levels.....	12
2. Biological Environment.....	13
a. General Description.....	13
b. Threatened or Endangered Species	13
3. Special Aquatic Sites.....	14
4. Public Interest Review	14
a. Existing Land Zoning	14
G. Environmental Effects of Proposed Project	16
1. Physical Environment.....	16
2. Biological Environment.....	16
3. Special Aquatic Sites.....	16
4. Human Use	17
5. Historical/Cultural Resources	17
6. Indirect Impacts.....	17
7. Cumulative and Other Impacts	18

H. Alternatives	18
1. Other possible sites for this proposal.....	18
2. Discharge of Fill Material to Convert Wetlands or Submerged Areas	18
3. Other designs or methods	18
4. Alternatives if permit is denied.....	18

LIST OF FIGURES

Figure 1. USGS Topographic Location Map	2
Figure 2. View of the Shoreline Fronting Makaha Surfside	8
Figure 3. Existing Sandbag Revetment Fronting Makaha Surfside	9
Figure 4. State Land Use Designations.....	11
Figure 5. City and County Zoning Map.....	15
Figure 6. Makaha Surfside Apartments.....	16

APPENDICES

Appendix A – Project Site Photographs

Appendix B – Construction Plans

**U.S. ARMY CORPS OF ENGINEERS
APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT
(33 CFR 325)**

OMB APPROVAL NO. 0710-0003
EXPIRES: 31 AUGUST 2012

Public reporting for this collection of information is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters, Executive Services and Communications Directorate, Information Management Division and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE
--------------------	----------------------	------------------	------------------------------

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME First - Clifford Middle - Last - Lau Company - Department of Design and Construction E-mail Address - clau1@honolulu.gov			8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required) First - Dayananda Middle - Last - Vithanage Company - Oceanit E-mail Address - dvithanage@oceanit.com		
6. APPLICANT'S ADDRESS: Address- 650 South King Street City - Honolulu State - HI Zip - 96813 Country - USA			9. AGENT'S ADDRESS: Address- 828 Fort Street Mall Suite 600 City - Honolulu State - HI Zip - 96813 Country - USA		
7. APPLICANT'S PHONE NOs. w/AREA CODE a. Residence b. Business c. Fax (808) 768-8478 (808) 768-4767			10. AGENTS PHONE NOs. w/AREA CODE a. Residence b. Business c. Fax 808-531-3017 808-531-3177		

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Dayananda Vithanage, Oceanit to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.


 SIGNATURE OF APPLICANT 7/2/13 DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions) Mauna Lahilahi Beach Park Rock Revetment	
13. NAME OF WATERBODY, IF KNOWN (if applicable) Pacific Ocean	14. PROJECT STREET ADDRESS (if applicable) Address 85-101 C Farrington Highway, Wai`anae HI 96792 City - Wai`anae State- HI Zip- 96792
15. LOCATION OF PROJECT Latitude: +N South 14°19'52.26" Longitude: +W West 170°47'51.21"	
16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions) State Tax Parcel ID 8-5-0017:005 Municipality City and County of Honolulu Section - Township - Range -	

17. DIRECTIONS TO THE SITE

The project site is located on the leeward side of Oahu at Mauna Lahilahi Beach Park between Lahilahi Point and Wai'anae High School in Wai'anae. The site is fronted by the Makaha Surfside Apartments at 85-175 Farrington Highway.

18. Nature of Activity (Description of project, include all features)

The activity is to construct a rock revetment for shoreline protection, there will be dredging and filling as part of this project. Approximately one-third of the proposed work will be constructed below the mean higher high water (MHHW) line. The remaining two thirds will be constructed above the MHHW line.

Please see the included Department of the Army Permit Application Supplemental Questionnaire.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

The goal of this project is to stabilize the beach park coastline fronting the Makaha Surfside Apartments. The shoreline has been eroding for at least 50 years and a previously constructed breakwater and nourished beach were only partially successful in stopping the erosion.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

A rock revetment will be constructed at Mauna Lahilahi Beach Park along the shoreline inside the cove fronting the Makaha Surfside Apartments. The revetment will minimize shoreline erosion and wave runup. The revetment will be constructed with armor stone, bedding stone, gravel, sand, and geotextile fabric.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
Armor and Bedding Stone, 990 CY.	Sand and gravel, 235 CY	

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres The revetment will cover approximately 0.2 acres below the MHHW line.

or

Linear Feet The revetment is approximately 350 feet long.

23. Description of Avoidance, Minimization, and Compensation (see instructions)

See supplemental questionnaire.

24. Is Any Portion of the Work Already Complete? Yes No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address- Wai'anae High School, 85-251 Farrington Highway

City - Wai'anae State - HI Zip - 96792

b. Address- Makaha Surfside Apartments, 85-175 Farrington Highway

City - Wai'anae State - HI Zip - 96792

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
DOH	401 WQC		In progress		
CZM	Federal Consistency		In progress		
DLNR	CDUP		In progress		

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.


7/2/13
 SIGNATURE OF APPLICANT DATE SIGNATURE OF AGENT DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than \$10,000 or imprisoned not more than five years or both.

**Department of the Army Permit Application
SUPPLEMENTAL QUESTIONNAIRE
Mauna Lahilahi Beach Park Rock Revetment
Department of Design and Construction, City and County of Honolulu**

A. Location

- Tax Map Key Number: 8-5-017:005
- Latitude: 21° 27' 29.16" N Longitude: 158° 12' 15.55" W
- Project Watershed: Wai`anae, O`ahu, Hawai`i

B. Proposed Action

1. Scope of Work

A new rock revetment approximately 300 feet long, 30-40 feet wide, and 15 feet high will be constructed at Mauna Lahilahi Beach Park in a small eroding cove that is partially protected by a rock breakwater constructed in 2003. The revetment will follow the shoreline along the existing sandbag revetment, which will be removed. The revetment is shown in the attached drawings. The revetment will consist of a double layer of armor stones over a double layer of bedding stones and additional gravel backfill that will serve as a water return filter for overtopping waves. A geotextile filter will be placed under the stones and gravel to prevent piping of existing fine soil through the stones into the ocean.

a. Construction Methods

The existing sandbag revetment will be removed and the new rock revetment will be constructed using heavy equipment. The sandbags will be emptied on the existing beach and the bag material will be disposed of offsite. The location of the revetment toe will be excavated to the depths shown on the plans. At the south end of the construction area, sand will be temporarily moved to allow space for revetment construction.

b. Machinery/Equipment

Equipment including an excavator and a front loader will be used to handle the revetment rock and backfill gravel. Dump trucks will haul rock and gravel to the site.

c. Staging/Access Requirements

Access to the construction site will be from two directions. Construction equipment can drive in or be towed in through Wai`anae High School to the south or through the old parking lot just to the north of the Makaha Surfside. An access map is attached. Hawaiian burials have been found in the park, and access is planned to avoid these.



Figure 1. USGS Topographic Location Map

d. Construction Sequence

The construction sequence is as follows:

1	Mobilization
2	Install BMPs and erosion control measures
3	Remove existing sand bags
4	Grading to create a 1.5:1 H:V slope and a wider path between the fence line and the revetment structure
5	Construct rock revetment
6	Place sand from sand bags on existing beach
7	Remove BMPs

e. Construction Scheduling

Construction should take no more than 3-4 months after the contractor receives the notice to proceed (NTP). The project is planned to start in October 2014 and finish in January 2015.

f. Stockpiling

The stockpiling and staging areas will be on both the west and east sides of the project site. Two temporary access paths are also planned on both the west and east sides of the site. No materials will be stockpiled in waters of the U.S.

2. Borrow and Upland Disposal Sites

There will be no excess material for this project. All of the excess construction material will be removed off site by the contractor and excavated material will be used for back fill or removed from the site. Sand from sandbags will be placed back on the beach.

3. Best Management Practices

A Best Management Practices Plan is included with the permit application. A temporary barrier consisting of filled sandbags and toe rocks will be used to mitigate storm water and construction runoff from entering the ocean. This BMP will also minimize ocean waves from entering the construction site. The temporary barrier will be moved along with construction progress provide wave protection for the work site. Once the work is completed, the sandbag barrier will be removed and the sand placed on the existing beach.

Work will be conducted on the beach area during the low tidal cycle. It will be easier to control potential runoff from the work area and inundation from waves overtopping the temporary breakwater.

C. Discharge of Dredged and/or Fill Material

1. Source of Dredged or Fill Material

Rock for the revetment will be field stone or quarried stone brought from off site. The revetment will require approximately 800 cubic yards of armor stone, 190 cubic yards of bedding stone, 65 cubic yards of sand, and 170 cubic yards of gravel below MHHW. Approximately 1,000 square yards of geotextile filter will be placed under the revetment stone. In addition, any sand remaining from the sandbag revetment will be placed on the existing beach.

2. Method of Discharge

An excavator and backhoe will be required to remove coral rubble and sand to create a 1:1.5 (V/H) slope and to excavate down to (-) 4.0 feet for the revetment toe. A clamshell excavator will be used to place the armor rock.

3. Location of Discharge

The location of the discharge is in front of the Makaha Surfside Apartments where an existing temporary sand bag revetment is currently in place. The sand bags will be removed and replaced with a permanent rock revetment. The revetment is approximately 350 feet long by 30-40 feet wide and is 15 feet high. The toe of the structure will be below the mean higher high water (MHHW) line by approximately 5 feet.

4. Structures/Facilities Constructed on Fill Area

Structures that will be constructed consist of sand, gravel, two layers of bedding stones, and two layers of armor stones for the purpose of protecting the shoreline from erosion (see attached Construction Plans).

D. Dredging Projects

1. Project Plans

This is not a dredging project; however the revetment slope will be graded to a depth of -4.0 feet MSL for placement of the revetment toe. The beach at the south end of the project will also be partially excavated to construct the rock revetment. Please refer to the construction plans.

2. Composition of Dredged Material

The excavated material will consist of beach sand, rubble, and hard limestone substrate.

3. Construction Window

Excavation and construction of the revetment will take approximately 3-4 months after the contractor starts work. Excavation will be accomplished in phases. No maintenance dredging is proposed. The project is a shoreline protection project.

4. Volume and Surface Area of Project Area

The total volume of material to be discharged is 1,255 cubic yards. The volume dredged below the MHHW line is 520 cubic yards. The surface area of fill below MHHW is approximately 10,915 square feet.

5. Dredging Methods

An excavator will be required to remove rocks and sand to create a 1:1.5 (V:H) slope and to excavate down to -4.0 feet for the toe of the revetment.

6. Dredged Material Dewatering Area

The excavated material will be used to grade the revetment slope and will not be dewatered.

7. Disposition of Dredged Materials Once Excavated

a. Disposal Location of Dredged Materials

No ocean disposal is planned. All of the excavated material will be re-used to create the backfill slope for the revetment or to enhance the beach.

b. Proposed Disposal Volume

There will be no disposal of excavated material.

c. Type and Composition of Material

Excavated material will consist of beach sand and rubble.

d. Length of Disposal Period

No disposal is proposed for this project.

e. Means of Transportation of Material to Ocean Disposal Site

There will be no ocean disposal for this project.

E. Structures in Navigable Waters

1. Structures Constructed and Machinery/Equipment Used

An excavator and front loader will be required to construct the revetment. Part of the revetment will be in navigable waters. A dump truck will also be used to haul the construction materials to the site. Equipment will not operate in the water.

2. Water Work Required

Revetment material (gravel, sand, and armor stone) and temporary BMPs will be placed in the water.

The planned rock revetment will be partially in the water below MHHW. The revetment will provide erosion protection for the shoreline and backshore areas.

One of the BMP's used on this project is a temporary wave barrier consisting of filled sandbags and toe rocks will minimize storm water and construction runoff from entering the ocean. The barrier will provide protection of the work site from waves. When the work is completed along a portion of the work area, the temporary barrier will be moved and set up in another portion of the work area so construction can continue.

3. Structure Use

The temporary breakwater is for debris catchment and wave protection in the immediate construction area. This temporary breakwater will be removed after construction completion. The permanent revetment construction is for the purpose of shoreline protection for the beach park and the Makaha Surfside Apartments.

4. Support or Anchoring System

The toe of the structure will be armor and bedding stones that will be placed below existing ground elevation and backfilled with gravel and excavated material.

F. Existing Environment

1. Physical Environment

a. Project and Surrounding Area

(1) Level of Development

The project site is part of the Mauna Lahilahi Beach Park, which is situated in front of the Makaha Surfside Apartments (Figure 1). Waianae High School is located east of the project site. The town of Wai`anae is immediately to the southeast. Makaha is to the northwest.

(2) Existing Land and Water Use

The location of the project site is urban. The cove fronting Makaha Surfside is used for beach recreation and provides a sheltered swimming area (Figure 2). The existing sandbag revetment is shown in Figure 3. Nearby residents also use the park for walking and occasional fishing.

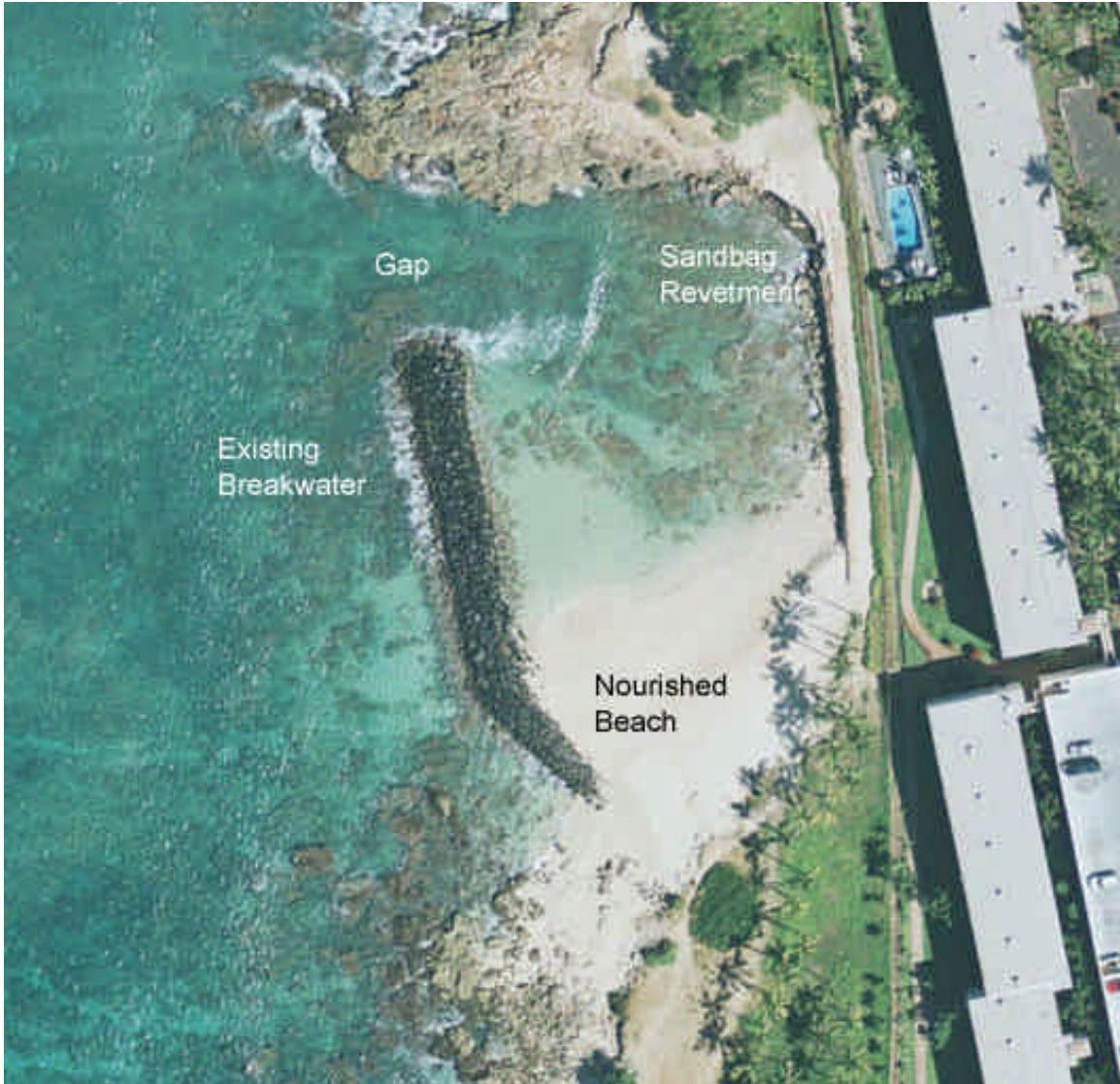


Figure 2. View of the Shoreline Fronting Makaha Surfside



Figure 3. Existing Sandbag Revetment Fronting Makaha Surfside

b. Site Substrate

Soil substrate at the site is classified by NRCS as Hanalei silty clay. A relatively thin layer of sand covers some of the site. The main Mauna Lahilahi Beach is coralline sand. The hard shoreline is classified as coral outcroppings.

c. Range of Water Levels

Tide levels relative to mean lower low water are as follows:

MHHW	1.9 ft
MHW	1.44 ft
MSL	0.8 ft
MLLW	0.0 ft
Maximum	3.39 on 2/14/1967
Minimum	-1.41 on 4/30/1911

During high deepwater waves, the embankment at approximately +10 ft MSL has been overtopped by wave runoff. During hurricanes in 1982 and 1992, storm surge ran through the bottom floor of the Makaha Surfside Apartments.

d. Water Currents and Circulation

Currents run in both directions along the coast driven by tide and wind. Before the existing breakwater was constructed in 2003, waves would push water along the south shoreline and into the cove. The water appeared to return out the center or along the north side of the cove sometimes carrying beach sand. Waves typically broke across the mouth of the cove. Since breakwater construction, waves break across the breakwater gap and surge into the northeast corner of the cove.



Figure 4. State Land Use Designations

e. Salinity of Waters

Water in the cove is seawater. However, freshwater moves through the coral rock substrate into the ocean near the landward end of the rock breakwater.

f. Water Quality

Wai`anae coastal waters are Class A as defined by the State Water Quality Standards. Mauna Lahilahi Beach coastal waters appear on the 2006 list of 303(d) Impaired Waters, but there was insufficient data to make a decision.

g. Groundwater Recharge Area

The project site is in the ocean; therefore, it is not considered a groundwater recharge area.

h. History or Possibility of Contamination in Fill Area

The Department of Parks and Recreation has reported no information that would indicate that there are contaminants/pollutants in the soil along the shoreline at the site.

i. Erosion Problems

Beach and backshore erosion has been extensive at the site and is the reason for installing shore protection structures.

j. Drainage Way or Floodplains

The project site is not located in or near a drainage way or flood plain. There is an intermittent stream (ʻEku Stream) located north of the site that is not affected by the rock revetment.

k. Air Quality

Air quality is excellent at the site. There might be temporary dust when armor stone is hauled to the site or sand is moved. No air quality degradation was noted during construction of the existing breakwater. The contractor watered the work site during rock operations to keep dust down.

l. Noise Levels

The site is typically quiet as the Makaha Surfside building blocks much of the traffic noise. Heavy equipment such as trucks, an excavator, and a front loader will be used during construction and will cause a temporary increase in noise during the work day. The city received no known noise complaints from residents during construction of the existing breakwater and beach.

2. Biological Environment

a. General Description

The Final Environmental Assessment for Proposed Shore Protection at Mauna Lahilahi Beach Park, published in July 2001, contains a description of the biological environment. A copy was sent to the USACE POD during permit processing for the existing breakwater and beach nourishment (Army file number 200000275). A new environmental assessment is being written and will be submitted for the proposed project. Oceanit monitored marine biology periodically over 5 years to assess changes that might be related to the existing breakwater and beach nourishment placed the summer of 2003. A copy of each report was sent to the Regulatory Branch, CEPOH-EC-R. The last progress report "Post Storm Monitoring #2," was based on surveys on October 17, 2008, and was submitted in December 2008. The report details information about the last post-construction observation of the existing breakwater. According to the report, no significant changes in benthic conditions were observed, the benthic sand plume outside the breakwater extends 50-60 feet seaward, and all fish observed were less than 6 inches in length. Extremely sparse coral establishment was noted on the breakwater boulders. Typical of a high wave energy environment, crustose coralline algae was found covering the rocks inside the breakwater nearest the beach, inside the breakwater 50 feet from the end, at the tip of the breakwater, outside the breakwater 50 feet from the tip, and at the outside breakwater 50 feet past the bend. Other algae observed include: turf algae on boulder faces inside the breakwater 50 feet from the end, and macro algae growth on boulders in the upper intertidal outside the breakwater, 50 feet from the tip. Inside the breakwater 50 feet from the end, the coral heads facing away from the breakwater and on rocks above the sand level remain healthy. Off the breakwater tip, in the deeper waters of the breakwater channel, numerous coral colonies were observed, many of the smaller ones with bleaching at their leading edges. Outside the breakwater, 50 feet from the tip, a coral colony growing on one of the boulders, continued to expand laterally.

b. Threatened or Endangered Species

An Oceanit employee saw a sea turtle of undetermined species in the cove one time prior to construction of the existing breakwater. No turtles or other endangered or threatened species were seen during the 5-year biological monitoring period. The existing breakwater significantly increased the rock surface area where several types of seaweed grow.

3. Special Aquatic Sites

There are corals on the rocks offshore from the project site. There are no wetlands, mudflats, vegetated shallows, or riffle and pole complexes near the project site.

4. Public Interest Review

a. Existing Land Zoning

The existing land is zoned P-2 (Preservation General) along the shoreline (see Figure 5). The existing land use is as a public beach park.

b. What is on the Land?

The land area includes beach, coral rock, and vegetation. The Makaha Surfside Apartments are located immediately mauka from the park property (Figure 6).

c. Do any of the following occur at or near the site?

Characteristic	Dredge Site	Discharge (fill) Site	Construction Site
Local fresh water supply			
Fishing (recreational, commercial)			X
Scenic areas			
Agriculture (type)			
Aquaculture (type)			
Historic sites (type)			
Other cultural resources (type)			X
Parks, monuments, preserves, etc.	X	X	X
Other (type)			

People fish along the park shoreline.

There are Hawaiian burials and cultural sites throughout the beach park.

The area is a City and County of Honolulu Beach Park.



Figure 6. Makaha Surfside Apartments

G. Environmental Effects of Proposed Project

1. Physical Environment

The new revetment will occupy about 1225 cubic yards below MHHW of the nearshore ocean bottom. During construction, heavy equipment will work from the shoreline. The ground surface will be disturbed, but will be restored after construction is complete. Construction will probably cause temporary turbidity in nearby waters and dust in the air. Best management practices (BMPs) will be used during construction. A best management practices plan is attached and will be included in the DOH 401 Water Quality Certification application.

2. Biological Environment

The revetment will destroy any marine plants or animals that cannot move away from its footprint. The rock structure will provide new habitat for fish, coral, crabs, algae, and other species as the existing breakwater has done.

3. Special Aquatic Sites

There are no coral reefs in the immediate vicinity of the construction site. Some coral was identified outside the existing breakwater, but the new construction will not be done in the coral area.

4. Human Use

The revetment will cut the backshore erosion rate, allow lateral access, and help protect the privately owned land behind the park from damage.

5. Historical/Cultural Resources

The land area in the beach park contains historic cultural and human remains. The State Department of Land and Natural Resources Historic Preservation Division (SHPD) reviewed the plans for the existing breakwater and beach nourishment in 2001. They determined that the construction would have no adverse impact on significant historic sites. They requested a monitoring plan that was written by Cultural Surveys Hawaii Inc. and submitted. The Department of Design and Construction (DDC) will notify the SHPD of the plans for the new breakwater. DDC anticipates that archaeological monitoring during construction will be requested by SHPD.

Since the existing breakwater was constructed, other cultural and archaeological reports were written. Three of these are listed here:

Shideler, David W. and Hallett H. Hammatt, Burial Treatment and Preservation Plan for Sites 50-80-07-4064 and -6634 in Support of the Mauna Lahilahi Beach Park Improvements Project, Wai`anae Ahupua`a, Wai`anae, Oahu, TMK: 8-4-01:1; 8-5-17:1-7 & 22, and 8-5-18:1-3, Cultural Surveys Hawai`i, Inc., July 2004

Jones, C. Kulani and Hallett Hammatt, Final Archaeological Monitoring Report for the Mauna Lahilahi Beach Park Improvement Project, Wai`anae Ahupua`a, Wai`anae District, TMK: (1) 8-4-001:001; 8-5-017:001-007 & 022, and 8-5-018:001-003, Cultural Surveys Hawai`i, Inc., January 2009

Perzinski, David and Hallett Hammatt, Archaeological Inventory Survey Report for Proposed Improvements at Mauna Lahilahi Beach Park in the Ahupua`a of Waianae, District of Wai`anae, Island of Oahu, Cultural Surveys Hawai`i, Inc., February 2004

DDC has been conducting a project to evaluate shore protection systems for the culturally sensitive areas in this section of the beach park. Community members and former Hawaiian residents of the park area have been consulted on burials and cultural areas in the park.

6. Indirect Impacts

The project will not encourage or discourage agricultural, urban, industrial, or resort activities. However, without the proposed revetment or other shore protection, the beach park and the private land inland from the park will be directly threatened with wave damage.

7. Cumulative and Other Impacts

The revetment project is similar to the breakwater and beach nourishment construction done in the summer of 2003. The new revetment will help protect the backshore from wave damage. There are now no plans for similar projects at this site. However, a hurricane or tsunami could cause sufficient damage to require a new or repaired shore protection system.

H. Alternatives

1. Other possible sites for this proposal

This project is site specific for stabilization of the coastal slope at fronting Makaha Surfside.

2. Discharge of Fill Material to Convert Wetlands or Submerged Areas

No fill material will be used to convert wetlands or submerged lands to dry land. The fill material will be used only for erosion protection.

3. Other designs or methods

Alternative methods to protect the shoreline in this area include (1) building an additional breakwater to block the wave surge coming through the gap between the existing breakwater and the reef rock shoreline on the north, (2) building a concrete or CRM seawall along the shoreline, or (3) extending the existing breakwater across the mouth to the northern shoreline. The City and County of Honolulu determined that building a rock revetment to replace the sandbags along the eroding shoreline was the most acceptable alternative for protecting inland property.

4. Alternatives if permit is denied

If the permit application was denied, the damage from wave surge would continue and would eventually reach the private property of the Makaha Surfside Apartments. The only way to stop future damage would then be to build a large seawall outside the jurisdiction of the Corps of Engineers (above the MHHW line). Such a wall would be very expensive, would block the ocean view, would require City and County permits, and would likely be strongly opposed by the community on both esthetic and cultural bases.

5. Avoid or Minimize Adverse Effects on the Environment

The proposed rock revetment is the second attempt to stop erosion and shoreline recession. The existing breakwater was built in 2003 and has preserved part of the eroding shoreline. The proposed revetment was selected by the City and County as more desirable than an additional offshore breakwater. The revetment replaces an existing sandbag revetment that has been re-built several times since the late 1990s. The proposed revetment footprint is the minimum necessary to be effective in reducing the erosion threat. The revetment will be placed in a highly eroded area and should not cause additional adverse environmental effects.

Appendix A
Project Site Photographs



Aerial View of Project Site and Surrounding Area



Project Area Configuration



Wave Surge Entering Through Breakwater Gap

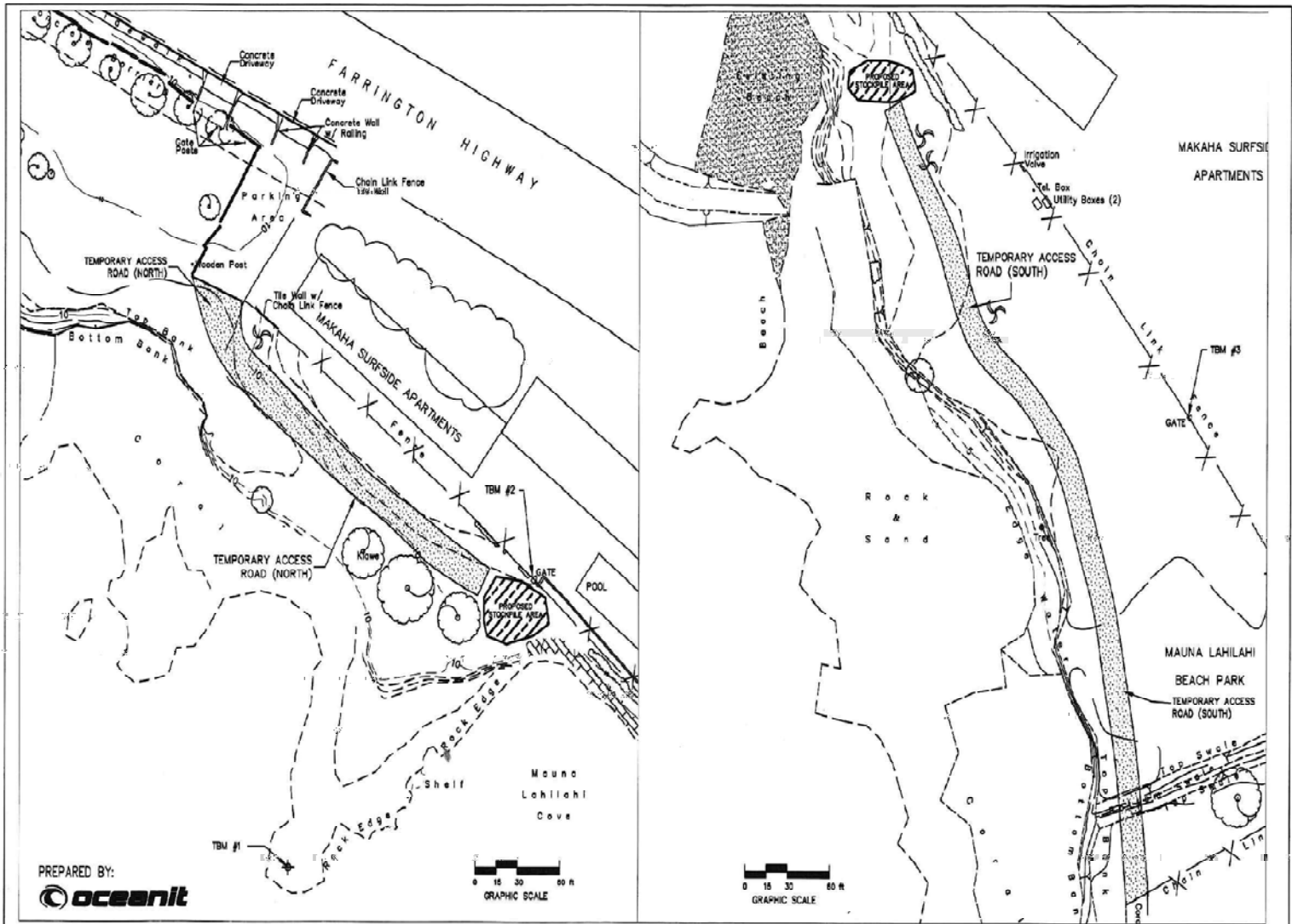


Damage to Sandbag Protection from Waves Entering Breakwater Gap
(Jan 19, 2006)



Sandbag Revetment and Beach at South End of Cove

Appendix B
Construction Plans

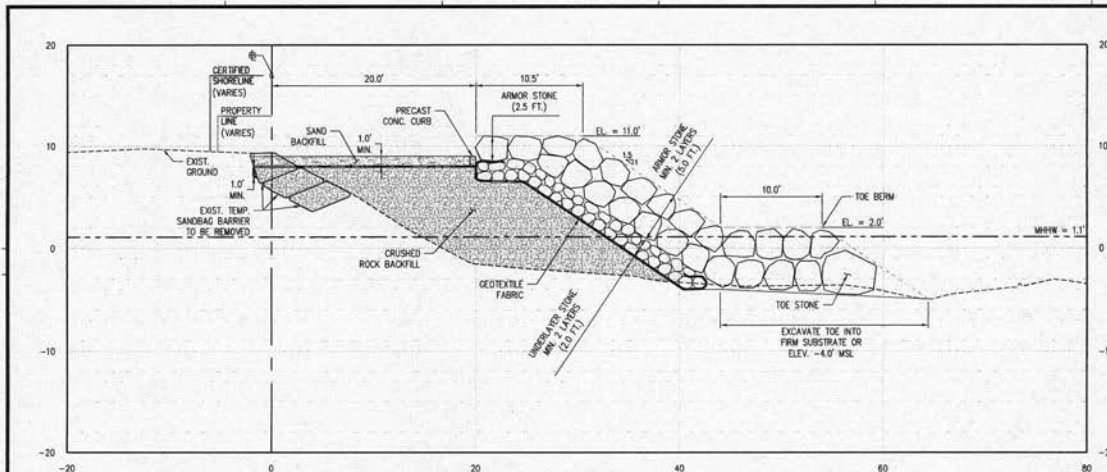


ROCK REVETMENT
 DATUM: MSL
 ADJACENT PROPERTY OWNERS:
 1. MAKAHA SURFSIDE
 2. WAI'ANA'E HIGH SCHOOL

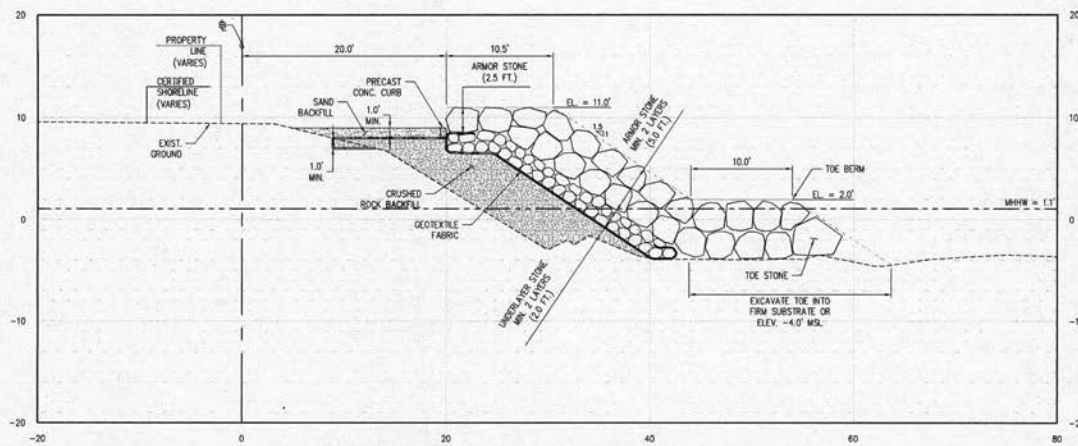
APPLICANT REFERENCE: POH-2012-00???
 LOCATION ADDRESS: MAUNA LAHILAH BEACH PARK, WAI'ANA'E, O'AHU
 TMK: 8-5-017:005

PROPOSED: NEW ROCK REVETMENT w EQUIPMENT ACCESS PATH
 AT: MAUNA LAHILAH BEACH PARK, CITY & COUNTY OF HONOLULU, HAWAII
 SHEET 1 OF 1
 JULY 18, 2012

Construction Equipment Access



ROCK REVETMENT TYPICAL SECTION: STA. 0+50 TO STA. 1+00
 SCALE: HOR: 1" = 5'-0"
 VER: 1" = 5'-0"



ROCK REVETMENT TYPICAL SECTION: STA. 0+20 TO STA. 0+50
 SCALE: HOR: 1" = 5'-0"
 VER: 1" = 5'-0"

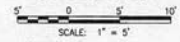
NOTES:

1. BEACH SAND SHALL BE EXCAVATED AS NECESSARY FOR CONSTRUCTION AND REDEPOSITED OVER REVETMENT TOE TO RESEMBLE PRE-CONSTRUCTION BEACH SLOPE.
2. ARMOR STONES SHALL HAVE A NOMINAL DIAMETER BETWEEN 2.2' TO 2.7' AND HEIGH BETWEEN 0.9 TO 1.6 TONS.
3. TOE STONES SHALL HAVE A MINIMUM NOMINAL DIAMETER OF 3.3' AND MINIMUM HEIGHT OF 3.0 TONS.
4. UNDERLAYER STONES SHALL HAVE A NOMINAL DIAMETER OF 1.0' TO 1.3' AND WEIGH BETWEEN 165 TO 300 LBS.
5. CRUSHED ROCK BACKFILL SHALL HAVE A NOMINAL DIAMETER OF 1" TO 3" OR LARGER (7" MAXIMUM).
6. FOR DETAIL OF PRECAST CONCRETE BLOCK REFER TO SHEET DT-1.

LEGEND:

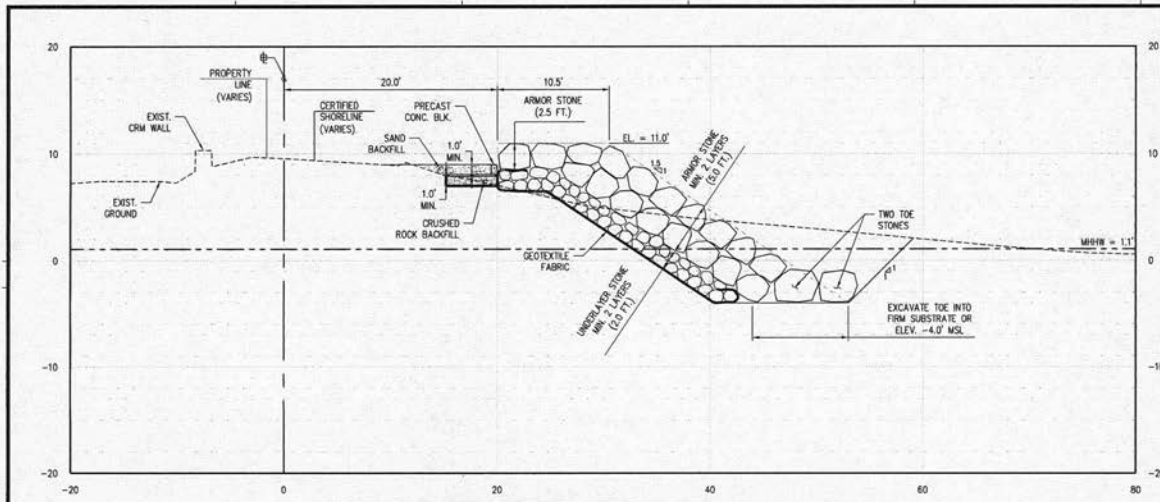
- BASELINE
- - - - - EXISTING GROUND
- FINISHED GROUND
- MEAN HIGHER HIGH WATER
- GEOTEXTILE FABRIC

GRAPHIC SCALE:



GRAPHIC SCALE: 1"=5'

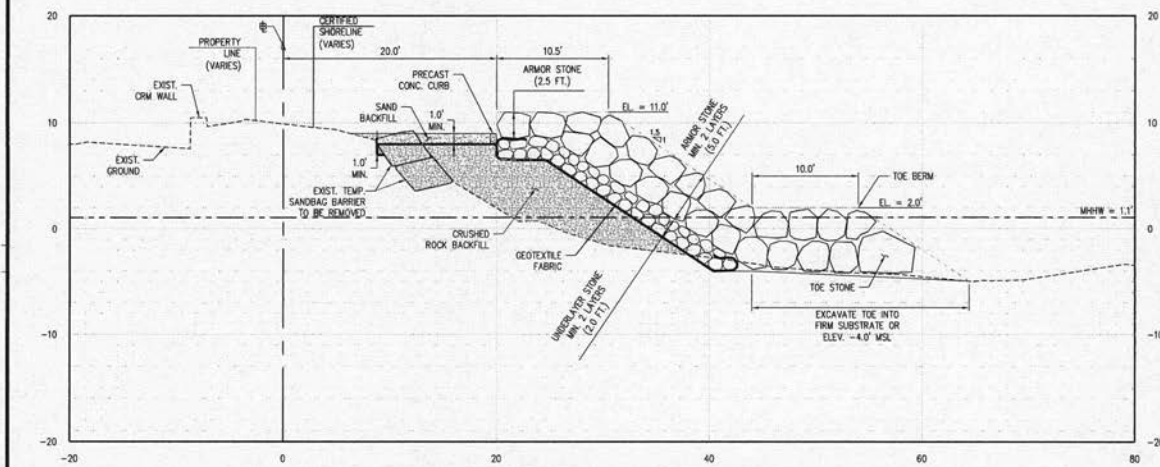
	DEPARTMENT OF DESIGN AND CONSTRUCTION CITY & COUNTY OF HONOLULU MAUNA LAHILAH BEACH PARK ROCK REVETMENT ROCK REVETMENT TYPICAL SECTIONS								
	DESIGN REVIEW DRAWN BY: _____ IN U.S.A.S. _____ DATE: 15 DECEMBER 2014 SHEET NO. 09 OF 18 FILE NO. 15/002								
JOB NO. 05-P-20 DRAWING NO. C-6 SHEET NO. 09 OF 18 FILE NO. 15/002									



ROCK REVETMENT TYPICAL SECTION: STA. 2+85 TO STA. 3+15
 SCALE: HOR. 1" = 5'-0"
 VER. 1" = 5'-0"

NOTES:

1. BEACH SAND SHALL BE EXCAVATED AS NECESSARY FOR CONSTRUCTION AND REDEPOSITED OVER REVELMENT TOE TO RESEMBLE PRE-CONSTRUCTION BEACH SLOPE.
2. ARMOR STONES SHALL HAVE A NOMINAL DIAMETER BETWEEN 2.2' TO 2.7' AND WEIGH BETWEEN 0.9 TO 1.6 TONS.
3. TOE STONES SHALL HAVE A MINIMUM NOMINAL DIAMETER OF 3.3' AND MINIMUM WEIGHT OF 3.0 TONS.
4. UNDERLAYER STONES SHALL HAVE A NOMINAL DIAMETER OF 1.0' TO 1.3' AND WEIGH BETWEEN 165 TO 300 LBS.
5. CRUSHED ROCK BACKFILL SHALL HAVE A NOMINAL DIAMETER OF 1" TO 3" OR LARGER (7" MAXIMUM).
6. FOR DETAIL OF PRECAST CONCRETE BLOCK REFER TO SHEET DT-1.



ROCK REVETMENT TYPICAL SECTION: STA. 1+00 TO STA. 2+75
 SCALE: HOR. 1" = 5'-0"
 VER. 1" = 5'-0"

LEGEND:

- BASELINE
- - - EXISTING GROUND
- FINISHED GROUND
- - - - - MEAN HIGHER HIGH WATER
- GEOTEXTILE FABRIC

GRAPHIC SCALE:

5' 0 5' 10'

SCALE: 1" = 5'

GRAPHIC SCALE: 1" = 5'

DEPARTMENT OF DESIGN AND CONSTRUCTION
 CITY & COUNTY OF HONOLULU

MAUNA LAHILAH BEACH PARK
 ROCK REVETMENT

ROCK REVETMENT TYPICAL SECTIONS

PROJECT NO. 05-P-20
 SHEET NO. C-7
 10 OF 16

DATE: 11/02/12

DESIGNED BY: [Signature]

DATE: 11/02/12

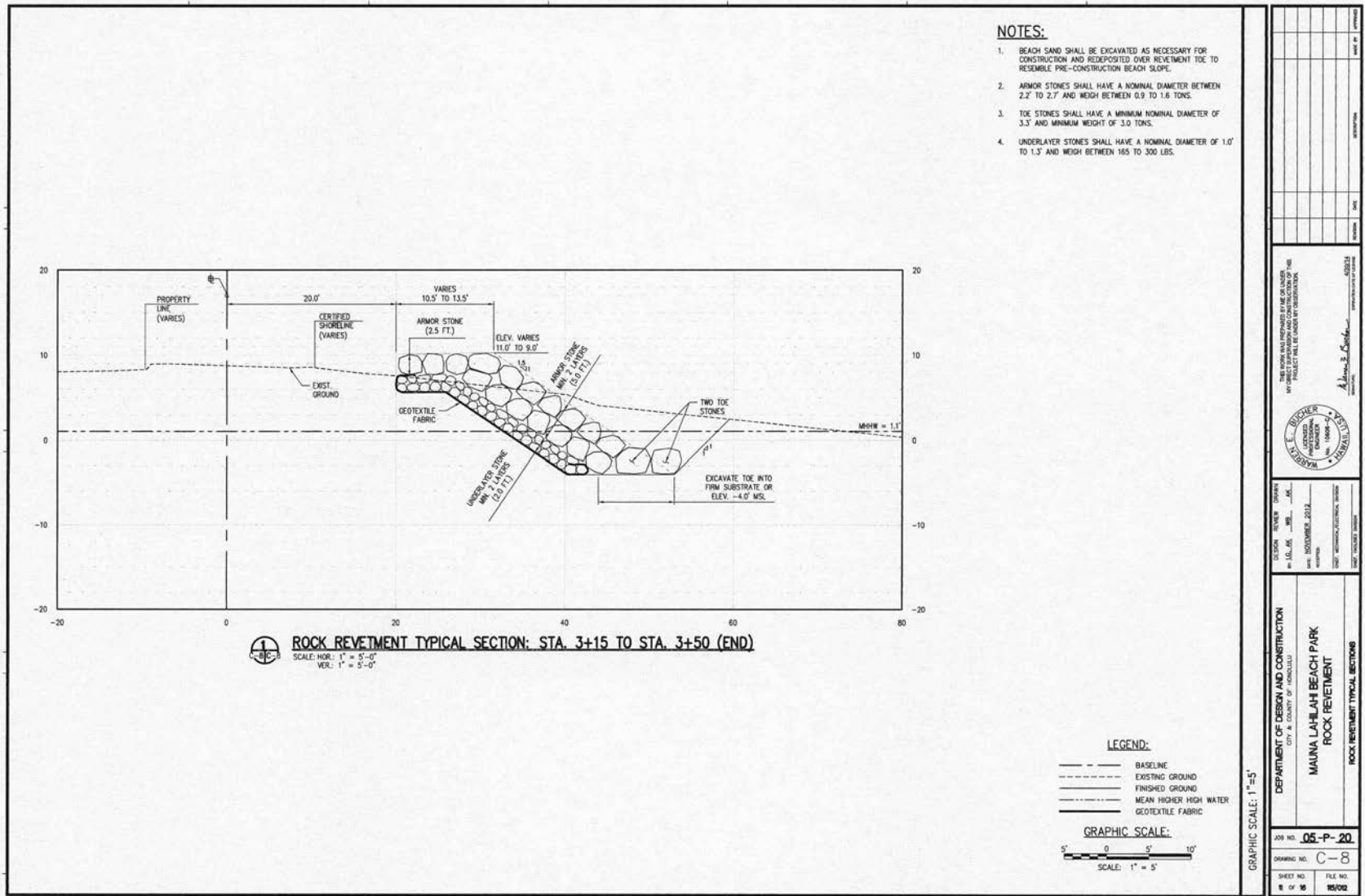
PROJECT NO. 05-P-20

PROJECT TITLE: MAUNA LAHILAH BEACH PARK

DATE: 11/02/12

SCALE: 1" = 5'

Sheet C-7 Typical Cross Sections of Rock Revetment



Sheet C-8 Typical Cross Sections of Rock Revetment

Mauna Lahilahi Rock Revetment Site Specific Best Management Practices Plan

Prepared for:

Department of Design and
Construction
City and County of Honolulu



Prepared by:

oceanity

Suite 600
828 Fort Street Mall
Honolulu, HI 96813

June 2013

BEST MANAGEMENT PRACTICES

a. Maps

Site maps are shown in Figures 1-3 below.

b. Site Characterization

The land between the shoreline and the Makaha Surfside property line was placed under the control of the City and County of Honolulu Department of Parks and Recreation via State Executive Order 3452. The former shoreline followed an embankment eroded into hard clay overlaying rock and boulders. The small cove fronting the Makaha Surfside shoreline is approximately 350 feet long and 250 feet wide. Water depth at the mouth of the cove is approximately 6 feet below Mean Sea Level (MSL).

The shoreline in the project area consists of a relatively flat limestone bench raised several feet above sea level. The shoreline substrate at the sides and bottom of the cove consists of relatively hard limestone covered with sand and rubble. In deeper areas coral and algae cover parts of the substrate. Both flanking sides of the bay are steep rocky areas. The nourished sand beach covers part of the south side of the cove.

A sandbag revetment has been maintained along the project shoreline since the late 1990s (Figure 1). A proposed new rock revetment will replace the sandbag revetment and provide better protection from wave erosion and inundation.

A shore-parallel rock breakwater (Figure 2) and a new beach were constructed in 2003. There is a 70-foot gap between the breakwater tip and the rocky point at the north end of the cove. Waves entering through the gap have been eroding the northeast corner of the cove and moving the nourished sand to the south end of the cove inside the breakwater. The cove's north-south inner shoreline is partially protected by a sandbag revetment.

The project site is subject to waves from Kona storms, southern swells, and North Pacific swells. The site is exposed to waves from the WNW to the SSE. The most frequent wave directions are from the south-southwest (southern swell) and from the northwest (north swell). The most frequent wave period is 12 to 14 seconds and the most frequent wave height is 3 feet. Wave refraction analysis indicates that waves from all directions within the site's exposure window align approximately parallel with the shoreline (southwest) upon reaching the project site.

The only specific measure that could be employed to protect the ecosystem during construction would be silt curtains to contain turbidity. However, the curtains probably would not work in the waves that occasionally overtop the

breakwater and surge through the breakwater gap. Silt curtains placed outside the breakwater could damage coral on submerged offshore rocks. Silt curtains were not used during the 2003 construction. The breakwater provides wave protection for much of the project shoreline.

c. Construction Sequence and Duration

The rock revetment construction sequence and duration are as follows:

1. Mobilize equipment and materials – 2-3 weeks.
2. Remove existing sandbag revetment – 1 week.
3. Place sand from the sandbags on the existing beach – 2 days.
4. Construct the revetment in increments – 4 weeks.
5. Demobilize – 1 week

Summer is probably the best time of year to work in the water at Mauna Lahilahi; however, waves have overtopped the existing breakwater during all seasons. The schedule for permits and an EA will drive the construction schedule. Work will start soon after permits are granted and a construction contract is awarded. The estimated start date is Fall of 2014; however, if permits can be expedited, the project could start months earlier.

d. Construction Method

The new rock revetment will be built along the shoreline. Equipment such as an excavator and a front loader will place a crushed rock filter, geotextile fabric, bedding stones, and armor stones and then work from the newly constructed section to continue building. Rock will be moved to a construction stockpile by truck and then moved to the excavator with a front loader.

e. Characteristics of the discharge and potential pollutants associated with the proposed construction activity

The following will be placed below MHHW.

Source	Composition	Quantity	Duration
Local Supplier	Armor and Bedding Stone	990 cy	Permanent
Local Supplier	Crushed Rock	200 cy	Permanent
Local Supplier	Beach Sand	65 cy	Permanent
Local Supplier	Geotextile Filter Fabric	1,000 sq yd	Permanent

f. Characteristics of the dredged/excavated material

The bottom will be excavated for the revetment toe to a depth of -4 ft MSL. The excavated coral rubble, rock, and sand will be used to backfill the revetment or removed from the site. Rock and sandbags from the existing revetment will be removed from the shoreline. The rocks are either basalt fieldstone or limestone and will be re-used. Sand from the bags will be used in construction or placed on the existing beach. Beach sand from the north edge of the beach will be moved to allow revetment construction. The sand will be left on the existing beach after construction.

g. Proposed control measures and/or treatment

Turbidity will be measured during in-water work.

Rocks for revetment construction will be washed away from the ocean before placement. No construction material will be washed in the ocean. Dirty rock will not be used for construction.

Dust in the work area will be controlled by watering as needed.

Construction equipment will not be fueled or maintained near the water. The contractor will be required to have materials to clean-up hydrocarbon spills.

MONITORING AND ASSESSMENT PLAN

Water Quality Monitoring

a. Characteristics of the discharge

The discharge includes beach sand, basalt stone, crushed rock, and geotextile fabric. Rock used for breakwater construction will be washed before being placed. The geotextile fabric should be clean when received. The sand will come from the sandbag revetment.

b. Monitoring Parameters

Water quality will be monitored before, during, and after construction as shown in the General Monitoring Guideline for Section 401 Water Quality Certification Projects. The primary parameter of interest is turbidity. Placing rocks in the water to build the revetment may cause sediment to be placed in suspension.

WQ Parameter	Sample Type	Pre-Construction	During Construction	Post-Construction
Turbidity	In situ	Ten sample sets over two weeks	Daily during in-water work	Once

Turbidity will be measured with in situ probes that can remain underwater for a week at a time. Sampling locations approximately 70 and 250 feet apart are shown on the following photo. Since currents flow in both directions along the shoreline, one sample point is north of the cove, one is to the south, and one is outside the breakwater gap (see Figure 3). Sample locations are approximate because the probes must be anchored to the bottom on hard substrate or a rock.

c. Description of the methods and means being used to monitor/maintain all pollutant control measures

Pre-construction turbidity results will be analyzed and plotted to determine the log-normal distribution for the local water. Water quality monitoring results will be provided to the Department of Design and Construction's Project Manager. If measured water quality values are significantly different from the log-normal plots, corrective action will be directed as needed. If visible sediment plumes are observed, corrective action will be directed as appropriate. If used, the contractor will inspect silt curtains daily. However, Oceanit does not recommend silt curtains because the wave climate outside the breakwater is too rough to make them effective. The water depth inside the breakwater is shallow, and silt curtains could damage bottom-dwelling marine life.

d. Reporting requirements

The results of pre- and post-construction monitoring will be submitted to DOH within 2 weeks of sampling. In situ measurements during construction will be sent to DOH via FAX or email within one week of downloading and analysis.

- e. A narrative of how the monitoring results will be used to demonstrate whether or not the project construction activity is in compliance with the applicable State water quality standards

If turbidity measurements outside the existing breakwater exceed the state standards, the contractor will take corrective action to minimize the turbidity source. The contractor's follow-on measurements will be used to determine if the control method was successful.

More detailed description of water quality assessment using log-normal statistics is given in the attached Data Quality Objectives process description.



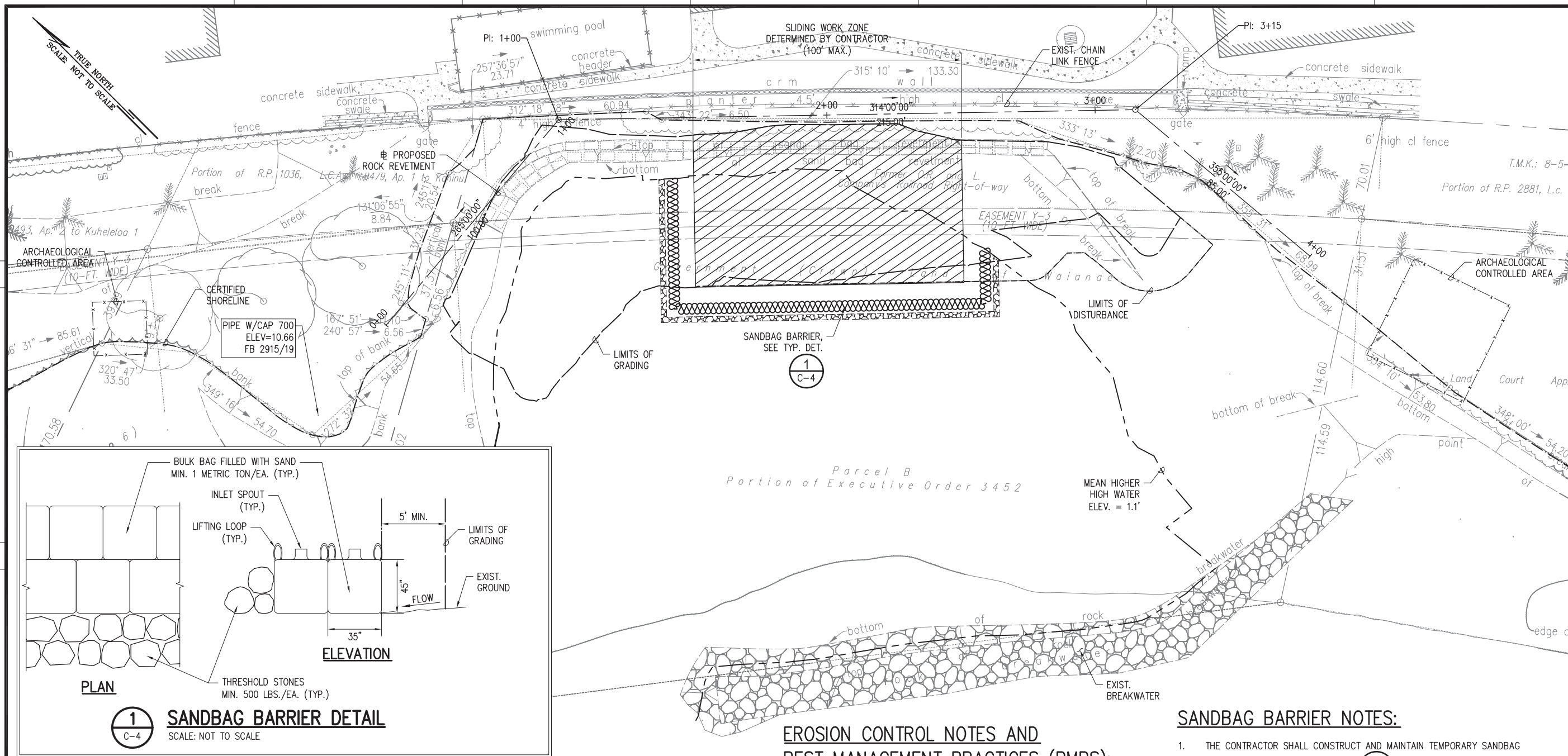
Figure 1. Existing Sandbag Revetment



Figure 2. Aerial Photo of Project Site



Figure 3. Water Quality Monitoring Locations



LEGEND:

- PROPOSED ROCK REVETMENT
- CERTIFIED SHORELINE
- LIMITS OF DISTURBANCE
- LIMITS OF GRADING
- ~ MEAN HIGHER HIGH WATER
- SANDBAG BARRIER (TEMPORARY)
- SLIDING WORK ZONE

- MAINTENANCE:**
- SANDBAG BARRIER SHALL BE INSPECTED IMMEDIATELY AFTER SIGNIFICANT WAVE EVENTS WHERE RUNUP OVERTOPS THE SANDBAGS. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.
 - SHOULD THE FABRIC ON A BULK BAG DECOMPOSE OR BECOME INEFFECTIVE PRIOR TO THE END OF THE EXPECTED USABLE LIFE AND THE BARRIER STILL BE NECESSARY, THE SANDBAGS SHALL BE REPLACED PROMPTLY.
 - SEDIMENT DEPOSITS SHALL BE REMOVED AFTER EACH STORM EVENT. SEDIMENT SHALL BE REMOVED WHEN DEPOSITS REACH APPROXIMATELY ONE-THIRD THE HEIGHT OF THE BARRIER.
 - ANY SEDIMENT DEPOSITS REMAINING IN PLACE AFTER THE SANDBAG BARRIER IS NO LONGER REQUIRED SHALL BE REMOVED BY THE CONTRACTOR.

EROSION CONTROL NOTES AND BEST MANAGEMENT PRACTICES (BMPs):

- REVETMENT CONSTRUCTION ACTIVITIES BELOW THE MEAN HIGHER HIGH WATER ELEVATION SHALL BE CONDUCTED ONLY DURING PERIODS OF LOW TIDE.
- THE CONTRACTOR SHALL PREPARE AND SUBMIT TEMPORARY EROSION AND SEDIMENT CONTROL PROCEDURES TO THE OFFICER-IN-CHARGE FOR APPROVAL PRIOR TO COMMENCEMENT OF GRADING.
- MEASURES TO CONTROL EROSION AND OTHER POLLUTANTS SHALL BE IN PLACE BEFORE ANY EARTH MOVING WORK IS INITIATED. THESE MEASURES SHALL BE PROPERLY CONSTRUCTED AND MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
- CONSTRUCTION SHALL BE SEQUENCED TO MINIMIZE THE EXPOSURE TIME OF CLEARED SURFACE AREA. SANDBAG BARRIER PROTECTION SHALL COMPLY WITH CONSTRUCTION SEQUENCING.
- INSPECT SANDBAG BARRIER DAILY AND REPAIR AS NECESSARY.
- TEMPORARY SOIL STABILIZATION WITH APPROPRIATE VEGETATION SHALL BE APPLIED ON AREAS THAT WILL REMAIN UNFINISHED FOR MORE THAN THIRTY (30) CALENDAR DAYS.
- PERMANENT SOIL STABILIZATION WITH PERENNIAL VEGETATION SHALL BE APPLIED AS SOON AS PRACTICAL AFTER FINAL GRADING.
- STORM WATER FLOWING TOWARD THE CONSTRUCTION AREA SHALL BE DIVERTED BY USING APPROPRIATE CONTROL MEASURES AS PRACTICAL.
- REMOVE ALL SEDIMENT DEPOSITED ON PAVED ROADWAYS WITHIN 24 HOURS.

SANDBAG BARRIER NOTES:

- THE CONTRACTOR SHALL CONSTRUCT AND MAINTAIN TEMPORARY SANDBAG BARRIER AS INDICATED. SEE DETAIL **1 C-4**. SANDBAG BARRIER ALIGNMENT SHOWN IS APPROXIMATE. CONTRACTOR SHALL ADJUST ACTUAL LOCATIONS TO ACCOMMODATE HIS/HER CONSTRUCTION METHODS OR STAGING AND RETAIN SILT ON-SITE.
- SANDBAG BARRIER SHALL CONSIST OF TWO ROWS OF SANDBAGS WITH LARGE STONES PLACED ALONG THE SEAWARD EDGE. THE HEIGHT OF THE BARRIER SHALL NOT EXCEED 48 INCHES.
- EACH SAND BAG SHALL BE WOVEN POLYPROPYLENE BULK BAGS MEASURING 35" X 35" X 45" FILLED WITH A MINIMUM ONE METRIC TON OF APPROVED COMPATIBLE BEACH SAND (< 6% FINES). THE BAGS MAY BE FILLED AT THE SAND SOURCE IF APPROVED BY THE OFFICER-IN-CHARGE AND LAND OWNER.
- STONES SHALL BE PLACED ALONG THE OUTSIDE OF THE BULK BAGS TO FORM A THRESHOLD TO HELP TO MITIGATE WAVE REFLECTION. STONES SHALL BE 1 1/2' TO 2' EQUIVALENT DIAMETER OF WEIGHT 500 LBS (MIN.). THE CONTRACTOR MAY USE STONES FROM THE PROJECT SITE IF APPROVED BY THE CONTRACTING OFFICER.
- SANDBAG BARRIERS SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UP-SLOPE AREA HAS BEEN PERMANENTLY STABILIZED. DURING REMOVAL, BULK BAGS SHALL BE CUT OPEN AND COMPATIBLE FILLER SAND SHALL BE DEPOSITED IN PLACE.
- BMP PROVIDED HEREIN ARE MINIMUM REQUIREMENTS, DURING BIDDING AND CONSTRUCTION, THE CONTRACTOR SHALL RETAIN A CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL (CPESC) TO ESTABLISH THE BMPs NECESSARY TO MEET FEDERAL AND LOCAL LAWS AND REGULATIONS REGARDING WATER QUALITY AND WATER POLLUTION CONTROL.

GRAPHIC SCALE: NOT TO SCALE

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY & COUNTY OF HONOLULU

MAUNA LAHILAH BEACH PARK
ROCK REVETMENT

EROSION CONTROL PLAN

JOB NO. **05-P-20**

DRAWING NO. **C-4**

SHEET NO. 07 OF 16 FILE NO. 115/012

DESIGN REVIEW DRAWN BY: AK WB AK DATE: NOVEMBER 2012 ACCEPTED: CHIEF, MECHANICAL/ELECTRICAL DIVISION CHIEF, FACILITIES DIVISION

THIS WORK WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

WAREN E. BUCHER
LICENSED PROFESSIONAL ENGINEER
No. 10806-C
HAWAII

Signature: *Warren E. Bucher*

EXPIRATION DATE OF LICENSE: 4/30/14

REVISION	DATE	DESCRIPTION	MADE BY	APPROVED

Final
Archaeological Monitoring Report
For the Mauna Lahilahi Beach Park
Improvements Project,
Wai‘anae Ahupua‘a, Wai‘anae District
TMK: [1] 8-4-001: 001; 8-5-017:001-007 & 022, and 8-5-
018:001-003

Prepared for
Department of Design and Construction
City and County of Honolulu

Prepared by
C. Kulani Jones B.S.
and
Hallett Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.
Kailua Hawai‘i
(Job Code: MAUN 22)

January 2009

O‘ahu Office
P.O. Box 1114
Kailua, Hawai‘i 96734
Ph.: (808) 262-9972
Fax: (808) 262-4950

www.culturalsurveys.com

Maui Office
16 S. Market Street, Suite 2N
Wailuku, Hawai‘i 96793
Ph: (808) 242-9882
Fax: (808) 244-1994

Management Summary

Report Reference	Archaeological Monitoring Report For the Mauna Lahilahi Beach Park Improvement Project, Wai'anae Ahupua'a, Wai'anae, O'ahu, TMK: [1] 8-04-001:001; 8-05-017: 001-007 & 022, and 8-05-018: 001-003 (Jones and Hammatt 2008)
Project Number	Cultural Surveys Hawai'i Inc. (CSH) Project Number: Maun22
Location	The project area comprises of TMK: [1] 8-04-001:001; 8-05-017: 001-007 & 022, and 8-05-018: 001-003, which are bounded by Farrington Highway and the Surf Side Apartments on the north, the wave cut banks along the ocean on the south and west, and Wai'anae High School on the east. The project area is located in Wai'anae Ahupua'a, Wai'anae District, O'ahu Island. This area is depicted on the 1998 Wai'anae 7.5-minute USGS topographic quadrangle.
Date Submitted	January 2009
Permit Number	Fieldwork was performed under CSH's annual archaeological research permit, No. 04-04, issued by DLNR/SHPD
Agencies	DLNR/SHPD, City and County of Honolulu (City)
Land Jurisdiction	Owned by City and County of Honolulu
Survey Acreage	11 acres
Development Project Description	<p>The purpose of this project was to beautify the Mauna Lahilahi Beach Park. Park improvements included the planting of 100 coconut trees and pruning of existing trees as well as the installation of waterlines for irrigation.</p> <p>Construction tasks within the on-site monitoring areas included excavation and installation of coconut trees, water lines, construction fencing, water line, fence posts, sidewalks, picnic tables, and grading.</p>
Historic Preservation Regulatory Context	CSHs study is being done to fulfill and in accordance with the Hawai'i Administrative Rules Title 13 (Department of Land and Natural Resources), Subtitle 13 (SHPD), Chapter 279 (Rules Governing Standards for Archaeological Monitoring Studies and Reports). The monitoring program was a historic preservation mitigation measure that focused on the identification and documentation of any historic properties within the project area that would otherwise be destroyed without documentation by project activities.

Field Effort	Fieldwork was completed intermittently over the course of 8 months starting on November 8 th , 2003. A total of 37 days were required for on-site monitoring. Archaeologists C. Kulani Jones B.S., Jesse York B.A., Dominique L. Cordy, B.A. and Todd Tulchin B.S. conducted archaeological monitoring during the course of the project under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).
Cultural Resources Potentially Affected by Project	There was a possibility that human burials (pre-contact or historic) and cultural deposits (pre-contact or historic) could be encountered within the project area.
Number of Historic Properties Identified	Two sites were identified during the course of the project. Both sites were human burials with no associated surface features. The sites were designated State Inventory of Historic Places (SIHP) Sites # 50-80-07-6704 and 50-80-07-6705
Site Significance Evaluations	SIHP # 50-80-07-6704 and SIHP # 50-80-07-6705 are human burials found significant under criteria D and E for their importance to yield information important for research on pre-history.
Recommendations	Preservation in place and a burial treatment plan are recommended for SIHP 50-80-07-6704 and SIHP 50-80-07-6705.
Summary of Monitoring Results	Monitoring revealed the presence of two burials designated SIHP # 50-80-07- 6704 & 50-80-07-6705.

Table of Contents

Management Summary	i
Section 1 Introduction	1
1.1 Project Background.....	1
1.2 Project Area Description.....	1
1.3 Scope of Work	1
Section 2 Methods	6
2.1 Excavation Methodology	6
2.2 Burial Encounter Methodology	7
2.2.1 Site # 50-80-07-6704.....	8
2.2.2 Site # 50-80-07-6705.....	9
Section 3 Historical Background	10
3.1 Pre-Contact To 1800's	10
3.2 Early Historic Period	12
3.3 Mid to Late 1800s.....	16
3.4 1900's to Present	17
Section 4 Previous Archaeological Research	19
4.1 Previous Archaeological Studies in the Vicinity of the Project Area	19
4.2 Burial Finds in the Vicinity of Mauna Lahilahi Beach Park.....	22
Section 5 Results of Fieldwork	27
5.1 Introduction.....	27
5.2 Stratigraphic Analysis.....	29
5.2.1 Primary Stratigraphic Sequence	29
5.2.2 Isolated Stratigraphic Sequences.....	30
5.3 SIHP # 50-80-07-6704.....	34
5.4 SIHP # 50-80-07-6705	37
Section 6 Summary	39
Section 7 Significance Assessments	40
7.1 Introduction.....	40
7.2 Significance	40
7.3 Recommendation	40
Section 8 References Cited	41

List of Figures

Figure 1. A portion of the USGS 7.5 minute series Wai‘anae quadrangle (1998) showing the project area.	4
Figure 2. A portion of Tax Map Key (TMK) [1] 8-05 map showing the location of the project area. (The TMK is overlaid onto the USGS 7.5 minute series Wai‘anae quadrangle (1998) map to ensure the project area matches in both maps).	5
Figure 3. Photograph of preventive construction fencing, view to northwest.....	6
Figure 4. Portion of the site plan map showing where the construction fence and trees were scheduled to be placed as well as the location of some of the trees to be planted and the location where SIHP# 50-80-07-6705 was encountered. Note that the construction fence was erected 10-40 feet (3.3 to 13 meters) <i>mauka</i> (landward of the cultural area (the cultural area is marked with crosshatching)).	7
Figure 5. Photograph of reinterment methodology, view to west. A water worn rock was placed on top of the coral rock as a cultural marker.	8
Figure 6. Previous archaeology in Wai‘anae <i>Ahupua‘a</i> near the current project area.	19
Figure 7. Photograph of the construction fence boundary (the orange fence is visible at the left side of the image) showing the excavations contained within the <i>mauka</i> half of the project area, view to northwest.	27
Figure 8. Map of project area showing the park improvement excavation area located <i>mauka</i> of the construction zone boundary fence,	28
Figure 9. Representative profile of the dominant (Type A) stratigraphic sequence in the project area.	29
Figure 10. Photograph of the sandbag revetment installed in 1999 to stop beach erosion near the Makaha Surfside apartments, view to north.	30
Figure 12. Map of the project area showing the three isolated areas where the stratigraphy varied from the primary (Type A) stratigraphy found throughout the excavation area.	31
Figure 11. Profile of Type D stratigraphic sequence, from an excavation on the northwest side of the project area, near the construction zone fence.	33
Figure 13. Photograph of excavation for coconut palm where site # 50-80-07-6704 was encountered, the stones mark the location of the inadvertent burial discovery, view to west.....	34
Figure 14. Plan view of SIHP 50-80-07-6704 burial encountered during project. Darkened rock illustrates water worn rock placed for cultural identification.....	35
Figure 15. Stratigraphic profile of SIHP # 50-80-07-6704.....	36
Figure 16. Plan view of Site 50-80-07-6705 showing the location of the remains and the stones placed over them for preservation purposes. The depths (measured in centimeters below the surface) at various places in the excavation and vicinity are marked in parentheses. The location and view direction of the stratigraphic profile (Figure 17) are indicated as well.	38
Figure 17. Stratigraphic profile of Site 50-80-07-6705 showing the stratigraphic sequence in the vicinity of Site 50-80-07-6705.	38

List of Tables

Table 1. Previous Archaeological Studies in the Vicinity of the Project Area..... 20
Table 2. Burial Finds in the Vicinity of Mauna Lahilahi Beach Park 23
Table 3. Historic Sites Identified During the Archaeological Inventory Survey..... 25

Section 1 Introduction

1.1 Project Background

Cultural Surveys Hawai'i, Inc. was contracted by the City and County of Honolulu to carry out an archaeological monitoring program for Mauna Lahilahi Beach Park improvements parcel at Wai'anae Ahupua'a, Wai'anae District, Island of O'ahu, (TMK: [1] 8-04-001:001; 8-05-017: 001-007 & 022, and 8-05-018: 001-003) (Figure 1 & Figure 2).

The purpose of the project was to beautify the beach park; improvements included the planting of 100 coconut trees and the installation of waterlines for irrigation as well as pruning of existing trees. Construction tasks within the on-site monitoring areas included excavations for the installation of coconut trees, water lines, fence posts for construction fencing, sidewalks, picnic tables, and grading.

1.2 Project Area Description

The project area is located *makai* (seaward) of Farrington Highway in coastal West O'ahu (see Figure 1 & Figure 2). Generally, the coastal areas of this region are characterized by white sand beaches with areas of old, uplifted coral reefs and limestone flats. Much of the coastal area has been disturbed by both historic and modern development as well as high surf, which have eroded large sections of the coastline. Historically, *muliwai*, or backwater marshy areas, would often develop behind dunes when streams were blocked.

Vegetation along this arid coast is sparse. With 20 inches (500 mm) or less of annual rainfall, only the hardiest plants adapted to coastal environments can thrive in this zone (Giambelluca et al. 1986). The vegetation in the project area is typical of dry seashore environments in Hawai'i and is dominated by alien species. Indigenous species include *hau* (*Hibiscus tiliaceus*), *kamani* (*Calophyllum inophyllum*), *naupaka* or *naupaka kahakai* (*Scaevola sericea*), and the coconut or *niu* (*Cocos nucifera*). Introduced species within the project area include *kiawe* (*Prosopis pallida*). The soils underlying the project area consist mainly of ancient reefs or compacted sandstone and sands overlain by alluvial clays. Beginning in the northwest (*mauka*) portion of the project area is Waialua silty clay, 0 to 3 percent slopes (WkA). Waialua series soils are characterized as moderately well drained soils developed from basic igneous rock and found on alluvial fans (Foote et al. 1972). The *makai* portion of the project area is dominated by beach sand (BS) which is also present below the imported fill material that has been deposited in the majority of the project area.

1.3 Scope of Work

Previous archaeological studies have documented the presence of significant cultural deposits including human burials at Mauna Lahilahi Beach Park. The archaeological inventory survey (Perzinski and Hammatt 2004) conducted in support of this project was reviewed and approved by SHPD/DLNR on April 13, 2004 (Log No 2004.1151, Doc No 0404SC10). The inventory survey documented an intact cultural layer that lies in two narrow discrete strips just back

from the coast. The extent of this cultural layer, (SIHP # 50-80-07-6634) was taken into consideration by the City and County in the layout of proposed park infrastructure. The proposed park improvements (consisting of tree planting and excavations for associated irrigation) were designed to remain far away from the cultural layer. Based on the findings and the overall cultural sensitivity of the project area, it was recommended that on-site archaeological monitoring take place during any subsurface construction activities associated with the proposed improvements at Mauna Lahilahi Beach Park.

Based upon background research and the results of previous archaeological studies in the area, the following archaeological monitoring provisions were recommended in an archaeological monitoring plan (Hammatt and Shideler 2004) that was reviewed and approved by SHPD/DLNR (Log No 2004.2008/ Doc No 0406SC16):

1. Anticipated finds: It is anticipated that isolated finds including human associated with pre-contact and post-contact Hawaiian habitation and/or burial may be encountered during excavation activities.
2. Treatment of remains encountered: If intact cultural deposits or human skeletal remains are encountered during ground disturbing activities, work will be stopped immediately in that area and the archaeologist will notify the SHPD/DLNR of the nature of the discovery. Burial finds will be treated according to HRS 6E-43.6 Burial Law and Administrative Rules Chapter 13-300. SHPD/DLNR will determine the appropriate treatment of the remains and any associated cultural material in consultation with the O'ahu Island Burial Council and the City and County. No remains will be removed without an SHPD determination. If any associated materials are encountered with an inadvertent human burial, all material will be treated according to SHPDs determination. If other cultural materials are encountered, not in association with human remains including an intact cultural layer, charcoal, artifacts or midden deposits, or any disturbed objects or deposits then select sorted samples of charcoal, and bulk samples of midden material will be collected and standard documentation conducted (i.e. scale maps, photographs, detailed descriptions, and interpretation). Reburial plans will be made in consultation with SHPD/DLNR, the O'ahu Island Burial Council, any recognized descendants, and the City and County.
3. The monitoring archaeologist has the authority to halt construction in the immediate area of the find in order to carry out the plan. The field archaeologist will make it clear to construction personnel with whom he/she is working that the archaeologist has the authority to halt work when it is appropriate.
4. Pre-construction conference between the archaeologist and the construction crew. As noted above, the archaeological monitor will hold an on-site meeting at the beginning of work to explain the monitoring plan and archaeological concerns. The entire construction crew will be informed of possible archaeological materials and the procedures to follow if such materials are encountered. The role of the archaeologist will be explained. At this time it will be made clear that the archaeologist must be on site for all ground disturbance activities.

At the time of the on-site pre-construction conference the archaeological monitor will demarcate the known inland edge of the intact cultural layer in the vicinity of any anticipated subsurface work. Because of the concern to avoid subsurface impacts and a concern to avoid demarcation that would be easily moved or removed it is anticipated that the marking would be with spray paint, renewed as necessary.

5. Extent of monitoring. The archaeologist(s) will monitor subsurface impacts into soft substrate. The monitoring archaeologist shall ensure that construction work, equipment, and personnel do not encroach onto adjacent areas not included in the proposed beach park improvements. Once the work area is set up, on-site monitoring may be changed to on-call monitoring, with the approval of the State Historic Preservation Division. The archaeological monitor shall ensure that sufficient personnel are present on the job site to conduct all needed monitoring of ground-disturbing activity.
6. Laboratory work to be done on remains collected. If remains are encountered, the SHPD/DLNR will decide if it is appropriate to remove the human skeletal remains and if osteological analysis of human remains may occur. If removal is appropriate the remains may be stored temporarily at the archaeological consultant's facilities for the purpose of completing bone inventory and will then be transferred to the SHPD Honolulu office until reburial plans are made. Artifactual material will be catalogued and analyzed along with samples of midden material, if collected. Charcoal and other datable materials will be submitted for dating, if recovered from an in situ context which has not mixed with historic materials.
7. Schedule for Reports. A draft Archaeological Monitoring Report will be submitted within 90 days of completion of monitoring fieldwork to the State Historic Preservation Division (SHPD) for review and approval. Cultural Surveys Hawai'i will submit the final archaeological monitoring report within 30 days after any review comments have been received.
8. Archiving of Collections. All burial materials will be given to DLNR/SHPD for storage. Materials not associated with burials will be temporarily stored at the archaeological consultant's offices until an appropriate curation facility is available on O'ahu. Disposition of any cultural materials, including artifacts, not associated with a human burial shall occur only after written concurrence of the City and County and in consultation with the State Historic Preservation Division.

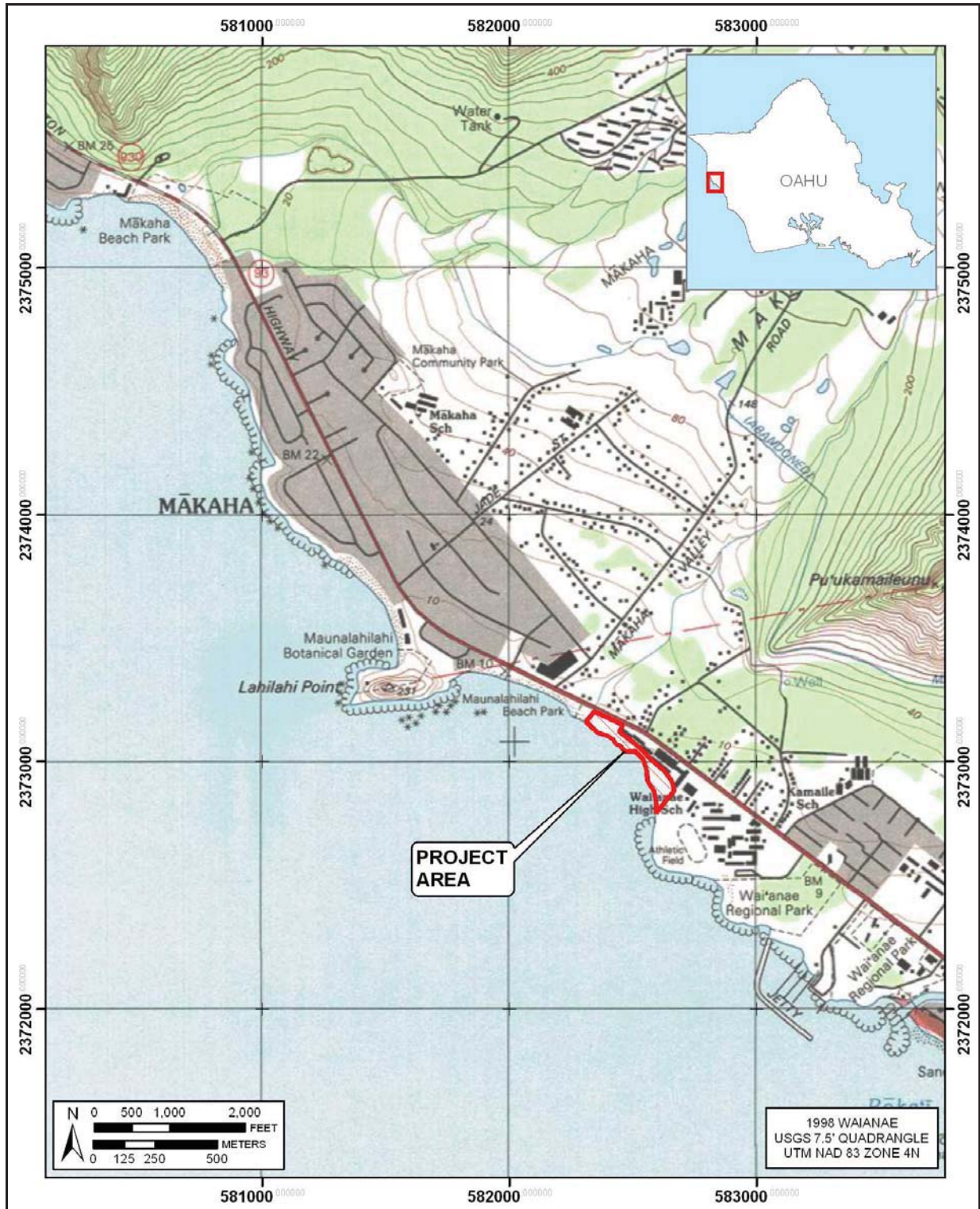


Figure 1. A portion of the USGS 7.5 minute series Wai'anae quadrangle (1998) showing the project area.

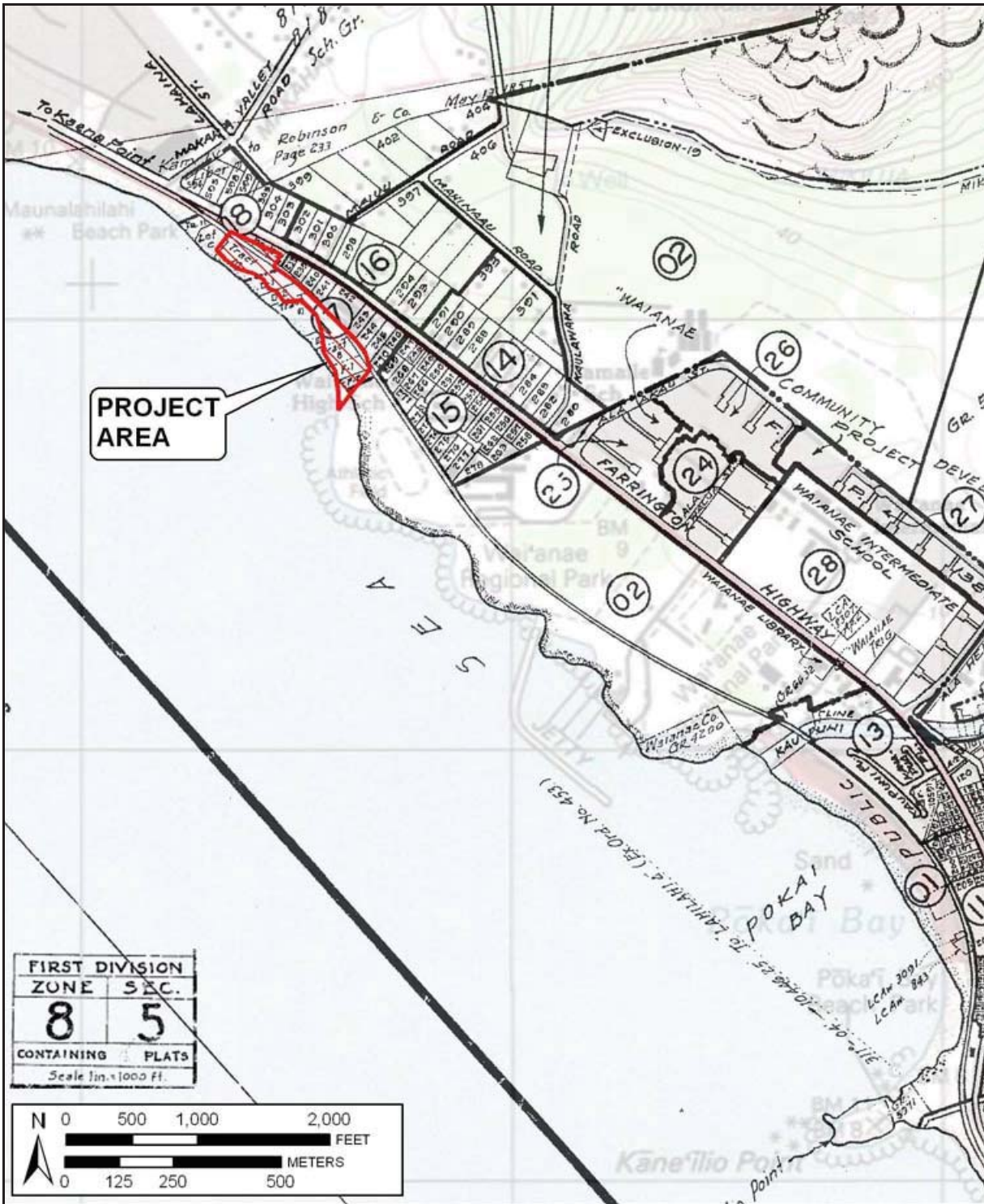


Figure 2. A portion of Tax Map Key (TMK) [1] 8-05 map showing the location of the project area. (The TMK is overlaid onto the USGS 7.5 minute series Wai'anae quadrangle (1998) map to ensure the project area matches in both maps).

Section 2 Methods

Historic and archival research included obtaining information from the University of Hawai'i at Mānoa Hamilton Library and the SHPD (State Historic Preservation Division) Library. Previous archaeological reports for the area were reviewed, as were historic maps and primary and secondary historical sources.

An archaeological monitor was present to observe all activities that impacted the soft sediment, including the loading and unloading of trucks, pruning of trees and all excavations in order to minimize potential impacts to subsurface deposits known or unknown.

2.1 Excavation Methodology

As part of the monitoring plan provisions, preventive construction fencing was erected prior to the beginning of construction in order to delineate the approximate extent of the cultural layer previously identified in the inventory survey (Figure 3 and Figure 4). The purpose of the fence was also to minimize any potential impact from excavation or heavy machinery to the SIHP # 50-80-07-6634 cultural layer and possible associated deposits. Due to the concern of disturbing cultural deposits (including human remains), the construction fence was erected some 10 to 40 feet (3.3 to 13 meters) *mauka* (landward) from the cultural area, as indicated in Figure 4.



Figure 3. Photograph of preventive construction fencing, view to northwest

All project excavation was done by a backhoe, using a bucket 24 inches (61cm) across. Prior to the encounter of human remains water main excavation depth was held to approximately 3ft (1m) below surface. Subsequent excavations for water lines took place at a later date after much consultation and were limited to less than 12 inches below the surface. Excavations for the new coconut trees varied in size and depth depending on the size of the tree. The larger excavations were approximately 6 feet wide by 6 feet long by 4.5 feet deep (2m by 2m by 1.5m deep).

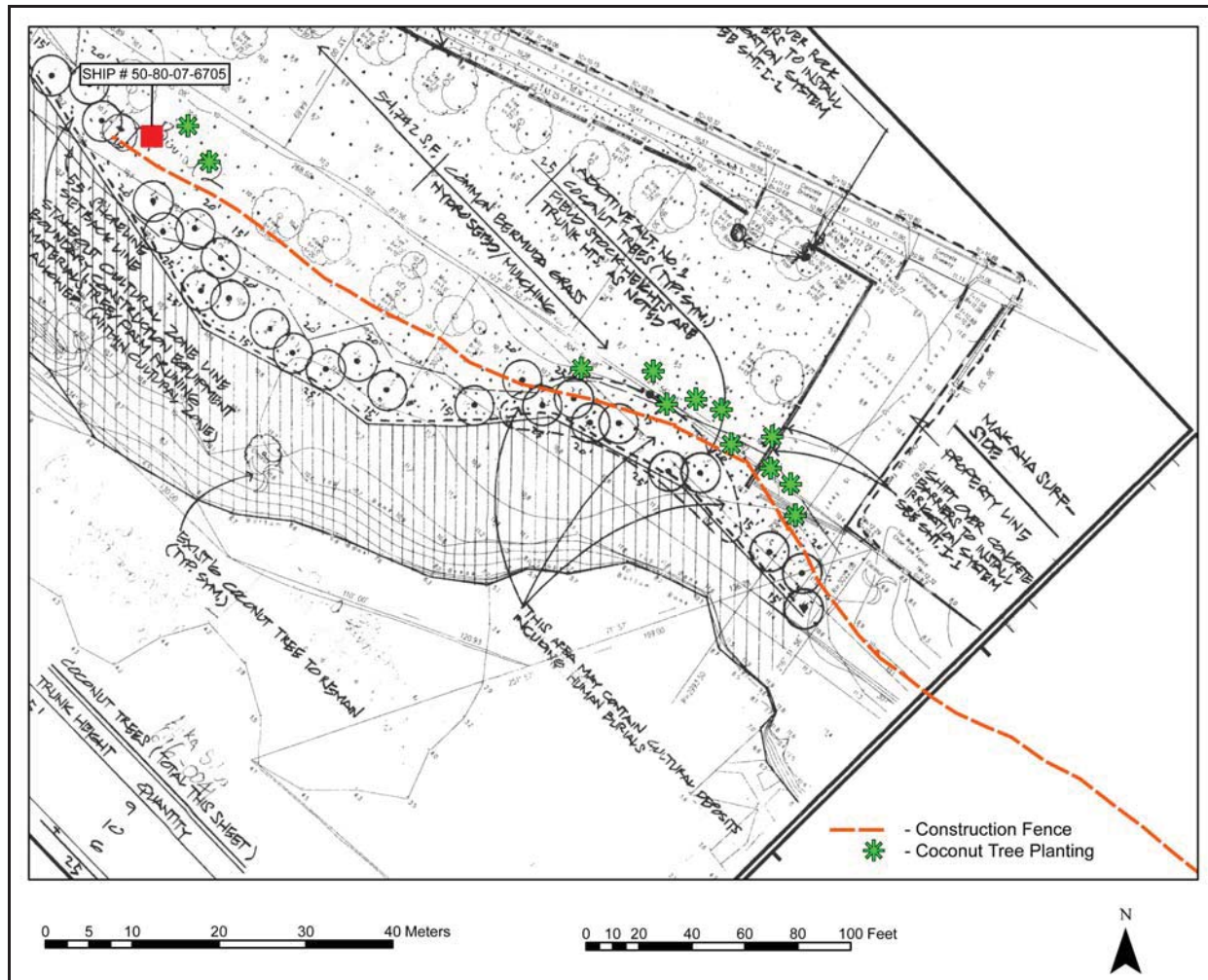


Figure 4. Portion of the site plan map showing where the construction fence and trees were scheduled to be placed as well as the location of some of the trees to be planted and the location where SIHP# 50-80-07-6705 was encountered. Note that the construction fence was erected 10-40 feet (3.3 to 13 meters) *mauka* (landward of the cultural area (the cultural area is marked with crosshatching)).

2.2 Burial Encounter Methodology

Two burial sites were identified during the course of the project (these sites were designated State Inventory of Historic Places (SIHP) # 50-80-07-6704 and # 50-80-07-6705). In both

instances, when human remains were encountered during project excavations all work in the immediate vicinity was stopped so that CSH personal could notify the SHPD burials program and the contractor, and to receive directives of how to proceed from the SHPD Burials Program staff.

2.2.1 Site # 50-80-07-6704

On November 13, 2004, the day of the first burial encounter (SIHP Site # 50-80-07-6704), SHPD burials program gave verbal notification that work could proceed outside a 50 foot buffer zone of the disturbed remains. Directives for burial treatment from SHPD were to recover all the remains impacted during the excavation and to re-inter them as close to the *in-situ* remains as possible.

In order to recover as much as possible, larger blocks of the clay soil containing the remains were placed next to the *in-situ* remains. The excavated material was thoroughly inspected to collect the larger fragmentary remains from the dense clay matrix. Finally the remaining excavated material was sifted through a 1/8th- inch screen in order to ensure complete recovery.

The screened material was placed in unmarked paper bags and reinterred next to the *in-situ* remains. Small boulders were placed around and over the remains to delineate the burial and disturbed material from other backfilled material and to provide protection from future excavations (Figure 5). The excavation was backfilled to the surrounding elevation and no further work was conducted within the immediate area until further consultation with SHPD had occurred.



Figure 5. Photograph of reinterment methodology, view to west. A water worn rock was placed on top of the coral rock as a cultural marker.

2.2.2 Site # 50-80-07-6705

On November 14, 2004 a second burial (SIHP Site # 50-80-07-6705) was encountered approximately 1 meter below the surface, while excavating for a coconut palm tree. The remains had been impacted by the project, but the concentration of *in-situ* remains appeared to be disarticulated. Based on the disarticulation of the remains it appeared to the monitor as though the remains were previously disturbed but it would have required further exposure of the remains in order to determine this aspect of the burial with greater accuracy. Due to the sensitivity of the site and in consultation with SHPD, no further burial documentation was undertaken.

In order to recover as much of the remains as possible, larger blocks of the clay soil containing the remains were placed next to the *in-situ* remains. The excavated material was thoroughly inspected to collect the larger fragmentary remains from the dense clay matrix. Finally the remaining excavated material was sifted through a 1/8th-inch screen in order to ensure complete recovery.

The screened material was placed in unmarked paper bags and re-intered next to the *in-situ* remains. Small boulders were placed around and over the remains to delineate the burial and disturbed material from other backfilled material and to provide protection from future excavations. The excavation was backfilled to the surrounding elevation and no further work was conducted within the immediate area until further consultation with SHPD had occurred.

SHPD Burials program staff Nathan Napoka and Mary Carney made a site visit associated with Burial SIHP # 50-80-07-6704 and -6705 on November 15, 2004, the first work day since the burials were encountered. Mr. Alikea Silva, who identified himself as a lineal descendant, also arrived for a meeting with the SHPD staff and to comment on the park improvement project. Following the meeting, SHPD staff requested that all excavations stop for the day and asked for information on the location of future excavations for the water lines. This was done so Mr. Silva could confer with his family about the location of other burials known to them that might be impacted, based on the areas of proposed excavations.

Construction activities did not resume until May 31, 2005. During the six months of work stoppage, coordination and consultation occurred between the City and County of Honolulu, SHPD, CSH and descendent representatives. Meetings and consultations continued to occur over the course of several months with one, two or all of the aforementioned parties by phone, email, letters, or in person. At some time during the duration of the stoppage an agreement was made between the City and County of Honolulu Parks Department, Mr. Silva, and Mr. Kila to limit excavations for the irrigation lines to 12 inches below surface, in order to mitigate the potential impact to other significant sites.

When work resumed in May, 2005, a CSH archaeologist was on-site for all ground-disturbance activities.

Section 3 Historical Background

The current project area is located within Wai'anae Ahupua'a in the district of Wai'anae. Clues to the history of land use and activity within the ahupua'a - and specifically within the project area - are found in preserved records - including journals, government records, scholarly studies, memoirs, archaeological studies, maps, historic photographs, and oral histories. The earliest records present glimpses of landmarks and events within the general Wai'anae area, especially around the coastal settlement above Poka'i Bay; however, by the middle decades of the 19th century, it is possible to focus more precisely on the project area as documentation becomes more abundant and specific.

3.1 Pre-Contact To 1800's

Archaeological study within the Wai'anae district suggests that the earliest permanent habitation of the district was focused in Wai'anae Ahupua'a along Kaupuni Stream. In an archaeological study of Mākaha (the ahupua'a immediately adjacent to Wai'anae) Green (1980) proposed:

The first settlement of the district was probably, as tradition tends to suggest, on the coast around the stream at the mouth of the Wai'anae-kai Valley where the foreign chief from Kahiki planted the first coconut of the famous grove. That area, with its well-watered valley behind, would have been the most favored locality in the district...(Green 1980:72)

Archaeological investigations at Pōka'i Bay have obtained dates for occupation of the area well within the prehistoric period. During monitoring of 943 meters of sewer and waterline trenching at the Wai'anae Army Recreation Center, five articulated human burials were recovered and a charcoal sample from the prehistoric cultural layer (Layer V) yielded a calibrated radiocarbon age of 1376 +/-50 AD (Riford 1984:14).

Hammatt et al. (1985) encountered additional burials at the Wai'anae Army Recreation Center; testing of a sample from a pit feature yielded a radiocarbon date of 1340 +/-70 AD. Hammatt notes:

The archaeological assemblage points to the heavy use of the site as a communal area for fishing preparation, canoe launching and return. The site was the focus of beach access for the inhabitants of Wai'anae-Kai as well as occasional informal sand burial from at least 1300 A.D. onwards. (Hammatt *et al.* 1985:i)

Shapiro and Rosendahl (1988) obtained radiocarbon dates (AD 1170-1430, 1270-1480 and 1299-1510) from three trenches in a complex of possible taro *lo'i* at a site inland of Pōka'i Bay (Shapiro and Rosendahl 1988:32). The aggregate of dates suggests that permanent habitation in lower Wai'anae Ahupua'a, where the only perennial water sources within the *makai* portion of the district were located, was established by the latter 1100's.

The elaboration and expansion of settlement throughout the ahupua'a during the prehistoric period is suggested by the number and variety of sites recorded during the first investigation of

Wai'anae during the 1930s. McAllister (1933) noted sixteen sites within the ahupua'a including ten heiau (seven of which had been destroyed), the Puehu fishpond, the Kawiwi place of refuge, and several house sites. The sites extended well mauka into lands adjacent to streams at the head of Wai'anae Valley. McAllister recorded one burial site, Site 162, at Mauna Kuwale, which he described as:

A small cave near the top of the peak facing Kawiwi. Contains fragments of skeletal material, but none of the objects said to have been buried with the dead. (McAllister 1933:116)

The number of heiau recorded within Wai'anae Ahupua'a point to its political centrality within the district and to its association with the ali'i (royalty) during the prehistoric period. The pioneering 19th-century Hawaiian historian Samuel Kamakau recorded the oral traditions that associated some of the Wai'anae heiau to prominent ali'i:

At Wai'anae [Ka-hahana, late 18th-century O'ahu ruling chief] restored the *heiau* of Ka-moho-ali'i...(Kamakau 1992:134)

Take the story of Ka-welo when he sailed for Kaua'i to make war. He set a tabu over the *heiau* at Puehu at Wai'anae, and at the end of the sacrifice ordered that the wood of the paehumu, both the fence and the images themselves, be used for firewood for the expedition to Kaua'i. (Kamakau 1992:203)

The Hawaiian traditions centered on Wai'anae further reflect the area's significance and association with the ali'i in prehistoric times. The district is a focus in the mythological cycles of Maui, Kamapua'a, and Kamohoali'i. The demigod Maui and his brothers were said to have been born in Wai'anae, and it was here that Maui learned the secret of making fire for mankind. Kamakau (1870) enumerates, among the famous locales in Wai'anae, the cave in which Hina (moon goddess and mother of Maui) made her tapa, the fishhook, Manaia Kalani (with which Maui attempted to unite the Hawaiian islands), the snare for catching the sun (which Maui used to advantage on Haleakalā), and the place where Maui's adzes were made. The pig demi-god, Kamapua'a, battled with the giant man-dog Kū-'īlio-loa (after whom the heiau in Wai'anae is named) and raised the taro patches of Wai'anae Valley. The people caught him, tied him up, and were preparing to sacrifice him when his many supernatural bodies swept over the plains, devouring the men of Wai'anae and sending them fleeing in terror. Pele's older and favorite brother, Kamohoali'i, the shark god, became enamored with a maiden of the Wai'anae coast and begot a half-man/half-shark child who devoured many people before being captured and killed.

By the time of the first contact with European expeditions during the latter 18th century, Wai'anae Valley appeared to remain the primary locus of settlement within the Wai'anae district. Captain George Vancouver, sailing off the southwest coast of O'ahu in 1792, noted:

From the commencement of the high land to the westward of Opooroah (Pu'uloa) was...one barren rocky waste, nearly destitute of verdure, cultivation or inhabitants, with little variation all the way to the west point of the island. Not far from the south-west point is a small grove of shabby coconut trees, and along those shores are a few straggling fishermen's huts. Nearly in the middle of this

side of the island is the only village [i.e. at Wai‘anae above Pōka‘ī Bay] we had seen westward from Opooroah. In its neighbourhood the bases of the mountains retire further from the sea-shore, and a narrow valley, presenting a fertile cultivated aspect, seems to separate and wind some distance through the hills. The shore here forms a small sandy bay. On its southern side, between the two high rocky precipices, in a grove of coconut and other trees, is situated the village, and in the center of the bay, about a mile north of the village, is a high rock (Mauna Lahilahi), remarkable for its projecting from a sandy beach...(Vancouver in Sterling and Summers 1978:67-68)

The coconut grove above Pōka‘ī Bay observed by Vancouver was not insignificant in the Hawaiian consciousness; it was recognized as the "largest and best-known coconut grove on Oahu, famed in chants and songs" (Pukui 1983:160).

The latter 18th century also saw the involvement of Wai‘anae Ahupua‘a and its population in the political changes impelled by the struggle of ali‘i from other islands for political control and conquest of O‘ahu. The Maui king Kahekili invaded O‘ahu ca. 1783, vanquishing the O‘ahu chiefs in a series of battles that culminated in Wai‘anae:

Pupuka [an O‘ahu chief] rallied the retainers of the chiefs of Kona, ‘Ewa, Wai‘anae, Waialua, and Ko‘olau at Kawiwi, a stronghold between Wai‘anae and Mākaha, where many died of starvation or were flung over the precipice because of famine, and many perished. (Kamakau 1992:139-140)

In 1794, Ka-‘eo-kū-lani recruited the "warriors of Waialua and Wai‘anae" to make war on his nephew Ka-lani-kū-pule, then ruler of O‘ahu (Kamakau 1992:168); by December 1794 Ka‘eokūlani had been killed and his forces were defeated. Kalanikūpule would himself be deposed the following year when the invading Hawai‘i Island forces of Kamehameha prevailed at the Battle of Nu‘uanu in April 1795. Although apparently Wai‘anae was not itself the site of major conflicts associated with Kamehameha's conquest of O‘ahu, traditions record it as the refuge where large numbers of Oahuans resettled after fleeing from the Hawai‘i Island invaders.

In 1796, Kamehameha would himself come to Wai‘anae where his fleet of eighty double canoes stopped on their way to invade Kaua‘i. "The fleet went on to Wai‘anae and the war god [Kū-ka‘ili-moku] was carried ashore that evening" (Kamakau 1992:173). Kamakau records that the fleet departed Wai‘anae before midnight but Wai‘anae tradition maintains that Kamehameha remained on the coast long enough to re-dedicate two *heiau* to his war god, and that his presumption so angered the Wai‘anae gods that they sent the storm which caused the disastrous end of his Kaua‘i expedition. That setback notwithstanding, Kamehameha's ascendancy on O‘ahu in the 1790's would have immediate consequences for Wai‘anae during the decades of the next century. Additionally, the isolation of the *ahupua‘a* would not protect it from the economic and social pressures impelled by the growing presence of western missionaries, settlers and entrepreneurs on O‘ahu.

3.2 Early Historic Period

The Hawaiian Islands began exporting sandalwood to the Orient shortly after 1800 and the commerce flourished until the supply dwindled in the mid-1830's. Trade in sandalwood was the

strict monopoly of the ali'i beginning with Kamehameha. At the height of the sandalwood boom, Kamehameha was buying foreign ships, including six vessels between 1816 and 1818, to transport his own wood to the Orient (Kuykendall 1965:87). When Kamehameha bought the schooner Columbia in 1817, it was paid for with sandalwood from Kauai and from the districts of Waimea and Wai'anae on O'ahu (Kuykendall 1965:88). Peter Corney, the chief officer on the Columbia, alluded to Wai'anae's perhaps more marginal involvement in the sandalwood trade on O'ahu. In an account of a voyage in March 1818 from Honolulu to Waimea Bay (O'ahu) Corney reported:

Next day we sailed for Whymea bay, on the west end of the island, to get another cargo of wood. In our passage we touched at Wyeni (Wai'anae), and took on board some wood and hogs. We lay here for a few days, and then sailed along the shore for Whymea...where we took on board a full cargo of wood in thirty-six hours - more than 200 canoes employed in bringing it off, day and night. (Corney 1896:89-90)

After Kamehameha's death in 1819, Liholiho (Kamehameha II) allowed his chiefs to share in the sandalwood trade, resulting in an unrestrained demand on the stocks of the wood and upon the commoners who did the harvesting.

"Traders' records from Kamehameha's last years show several important ali'i trafficking in sandalwood on their own, including...Kalaimoku, Cox, Boki, Ka'ahumanu, and some others" (Kirch and Sahlins 1992:59). Among these ali'i, Boki Kama'ule'ule was the Kamehameha chief that the monarch had made chief of Wai'anae. Sometime before Kamehameha's death, Boki also became governor of O'ahu. Diaries and journals of the western entrepreneurs on O'ahu record Boki's travels to and from Wai'anae and the unfolding of the sandalwood trade there. Don Francisco de Paula Marin, who had arrived in the islands in the 1790s, noted in his diary Boki's departure from Honolulu to Wai'anae aboard the schooner Paula on April 18, 1820. Three days later, on April 21, Boki returned "with a cargo of taro, dogs & hogs from Guallanae [Wai'anae]" (Gast and Conrad 1973:239). During succeeding months, until May 1822, Marin recorded four more voyages by Boki to and from Wai'anae, presumably to procure additional goods from the Leeward coast. In December 1829 Boki sailed to the New Hebrides in search of sandalwood; Boki and his ship were lost at sea. Boki had appointed his favorite wife, Liliha, governor of O'ahu during his absence. She continued in that position - and also retained control of Wai'anae - after his death had been reported.

More detailed accountings of Wai'anae's role in the sandalwood trade during the 1820s appear in the journal of Stephen Reynolds, a clerk for the Honolulu merchant William French. French had settled in Honolulu in the 1820's, becoming involved in business enterprises throughout the islands. In 1828, he was among a company of foreign residents who converted a Honolulu sugar mill into a rum distillery. Unfortunately for the investors:

...by this time the Queen Regent Ka'ahumanu and most of the powerful chiefs had become Christians and had taken a strong stand in favor of temperance. A kapu was placed upon the business of making rum; the missionaries, who had the only ox-carts in the village [Honolulu], refused to allow them to be used for carrying cane to the mill; and Ka'ahumanu caused the cane fields to be destroyed. This

was about 1829. The foreign residents were greatly enraged and one of them, William French, afterwards accused the missionary Rev. Hiram Bingham of having made him lose \$7,000 through the failure of the distillery. (Kuykendall 1965:173)

Other investments undertaken by French were more successful and by the 1830's he was a leading merchant in the islands.

Stephen Reynolds' journal suggests how haphazard was the collection of the wood. On May 10, 1824 the vessel *Water-witch* went to Wai'anae; it returned to Honolulu on May 12 and, Reynolds recorded, "got no wood, nor saw any" (King 1989:29). Two months later, the *Prince-Regent* "sailed for Wainai after wood" and returned with "160 piculs" (King 1989:44). Reynolds' journal contain no further record of Wai'anae sandalwood until August 5, 1827 when he noted: "Fine morn. Fine day. Black Joe came from Wainai said Teignmouth took about Four hundred pics sand'wood on board & sailed for Wainea" (King 1989:193). William French himself was in Wai'anae in November 1827, awaiting "goods" which were shipped to him there, perhaps in payment for a stock of sandalwood (King 1989:203). On January 17, 1828 Boki "went to Wainai to weigh Sandlewood...", and later that month, on the 28th, Reynolds reported: "Hunnewell [a trader] weighing Tax wood from Wainai" (King 1989:211-212). The next month, February 1828, Reynolds recorded that Boki was in Wai'anae and that "Capt Meek, Chinchilla went to Wainai after tax wood"; on February 26, Meek returned from Wai'anae with "508 piculs tax wood" (King 1989:214-215). Reynolds sailed to the Leeward coast in June 1828, reporting his vessel "got 171 piculs on Board" at Makua on the 18th, but at Wai'anae the next day:

Went ashore at daylight. Tabuiki [Kapuiki], the Head man of Wainai was in the mountains & would not come down At 10 got under weigh. (King 1989:228)

Apparently, no sandalwood was loaded at Wai'anae. The June 19, 1828 entry is the last record in Reynolds' journal of any attempt, successful or not, to procure sandalwood at Wai'anae. By the middle of 1828 the stands of sandalwood above the Wai'anae coast may already have been depleted; significantly, perhaps, when Boki himself supervised "collecting Sandlewood to pay [his] Debts" in August 1828, he went to the Ko'olaus (King 1989:234).

Already in October 1817, a Russian visitor noted on O'ahu: "There are now many fields left uncultivated, since the natives are obliged to be cutting sandalwood" (Barratt 1988:218). By 1828, the disruptive force of the sandalwood commerce must have been extreme in Wai'anae where the existing limited agricultural resources would have demanded strict marshalling.

During the same decades that commercial ventures were forcing changes upon the Hawaiian landscape, western missionary interests were establishing their foothold in the islands. The American Board of Commissioners for Foreign Missions, headquartered in Boston, sent its first company of missionaries to the Hawaiian Islands in 1819, leaving Boston on October 23rd aboard the brig "*Thaddeus*". By the 1820's, the Protestant missionaries had established close links with the ali'i. From July to August 1826, Ka'ahumanu and an entourage consisting of up to 300 persons conducted a proselytizing tour around O'ahu. Rev. Hiram Bingham's account of the proceedings in Wai'anae suggests that traditional beliefs remained strong in the district, and that its inhabitants knew how to deal with their visitors:

...we passed on round the promontory [Ka'ena Point] to Waianae, the western district of Oahu, separated from the rest of the island by a range of mountains. Its valleys and plains, nearly level with the sea, are interspersed with small steep mountains. The district was called Boki's. Here we spent the third Sabbath. While there, Ka'ahumanu spoke with concern of the stupidity of the people...

A man in that region, pretending to know something about the fabled god, Kamapuaa, assuming the form of a hog, was sent for to tell us what he knew; but his efforts to enlighten us on that subject, proved the ignorance, darkness, imbecility, and confusion of the heathen mind, as did also the first efforts to lead this man into the light of Christianity. He was once asked by a native teacher, at a meeting for prayer and conference, to tell his thoughts, that it might be known how to stand in respect to the service of God. Dropping his face low towards the ground, he stretched forth his hand, holding a small stone, and said: "What is this? It is a stone, by which we cook food;" then holding up a little tinder, said: "What is this? It is tinder, by which we kindle fire." Having made some advance when we arrived and conversed with him, he said: "I have been fed with the Word of God; and Jesus Christ has given me light. I know this body of dust will soon die, but my spiritual body will continue, and it is for that I want salvation." He continued with us several days, and had opportunity to learn something infinitely above the idle stores about Kamapuaa.

As we took leave of the place, the headman, Kapuiki, being personally pressed to give his heart to God without delay, said, "Such is my intention." Such personal appeals extensively and kindly made, were generally kindly received. (Bingham 1847:296-297)

Censuses taken by Protestant missionaries throughout the Hawaiian Islands beginning in 1831 provide the earliest documentation of the size of the native population after the first decades of western contact. During the first census of O'ahu in 1831-1832, the population of the ahupua'a within the Wai'anae District totalled 1,868 people: 757 adult males, 695 adult females, and 416 children (Schmitt 1973:19). Four years later, in 1835-1836, the total district population had dropped to 1,654 (Schmitt 1973:9).

The Organic Acts of 1845 and 1846 initiated the process of the Mahele - the division of Hawaiian lands - which introduced private property into Hawaiian society. In 1848 the crown and the ali'i (royalty) received their land titles. Wai'anae Ahupua'a was retained by the crown.

Kuleana awards for individual parcels within the ahupua'a of the Hawaiian Islands were subsequently granted in 1850. These awards were presented to tenants - native Hawaiians, naturalized foreigners, non-Hawaiians born in the islands, or long-term resident foreigners - who could prove occupancy on the parcels before 1845. No parcels were claimed or awarded, according to the tax map.

3.3 Mid to Late 1800s

In October of 1819, two whale ships had anchored in the Hawaiian Islands. During the next decades, other whale ships would follow, as the islands became a victualing and layover base in the mid-Pacific. Supplies of beef, fresh and salted, were in demand; and a trade in hide and tallow developed. Following the collapse of the sandalwood trade, since the 1840's, the Hawaiian economy had been dependent primarily on supplying whale ships during their long layovers in the islands. The trade sustained the islands until the collapse of the whaling industry in the mid-1860's.

In 1851, Paul F. Manini, son of Don Francisco de Paula Marin, leased 17,000 ac. in Lualualei Valley for grazing livestock; by 1863, a missionary could report that "most of the land in the Wai'anae District was devoted to grazing and had already been divided into six or seven divisions; and secured to as many parties or individuals on long lease or fee simple titles" (McGrath et al. 1973:31). The experience of the maka'āinana in Waialua likely mirrored that of the remaining Hawaiians in Wai'anae:

...the depredations of the foreigners' cattle had virtually reduced agriculture to the cultivation of wetland taro. For destruction of sweet potato fields and gardens of melons, bananas, maize, and other crops was causing the people to take these out of cultivation, and in some cases to take themselves out of Waialua. (Kirch and Sahlins 1992:149)

A missionary account in 1863 reported that only a hundred acres were in taro in Wai'anae Valley and that the only items for sale were fish and fungus. Censuses taken during the second half of the 19th century record the diminishing population of the Wai'anae District. In 1853 a combined total of 2,451 persons were recorded in the 'Ewa and Wai'anae districts; nineteen years later, in 1872, that total had dropped to 1,671. By 1890, when the districts were recorded separately, the population of Wai'anae had been reduced to 903 (Schmitt 1977:12-13).

Part of that population of 903 in 1890 would have consisted of workers at the then twelve-year old Wai'anae Plantation. The livestock industry in the islands had reached its peak in the 1870's. At Wai'anae, a new venture arose to supplant ranching. In 1878, Hermann A. Widemann, a retired Hawaiian Supreme Court justice, acquired Wai'anae Plantation, the first sugar plantation on O'ahu. In 1879, he leased most of Wai'anae-Kai for 25 years.

Between 1878 and 1884 the economy and community of Wai'anae underwent a major change, in which the former Hawaiian landscape virtually disappeared. The reason was the production of sugar. The results were the conversion beginning in 1878 of coastal and central valley garden plots and irrigation systems to large fields of sugarcane, the construction in 1880 of a plantation railway to haul the cane to the mill, and the building, in the former Hawaiian village, not only of the mill itself, but the creation of a whole town to support the processing of cane. (Green 1980:12)

Widemann hired twenty local Hawaiians, brought in 15 technicians and almost sixty Chinese laborers. He built 24 new houses in Wai'anae Valley and a plantation manager's mansion on the site of Haua Heiau. He built a water reservoir and installed a flume system to bring water from

the reservoir to the mill. A tramway was built from the mill site to the coast where a jetty was constructed. Seven miles of track were laid to haul harvested cane to the mill. In 1880, a Chinese firm planted 122 ac. of cane in Wai'anae and employed about 30 men. One hundred and fifty acres were planted in sugar in Mākaha Valley by A. Hastings and Company.

By 1884 Wai'anae Sugar Company had 475 ac. under cultivation, nine miles of railroad, and 175 men employed. A map of the port of Wai'anae (Hydrographic Office, U.S. Navy, Port Wai'anae, 1891) based on an 1884 Hawaiian Government survey indicates that sugar cultivation had not reached the area containing the present study.

In 1890, Wai'anae Sugar Company had 600 ac. in cultivation. On July 4, 1895 Wai'anae's isolation was broken when a rail line from Ewa Mill reached the Wai'anae Sugar Company track. In 1898, the railway was extended around Ka'ena Point, linking Wai'anae with Waialua on O'ahu's north shore.

3.4 1900's to Present

According to Schilz (1994:23), a business directory of 1900 identified 23 taro planters in the Wai'anae District; by the 1924 edition, only one was listed. Other Hawaiian traditions remained in practice at Wai'anae into the first decades of the 20th century; a kama'āina reported: "...between 1910 and 1912 there lived in the Wai'anae area about 25 kahunas known (only) to the Hawaiians" (McGrath et al. 1973:84). However, the sugar plantation continued to dominate the landscape. A 1922 U.S. Army Corps of Engineers Fire Control Map based on a 1908-1913 survey indicates that the area containing the present study was by then planted in sugar cane; the map also indicates, within the study area, a portion of the network of stone walls and fence lines that covered Wai'anae Valley. The stonewall shown within the study area may correspond to Site 50-80-07-5493.

In 1933 a Naval Ammunition Depot was opened on 4000 acres of land in the Lualualei Valley portion of Wai'anae Ahupua'a. The military bunker SIHP 50-80-07-5494 may be associated with the development of the ammunition depot facility.

During the years of World War II, the Wai'anae area became the site of massive amphibious training operations, training more than 200,000 men. The sugar plantation never recovered after the war. On October 17, 1946, the stockholders of American Factors Ltd. (which had bought the plantation in 1931) voted to liquidate, eliminating the economic mainstay of the Wai'anae Coast. Chinn Ho, head of Capital Investment Co., bought the nearly 10,000-acre plantation parcel for \$1.25 million in 1947.

During the late 1940's, Chinn Ho was promoting the establishment of new ventures in Wai'anae:

By 1949, [Chinn Ho] was trying to interest dairy operators in farm lots. The manager of a large dairy company in San Francisco turned down an offer of about 450,000 acres of prime sugar land in Wai'anae Valley because "land in Hawaii is going to be much cheaper in the future." The wife of a local dairy operator was concerned about the schools in Wai'anae, but her husband bought the farm anyway. (McGrath *et al.* 1973:151)

Dairy operations Honolulu City and County records indicate that by the early 1950's, the Territory of Hawaii had title to the parcel comprising the major portion of the study area - TMK [1] 8-05-004:002. At the time, the parcel was leased to the Dairy Products Sales Co., Ltd. During the 1960s, title to the parcel was transferred to the Department of Hawaiian Home Lands. Beginning in the 1970's, the parcel was leased to the George Freitas Dairy Inc. which occupied the parcel into the 1990's.

Section 4 Previous Archaeological Research

4.1 Previous Archaeological Studies in the Vicinity of the Project Area

Figure 6 and Table 1 below depict previously completed archaeological investigations in the vicinity of the project area. The table includes the source of the study, location, type (nature) of study, and any important findings.

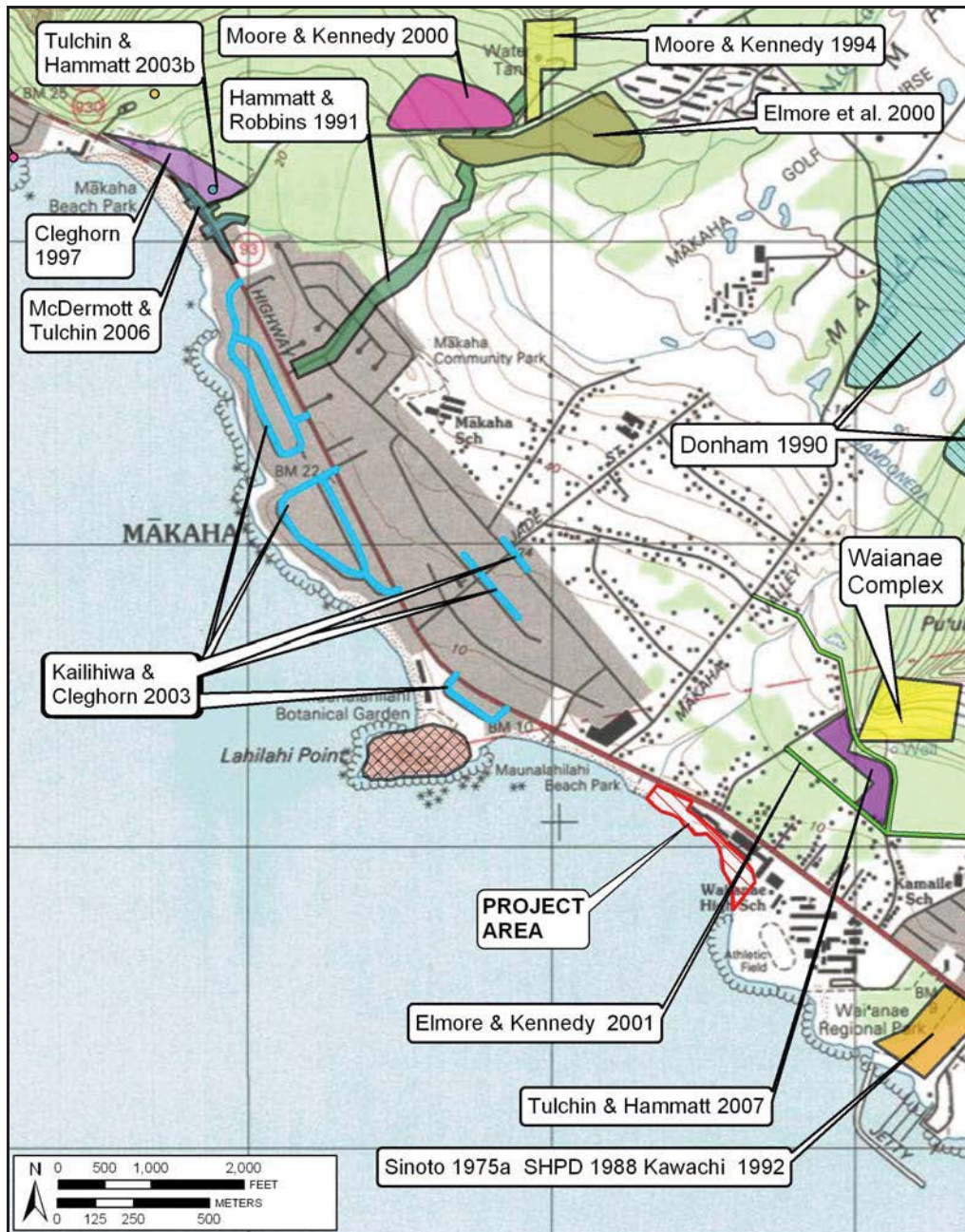


Figure 6. Previous archaeology in Wai'anae Ahupua'a near the current project area.

Table 1. Previous Archaeological Studies in the Vicinity of the Project Area

Source	Location	Nature of Study	Findings
McAllister 1933	Island-wide	Reconnaissance	Designates sites 152-168
Sinoto 1975a	Central coast	Reconnaissance Survey	Recorded 5 sites (3 enclosures, a wall & an L-shape)
Kennedy 1986	Mauna Lahilahi	Archaeological Investigations	Identifies five archaeological sites.
Komori 1987	Mauna Lahilahi	Archaeological Survey & Testing	Relocates Kennedy's five sites and describes eleven more. Reports eight carbon dates.
Donham 1990	Two areas on southeast side of the valley	Archaeological Inventory Survey	Identified a terrace assoc. with dry-land ag. and/or habitation.
Kawachi 1990	Mauna Lahilahi	Burial report	Describes remains of 2+ individuals, artifacts & sites.
Hammatt & Robins 1991	Water Street/ Kili Drive Area	Archaeological Inventory Survey	Identified a linear earthen berm understood as associated with commercial sugar cane cultivation.
Kawachi 1992	84-325 Makau St., Kepuhi Point	Burial Report	1 burial? "First in this particular area".
Moore & Kennedy 1994	Northwest side of the valley, 242-foot elevation	Archaeological Investigations	No historic features were located.
Cleghorn 1997	<i>Mauka</i> of Farrington Hwy, north of Kili Drive	Archaeological Inventory Survey	A cultural layer, a pond/wetland area remains of structures associated with the O. R. & L. Railroad, and a bridge foundation .

Source	Location	Nature of Study	Findings
Elmore et al. 2000	South side of Kili Drive (Site area - 776)	Archaeological Inventory Survey	Identified three features poss. assoc. with dry-land ag. and/or habitation.
Moore & Kennedy 2000	North side of Kili Drive (Site area - 776)	Archaeological Inventory Survey	Identified two features poss. assoc. with dry-land ag.
Elmore & Kennedy 2001	Wai'anae Coast Emergency Access Road	Archaeological Inventory Survey	Identified two historic properties: 50-80-07-5949 traditional subsurface deposit (associated with the Wai'anae Complex) and 50-80-07-5950 historic foundations and well (associated with Wai'anae Plantation Camp and pumping station)
Kailihiwa & Cleghorn 2003	Lower Mākaha	Archaeological Monitoring Report	Identified three sites with five features.
Tulchin and Hammatt 2003	Kili Drive and Farrington Hyw.	Archaeological Inventory Survey	No cultural resources identified.
McDermott, and Tulchin 2006	Mākaha Bridges 3 and 3A, TMK: [1] 8-4-001:012, 8-4-002:045, 47, 8-4-018:014, 122, 123, 8-4-08:018, 019, 020	Archaeological Inventory Survey	Identifies 5 historic properties: 50-80-7-6822 Mākaha Bridge 3; 50-80-7-6823 Mākaha Bridge 3A; 50-80-7-6824 Farrington Highway; 50-80-7-6825 cultural layer with human remains; 50-80-12-6714 OR&L railroad
Tulchin and Hammatt 2007	Mai'u'u Road and Mahinaau Road, TMK: [1] 8-5-002.	Archaeological Inventory Survey	Identifies 1 historic property: 50-80-07-6858 L-shaped structure

4.2 Burial Finds in the Vicinity of Mauna Lahilahi Beach Park

Documents relating to at least six burial finds (apparently representing 10 individuals) have been produced relating to Mauna Lahilahi Beach Park (Table 2, below).

A memorandum from Carol Kawachi of the State Historic Preservation Division, dated 2 May 1991, documented the discovery at SHPD that year of remains disinterred by the State Historic Preservation Office twelve years earlier (in October 1979). The remains were reported to be those "of a 5 ft 10 inch tall middle-aged male and a probable adult female?" (Kawachi 1991a:5). The provenance of the remains was described as the central portion of TMK 8-5-17:5, located south of the intersection of Maiu'u Road and Farrington Highway and makai of the Makaha Surfside condominium. No other information on the circumstance of burial discovery was given but the location would be consistent with coastal erosion. While five buttons (including a porcelain button perhaps dating to 1860) and a nail were included with the remains, Kawachi noted that the historic artifacts might not have had anything to do with the burial itself. CSH was informed that these remains were re-interred with others at the Badayos family designated re-interment site within Mauna Lahilahi Beach Park.

Douglas and Pietruszewsky (1988) documented another burial discovered in the vicinity of the Makaha Surfside on December 30, 1987. A couple walking on the beach looking for shells came across what appeared to be human bones. The police report of 12/30/87 places the discovery directly behind 85-175 Farrington Highway (Makaha Surfside) and notes: "They appeared to be very old. The dirt and sand appeared to have been washed away." Douglas and Pietruszewsky (1988) concluded that the remains were those of a male of about age 48. CSH was informed that these remains were re-interred with others at the Badayos family designated re-interment site within Mauna Lahilahi Beach Park.

Kawachi (1991b) reported another burial discovery in the vicinity of the project area on February 27, 1991. The burial was reported as eroding out "24.4 m at 22 - 202 degrees south of the beach Ka'ena corner of the [Makaha Surfside] apartment fence". A cultural layer with dark staining, charcoal and midden, 30 cm thick, was noted starting at 54 cm below surface. A shell fishhook pre-form was found in this cultural layer. The site was designated SIHP Site # 50-80-07-4064 Kawachi (1991b) noted the two previous (in 1979 and 1987) burial discoveries in the vicinity discussed above. Osteological study (Douglas 1991) concluded two individuals were present; an 8-9 year old child and a middle aged individual, probably male. These remains were re-interred with others at the Badayos family designated re-interment site within Mauna Lahilahi Beach Park.

A Memorandum (Case #505) to the SHPD files from SHPD burial sites program staff member Edward H. Ayau documents a call from Mr. Glen Kila of Koa Mana Resources/Wai'anae High School on October 20, 1992 regarding remains found on the shoreline fronting the Makaha Surfside Apartments. Mr. Kana'i Kapeliela picked up the remains that same day. CSH was informed that these remains were reinterred, along with other remains, at the Mākua Sinkhole Complex ("Po'ohuna") by the Koa Mana organization.

Table 2. Burial Finds in the Vicinity of Mauna Lahilahi Beach Park

Source	SIHP Number	Location of Find	Circumstance of Find	Sets of Remains	Reinterment Site
Kawachi (SHPD) 1991a	50-80-07-4064	Central portion of TMK 8-5-17:5 located south of the intersection of Maiu'u Road and Farrington Highway and seaward of the Makaha Surfside condominium.	Recovered in October 1979, the bones were stored at SHPD for 12 years before they were written up	2	Uncertain
Douglas and Pietrusewsky 1988	50-80-07-4064	Directly behind 85-175 Farrington Highway (Makaha Surfside)	December 30 1987. A couple walking on the beach came across what appeared to be human bones.	1	Badayos family re-interment area within Mauna Lahilahi Beach Park?
Kawachi, (SHPD) 1991b	50-80-07-4064	24.4 m at 22 - 202 degrees south of the beach Ka'ena corner of the [Makaha Surfside] apartment fence	February 26, 1991, Burials eroding out of beach	2	Badayos family re-interment area within Mauna Lahilahi Beach Park.?
Ayau 1992 Memo (Case #505) to the SHPD files	50-80-07-4064	Fronting the Makaha Surfside Apartments	October 20, 1992, Reported by Glen Kila	1?	Mākua Sinkhole Complex ("Po'ohuna")?
Jourdane 1995	Burial #1 was designated site 50-80-07-6592-1,	Two burial sites are reported: Burial #1 was reported 40 m west of the Makaha Surfside Complex in the face of a sand bank on the western edge of a small cove and	June 1995, Found on shoreline following high surf by Alikea Silva	2	Badayos family re-interment area within Mauna Lahilahi Beach Park.?

Source	SIHP Number	Location of Find	Circumstance of Find	Sets of Remains	Reinterment Site
	Burial # 2 designated site 50-80-07-4064	Burial # 2 was at the edge of the lawn fronting the 2nd building from the Nānākuli end of the complex, 10 to 15 yards from the waters edge.			
Cordy April 7, 1997 Memo to SHPD Burial Program	50-80-07-6592-2 and 50-80-07-6592-3	SHPD Archaeologist observed burials exposed on coast	April 1997, Exposed by erosion	2	1 still in-situ, the other presumed lost to erosion
Perzinski and Hammatt 2004	50-80-07-4064	50-80-07-4064 was reported approximately 30 m west of Makaha Surfside Complex within Mauna Lahilahi Beach Park	Encountered during Inventory survey	1	Still <i>in-situ</i> within Mauna Lahilahi Beach Park

Another burial find was reported by Mr. Alika Silva in June 1995 (Jourdane 1995). Human remains were found while Mr. Silva was walking the beaches looking for burials following a period of large surf. Two burial sites are reported: Burial #1 (designated site 50-80-07-6592-1) was reported 40 m west of the Makaha Surfside Apartments in the face of a sand bank on the western edge of a small cove and Burial # 2 (designated site 50-80-07-4064) was at the edge of the lawn fronting the 2nd building from the Nānākuli end of the complex, 10 to 15 yards from the waters edge. The SHPD staff recommended relocation and the remains were disinterred in October 1995 in consultation with the Lucio Badayos family. It is understood that the remains were re-interred in the known Badayos re-interment location within the park on January 2, 1996.

Dr. Ross Cordy reported two sets of human remains (later designated site 50-80-07-6592-2 and 50-80-07-6592-3) in a memo to the Burial Program on April 7, 1997. We believe that one of these was the burial reported in the 2004 archaeological inventory survey (SIHP# 50-80-07-4064-1) and that the other was most likely lost to high surf between 1997 and 2004.

The archaeological inventory survey for the Beach Park Improvements Project included both surface survey and subsurface testing components. The archaeological inventory survey documented an intact cultural layer which contained varying concentrations of charcoal, historic and indigenous artifacts and midden. Radiocarbon dating of charcoal from the cultural layer returned dates ranging from A.D. 1430-1640, suggesting settlement of the project area by the 15th century, with occupation continuing into historic and modern times. Historic documentation of commercial agriculture and transport indicated the presence of a portion of the Oahu Railway and Land Company (OR&L) railroad passing through the project area. Along the makai side of the Makaha Surfside Condominiums a low, linear berm was observed and tested and found to contain compact, crushed coral and a railroad spike which confirmed the presence of the abandoned rail line. Four sites were identified and documented and are summarized below in Table 3.

Table 3. Historic Sites Identified During the Archaeological Inventory Survey

SIHP #	Site Type	Significance	Recommendations
50-80-07-4064	Human Burials	D, E	Preservation
50-80-07-6634	Cultural Layer	D	Preservation
50-80-07-6635	Historic Alignment	D	No further work
50-80-12-9714	O.R. & L. Railroad	D	No further work

Two sites in the project area were recommended for preservation including a previously documented burial actively eroding out of the shoreline and one adjacent probable crypt burial (50-80-07-4064: 4 and 5), as well as the intact cultural layer that runs along the southern portion of the project area (south of the drainage/existing beach park). Preservation of the human burials were recommended, though it was also suggested that the remains that are actively eroding be subjected to a burial treatment plan that would address the long term preservation and immediate concerns regarding this burial.

A Burial Treatment Plan (Hammatt & Shideler 2004) was developed and on September 17, 2004, SHPD staff CSH archaeologists and Mr. Alike Silva inspected the site to assist in identifying the location of burial 50-80-07-6592-2. No remains were visible on the surface of the location of said burial. Based on observations, the burial site area had undergone natural erosional activities (e.g. high surf) and there were no remains of this specific site to be recovered.

Section 5 Results of Fieldwork

5.1 Introduction

Cultural Surveys Hawaii Inc. was contracted to conduct archaeological monitoring on the Mauna Lahilahi Beach Park Improvements Project, which consisted of planting 100 new coconut palms as well as installing water lines for their maintenance.

According to previous archaeological studies conducted within the project area, evidence of cultural activity increased with proximity to the ocean, especially in areas with Jaucas Sand. The creation of a buffer zone kept excavations associated with the beach park's improvements closer to Farrington Hwy, limiting all construction activities to the *mauka* half of the project area (Figure 7), and away from the ocean-cut banks containing cultural evidence (see Figure 8). Despite these precautions to reduce damage to any known or unknown cultural deposits, the *mauka* construction zone revealed additional cultural deposits along with human burials.



Figure 7. Photograph of the construction fence boundary (the orange fence is visible at the left side of the image) showing the excavations contained within the *mauka* half of the project area, view to northwest.

Fieldwork was completed intermittently over the course of 8 months, from November 8, 2004 to July 14, 2005. A total of 37 days were required for on-site monitoring. All excavation was limited to the two areas marked on Figure 8. The excavations for the new coconut trees varied in size and depth depending upon the size of the tree; the larger excavations were approximately 6 feet wide by 6 feet long by 4.5 feet deep (2m by 2m by 1.5m deep). Prior to the encounter of human remains water main excavation depth was held to approximately 3ft (1m) below surface. Subsequent excavations for water lines took place at a later date after much consultation and were limited to less than 12 inches below the surface. Two human burials were encountered, noted as SIHP sites 50-80-07-6704 & -6705, on opposite ends of the park; Site -6704 on the southeast end and Site -6705 on the northwest end (see Figure 8). No other significant cultural deposits were encountered.

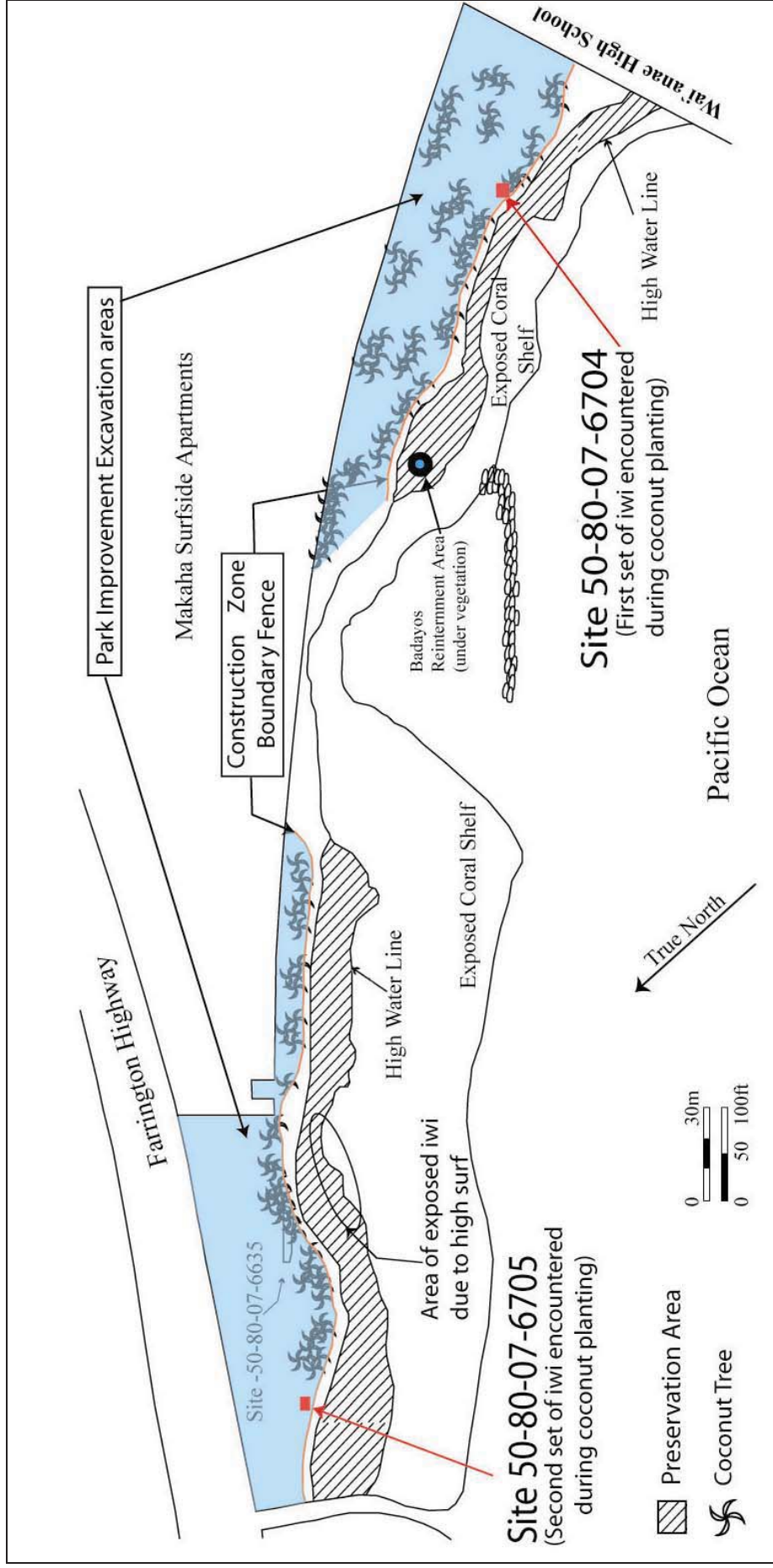


Figure 8. Map of project area showing the park improvement excavation area located mauka of the construction zone boundary fence, .

5.2 Stratigraphic Analysis

5.2.1 Primary Stratigraphic Sequence

This archaeological monitoring project was specific to landscaping improvements to the southern end of Mauna Lahilahi Beach Park. In accordance with the Improvement Plan the proposed park improvements (consisting of tree planting and excavations for associated irrigation) were designed to maintain a safe distance from the cultural layer along the coast, where burials and cultural deposits had previously been identified. Based on the proposed location of project excavations related to the landscaping improvements a primarily terrestrial stratigraphic sequence was anticipated.

The primary stratigraphic sequence documented throughout the project area (designated as Type A stratigraphy) (Figure 9) consisted of three layers; Stratum I, a very dark gray sandy clay characterized by the mixing of marine sediment (i.e. sand) and terrestrial sediment (dark grayish clay loam) which can be related to the wave action that routinely floods the area and to wind distribution of beach sand; Stratum II, a very dark grayish brown clay loam; and Stratum III, a very dark brown clay matrix with few inclusions as well as generally hard to very hard consistency. These observations agree with the USDA soil data for the project area and its vicinity (Foote et al. 1972).

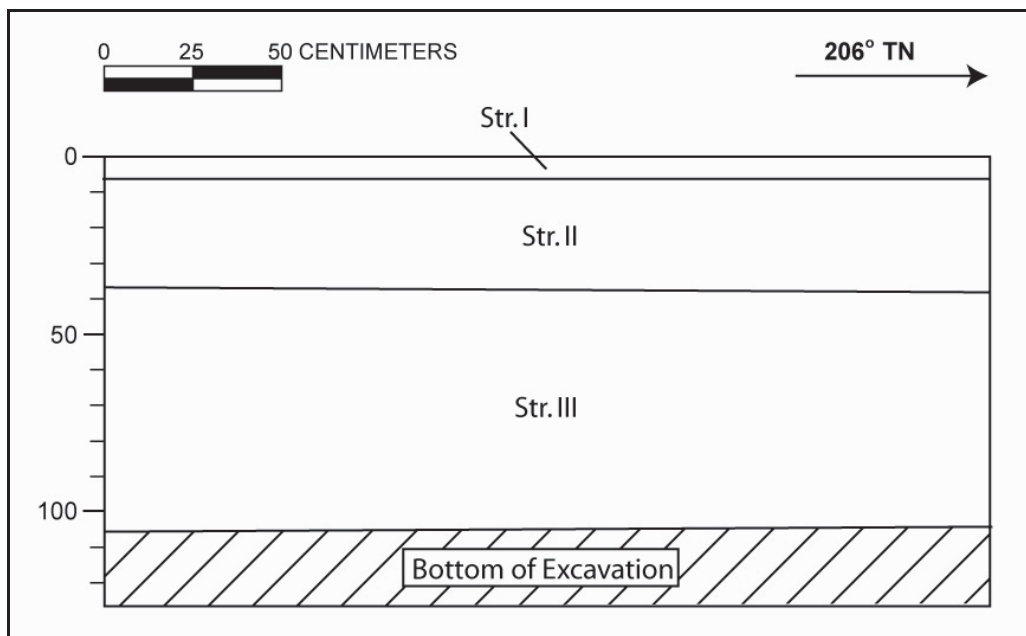


Figure 9. Representative profile of the dominant (Type A) stratigraphic sequence in the project area.

The Type A stratigraphic sequence consisted of three strata (Strata I, II and III):

Stratum I- (0-7 cmbs) 10 YR 3/1 very dark gray sandy clay; fine moderate sub-angular blocky structure; dry hard consistency; slightly plastic; a mixture of terrestrial and marine sediments; the lower boundary was smooth and abrupt.

Stratum II- (7-38 cmbs) 10 YR 3/2 Very dark grayish brown clay loam; moderate, medium blocky structure; dry hard consistency; the lower boundary was clear and smooth.

Stratum III- (38 cmbs –BOE) 10 YR 2/2 Very dark brown clay; moderate, medium block structure; dry very hard consistency; slightly plastic; no cementation.

According to the initial inventory survey, the Type A stratigraphy would probably continue to be the basic sequence throughout the proposed Park Improvements Project area (Perzinski and Hammatt, 2004) and, within isolated pockets, might contain cultural deposits.

5.2.2 Isolated Stratigraphic Sequences

Three isolated areas that differed from the Type A stratigraphic sequence were identified during the current project; these were designated as Types B, C, and D stratigraphy (see Figure 11 for the locations of these isolated areas).

The Type B stratigraphic sequence was found in the area near the newly-created swimming bay and the breakwater wall fronting the Makaha Surfside Apartments (see Figure 11) There was no evidence of naturally deposited soils in this area. The stratigraphic profile showed a single layer of imported beach sand (Stratum I) ranging from 0 – 1.2 mbs, composed entirely of imported beach sand and large sand bags from the surface to the base of excavation. These sand bags were components of a temporary revetment which was installed in 1999 to prevent beach erosion (Figure 10). Once the revetment was in place sand was imported to cover the sandbag revetment and nourish the eroded portion of the beach (Oceanit 2001). In 2003 the City and County of Honolulu Department of Design and Construction constructed a breakwater to reduce further beach erosion at this location and imported more sand to nourish the beach at this location (Jones and Hammatt 2003).

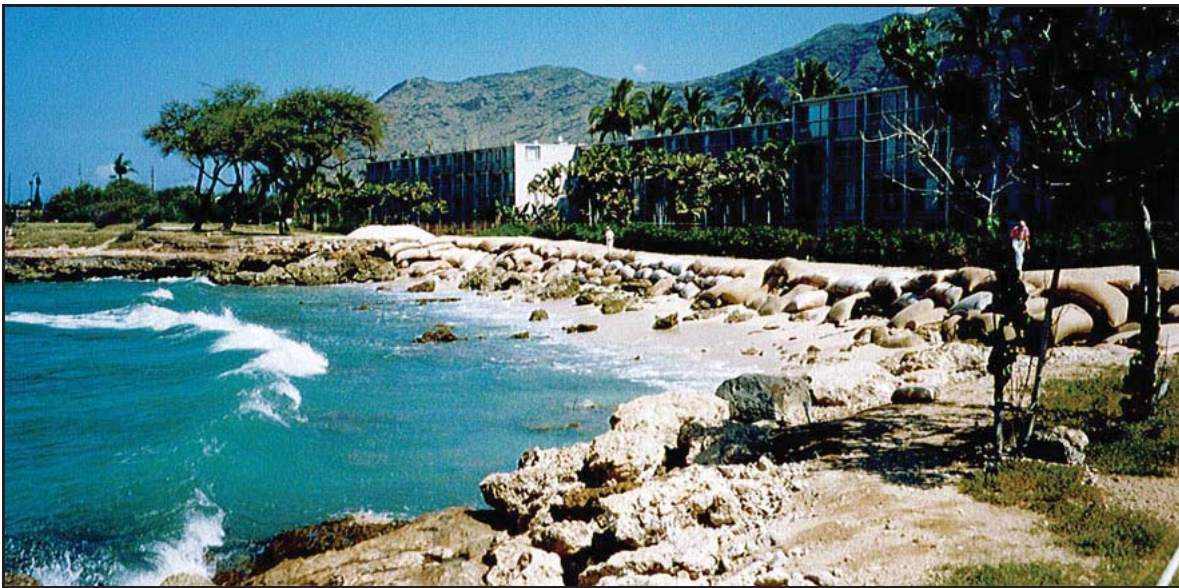


Figure 10. Photograph of the sandbag revetment installed in 1999 to stop beach erosion near the Makaha Surfside apartments, view to north.

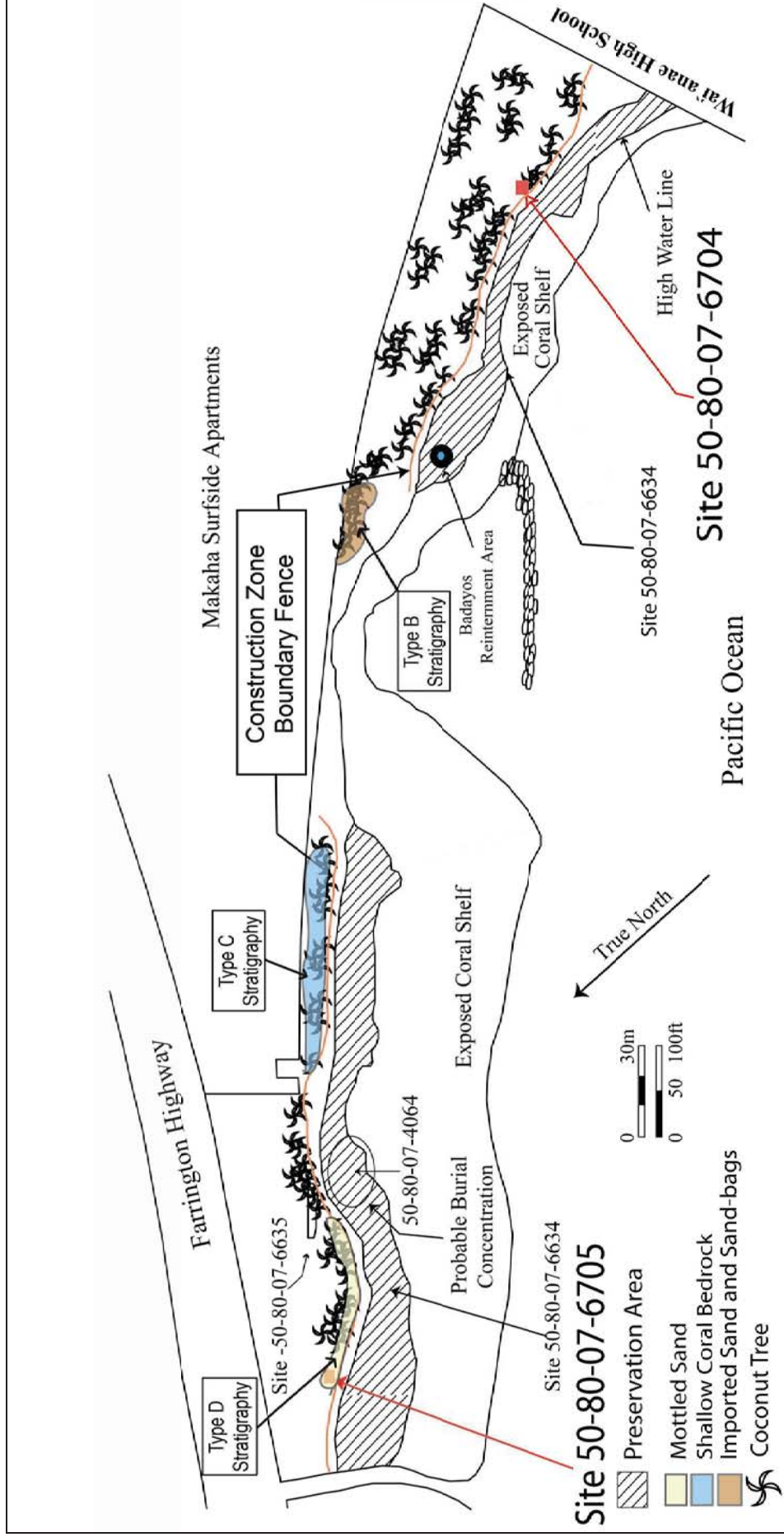


Figure 11. Map of the project area showing the three isolated areas where the stratigraphy varied from the primary (Type A) stratigraphy found throughout the excavation area.

The Type C stratigraphic sequence was found during excavations near the Makaha (North) end of the Makaha Surfside Apartments (see Figure 11) Type C stratigraphy consisted of a shallow (25-45 cmbs) soil deposit atop the hardened coral shelf. The soil deposit (Stratum I) contained sparse deposits of historic trash and gravel probably associated with the construction of the nearby Makaha Surfside Apartments. Type C consisted of a single stratum (Stratum 1):

Stratum I- (0-25 cmbs) 10 YR 5/2 Grayish brown silty sand; structureless; dry hard consistency; a mixture of terrestrial and marine sediments; the lower boundary was abrupt and smooth.

The Type D stratigraphic sequence was observed in excavations within 3 meters of the construction zone fence on the Makaha side (northwest) of the project area (see Figure 11). Type D stratigraphy consisted of mottled sand and clay layers and appeared to be a transition area between the sandy beach deposits and the clay soil found throughout the mauka portion of the project area. The Type D sequence comprised four strata designated I, II, III and IV:

Stratum I (0-10 cmbs) 2.5 YR 7/4 Pale yellow medium-grain sand; structureless with dry loose consistency; marine sediment; the lower boundary was smooth and abrupt.

Stratum II (10-50 cmbs) 10 YR 5/2 Grayish brown silty loam; structureless with dry loose consistency; a mixture of terrestrial and marine sediments, the lower boundary was abrupt and smooth. Lenses of clean beach sand and lenses of dark stained sand were identified in this layer.

Stratum III (50-90 cmbs) 10 YR 3/1 very dark gray silty clay loam, structureless with moist friable consistency; slightly plastic; terrestrial sediment; the lower boundary was smooth and abrupt. Lenses of pale brown beach sand and silty sand were identified in this layer.

Stratum IV (90 cmbs-BOE) 10 YR 3/2 Very dark grayish brown clay; weak, fine crumb structure with moist very firm consistency; plastic; terrestrial sediment. Lenses of pale brown beach sand and silty clay/sand were identified in this layer. (Burial site SIHP # 50-80-07-6705 was discovered in this stratum).

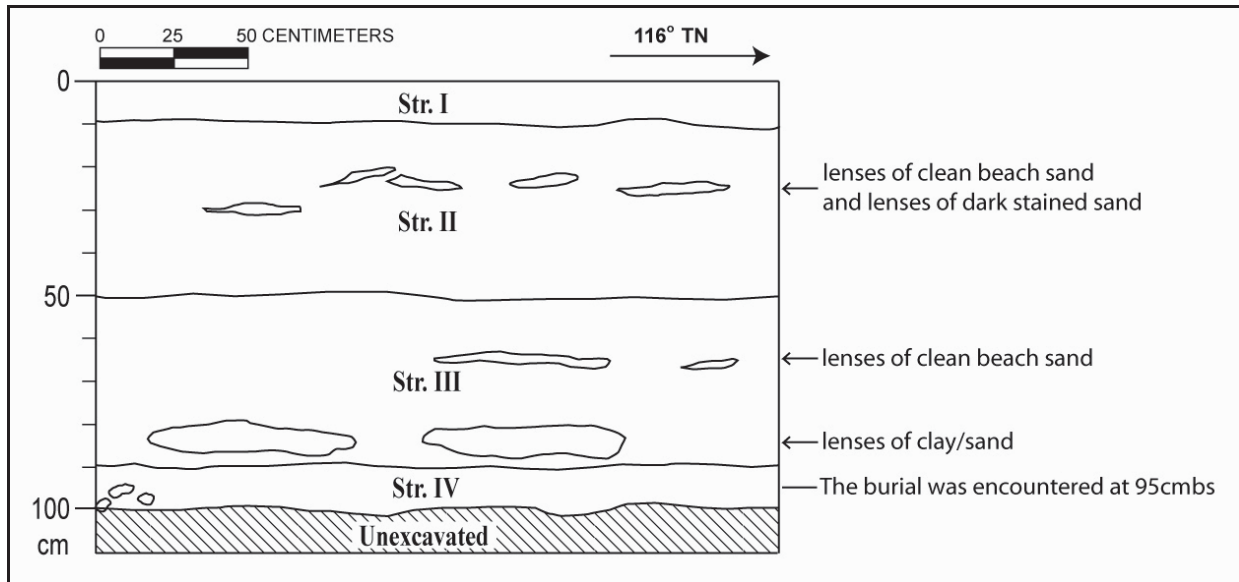


Figure 12. Profile of Type D stratigraphic sequence, from an excavation on the northwest side of the project area, near the construction zone fence.

5.3 SIHP # 50-80-07-6704

Site Type: Human Burial

Site Function: Religious/ Ceremonial

of Features: 1

Age: Post Contact

Description:

On November 13, 2004, a human burial was encountered while excavating for a coconut palm (Figure 13) in the southern portion of the project area. Work was halted and SHPD/DLNR was notified.



Figure 13. Photograph of excavation for coconut palm where site # 50-80-07-6704 was encountered, the stones mark the location of the inadvertent burial discovery, view to west

The encountered remains were a primary burial found lying on its back in a fully extended position within a coffin. The burial was oriented roughly north/south with the head at the southern or *makai* end of the coffin (Figure 14). The burial was found with historic era artifacts including buttons, nails, and the coffin itself. Based on verbal accounts of descendants in the area the burial is definitely historic but believed to be of Hawaiian ancestry. Though the human remains were encountered at 80 cmbs, the *in-situ* coffin remains illustrated that the top of the coffin was probably closer to 70 cmbs originally but had slumped in some areas to the depth of the human remains due to decay.

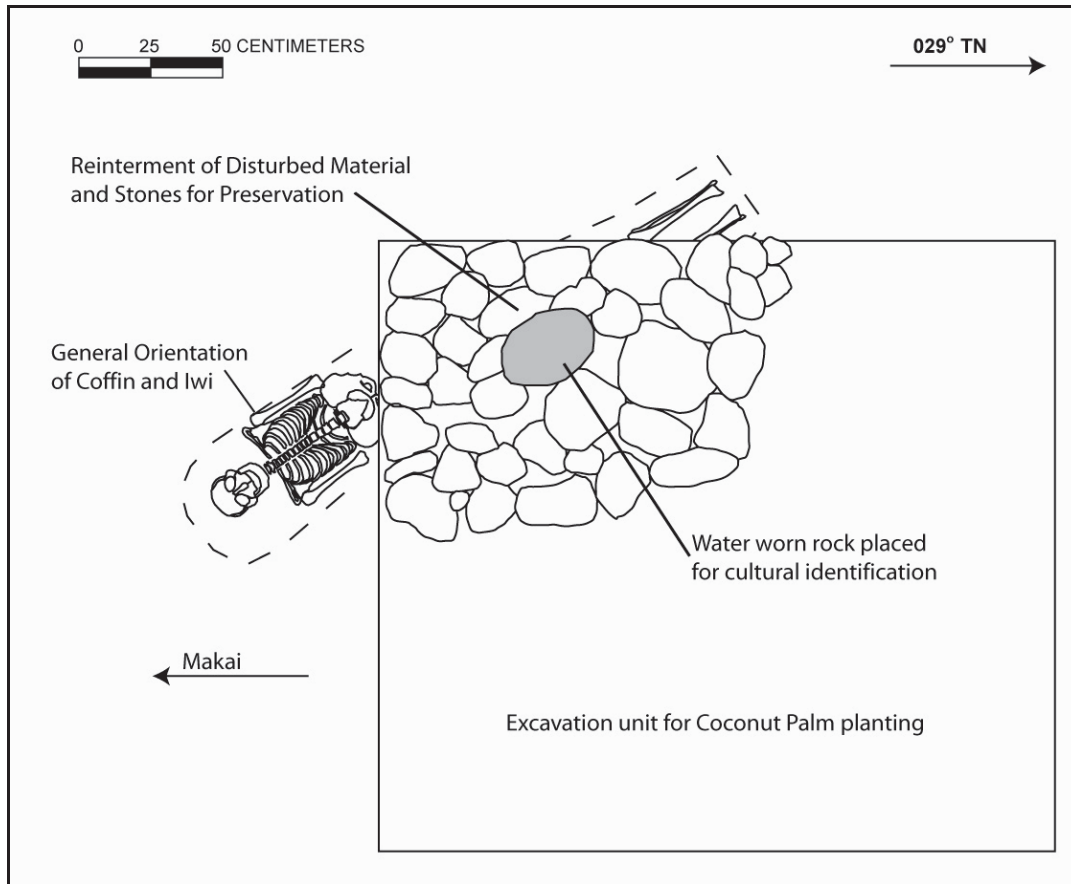


Figure 14. Plan view of SIHP 50-80-07-6704 burial encountered during project. Darkened rock illustrates water worn rock placed for cultural identification.

Site 50-80-07-6704 did not exhibit any discernible pit outline. The stratigraphy within this excavation (Figure 15) resembled the dominant (Type A) stratigraphic sequence for the project area, and consisted of three layers:

Stratum I (0-7 cmbs) 10 YR 3/1 very dark gray sandy clay, fine moderate sub-angular blocky structure; dry hard consistency; slightly plastic; a mixture of of terrestrial and marine sediments; the lower boundary was smooth and abrupt.

Stratum II (7-28 cmbs) 10 YR 3/2 Very dark grayish brown clay loam; moderate, medium blocky structure; dry hard consistency; the lower boundary was clear and smooth.

Stratum III (28 cmbs-BOE) 10 YR 2/2 Very dark brown clay; moderate, medium block structure; dry very hard consistency; slightly plastic; no cementation.

After SIHP # 50-80-07-6704 was encountered, procedures followed the methodology discussed in the section 2.2 (Burial Encounter Methodology) of this report. The site was mapped and GPS points were taken for long-term preservation. The disturbed remains were reinterred with the *in situ* portion of the burial, small boulders were placed around and over the remains to delineate the burial (see Figure 14 and Figure 5), and the excavation was backfilled to the surrounding elevation.

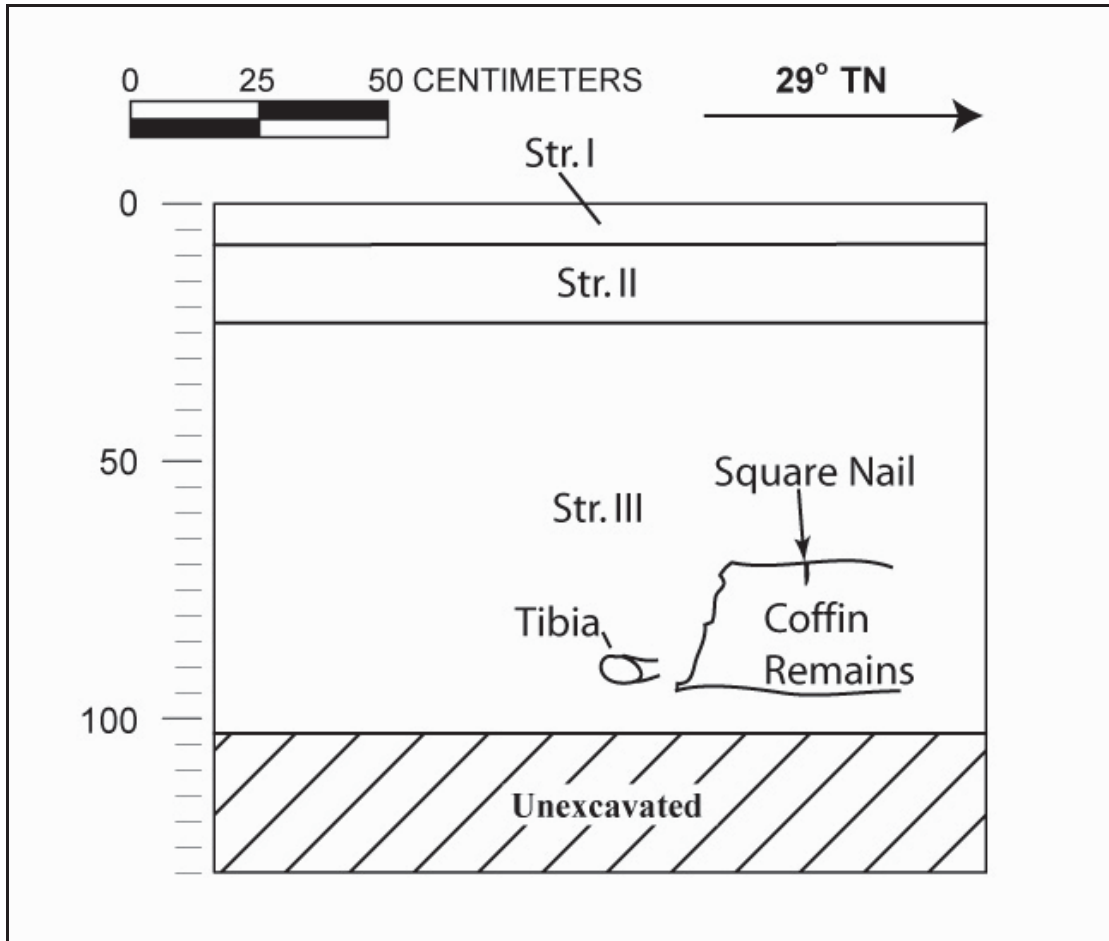


Figure 15. Stratigraphic profile of SIHP # 50-80-07-6704.

5.4 SIHP # 50-80-07-6705

Site Type: Human Burial

Site Function: Religious/ Ceremonial

of Features: 1

Age: Pre-Contact

Description: On November 14, 2004 a second burial (designated SIHP # 50-80-07-6705) was encountered while excavating for a coconut palm tree in the northern portion of the project area (see Figure 8 and Figure 11). The remains had been impacted by the excavation but they appeared to have become disarticulated prior to their discovery (it appeared as though the remains were previously disturbed, but would have required further exposure of the remains to determine this aspect of the burial with greater accuracy). Due to the sensitivity of the site and in consultation with SHPD, no further burial documentation was undertaken. The remains were recovered following the methodology previously described in Section 2 and preserved in place (Figure 16).

The (Type D) stratigraphic sequence in the vicinity of SIHP # -6705 was unique to a relatively small portion of the project area (see Figure 11), which appeared to be an isolated area of transition between the beach sand sediments in the preservation area and the primary (Type A) stratigraphic sequence observed throughout most of the project area. A profile of the sidewall adjacent to the burial was taken in order to describe and illustrate the stratigraphic sequence in the vicinity of the burial (Figure 17). This profile does not illustrate the exact position of the burial in the profile only because the burial was located in the center of the excavation, some 25cm away from the sidewall that was recorded in Figure 17. The depth of the remains is marked on the profile for reference.

Stratigraphy in the excavation consisted of four strata (designated I, II, III and IV):

Stratum I (0-10 cmbs) 2.5 YR 7/4 Pale yellow medium grain sand; structureless; dry loose consistency; marine sediment; the lower boundary was smooth and abrupt.

Stratum II (10-50 cmbs) 10 YR 5/2 Grayish brown silty loam; structureless; dry loose consistency; a mixture of terrestrial and marine sediments, the lower boundary was abrupt and smooth. Lenses of clean beach sand and lenses of dark stained sand were identified in this layer.

Stratum III (50-90 cmbs) 10 YR 3/1 very dark gray silty clay loam, structureless; moist friable consistency; slightly plastic; terrestrial sediment; the lower boundary was smooth and abrupt. Lenses of pale brown beach sand and silty sand were identified in this layer.

Stratum IV (90cmbs-BOE) 10 YR 3/2 Very dark grayish brown clay; weak, fine crumb structure; moist very firm consistency; plastic; terrestrial sediment. Lenses of pale brown beach sand and silty clay/sand were identified in this layer. SIHP # 50-80-07-6705 was discovered in this stratum.

Based on the lack of historic artifacts, the spatial relationship to the SIHP # 50-80-07-6634 cultural layer, and accounts of lineal relationship, it is probable that the remains of SIHP # 50-80-07-6705 were pre-Contact and of native Hawaiian ancestry.

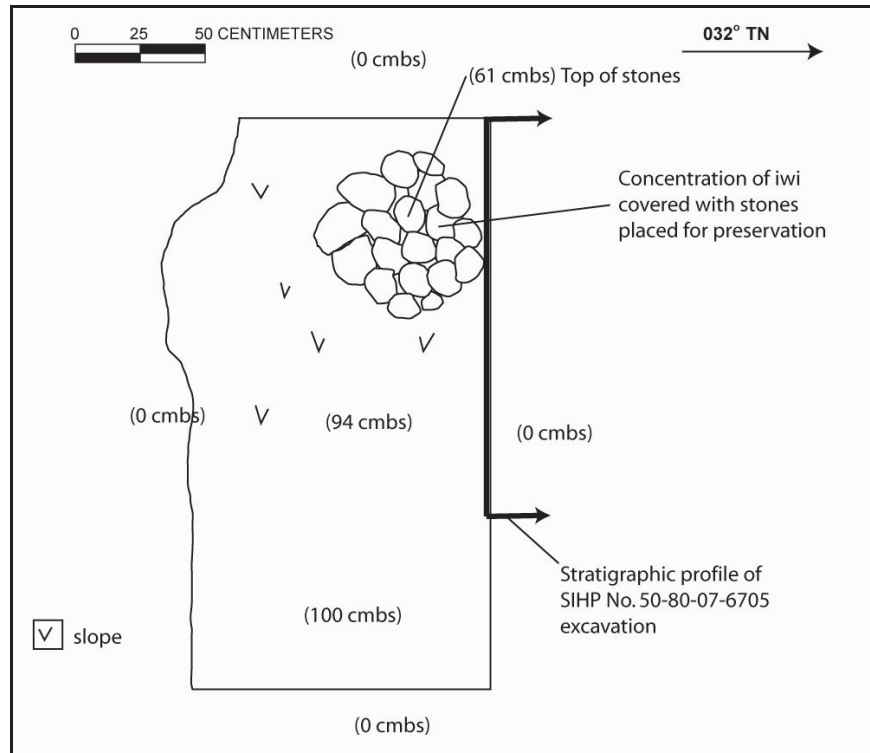


Figure 16. Plan view of Site 50-80-07-6705 showing the location of the remains and the stones placed over them for preservation purposes. The depths (measured in centimeters below the surface) at various places in the excavation and vicinity are marked in parentheses. The location and view direction of the stratigraphic profile (Figure 17) are indicated as well.

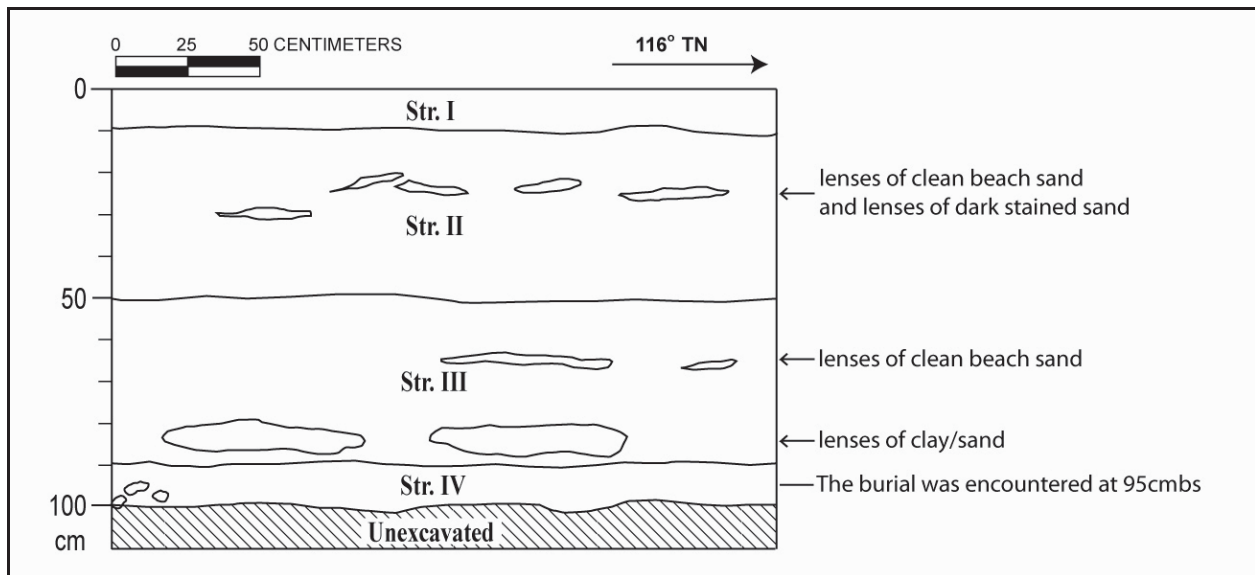


Figure 17. Stratigraphic profile of Site 50-80-07-6705 showing the stratigraphic sequence in the vicinity of Site 50-80-07-6705.

Section 6 Summary

Prior to the beginning of construction work within the project area, an archaeological inventory survey (Perzinski and Hammatt, 2004) documented a cultural layer, site 50-80-07-6634, within the sand deposits of the beach park. Human burials and isolated human bones have previously been documented within the beach park, some of which were reinterred at the Badayos site (Douglas and Pietrusewsky 1988, Kawachi 1991a and b). Therefore, preventative measures were put in place during this project to minimize the impact to significant cultural deposits, including erecting a construction zone fence line 10 to 40 feet (3.3 to 13 m) *mauka* (landward) of the edge of the cultural layer (SIHP # 50-80-07-6634).

With three isolated exceptions (described in this report as stratigraphic Types B, C, and D), the primary (Type A) stratigraphic sequence, found throughout the project area, matched the soil descriptions from the 2004 archaeological inventory survey of the project area (Perzinski & Hammatt 2004).

Two burials were discovered during excavations for the planting of coconut trees. The first burial (SIHP # 50-80-07-6704) was encountered on November 13, 2004, in the southeast portion of the project area. The burial was discovered in a layer of clay sediment with no cultural layer present. The burial was clearly historic as the remains had been interred in a coffin; accounts by descendants stated that the individual was of native Hawaiian ancestry. The second burial (SIHP # 50-80-07-6705) was encountered November 14, 2004, in the Northwest portion of the project area. Site -6705 was discovered in a layer of sandy clay sediment with no historic or pre-Contact artifacts. The stratigraphy of the area where Site -6705 was discovered appears to be a transition area between the sandy beach deposits and the clay soil found throughout the project area. Based on the spatial difference between the burials and the presence of historic artifacts associated with one of the burials (while no historic artifacts were discovered in association with the other burial), it does not appear that the remains are directly related.

Both burials encountered were left in-situ, secured and covered to surrounding elevation. No other significant cultural deposits were identified during the project excavations. Though previous archaeology has determined a greater concentration of cultural deposits within the sand deposits, the presence of burials within the project area clay deposits suggests that cultural deposits might be found anywhere within the project area.

Section 7 Significance Assessments

7.1 Introduction

According to the Hawaii Administrative Rules:

To be considered significant a historic property shall possess integrity of location, design, setting, materials, workmanship, feeling, and association and shall meet one or more of the following criterion:

Criterion "A"- Be associated with events that have made an important contribution to the broad patterns of our history;

Criterion "B"- Be associated with the lives of persons important in our past;

Criterion "C"- Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, or possess high artistic value;

Criterion "D"- Have yielded, or is likely to yield, information important for research on prehistory or history; or

Criterion "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 [Hawaii Administrative Rules 13-275-6b]

7.2 Significance

SIHP # 50-80-07-6704 is assessed as significant under criteria D and E. This site represents a human burial within a coffin. The human remains are believed to be of Native Hawaiian ancestry and have cultural value per criterion E.

SIHP # 50-80-07-6705 is assessed as significant under criteria D and E. This site represents the remains of an individual encountered during the current project. The human remains are believed to be of Native Hawaiian ancestry and have cultural value per criterion E.

7.3 Recommendation

Preservation in place and a Burial Treatment Plan are recommended for SIHP # 50-80-07-6704 and SIHP # 50-80-07-6705. Based on the stratigraphy of the current study and the presence of significant cultural properties, archaeological monitoring is recommended for any future subsurface work in the vicinity of the current project area. Numerous burials and pre-contact cultural deposits have been recorded within the current project area as well as nearby areas, it is therefore recommended that the Burial Treatment Plan accompany any monitoring plan created for future work within the area.

Section 8 References Cited

Ayau, Edward H

- 1992 Memorandum (Case #505) to SHPD burial site program staff regarding remains discovered by Glen Kila on October 20, 1992 on the shoreline fronting the Makaha Surfside Apartments.

Barratt, Glynn

- 1988 *The Russian View of Honolulu, 1809-26*. Ottawa: Carleton University Press.

Bingham, Hiram

- 1847 *A Residence of Twenty-One Years in the Sandwich Islands*. Hartford: Hezekiah Huntington.

Cleghorn, Paul L.

- 1997 *The Results of An Archaeological Inventory Survey in Coastal Mākaha, Wai'anae, O'ahu, Hawaii (TMK 8-4-2:47)*, Pacific Legacy, Inc. 332 Uluniu Street, Kailua, HI.

Cordy, Ross

- 1997 Memorandum to the SHPD Burial Program reporting two sets of remains (later designanted SIHP # 50-80-07-6592-2 and SIHP# 50-80-07-6592-3).

Corney, Peter

- 1896 *Voyages in the Northern Pacific*. Honolulu: Thos. G. Thrum.

Donham, Theresa K.

- 1990 *Archaeological Inventory Survey, Makaha Valley Planned Development-Housing (PD-H) Site, Land of Makaha, Waianae District, Land of Oahu (TMK 8-0-4-02:7)*, Letter Report PHRI, Hilo, HI.

Douglas, Michele T.

- 1991 Report on a Child's Skeleton Recovered from the Beach at Makaha Surfside Apartments, SHPO, Honolulu, HI.

Douglas, Michele Toomay and Michael Pietrusewsky

- 1988 Human Remains at Makaha Beach, Makaha, O'ahu, TMK 8-5-17:08, Site 80-07-4064, Police Report, Medical Examiner's Report and Physical Anthropologist's Report, UH-Manoa, Honolulu, HI.

Elmore, Michelle and Joseph Kennedy

- 2001 An Archaeological Inventory Survey Report for the Wai'anae Coast Emergency Access Road Wai'anae District, island of O'ahu December 2001(TMK Portions: 8-4-2, 8-4-2, 11,14,15,17,19,20,21,22,24,25,26,29) , Archaeological Consultants of the Pacific, Inc.

Elmore, Michelle, James R. Moore and Joseph Kennedy

- 2000 *An Archaeological Inventory Survey Report for TMK: 8-4-02:50 Located in Makaha Ahupua'a, Waianae District, Island of O'ahu*, Archaeological Consultants of the Pacific, Inc., Honolulu, HI.

Foote, Donald E., E.L. Hill, S. Nakamura and F. Stephens

- 1972 Soil Survey of the Islands of Kaua'i, Oahu, Maui, Molokai and Lanai, State of Hawaii, U.S. Dept. of Agriculture, U.S. Government Printing Office, Washington, D.C.
- Gast, Ross and Agnes C. Conrad (ed.)
1973 *Don Francisco de Paula Marin*. Honolulu: Hawaiian Historical Society.
- Green, Roger C.
1980 *Makaha Before 1880 A.D.* Pacific Anthropological Records No. 31, Department of Anthropology. Bernice P. Bishop Museum, Honolulu, HI.
- Hammatt, Hallett H., Douglas Borthwick and David Shideler
1985 *Archaeological Excavations at the Wai'anae Army Recreation Center, Poka'i Bay, Wai'anae, O'ahu, Hawaii*. Cultural Surveys Hawaii, Kailua, HI.
- Hammatt, Hallett H. and Jennifer Robins
1991 *An Archaeological Inventory Survey for the Proposed Kili Drive/Water Street 20 inch Watermain, Mākaha, Wai'anae, O'ahu*, Cultural Surveys Hawai'i, Kailua, HI.
- Hammatt, Hallett H. and David Shideler
2004 *Burial Treatment and Preservation Plan for Sites 50-80-07-4064 and -6634 in Support of the Mauna Lahilahi Beach Park Improvements Project, Wai'anae Ahupua'a, Wai'anae, O'ahu* (TMK: 8-4-01:1; 8-5-17: 1-7 & 22, and 8-5-18: 1-3). Cultural Surveys Hawaii, Kailua, HI.
- Jones, Kulani and Hallett H. Hammatt
2003 *Archaeological Monitoring Report for the Mauna Lahilahi Shoreline Protection Project, , Wai'anae Ahupua'a, Wai'anae, O'ahu*, (TMK 8-5-017:005). Cultural Surveys Hawaii, Kailua, HI.
- Jourdane, Elaine Rogers
1995 *Inadvertent Discovery of Human Remains at Makaha Surfside Condominiums, Makaha, Waianae, Oahu , SHPD/DLNR, State of Hawai'i, Honolulu, HI.*
- Kailihiwa III, Solomon and Paul L. Cleghorn
2003 *Archaeological Monitoring of Mākaha Water System Improvements Phase II, For Ten Streets in the Ahupua'a of Mākaha* (TMK: 8-4-03m 05-08, 11, 12, 14, 16), Island of O'ahu , Pacific Legacy, Inc., Kailua, HI.
- Kamakau, Samuel M.
1992 *Ruling Chiefs of Hawaii*. Honolulu: Kamehameha Schools Press.
- Kawachi, Carol T.
1992 *Burial Exposed by Hurricane Iniki, Waianae Regional Park, Waianae, Oahu, TMK 8-5-02:11*, Memorandum to files, SHPD, Honolulu, HI.
1991a *Makaha Surfside Burial (1979): Artifacts, Kamaile, Wai'anae O'ahu, TMK 8-5-17:005, State Site No. 80-07-4064* SHPD, Honolulu, HI.
1991b *Recovery of Burial Beachside of Makaha Surfside*. SHPD, Honolulu, HI.
1990 *Mauna Lahilahi Crevice Burials, Makaha, Wai'anae, O'ahu*, SHPD, Honolulu, HI.

- Kennedy, Joseph
1986 *Archaeological Investigations at Mauna Lahilahi, Wai'anae, Island of O'ahu*.
Archaeological Consultants of Hawaii, Inc.
- King, Pauline (ed.)
1989 *Journal of Stephen Reynolds*, Vol I:1823-1829. Honolulu: Ku Pa'a Inc.
- Kirch, Patrick and Marshall Sahlins
1992 *Anahulu: The Anthropology of History in the Kingdom of Hawaii, Vol. I*. Chicago:
University of Chicago Press.
- Komori, Eric
1987 *Archaeological Survey and Testing at Mauna Lahilahi, Wai'anae District, Island
of O'ahu* Dept. of Anthropology, Bishop Museum, Honolulu, HI.
- Kuykendall, Ralph
1965 *The Hawaiian Kingdom, vol I*. Honolulu: The University Press of Hawaii.
1953 *The Hawaiian Kingdom, vol II*. Honolulu: The University Press of Hawaii.
- McAllister, J. Gilbert
1933 *Archaeology of Oahu*, Bulletin 104, Bernice P. Bishop Museum, Honolulu, HI.
- McDermott, Matt and Jon Tulchin
2006 *Archaeological Inventory Survey for the Proposed Replacement of Mākaha
Bridges 3 and 3A, Farrington Highway, Mākaha Ahupua'a, Wai'anae District,
Island of O'ahu, TMK: [1] 8-4-001:012, 8-4-002:045, 47, 8-4-018:014, 122, 123,
8-4-08:018, 019, 020*, Cultural Surveys Hawai'i, Inc., Kailua, HI.
- McGrath, Edward J., Kenneth M. Brewer and Bob Krauss
1973 *Historic Waianae: A Place of Kings*. Honolulu: Island Heritage Limited.
- Moore, James R. and Joseph Kennedy
2000 *An Archaeological Inventory Survey Report for a Portion of TMK: 8-4-02: 58
Located in Makaha Ahupua'a, Waianae District, Island of O'ahu*, Archaeological
Consultants of the Pacific, Inc., Honolulu, HI.
1994 *Archaeological Investigations for the Board of Water Supply's Proposed Makaha
242 Reservoir site Located at TMK: 8-4-02:11 (Lot 1236) in Makaha Ahupua'a,
Waianae District, on the Island of Oahu, (TMK 8-4-02)*, Archaeological
Consultants of Hawai'i, Inc, Haleiwa, HI.
- Oceanit Laboratories, Inc
2001 *Final Environmental Assessment for Proposed Shore Protection at Mauna
Lahilahi Beach Park*, Oceanit Laboratories, Inc., Honolulu, HI.
- Perzinski, David and Hallett H. Hammatt
2004 *An Archaeological Inventory Survey Report for Proposed Improvements at
Mauna Lahilahi Beach Park in the Ahupua'a of Wai'anae, District of Wai'anae,
Island of O'ahu*
- Pukui, Mary K.
1983 *'Olelo No'eau: Hawaiian Proverbs and Poetical Sayings*. Honolulu: Bishop
Museum Press.

- Riford, Mary F.
1984 *Report of Archaeological Consulting Services During Repair of Sewer Lines and Replacement of Water Main Lines at Waianae Army Recreation Center, O'ahu, Hawaii*. Department of Anthropology, Bernice P. Bishop Museum, Honolulu, HI.
- Schilz, Allan J.
1994 *Subsurface Archaeological Intensive Survey and Data Recovery and Construction Monitoring and Sampling at Waianae Army Recreation Center (WARC), Wai'anae, O'ahu Island, Hawai'i*. Ogden Environmental and Energy Services Co., Inc.
- Schmitt, Robert C.
1973 *The Missionary Censuses of Hawaii*. Bishop Museum: Honolulu, HI.
- Schmitt, Robert C.
1977 *Historical Statistics of Hawaii*. University Press of Hawaii: Honolulu, HI.
- Shapiro, William and Paul H. Rosendahl
1988 *Archaeological Reconnaissance Survey and Limited Subsurface Testing Waianae Kai Property*. Paul H. Rosendahl, Inc.
- Sinoto, Akihiko
1975a *Archaeological Reconnaissance Survey of the Wai'anae Light-draft Harbor Project Site, Wai'anae O'ahu* Ms. on file Bishop Museum, Honolulu, HI.
- Sterling, Elspeth P. and Catherine C. Summers (comp.)
1978 *Sites of O'ahu*, Dept. of Anthropology, B.P. Bishop Museum, Honolulu, HI.
- Tulchin, Todd and Hallett H. Hammatt
2007 *Archaeological Inventory Survey for the Spotkaeff House Project, Wai'anae Ahupua'a, Wai'anae District, Island of O'ahu [TMK: (1) 8-5-002:025]*. Cultural Surveys Hawai'i, Inc. Kailua, Hawai'i.
- 2004 *Archaeological Monitoring Report for BWS Farrington highway Part III Project, Jade Street to Kaulawaha Road, Mākaha and Wai'anae Ahupua'a, Wai'anae District, Island of O'ahu (TMK 8-4-01,03,04,11,13, 14; 8-5-02, 14-18)*. Cultural Surveys Hawai'i, Inc. Kailua, Hawai'i.
- 2003 *Archaeological Inventory Survey in Support of the Proposed Sandwich Isles Fiber Optic Cable Landing at Kili Drive, Mākaha Ahupua'a, Wai'anae District, Island of O'ahu*. Cultural Surveys Hawai'i, Inc. Kailua, Hawai'i.

APPENDIX A

Marine Biological Survey

**From Final Environmental Assessment for Proposed Shore Protection at Mauna Lahilahi
Beach Park, July 2001**

Marine Biology Survey 2001

This shoreline is generally categorized as an uplifted calcareous or carbonate solution bench separated at the shore by a raised, sharply pitted limestone face undercut at the base [Devaney and Eldredge, 1987]. Along this coast the limestone shoreline appears to be the remnant of a prehistoric deposition of beach rock when the sea was at a higher level. At the present sea level erosion has broken through the fascia of beach rock forming this small cove. Remnants of the old shoreline escarpment are visible underwater just seaward of the boulders and exposed limestone in the center of the cove. The cove itself then represents relatively new marine benthic habitat that is being colonized by a number of species.

The biological habitat present within the project area is determined to a large degree by physical characteristics including depth, wave energy, substrate type, and water quality. The cove is quite small, measuring approximately 350 feet across the mouth and 250 feet from the beach to the mouth; for a total area of roughly 100,000 square feet. The cove is also relatively shallow, sloping gradually from the beach toe out to a maximum depth of 6 feet at the mouth. Even small southern swells or wind-generated chop lead to waves large enough (1-2 feet) to break across the mouth of the cove creating a turbulent shallow water habitat. Therefore wave energy is a significant factor in determining species that can inhabit a given area.

The site was examined on three occasions by a marine biologist from Oceanit [Bourke]. On the first occasion general qualitative observations were made using mask and snorkel. On the second occasion a transect was laid out along the path of the proposed structure to quantify benthic habitat. On both of these first two occasions the water was too turbulent to obtain photographs of adequate quality for publication or documentation of species cover. The survey quantified coral cover in the footprint at the end of the breakwater within 16 square meter quadrants. Coral cover would be expected to be the highest at the extreme end of the breakwater, providing a “worst case” highest estimate for coral coverage along the length of the breakwater. Data from this survey was quantified using two standard methods. By the “point method” eight of the sixteen quadrants had 0 percent coral, two were less than 10 percent cover, two at 10 to 20 percent cover, two at 20 to 30 percent cover, and two at 30 to 40 percent cover, for an average of 10.8 percent cover. By the visual quadrant estimate method, the percent coverage was 5.8%. Coral cover by either method can be qualified as patchy.

During a third visit to the site water conditions were much better, with no swell and much improved water clarity. On this occasion five transects, each roughly 300 feet long, were surveyed. The five transects were set perpendicular to the beach at 50 foot intervals across the beach. Each transect began at the edge of the lowest sand bag and ended in approximately 8-feet of water well beyond the area of the proposed breakwater. Photographs were taken at 10 foot intervals of a 1/4 square yard quadrant frame held against the substrate. In addition, the distance was recorded along each transect from shore to the first coral within one yard to the left or right of the transect tape. This provided an estimate of the absolute inner limit of coral growth in the cove. Photographs were taken to document the general condition of the reef beyond the breakwater at 300' to 700' off shore. Graphical results of the survey are shown in Figure 1.

As can be seen in Figure 1 there is isolated coral growth from about 100 feet off shore to about 200 feet off shore, but significant coral growth only begins to occur about 220 to 250 feet off shore. While none of these coral heads are very large and do not contribute significantly to the structure of the benthic habitat, they do account for up to 1/3 of the bottom coverage in certain areas. To avoid these areas of high coral coverage, the tip of the initial breakwater design has been moved shoreward approximately 50 feet from the original design.

Although no turtles were seen at the site during biological surveys, it is highly probable that this cove area provides foraging habitat for turtles. However, the cove and adjacent areas are too shallow and turbulent to provide any nesting habitat for turtles, and the beach does not provide adequate sand depth for nesting. Research has never suggested foraging habitat area was a limiting factor in the recovery of sea turtle populations in Hawaii. Similarly no impact is foreseen to the occasional monk seal along this shoreline from the proposed project.

The cove may be divided into four descriptive ecotypes for the purposes of this discussion:

1. Intertidal zone with exposed rock faces and tide pools;
2. Sandy beach and wave swept rubble;
3. Shallow water zone with wave-swept rocks; and
4. Deep-water zone (to 8 ft).

Intertidal Zone

This coastline, in general, consists of a series of limestone headlands enclosing small sand beaches. The relatively flat limestone bench (consolidated coral from a previous higher sea level) is eroded and often undercut at the shoreline presenting a vertical drop of several feet to the water. This creates a wave impacted intertidal and subtidal hard substrate. The headlands and boulders flanking both sides of the bay are representative of this biotype.

Although the tidal range in Hawaii is only about three feet, the true intermittently wetted zone in this vertical habitat is extended both upward and downward by waves. In this zone most of the surface is colonized by a myriad of algae and invertebrate species adapted to the high-energy wave impact. Typical algae species include *Giffordia*, sp., *Turbinaria ornata*, *Grateloupia* sp., and *Sargassum echinocarpum*. Invertebrates typically seen in this habitat include the `a`ama rock crab (*Grapsus tenuicrustatus*) above water, rock boring sea urchin (*Echinometra mathaei*), Opihi (*Cellana* sp.), pipipi (*Nerita* sp.) at the water interface, and various encrusting sponges, particularly in the underwater caves.

The erosive powers of the waves are coupled with biological erosion in this zone as sea urchins and mollusks wear away at the rock surface creating jagged sculptured surfaces in the relatively soft limestone. On the north shoreline of the cove the higher limestone bench provided a few splash zone tide pools that are inhabited by typical tide pool fish including gobies, and juvenile surgeon fish (manini, *A. sandvicencis*). The southern shoreline has more boulders forming interconnected tide pools regularly washed by waves.

Sandy Beach and Wave Swept Rubble

The narrow beach on the landward side is presently layered with large sand bags to reduce erosion, exposing a strip of sand only about 10 feet wide at low tide. This entire zone is subject to rapid movement during periods of heavy surf, and species are typically either short-lived with rapid re-colonization, or have the capacity to burrow deeply into the substrate. No ghost crab (*Ocypode* sp.) burrows were seen on the beach. The sand beach habitat ends abruptly at the water line and is replaced by rock and coral rubble substrate. The rubble substrate is visibly barren on the surface, but active communities of small crustaceans, brittle stars and annelid worms can be found underneath the rocks. Very small patches of the green algae, *Ulva*, could be seen on some of the larger rocks in this zone. No coral was present in this zone.

Shallow Water Zone

The center of the bay is shallower than either side with large (2-5 foot diameter) rocks emerging above the water line even at a moderately high tide. Some of these rocks appear to be limestone remnants of a previous coastline eroded to below waterline. These rocks are still physically part of the substrate although many are severely undercut forming shallow caves and ledges underneath. Other large rocks are broken reef fragments that are probably the result of storm surf. This habitat is characterized by greater algae cover with an unbroken algae mat, fewer mobile invertebrates on exposed surfaces, and some small patches of encrusting coral beginning at about 100 feet from shore. These corals were primarily small (<10 sq in.) squamous colonies of lobe coral (*P. lobata*) with a few scattered very small colonies of cauliflower coral *Pocillopora meandrina* and lace coral (*P. damicornis*) noted occasionally in this zone. The most plentiful large invertebrates were sea urchins wedged tightly between or under rocks.

The surge and impact wave energy in this zone, (coupled with grazing by herbivorous fish during high tide quiescent periods) limits the algae growth to a short dense mat of fleshy algae (*Sargassum*, *Dictyota*, *Dictyosphaeria*, *Enteromorpha*, *Chnoospora*, *Amansia*) with patches of encrusting calcareous algae. Fish in this zone tend to be small mobile species adapted for life in this wave swept habitat and include damselfish (*Stegastes fasciolatus*, *Abudefduf abdominalis*), small wrasses (*Hinalea*, *Thalassoma duperrey*, *T. purpurum*), and a few juvenile surgeonfish. Although small caves and under-cuts were plentiful, no typical cave fish (squirrel fish, soldier fish, *Aweoweo*) or lobster were seen. However, these species are likely to inhabit this zone.

Deep Water Zone

The "Deep Water" zone begins at a depth of about 4 feet and extends out to a depth of about 8 feet, 300 feet from shore. This zone is subject to a great deal of wave surge, but is spared the constant impact energy from breaking waves. The surge picks up sand from small pockets at the base of the ledge. This sand serves to scour the lower portions of any hard substrate within about a foot off the bottom, and limits growth in these areas to fast colonizing and fast growing brown or red algae.

Above this depth, however, the hard substrate provides habitat for at least four species of coral including (from most to least common) lobe coral (*Porites lobata*) cauliflower coral (*Pocillopora meandrina*), blue rice coral (*Montipora flabellata*), and lace coral (*Pocillopora damicornis*). These corals are isolated and do not cover a large portion of the substrate area. Squamous (flat) colonies of lobe coral account for the most cover.

Nowhere within the cove, delimited by the 300' survey transects, did coral growth provide any significant structure to the substrate. All corals within the cove are growing over pre-existing substrate, primarily beach rock or lithified sandstone, which provides the benthic structure of the site. It is probable that coral growth in this nearshore area is limited by a number of factors including siltation, wave energy, sand scouring, and rare but devastating impacts from large storms. The benthic surface is highly irregular, or rugose, in the "deep" portion of the cove offering numerous surfaces, shallow cracks, holes, and ledges for fish and invertebrate habitat. However, it is important to note that this 3-dimensional structure is the result of erosive actions on the limestone or beach rock substrate and not due to coral reef growth. There are individual corals on the submerged and eroded beach rock substrate, but these colonies do not form a reef structure in or near this area. Further, these individual coral colonies are all, in general, small and subject to regular erosive mortality due to seasonal storms and large waves.

Whereas in the shallower boulder zone the coralline algae tended to be of a flat encrusting morphology; in this deeper zone more ramose species such as *Amphiroa fragilissima*, *Corallina* sp, and *Porolithon* become more common. A greater diversity of fish were seen in this zone, as would be expected, and ranged from numerous juvenile surgeonfish (Acanthurids) of several species, adult butterfly fish (primarily lemon peal, *Chaetodon miliaris*), small blue-line snappers (Ta'ape, *Lutjanus kasmira*) and adult parrot fish (*Scarus* sp.). Kole (goldring surgeonfish, *Ctenochaetus strigosus*) were not seen during visits to the site. The only Manini (*Acanthurus sandvicensis*) seen were small juveniles in the tide pools and shallow water boulder habitats.

A well developed coral reef exists offshore of the project site, beginning in about 15 feet of water approximately 400 feet from shore. The reef is a mixed community made up primarily of lobe coral (*P.lobata*) with vertical relief up to about 6 feet in height separated by open sand patches or open expanses of hard bottom. This reef continues out to a depth of at least 40 feet.

Additional information on the marine environment can be found in the Final Environmental Impact Statement, Wai'anae Boat Harbor, Waianae, Oahu, Hawaii (1976).