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DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION HAWAII
850 TICONDEROGA ST STE 110
JBPHH, HAWAII 96860-5101

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OFC. OF ENVIRONMENTAL QUALITY CONTROL

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December 20, 2011

CERTIFIED MAIL NO. 7010 2780 0003 1014 4486

Mr. Gary Hooser
Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

Dear Mr. Hooser:

SUBJECT: FINAL ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR THE IROQUOIS POINT BEACH NOURISHMENT AND STABILIZATION, EWA BEACH, O'AHU, HAWAI'I

The Department of the Navy has prepared an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the above-referenced project, and has determined that an Environmental Impact Statement is not required for the proposed action. Please publish notice in the next available *OEQC Environmental Notice*.

Enclosed with this letter is one (1) hard copy of the EA, one (1) copy of a completed OEQC Publication Form, and one (1) compact disc containing one (1) copy of the EA and one (1) copy of the completed OEQC Publication Form in pdf format.

Should you have any questions please contact April Teekell at 471-1171, x232 or via email at april.teekell@navy.mil

Sincerely,

J. Coronado

J. CORONADO
Captain, CEC, U.S. Navy
Regional Engineer
By direction of
Commander, Navy Region Hawaii

Enclosure: 1. Environmental Assessment for the Iroquois Point Beach Nourishment and Stabilization, November 2011.
2. OEQC Publication Form
3. CD containing EA and OEQC Publication Form (PDF format)

Project Name: IROQUOIS POINT BEACH NOURISHMENT AND STABILIZATION

Publication Form
The Environmental Notice
Office of Environmental Quality Control

Instructions: Please submit one hardcopy of the document along a with determination letter from the agency. On a compact disk, put an electronic copy of this publication form in MS Word and a PDF of the EA or EIS. Please make sure that your PDF documents are ADA compliant. Mahalo.

Applicable Law:	**National Environmental Policy Act**
Type of Document:	**Environmental Assessment**
Island:	**Oahu**
District:	**Ewa**
TMK:	**91001001**
Permits Required:	**Department of the Army, Section 10 and Section 404** **Clean Water Ace Section 401 Water Quality Certification**
Applicant or Proposing Agency:	**Joint Base Pearl Harbor-Hickam**
Address	850 Ticonderoga Street, Suite 110 JBPHH, HI 96860-5101
Contact & Phone	John Muraoka, (808) 473-0384
Approving Agency/ Accepting Authority:	**Commander Navy Region Hawaii**
Address	850 Ticonderoga Street, Suite 110 JBPHH, HI 96860-5101
Contact & Phone	Aaron Poentis, (808) 471-1171 x226
Consultant:	**Sea Engineering, Inc.**
Address	Makai Research Pier Waimanalo, HI 96795-1820
Contact & Phone	Scott Sullivan, (808) 259-7966

ENCLOSURE (2)

Project Summary: Summary of the direct, indirect, secondary, and cumulative impacts of the proposed action (less than 200 words). Please keep the summary brief and on this one page.

DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY
NOTICE OF AVAILABILITY OF THE FINDING OF NO SIGNIFICANT IMPACT (FONSI) AND ENVIRONMENTAL ASSESSMENT (EA) FOR the IROQUOIS POINT BEACH NOURISHMENT AND STABILIZATION, EWA BEACH, OAHU, HAWAII

Pursuant to Council on Environmental Quality Regulations implementing the National Environmental Policy Act and the Office of the Chief of Naval Operations Instruction 5090.1C, the Department of the Navy gives notice that an EA and FONSI have been prepared for the Iroquois Point Beach Nourishment and Stabilization, Ewa Beach, O‘ahu, Hawai‘i.

The Navy intends to grant Ford Island Housing, LLC sufficient property interests and authorization to undertake a proposed beach stabilization and improvement project along approximately 4,000 feet of shoreline fronting the Iroquois Point housing area. The proposed plan consists of constructing nine **T**-head groin structures along the shoreline to restore and stabilize the sandy beach, and to construct an earthen berm to protect the housing area from flooding during storm events.

The Navy consulted with National Marine Fisheries Service and the Hawai'i State Historic Preservation Officer, and obtained concurrence that the proposed action would have no adverse impact on threatened or endangered species, essential fish habitat, or historic properties. The Army Corps of Engineers issued a Section 404 permit for the project which includes a compensatory mitigation plan. Pursuant to Executive Order 11988 Floodplain Management, the Navy has determined that the project site is located within the 100-year floodplain, and that there is no practicable alternative location outside the 100-year floodplain.

Based on the information gathered during preparation of this EA, the Navy has determined that the proposed action will have no significant impacts on the quality of the human environment. Interested parties may obtain a copy of the EA from: Commander Navy Region Hawaii, Regional Environmental Coordinator's Office, 850 Ticonderoga Street, Suite 110, Joint Base Pearl Harbor-Hickam, HI 96860-5101, Attn: John Muraoka, (808) 473-0384.

Environmental Assessment

Iroquois Point Beach Nourishment and Stabilization, Ewa Beach, Oahu, Hawaii

Commander, Joint Base Pearl Harbor-Hickam

November 14, 2011

COVER SHEET

Proposed Action:	Iroquois Point Beach Nourishment and Stabilization, Ewa Beach, Oahu, Hawaii
Type of Document:	Environmental Assessment
Lead Agency:	Commander, Joint Base Pearl Harbor-Hickam
For Further: Information	Mr. John Muraoka Commander, Joint Base Pearl Harbor-Hickam Regional Environmental Coordinator's Office 850 Ticonderoga Street, Suite 110 JBPHH, HI 96860-5101 Phone: (808) 473-0384

Summary:

This document was initiated to serve as support for Department of the Army Section 10 and Section 404 permit applications. The document has been revised to serve as an Environmental Assessment (EA) pursuant to the National Environmental Policy Act of 1969, the Council of Environmental Quality Regulations implementing the procedural provisions of NEPA, and the Chief of Naval Operations Instruction 5090.1 latest edition, and is being used by the U.S. Department of the Navy in support of the Navy's proposed action.

The EA evaluated the potential environmental impacts of proposed beach nourishment and stabilization at Iroquois Point Beach, which is adjacent to the existing Iroquois Point housing area located on the central south shore of Oahu, immediately west of the Pearl Harbor entrance channel. In 2003, under special legislation enacted by Congress and as part of the Ford Island Master Development Plan, the Iroquois Point housing area was leased by the U.S. Navy to Ford Island Housing, LLC. This lease has recently been extended to 99 years. The Navy, as the lessor, proposes to grant Ford Island Housing the requisite property interest and accompanying authority to undertake the proposed beach stabilization and improvement project.

The proposed plan authorized by the Navy in the lease is to construct nine T-head groin structures extending along the project shoreline, dividing the beach into eight cells, each being 400 to 450 feet long. The groins would be constructed of rock, with stems (perpendicular to shore) 140 feet long and heads (parallel to shore) 100 to 200 feet long. Sand fill (80,000 cubic yards total) would be placed within each cell. This plan includes removal of debris along the shoreline, improve the recreational beach value at the site, improve water quality by reducing erosion of dirt fill, and reduce the need for maintenance dredging at the mouth of the Pearl Harbor entrance channel.

Alternatives considered included beach nourishment with five T-head groins, beach nourishment without retaining structures, revetment shore protection, and a no action alternative.

The proposed plan would not result in any significant long-term degradation of the environment or loss of habitat.

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ACRONYMS AND ABBREVIATIONS

APE	Area of Potential Effect
BMPs	Best Management Practices
C	Centigrade
CEQ	Council on Environmental Quality
cm	Centimeter
CMU	Concrete Masonry Unit
COE	Corps of Engineers
CWA	Clean Water Act
cy	Cubic yards
CZM	Coastal Zone Management
DA	Department of the Army
deg	Degree
DERP	Defense Environmental Restoration Program
DMM	Discarded Military Munitions
DO	Dissolved oxygen
DoD	Department of Defense
DSMOA	Department of Defense and State Memorandum of Agreement
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act
ESS	Explosive Safety Submission
ESSDR	Explosive Safety Submission Determination Request
FFA	Federal Facilities Agreement
FIH	Ford Island Housing, LLC
FMP	Fisheries Management Plan
ft	Foot or feet
FUDS	Formerly Used Defense Sites
FWCA	Fish and Wildlife Coordination Act
H	Horizontal
HAPC	Habitat Areas of Particular Concern
HDOH	Hawaii Department of Health

in	Inch
m	Meter
MC	Munitions Constituents
MEC	Munitions of Explosive Concern
mhhw	Mean higher high water
mllw	Mean lower low water
mm	Millimeter
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MRA	Munitions response areas
MRP	Munitions Response Program
msl	Mean sea level
N	Nitrogen
NDAA	National Defense Authorization Act
NDSA	Naval Defensive Sea area
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOSSA	Naval Ordnance Safety and Security Activity
NTU	Nephelometric turbidity units
P	Phosphorous
PACDIV	Pacific Division
RAB	Restoration Advisory Board
sec	Second
SEI	Sea Engineering, Inc.
SHPO	State Historic Preservation Office
SI	Site Inspection
swl	Still water level
TN	Total nitrogen, true north
TP	Total phosphorous
TSS	Total Suspended Solids
WPRFMC	Western Pacific Regional Fishery Management Council
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance
WQC	Water Quality Certification
V	Vertical

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

The Iroquois Point housing area is located on the central south shore of Oahu, immediately west of the Pearl Harbor entrance channel. A location map is shown on Figure 1-1, and the housing area vicinity and key locations are shown on Figure 1-2. The project area extends along 4,200 feet of shoreline, from the western boundary of the housing area at the Puuloa rifle range, to the east along Keahi Point and to the wastewater pumping station at Hammer Point. The western-most groin would be located seaward of Building 5375, and the eastern-most would be seaward of Building 5231B. The project site is bordered on all sides by military reservation land, and the offshore waters are part of the Naval Defensive Sea Area.

In 2003, under special legislation enacted by Congress, the Iroquois Point housing area was leased by the U.S. Navy to Ford Island Housing, LLC, to maintain and operate for 65 years. This lease was later extended to 99 years. The nearshore waters below the high water line are in the Pearl Harbor Naval Defensive Sea Area, and remain under the jurisdiction and control of the U. S. Navy. The chronic shoreline erosion problem was noted during the lease negotiations, and a lease “credit” was given by the Navy to Ford Island Housing in recognition of the erosion problem. The Navy lessor proposes to grant Ford Island Housing the requisite property interest and accompanying authority to undertake the proposed beach nourishment and stabilization project. Ford Island Housing (or successor) would be responsible for conduct of the work, and ownership and maintenance of the project features would also be the responsibility of Ford Island Housing for the duration of the lease. Upon expiration of the lease, ownership of and responsibility for the beach stabilization project features will revert back to the Navy.

The housing area, built in 1960, lies on a fossil reef platform, with a layer of earthen fill placed over coral rubble reef deposits. The existing nearshore ground elevation is +5 to +7 feet above mean lower low water. The shoreline along the entire 4,200-foot-long project reach consists of a sandy beach. Chronic erosion and shoreline recession, coupled with backshore flooding due to wave overtopping of the low-lying shore, have resulted in the abandonment and demolition of 16 shoreline homes to-date. Several more homes are threatened by shoreline recession, and emergency shore protection for these homes was constructed in February 2004. Sewer lines running along the shore were abandoned and relocated in the 1980’s, and now the old concrete sewer pipe lies exposed and broken on the beach. Analysis of aerial photographs and other information shows that the beach in the project area receded as much as 130 feet between 1928 and 1961, and an additional 150 feet between 1961 and 2003. A project site topographic survey was completed in January 2004, and updated in June 2008. The survey shows that along the project reach the shoreline typically receded 30 to 50 feet, and up to 70 feet at one location, over the 4.5 year period. This equates to erosion of over 30,000 cubic yards of sand, or 6,700 cubic yards per year. In the 1970’s and 1980’s, rocks were placed along the shore at Keahi Point to try to stop the erosion. As recently as 1995, sand berms, wooden walls, and concrete masonry unit (CMU) walls were constructed behind the beach crest to prevent flooding. These measures, which are generally considered to be non-engineered solutions, have been unsuccessful at curtailing the erosion. As a result of the ongoing erosion, scattered rocks, concrete rubble, and steel debris from those previous erosion control attempts are found along the shoreline. The eroded sand is transported to the east and into the Pearl Harbor entrance channel, and has resulted in the need for maintenance dredging by the Navy due to sand infill in the channel.

Figure 1-1. Oahu, Hawaii with Iroquois Point project area circled beside Pearl Harbor entrance channel.

Figure 1-2. Iroquois Point Housing Vicinity Map

1.2 Summary Description of the Proposed Action

Commander, Joint Base Pearl Harbor-Hickam, as part of the lease agreement with Ford Island Housing under the Ford Island Master Development Plan, proposes to grant Ford Island Housing the requisite property interest and accompanying authority to undertake the proposed beach nourishment and stabilization project. The proposed beach nourishment and stabilization plan, designed based on proven engineering principles, consists of nine T-head groin structures extending along the Iroquois Point housing area shoreline, dividing the beach into eight cells 400 to 450 feet long. The groin stems would be 140 feet long, extending seaward from the approximate existing low water line, and would have heads varying in total length (both sides of the stem) from 100 to 200 feet. The crest elevation of the groin stem and head would be up to +5.3 feet mean lower low water (mllw), and the crest width would be 8 feet. The groins would be constructed of 2,000 to 4,000 pound armor stone, 2 stones thick, over a 200 to 400 pound stone core, with a 1V:1.5H side slope. Sand fill with appropriate characteristics to match the existing sand would be placed to the design beach plan and section within each cell, with a design slope of 1V:10H up to a crest elevation of +6 feet. The total volume of sand fill required is approximately 80,000 cubic yards. The sand would be obtained by taking accumulated sand and dredging of accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance--the sand would be dredged from nearshore areas of the entrance channel, and use of an onshore clamshell crane is anticipated.

1.3 Purpose of and Need for Action

In 2003, as part of the Navy's enhanced leasing program, the Iroquois Point housing area was leased to Ford Island Housing, LLC (a subsidiary of Ford Island Properties, a joint venture between Hunt Building Company, Ltd. and Fluor Federal Services, LLC) to maintain and operate for 65 years. The lease has been extended to 99 years. Ford Island Housing is proposing to construct significant upgrades to the homes and area infrastructure, including improved beach recreation facilities. The beach is undergoing chronic erosion, limiting its recreation value and exposing the backshore to increased flooding. During the lease negotiations the eroded nature of the shoreline, and the need for erosion control measures, was considered.

The Iroquois Point housing area is located on the central south shore of Oahu, immediately west of the Pearl Harbor entrance channel. The housing area is built on a coralline limestone reef, with a layer of earthen fill placed over coral rubble reef deposits. The existing nearshore ground elevation is +5 to +7 feet above mean lower low water. The shoreline along the entire 4,200 foot long project area consists of a sandy beach. Chronic erosion and shoreline recession, coupled with backshore flooding due to wave overtopping of the low-lying shore, has resulted in the abandonment and demolition of 16 shoreline homes to-date. Emergency shore protection for several other homes was constructed in February 2004, as a result of the erosion. Sewer lines running along the shore were abandoned and relocated in the 1980's, and now the old concrete sewer pipes lie exposed and broken on the beach. Earthen fill has been exposed and is being eroded, resulting in a turbid plume emanating from the beach. Figure 1-3 is an image from Google Earth showing the extent of turbid water resulting from the present shoreline condition.

Analysis of aerial photographs and other information shows that the beach in the project area receded as much as 130 feet between 1928 and 1961, and an additional 150 feet between 1961 and 2003. In response to the severe erosion, and the threat posed by wave runup overtopping the beach crest and flooding the homes along the shore, a number of measures have been undertaken from the late 1970's to as recently as 1995 to try to reduce the erosion and protect the houses. Rocks placed along the shore at Keahi Point, sand berms, wooden walls, and CMU walls have been constructed behind the beach crest to prevent flooding. These measures proved to be ineffective at curtailing the on-going erosion. Scattered rocks, concrete rubble, and steel debris on the shore are all that remain of these efforts. These rocks and debris along the shoreline at Keahi Point can also be seen in Figure 1-3.

The purpose of the proposed project is to nourish and stabilize the sandy beach along the Iroquois Point housing area shoreline in order to address the on-going erosion and shoreline recession problems, to reduce the erosion threat to homes and home sites, and to prevent flooding of the backshore area and homes therein by storm wave overtopping of the shore. The project will also remove scattered rocks, concrete and steel debris, and other rubble from the beach and nearshore waters, and improve sandy beach recreation opportunities. The eroded sand is transported to the east and into the Pearl Harbor entrance channel, and has resulted in the need for maintenance dredging by the Navy due to sand infill in the channel. The proposed project will reduce the on-going erosion, and the resultant migration of sand into the Pearl Harbor entrance channel. The nearshore marine environment will be improved by reducing shoreline erosion of earthen material which contributes to degraded water quality, and the rock groin beach stabilization structures will increase habitat for small fish and provide solid substrate for colonization by corals.

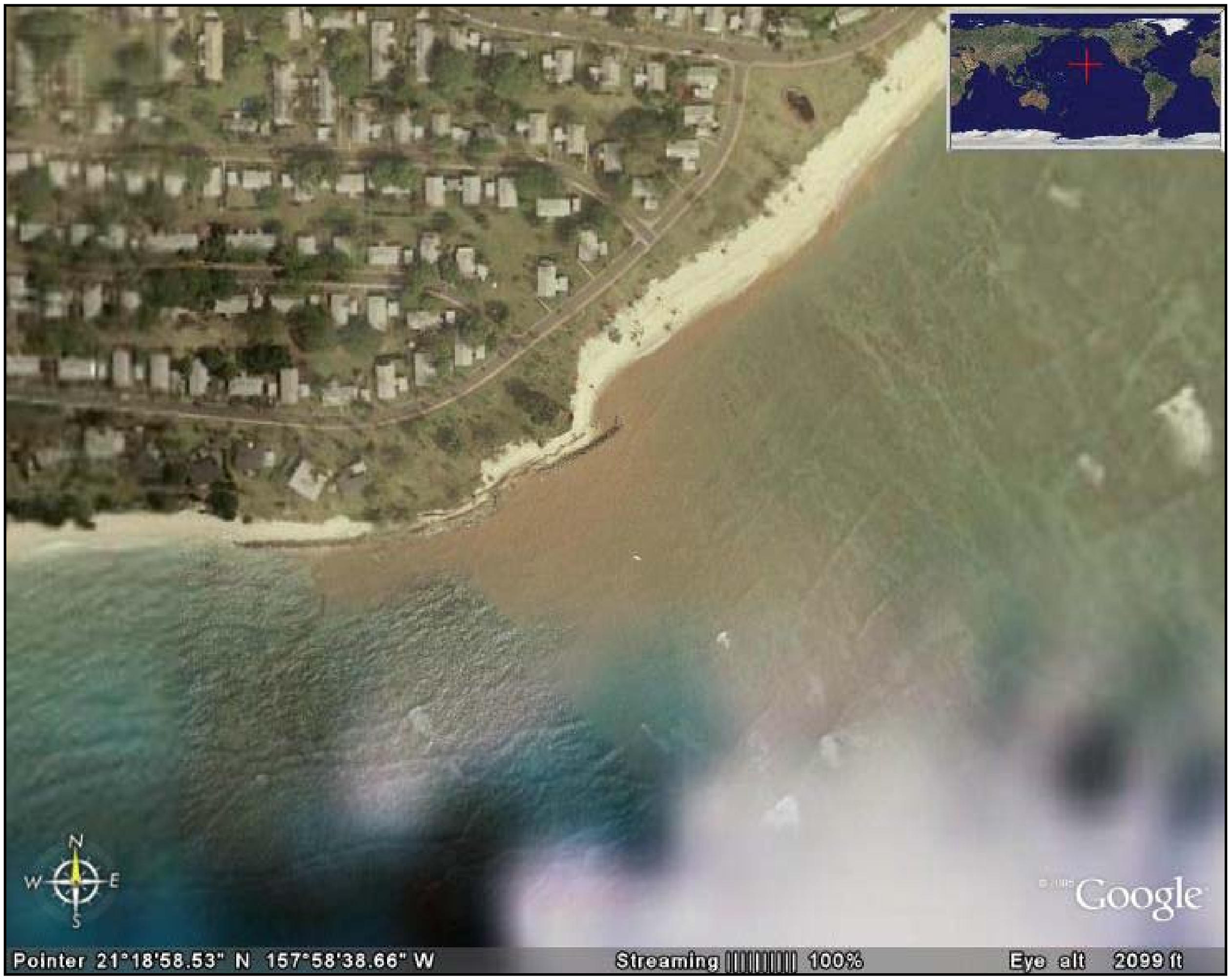

Figure 1-3 Google Earth image showing turbid water and debris on the shore at Keahi Point (imagery date: July 31, 2004).

1.4 Regulatory Overview

The project is subject to Federal law and requires Department of the Army and related permits. The project site is within the Pearl Harbor Naval Defensive Sea Area. The following is a description of the federal laws and processes that apply to the proposed action.

1.4.1 Laws Relevant to Proposed Project

1.4.1.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 (42 USC § 4321 *et seq*.), as amended, requires Federal agencies to prepare an EA or EIS for Federal actions that have the potential to significantly affect the quality of the human environment, including both natural and cultural resources. The Act establishes Federal agency procedures for preserving important aspects of the national heritage and enhancing the quality of renewable resources. This document has been prepared in compliance with NEPA and the implementing Council on Environmental Quality (CEQ) regulations (40 CFR §§1500-1508).

1.4.1.2 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) of 1966 [16 USC § 470(f)], as amended, requires Federal agencies having direct or indirect jurisdiction over a Federal undertaking to take into account effects on any district, site, building, structure, or object that is included or is eligible for inclusion in the National register of Historic Places. Sections 3.9 and 4.6 discuss historical and cultural resources in the project area. The State Historic Preservation Officer (SHPO), by letter dated September 21, 2007 (Appendix E), stated that: "*…provided that the five stipulations are followed accordingly, then we believe that the proposed undertaking will have no adverse effect on historic properties*." They also stated that: "*…we believe that the restoration and stabilization of this area of shoreline may in fact help to preserve these sites.*"

1.4.1.3 Coastal Zone Management Act

Enacted as Chapter 205A, HRS, the Hawaii Coastal Zone Management (CZM) Program was promulgated in 1977 in response to the Federal Coastal Zone Management Act of 1972 [16 USC § 1456 (c)(1)]. By letter dated September 29, 2010 (Appendix A), the State Department of Business, Economic Development & Tourism stated that: "*We concur with our certification that the proposed activity is consistent with the enforceable policies of the Hawaii CZM Program*" based on conditions outlined in Appendix A.

1.4.1.4 Endangered Species Act

The Endangered Species Act (ESA) of 1973 (16 USC § 1531 *et seq.*), as amended, provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the U.S. or elsewhere. Sections 3.5.3 and 4.4.1 and Appendix C of this EA discuss endangered species in the project area. The National Marine Fisheries Service (NMFS), by letter dated May 21, 2008, stated that: "*NMFS concurs with the determination that the proposed beach stabilization project is not likely to adversely affect the Hawaiian monk seal, the hawksbill sea turtle, or the green sea turtle."*

1.4.1.5 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act (16 USC §1801 *et seq.*), as amended, calls for action to stop or reverse the loss of marine fish habitat. The Fisheries Management Plan for Hawaii designates all the ocean waters surrounding Oahu to a depth of 100 feet as "Essential Fish Habitat" (EFH). A subset of the EFH are identified as "Habitat Areas of Particular Concern" (HAPC). Based on investigations conducted for this project, and consultation with the NMFS, there would be no significant adverse effects to EFH (see Section 3.5.4 and 7.2). The project area is not in a HAPC.

1.4.1.6 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) [16 USC §§661-666 (c) *et seq*.], as amended, provides for consultation with the NMFS and USFWS and other relevant Federal agencies when a Federal action proposes to modify or control U.S. waters for any purpose. This consultation was accomplished during the Department of the Army permit processing.

1.4.1.7 Clean Water Act

The Clean Water Act (CWA) of 1977 (33 USC §§1251-1387), as amended, governs surface water quality protection in the U.S. Sections 401 and 404 require permits for actions that involve the discharge of dredged or fill material into waters of the U.S. Section 404 is administered by the Department of the Army (Corps of Engineers), and Section 401 is administered by the State Department of Health. The discharge of stone for groin construction and the placement of sand to restore the beach constitute fill as defined in the CWA. Section 401 and Section 404 permits for the project have been obtained for the project (see Appendix A).

Compensatory mitigation is a tool used by the U.S. Army Corps of Engineers to offset unavoidable impacts to waters of the U.S. as a result of Section 404 permits [33 CFR 325.1(d)(7)]. A Compensatory Mitigation Plan has been prepared and accepted by the Corps of Engineers (*AECOS,* 2010). A marine debris removal plan is also included in the project mitigation plan.

1.4.1.8 Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act (33 USC §403) requires a Department of the Army (DA) permit for any activity that obstructs or alters navigable waters of the U.S. The proposed groins represent an obstruction/alteration of navigable waters as defined in the statute. A DA Section 10 permit has been obtained for the project (see Appendix A).

1.4.2 Permits and Approvals Obtained for the Project

The following required permits and approvals have been obtained, and are provided in Appendix A.

- Department of the Army, Section 10 and Section 404 (November 9, 2011)
- Hawaii CZM Program Federal Consistency Concurrence (September 29, 2010)
- Clean Water Act Section 401 Water Quality Certification (June 9, 2011)

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

Shoreline and nearshore problems in the study area include erosion and recession of the shoreline resulting in loss of land and damage to nearshore structures, flooding of the low-lying backshore area by waves overtopping the beach, eroded sand transport and infill of the mouth of the Pearl Harbor entrance channel, and chronic nearshore water turbidity resulting from the erosion of earthen material. Basic alternatives to address the erosion and related problems include no action, seawall or revetment shore protection, beach nourishment, and beach nourishment with stabilization structures.

No action would involve only removing hazardous debris from the shoreline, and letting the shoreline continue to recede. Seawall or revetment shore protection is currently viewed as an undesirable alternative for sand beach shorelines as it would likely result in the loss of the beach fronting the shoreline hardening structure. Constructing or nourishing a protective beach by placing sand in an appropriately designed manner along a shoreline can be an effective and attractive means of mitigating beach loss, protecting against shoreline recession, protecting the backshore area, and providing for recreational and aesthetic enjoyment. Beach nourishment can be accomplished by placing sand on the shore, or by placing sand in conjunction with stabilizing retaining structures. These alternatives are discussed below.

2.1 No Action

An option for the Iroquois Point housing area would be to abandon the nearshore area and provide an adequate setback for the shoreline to continue its position adjustment. Figure 2-1 plots the predicted shoreline position in year 2033 based on erosion trends measured for the years 1961 – 2003 and 1990 – 2003. Based on the recent erosion trends from 1990 to 2003, the project shoreline between Keahi Point and Hammer Point is projected to recede between 22 to 146 feet by the year 2033 (Figure 2-1). The exception to this is at Keahi Point, where boulders remaining from previous shore protection reduce the erosion potential.

This erosion data indicates that the No Action alternative would ultimately require abandoning all homes makai of Edgewater Drive and Iroquois Avenue, loss of portions of the road along Edgewater Drive and Iroquois Avenue, and possibly loss of some housing landward of Iroquois Avenue. The rock and concrete rubble on the beach would be removed, as this is doing little to curb erosion and interferes with natural beach processes. Removal of the rock would reduce the end-effect erosion in the vicinity of Keahi Point, and result in a more uniform shoreline shape. However, removal of the rocks can be expected to result in increased erosion at Keahi Point.

Recent improvements, including construction of beach cabanas, palapas, restroom buildings, and the beach wall, would be removed as the erosion threatens the amenities.

The present ongoing erosion has exposed dirt fill, which is being released into the ocean – a brown plume emanating from the beach is frequently visible in the nearshore water. The No Action alternative is projected to result in as much as 146 feet of shoreline recession by 2033. This recession would result in the release of substantial additional quantities of dirt fill into the water, and thus, would have continued negative impacts to the marine environment. Based on the long term historical trend, the chronic beach erosion can be expected to continue until all the sand is gone and only reef rock, coral rubble, and earth fill remains. Flood risk to the backshore infrastructure would worsen, and the eroded material would continue to infill the Pearl Harbor channel.

2.1.1 No Action Cost

Based on current erosion rate analyses, the No Action alternative is expected to result in the loss of an estimated 30 homes located along Edgewater Drive and Iroquois Avenue within the next 30 years. This would in turn result in a a quantifiable loss of rental income or proceeds from the possible sale of these homes, as well as a demolition and removal cost. Each of these homes presently rents for approximately $2,500 per month, or $30,000 per year (2008 dollars). A conservative cost assumption would be that the homes are lost by year 30 of the 99-year lease life, thus losing 69 years of rental income, or $62,100,000 (30 homes x $30,000/year x 69 years). Estimated demolition costs of $20,000 per home would add $600,000 to this loss. Thus, a reasonable estimate of the No Action cost in terms of lost revenue is about $63 million (2008 dollars).

Figure 2-1. 2003 and Projected 2033 Vegetation Lines Overlaid on the 1961 Aerial Photo

2.2 Beach Nourishment with Nine T-head Groins (Proposed Plan)

Constructing or nourishing a protective beach by placing suitable sand in an appropriately designed manner along a shoreline can be an effective and attractive means of mitigating beach loss, protecting against shoreline recession, protecting the backshore area, and providing for recreational and aesthetic enjoyment. However, for shorelines subject to chronic long-term erosion, such as the Iroquois Point project site, simply placing sand on the shoreline is not a long-term solution. New sand would be rapidly eroded and transported down the shoreline and into the Pearl Harbor channel, necessitating regular re-nourishment to maintain the protective beach. Beach nourishment with structures to stabilize the beach fill can be used to create a stable beach shoreline and reduce the need for periodic nourishment.

For this project, shore-perpendicular rock T-head groins are proposed to construct a stable beach fill project. The T-head groins have crests above the water line and a spur or head at the seaward end to further compartmentalize the beach and reduce sand transport. In present practice, design guidance for stabilized beach fill projects is based principally on empirical experience. For this project, the design guidelines presented by Dr. Kevin R. Bodge, who served as a design consultant for this project, were used extensively (Bodge, 2003). Consideration was also given to guidelines presented by Dr. Richard Silvester and Dr. John Hsu (Silvester and Hsu, 1993).

Key parameters in designing a beach nourishment project with T-head groins include groin length, head length and orientation, the gap width between heads, and the desired beach shape and width (see Figure 2-3 for terminology). In general, the beach shape responds more to the gap width (opening) between the groin heads than it does to the heads themselves. Thus, the beach is a function of the length and orientation of the gaps. Orientation of the gaps is primarily dictated by the shape of the shoreline and the prevailing wave approach. The following general groin and beach layout considerations were used for this project.

- In the T-head design methodology employed, the groin lengths and spacing are interated to achieve a balance by engineering standards. The iterations resulted in the fewest number of groin structures while limiting the maximum gap width to about 300 feet. Gap widths of up to 300 feet have been shown to result in a stable beach, with little sand loss even during severe storms and hurricanes.
- The gap in the groins produces an arc-shaped shoreline, the location of which is a function of the gap length and orientation. The mean low water shoreline is located a distance of 0.35 to 0.4 times the gap width landward of the groin head. This ratio is based on long-term monitoring of numerous existing T-head groin beach nourishment projects.
- Alignment of the new beach crest and structures to straighten out the shoreline and reclaim the severely eroded area on the east side of Keahi Point, but no extension of the beach past its prior historical position. A minimum distance of 80 to 100 feet is also maintained between existing homes and the top of the beach crest to allow for construction of a flood control berm behind the beach.

- A design beach crest elevation of +6 feet in order to be at or above the prevailing condition wave runup elevation, and a design beach slope of 1V:10H, assuming a slightly flatter slope than the existing beach has as a result of the stabilization structures.
- The ration of groin head length to gap width is used to assess the visual impact on the viewscape. A head length of approximately 40% of the gap width or less to minimize visual impact of the groins is desired (i.e., horizon consists of 40% groin head and 60% gap).
- The most stable beach is produced when the groin heads and gap orientation are positioned, or "tuned", so that the gap is parallel the incoming wave so far as practicable. Due to waves from different directions, a weighted average wave crest approach was used to determine the appropriate gap orientations.
- Groin stems extended landward to the location of the design beach crest, and a groin crest elevation up to +5.3 feet, to minimize sand transport between cells either behind or over the groins.
- To assure that armor stones are not dislodged from the groins, the designs were undertaken based on forces from a 50-year return period wave event.
- The critical shoreline areas are from Keahi Point to Hammer Point. The groins are situated to maximize protection afforded to the shoreline and homes along this stretch of shoreline.

The potential for groins or other beach stabilization structures to affect downstream shorelines where there is unidirectional longshore transport is well documented in coastal engineering literature (see Bodge, 2003; Bodge, 1998; Silvester and Hsu, 1993; and USACE, 1984). Placing a structure on the shore to block the longshore transport of sand results in sand accumulation on the updrift side of the structure, and erosion of the downdrift side which is deprived of sand. However, in the case of the proposed project, adverse downdrift impacts would not occur for the following reasons:

- The predominant longshore transport is to the east toward the Pearl Harbor entrance channel, and the project is located at the terminous of the littoral cell. Much of the sand being transported is presently carried into the channel and lost to the system.
- The erosion problem begins at Keahi Point at the west end of the housing area, where the shoreline orientation orientation changes, and the prevailing wave approach direction becomes more oblique to the shore and results in the prevailing longshore current and transport toward the Pearl Harbor entrance channel.
- The eastern end of the project site as it approaches the Pearl Harbor entrance channel is an area of decelerating longshore transport gradient resulting from channel wave refraction effects.
- The shoreline west of the project site and the housing area has been very stable historically, and there is little if any evidence of longshore transport from the project site toward the west. Therefore, stabilizing the housing area shoreline is not expected to affect the beach to the west as it does not receive sand coming from the project site.

The cells between the groins would be filled with sand to their projected stable design configuration as part of the project. The groins produce individual beach cells that are sheltered from the ambient littoral drift, which would continue offshore of the groin heads, not affecting the individual beach cells. The sand, therefore, would not be subject to longshore drift and would stay in the individual cells. Sand would also be placed on the outboard side of the eastern-most and western-most groins to nourish these areas.

2.2.1 Beach and Groin Plan

The proposed beach and groin plan is shown on Figures 2-2 and 2-3. This plan consists of 9 T-head groin structures extending along the project shoreline, dividing the beach into 8 cells 400 to 450 feet long. The western-most groin would be located seaward of Building 5375, and the eastern-most would be seaward of Building 5231B (see Figure 2-2). The eastern-most groin is 396 feet from the Pearl Harbor entrance channel.

The groin stems would be 140 feet long, extending seaward from the approximate existing low water line, and would have heads varying in total length (both sides of the stem) from 100 to 200 feet. The crest elevation of the groin stem and head would be up to +5.3 feet, and the crest width would be 8 feet. The groins would be constructed of 2,000 to 4,000 pound armor stone, two stones thick, over a 200 to 400 pound stone core, with a 1 vertical to 1.5 horizontal (1V:1.5H) side slope as shown in Figure 2-3.

Sand fill with appropriate characteristics to match the existing sand would be placed to the design beach plan and section within each cell, with a design slope of 1V:10H up to a crest elevation of +6 feet. The minimum horizontal beach crest width would be about 50 feet. The total volume of sand fill required is approximately 80,000 cubic yards. The sand would be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance, north of Hammer Point.

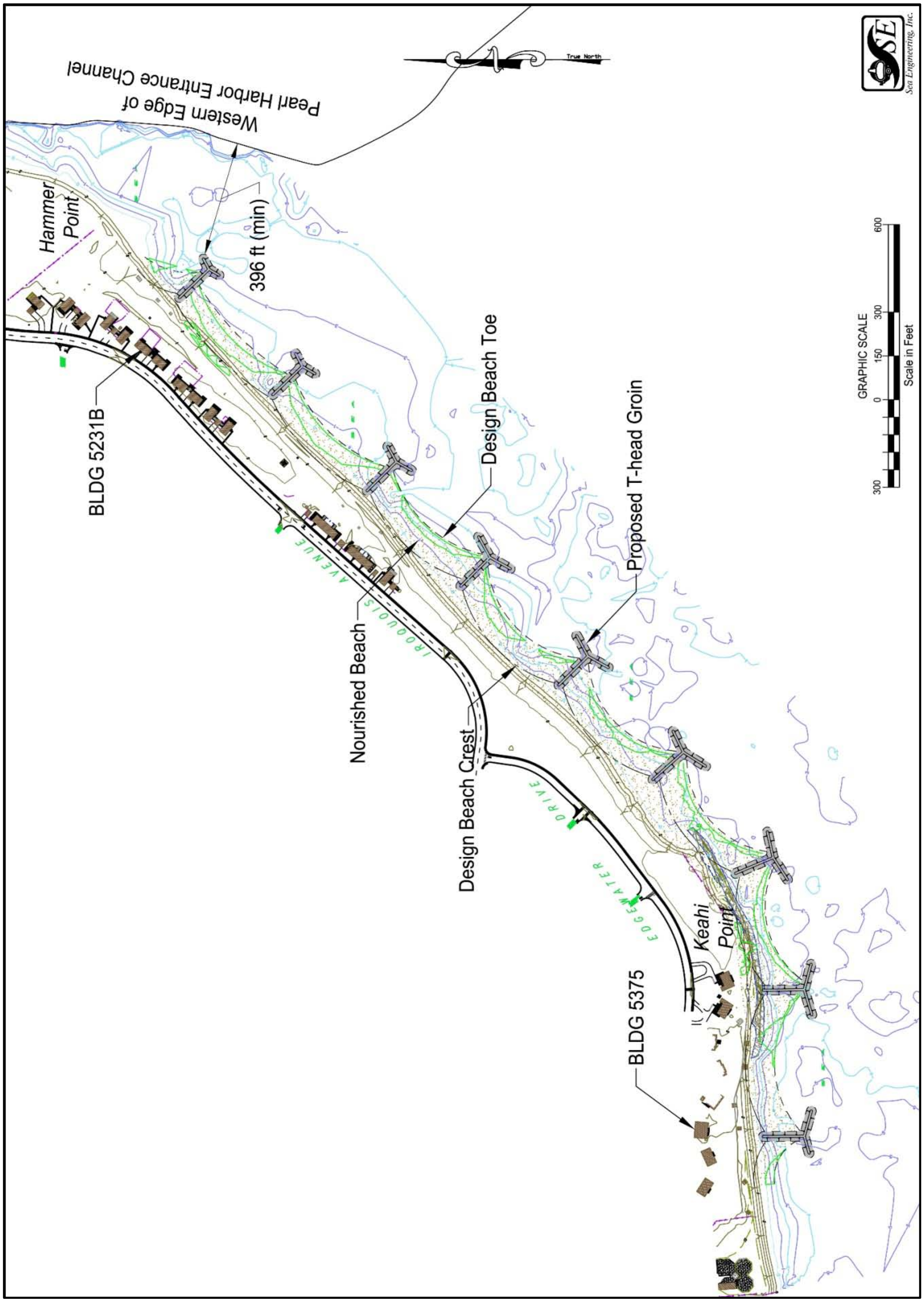

Figure 2-2. Beach and 9 T-Head Groin Plan

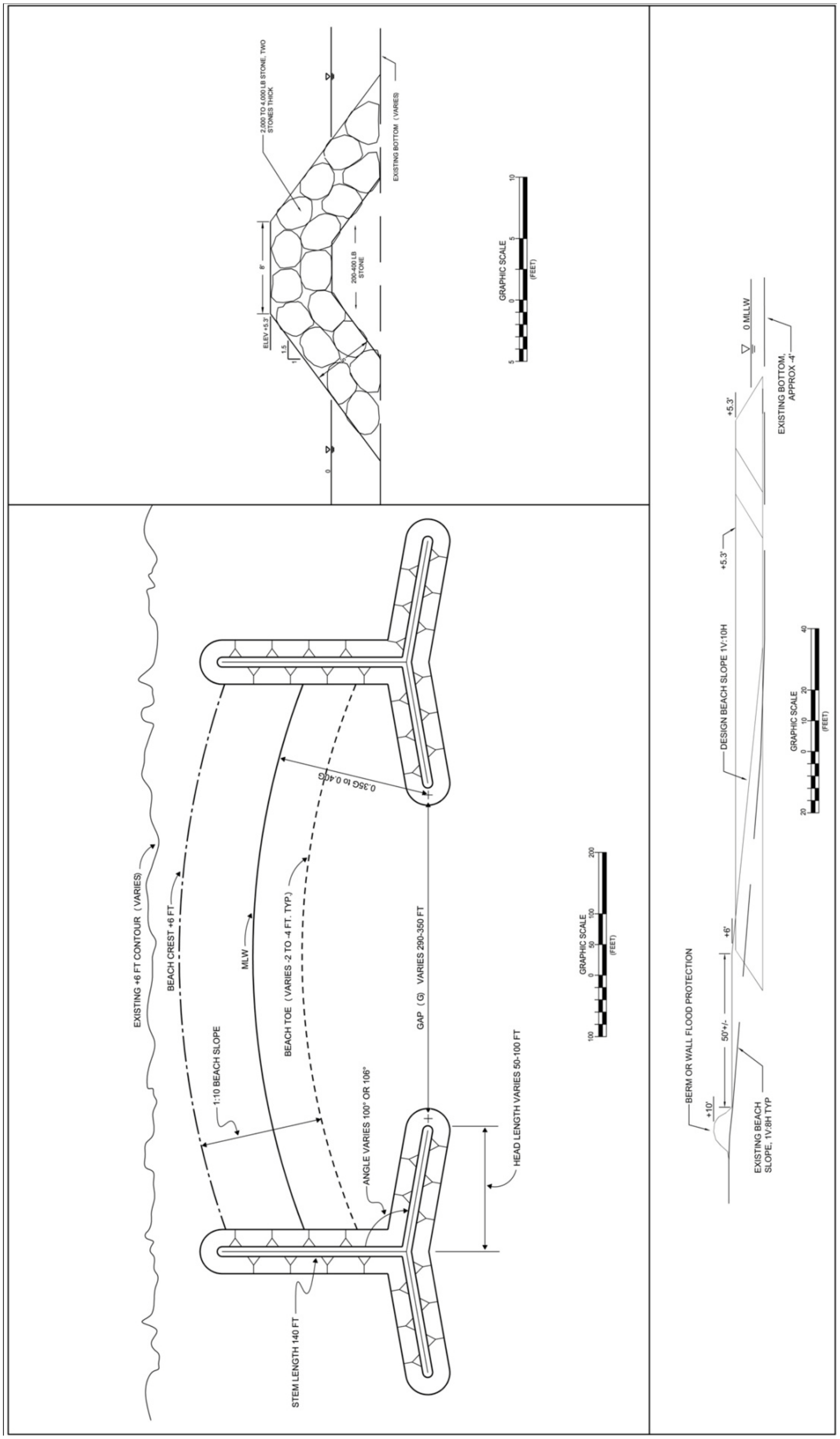

Figure 2-3. Detailed Plan and Section Views

2.2.2 Storm Wave Runup Protection

Large wave events due to swell or storms have the capacity to produce an increase in still water level at the shoreline. This increase in water level results in increased wave energy reaching the shoreline. A still water level rise due to storm conditions coupled with large breaking wave heights on the beach would result in wave runup to elevations of +7 to +13 feet during a 50-year return period wave event, and +10 feet during a severe kona (means approaching from the west) storm. The design beach crest of +6 feet and the +5 to +7-foot high backshore ground elevation could thus be subject to wave inundation and flooding during storm conditions. With the beach stabilized and erosion minimized, it would be possible to re-build either a landscaped earthen berm or a vertical wall behind the beach, both of which were previously employed as attempted measures to reduce the flood potential. A landscaped berm constructed to an elevation of +10 feet situated approximately 50 feet behind the beach crest is proposed to protect against storm wave flooding of the backshore area. This would provide reasonable protection against likely high water and wave conditions without blocking the ocean viewscape.

2.2.3 Beach Sand Fill

Approximately 80,000 cubic yards of sand fill is proposed as part of the beach nourishment with nine T-head groins plan. This sand fill would be obtained from the accreted sand deposits along the Pearl Harbor entrance channel in the vicinity of the mouth of Iroquois Lagoon (Figure 2-4) at the northeast end of the beach. The historical shoreline analysis indicated that as the shoreline in the vicinity of Keahi Point eroded between 1960 and 2003, the vegetation line in the proposed borrow area accreted as much as 125 feet, engulfing previously used docks and a channel marker (Figure 2-4). This suggests that the accreted sand was likely eroded from the beach around Keahi Point, transported to the east and deposited. In conjunction with a 2006 scheduled dredging project of the Pearl Harbor entrance channel, approximately 22,000 cy of this accreted sand was dredged and stockpiled on vacant land at Hammer Point, and could possibly be recycled back to the beach between Keahi and Hammer Points as sand fill for the proposed beach nourishment and stabilization project. Additional sand would be dredged from this area in conjunction with the beach nourishment project to provide the balance of the required sand, approximately 60,000 additional cubic yards.

The suitability of the sand for placement as beach fill on the eroding sections of the beach is based on criteria set forth by the State Department of Land and Natural Resources to compare the sand size from the “borrow” area (i.e., along the entrance channel) with the “native” beach sand. To address the suitability of the borrow sand, samples were collected, analyzed for grain size, and compared with sand from the native beach. Figure 2-5 presents the grain size distribution graphs, while Table 2-1 lists parameters calculated from the distributions. Three samples were collected from shallow pits dug in the sand accretion area: *13 inland* was taken in the backshore area, *13A* was taken from the beach berm, and *13B* was taken from the beach swash zone. Following maintenance dredging of sand from the entrance channel in August 2006, a composite sample from random locations within the sand stockpile was obtained and analyzed. This sample represents a good cross section of the material to be dredged and used for beach fill. Iroquois Point Beach samples *A* and *B* represent a composite of 3 samples each collected from the top and middle of the beach in the project area, respectively. The graphs reveal that the sand from the accretion area is very similar to sand from the proposed nourishment area, and is suitable for use as beach fill.

The dredged sand stockpile material has a slightly larger median grain size than does the sand on the beach. The larger median grain size presumably results from fine material being lost as the sand is transported along the shore and deposited in the Pearl Harbor channel. The larger grain size would improve stability of the beach fill, and decrease initial loss and the need to overfill with sand to achieve the desired beach size and shape.

Table 2-1. Grain Size Parameters

Location	D_{50} (mm)	Sorting (ϕ)	% Fine	% Coarse
Dredge sand 13A	0.55	0.83	<0.1%	<1%
Dredge sand 13B	0.54	0.90	<0.2%	0
Dredge sand 13 Inland	0.49	0.80	<0.2%	<1%
Dredged sand stockpile	0.80	0.72	0%	4%
Iroquois Pt. Beach A	0.59	0.60	0%	0%
Iroquois Pt. Beach B	0.57	0.67	0%	0%

The stockpiled sand from the previous channel maintenance dredging was sampled and tested for the following contaminants in accordance with Hawaii Department of Health, Hazard Evaluation and Emergency Response Office (HEER) and Solid and Hazardous Waste Branch (SHWB) requirements (*AECOS*, November 16, 2010):

- RCRA 8 Metals (Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, and Silver)
- Polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs)

The chemical testing results showed that the sand is not contaminated and is suitable for use along the shore to create a recreational sand beach. All chemicals tested for in the samples were either not detected or detected in quantities much less than the appropriate environmental action level.

Figure 2-4. Sand accretion area and bathymetry, Iroquois Point. Contour interval is 10 ft.

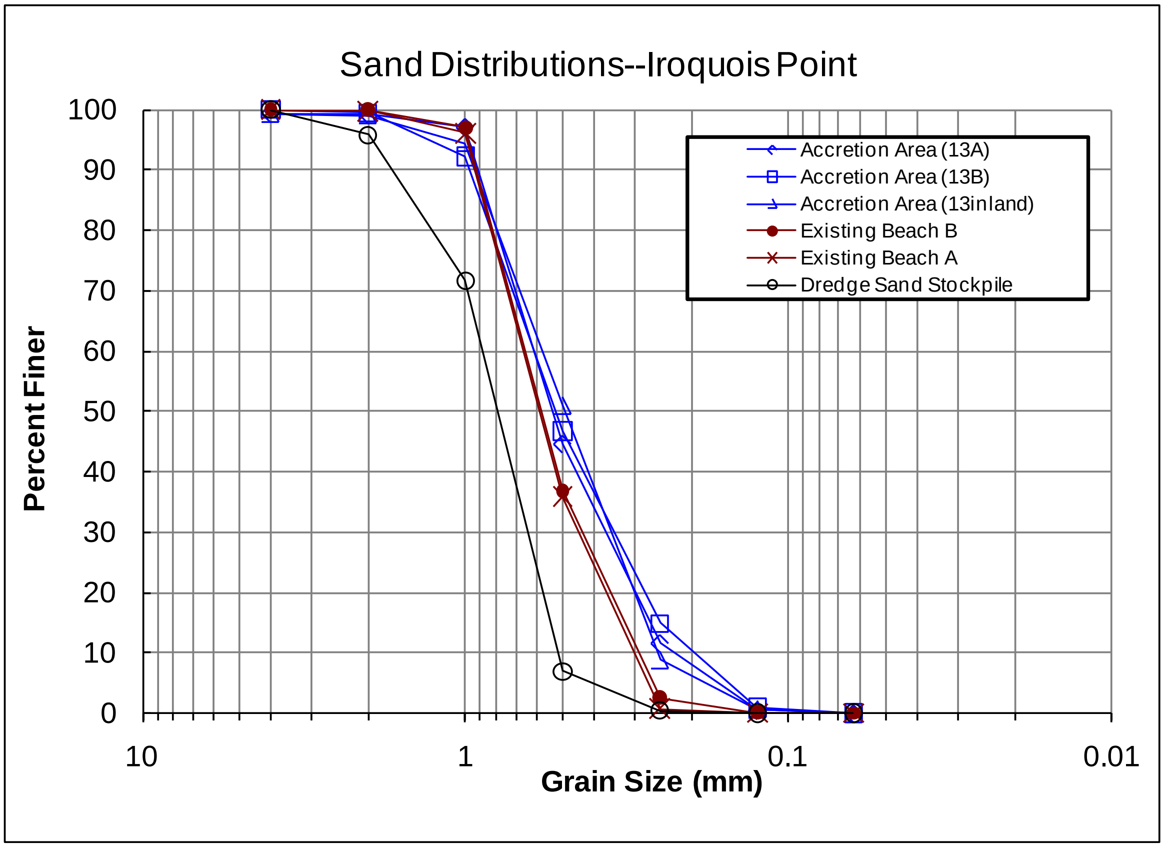

Figure 2-5. Grain Size Distribution - Existing Beach Accretion Area and Dredged Sand Stockpile. (coarse sand: 5-2 mm, medium: 2-0.4 mm, fine: 0.4-0.074 mm)

2.2.4 Construction Operations

Construction of the proposed project is estimated to take nine to twelve months. Construction of the proposed beach nourishment plan would involve the following general work tasks.

Mobilization and Demobilization – includes items such as the establishment of a site field office, mobilization of the necessary equipment, general site prep work, and cleanup and demobilization following completion of the work.

Environmental Protection – includes preparation of Best Management Practices (BMPs) and an Environmental Protection Plan for the conduct of the work, providing necessary materials and equipment for protecting the environment (e.g. dust screens, in-water silt curtain or turbidity barriers to isolate the construction activity and avoid degradation of marine water quality), and conducting a water quality monitoring program. An "Applicable Monitoring and Assessment Program" (see Appendix B) will be accomplished as required by the Section 401 WQC.

Site Preparation – includes removal and disposal of remnants of previous shore protection (existing rock debris, concrete block wall, concrete rubble and debris), as well as abandoned sewer pipe, etc., as necessary to construct the project plan. The abandoned sewer pipes would be removed only as far inland as necessary to construct the project. Recently constructed amenities, including palapas, beach cabanas, and the 28-inch landscaping wall, would be removed or relocated as necessary.

Construct Rock Groins – includes construction of 9 rock rubblemound T-head groin structures. Groin construction would proceed from shore, with temporary rock access berms built from the backshore as required at each groin location. The groin and head sections would be overbuilt to approximately 15 feet in width to provide for construction equipment access and a working platform, and then the groins would be completed working from the head landward, removing excess stone as the work proceeds landward. Groin construction would proceed one at a time. Construction equipment would include dump trucks, front end loaders, and backhoes to move and place the rock. The rock would be rinsed prior to placement in the water to minimize the introduction of fine material and reduce turbidity impacts.

Dredge Sand – includes maintenance dredging of approximately 60,000 cubic yards of accreted sand from the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance, north of Hammer Point. The sand would be dredged by drag line from the shore, loaded into trucks, and stockpiled along the backshore within the project area. A berm would be constructed to contain the stockpile and prevent any water runoff back into coastal waters.

Place Beach Fill – includes placement of the sand beach fill between the groins to the design lines and grades. Sand fill would be accomplished after completion of adjacent groins, and would proceed as rapidly as possible in order to limit the duration of possible water quality impacts. The sand would be pushed seaward from shore, with no equipment working in the water or below the water line. A silt curtain would be deployed between the groin heads to contain any increase in water turbidity, and maintained in place until turbidity decreased to baseline conditions.

Construct Backshore Earth Berm or Flood Wall – includes importing fill, grading and compacting, and grassing of an earthen berm behind the beach crest to the design elevation, or, alternatively, construction of a concrete block or rock wall.

2.2.5 Material Quantities

Material quantities for constructing the rock groins and placing the beach fill are estimated in Table 2-2. The surface area (footprint) covered by the structures and sand would be 4.6 acres.

Table 2-2. Material Quantities

Material Type	Quantity Below MHHW	Quantity Above MHHW	Total
Stone:			
200 to 400 lb stone	3,535 cy	0	3,535 cy
2,000 to 4,000 lb stone	11,665 cy	3,760 cy	15,425 cy
Total Stone:	15,200 cy	3,760 cy	18,960 cy
Sand:	48,000 cy	32,000 cy	80,000 cy
Total Material:	**63,200 cy**	**35,760 cy**	**98,960 cy**

2.2.6 Estimated Construction and Maintenance Cost

Construction costs presented in Table 2-3 are based on the following tasks and assumptions:

1. Dollar costs are based on 2008 prices, with no future escalation taken into account. Costs are rounded to the nearest $1,000.
2. Unit and job costs are based on discussions with and estimates received from experienced contractors and similar marine construction projects.
3. Mobilization and demobilization includes furnishing all equipment at the site, and removal of all equipment and cleanup following completion of construction.
4. Environmental protection includes furnishing all materials and equipment required by the Best Management Practices and Environmental Protection Plans, and the cost of required environmental monitoring.
5. Site preparation includes removal and disposal of existing nearshore rock, concrete, and steel debris as required for construction to the project lines and grades.
6. Sand fill costs are based on obtaining sand from the Pearl Harbor entrance, with unit costs based on prices received from the recent (2006) Navy maintenance dredging contractor.
7. Average annual maintenance costs for repair of the groin structures and nourishment of the beach as needed are estimated at 0.5% of the initial costs.
8. A 15% contingency cost is used for initial construction.

Table 2-3. Cost of Beach Nourishment with 9 T-Head Groins

Item	Quantity	Unit	Cost ($)	Amount ($)
Initial Construction Cost:				
Mobilization and Demobilization	1	Job		150,000
Environmental Protection	1	Job		150,000
Site Preparation	1	Job		100,000
Rock Groins:				
Stone	18,960	cy	35	664,000
Construction	1	Job		1,550,000
Sand Fill:				
Dredge	60,000	cy	30	1,800,000
Place	80,000	cy	18	1,440,000
Backshore Earth Berm	1	Job		500,000
				$ 6,354,000
Contingency				953,000
Total Initial Cost				$ 7,307,000
50-Year Project Life Cost:				
Initial Construction Cost				$ 7,307,000
Maintenance Cost (0.5% x $7,307,000 x 49 years)				1,790,000
Total 50-Year Project Cost				**$ 9,097,000**

2.3 Beach Nourishment with Five T-head Groins

An alternative to the proposed action presented above is to reduce the number of T-head groins used to stabilize the beach fill. In this section we present an alternative for the beach that would include 5 T-head groins, in order to evaluate a plan with fewer rock groin structures to stabilize the sand fill. The key design parameters remain the same as presented previously in Section 2.2, and include groin length, head length and orientation, gap width between heads, and desired beach shape and width. Design guidance is presented by Bodge (2003), who has successfully applied his methods on numerous projects with structure head gaps of up to about 330 feet. Limited data exists for projects with gap widths greater than 330 feet. A compilation of existing beach stabilization projects presented by Bodge suggests that for gap distances of 330 to 650 feet, the mean low water shoreline is located a distance landward of the groin head that is approximately equal to the gap between the structure heads. Thus, while the groins would extend far from shore, there would not be a corresponding increase in beach width.

2.3.1 Beach and Groin Plan

The beach and 5 T-head Groin Plan is shown on Figures 2-6 and 2-7, assuming a design shoreline position similar to that in the 9 T-head alternative (Figure 2-2), and that this shoreline position is located a distance inland of the groin heads equal to the gap width between the groin heads. The Plan consists of 5 T-head groin structures extending along the project shoreline, dividing the beach into 4 cells approximately 900 feet long. The groin stems would be about 480 feet long, extending seaward from the approximate existing low water line, and would have heads approximately 275 feet long (both sides of the stem). The gap width between the T-heads would be approximately 540 feet. Reducing the number of groins requires increasing the groin stem and head lengths to produce stable beach cells at the desired locations. The eastern-most groin would extend to the edge of the Pearl Harbor entrance channel.

The groin characteristics would be the same as for the 9 T-head configuration: the crest elevation of the groin stem and head would be +5.3 feet, the crest width would be 8 feet, and the groins would be constructed of 2,000 to 4,000 pound armor stone, two stones thick, over 200 to 400 pound stone core, with a 1V:1.5H side slope.

Sand fill with appropriate characteristics to match the existing sand would be placed to the design beach plan and section within each cell, with a design slope of 1V:10H up to a crest elevation of +6 feet. The horizontal beach crest width would be about 50 feet. The total volume of sand fill required is approximately 128,000 cubic yards. The sand would be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance, north of Hammer Point (same as for the proposed project presented in Section 2.2).

Figure 2-8 shows the two groin plans together to illustrate the relative sizes of the two plans.

2.3.2 Storm Wave Runup Protection

Storm wave inundation and flooding protection would be provided by the same means as described in Section 2.2.2 – a 10-foot high landscaped berm constructed approximately 50 feet behind the beach crest.

2.3.3 Beach Sand Fill

Approximately 128,000 cubic yards of sand fill would be required for the nourishment project, approximately 60% more than for the 9 T-head groin system. As is the case for the 9 T-head groin alternative, this sand fill is to be obtained from the accreted sand deposits in the Pearl Harbor entrance channel. Section 2.2.3 describes the suitability of this sand fill.

2.3.4 Construction Operations

Construction operations would be the same as that presented in Section 2.2.4, and would include: mobilization and demobilization; environmental protection work; site preparation; rock groin construction; sand dredging; placement of fill sand on the beach; and construction of the backshore flood berm.

2.3.5 Material Quantities

For this alternative, the quantities of both sand fill and rock are greater than for the 9 T-head groin system. The volume of rock required is 31,260 cubic yards, as compared to 18,960 cubic yards for the 9 groin system. The surface area covered by the structures' "footprint" would be about 8.2 acres, 80% more than the 4.6 acre surface area covered by the 9 groin system.

2.3.6 Estimated Construction and Maintenance Cost

Construction costs presented in Table 2-4 are based on the same tasks and assumptions as discussed in Section 2.2.6.

The wide gap widths associated with using 5 groins necessitates using groins nearly three times as long as for the 9 groin system, and with correspondingly longer groin heads. Thus, although there are four less structures, the increased size of each structure results in the need for 65% more stone and 60% more sand to create and maintain an equivalent beach width. This results in a project life cost 60% greater than for the 9 groin plan.

Table 2-4. Cost of Beach Nourishment with 5 T-Head Groins

Item	Quantity	Unit	Cost ($)	Amount ($)
Initial Construction Cost:				
Mobilization and Demobilization	1	Job		150,000
Environmental Protection	1	Job		150,000
Site Preparation	1	Job		100,000
Rock Groins:				
Stone	31,260	cy	35	1,094,000
Construction	1	Job		2,776,000
Sand Fill:				
Dredge	106000	cy	30	3,180,000
Place	128,000	cy	18	2,304,000
Backshore Earth Berm	1	Job		500,000
				$ 10,254,000
Contingency				1,538,000
Total Initial Cost				$ 11,792,000
50-Year Project Life Cost:				
Initial Construction Cost				$ 11,792,000
Maintenance Cost (0.5% x $9,900,000 x 49 years)				2,889,000
Total 50-Year Project Cost				**$ 14,681,000**

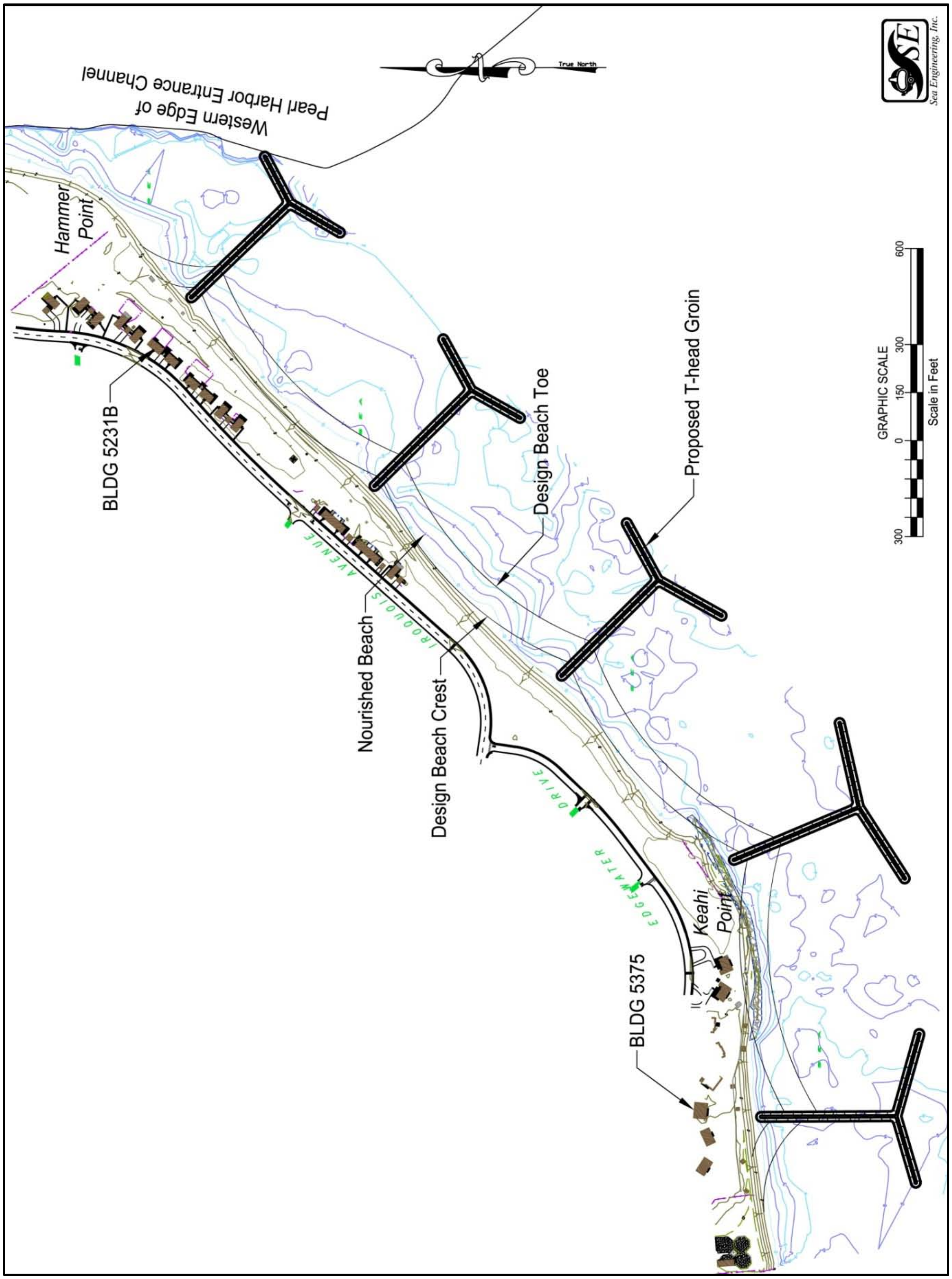

Figure 2-6. Beach and 5 T-Head Groin Plan

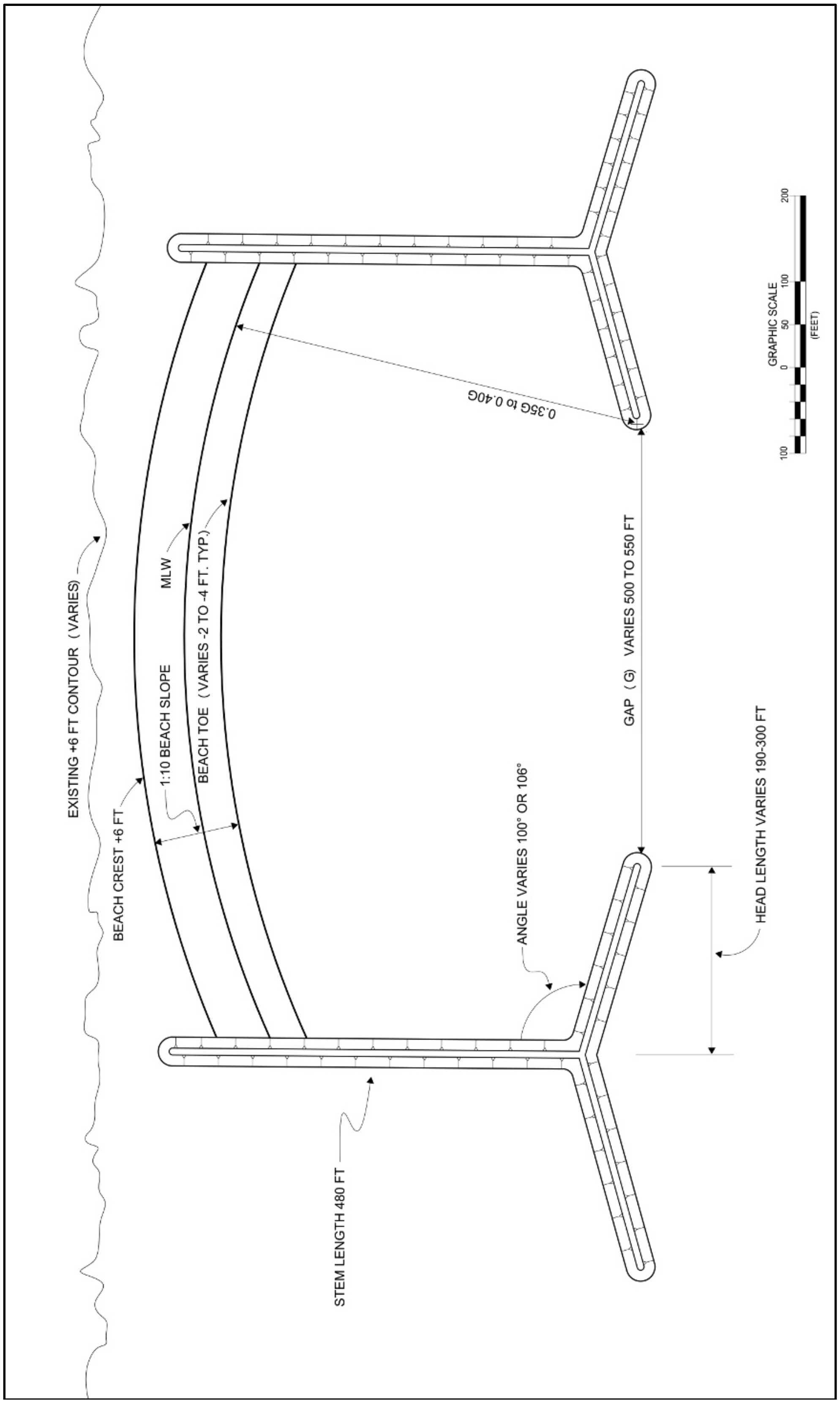

Figure 2-7. Detailed Groin Plan

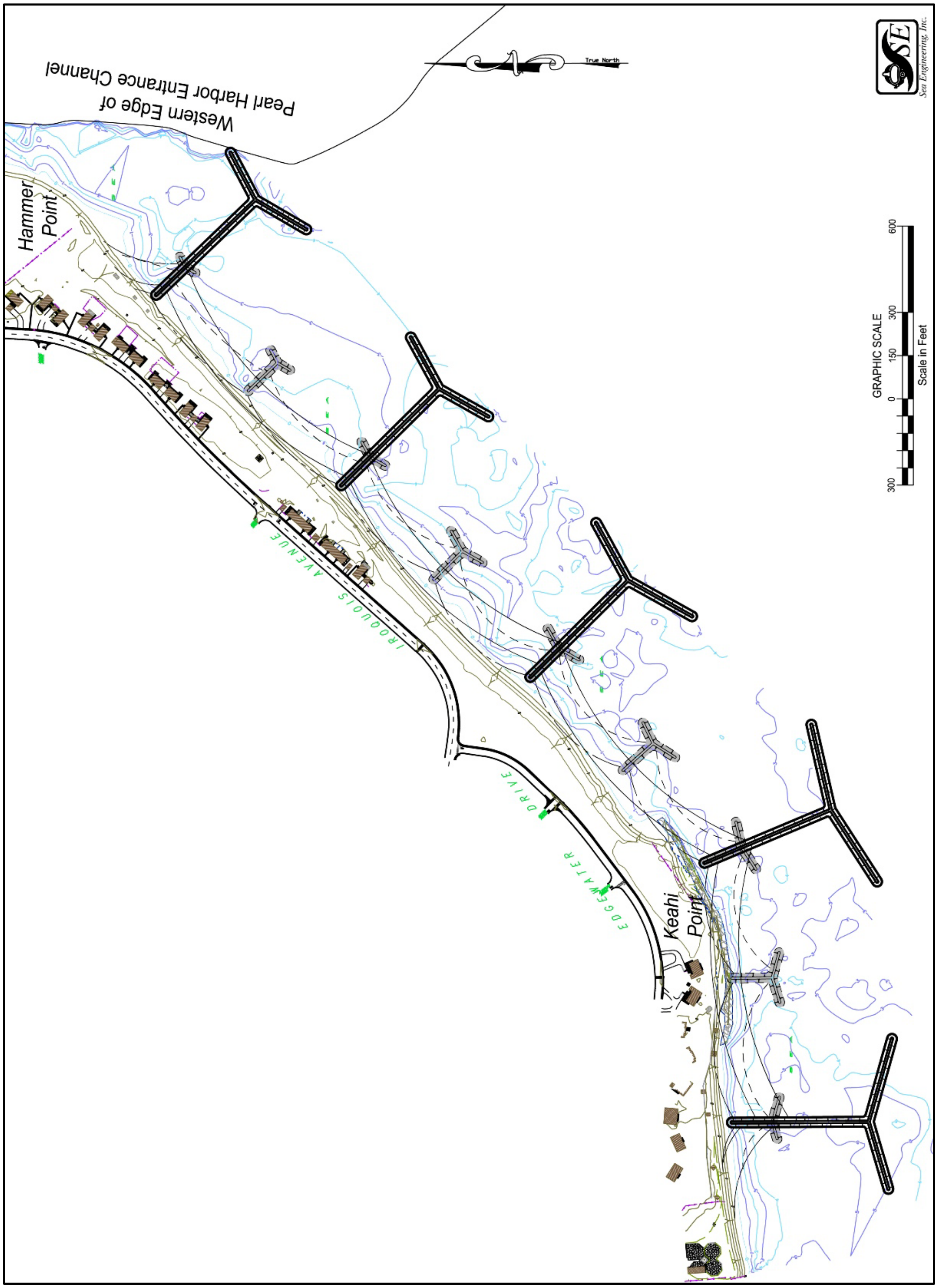

Figure 2-8. Comparison of 5 groin and 9 groin plans

2.4 Beach Nourishment (without stabilization structures)

Beach nourishment can be accomplished by placing suitable sand in an appropriately designed manner along the shoreline. However, for shorelines undergoing chronic long-term erosion, such as the project site, and in the absence of structures to stabilize the beach fill, regular nourishment and a virtually inexhaustible source of sand would be required to maintain an adequate beach to meet the project objectives. Because the sand transport along the project shoreline is primarily to the east, where it then fills in and accretes along the side of the Pearl Harbor entrance channel, it is reasonable to assume that the sand could be periodically dredged from the channel and placed back on the eroding shoreline. This “back passing” of sand would be the permanent source of nourishment material.

2.4.1 Beach Plan

Sand fill with appropriate characteristics to match the existing sand would be placed to the design beach plan and section within each cell, with a design slope of 1V:10H up to a crest elevation of +6 feet. The horizontal beach crest width would be about 50 feet. The total initial volume of sand fill required would be approximately 136,000 cubic yards. Additional nourishment is estimated to be necessary every 5 years, requiring about 30,000 cy of sand each time. The sand would be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance, north of Hammer Point. Suitability of this sand was addressed in Section 2.2.3). This alternative assumes the long-term ability to obtain the necessary sand for additional periodic nourishment efforts. The beach plan is shown on Figure 2-9. The removal of rock and other nearshore debris addressed in Section 2.2.4 would also be included under this alternative.

2.4.2 Storm Wave Runup Protection

Storm wave inundation and flooding protection would be provided by constructing a 10-foot high landscaped berm constructed approximately 50 feet behind the beach crest. This is described in Section 2.2.2.

2.4.3 Construction Operations

Construction operations would include: mobilization and demobilization; environmental protection work; site preparation; sand dredging; placement of fill sand on the beach; and construction of the backshore flood berm. These operations are described in Section 2.2.4.

2.4.4 Material Quantities

Sand is the only material required for this alternative. The initial sand quantity required is 136,000 cubic yards. This alternative would also require additional sand to be placed on the beach at regular intervals in the future, to maintain the beach width. Beach erosion volumes and annual erosion rates were determined using two different methodologies: aerial photographic analysis of shoreline change between 1990 and 2003, and field measurements of beach profiles surveyed on September 16, 2004 and August 21, 2006. The aerial photographic analysis represents a longer-term erosion volume based on shoreline locations determined using historical aerial photographs spanning a period of 12.4 years. The shoreline profiles show the recent trend over the last 2 years, and avoid seasonal bias because both sets of measurements were conducted at the end of summer. For both erosion volume calculations, the shoreline was segmented with the transect lines used for the beach profile surveys, and the calculation was limited along the shoreline between Transects 2 and 9, a total shoreline length of 3,730 feet. The aerial photographic analysis assumed the beach profiles were as measured on December 16, 2003.

The beach profile measurements indicate a total erosion volume of 8,776 cubic yards for the two-year period from September 16, 2004, to August 21, 2006, with an annual erosion rate of 4,547 cubic yards. The total erosion volume for the 12.4 year period assessed with the aerial photographs (October 16, 1990 through February 8, 2003) is 50,467 cubic yards with an average annual erosion rate of 4,070 cubic yards. This suggests a prevailing steady erosion rate of over 4,000 cubic yards per year. However, monitoring data of numerous beach nourishment projects conducted without sand retention structures has indicated that erosion rates typically increase dramatically in areas of new sand fill placement. Sylvester and Hsu (1993) cite studies of durability of numerous nourishment projects on Pacific, Atlantic, and Gulf coasts that report that 55% of nourishment projects had a durability of less than 2 years, and 20% had a durability of less than 1 year. The average durability of all projects was 3 years. Durability was conservatively defined as the period in which more than 50% of fill material was lost.

A conservative maintenance nourishment quantity can be estimated to be a minimum of 20,000 cubic yards and up to half the initial fill volume, or about 68,000 cubic yards, every 3 to 5 years. For cost estimation purposes, periodic nourishment quantities are assumed to be 30,000 cubic yards every 5 years.

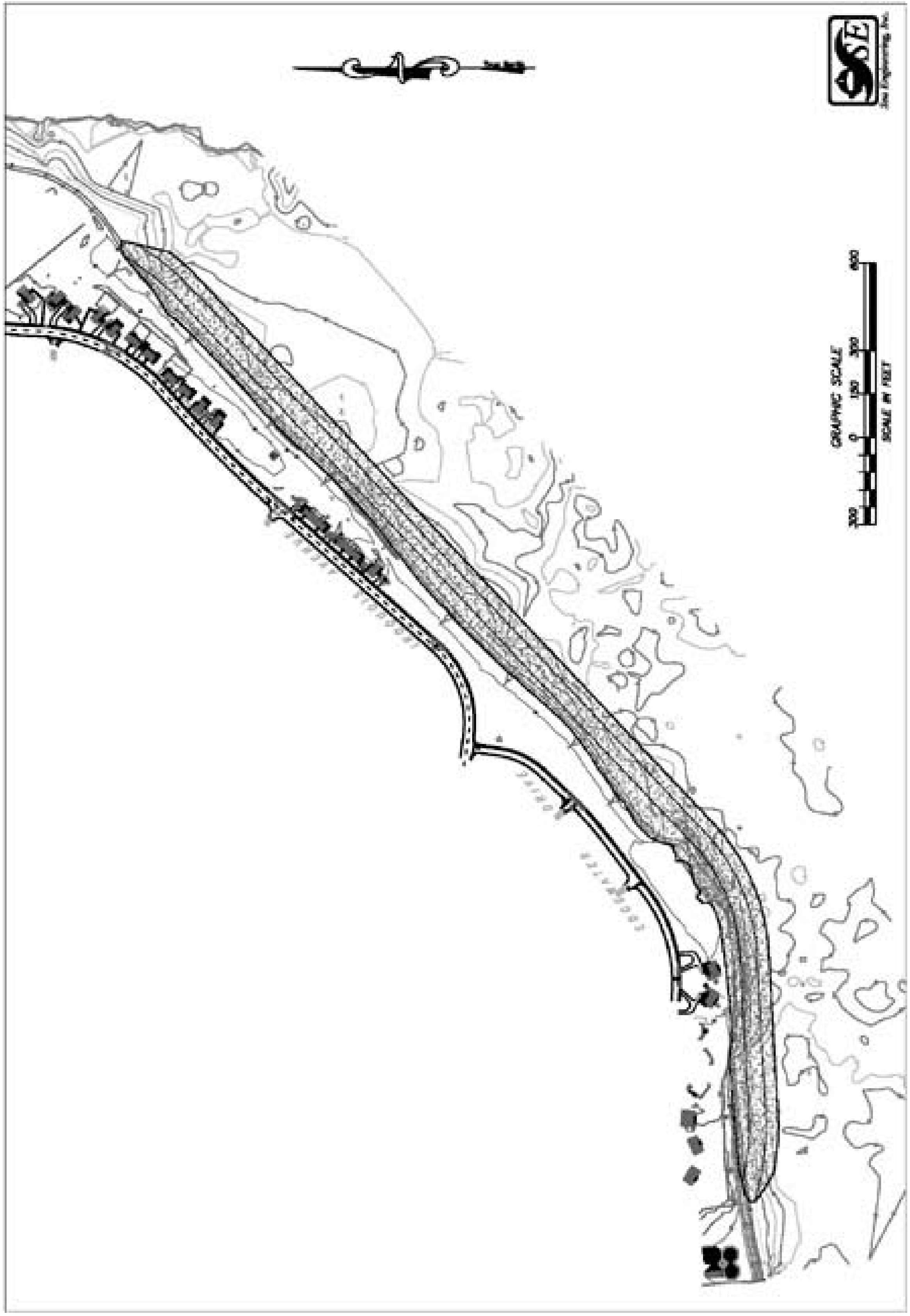

Figure 2-9. Beach Nourishment (without stabilization structures)

2.4.5 Estimated Construction and Maintenance Cost

Construction costs presented in Table 2-5 are based on the following tasks and assumptions:

1. Dollar costs are based on 2008 prices, with no future escalation.
2. Unit and job costs are based on discussions with and estimates received from experienced contractors and similar marine construction projects.
3. Mobilization and demobilization includes furnishing all equipment at the site, and removal of all equipment and cleanup following completion of construction.
4. Environmental protection includes furnishing all materials and equipment required by the Best Management Practices and Environmental Protection Plans, and the cost of required environmental monitoring.
5. Site preparation includes removal and disposal of existing nearshore rock, concrete, and steel debris as required for construction to the project lines and grades.
6. Sand fill costs are based on obtaining sand from the Pearl Harbor entrance, with unit costs based on prices received from the recent (2006) Navy maintenance dredging contractor.
7. Nourishment costs assume a 5-year interval (nine times over a 50-year project life).
8. A 15% contingency cost is used for initial construction, and a 20% contingency for future re-nourishment costs.

Table 2-5. Cost of Beach Nourishment without Stabilization

Item	Quantity	Unit	Cost ($)	Amount ($)
Initial Construction Cost:				
Mobilization and Demobilization	1	Job		100,000
Environmental Protection	1	Job		150,000
Site Preparation	1	Job		100,000
Sand Fill:				
Dredge	114,000	cy	30	3,420,000
Place	136,000	cy	18	2,448,000
Backshore Earth Berm	1	Job		500,000
				$ 6,718,000
Contingency				1,008,000
Total Initial Cost				$ 7,726,000
Periodic Nourishment Cost (Each):				
Mobilization and Demobilization	1	Job		$ 100,000
Environmental Protection	1	Job		150,000
Sand Fill:				
Dredge	30,000	cy	30	900,000
Place	30,000	cy	18	540,000
				1,690,000
Contingency				340,000
Re-Nourishment Cost				$ 2,030,000

50-Year Project Life Cost:	
Initial Construction Cost	$ 7,726,000
Nourishment Cost ($ 2,030,000 x 9)	18,270,000
Total 50-Year Project Cost	**$ 25,996,000**

2.5 Rock Revetment Shore Protection

Shore protection and erosion control can be provided by constructing structures to "harden" the shore and prevent erosion of unconsolidated sandy sediment. Seawalls and revetments are typical shoreline hardening measures. Seawalls are vertical or sloping reinforced concrete or grouted masonry walls used to protect the land from wave damage, with use as a retaining wall a secondary consideration. Seawalls are discouraged on sandy shorelines, due to their potential to increase erosion and prevent accretion. A revetment is a sloped structure built of wave resistant material. Revetments are usually the preferred wall type on sandy shorelines, due to their rough and porous surface and sloping face that absorbs more energy than smooth vertical walls, thus reducing wave reflection, runup, and overtopping. These characteristics also increase the possibility of sand accumulation in front of the structure compared to a vertical wall. However, given the long-term chronic erosion of the project area shoreline and net transport of the sand eastward, it is virtually certain that there would be no sand beach following construction of a shore protection revetment.

2.5.1 Revetment Plan

The rock revetment would extend along 3,900 linear feet of shoreline; plan and section views are shown on Figures 2-10 and 2-11. The most common method of revetment construction is to place an armor layer of stone, sized according to the design wave height, over an underlayer and bedding layer designed to distribute the weight of the armor layer and to prevent loss of the shoreline material through voids in the revetment. In Hawaii, almost all revetments are constructed of basalt boulders. The revetment would be constructed of 2,000 to 4,000 pound armor stone, over 200 to 400 pound stone core, with a 1V:1.5H side slope. An important aspect of a revetment (or any type of wall) on an unconsolidated sand foundation is to prevent scour around the toe which would result in displacement of armor stone and unsatisfactory structure performance. Toe scour protection can be provided by excavating to place the toe on solid substrate where possible, constructing the foundation as much as practicable below the depth of anticipated scour, or extending the toe to provide excess stone to prevent scour from undermining the revetment. The inadequate erosion control resulting from the randomly placed large stones previously implemented on the Iroquois Point shoreline was largely due to the absence of a filter layer behind the large stones, the low-elevation crest not sufficiently preventing overtopping and scouring of material from behind it, and lack of toe protection to prevent undermining. Excavation to –4 feet mllw would be required to place the revetment on a solid limestone reef rock foundation.

Ideally, a revetment should be constructed with a crest elevation high enough to prevent storm wave overtopping. At the project site, the wave runup elevation on the rock revetment presented herein would be about +10 feet during a severe winter season kona storm, up to +12 feet during a 50-year return period wave event, and up to about +15 feet during a possible hurricane event. The backshore ground elevation is only +7 feet; building a non-overtopping revetment would compromise the seaward view plane, and thus is not desirable. It is recommended that a revetment be constructed with a crest elevation of +8 feet, and designed to be stable during overtopping wave conditions. Storm wave overtopping protection would be provided by a backshore berm similar to the one in the other alternatives.

2.5.2 Storm Wave Runup Protection

Storm wave inundation and flooding protection would be provided by the same means as described in Section 2.2.2 – a 10-foot high landscaped berm constructed approximately 50 feet behind the revetment crest.

2.5.3 Beach Sand Fill

No beach sand fill would be required for this alternative.

2.5.4 Construction Operations

Construction operations would include the same basic mobilization and demobilization, environmental protection, and site preparation work as would the other alternatives (see Section 3.2.4). Rock work would be similar in nature to groin construction, except that for this alternative all work would be done on the shoreline, with only the revetment toe being constructed in the water. There would be no dredging of the Pearl Harbor entrance channel to obtain sand, and no sand fill placed in the water.

2.5.5 Material Quantities

Material for constructing the 3,900-foot long rock revetment would primarily consist of stone and geotextile filter fabric. Quantities would be as follows:

2,000 to 4,000 lb Armor Stone	20,130 cy
200 to 400 lb Underlayer Stone	9,180 cy
Geotextile Filter Fabric	10,425 sy

2.5.6 Estimated Construction and Maintenance Cost

Construction costs presented in Table 2-6 are based on the same assumptions as discussed in Section 2.2.6, with the exception of no sand fill:

Table 2-6. Cost of Rock Revetment Shore Protection

Item	Quantity	Unit	Cost ($)	Amount ($)
Initial Construction Cost:				
Mobilization and Demobilization	1	Job		100,000
Environmental Protection	1	Job		100,000
Site Preparation	1	Job		100,000
Rock Revetment:				
Stone	29,310	cy	35	1,026,000
Geotextile	29,310	sy	27	281,000
Construction	1	Job		2,500,000
Backshore Earth Berm	1	Job		500,000
				$ 4,607,000
Contingency				693,000
Total Initial Cost				$ 5,300,000
50-Year Project Life Cost:				
Initial Construction Cost				$ 5,300,000
Maintenance Cost (0.5% x $5,300,000 x 49 years)				1,300,000
Total 50-Year Project Cost				**$ 6,600,000**

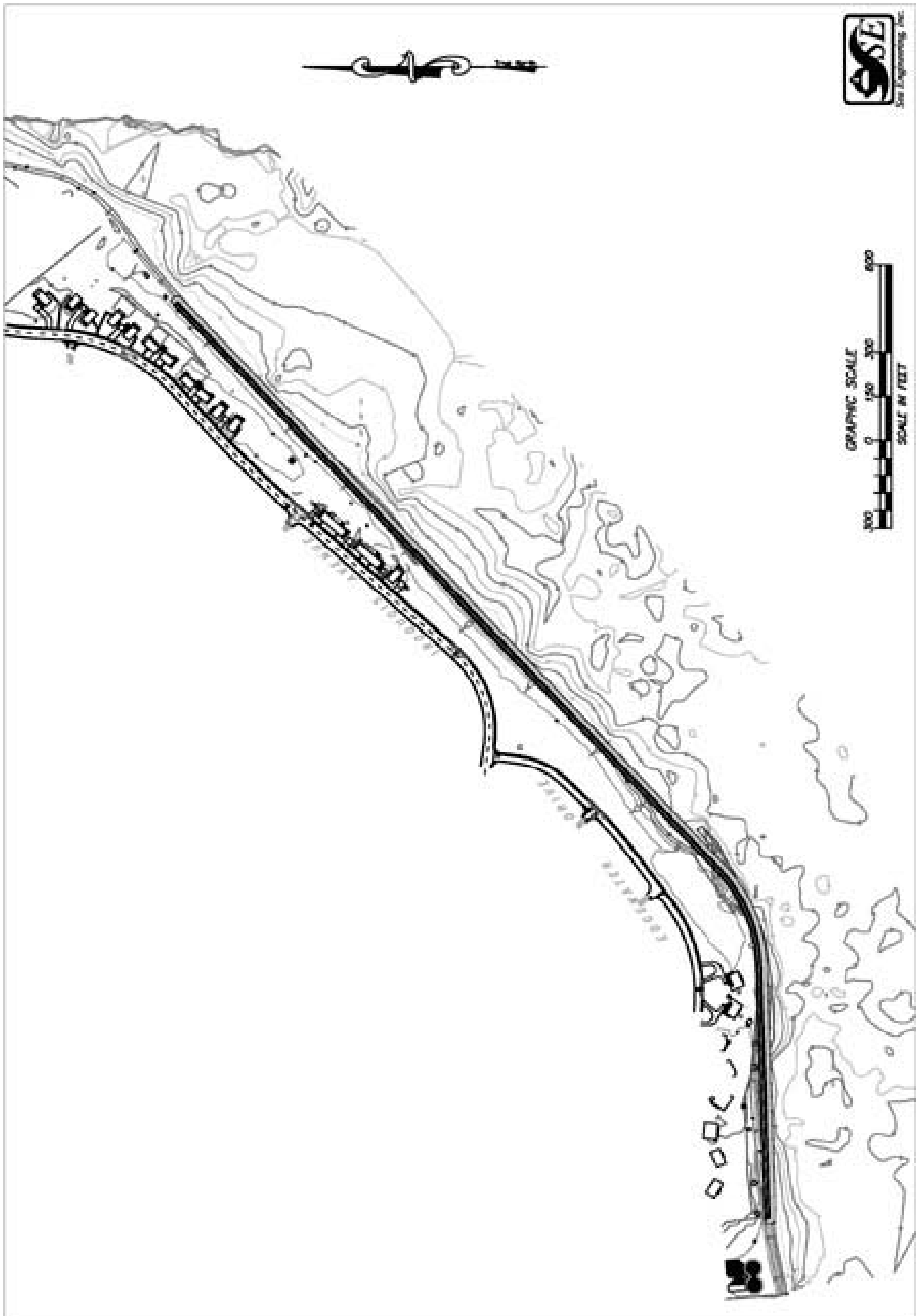

Figure 2-10. Rock Revetment Plan

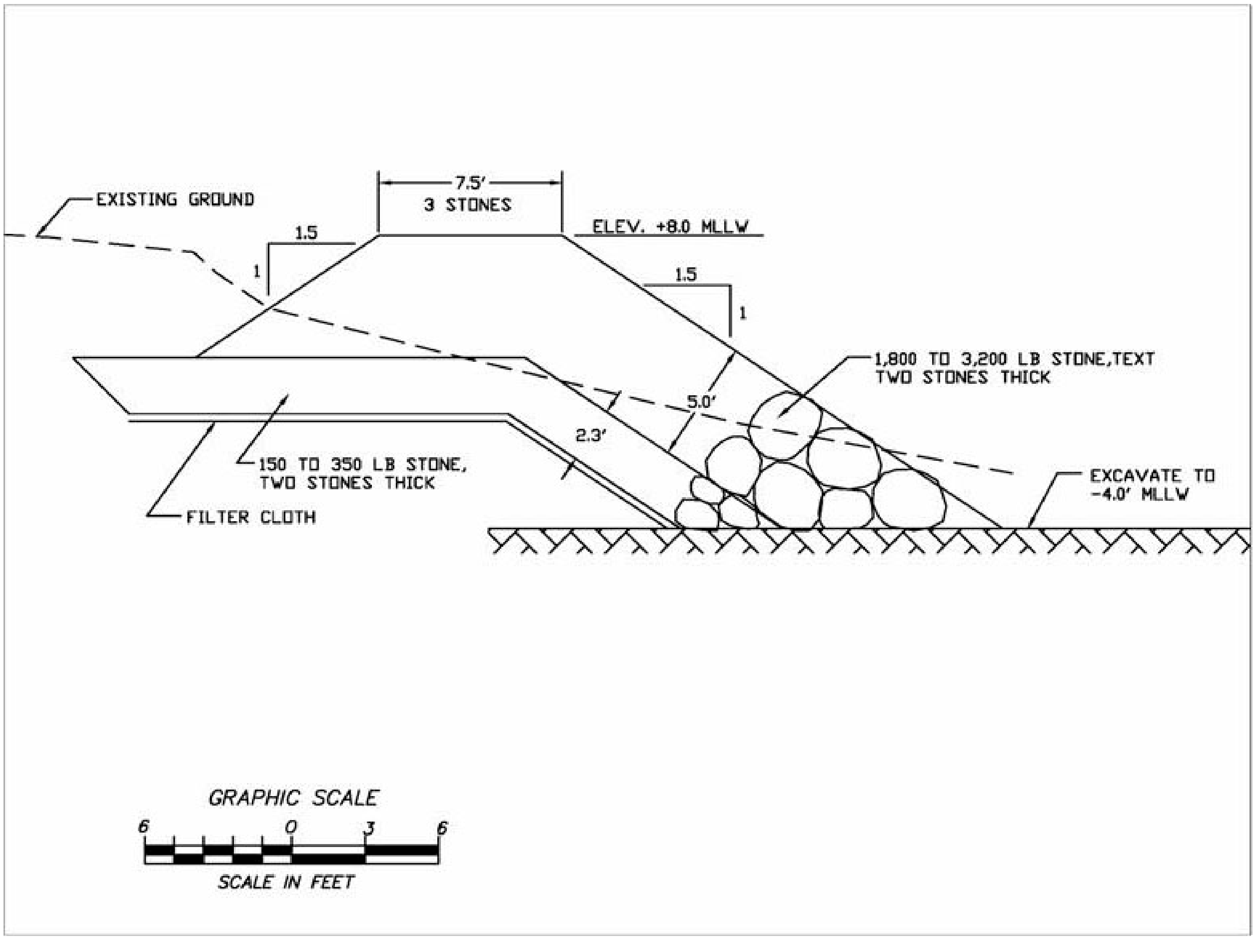

Figure 2-11. Rock Revetment Typical Section

2.6 Engineering Summary Comparison of Alternative Plan Quantities and Costs

A brief summary of the alternative plans in terms of general size, quantities of materials required, and the initial cost of construction and project life cost is shown on Table 2-7. Size is considered as the "footprint" of the project, the square footage of area occupied by the structures and/or sand beach. The material quantities are the total stone volumes and/or sand required to construct the projects. The cost is presented both as the initial cost to construct the project, and the total cost including maintenance over a 50-year project life. In the case of the No Action alternative, the 50-year cost is the loss of revenue resulting from abandonment of habitable homes.

Table 2-7. Engineering Summary Comparison of Alternate Plan Features

	No Action	9 Groins + Beach Fill	5 Groins + Beach Fill	Beach Fill	Rock Revetment
Footprint		4.6 Acres	8.2 Acres	5.5 Acres	3.0 Acres
Material Quantity					
Stone Sand	n/a n/a	19,860 cy 80,000 cy	31,260 cy 128,000 cy	n/a 136,000 cy	29,310 cy n/a
Cost					
Initial Construction Project Life	n/a $63,000,000	$ 7,307,000 $ 9,097,000	$ 11,792,000 $ 14,681,000	$ 7,726,000 $25,996,000	$ 5,300,000 $ 6,600,000

3.0 AFFECTED ENVIRONMENT

3.1 Project Location

The Iroquois Point housing area is located on the central south shore of Oahu, immediately west of the Pearl Harbor entrance channel. A location map was shown previously on Figure 1-1, and the housing area vicinity was shown on Figure 1-2. The project area extends along 4,200 feet of shoreline, from the western boundary of the housing area at the Puuloa rifle range, to the east along Keahi Point and to the wastewater pumping station at Hammer Point. The project site is bordered on all sides by military reservation land, and the offshore waters are part of the Naval Defensive Sea Area.

3.2 Shoreline and Beach

3.2.1 Beach Characteristics

The existing shoreline at Iroquois Point is composed primarily of calcareous sand. Patches of the backshore earthen fill are evident on the beach face where the erosion and shoreline recession have exposed it. Turbid, brown water caused by erosion of the earthen fill is often visible along the shore. Grain size analysis of representative sand samples shows a median grain size (D_{50}) of 0.5 to 0.7 mm, and the samples range from well sorted to moderately sorted. Only a very small percentage (less than 1%) of fine (< 0.074 mm) and coarse (> 4.76 mm) material was present in the samples. The existing beach condition is shown in Figures 3-1 through 3-4. Figure 3-1 illustrates the turbid plume extending seaward from erosion of dirt fill at the shore.

To assess typical beach morphology and recent erosion and accretion trends, beach profiles were surveyed during a 2.5-year period at 15 locations extending from Ewa Beach Park to the Pearl Harbor channel. Figure 3-5 shows the profile locations. Profiles 1 through 13 are located along Iroquois Point Beach from the southwest to northeast in the study area. Profiles 14 and 15 are located west of Profile 1 at Puuloa Firing Range and Ewa Beach Park. Shoreline profiles were measured on four occasions: December 16, 2003; May 5, 2004; Sept 16, 2004; and August 21, 2006. Profiles extend from landward of the beach and dune, and into the nearshore water beyond the beach toe. The profiles indicate that typical beach slopes are 1V:7H to 1V:8H. Between Keahi Point and Hammer Point, the beach crest is at an elevation of approximately +8 feet, and the sand transitions to coral bottom at elevations -2 to -4 feet. To the north of Hammer Point, the beach crest elevation decreases to approximately +5 feet because of the diminished exposure to waves.

The profiles indicate that there was shoreline erosion between December 2003 and August 2006 along the main portion of Iroquois Point Beach – Profiles 4 to 8. The shoreline, defined as the 0-foot MLLW elevation, retreated landward 10 to 20 feet in this shoreline segment during the 2.5-year measurement period. The volume of sand lost to erosion from this part of the beach was 8,400 cubic yards in the two-year period between September 2004 and August 2006. This is equivalent to an erosion rate of 4,350 cubic yards per year. The shoreline at Profiles 3 and 4 has also experienced erosion, although boulders located at the shoreline make quantitative analysis of the profiles difficult. At Profile 3, temporary shore protection has been emplaced to protect homes, while at Profile 4, the beach crest eroded 7 feet between 2003 and 2006.

Along the Pearl Harbor entrance channel to the east and north of Profile 9, the beach has been relatively stable as indicated by Profiles 10 and 12 (Profiles 11 and 13 were not measured in August 2006 because the elevation markers were not located). There is also no established pattern of erosion or accretion along the beach to the west of Iroquois Point. Profile 2 indicates about 15 feet of accretion between December 2003 and August 2006. Profile 1 indicates about 3 feet of accretion between December 2003 and August 2006, but 8 feet of erosion from September 2004 and August 2006. Profile 14 at Puuloa Firing range shows 10 feet of erosion, while Profile 15 at Ewa Beach Park indicates slight accretion.

Figure 3-1. Oblique Aerial Photograph of Iroquois Point Shoreline. (Photo: Nov 10, 2003, NOAA/NOS)

Figure 3-2. Existing Shoreline in the Vicinity of Keahi Point Looking East.

Figure 3-3. Existing Shoreline on the East Side of Keahi Point Looking West

Figure 3-4. Hammer Point Looking West

Figure 3-5. Shoreline Profile Locations

3.2.2 Historical Shoreline Changes

A historical aerial photographic analysis was completed to evaluate the shoreline history and processes in the project area, using vertical aerial photographs taken in 1961, 1976, 1990, 1998, and 2003. The scale of the photographs was 1 inch = 200 ft. for the 1961, 1976 and 1990 photos, and 1 inch = 300 ft. for the 1998 photo. A high-resolution, digital Ikonos satellite image provided the 2003 data and serves as the base map for the comparisons. The photos were digitized, registered to a common coordinate system using the 2003 Ikonos image, and common reference points were selected in each photo to correct for scale and rotation distortion.

The vegetation line and beach toe positions were digitized to assess shoreline changes over the years. On natural shorelines, the vegetation line typically marks the landward edge of the active beach face, and thus is a good indicator of beach processes where the shoreline has not been hardened or artificially maintained. The beach toe is defined as the change in slope at the transition between the nearshore and foreshore regions of the beach. It appears as a change in color or tone in vertical aerial photographs. The beach toe is a good indicator of shoreline erosion or accretion because it marks the seaward edge of the foreshore, or beach face. However, the beach toe can also vary with seasonal or short-term erosion or accretion, or changes in beach slope and width, and thus may also indicate the dynamic nature of a beach, rather than long-term erosion or accretion trends.

Historical vegetation line positions digitized from the aerial photographs are presented in Figure 3-6. Each colored line represents the location of the beach vegetation line for the particular year. A vegetation line position that is further seaward indicates an advancing, accreting beach, while a vegetation line position closer to the buildings indicates a receding or eroding beach. To quantitatively assess the shoreline movement, the specific locations of the vegetation line relative to the position in 1961 were measured along 15 transects spaced along the beach (Figure 3-6). These measurements are presented in Table 3-1. The changes in vegetation line relative to the previous photo are listed in the table in parentheses.

Overall, both the vegetation line and beach toe analyses show that the beach has eroded between Transects 3 and 10, and the most severe erosion has occurred in the vicinity of Transects 8 and 9, which are located at Keahi Point. The overall trend indicated by this photographic analysis is continued erosion at Keahi Point, with erosion steadily progressing to the east along the beach. Transects 11 to 13 to the west of Keahi Point indicate a more stable shoreline with alternating erosion/accretion cycles.

The digitized vegetation lines plotted on Figure 3-6 also indicate that while severe erosion was occurring at Keahi Point (Transects 8 and 9), the beach was accreting moderately around Transects 2 and 3. This suggests that Keahi Point has apparently been the source of littoral drift material that has been deposited along the beach east of Hammer Point. The longshore transport of sand is predominantly to the northeast. One consequence of the north-eastward transport is likely permanent loss of the material. The dredge cut for the Pearl Harbor entrance channel is adjacent to and parallels the shoreline near the sewage lift station located at Transect 1. A percentage of the sand being transported toward the east likely drops into the deeper channel and is lost since there would be no mechanism to return this sand to the reef flat. Transect 1 is located adjacent to the wastewater pumping station and shows a cyclical pattern of erosion and accretion.

While Transect 1 shows cyclical erosion/accretion patterns, the shoreline to the northeast is accreting. Transects 0 and –1 are located further in the Pearl Harbor channel and have histories of accretion, with net increases of 104 and 125 feet respectively over the study years. The accretion appears as a bulge in the shoreline and has land-locked formerly used docks and channel markers.

The extent of the change in vegetation line position that has occurred since 1961 is shown in Figure 3-7, as well as the predicted shoreline position 30 years from 2003 (in 2033), based on the historic change in shoreline position. The 2003 vegetation line is shown as the red line overlaid upon the 1961 aerial photo of Iroquois Point. The figure clearly shows the amount of erosion which has occurred in the vicinity of Keahi Point, as well as the accretion in the northeast portion of the project area along the side of the channel. This accretion is of interest because it shows that not all of the sand that is transported toward the northeast from Keahi Point is lost into Pearl Harbor channel, rather that a portion may be transported northeast along the shoreline into Pearl Harbor and then deposited along the shore. While the vicinity of Keahi Point has receded about 50 to 150 feet since 1961, the shoreline at the northeast end adjacent to the channel moved seaward about 75 to 90 feet. More shoreline growth may have been possible, but the presence of the channel prevents further movement seaward.

Two predictions of the shoreline position 30 years after 2003 are shown on Figure 3-7. One prediction is based on all of the data from 1961 through 2003, and the other prediction is based on recent trends revealed by the 1990 - 2003 photographs. The 1961-2003 based prediction shows erosion continuing at Keahi Point, with decreasing erosion and then some accretion with distance along the shoreline toward the northeast. The 1961-2003 prediction, however, does not fully take into account recent trends that show the erosion progressing to the east. The 1990-2003 based prediction shows erosion extending further to the northeast. Both predictions, however, show a continuing shoreline erosion problem, and the possibility of having to abandon virtually the entire shoreline seaward of Edgewater Drive and Iroquois Avenue.

A project site topographic survey was completed in January 2004, and recently updated in June 2008. The survey shows that along the project reach the shoreline typically receded 30 to 50 feet, and up to 70 feet at one location, over the 4.5 year period. This equates to erosion of over 30,000 cubic yards of sand, or 6,700 cubic yards per year.

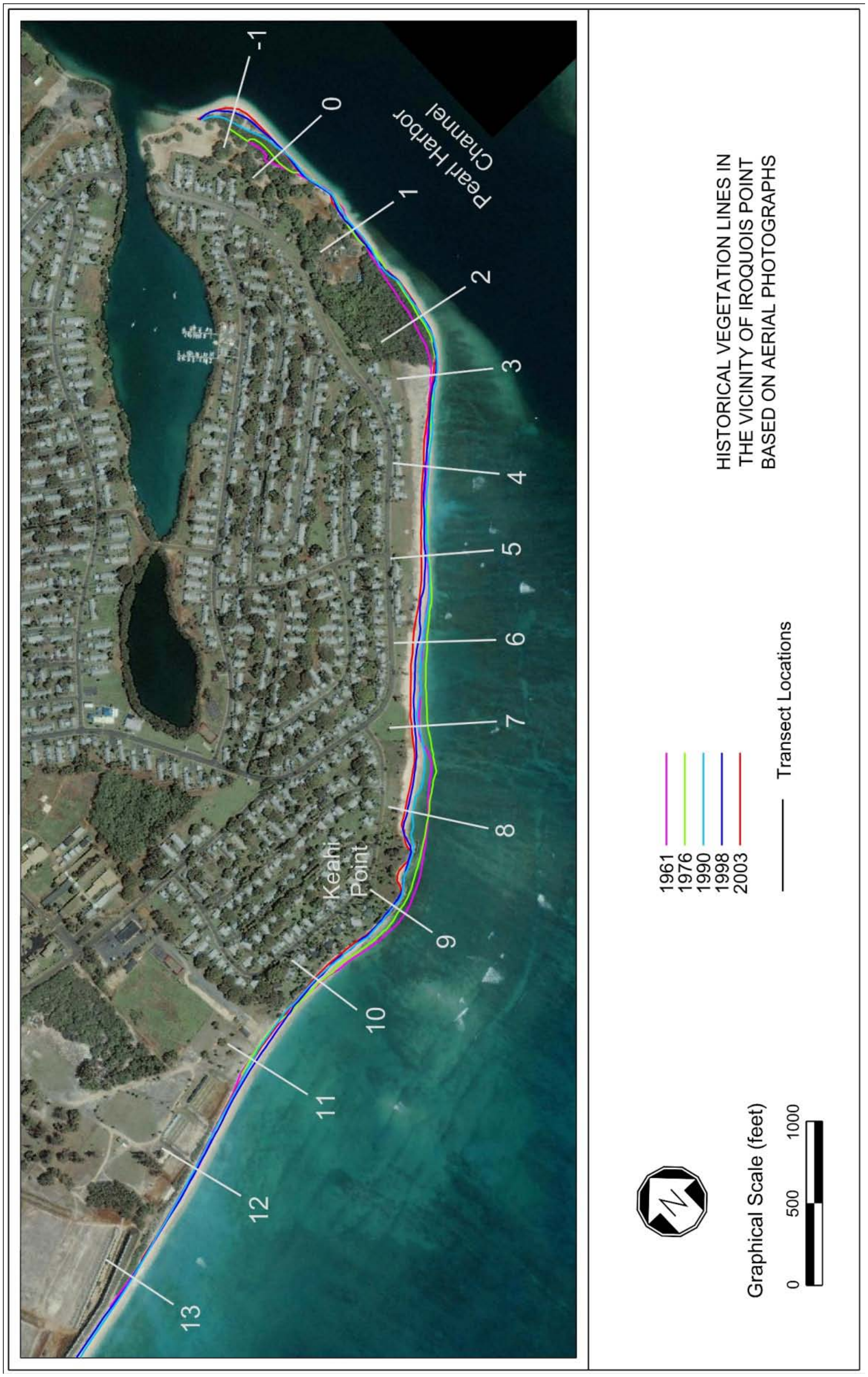

Figure 3-6 Historical Vegetation Lines from Aerial Photographs (1961 – 2003)

Figure 3-7 2003 and Projected 2033 Vegetation Lines Overlaid on the 1961 Aerial Photo

Table 3-1. Historical Vegetation Line Changes in Feet Since 1961 in the Vicinity of Iroquois Point

Photo Date	Transect Number														
	#-1	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
1/20/1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/12/1976	0	41	-15	43	35	12	6	23	53	2	-39	-5	-2	---	---
	0	-41	(-15)	-43	-35	-12	-6	-23	-53	-2	(-39)	(-5)	(-2)		
10/16/1990	39	105	10	57	36	10	2	-3	-5	-94	-79	-35	10	-10	8
	-39	-64	-25	-14	-1	(-2)	(-4)	(-26)	(-58)	(-96)	(-40)	(-30)	-12	(-10)	-8
1/13/1998	102	109	-1	57	28	-11	-11	-30	-26	-129	-89	-29	31	0	6
	-63	-4	(-11)	0	(-8)	(-21)	(-13)	(-27)	(-21)	(-35)	(-10)	-6	-21	-10	(-2)
2/8/2003	125	104	3	61	14	-22	-37	-63	-45	-144	-77	-44	12	-12	9
	-23	(-5)	-4	-4	(-14)	(-11)	(-26)	(-36)	(-19)	(-15)	-12	(-15)	(-19)	(-12)	-3
2033 Estimate[1]	89	74	2	44	10	-16	-26	-45	-32	-103	-55	-31	9	-9	6
2033 Estimate[2]	210	-2	-17	10	-54	-78	-95	-146	-98	-122	5	-22	-5	-5	2

* Changes relative to the previous photo are in parentheses.

[1] Based on the annual rate from 1961-2003, change relative to the 2003 vegetation line.

[2] Based on the annual rate from 1990-2003, change relative to the 2003 vegetation line.

3.2.3 Shoreline Processes

The primary forces driving shoreline processes along most Hawaiian beaches including Iroquois Point are waves and wave induced currents. As deepwater waves propagate toward shore, they begin to encounter and be transformed by the ocean bottom. In shallow water, the wave speed becomes related to the water depth. Wave refraction occurs as changes in water depth cause parts of the same wave to travel at different speeds and thus change direction; wave fronts tend to align parallel to existing bathymetric contours due to this refraction. As waves slow down with decreasing depth, wave height can begin to increase due to shoaling. The wave crest steepens, usually to the point that the wave becomes unstable leading to breaking and dissipation of wave energy. Wave energy can also be attenuated due to bottom friction. Wave diffraction is the lateral transmission of wave energy along the wave crest, and will cause the spreading of waves in a shadow zone, such as occurs behind a breakwater or other barrier.

Waves can transport sediment in two ways: as longshore drift along the shoreline, and as cross-shore transport from production areas on the reef to the shoreline or from the beach to offshore. If waves approach the shore at an angle, there will be a net transport of sediment along the beach face due to wave action in the swash zone, and there will also be transport of fine grain sediment in the longshore current that results. As a general rule, due to the longshore transport, beaches tend to align themselves to be perpendicular to the direction of wave approach, thus establishing a condition of equilibrium. When the wave angle changes, the equilibrium condition changes and the beach re-aligns itself. The phenomena of wave refraction and diffraction can greatly affect the angle of wave approach. The size of the waves that affect the shoreline is dependent on the water depth just offshore of the beach. Wave shoaling and breaking will tend to reduce the amount of wave energy that actually reaches the beach.

Iroquois Point is characterized by a wide and shallow fringing reef; water depths less than 4 feet extend over 1,000 feet from shore. This shallow, uneven reef surface limits wave energy approaching the shore. However, it also results in complex wave patterns as waves approach the shore. The lack of appreciable sand on the reef indicates that onshore-offshore sand transport is neglible and that transport is therefore primarily longshore. The wave approach direction is therefore a critical determinant of sediment transport along the beach. To assess the predominant longshore sediment transport directions at Iroquois Point beach, the numerical model REF/DIF (Kirby and Dalrymple, 1994) was used to simulate wave transformation as waves propagate from deepwater to shallow water nearshore. The model incorporates detailed nearshore reef and offshore bathymetry derived from U.S. Army Corps of Engineers LIDAR surveys.

The project site is directly exposed to waves from the southeast (140°) to the southwest (220°) (see Figure 3-11). Table 3-2 summarizes the frequency of occurrence of waves further broken down into 15-degree directional windows (Sea Engineering, Inc., 2004). REF/DIF was utilized to simulate the nearshore wave characteristics resulting from these deep water wave conditions. Figure 3-8 illustrates representative results of the modeling. The figure shows the wave front alignment at the shoreline for waves from 165, 180 and 195 degrees, the three dominant wave approach directions for Iroquois Point. Waves approach Keahi Point and most of the beach toward Hammer Point obliquely, such that sand would be transported to the northeast toward Pearl Harbor. The arrows on the figure indicate sand transport direction and relative magnitude. In the vicinity of Hammer Point, for some cases, sand transport in the opposite direction could occur along a small segment of the beach. This is due to the proximity of deep water in the entrance channel and the resulting refraction of the wave fronts in this area. To the west of Keahi Point, wave approach is typically parallel to the shoreline, indicating minimal sand transport potential in this area.

These modeling results are consistent with results of both the aerial photographic analysis (Section 3.2.2) and beach profile field measurements (Section 3.2.1). The aerial photographic analysis indicates that the most severe erosion between 1961 and 2003 has occurred on the same segment of beach between Keahi Point and two-thirds of the beach toward Hammer Point. While the severe erosion was occurring at Keahi Point, the beach in the northern vicinity of Hammer Point was accreting, indicating sand transport to the northeast along the beach. However, the shoreline to the west of Keahi Point has been relatively stable, with alternating periods of erosion and accretion. Beach profile measurements conducted between December 2003 and August 2006 show a similar pattern of ongoing erosion in the same area of the beach between Keahi and Hammer Points, and no pattern of erosion or accretion to the west of the project site.

In summary, wave driven longshore sediment drift is the dominant process affecting Iroquois Point beach. Numerical wave modeling indicates that the predominant sand transport direction is to the northeast along the beach towards the Pearl Harbor entrance channel. Aerial photographic analysis confirms this modeling result. Waves arriving from the southeast to southwest approach most of the shoreline obliquely, causing beach erosion and sand transport to the northeast. This sand has resulted in accretion of the shoreline between Hammer Point and the entrance to the Iroquois Point Lagoon. Much of the eroded sand is also likely lost into the entrance channel, permanently removed from the beach system. The presence of the entrance channel means that eroded sand would continue to be permanently lost, the beach would likely not be able to achieve a new stable configuration in equilibrium with the prevailing wave conditions, and erosion would likely continue into the future.

Table 3-2. Prevailing Deepwater Wave Conditions

Deepwater Wave Direction (deg)	Wave Period (sec)	Wave Height (ft)	Annual Percent Occurrence
150	8,9	4.7	2.8
165	9,12	5.3	5.1
180	12,15,17	5.9	7.1
195	12,15,17	5.9	4.4
210	12,15,17	5.9	1.7

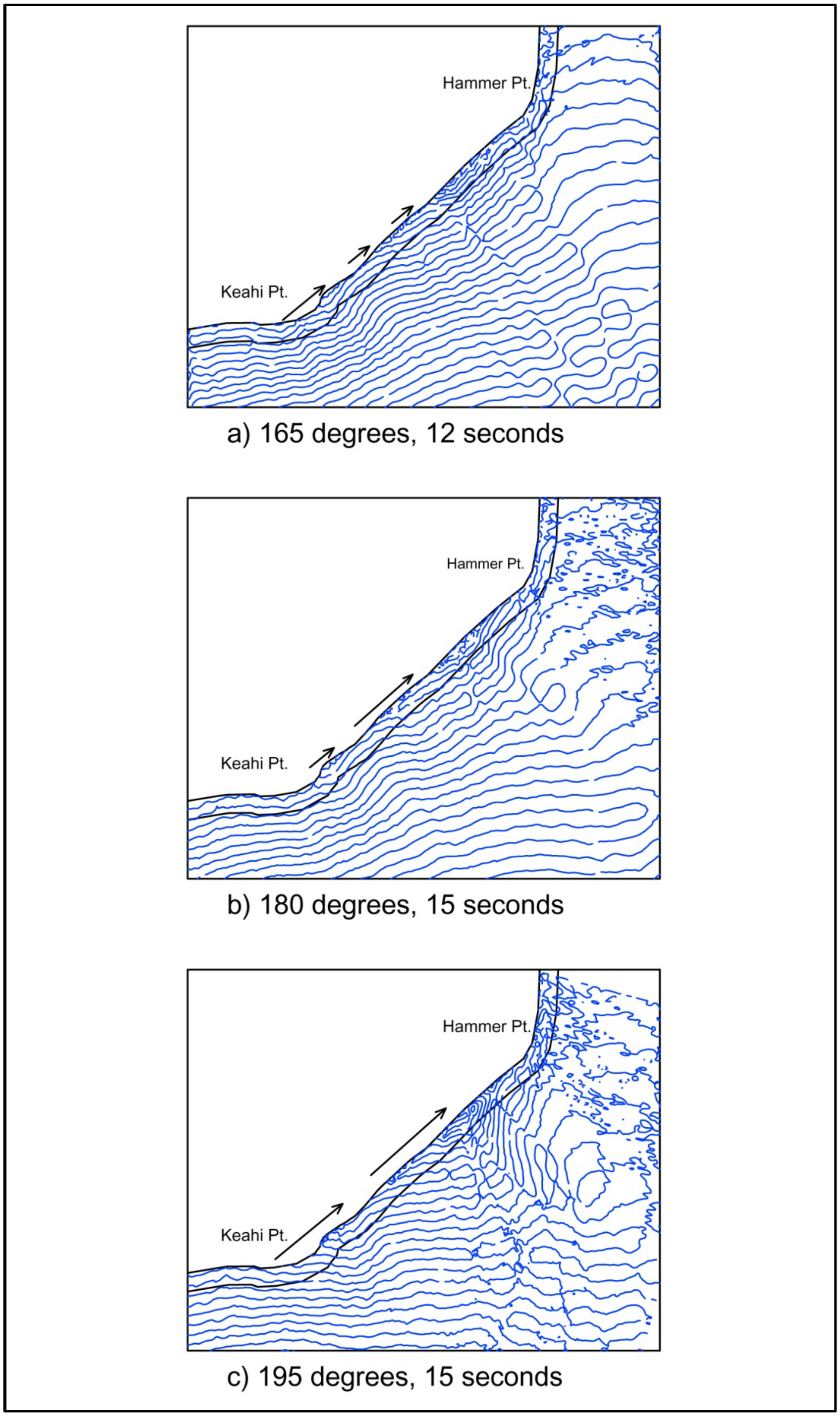

Figure 3-8. REF/DIF Calculated Wave Front Directions for the Predominant Deep Water Wave Conditions at Iroquois Point. Arrows indicate resultant sand transport directions and magnitude.

3.2.4 Previous Shoreline Erosion and Flood Control Measures

In response to the severe erosion discussed in the previous sections, and the threat posed by wave runup overtopping the beach crest and flooding the homes along the shore, a number of measures were undertaken to reduce the erosion and protect the houses. Many homes have been removed entirely. The measures are discussed below in chronological order, and their location is shown on Figure 3-9 (numbers on Figure 3-9 are keyed to the following paragraphs).

1. 1978 – 1980: A rock berm was constructed on the beach fronting Building 5405, located at the apex of Keahi Point.

2. 1984: High waves overtopped the beach crest and flooded the backshore area and several buildings. The Navy subsequently constructed an approximately 1,000-foot-long non-engineered rock revetment fronting buildings 5391 through 5417. By early 1985, settlement, undermining, large voids and displaced stones indicated the rapid deterioration of this revetment. Erosion and shoreline recession exposed portions of a sewer force main, originally constructed along the shore in 1974, and 600 feet of the main was relocated by the Navy in December 1984. (This force main continued to be exposed as erosion continued and was eventually abandoned and replaced by a new sewer main further inland.)

3. 1985: A sand berm was constructed at the top of the beach and edge of vegetation to reduce flooding caused by waves overtopping the beach crest. Sand bag dikes were placed behind the berms to keep wave inundation from damaging the grass and flooding the homes.

4. 1986: A 3-foot high CMU wall was constructed behind the beach to provide protection from overtopping wave flooding and wave tossed sand and debris. The wall was 1,640 feet long, extending from Building 5369 to Building 5429, and was located 30 to 50 feet behind the beach crest.

5. 1993: A 3-foot high wooden wall was constructed fronting Buildings 5175 to 5197, again to prevent water and sand from entering the housing units. Sand rapidly accreted to the top of the seaward side of the wall, forming a ramp for wave runup to wash over the wall.

6. 1995: Continuing erosion resulted in portions of the CMU wall being undermined and the wall in the vicinity of Building 5417 collapsing. Erosion at this location was accelerated because of end effects from the rock revetment. The Navy Public Works Center attempted to prevent further damage to the CMU wall by constructing a wall of wooden timber piles held in place by steel I-beams. By 1996 the timber pile wall was essentially damaged by wave action.

7. 1995 to Present: Erosion has continued to result in undermining and destruction of progressively more and more of the CMU wall, particularly at the east end of the rock revetment. Ten homes along Edgewater Drive have been abandoned and removed as a direct result of the erosion. In addition, 6 homes have been removed at the west end of Iroquois Avenue in response to the shoreline recession and high wave flood hazard.

Several other homes are abandoned, and threatened by the on-going erosion and wave runup.

8. 2004: In late 2003 erosion reached the CMU wall fronting the remaining homes on Keahi Point, and a portion of the wall fronting Buildings 5397 and 5399 was undermined and collapsed. Emergency shore protection for these buildings was constructed in February 2004, consisting of a 175-foot long articulating concrete block mat revetment backed by a 2-foot high wall constructed by filling a geotextile fabric tube with a cement mix.

In 2009, a 28-inch landscaping block retaining wall was constructed and beach fill was added to increase beach crest elevation to reduce inshore flooding. The wall extends along approximately 2,700 feet of shoreline between Keahi Point and Hammer Point.

The rock revetment at Keahi Point (item 1 discussed above) is now essentially an offshore breakwater along most of its length as a result of erosion and shoreline recession behind it. Erosion has continued at the east end of the revetment, resulting in a shoreline recession of 150 feet since 1976. Erosion and shoreline recession has resulted in the complete loss of the eastern half of the CMU wall, and it presently appears that erosion may eventually result in the loss of the remaining portion of the wall.

The existing condition of the shoreline was shown on the photographs on Figures 3-2 and 3-3. Figure 3-2 shows Keahi Point in the vicinity of the 1995 timber pile wall construction – the collapsed CMU wall, the exposed abandoned 12-in sewer main, and the fallen coconut trees are all indicative of the extensive erosion occurring in the area. Figure 3-3 shows the extensive erosion and shoreline recession at the east end of the rock revetment. A broken storm drainpipe that extended offshore now simply sticks out of the beach, and sand has been pushed over the beach crest and onto the grass by wave action.

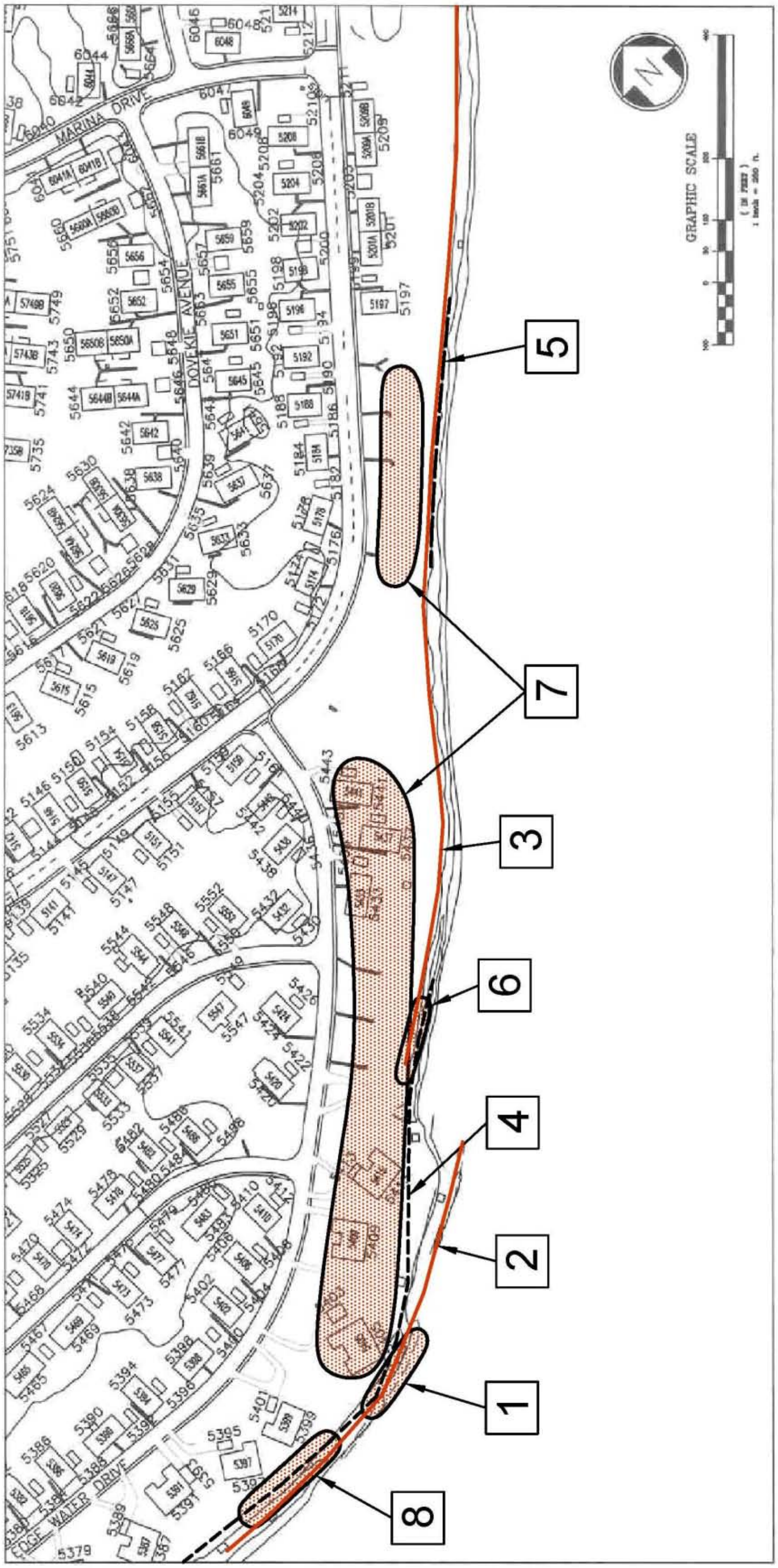

Figure 3-9. Location of Previous Erosion and Flood Control Measures

3.3 General Physical Environment

3.3.1 Bathymetry and Nearshore Characteristics

The shoreline at Iroquois Point is fronted by a wide and shallow fringing reef, as shown on Figure 3-10. Water depths less than 4 feet extend over 1,000 feet from the shore, with the 12-foot depth contour about 2,200 feet offshore, and the 18-foot depth contour more than 6,000 feet offshore. To the east, the project site is bordered by the 1,000-foot-wide and 50-foot plus deep Pearl Harbor entrance channel. The shallow nearshore water provides good natural protection from large deepwater waves; however, the wide expanse of relatively shallow water also results in complex wave patterns as the incident waves propagate toward shore. Wave patterns at the shore are further complicated by the presence of the deep entrance channel.

Bottom conditions seaward of the existing shoreline consist primarily of a hard limestone (fossil calcareous reef rock) substrate that underlies the entire project reach. Over the limestone are various combinations of sand deposits, coral rubble and cobbles, and reef rock outcrops. Bottom surface composition is approximately 40% sand, 40% rubble (gravel, cobbles, rocks, debris), and 20% hard limestone reef rock. The rock outcrops have a vertical relief of 1 to 2 feet above the surrounding area. The outcrops generally increase in size and percent of bottom cover from west to east across the project reach, toward the Pearl Harbor channel. Most of the bottom is covered by a thin layer of coral rubble and cobbles, with some patches of sand. Sand patch thickness within the project construction area is less than 1 foot. The hard, consolidated limestone reef rock bottom provides a good foundation for rubblemound groin construction, reducing scour and bottom erosion concerns and the need for scour protection.

Surveys of marine biological resources (*AECOS*, 2007, 2007b) in the project area showed a west to east gradient with respect to habitat complexity and marine species diversity. In the west, the bottom is characterized by a wave scoured sand bottom with sparsely distributed small limestone outcrops covered by algal growth but with few other organisms present. To the east, the bottom is primarily a honeycombed limestone reef platform dominated by algae and occupied by numerous benthic invertebrates and various reef fishes.

Nearshore water quality is generally typical of Hawaii’s coastal waters, and is generally in conformance with State water quality standards, with the exception of turbidity, chlorophyll α and nutrients, as shown over a year-long series of samples. The chlorophyll geometric mean was about 7 times the State dry season criteria. Turbidity typically ranged from 1 NTU (Nephelometric Turbidity Units) to about 10 NTU, with an overall geometric mean of 2.6 NTU, versus the State dry season criteria of 0.2. The greatest turbidity occurred near the middle of the project area where a turbid plume was observed extending offshore as a result of erosion of soil exposed by shoreline recession.

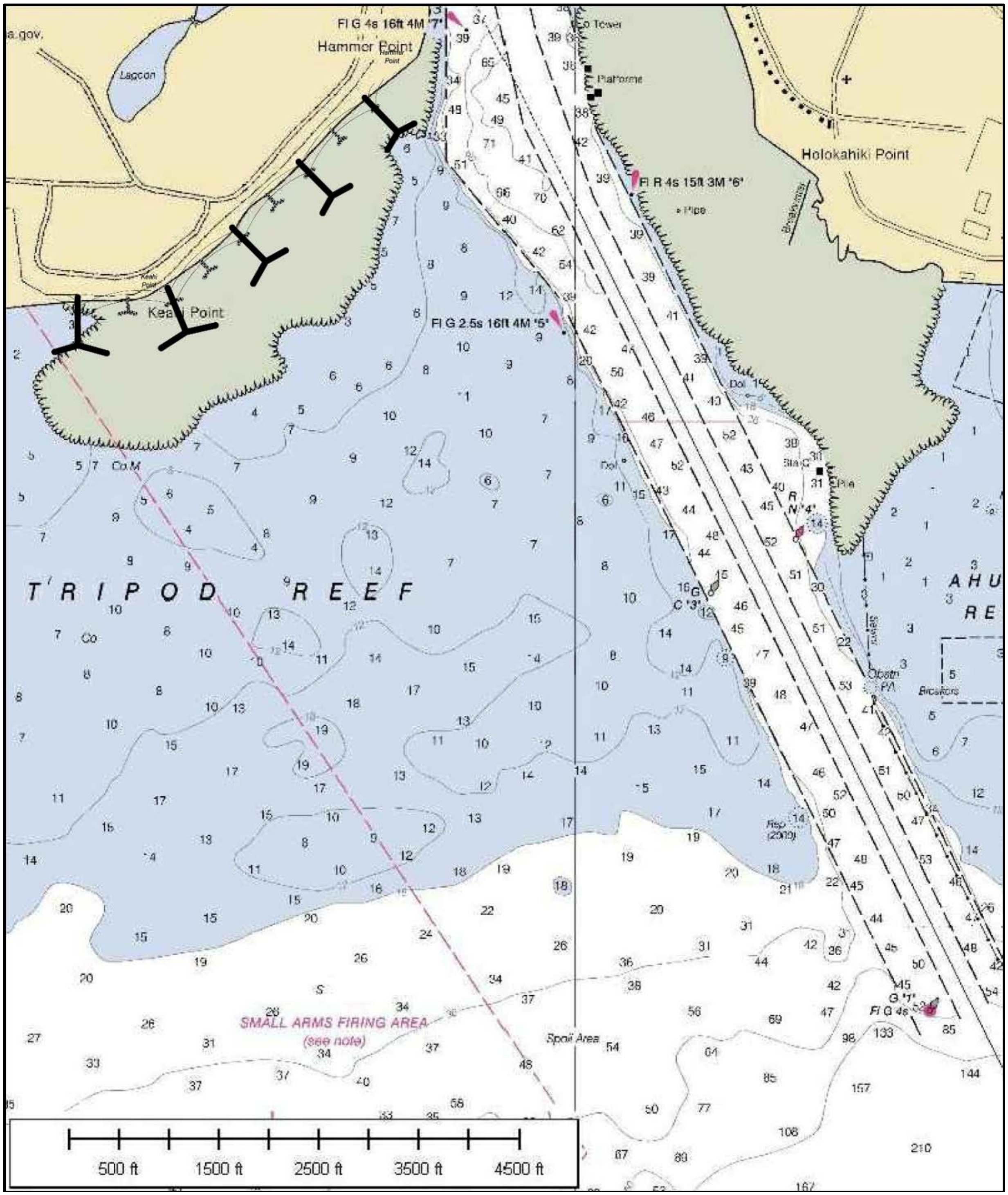

Figure 3-10. Nearshore Bathymetry (depths in feet) (groin plans are shown for overall comparison).

3.3.2 Wind

The general wind climate in Hawaii is characterized by two distinct seasons, primarily defined by the annual variation in persistence of the northeast tradewinds. During the summer months of April through September, the tradewinds predominate, blowing from an easterly to northeasterly direction about 70% of the time with an average speed of 12 to 15 knots. On occasion, the occurrence of strong tradewinds can result in accelerated downslope wind speeds on the leeward (south) side of the Koolau mountains and through valleys such as Moanalua and Halawa, causing strong, gusty winds at the project site.

During the winter months of November through March, the tradewinds weaken in persistence and the occurrence of southerly or westerly winds increase as a result of localized weather systems moving from west to east past the Hawaiian Islands. Westerly, or kona winds occur typically during the winter months, generated by low pressure or cold fronts that move toward Hawaii from the west. Periods of kona winds are generally of short duration (1 to 3 days) with relatively low (10 knot) wind speeds. However, there are occasional severe kona storms. A kona storm in January 1980 had sustained wind speeds of 30 knots or greater for a period of 4 to 5 days, and resulted in considerable wind and wave damage to south and west facing shorelines of all the islands.

In any given year tropical storms and hurricanes can be expected to occur in the central north Pacific between 140^o and 180^o west longitude and north of the equator. The Hawaiian Islands lie in the center of this region. Although hurricanes occur infrequently in the immediate vicinity of Hawaii, they do occasionally pass near the islands, and in recent times 3 hurricanes struck the island of Kauai. Hurricane Dot passed over Kauai in 1959, Hurricane Iwa passed within 30 miles of Kauai in 1982, and in 1992 Hurricane Iniki passed directly over Kauai with sustained winds exceeding 100 mph. Both Hurricanes Iwa and Iniki passed to the west of Oahu, and sustained wind speeds on Oahu were relatively low as measured at the Honolulu International Airport, peaking at about 40 knots. However, the report *Hurricanes in Hawaii* (Haraguchi, 1984) prepared for the U.S. Army Corps of Engineers following Hurricane Iwa, suggests that hurricanes can potentially approach any of the islands from the southeast to southwest. Thus, although the likelihood of occurrence is very low, the Iroquois Point area is vulnerable to direct hurricane attack.

3.3.3 Waves

3.3.3.1 General Wave Climate

The general Hawaiian wave climate can be described by four primary wave types: northeast tradewind waves, North Pacific swell, south swell, and kona storm waves. Tradewind waves occur throughout the year, but are most frequent from April through September when they usually dominate the local wave climate. They result from the strong and steady tradewinds blowing from the northeast quadrant over long fetches of open ocean. Typically, the deepwater tradewind waves have periods of 6 to 8 seconds and heights of 4 to 10 feet. The project site is well sheltered from the direct approach of tradewind waves by the island itself, and only a small portion of the tradewind wave energy refracting and diffracting around the southeast end of the island reaches Iroquois Point.

Storms in the North Pacific and mid-latitude low-pressure systems produce large waves which approach Oahu year round, but are most frequent during the winter months of October through March. Some of the largest waves reaching the island are of this type. Typical deepwater heights are 5 to 15 feet with periods of 12 to 20 seconds. The project site is also well sheltered from north swell approach, and receives only a small percentage of the energy from waves wrapping around Barbers Point at the southwest corner of the island.

South swell is generated by storms in the southern hemisphere and is most prevalent during the summer months of April through September. These waves are typically long and low, with periods of 12 to 20 seconds and deepwater heights of 2 to 6 feet. These waves are fairly common, occurring nearly 25% of the time during a typical year. They approach Iroquois Point directly and represent the greatest source of wave energy reaching the project site.

Kona storm waves also directly approach the project site; however, these waves are fairly infrequent, occurring only about 10% of the time during a typical year. However, since kona waves can reach a large size and approach from a direction different from the more prevailing waves, they can result in rapid sandy shoreline changes. Kona waves typically range in period from 6 to 10 seconds with heights of 5 to 10 feet, and approach from the southwest. Deepwater wave heights during the severe kona storm of January 1980 were about 17 feet. These waves had a significant impact on south and west shores of Oahu and Maui.

Severe tropical storms and hurricanes obviously have the potential to generate unusually large waves which in turn could potentially result in large waves at the project site. Although not a frequent or even likely event, they are important to consider in the project design, particularly with regard to coastal structure stability.

Waves are the primary driver of coastal processes at Iroquois Point. They create onshore/offshore and alongshore directed currents which transport sand and cause erosion, impact coastal structures, and runup on the beach causing backshore flooding. Thus, both prevailing and extreme wave conditions need to be considered in the design of the beach nourishment project. Prevailing conditions are defined as those that occur typically during the year. Prevailing conditions are the primary factor influencing the beach plan configuration, while possible extreme wave events are used to design the beach stabilization structures against storm wave damage and to evaluate storm wave flooding. Determining the prevailing and extreme wave conditions at the project site involved several analytical steps. First, existing available wave data was compiled and analyzed to determine the deepwater wave heights, periods, and approach directions pertinent to the site for both prevailing and extreme or storm conditions. Then numerical wave models were used to determine the range of deepwater wave approach directions that impact the site, and to transform the waves from deepwater to shallow water at the shoreline. This process includes wave refraction, diffraction, shoaling and energy dissipation. Wave refraction involves changes in wave height and direction as waves pass over changing bottom contours, and diffraction is the process by which wave energy spreads laterally along the wave crest when propagating over a submerged shoal. Wave shoaling is the increase in wave height as the waves move into increasingly shallower water. Energy dissipation is primarily the result of bottom friction. The waves travel toward shore until the water depth becomes shallow enough to initiate wave breaking. The maximum breaker height in shallow water is a function of the water depth, the bottom slope and the incident wave height and period. The large storm waves initially break some distance offshore. The waves then reform and continue shoreward as smaller waves, which may break and reform several times before finally reaching the shore. This multiple wave breaking can typically be seen off Iroquois Point even during prevailing wave conditions. Additional modeling analysis was completed to determine stillwater level rise and wave runup. The elevation of the water surface excluding waves is termed the stillwater level. During typically prevailing conditions, variations in the stillwater level are primarily a function of the rise and fall of the tide. During storm or hurricane occurrence, the nearshore stillwater level increases as a result of storm surge and wave setup. Storm surge is due to atmospheric pressure reduction and wind stress on the water surface, and wave setup is due to onshore mass transport of water by wave breaking. Wave runup is the vertical height above the stillwater level to which water from a breaking wave runs up on a shoreline slope.

3.3.3.2 Prevailing Wave Conditions

As discussed above, the project site is directly exposed to waves from the southeast to southwest, as shown on Figure 3-11, which includes south swell and kona storm waves, and has some exposure to northeasterly tradewind seas and north swell which wraps around the island. Deepwater wave data from seven wave buoys located around the Hawaiian Islands were analyzed to determine the prevailing deepwater wave climate appropriate to Iroquois Point. Numerical modeling was then used to compute the changes in wave parameters (height, period, direction) as the waves propagate from deep water to shallow nearshore waters. The numerical modeling results indicated that the typically prevailing northeasterly tradewind waves and winter season north swell have very little influence on beach processes at the project site. Beach processes are influenced primarily by waves approaching the project site directly.

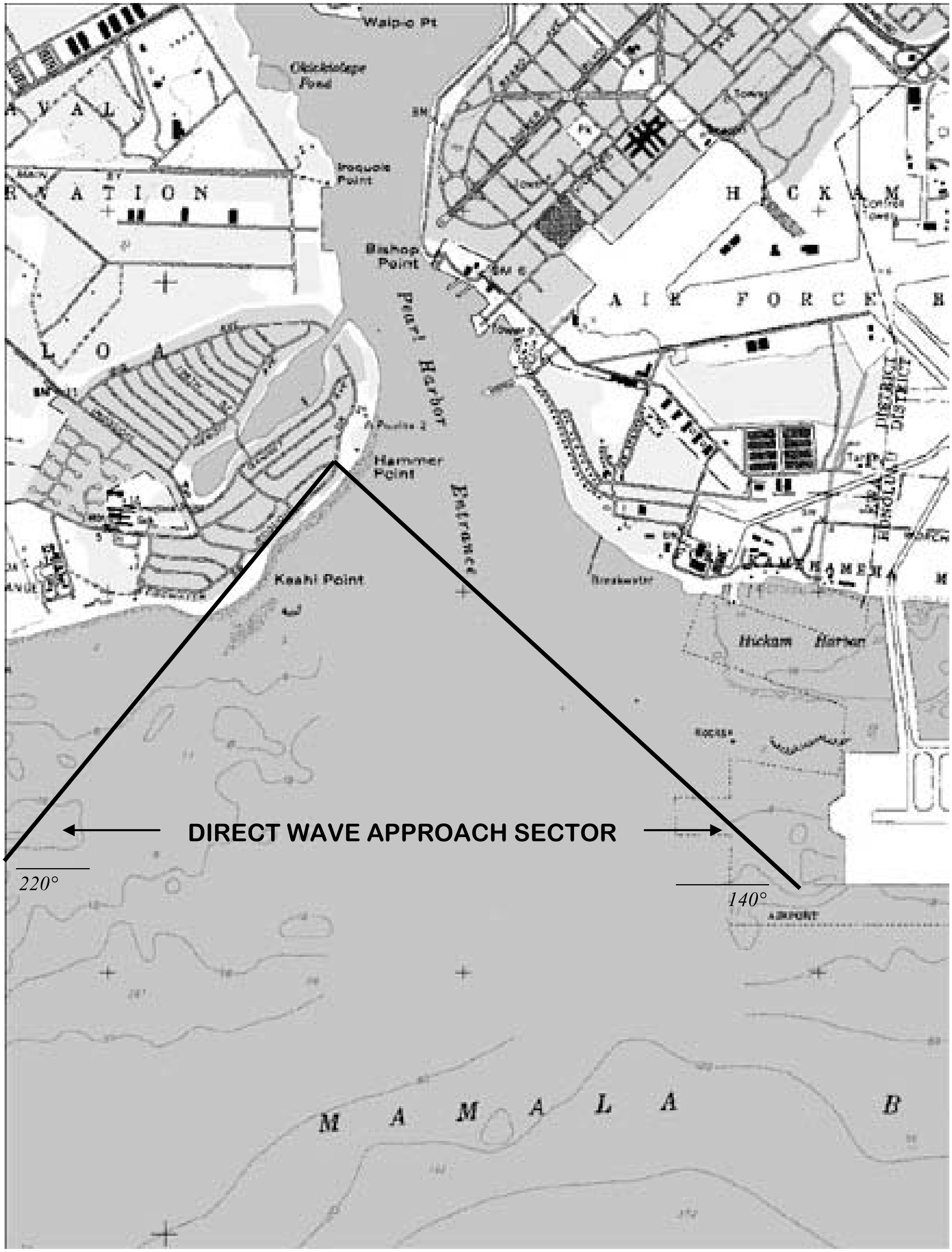

Figure 3-11. Direct Wave Approach Exposure

Table 3-3 summarizes the prevailing deepwater wave heights and periods for a range of directions compiled from the wave data buoys, and the associated nearshore wave height and runup computed by the numerical models. Prevailing nearshore wave heights are less than about 3.5 feet, and wave runup on the shoreline ranges up to about +6 feet during typically prevailing wave conditions. This is consistent with the typical existing beach berm elevation of approximately +6 feet.

Table 3-3. Prevailing Condition Nearshore Wave Heights and Wave Runup Elevations

Direction (°TN)	Deepwater Wave		Nearshore Wave Height (ft)	Wave Runup Elevation on Beach Slope (ft)
	Height (ft)	Period (sec)		
150	4.7	8	3.1	5.3
	4.7	9	3.1	5.5
165	5.3	9	3.0	5.4
	5.3	12	3.2	5.6
180	5.9	12	3.2	5.6
	5.9	15	3.4	5.8
	5.9	17	3.4	5.8
195	5.9	12	2.8	5.2
	5.9	15	3.3	5.8
	5.9	17	3.2	5.7
210	5.9	12	3.5	5.9
	5.9	15	3.4	5.9
	5.9	17	3.4	5.7

3.3.3.3 Extreme Wave Conditions

As previously discussed, the Hawaiian Islands are annually exposed to severe storms and storm waves generated by passing low pressure systems (kona storms), tropical storms including hurricanes, and large swell waves generated by distant north or south Pacific storms. Extreme wave conditions that could occur during these events must be incorporated into the design of the beach nourishment project to ensure stability of the beach fill and groin structures. This process involves determining representative deepwater wave conditions for these events and then transforming those deepwater waves into nearshore waves at the project site that would impact the project structures and beach fill. Deepwater wave conditions were determined for possible hurricanes, a severe kona storm, and a 50-year return period wind wave or swell.

A detailed study of hurricane storm wave inundation limits for the island of Oahu has been completed by Bretschneider and Noda (1984) for two hurricane scenarios – a model, or most probable type hurricane, and a worst case hurricane. The deepwater hurricane wave heights, periods and approach directions off the south shore of Oahu as reported by Bretschneider and Noda (1984) for the model and worst case hurricanes are 31 feet, 12 seconds, 175° and 41 feet, 14 seconds, 210°, respectively. The severe kona storm of January 1980 is commonly used as a "design" kona storm condition. The severity of this storm has been described as a "50-year" or even less frequent event. Hindcasts of the wave conditions by SEI following the storm indicated deepwater wave heights of 17 feet with a 9 second period approaching from the south-southwest.

The 50-year return period sea (waves generated by locally occurring winds) and swell waves (waves generated by distant storms and propagating toward Hawaii) were determined by statistically analyzing long-term wave data records. The 50-year deepwater sea and swell wave heights and periods are 23 feet, 11 seconds, and 16.8 feet and 15 seconds, respectively.

These selected deepwater wave conditions were entered into numerical model REF/DIF to simulate the wave transformation as the waves propagate from deepwater to shallow water nearshore. A summary of the extreme wave conditions calculated for the project site is shown in Table 3-4. Wave heights and wave runup elevations are presented as the significant height or runup, defined as the average of the highest one-third of all the wave heights or runup elevations. The stillwater level (SWL) rise at the shoreline and the runup elevations are referenced to the mllw elevation datum. Wave heights 200 feet offshore ranged from 3.5 to 6.3 feet. The approximate 4-foot water depth below mllw coupled with the stillwater level rise yields a total water depth sufficient for these offshore waves to be technically “non-breaking”. The breaker heights on the shore ranged from 4.4 to 8.1 feet, and wave runup ranged from +7 to about +16 feet. The wave height indicates how much force will be acting on the structures, and the runup reveals the extent of possible backshore flooding. This information was used to determine groin parameters such as rock size, groin crest elevation, and backshore berm elevation.

Table 3-4. Summary of Extreme Wave Conditions

Wave Type	Deepwater Wave			Wave Height 200 ft Offshore	At the Shoreline		
	Height (ft)	Period (sec)	Direction (° TN)	(ft)	SWL (ft)	Wave Height (ft)	Runup Elevation (ft)
Hurricane:							
Worst-case	40.5	14	175	6.3	+7.8	8.1	15.9
Model	30.8			5.4	+6.4	7.3	14.2
Kona Storm	17.0	9	210	3.5	+3.6	4.4	10.1
50-Year Return:							
Sea	23.0	11	150	4.1	+4.3	5.5	12.7
Swell	16.8	15	190	3.6	+3.5	4.8	7.0

Note: SWL and Runup Elevation are referenced to the mllw datum.

3.3.4 Tide

The tides in Hawaiian waters are semi-diurnal with pronounced diurnal inequalities (i.e. two tidal cycles each day with the range of high and low water levels being unequal). Tidal data for Honolulu Harbor, which is applicable to the project site, is as follows:

	MLLW Datum	MSL Datum
Mean Higher High Water	1.9 feet	1.1 feet
Mean High Water	1.4 feet	0.6 feet
Mean Sea Level	0.8 feet	0.0 feet
Mean Low Water	0.2 feet	-0.6 feet
Mean Lower Low Water	0.0 feet	-0.8 feet

The spring tides during new and full moons can reach elevations of about 2.8 feet during certain times of the year. Elevations in this report are referenced to mllw (long-term average of the daily lowest tide).

3.4 Marine Water Quality

Water quality investigations at the project site have been investigated by *AECOS*, Inc. (2007). Two types of survey investigations were conducted to assess the marine water quality conditions in the Iroquois Point project area. One survey was to establish baseline turbidity/suspended solid concentrations off the project beach and consisted of a year-long series of samples (events at approximately 2-month intervals) collected along each of 6 transects (Figure 3-12) throughout the proposed nourishment area (A through F) at 3 distances from the shore. Labeling of these stations is as follows: Stations A-10, A-30, and A-60 occur along Transect A and are located 10 m (33 ft) from the water line, 30 m (100 ft) from the beach crest and 60 m (200 ft) from the beach crest, respectively. Stations B through F are labeled similarly. The second water quality survey involved measuring basic water quality parameters under a variety of sea and tide conditions in order to characterize water quality conditions as part of the overall marine resources characterization. These samples were collected on Transects A, D, and F (Figure 3-12) at a distance of 50 m (164 ft) from the beach crest (Stations A-50, D-50, and F-50). Beginning in December 2005 a fourth station was added along the Pearl Harbor channel (G or PHC). Table 3-5 lists date, tidal stage, and parameters measured for each sampling event that was part of this series.

All transects (solid and dashed lines) were surveyed for the TSS and turbidity baseline survey. Transects A, D, F (solid lines), and G were also surveyed for the full suite of water quality parameters, substratum characteristics, and marine biota.

Table 3-5. Water quality parameters, survey dates, tidal stages, and collection locations at Iroquois Point, Oahu.

Sampling Dates	Tidal stage	Transects	Parameters
October 19, 2004	Ebb	A (West) D (Middle) F (East)	Temperature, salinity, dissolved oxygen, pH, turbidity, total suspended solids (TSS), NO3+NO2, total N, total P, and chlorophyll-α
December 29, 2004	Ebb		
February 25, 2005	Flood		
August 15, 2005	Flood		
December 19, 2005	Ebb	A (West) D (Middle) F (East) G (PHC)	
February 9, 2006	Flat		
May 25, 2006	Flood		
August 21, 2006	Flood		
November 28, 2006	Ebb		
February 23,2007	Ebb		

Figure 3-12. Water quality survey transects along Iroquois Point, Oahu.

3.4.1 Water Quality Sampling

Summarized results of the water quality sampling programs at Iroquois Point are presented in Table 3-6 (*AECOS*, 2007).

Table 3-6. A summary of mean water quality conditions off Iroquois Point from samples obtained between October 2004 and February 2007

Parameter	Station				Grand Mean
	West (A-50)	Middle (D-50)	East (F-50)	PHC (G)	
Temperature (C°)	**26.1**	**26.1**	**26.1**	**25.8**	**26.0**
n	*10*	*10*	*9*	*6*	*35*
Salinity (‰)	**35.0**	**34.9**	**34.6**	**33.5**	**34.5**
n	*10*	*10*	*10*	*6*	*36*
DO sat. (%)	**106**	**107**	**101**	**94**	**103**
n	*10*	*10*	*9*	*6*	*35*
pH	**8.14**	**8.19**	**8.17**	**8.10**	**8.15**
n	*10*	*10*	*10*	*6*	*36*
Turbidity (NTU)	**2.78**	**4.32**	**1.97**	**1.92**	**2.75**
n	*10*	*10*	*10*	*6*	*36*
TSS (mg/l)	**9.2**	**11.0**	**6.4**	**8.3**	**8.7**
n	*10*	*10*	*10*	*6*	*36*
Nitrate + Nitrite (µg/l)	**1.9**	**3.8**	**5.5**	**2.4**	**8.5**
n	*10*	*10*	*10*	*6*	*36*
Total Nitrogen (µg/l)	**143**	**147**	**165**	**196**	**163**
n	*10*	*10*	*10*	*6*	*36*
Total Phosphorus (µg/l)	**17**	**18**	**17**	**20**	**18**
n	*10*	*10*	*10*	*6*	*36*
Chlorophyll □ (µg/l)	**0.85**	**0.74**	**1.02**	**1.86**	**1.12**
n	*10*	*10*	*9*	*6*	*35*

Note: Geometric means calculated for turbidity, TSS, nutrients and chlorophyll α
Grand Mean: Mean of all values from all sites for each parameter.

On average, water temperature decreased with proximity to the Pearl Harbor entrance channel, located at the east end of the survey area. Water temperature varied by 6.5 C° among baseline water quality stations with a low of 22.1ºC on February 9, 2006 at Sta. A-50 and a high of 28.6ºC on August 21, 2006 at Sta. G, Pearl Harbor Channel. Salinity was consistently recorded in the range of 34 to 36‰ at all stations except Sta. G and Sta. F-50 with values of 31, 32, and 33‰, in May, August, and November, respectively. The depressed salinities are indicative of estuarine water exiting Pearl Harbor. In addition, a value of 31‰, measured on December 29, 2004 during a falling tide at Sta. F-50, coincides with a rain event and extreme values for several other water quality parameters described in the following paragraphs.

Average dissolved oxygen (DO) saturation tended to increase with distance from the Pearl Harbor entrance channel. Saturation levels ranged from a low of 81% at Sta. A-50 on February 9, 2006 to a high of 146% at the same station on December 29, 2004. Super-saturated conditions were common at all three of the open coastal stations and possibly reflect local wave action.

In an average sense, pH varied little from station to station. Individual pH readings fell within the range of 7.90 at Sta. D-50 on October 19, 2004 to 8.99 also at Sta. D-50 on December 29, 2004. The pH at Sta. A-50 and Sta. F-50 varied slightly from 8.02 to 8.33 during all 10 sampling events and from 7.91 to 8.20 during three sampling events at Sta. G in Pearl Harbor entrance channel.

The geometric means for turbidity and TSS were highest at Sta. D-50 (middle of the project area) and lowest at Sta. G. Individual values for turbidity ranged from a low of 0.92 NTU at Sta. F-50 on December 19, 2005 to a high of 10 NTU at Sta. F-50 on November 28, 2006. Individual TSS concentrations ranged from a low of 2.9 mg/l at Sta. A-50 and Sta. F-50 on December 29, 2004 and February 9, 2006 respectively to a high of 33.2 mg/l at Sta. A-50 on October 19, 2004.

The geometric mean concentration of nitrate + nitrite (NO_3 + NO_2) was low at Sta. A-50 and Sta. G, located at either end of the survey area, as compared with mean levels at both Sta. D-50 and Sta. F-50. Individual nitrate + nitrite levels ranged from undetectable at Sta. A-50 on February 9, 2006 and May 25, 2006, as well as Sta. G on May 25, 2006 to a high of 175 µg N/l at Sta. F-50 on December 29, 2004. The latter value was coincident with the low salinity water (31‰ – see above) exiting from Pearl Harbor and is representative of high nutrient conditions typically found in Pearl Harbor (HDOH/EPO, 2004).

There was a general increase in mean total nitrogen (TN) concentrations from west to east (Sta. A-50 to Sta. G) that is probably associated with high nutrient conditions in Pearl Harbor (HDOH/EPO, 2004). Individual total N concentrations ranged from a low of 114 µg N/l at Sta. A-50 on May 25, 2006 to a high of 375 µg N/l at Sta. F-50 on December 29, 2004. The high total N concentration at Sta. F-50 is mostly accounted for by the high nitrate + nitrite and correlates with the low salinity conditions at this location during a wet-season sampling event.

Geometric mean total phosphorus (TP) ranged from 17 at A-50 and F-50 to 20, at Sta. G. Individual total P values ranged from a low of 12 µg P/l at Sta. A-50 on December 29, 2004, at Sta. D-50 on February 25, 2005, and at Sta. F-50 on August 15, 2005 to a high of 26 µg P/l at Sta. F-50 on December 29, 2004 which again corresponds to the low salinity and high TN levels recorded at this station on this date.

Geometric mean chlorophyll α concentrations generally increased with proximity to Pearl Harbor entrance channel. The mean levels occurring at Pearl Harbor channel (Sta. G) were twice that at Sta. A-50 in the west. Individual chlorophyll α concentrations ranged from a low of 0.37 µg/l at Sta. F-50 on August 21, 2006 to a high of 5.47 µg/l at Sta. A-50 on December 29, 2004. Chlorophyll α levels were also elevated at Sta. F-50 (3.71 µg/l) on December 29, 2004, associated with the low salinity, high nutrient water flowing out of Pearl Harbor at this time.

3.4.2 Turbidity Investigations

Numerous measurements were made of turbidity and total suspended solids (TSS) during the water quality investigations because of the on-going shoreline erosion conditions in the Iroquois Point survey area. In addition to characterizing the prevailing conditions in these coastal waters, a specific reason for collecting these particulate data was to develop equations to estimate TSS concentrations in the survey area based on turbidity measurements. The collection and analysis of TSS data is time-consuming and, hence, costly compared with that for turbidity which can be measured directly with a turbidimeter. Once a relationship between turbidity and TSS is established for a specific site, turbidity measurements alone can be used during construction for water quality monitoring.

Turbidity and total suspended solids (TSS) were sampled at approximately three-month intervals between October 19, 2004 and November 28, 2006 at 21 stations across the survey area (see Figure 3-12 and Tables 3-7 and 3-8). Turbidity was measured at each station during each sampling event, while TSS was measured in samples on a more or less random basis. These data were collected to define baseline turbidity conditions in the survey area. TSS was measured less frequently for use in developing an equation to estimate TSS levels in the future based upon turbidity measurements.

Table 3-7. A summary of geometric means and ranges for turbidity (NTU) at Iroquois Point between October 19, 2004 and November 28, 2006

Distance from Beach Crest	Transect A (West)	B	C	D (Middle)	E	F (East)	Grand Mean	*n*
10 m*	4.65**	5.58	7.41**	16.7	4.68	2.06	**5.57**	*42*
30 m	4.16	3.88	5.99	9.37	3.99	1.56	**4.22**	*42*
50 m	2.94	---- ***	---- ***	4.30	---- ***	1.40	**2.61**	*21*
60 m	2.20	2.50	4.11	3.62	2.48	1.37	**2.56**	*42*
Geo Mean	**3.34**	**3.78**	**5.67**	**6.97**	**3.59**	**1.58**		
Range	1.18 – 11.8	0.98 - 13.6	1.16 - 19.4	2.02 - 87	1.06 – 19.9	0.66 – 6.44		
n	*28*	*21*	*21*	*28*	*21*	*28*		

Grand Mean: Mean of all values from all sites for each parameter.
* Samples collected 10 m from waterline.
** Samples were collected at 6 m at Sta. A-10 and Sta. C-10 on October 19, 2004.
*** Samples collected at the 50 m distance for Transects A, D, and F only.

The highest turbidity levels occurred near the middle of the project area (Table 3-7). The high turbidity values consistently recorded at stations along Transect D were coincident with a turbidity plume that was generally present coming from the shoreline (especially at high tides) where erosion was removing soil from the top of the beach. There was also a general trend of lower turbidity levels with distance from shore. Mean turbidity levels were lowest at stations along Transect F adjacent to the entrance channel to Pearl Harbor.

Table 3-8. A summary of geometric means and ranges for total suspended solids (TSS) (mg/l) at Iroquois Point between October 19, 2004 and November 28, 2006

Distance from Beach Crest	Transect A (West)	B	C	D (Middle)	E	F (East)	Grand Mean	*n*
10m*	12.2**	11.8	18.6**	20.3	13.2	7.7	**13.5**	*22*
30m	12.5	12.6	20.2	22.8	14.6	7.6	**13.8**	*23*
50m	9.8	---***	---***	10.3	---***	5.0	**8.0**	*21*
60m	9.8	16.5	12.0	12.1	14.8	6.2	**11.4**	*21*
Geo Mean	**10.7**	**13.4**	**16.8**	**14.4**	**14.2**	**6.3**		
Range	2.9 – 33.2	6.0 – 40.4	7.1 – 39.0	4.5 – 45.6	5.7 – 33.2	2.9 – 21.2		
n	*18*	*10*	*10*	*19*	*12*	*18*		

Grand Mean: Mean of all values from all sites for each parameter.
* Samples collected 10m from waterline.
** Samples were collected at 6m at Sta. A-10 and Sta. C-10 on October 19, 2004.
*** Samples collected at the 50m distance for Transects A, D, and F only.

The longshore TSS distribution pattern (i.e., parallel to the shore) was similar to that for turbidity with the highest TSS concentrations occurring near the middle of the project area at stations along Transects C and D (Table 3-8). As with turbidity, the highest mean concentrations of TSS along each transect (perpendicular to shore) consistently occurred at the 10 m and 30 m stations. The lowest mean TSS concentrations were recorded on the eastern portion of the study area (Transects E and F) by Pearl Harbor entrance channel. Perhaps this is related to the constant flushing of waters across the shallow reef bench of Transects E and F by tidal currents entering and exiting Pearl Harbor. These sites also experience the least wave energy of all the transect locations and unlike at Transect D lack a source of fine sediments to be resuspended by the minimal wave energy typical for this transect location.

Linear regression analysis was used to determine the relationship between turbidity and TSS. The analysis of the relationship between turbidity levels and total suspended solids (TSS) indicates that turbidity measurements can be used to estimate TSS. The data shows that turbidity can account for more than 70% of the variation in TSS when data from all 21 stations is considered. Similarly, turbidity can be used to estimate more than 80% of the variation in TSS to a distance of 30 m from shore. It is typically the case that the turbidity versus TSS relationship gets stronger further from shore, but the "typical" situation off most beaches is one of rapidly increasing depth. Here, there is a shallow shelf, and the offshore values for TSS are difficult to predict from turbidity alone as wave energy influences on TSS are not constant and will vary depending on wave height impinging in the reef, i.e. when seas are calm, no resuspended material is incorporated into the sample; however, when waves are large enough, some resuspended sediment is incorporated in the TSS sample. Therefore, it is reasonable to use turbidity as an indirect measure of TSS as long as it is taken into consideration that there is greater accuracy using this estimation within 30 m of shore due to the variable affect of wave energy on sediment resuspension.

3.4.3 Comparison with State Water Quality Standards

The marine waters in the Iroquois Point survey area are classified as open coastal in Hawaii's Water Quality Standards (HAR Chapter 11-54; HDOH, 2004). The State water quality criteria for the parameters monitored during this survey are given in Table 3-9. The criteria for temperature, salinity, DO and pH are based on deviations from ambient conditions, while the criteria for turbidity, nutrients (nitrogen and phosphorus), and chlorophyll α are based on comparisons to geometric mean values.

Table 3-9. Selected State of Hawaii water quality criteria for open coastal waters for both dry (upper value) and wet (lower value) seasons (HAR §11-54-05.2; HDOH, 2004)

Parameter	Geometric Mean value not to exceed this value	Value not to be exceeded more than 10% of the time	Value not to be exceeded more than 2% of the time
Nitrate+Nitrite (µg N/l)	3.50 *5.00*	10.00 *14.00*	20.00 *25.00*
Total Nitrogen (µg N/l)	110.00 *150.00*	180.00 *250.00*	250.00 *350.00*
Total Phosphorus (µg P/l)	16.00 *20.00*	30.00 *40.00*	45.00 *60.00*
Chlorophyll α (µg/l)	0.15 *0.30*	0.50 *0.90*	1.00 *1.75*
Turbidity (NTU)	0.20 *0.50*	0.50 *1.25*	1.00 *2.00*

Two values: upper, "dry" criteria apply when the open coastal waters receive less than three million gallons per day of freshwater discharge per shoreline mile; lower, "wet" (italicized) criteria apply when the open coastal waters receive more than three million gallons per day of freshwater discharge per shoreline mile.

Other "standards":

- pH units shall not deviate more than 0.5 units from a value of 8.1.
- Dissolved oxygen shall not decrease below 75% of saturation.
- Temperature shall not vary more than 1^{o}C from ambient conditions.
- Salinity shall not vary more than 10% from natural or seasonal changes.

Two sets of water quality criteria ("wet" and "dry") are specified for open coastal waters for turbidity, nutrients and chlorophyll α. Whether "wet" or "dry" criteria are used depends upon a volume freshwater discharge at the shoreline (see Table 3-9 footnotes for details). For the purposes of this analysis it is assumed that "dry" criteria apply as the survey area is not subject to extensive surface runoff or shallow groundwater discharges, although located adjacent to the Pearl Harbor entrance channel, there is opportunity for large volumes of brackish water to be injected into the nearshore waters with every ebb tide.

The Iroquois Point area has been subjected to decades of shoreline erosion and this is apparent in water quality conditions in nearshore waters, especially in regards to nutrients and particulates. Temperature and salinity values were generally quite constant and within the range to be expected in the coastal waters in Hawaii. The single exception was a low salinity value (31‰) on December 29, 2004 at Sta. F-50 during an ebbing tide that may be related to estuarine water flowing out of Pearl Harbor. Nutrient concentrations were also notably elevated at Sta. F-50 during this sampling event, with the exception of total phosphorus, and support the contention that the water sampled was from inside Pearl Harbor.

The DO saturation levels were always in compliance with the minimum saturation level of 75%, probably primarily as a result of the mixing processes generated by breaking wave action in the survey area and algal photosynthesis on the reef platform.

The pH levels were in compliance with the State's criterion that pH levels shall be within a range of 7.6 to 8.6 with one exception: a pH of 8.99 was recorded at Sta. D-50 on December 29. 2004. The reason for this high pH value is not apparent, although a dense growth of benthic algae in shallow water can, by photosynthesis and uptake of carbon dioxide in the water, drive the local pH up.

The geometric means for nitrate + nitrite concentration exceeded the State's criterion (3.5 µg N/l) at Sta. D-50 (3.8 µg N/l) and Sta. F-50 (5.5 µg N/l), while the geometric means at Sta. A-50 (1.9 µg N/l) and Sta. G (2.4 µg N/l) were below the criterion value. Both total nitrogen and total phosphorus geometric means exceeded the State's geometric mean criterion at all stations. Additionally, total nitrogen exceeded the State "not to exceed 10% of the time" criterion.

Chlorophyll α geometric mean concentrations at all three stations exceeded the geometric means for both "wet" and "dry" criteria in the water quality regulations. The high chlorophyll α concentrations in the survey area can be attributed to the continuing supply of nutrients associated with the shoreline erosion and periodic nutrient inputs from Pearl Harbor.

The geometric means for turbidity at all 3 stations exceeded all of the State criteria, even the "not to exceed 2% of the time" criterion. There are no State criteria for TSS in marine waters. The high particulate levels in the survey area are attributed to resuspended bottom sediments as a result of wave action, coupled with shoreline wave erosion of clay soil.

In summary, basic water quality parameters (temperature, salinity, DO saturation and pH) in the nearshore waters of Iroquois Point are in compliance with State water quality criteria. However, turbidity levels, chlorophyll α concentrations, and nutrients exceed their respective geometric mean criteria. Turbidity levels and chlorophyll α concentrations appeared to be influenced mainly by wave action and shoreline erosion. Nutrient levels exceeded the State's geometric mean and there was a tendency for all nutrients to increase from west to east indicating that inputs from Pearl Harbor influence nutrient concentrations in the project area. The water quality parameters which exceed State criteria neither pose a human health risk for swimmers or divers, nor do they result in any fish contamination.

3.5 Marine Biological Resources

3.5.1 Benthic Environment

The benthic environment was surveyed along three transects laid perpendicular to shore – Transect A, Transect D, and Transect F in Figure 3-12. These were located at either end of the project area (Transects A and F) and in the approximate middle (Transect D) between the outer two. Marine bottom characteristics were surveyed from the waterline out to approximately 50 m to 77 m (164 ft to 236 ft) from shore. Results are discussed below (from *AECOS*, 2007).

Transect A (West): At the west end of the survey area, along Transect A, the sand beach slopes steeply down to the shoreline. The submerged lands were surveyed out to about 73 m (240 ft) from the beach crest and are primarily sand with sparsely situated limestone outcrops which become more common and pronounced with distance from shore. The limestone outcrops gradually flatten to a fossilized reef platform with a thin covering of sand and little topographic relief. The area surveyed by Transect A experiences the highest wave energy of all transects surveyed which was further indicated by the large sand ripples out to about 64 m (210 ft) from the beach crest.

Transect D (Middle): Near the middle of the survey area, along Transect D, the submerged lands were surveyed out to about 77 m (253 ft) from the beach crest and are dominated by sand bottom with large (about 5 to 10 cm, 2 to 4 inch) coral cobbles. At about 65 m (213 ft) the sand bottom gives way to a flat fossilized reef platform with a thin covering of sand and little topographic relief. This continues out past the end of the 77 m (236 ft) transect. The waters of this transect were noted as exceptionally turbid with a milky orange coloration.

Transect F (East): At the Pearl Harbor end of the survey area, along Transect F, the submerged lands were surveyed out to about 54 m (177 ft) from the beach crest and are dominated by a honeycombed limestone bench with small ledges, vertical surfaces and overhangs with intermittent sand patches. The bottom topography gradually flattens to a fossilized reef platform with a thin covering of sand at 54 m (177 ft) which extends out past the end of the 65 m (213 ft) transect length. This site was visually assessed to have the lowest wave energy of the survey area.

3.5.2 Marine Biota

Marine flora and fauna encountered along Transect A (West), Transect D (Middle), and Transect F (East) are described below (from *AECOS*, 2007). Although this is not a comprehensive list of biota, common and representative species were likely encountered.

The marine flora and fauna survey revealed 81 species among the three transects; Transect A (24 species), Transect D (21 species), and Transect F (56 species). The dominant grouping was algae (43 species) with more than twice as many species as compared to either invertebrates (18 species) or fish species (18 species). Random sightings of a ray and a Hawaiian monk seal within the project area are not included in these tallies.

Transect A (West): Of the 24 species recorded for the western-most transect, algae were the dominant grouping with 22 species, all of which were found growing on low profile limestone outcrops. Roughly equal numbers of red (7), green (7), and brown (6) algal species were present. Macro-invertebrate species encountered were limited to a sea cucumber and a cone shell. No fish species were recorded along this transect.

Transect D (Middle): Of the 21 species recorded along Transect D, there were 12 alga, 6 invertebrate, and 3 fish species. Most notable was the complete lack of green algae and the nearly complete lack of brown algae, with a single brown alga recorded from this transect. *Gracilaria coronopifolia* (limu manauea) and *Grateloupia felicina* (limu huluhuluwaena) are 2 edible red algae (Abbott, 1996) encountered. Invertebrates were represented by a single coral species (*Pocillopora damicornis*) and 4 echinoderms (3 sea urchins and 1 brittle starfish). A single grouping of small (fist-size) *Pocillopora damicornis* coral colonies was recorded at the most seaward point along this transect. Of the 3 fish species encountered along this transect only the Hawaiian dascyllus (*Dascyllus albisella*) has a strong site affiliation with a restricted home range, while the milkfish (*Chanos chanos*) and the leather jacket (*Scomberoides lysan*) are mobile fish that could be expected to traverse the entire project area.

Transect F (East): The eastern-most transect has the greatest number of species recorded (56). Algae make up the majority of species recorded with a total of 28. The red algae (17) were the most diverse group, followed by green algae (7), and brown algae (4). The overall dominant species in this area is the introduced red alga, *Gracilaria salicornia* (Figure 3-13). Diversity appeared to increase with distance from shore with *G. salicornia* becoming mixed with other species. In addition to having the greatest number of alga species, the eastern-most transect also had the greatest number of invertebrate (13) and fish species (15).

The honeycombed limestone network of this site created habitat for a great number of encrusting creatures (sponges most noticeably) as well as hiding places for many other invertebrates and fishes. Invertebrates were represented by the following phyla; Cnidaria (corals), Porifera (sponges), Ascidiacae (sea squirts), Mollusca (mollusks), Anellida (worms), Arthropoda (crabs), and Echinodermata (sea urchins and star fish). Several of the reef fish species encountered are endemic to the Hawaiian Islands; the milletseed butterflyfish (*Chaetodon miliaris*), Hawaiian sergeant (*Abudefduf abdominalis*), Hawaiian dascyllus (*Dascyllus albisella*), belted wrasse (*Stethojulis balteata*), and saddle wrasse (*Thalassoma duperrey*).

Only 2 species of coral were encountered: *Pocillopora damicornis* along Transect D, and *Pocillopora meandrina* along Transect F. Of the 10 coral colonies recorded, 3 are attached to natural substrate while the remaining colonies were attached to metal debris.

A Hawaiian monk seal (*Monachus schauinslandi*) with a pink tag was sighted east of Keahi Point on April 26, 2005 at the shoreline between Transects D and E. Also, a ray of indeterminate species was sighted on August 15, 2005 swimming near the water surface between Transects B and C. There were 76 documented monk seal sightings at Iroquois Point from 1993 through 2009 (Wurth, 2008; 2010). At least sixteen of the reported sightings can be attributed to three known individuals—two adult male seals (ID numbers RK15 and T757) and one adult female seal (ID number RS00).

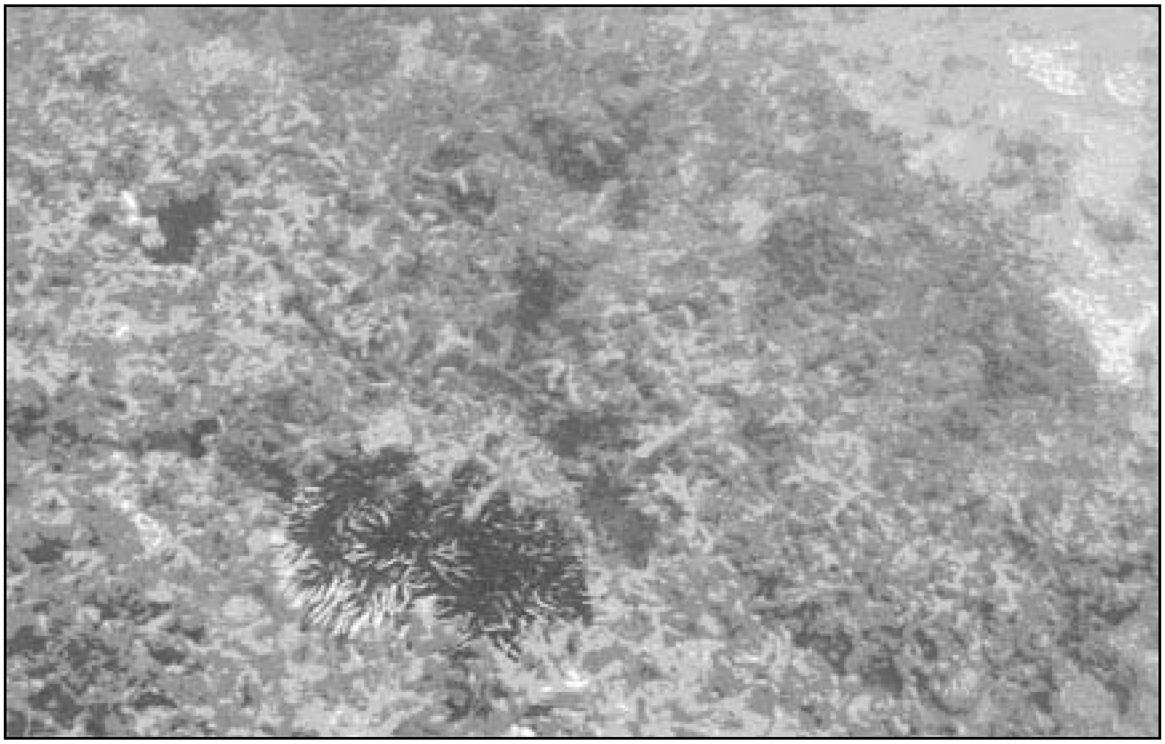

Figure 3-13. *Gracilaria salicornia* dominates the benthos along Transect F near the Pearl Harbor entrance channel.
(*Tripneustes gratilla*, the collector urchin, can be seen in the foreground.)

3.5.3 Threatened and Endangered Species

The project site has not been designated as critical habitat by the Federal Government or the State of Hawaii for endangered species. However, Endangered Species Act (ESA) listed species have been sighted within the proposed project area, including the endangered Hawaiian monk seal (*Monachus schauinslandi*), the endangered hawksbill sea turtle (*Eretmochelys imbricata*), and the threatened green sea turtle (*Chelonia mydas*).

The Hawaiian monk seal is a federally listed endangered species with approximately 1,200 individuals remaining and endemic to the Hawaiian Islands, and is the only pinniped found in Hawaii. A single individual monk seal was sighted during environmental field surveys resting on the beach within the project area. Hawaiian monk seals are known to use Pearl Harbor and Iroquois Point, with a total of 76 documented seal sightings having been reported at Iroquois Point from 1993 through 2009. However, the project area is not considered critical habitat for this species (50 CFR 226.201).

Although sea turtles were not sighted during the field investigations for this EA, green sea turtle sightings are common in the nearshore waters around the Pearl Harbor entrance channel, while hawksbill turtle sightings are very rare. Of the many benthic marine algae and plants considered as food resources of the green sea turtle, the project area supports growth of *Pterocladia* sp., *Acanthophora spicifera*, and *Hypnea musciformis*. These species are in low quantities over most of the project area, and are likely not a substantial foraging resource for green sea turtles. The

Pearl Harbor end of the project area has the richest algal and sponge assemblage and is more likely to be frequented by green sea turtles.

3.5.4 Essential Fish Habitat

The waters out to 200 miles around the Hawaiian Islands are under the jurisdiction of the Western Pacific Regional Fishery Management Council (WPRFMC). The WPRFMC has approved a Fisheries Management Plan (FMP) for Hawaii that designates all the ocean waters surrounding Oahu, from the shore to depths of over 100 feet, including the area that would be affected by the proposed project, as "Essential Fish Habitat" (EFH). The WPRFMC has also identified "Habitat Areas of Particular Concern" (HAPC). The area that would be affected by the proposed project is not within a HAPC.

3.6 Sand Recovery Site

The sand recovery site is located alongside the Pearl Harbor entrance channel, between an old abandoned wharf and the Iroquois Lagoon entrance at the far eastern end of the housing area. Sand eroded from the ocean side beach is transported toward the Pearl Harbor channel and around Hammer Point into the channel where it is deposited. The steady accretion of sand at this location can be seen on Figure 3-6 (Transect -1). The sand slopes at about 1V:2H down to a depth of about 40 feet. The slope is composed of beach quality sand, and at the 40-foot depth it transitions to finer harbor bottom sediment and coral rubble. This area is very dynamic, due to the continual movement and accretion of sand, thus it does not provide habitat for corals or bottom dwelling flora and fauna. In addition, in 2007 the Navy performed maintenance dredging in this area, removing approximately 22,000 cy of beach quality sand. This sand has been stockpiled on the nearby shoreline for possible future use in the proposed beach enhancement and stabilization project. Fishes and turtles likely transit the area, traveling between Pearl Harbor and coastal areas outside the harbor. The primary use of the Pearl Harbor entrance by green sea turtles occurs near the outer portions of the entrance channel (approximately 1 mile seaward of the project site) at water depths between 20 and 60 feet (PACDIV, 1999).

Water quality at this site is heavily influenced by natural and man-made inputs into Pearl Harbor. Temperature and salinity levels are low, indicative of the large natural freshwater inputs to the harbor. Nutrient (nitrogen and phosphorus) and phytoplankton levels are elevated, compared to the rest of the project area shoreline, while turbidity and suspended sediment levels are similar to the rest of the project area shoreline; however, as discussed earlier, turbidity exceeds the State Water Quality Standards maximum criteria.

3.7 Existing Land Uses

The project site is within the Iroquois Point housing area, on the central south shore of the island of Oahu, immediately west of the entrance to Pearl Harbor. Figure 1-2 shows the area and the extent of infrastructure at the site. The housing area was constructed around 1960, on 370 acres of what was formerly a portion of the Army's Fort Weaver, which was established in 1924. Slab-on-grade houses were built, including 41 homes along the ocean side of Edgewater Drive and Iroquois Avenue. There are a total of 1,110 buildings with 1,450 homes. Erosion has resulted in the loss of 16 of the shoreline homes. The project area extends along 4,200 feet of shoreline, from the western boundary of the housing area at the Puuloa rifle range east along

Keahi Point and to the wastewater pumping station at Hammer Point (see Figure 2-2). The project site is bordered on all sides by military reservation land, and the offshore waters are part of the Naval Defense Sea Area.

In 2003, as part of the Navy's enhanced leasing program, the Iroquois Point housing area was leased to Ford Island Housing, LLC (a subsidiary of Ford Island Properties, a joint venture between Hunt Building Company, Ltd. and Fluor Federal Services, LLC) to maintain and operate for 65 years. The lease has recently been extended to 99 years. Ford Island Housing is proposing to construct significant upgrades to the homes and area infrastructure, including improved beach recreation facilities.

3.8 Beach and Ocean Recreation

Beach and ocean recreation at the project site consists primarily of sunbathing and occasional swimming, kayaking, surfing, and shoreline fishing. The housing area is open to the public, as is the beach, and access is recorded at a security gate. The nearshore is shallow, generally turbid, and has a rocky bottom. Although breaking waves are frequent on the shallow fringing reef, they are generally not well-formed or organized, and provide relatively limited board surfing opportunities, particularly nearshore within the immediate project area. A small beach park with parking and restrooms is located adjacent to Puuloa Rifle Range, at the west end of the project site.

Although the Iroquois Point housing area is a private, gated community located adjacent to the Naval Defensive Sea area, Ford Island Housing has worked with the Navy to be able to provide for public access and use of the beach from sunrise to sunset. Everywhere housing area residents can go the public can go also. Access has been facilitated by providing public parking adjacent to the beach, and the public may use the beach restrooms.

3.9 Historical and Cultural Resources

This section describes the existing cultural resources that are located within the area of potential effect (APE). Cultural resources include archaeological sites, including prehistoric (pre-contact) and historic and military era sites; traditional cultural properties; and architectural resources (buildings, structures, and historic districts).

In accordance with Section 106 of the National Historic Preservation Act (NHPA), the Navy is required to consider the effects of this undertaking on historic properties, which constitute resources that are listed or eligible for listing on the National Register of Historic Places. Properties are further described in Section 3.9.1.

3.9.1 Site Investigations

Archaeological surveys of Iroquois Point conducted between 2001 and 2007 identified several sites in and near the project area (Roberts and Roberts, 2001; Magnussen, et al., 2002; Carson, 2007). These investigations documented scattered subsurface cultural deposits containing discarded tools and ornaments, food debris, charcoal, and small pits, as well as historic and military structures. Nine sites have been identified in the vicinity of the proposed project area, but one of the sub-surface sites, 3703, is located outside of the proposed project area. The remaining eight are listed in Table 3-10.

Table 3-10. Historic Properties Identified in the Project Area

Site 50-80-13-	Description	NRHP Criteria	Recommendations
5874	Pre-contact subsurface midden deposit	D	Complete
5875	Late pre-Contact and post-Contact subsurface midden/ cultural deposit	D	Complete, but very low possibility of isolated burial feature in northeast portion of site
5877	remnants of concrete wharf	D	Complete
5878	Post-Contact mapping survey marker	Not eligible	No further work
6905	Post-Contact subsurface cultural deposit	D	Complete
6906	Remnants of military gun mount	A, D	Complete
6907	Late pre-Contact and post-Contact subsurface cultural deposit	D	Complete, but very low possibility of isolated burial feature
6908	Post-Contact subsurface cultural deposit	D	Complete

Site investigations for the proposed project included research of existing information pertinent to the project site, a surface field survey, and subsurface testing to prepare an archaeological inventory survey of the land and shallow nearshore water area. This work was conducted by International Archaeological Research Institute, Inc. (Carson, 2007). The surface field survey included pedestrian transects and extensive subsurface testing. Transects were spaced no more than about 13 feet apart, covering nearly 12 acres of on-land and shallow water area, and subsurface testing involved 57 backhoe trenches, generally 25 to 40 feet apart, excavated to depths of at least 10 cm below the water table in each location. The following site discussion is taken from the report.

The Ewa Plain comprises the widespread, nearly flat coastal plain west of Pearl Harbor, and it shares its name with one of the traditional districts of Oahu. The Ewa Plain and Pearl Harbor (also called Puuloa) present two highly visible and obvious landscape features, and they are both acknowledged as cultural reference points for a variety of reasons and with numerous associations, some of which have changed over time. The project area is within this general context, and it also relates to three specific traditional places of Kaupea, Keahi, and Pakule (also known as Hammer Point). The major areas of traditional and historical land uses in and around the project area are illustrated on Figure 3-14, and included food production (primarily collection of shellfish, nearshore fishing, and use of fishponds), a salt production plant, and a small village. Precise time periods are difficult to specify for the various activities. Use of the fishpond at Pakule must have been prior to dredging of Pearl Harbor in 1909, but its date of construction is unknown. The salt works plant in Puuloa was created in the early to middle 1800s, prior to 1849. The coastal village or hamlet of Puuloa supported a small population in the 1820s through 1870s, but its antiquity is unclear. Various U.S. military uses of the area occurred between 1902 and the 1950s, and the area has been used for housing since then.

Site 5877 comprises remnants of a post-Contact wharf from as early as A.D. 1888 but perhaps a decade or so earlier, and it served as an active wharf until 1950 (Magnuson, et al., 2002, p. 58-62). Site 5878 is interpreted as a survey marker and consists of a metal pyramid formed of four bars, emplaced in a rectangular concrete slab. Technically this feature is within the geographic boundary of the Pearl Harbor National Historic Landmark, but it does not contribute to the defined significance of the landmark, and does not constitute a significant cultural resource, thus is not considered to be an archaeological site.

Site 6906 is presently in the water about 30 feet from the present shoreline, and consists of a 20-foot diameter circular concrete foundation, with an iron rail around its perimeter and a filled iron circle at its center. The feature at Site 6906 is the remnant of a mount for a 155-mm gun, one of four such mounts constructed around 1932 for the defense of the Fort Weaver Army complex. The gun has been removed, presumably in the 1950s after decommissioning of Fort Weaver, and the mount is tilted indicating some displacement from its original position. Site 6906 is within the geographic boundary of the Pearl Harbor National Historic Landmark, and potentially it may contribute to the defined significance of the landmark as an important place in world history. Specifically, the site was part of the coastal defense system of Fort Weaver, among the targets of the Japanese attack at Pearl Harbor and other U.S. military installations on the island of Oahu at the beginning of WW II in the Pacific.

Sites 5875, 6905, 6907, and 6908 are buried cultural deposits of pre-Contact and post-Contact age, containing scattered charcoal, non-human animal remains, small pits and post molds, and remnants of pebble pavings. Sites 3703 and 5874 are buried deposits containing general habitation debris, such as discarded tools and ornaments, food debris, charcoal, and small pits (Magnuson, et al., 2002). Remnants of former house structures may be evident in pebble and coral pavings, postmolds, and other features. Post-Contact materials such as metal and glass indicate 19th and 20th century use in many cases, but earlier site use is attested by traditional stone tools and also by radiocarbon dates as early as the A.D. 1300s (Magnuson, et al., 2002; NavFac Pacific, 2004).

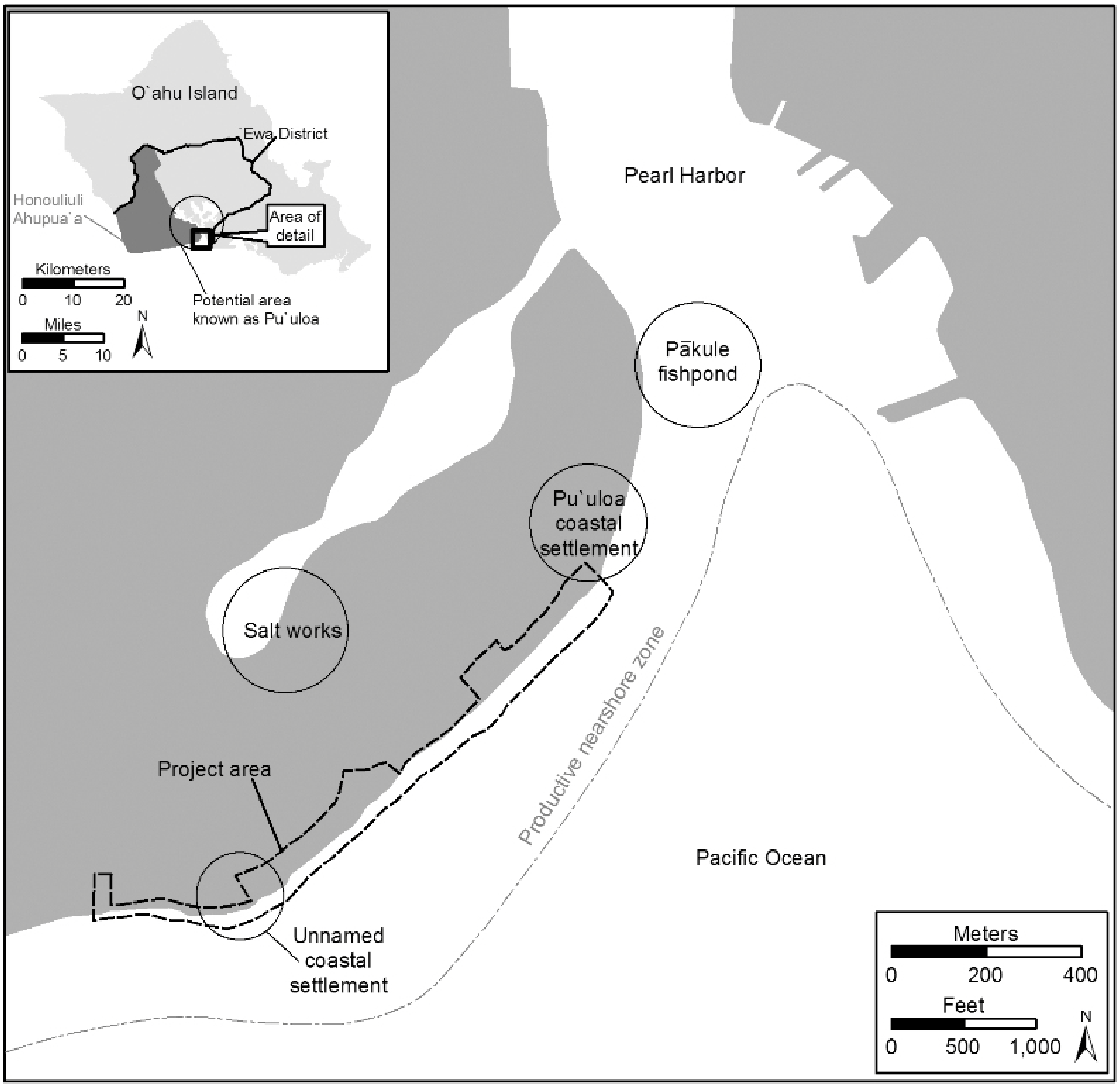

Figure 3-14. Approximate areas of traditional and historical land uses in relation to the project area (from Carson, 2007).

3.10 Air and Noise Quality

The project site is in a residential area along the shoreline at Iroquois Point. The air quality is therefore excellent, as is typical of shoreline areas in Hawaii. The noise environment is typical of a residential neighborhood. The exception to the generally quiet environment is the frequent noise of planes landing at the Hickam and Honolulu airports.

3.11 Hazardous and Regulated Materials

Defense Environmental Restoration Program (DERP)

In 1986, Congress created the DERP. The DERP addresses the identification and cleanup of hazardous substances and military munitions remaining from past activities at DoD installations and formerly used defense sites (FUDS) in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Within DERP, DoD under Environmental Restoration (ER) created two program categories, the Installation Restoration Program (IRP), and the Military Munitions Response Program (MMRP).

MMRP

In September 2001, DoD established the MMRP to address hazards associated with MEC within areas no longer used for operational range activities. These former range training areas are called munitions response areas (MRAs). MRAs often contain one or more discrete munitions response sites (MRSs). In December 2001, Congress passed the National Defense Authorization Act (NDAA). This Act required DoD to develop an initial inventory of areas not located within operational ranges (i.e., active or inactive ranges) that are known or suspected to contain MEC. As part of this inventory process, DoD is coordinating with HDOH to conduct preliminary assessments and site inspections of Navy properties.

In 2008, suspected munitions shapes were discovered approximately 1,500 ft and further offshore by a Navy diver. Subsequent Navy historical records searches identified the shoreline batteries or historical disposal practices as potential sources. The U.S. Army constructed forts and artillery batteries at the mouth of Pearl Harbor, Oahu, Hawaii, and along the southern shores of Oahu beginning in the early twentieth century. These fortifications were constructed for defense purposes and had the capability to fire ordnance, ranging in size from small arms up to 16-in projectiles, beyond the shores of Oahu in the event of enemy attack. Numerous training activities at the forts and artillery batteries conducted up until about 1948 involved firing into waters of the south shore in the vicinity of Pearl Harbor.

In 2009, the Navy added the ER MMRP site UXO 000002 FT Battery Water Range PH to the inventory and has called the site “Underwater Munitions Defensive Sea Area (NDSA) Pearl Harbor”. Figure 3-15 shows the location of the site currently under investigation.

In September 2010, the Navy completed the Munitions Response Program (MRP) Preliminary Assessment – Underwater Munitions, NDSA Pearl Harbor, Hawaii and recommended further inspection with a Site Inspection (SI). In accordance with 32 CFR Part 179 Munitions Response Site Prioritization Protocol, the site was assessed to have priority “3” rank. The rank is used to ensure higher priority and risk sites are sequenced with funding first. The 3 rank is the highest priority for MRP sites in the Navy’s Pearl Harbor inventory.

In September 2010, the SI was initiated and approximately 45% of the NDSA was completed before sea conditions, weather and equipment limitations halted the operation. The fieldwork for the remaining areas and assessment of potential anomalies is planned for 2012.

The Navy and HDOH have agreed that outside of the Pearl Harbor entrance does not fall under the Pearl Harbor Naval Complex Federal Facilities Agreement (FFA) and has designated the site as Non-National Priorities List (NPL). EPA Region IX is kept informed in accordance with 32 CFR Part 179 and participates in regulatory briefs.

The DoD and State Memorandum of Agreement (DSMOA) established a program where HDOH staff work closely with DoD representatives to discuss and facilitate environmental restoration and clean-up work on Oahu. Under the DSMOA program, DoH maintains regulatory oversight of environmental restoration efforts undertaken for this site to ensure compliance with applicable local and federal laws and regulations.

In addition, to facilitate hazardous waste site restoration, the DoD has established restoration advisory boards (RABs). RABs are established to improve overall communications between all interested parties and expedite hazardous waste site cleanup. RABs act as focal points for information exchange between DoD and the local community. RAB members typically include DoD and regulatory agency representatives and community members and meet to discuss ongoing environmental studies and cleanup activities. RAB members in turn serve as liaisons to the overall local community to address issues of concern. RAB meetings are open to the general public and the community is actively encouraged to participate.

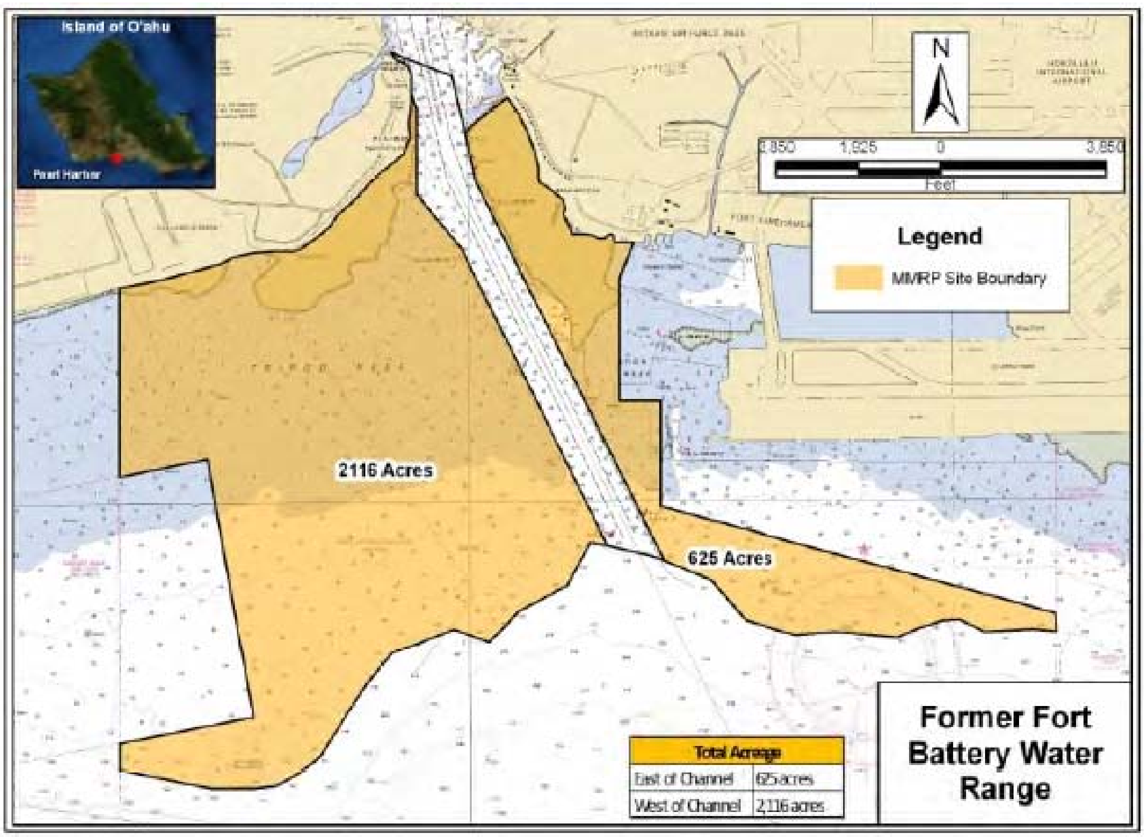

Figure 3-15. Underwater Munitions Navy Defensive Sea Area Pearl Harbor MMRP SI Site

3.12 Recreational Fishing

As a condition of the Department of the Army permits, fishing in the project area will be restricted to two areas of the property at the eastern and western ends, away from the rock groins in order to prevent over-fishing and adverse impacts to the expected increased fish population. To promote sustainable fisheries activities in the project area, signs will be installed near the shore at the two fishing areas and at five additional shoreline access locations

Warning signs are posted at various locations around Pearl Harbor stating that fish and shellfish are contaminated and should not be eaten. The Agency for Toxic Substances and Disease Registry (2005) published a public health assessment for the Pearl Harbor Naval Complex. The assessment specifically addressed fish and shellfish consumption as follows:

> *"Are fish and crabs collected from Pearl Harbor safe to eat?* ATSDR reviewed and evaluated the levels of contaminants measured in samples of fish and crabs collected from Pearl Harbor. The Hawaii Department of Health issued an advisory in 1998, cautioning against the consumption of fish and crabs collected from Pearl Harbor. ATSDR evaluated the level of contaminants found in the fish and crab samples and concluded that the polychlorinated biphenyl (PCB) concentrations were elevated. Therefore, ATSDR supports the Hawaii Department of Health advisory to avoid eating fish and shellfish from Pearl Harbor."

While fishing is allowed at the ends of the project site as outlined above, the Navy cannot assure users that fish and shellfish taken from these sites are safe to eat.

4.0 ENVIRONMENTAL CONSEQUENCES

This section evaluates the possible environmental consequences of the proposed action and alternatives. The environmental resources considered in the assessment include the following: 1) shoreline and beach; 2) water quality; 3) marine biology; 4) threatened and endangered species; 5) air and noise quality; 6) historical and cultural resources; 7) human infrastructure; and 8) visual aesthetics.

Environmental consequences can be categorized into long-term impacts, and short-term construction impacts. The possible environmental consequences of the proposed action and the alternatives on each of these environmental resources are discussed below, and further, a ranking is assigned to designate the relative degree of impacts. The rankings are assigned as follows:

Ranking	Description
-2	Significant negative impact
-1	Minor negative impact
0	No net impact
+1	Minor positive impact
+2	Significant positive impact

Where possible the rankings are based on a comparison of quantifiable features, e.g. project footprint, volume of material, expected maintenance, first cost of construction and 50-year cost. In some instances the ranking is more subjective, e.g. visual aesthetics such as a rock revetment versus a sand beach. In the closing summary part of this section, the rankings are tabulated to allow a comparative assessment of the possible environmental consequences of the proposed action and alternatives.

The Affected Environment sections in Section 3 corresponding to the Environmental Consequences sections which follow are shown in parentheses following the Section 4 section titles below.

4.1 Shoreline and Beach (*Section 3.2*)

Chronic erosion and shoreline recession, coupled with backshore flooding due to wave overtopping of the low-lying shore, has resulted in the abandonment and demolition of 16 shoreline homes to-date. Several more homes are threatened by shoreline recession, and emergency shore protection for these homes was constructed in February 2004.

Analysis of aerial photographs and other information shows that the beach in the project area receded as much as 130 feet between 1928 and 1961, and an additional 150 feet between 1961 and 2003. A project site topographic survey was completed in January 2004, and updated in June 2008. The survey shows that along the project reach the shoreline typically receded 30 to 50 feet, and up to 70 feet at one location, over the 4.5-year period. A number of measures have been undertaken to try and reduce the erosion and protect the houses. Rocks placed along the shore at Keahi Point, sand berms, wooden walls, and CMU walls have been constructed behind the beach crest to prevent flooding. These measures proved to be ineffective at curtailing the ongoing erosion. Scattered rocks, concrete rubble, and steel debris on the shore are all that remain of these efforts. These rocks and debris along the shoreline at Keahi Point can also be seen previously in Figure 1-3. Sixteen houses were demolished and an old concrete sewer pipe lies exposed and broken on the beach. Portions of the shoreline are therefore presently in degraded condition, particularly in the vicinity of Keahi Point.

The proposed project is designed to nourish and stabilize the sandy beach along the shoreline with a system of 9 T-head groins and sand fill. Alternatives include no action, a 5 T-head groin system, beach nourishment without stabilizing structures, and a rock revetment. All alternatives will include removal of scattered boulders, concrete and steel debris, abandoned sewer pipe, and other rubble from the beach and nearshore waters. Possible environmental consequences of the preferred action and alternatives are discussed below.

1. No Action – The consequences of no action include the continued erosion of the beach and shoreline and the purpose and need for the proposed action would not be accomplished. Based on the erosion trends from 1990 to 2003, the entire project shoreline is projected to recede between 22 and 146 feet by the year 2033. This could result in abandoning all homes makai of Edgewater Drive and Iroquois Avenue, loss of portions of the road along Edgewater Drive and Iroquois Avenue, and possibly loss of some housing mauka of Iroquois Avenue. It is estimated that under a No Action alternative 30 more homes may be lost within the next 25 years. Dirt fill would continue to be exposed and released into the nearshore water. If all threatened shoreline structures are continually removed, and the shoreline continually cleared of erosion debris, this alternative would maintain the sand beach shoreline, with its recreational and aesthetic value, until all the sand is gone and only reef rock, coral rubble and earth fill remains. This alternative is considered to have a minor negative impact because a sand beach could be maintained; however, it would likely be in a degraded, eroded state with extensive debris and dirt exposure. Existing water quality issues would continue and sand would continue to migrate towards the Pearl Harbor channel.
   Ranking: -1 (minor negative impact)

2. Beach Nourishment with 9 T-head Groins – This proposed action consists of nourishing the beach with 80,000 cubic yards of sand to build a beach approximately 50 feet wide (horizontal crest width), and stabilizing the beach fill with 9 T-head groins. This action would reduce the ongoing beach erosion, and would produce and maintain a relatively wide sandy recreational beach. One possible impact that is typically of concern when groins are placed on a beach is the interruption of longshore transport, resulting downdrift erosion. The potential for groins or other beach stabilization structures to affect downstream shorelines where there is unidirectional longshore transport is well documented in coastal engineering literature (see Bodge, 2003; Bodge, 1998; Silvester and Hsu, 1993; and USACE, 1984). Placing a structure on the shore to block the longshore transport of sand results in sand accumulation on the updrift side of the structure, and erosion of the downdrift side which is deprived of sand. However, in the case of the proposed project, adverse downdrift impacts would not occur for the following reasons:

- Numerical modeling and aerial photographic erosion analysis indicate that the predominant longshore transport is to the east toward the Pearl Harbor entrance channel, and the project is located at the terminus of the littoral cell. Much of the sand being transported is presently carried into the channel and lost to the system.
- The erosion problem begins at Keahi Point at the west end of the housing area, where the shoreline orientation changes significantly, and the prevailing wave approach direction becomes more oblique to the shore and results in the prevailing easterly longshore current and transport.
- The eastern end of the project site as it approaches the Pearl Harbor entrance channel is an area of decelerating longshore transport resulting from channel wave refraction effects.
- The shoreline west of the project site and the housing area has been very stable historically, and there is little if any evidence of significant longshore transport from the project site toward the west. Stabilizing the housing area shoreline, therefore, is not expected to affect the beach to the west as it does not receive sand transported from the project site.
- The cells between the groins would be filled with sand to their projected stable design configuration as part of the project. The groins produce individual beach cells that are sheltered from the ambient littoral drift, which would continue offshore of the groin heads, not affecting the individual beach cells. The sand, therefore, would not be subject to longshore drift and would stay in the individual cells. Sand would also be placed on the outboard side of the eastern and western most groins to nourish these areas.

The groins and sand fill would stabilize Keahi Point and prevent erosion from progressing westward. To the east, the project site is bounded by the Pearl Harbor entrance channel and the accreted shoreline along the channel landward of Hammer Point. This project would reduce the amount of sand deposited in the channel and accreted along the channel bank. To mitigate any possible end effects of the bounding groins at either end of the project, the beach on the outside of these groins would also be nourished and monitored. This action is considered to have a significant positive impact on the beach and shoreline because it would reduce the erosion and shoreline recession, and result in the creation of a stable recreational beach.
Ranking: +2 (significant positive impact)

3. Beach Nourishment with 5 T-head Groins – This alternative consists of nourishing the beach with 128,000 cubic yards of sand to build a beach 50 feet wide, and stabilizing this beach fill with 5 longer T-head groins. The discussion of impacts is as presented above for the 9 T-head action. This action is considered to have a significant positive impact on the beach and shoreline because it would reduce the shoreline erosion, and result in the creation of a stable, wide recreational beach.
Ranking: +2 (significant positive impact)

4. Beach Nourishment – This alternative consists of nourishing the beach with 136,000 cubic yards of sand without the use of retaining structures. Monitoring data of numerous beach nourishment projects nationwide has indicated that erosion rates typically increase dramatically in areas of new sand fill placement. Generally, nourishment projects lose one half of the sand nourishment volume in 3 years. This alternative is considered to have a minor positive impact because it would result in an improved beach for a relatively short period and the existence of this beach over the long-term would depend on continued nourishment.
   Ranking: +1 (minor positive impact)

5. Rock Revetment – This alternative consists of building a rock revetment at the location of the current beach berm. On shorelines suffering chronic erosion such as Iroquois Point, the revetment would fix the shoreline position and protect the homes behind it, but would likely result in the loss of the recreational beach area. This alternative is considered to have a significant negative impact on the shoreline and beach because it will eventually lead to loss of the beach.
   Ranking: -2 (significant negative impact)

4.2 Marine Water Quality (*Section 3.4*)

Survey results have shown that the basic water quality parameters of temperature, salinity, DO saturation and pH in the nearshore waters of Iroquois Point are in compliance with State water quality criteria. However, turbidity levels, chlorophyll α concentrations, and nutrients were not in compliance. Turbidity levels and chlorophyll α concentrations appeared to be influenced mainly by wave action and shoreline erosion. Nutrient levels exceeded the State's geometric mean for compliance and there was a tendency for all nutrients to increase from west to east indicating that inputs from Pearl Harbor influence nutrient concentrations in the survey area.

The highest turbidity levels occurred near the middle of the project area, where a turbid plume was typically visible coming from the shoreline. This is caused by erosion of the dirt fill landward of the beach. The proposed project is designed to stop the shoreline erosion, build the sand beach seaward, and reduce wave energy at the shore. All but the No Action alternative would reduce this continual source of turbidity in the nearshore waters, resulting in a long-term, general improvement in water quality in the area. A possible significant negative impact could result from the beach nourishment alternative, if sand fill continuously is washed from the beach onto the surrounding reef flat, possibly increasing turbidity in the nearshore waters. The groin structures are designed to prevent this from occurring.

There is potential for short-term impacts on the water quality due to possible increases in turbidity and suspended solids in the water during the construction phase. Plumes of increased turbidity and sediment plumes from construction in shallow nearshore waters should be contained by the use of silt curtains. Sand would only be placed following construction of the T-head groins. This would minimize turbidity by reducing wave energy at the beach and allowing more effective containment with silt curtains. The temporary increases in turbidity and suspended sediments as a result of construction activities would cease once the project is complete. Water quality monitoring would be conducted during the construction period to ensure that water quality standards are not exceeded outside of the construction area.

Best Management Practices (BMPs) for construction in coastal waters would be employed, such as daily inspection of equipment for conditions that could cause spills or leaks; cleaning of equipment prior to deployment near the water; proper location of storage, refueling, and servicing sites; implementation of adequate spill response, storm weather preparation plans, and the use of silt curtains to minimize potential impacts.

Possible long-term impacts of the proposed action and alternatives on water quality are discussed below.

1. No Action – The consequences of no action include the continued erosion of the beach and shoreline. Dirt fill would continue to be exposed and released into the nearshore water. Erosion of this dirt fill regularly results in a brown turbid plume emanating from shore. This alternative is therefore considered to have a significant major impact on water quality because it would result in continual release of dirt fill into the water.
   Ranking: -2 (significant negative impact).

2. Beach Nourishment with 9 T-head Groins – This action would reduce the ongoing beach erosion and the release of dirt fill into the water, resulting in long-term improvement in water quality. The proposed action would therefore have a significant positive impact on water quality.
   Ranking: +2 (significant positive impact).

3. Beach Nourishment with 5 T-head Groins – This action would reduce the ongoing beach erosion and the release of dirt fill into the water, resulting in long-term improvement in water quality. This alternative will therefore have a significant positive impact on water quality.
   Ranking: +2 (significant positive impact).

4. Beach Nourishment – This alternative consists of nourishing the beach with 136,000 cubic yards of sand without the use of retaining structures. Monitoring data of numerous beach nourishment projects nationwide has indicated that generally, nourishment projects lose one half of the sand nourishment volume in 3 years. This alternative is considered to have no net impact, because although it would reduce the release of dirt fill into the water, the continual renourishment with sand may result in increased turbidity in the nearshore waters.
   Ranking: 0 (no net impact)

5. Rock Revetment – This action would reduce the ongoing shoreline recession and the release of dirt fill into the water, resulting in long-term improvement in water quality. This alternative would therefore have a significant positive impact on water quality.
   Ranking: +2 (significant positive impact).

4.3 Marine Biological Resources (*Section 3.5*)

The shallow subtidal zone of Iroquois Point is marginal fish habitat, due primarily to low habitat complexity and sand scour. Boulders and sand fill would bury a portion of the existing subtidal environment, which is primarily low relief habitat: sand, rubble and consolidated limestone reef. The footprint of the boulder groins and sand fill below mean lower low water would be approximately 4.6 acres (1.9 ha). It should be noted that much of the footprint area is relatively new sea bottom created by the erosion and recession of the shore, and thus does not have established long term benthic flora and fauna. It is also an area of active sand movement, which results in scour of and stress on benthic organisms. Placement of boulders and sand would result in the temporary loss of some benthic organisms (fish foraging resources) including: algae, crustaceans, sponges, and other invertebrates. Benthic invertebrates would repopulate from surrounding habitat after construction is complete and sessile organisms would colonize new exposed hard surfaces.

A short-term reduction in fish habitat would occur during project construction. Adult and juvenile fishes are mobile and are expected to avoid the area during construction activities. However, some adult fish such as eels could be buried. There is potential for demersal fish eggs to be buried; however, new hard substrata created would provide greater surface area for these species to lay eggs in the future. No rare or endangered fish species would be lost in this already disturbed environment. Placement of boulders in the nearshore area may bury some coral colonies.

The shoreline stabilization project at Iroquois Point would create new reef fish habitat in the form of boulder groins and sand fill. Approximately 0.4 acres of intertidal (between mhhw and mllw) boulder habitat and 0.7 acres of shallow subtidal (below mllw) boulder habitat would be created. Boulder groins would provide bare, stable surfaces for recruitment of corals, algae and other invertebrates. The boulder groins are porous, permeable structures, with approximately 37 percent interstitial void space between boulders within the envelope of the groins. Approximately 86,000 cubic feet of interstitial space between the stones below mllw would be created. The interstitial spaces found amongst placed boulders would provide additional habitat for cryptic benthic (crabs, shrimps, worms, etc.) and sessile organisms (sponges and tunicates) which would provide additional foraging resources for fishes. Areas of greater reef habitat complexity generally host greater species diversity (Rogers, 1990), which has also been observed at Iroquois Point (*AECOS*, 2007b).

Approximately 1.7 acres of intertidal sand habitat and 2.9 acres of subtidal sand habitat would be created. Additional sand would provide additional habitat for infauna such as small worms, crustaceans and echinoderms (Randall, 2002). It is likely that these would be foraged by goatfishes (Mullidae) and other bottom feeding fishes. The proportion of infauna eaten by fishes that feed over sand is not known for the area. Most infaunal organisms are in the 0.02 to 0.4 in (0.5 mm to 1 cm) size range. The time it would take for infauna to recover is unknown, but is anticipated to be rapid due to the small size and rapid regeneration time of infauna.

Obligate reef dwellers are often limited by the availability of suitable shelter, especially juveniles (Pickering and Whitmarsh, 1996). Reef fishes prefer reef holes and crevices commensurate with the size of the fish, smaller fishes preferring smaller crevices. Topographically complex reefs have significantly more fish associated with them than simple structure reefs (Clark and Edwards, 1994). The boulder groin structure and associated interstitial spaces would provide habitat for many fish, invertebrate, and algal taxa (fish foraging resources). Fish and invertebrate densities within the project area would likely increase after initial work is complete.

An increase in available sand bottom would provide additional foraging for fishes such as carnivorous goatfishes, spotted eagle rays, and jacks. Also, additional sand shelter would be provided to wrasses, many of which bury themselves in the sand to rest and to escape predators (Breder, 1952).

The basalt boulders that would be used for groin construction are not ideal for coral larvae settlement; however, basalt boulders are used by corals as observed at other locations in Hawaii (Hana, *AECOS*, 2007c; Kahe Point, Coles, 1984). Corals that recruit to the groin structure would likely benefit from being elevated above shifting sand and rubble. *P. damicornis* is fast growing and planulates monthly throughout the year in Hawaii (Richmond and Hunter, 1990). The oldest colonies are estimated to be less than 10 years old (branch lengths < 20 cm; Richmond and Hunter, 1990). *P. meandrina* spawns in April and/or May, five days after the full moon (Fiene-Severns, 1998).

Shoreline stabilization would reduce sediment plumes that plague the nearshore environment. Siltation events are problematic to fishes, corals, and sessile invertebrates. Fish rely on their gills for oxygen exchange and are compromised by high levels of gill-clogging silt (Alabaster, 1972). Fine sediments are well known to inhibit settlement of coral larvae (Hodgson, 1990; Te, 1992) and to smoother established colonies (Jokiel and Brown, 2004). Elevated turbidity reduces light penetration to the benthos, further reducing productivity of corals and algae (Rogers, 1990). The present adverse turbidity conditions at Iroquois Point would be improved by the shoreline stabilization proposed. Reduction in terrigenous inputs to the marine environment is a management priority identified in Executive Order 13089 (Clinton, 1998) for protection of coral reefs.

In order to quantify potential direct impacts to corals, a survey was conducted to quantify corals within the proposed footprint of the groins and sand fill associated with the alternative plans (*AECOS*, 2007b). The potential direct impact on corals of the Beach Nourishment with 9 Groins, Beach Nourishment with 5 Groins, and the Beach Nourishment without structures plans was evaluated based on the survey results. The Rock Revetment plan would essentially be constructed on the shore at or behind the existing beach, and thus would not directly impact benthic organisms in the water.

The predominant coral found in the project area was *P. damicornis,* a hardy coral commonly found in nearshore waters of Hawaii. Many colonies noted in the project area exhibit a stunted growth form, with short blunt branches in contrast to the more delicate branching growth form usually associated with *P. damicornis*. The average size of coral heads was 5.9 in^2, roughly the size of a clenched fist. Coral colony size ranged from 0.2 in^2 to 50 in^2, with 30% of the colonies being 0.6 in^2 or less in size. The average number of corals in the project area is 347 corals/acre (0.0856 corals/m^2). The average percent coral cover is estimated to be 0.03% across the entire survey area, less than a tenth of one percent.

Based on the survey results, the direct impact on corals for the three alternative plans which would involve fill in the water is shown on Table 4-1.

Table 4-1. Direct Impact on Corals of Alternative Plans

Alternative	Footprint (m^2)	Total Coral Cover (m^2)	Total Number of Corals
Sand w/9 Groins	16,908	5.77	1,447
Sand w/5 Groins	24,643	8.40	2,109
Sand only	10,047	3.43	860

In summary, important points regarding corals in the project area are as follows:

- The corals present are very common species and none of the colonies are remarkable, based upon their size and growth patterns.
- Most of the colonies are small.
- Coral cover is less than 1/10th of one percent. Based on this very sparse cover and the size of the colonies, the corals present within the proposed project area are not functioning ecologically as a coral reef.
- The nearshore environment is not conducive to successful coral recruitment, due primarily to the movement of sand.
- The groins would provide a solid and complex substrate for coral recruitment and for other marine invertebrates and fishes as well. It is highly likely that the net impact would be beneficial in that a greater biomass and diversity of corals would be present within a few years following construction than at present. The same increases are expected for other invertebrates and fishes.
- The short term loss of marine natural resources, including coral, from the construction process is expected to be more than offset by gains which would occur after the groins are in place.

Possible long-term impacts of the proposed action and alternatives to the marine biology are discussed below.

1. No Action – The consequences of no action include the continued erosion of the beach and shoreline. Dirt fill would continue to be exposed and released into the nearshore water. Erosion of this dirt fill regularly results in a brown turbid plume emanating from shore. This alternative is therefore considered to have a significant negative impact on marine biota because it would result in the continual release of dirt fill into the water. Ranking: -2 (significant negative impact)

2. Beach Nourishment with 9 T-head Groins – This action includes removal of shoreline debris, and would reduce the ongoing beach erosion the release of dirt fill into the water, resulting in long-term improvement in water quality and marine biological habitat. There

is potential for some loss of corals associated with the actual placement of groin structures and sand. However, the proposed groin structures would provide vertical relief and increase available habitat. Groins would act as substrate for attached flora and fauna, as well as habitat for many fishes, mollusks, and crustaceans. The proposed 9 T-head groin with beach nourishment plan is considered to have a minor negative impact on marine biology due to the loss of corals within the footprint of the groin and beach fill.
Ranking: +1 (minor positive impact)

3. Beach Nourishment with 5 T-head Groins – This alternative includes removal of shoreline debris, and would reduce the ongoing beach erosion and the release of dirt fill into the water, resulting in long-term improvement in water quality and marine biological habitat. These groins extend 340 feet further from shore than the 9 T-head groins, and the overall seafloor area covered by the groins is significantly greater. This alternative would, therefore, have potentially greater short term adverse impacts than the 9 T-head groin alternative.
Ranking: +1 (minor positive impact)

4. Beach Nourishment – Monitoring data of numerous beach nourishment projects nationwide has indicated that generally, nourishment projects lose one half of the sand nourishment volume in 3 years. Without stabilizing structures to maintain the sand on the beach, the sand fill could be eroded and dispersed throughout the reef flat. This has the potential to fill in reef holes, cover marine habitat, and bury corals. This alternative is therefore considered to have significant negative impacts.
Ranking: -2 (significant negative impact)

5. Rock Revetment – This action would reduce the ongoing shoreline recession and the release of dirt fill into the water, resulting in long-term improvement in water quality and nearshore marine habitat. The revetment would also likely result in the loss of the sand beach, and thus would result in the loss of sand beach habitat. This alternative is therefore considered to have no net impact on marine biology.
Ranking: 0 (no net impact)

4.4 Threatened and Endangered Species and Essential Fish Habitat

4.4.1 Threatened and Endangered Species (*Section 3.5.3*)

Endangered Species Act (ESA) consultation has been conducted with the National Marine Fisheries Service (NMFS) and the U.S. Fish & Wildlife Service (USFWS), and this coordination is contained in Appendix C. ESA-listed marine species that may be affected by the proposed project include the endangered Hawaiian monk seal (*Monachus schauinslandi*), the endangered hawksbill sea turtle (*Eretmochelys imbricata*), and the threatened green sea turtle (*Chelonia mydas*). There is no designated critical habitat for any of these species on Oahu.

Consultation with NMFS on endangered species in Hawaii provided the following information (see Appendix C, NMFS letter dated May 21, 2008). The Hawaiian monk seal is endemic to the Hawaiian Archipelago, with an estimated total population of 1,200 individuals, the majority which occur in the Northwestern Hawaiian Islands. An estimated 100 to 150 individuals occur in the main populated Hawaiian Islands. Hawaiian monk seals are known to use Pearl Harbor and Iroquois Point, with a total of 76 documented Hawaiian monk seal sightings having been reported at Iroquois Point from 1993 through 2009. At least sixteen of the reported sightings are attributed to three known individual seals, two adult males and one adult female. Hawksbill sea turtles occur around all of the main Hawaiian islands; however, they are uncommon and occur in much lower numbers than green sea turtles. Green sea turtles are the most common sea turtle in Hawaii, with foraging and resting areas along the coastlines of all the main islands. Some nesting does occur on the main islands, though no nesting has been documented at Pearl Harbor or Iroquois Point. Green sea turtle sightings are common in the nearshore waters around the Pearl Harbor entrance channel, while hawksbill turtle sightings are very rare. A detailed diving survey of sea turtles in the Pearl Harbor entrance ehannel was conducted by Navy biologists between October and December 1999. The turtle population at that time was estimated to range from 32 to 41 individual green sea turtles. Regular observations in this area between 1999 and 2008 indicate that those numbers appear to be stable year round. No hawksbill turtles are believed to be resident in or adjacent to the Pearl Harbor entrance ehannel. Most of the turtles are found in the outer portions of the channel (approximately one mile seaward of the project site) in water depths between 20 and 60 feet. The proposed sand recovery area is located landward of the area where turtles were sighted, and the bottom is sandy with no hard substrate, undercuts or ledges. The rock groin structures would be placed in waters less than four feet deep.

The NMFS recommended that the following Best Management Practices (BMPs) be adhered to during construction of the project.

1. Conduct a survey for marine protected species before any work starts, and postpone or halt all work if a marine protected species is seen in the area. If a marine protected species is in the area, either hauled out onshore or in the nearshore waters, a 150 foot buffer must be observed with no humans approaching them. If a monk seal/pup pair is seen, a minimum 300 foot buffer must be observed.

2. Establish a safety zone around the project area whereby observers would visually monitor this zone for marine protected species 30 minutes prior to, during, and 30 minutes post daily project activity. Record information on the species, numbers, behavior, time of observation, location, start and end times of project activity, sex or age class (when possible), and any other disturbances (visual or acoustic).

3. Conduct activities only if the safety zone is clear of monk seals and turtles.

4. Upon sighting of a monk seal or turtle within the safety zone during project activity, immediately halt the activity until the animal has left the zone. In the event a marine protected species enters the safety zone and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals contact the Marine Mammal Response Coordinator, David Schofield, at (808) 944-2269, as well as the monk seal hotline at (808) 220-7802. For turtles, contact the turtle hotline at (808) 983-5730.

5. For on-site project personnel that may interact with a listed species potentially present in the action area, provide education on the status of any listed species and the protections afforded to those species under Federal laws. NMFS may be contacted for scheduling educational briefings to convey information on marine mammal behavior, and explain why and when to call NMFS and other resource agencies.

Conclusions of the NMFS ESA analysis included the following:

1. By using the above BMPs the NMFS would expect any noise/physical disturbance to Hawaiian monk seals and hawksbill and green turtles to be temporary and insignificant and not result in adverse behavioral changes.

2. Based on the in-water work being conducted in relatively shallow water with silt curtains confining the sediment, along with the minimal tidal flux in the area, the dearth of occurrence of sea turtles in or near the immediate dredge area, as well as implementation of the BMPs listed above, NMFS expects any exposure to turbidity and sedimentation to marine protected species to be temporary and insignificant and not result in adverse behavioral changes.

3. Based on the limited suitable forage resources in the area and the minimal impact to forage resources that may occur in the area, coupled with the likelihood that turtles and monk seals forage elsewhere, NMFS expects any changes in forage habitat to be insignificant.

4. Completion of the beach stabilization at Iroquois Point would likely provide a few benefits to marine listed species. For instance, the project would retain, and even expand the beach area for seal haul out. The area would also be cleared of scattered rocks, concrete and steel debris, and other rubble from the beach and nearshore waters. The groins are also likely to result in a greater diversity and biomass of fishes and crustaceans, which may provide nearshore forage resources for monk seals.

5. Given the insignificant probability of exposure of protected species to the construction and dredging activities, the anticipated insignificant effects to sea turtles and monk seals from turbidity, sedimentation, noise disturbance, and changes to forage habitat, coupled with the implementation of the recommended BMPs, the NMFS does not expect the proposed action to result in adverse behavioral effects to Hawaiian monk seals or hawksbill and green sea turtles.

The National Marine Fisheries Service (NMFS), by letter dated May 21, 2008, stated that: "*NMFS concurs with the determination that the proposed beach stabilization project is not likely to adversely affect the Hawaiian monk seal, the hawksbill sea turtle, or the green sea turtle."* They went on to state that this concluded the consultation responsibilities under the ESA for species under NMFS's jurisdiction.

4.4.2 Essential Fish Habitat (*Section 3.5.4*)

Few fish were observed during surveys of nearshore waters of Iroquois Point and coral cover was less than a tenth of one percent (*AECOS*, 2007a). The most well represented fish families at Iroquois Point are the surgeon fishes (Acanthuridae) with nine taxa, the butterfly fishes (Chaetodontidae) with six taxa, and the wrasses (Labridae) with five taxa. Fish at Iroquois Point are attracted to and associate with derelict metal debris, limestone outcrops, coral heads, and small overhangs, all of which provide shelter from predators (*AECOS*, 2007a).

The shallow subtidal zone of Iroquois Point is marginal fish habitat due to the low habitat complexity and degraded water quality found there. Boulders and sand fill would bury a portion of the existing subtidal environment, which is primarily low relief habitat: sand, rubble and consolidated limestone reef. The footprint of the boulder groins and sand fill below mllw would be approximately 4.6 acres (1.9 ha). However, it should be noted that much of the footprint area is relatively new sea bottom created by the erosion and recession of the shore, and thus does not have long-term established benthic flora and fauna. It is also an area of active sand movement, which results in scour of and stress on benthic organisms. Placement of boulders and sand would result in the temporary loss of some benthic organisms (fish foraging resources) including: algae, crustaceans, sponges, and other invertebrates. Benthic invertebrates would repopulate from surrounding habitat after construction is complete and sessile organisms would colonize new exposed hard surfaces.

A short-term reduction in fish habitat would occur during project construction. Adult and juvenile fishes are mobile and are expected to avoid the area during construction activities. However, some adult fish such as eels could be buried. There is potential for demersal fish eggs to be buried; however, new hard substrata created would provide greater surface area for these species on which to lay eggs in the future. No rare or endangered fish species would be lost in this already disturbed environment. After construction, fishes are expected to repopulate newly provided habitat.

The beach nourishment and stabilization project of Iroquois Point would create new reef fish habitat in the form of boulder groins and sand fill. Approximately 0.4 acres of intertidal (between mhhw and mllw) boulder habitat, and 0.7 acres of shallow subtidal (below mllw) boulder habitat, would be created. Boulder groins would provide bare, stable surfaces for recruitment of corals, algae, and other invertebrates. The boulder groins are porous, permeable structures, with approximately 37% interstitial void space between boulders within the envelope of the groins. Approximately 86,000 cubic feet of interstitial space between the stones below mllw would be created. The interstitial spaces found amongst placed boulders would provide additional habitat for cryptic benthic (crabs, shrimps, worms, etc.) and sessile (sponges and tunicates) organisms which would provide additional foraging resources for fishes. Areas of greater reef habitat complexity generally host greater species diversity (Rogers, 1990), which has also been observed at Iroquois Point (*AECOS*, 2007b).

Approximately 1.7 acres of intertidal sand habitat and 2.9 acres of subtidal sand habitat would be created. Additional sand would provide additional habitat for infauna such as small worms, crustaceans and echinoderms (Randall, 2002). It is likely that these would be foraged by goatfishes (Mullidae) and other bottom feeding fishes.

Obligate reef dwellers are often limited by the availability of suitable shelter, especially juveniles (Pickering and Whitmarsh, 1996). Reef fishes prefer reef holes and crevices commensurate with the size of the fish, smaller fishes preferring smaller crevices. Topographically complex reefs have significantly more fish associated with them than simple structure reefs (Clark and Edwards, 1994). The boulder groin structure and associated interstitial spaces would provide habitat for many fish, invertebrate, and algal taxa (fish foraging resources). Fish and invertebrate densities within the project area would likely increase after initial work is complete.

The EFH is expected to improve upon implementation of this project with improved water quality, increased fish shelter, and increased fish foraging resources. The Fisheries Management Plan will further enhance and protect the EFH. Based on the project design, the habitat improvements, and the fisheries management mitigation plan, the proposed beach nourishment and stabilization project is considered to not likely adversely affect EFH.

4.4.3 Long Term Impacts

Possible long-term impacts of the proposed action and alternatives to threatened and endangered species and EFH are discussed below:

1. No Action – The No Action alternative includes removal of hazardous debris currently exposed along the shoreline, and this would improve shoreline conditions. However, the No Action alternative would also lead to the continued erosion of the beach and shoreline. Dirt fill would continue to be exposed and released into the nearshore water, and debris may also accumulate on the shoreline. This alternative is therefore considered to have no net impact on threatened and endangered species.
   Ranking: 0 (no net impact)

2. Beach Nourishment with 9 T-head Groins – This action includes removal of shoreline debris, and would reduce the ongoing beach erosion, and create a wide recreational beach. Monk seals are known to occasionally haul out on the manmade beach systems at Ko Olina. The proposed 9 T-head groin nourishment system is considered to have a minor positive impact on threatened and endangered species.
   Ranking: +1 (minor positive impact)

3. Beach Nourishment with 5 T-head Groins – As discussed above, this action includes removal of shoreline debris, and would reduce the ongoing beach erosion, and create a wide recreational beach. Monk seals are known to frequent the manmade beach systems at Ko Olina. The proposed 5 T-head groin nourishment system is considered to have a minor positive impact on threatened and endangered species.
   Ranking: +1 (minor positive impact)

4. Beach Nourishment – This action would include removal of hazardous shoreline debris, and would reduce the ongoing shoreline recession. Monitoring data of numerous beach nourishment projects nationwide has indicated that generally, nourishment projects lose one half of the sand nourishment volume in 3 years. Without stabilizing structures to maintain the sand on the beach, the sand fill could be eroded and dispersed throughout

the reef flat. This has the potential to fill in reef holes, cover marine habitat and bury corals, with possible negative impacts to threatened and endangered species. This alternative is therefore considered to have no net impacts.
Ranking: 0 (no net impact)

5. Rock Revetment – This action would reduce the ongoing shoreline recession and the release of dirt fill into the water, resulting in long-term improvement in water quality and nearshore marine habitat. The revetment would also likely result in the loss of the sand beach, and thus would result in the loss of sand beach habitat. This would have a negative impact on monk seals that occasionally haul out in the area. This alternative is therefore considered to have a minor negative impact on threatened and endangered species.
Ranking: -1 (minor negative impact)

4.5 Air and Noise Quality (*Section 3.10*)

The project would result in no long-term changes to air and noise quality in the area. There may be short-term impacts during the construction period. Noise would increase during construction due to operation of heavy equipment and other construction activities. Air quality may also be impacted due to exhaust from construction equipment and wind-blown dust during sand replenishment. Best management practices would be employed to minimize these effects, such as installation of dust fences, spraying down sand, and operation of equipment only during authorized work hours. Dust generated by construction activities would generally be blown offshore by the prevailing tradewinds.

There are anticipated to be no long-term impacts to air and noise quality resulting from the proposed action or alternative. The ranking for each is 0 (no net impact).

4.6 Historical and Cultural Resources (*Section 3.9*)

The proposed shoreline stabilization project would affect the gun mount at Site 6906 and the probable mapping survey marker at Site 5878, but no other sites in the project area would be affected. Non-destructive construction work and archaeological monitoring during construction are recommended at Site 6906. The beach nourishment alternatives would bury the gun mount beneath sand, but its location and form would be unaltered. No further archaeological work is recommended for Site 5878. None of the project alternatives involve backshore excavation, thus on-land construction work is not expected to intrude into any subsurface sites. The chance of inadvertent discovery of a burial feature can be managed appropriately by archaeological monitoring of any ground disturbing activities, and a monitoring plan would be utilized during construction as required.

The planned dredging and dredging-related activities would create no adverse effects on Sites 5874 and 5877. The dredging would be seaward of these sites. Sand may be stockpiled over or near portions of Sites 5874 and 5877, but the later retrieval of sand would not intrude lower than the existing ground surface. In the case of Site 5874, the cultural deposit is at least 30 cm below the present ground surface, where stockpiling and later retrieval would not adversely affect the subsurface deposit. In the case of Site 5877, the surface-visible wharf would not be affected.

Review of the proposed beach nourishment and stabilization project was requested of the State Historic Preservation Division, the State Office of Hawaiian Affairs, and the Oahu Council of Hawaiian Civic Clubs, pursuant to Section 106 of the National Historic Preservation Act (NHPA). The State Historic Preservation Officer (SHPO), by letter dated September 21, 2007 (Appendix E), stated that: "*...provided that the five stipulations are followed accordingly, then we believe that the proposed undertaking will have no adverse effect on historic properties*." They also stated that: "*...we believe that the restoration and stabilization of this area of shoreline may in fact help to preserve these sites.*" By letter dated September 13, 2007, the Office of Hawaiian Affairs provided constructive comments and suggestions for the project. No response was received from the Oahu Council of Hawaiian Civic Clubs. The complete Section 106 correspondence is shown in Appendix E, NHPA Section 106 consultation.

The project plan would include the following requirements stipulated by the State Historic Preservation Officer:

1. The sand stockpile area would be cleared of surface vegetation only, with no subsurface excavation, and if necessary an appropriate barrier would be placed on the ground where the dredged sand would be stockpiled;

2. The beach nourishment sand would be recovered from recently accreted sand that does not contain any archaeological/historic materials;

3. No intact sand or soil landward of the old bulkhead would be excavated;

4. Emplacement of sand over site 6906, a gun mount, would be non-destructive and an archaeological monitor would be present during construction activity in the vicinity of site 6906; and

5. Archaeological monitoring would be conducted for any ground disturbing activities within the boundaries of the identified subsurface cultural layers.

Long-term impacts are ranked below:

1. No Action – The No Action alternative would also lead to the continued erosion of the beach and shoreline, and thus disturbance to and loss of any historical and cultural resources along the shoreline. This alternative is therefore considered to have a significant negative impact on historical and cultural resources.
   Ranking: -2 (significant negative impact)

2. Beach Nourishment with 9 T-head Groins – This action would reduce the ongoing beach erosion, and thus help preserve the resources identified in the archeological study. The proposed 9 T-head groin nourishment system is considered to have no impact on historical and cultural resources.
   Ranking: 0 (no net impact)

3. Beach Nourishment with 5 T-head Groins – This action would reduce the ongoing beach erosion, and thus help preserve the resources identified in the archeological study. The proposed 5 T-head groin nourishment system is considered to have no impact on historical and cultural resources.
   Ranking: 0 (no net impact)

4. Beach Nourishment – This action would mitigate the ongoing shoreline recession, and thus preserve the resources identified in the archeological study. This alternative is considered to have no net impacts on historical and cultural resources.
   Ranking: 0 (no net impact)

5. Rock Revetment – This action would reduce the ongoing shoreline recession, and thus preserve the resources identified in the archeological study. However, excavation of the beach crest would be required to emplace the revetment, with the possibility of impacting unknown historical sites. There is also an increased possibility of construction impacting the gun mount (site 6906). This alternative is therefore considered to have a minor negative impact on historical and cultural resources.
   Ranking: -1 (minor negative impact).

4.7 Hazardous and Regulated Materials (*Section 3.11*)

The proposed construction on the ER MMRP UXO 000002 NDSA site for any in-water sea bottom intrusive activities shall be conducted in accordance with Naval Ordnance Safety and Security Activity (NOSSA) Instruction 8020.15C Explosives Safety Review, Oversight, and Verification of Munitions Responses.

Investigation, identification, treatment and disposal of Munitions of Explosive Concern (MEC) consisting of Unexploded Ordnance (UXO), Discarded Military Munitions (DMM), Munitions Constituents (MC), and/or Material Potentially Presenting an Explosive Hazard (MPPEH) shall be conducted in accordance with DoD and Navy policies along with CERCLA, RCRA and all other applicable federal, state, and local laws and regulations.

Where potential MEC/MPPEH is discovered, Navy EOD shall be contacted to determine if an emergency response is required.

If no munitions are found in the project area during the Navy's site investigation, the Navy is planning to include historical erosion patterns, lack of previous munitions reports, dive surveys, and firing range distances information to support a "low" probability of encountering munitions with an Explosive Safety Submission Determination Request (ESSDR) for the in-water construction activities. The ESSDR may require on-call or on-site munitions qualified personnel and/or Navy EOD on call.

If munitions are found at any time in the project area, a complete Explosive Safety Submission (ESS) is required with approval from NOSSA and Department of Defense Explosive Safety Board (DDESB). The ESS would provide, but not be limited to explosive safety procedures for intrusive work, munitions clearance requirements, maximum munitions size expected to be encountered, armoring of mechanical equipment, exclusions zones and UXO contractor quality assurance oversight.

If construction will be conducted prior to the completion of the Navy's site investigation fieldwork for the project area, an ESS in accordance with NOSSA INST 8020.15C is required.

Where appropriate, restrictions, notifications, or covenants will be included in lease real estate documents to ensure protection of human health and the environment.

4.8 Beach and Ocean Recreation (*Section 3.8*)

The project would provide an improved recreational beach, and would include removal of shoreline and nearshore debris, and this would have a positive water recreation benefit. Incoming waves break, reform and break again with little or no consistent pattern as they progress shoreward across the wide fringing reef. Recreational surfing on these waves with surf boards, body boards, kayaks, etc., occurs within the general area of the project. However, no identified or named board surfing sites are located within the project area (Clark, 1977). Significant impacts on surfing are thus not expected to result from the project The project will not affect the canoe halau at Hammer Point.

1. No Action – The consequences of no action include the continued erosion of the beach and shoreline. Based on the erosion trends from 1990 to 2003, the entire project shoreline is projected to recede between 22 to 146 feet by the year 2033. This could result in abandoning all homes makai of Edgewater Drive and Iroquois Avenue, loss of portions of the road along Edgewater Drive and Iroquois Avenue, and possibly loss of some housing mauka of Iroquois Avenue. It is estimated that 30 more homes may be lost by 2033. Furthermore, planned upgrades to the shoreline area infrastructure would not be possible. The No Action alternative would have significant negative impacts to the backshore infrastructure and resources.
   Ranking: -2 (significant negative impact)

2. Beach Nourishment with 9 T-head Groins – This proposed action would reduce the ongoing beach erosion, and would create a wide recreational beach. This would also reduce backshore damage and allow planned upgrades to proceed. This action is considered to have a significant positive impact on backshore because it would reduce the shoreline erosion, and result in the creation of a stable, wide recreational beach.
   Ranking: +2 (significant positive impact)

3. Beach Nourishment with 5 T-head Groins – This alternative would reduce the ongoing beach erosion, and would create a wide recreational beach. This would reduce backshore damage and allow planned upgrades to proceed. This action is considered to have a significant positive impact.
   Ranking: +2 (significant positive impact)

4. Beach Nourishment – This alternative offers the possibility of reducing the shoreline recession, provided that frequent renourishment of the beach is maintained indefinitely. This alternative is therefore considered to have only a minor positive impact because of

the possibility that maintainance renourishment would not occur as required, and beach erosion will resume.
Ranking: +1 (minor positive impact)

5. Rock Revetment – This alternative consists of building a rock revetment at the location of the current beach berm. On shorelines suffering chronic erosion such as Iroquois Point, the revetment would fix the shoreline position and protect the backshore behind it. This would allow planned upgrades to the backshore to proceed. This alternative is considered to have a significant positive impact.
Ranking: +2 (significant positive impact)

4.9 Shoreline Appearance

Each of the proposed alternatives would result in a different appearance to the shoreline area, which could range from attractive to unsightly. The shoreline appearance of the alternatives are ranked below:

1. No Action – The No Action alternative includes removal of debris currently exposed along the shoreline, and this would improve shoreline conditions. However, the No Action alternative would also lead to the continued erosion of the beach and shoreline. Dirt fill would continue to be exposed and released into the nearshore water, and debris may also accumulate on the shoreline. This alternative would result in an unsightly appearance to the shoreline, or a significant negative impact.
Ranking: -2 (significant negative impact)

2. Beach Nourishment with 9 T-head Groins – This action includes removal of shoreline debris, and would reduce the ongoing beach erosion, and create a wide recreational beach. Design criteria included minimizing groin head length relative to the gap width to reduce the impact on seaward view planes. In addition, the groin crest elevation is below the backshore ground elevation, so the groins will not block ocean views from the homes. The proposed 9 T-head groin nourishment system is considered to have a minor positive impact visual appearance.
Ranking: +1 (minor positive impact)

3. Beach Nourishment with 5 T-head Groins – This action includes removal of hazardous shoreline debris, and would reduce the ongoing beach erosion, and create a wide recreational beach. The groin heads and stems are significantly longer than with the 9 T-head plan, and thus could be more visually intrusive. The 5 T-head groin nourishment alternative is considered to have no net impact on visual appearance because the creation of a beach may be offset by the appearance of the long structures.
Ranking: 0 (no net impact)

4. Beach Nourishment – This action would include removal of shoreline debris and creation of a beach. If this nourishment is maintained, this alternative would result in a significant improvement to the shoreline appearance.
Ranking: +2 (significant positive impact)

5. Rock Revetment – This action would consist of the construction of a boulder rock revetment on the shoreline. The revetment would likely result in the eventual loss of the natural sand beach, leaving a man-made "engineered" appearance. This would be a significant negative impact to the existing sandy shoreline appearance.
   Ranking: -2 (significant negative impact)

4.10 Construction and Maintenance Cost

Construction and maintenance costs (2008 dollars) for a 50-year project life are estimated in Section 2 (costs are for construction only, and do not include design and ancillary costs such as for monitoring). A summary of the alternative costs is presented as Table 4-2.

Table 4-2. Project Alternative Costs

Alternative	Construction Cost	50-Year Life Cost
No Action	n/a	$63,000,000*
9 Groins + Beach	$ 7,307,000	$ 9,097,000
5 Groins + Beach	$11,792,000	$14,681,000
Beach Fill Only	$ 7,726,000	$25,996,000
Rock Revetment	$ 5,300,000	$ 6,600,000

*Anticipated loss of housing income due to beach erosion.

1. No Action – Although there is no initial cost of construction for this alternative, the project life costs in terms of lost revenue, demolition costs, and other costs associated with abandoning the present shoreline is the highest of all the alternatives.
   Ranking: -2 (significant negative impact)

2. Beach Nourishment with 9 T-head Groins – The initial construction cost and 50-year maintenance cost places it second lowest in total project life cost.
   Ranking: +1 (minor positive impact)

3. Beach Nourishment with 5 T-head Groins – This alternative has an initial construction cost and project life cost 60% higher than the 9 groin alternative, due to its large footprint and material requirements.
   Ranking: -1 (minor positive impact)

4. Beach Nourishment – This alternative has the second lowest initial cost; however, the need for regular periodic re-nourishment over the life of the project makes it costly over the life of the project. It would cost about 2 to 3 times the cost of either of the beach fill with stabilization structures alternatives.
   Ranking: -2 (significant negative impact)

5. Rock Revetment – This alternative has both the lowest initial construction cost and project life cost.
   Ranking: +2 (significant positive impact)

4.11 Impacts Summary

The discussion presented above has outlined the possible environmental consequences of the proposed action and alternatives in nine environmental resource categories. Relative rankings were assigned to allow a comparison of the alternatives. The rankings were assigned based on a quantitative valuation where possible (e.g. footprint area, volume of material, water quality improvement, cost) of the positive and negative impacts of each alternative on the environmental resource. In some instances the ranking was based on a qualitative valuation, e.g. the value of a sand beach, the appearance of a sand beach versus a rock revetment. The rankings are not meant to be definitive assignments, but rather best estimates to allow qualitative comparison and evaluation of the alternatives considered. Differing viewpoints and perspectives could result in different rankings.

Table 4-3 summarizes the rankings of each alternative on each environmental resource. The table shows that the No Action alternative results in negative impacts on all resource categories with the exception of air and noise quality. In contrast, Beach Nourishment with 9 T-head structures has the highest total positive ranking of +10. Minor negative impacts were associated with the possible destruction of some coral by the placement of the rock groins. This should be mitigated by the increased habitat provided by the relief and holes in the groin structure. Beach Nourishment with 5 T-head structures realizes the same benefits as the 9 T-head alternative, but with greater cost. In addition, the groins are longer, and therefore, construction footprints would be larger. Beach Nourishment without stabilizing structures potentially could have significant negative environmental impacts resulting from sand eroding off the beach and harming nearshore reef habitat. A Rock Revetment would protect the backshore, but would eventually result in the loss of a beach at the site.

4.12 Relationship to other shoreline improvements

Ford Island Properties, LLC has constructed shoreline amenities between the roadways and the existing beach to improve recreational opportunities for the residents of the housing area. These include:

- Two sand volleyball courts, with concrete curbs and permanent net posts;
- Picnic tables/BBQs/Palapas (large thatch covered umbrellas);
- Children's Space Net playground structure;
- Beach Cabanas – wooden structures with shingle roofs and engineered foundations, providing shade, chairs and a gathering place;
- Restrooms and Showers – two bathroom buildings (in addition to the pool area bath) and three showers would be built for beach users;
- Beach Wall – a 28-inch high retaining wall has been built to stabilize the landside of the beach area.

The proposed beach stabilization project would complement the backshore amenities, and would protect them from damage due to erosion and shoreline recession. The beach would also protect the backshore from storm wave overtopping and inundation of the nearshore facilities. NHPA

Section 106 consultation and review has been conducted with the State Historic Preservation Office (SHPO) for construction of the beach wall. SHPO concurred with the determination of "no effect" for this project, and furthermore, stated they felt construction of the wall may actually preserve and protect existing subsurface archaeological sites.

Table 4-3. Project Alternatives Ranking Summary

	Alternatives				
Resource	**No Action**	**9 T-Head Beach Nourishment**	**5 T- Head Beach Nourishment**	**Beach Nourishment**	**Revetment**
Shoreline and Beach	-1	+2	+2	+1	-2
Water Quality	-2	+2	+2	0	+2
Marine Biology	-2	+1	+1	-2	0
Threatened Species and EFH	0	+1	+1	0	-1
Air and Noise Quality	0	0	0	0	0
Historical, Cultural Resources	-2	0	0	0	-1
Hazardous Materials	0	0	0	0	0
Beach and Ocean Recreation	-2	+2	+2	+1	+2
Shoreline Appearance	-2	+1	0	+2	-2
Construction Cost	-2	+1	-1	-2	+2
TOTAL	**-13**	**+10**	**+7**	**0**	**0**

The rankings are assigned as follows: -2 Significant negative impact; -1 Minor negative impact; 0 No net impact; +1 Minor positive impact; +2 Significant positive impact

5.0 MONITORING AND MITIGATION

5.1 Mitigation During Construction

The following subsections outline the required monitoring and mitigation to be performed during construction. All monitoring and mitigation measures presented in the following subsections will be incorporated into the lease agreement and compliance with those measures will be the responsibility of Ford Island Housing (or its successor).

5.1.1 Marine Debris Removal

Over the past 40 years a number of non-engineered shore protection and erosion control measures have been emplaced along the shoreline around Keahi Point. These have included boulders, CMU walls, concrete pile butts, and steel framed timber walls. There are also a number of existing 30-inch concrete drainage outfalls extending from the shoreline. Some of this debris will be removed in order to construct the proposed project. During project consultation with NOAA/NMFS staff, they suggested that project impact mitigation could include the removal of other undesirable nearshore marine debris, beyond that which is necessary to remove to construct the project. Field investigations have been conducted to inventory and characterize the existing debris in the project area, and based on this a removal plan and estimate of the location, type, size and volume of debris has been made. Removal will be accomplished during project construction, and will be included in the construction plans and specifications.

Debris is randomly scattered over the entire project area; however, the greatest concentration of debris is in the vicinity of Keahi Point, primarily resulting from prior efforts to stop the shoreline erosion and wave runup flooding of the nearshore area. It is desirable to minimize construction equipment operating in the water to the maximum extent possible, both to reduce direct physical impacts to the marine environment and to minimize the potential for leaks and spills which could impact water quality. The Section 401 Water Quality Certification application for the project states that during placement of the sand beach fill no equipment would be working in the water or below the water line. For these reasons, the debris removal operation would be restricted to that which can be removed by land-based equipment operating from within the project footprint, i.e. from the groin crests and the beach fill above the water line. Concrete, rock or steel debris which is firmly stuck to or embedded into the sea floor by marine growth shall not be removed.

The debris to be removed represents unstable foreign material, subject to degradation and movement by wave action, and which does not provide good habitat for colonization by benthic organisms. The objective of marine debris removal is to expose additional natural hard fossil reef substrate, and to reduce the volume of loose foreign material which can move and damage benthic organisms such as corals and other fixed or slow moving flora and fauna. The goal of the marine debris removal is to locate and remove all concrete, steel and other loose debris from within the designated areas. A detailed marine debris removal plan has been prepared (Sea Engineering, Inc., 2011).

5.1.2 Protection of Endangered Species (Section 4.4)

The following endangered species BMPs as recommended by NMFS (2008) would be adhered to during construction of the project.

1. Conduct a survey for marine protected species before any work starts, and postpone or halt all work if a marine protected species is seen in the area. If a marine protected species is in the area, either hauled out onshore or in the nearshore waters, a 150 foot buffer must be observed with no humans approaching them. If a monk seal/pup pair is seen, a minimum 300 foot buffer must be observed.

2. Establish a safety zone around the project area whereby observers would visually monitor this zone for marine protected species 30 minutes prior to, during, and 30 minutes post daily project activity. Record information on the species, numbers, behavior, time of observation, location, start and end times of project activity, sex or age class (when possible), and any other disturbances (visual or acoustic).

3. Conduct activities only if the safety zone is clear of monk seals or turtles.

4. Upon sighting of a monk seal or turtle within the safety zone during project activity, immediately halt the activity until the animal has left the zone. In the event a marine protected species enters the safety zone and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals contact the Marine Mammal Response Coordinator, David Schofield, at (808) 944-2269, as well as the monk seal hotline at (808) 220-7802. For turtles, contact the turtle hotline at (808) 983-5730.

5. For on-site project personnel that may interact with a listed species potentially present in the action area, provide education on the status of any listed species and the protections afforded to those species under Federal laws. NMFS may be contacted for scheduling educational briefings to convey information on marine mammal behavior, and explain why and when to call NMFS and other resource agencies.

5.1.3 Protection of Cultural and Historical Resources

The project plan would include the following requirements stipulated by the State Historic Preservation Officer:

1. The sand stockpile area would be cleared of surface vegetation only, with no subsurface excavation, and if necessary an appropriate barrier would be placed on the ground where the dredged sand would be stockpiled;

2. The beach nourishment sand would be recovered from recently accreted sand that does not contain any archaeological/historic materials;

3. No intact sand or soil landward of the old bulkhead would be excavated;

4. Emplacement of sand over site 6906, a gun mount, would be non-destructive and an archaeological monitor would be present during construction activity in the vicinity of site 6906; and

5. Archaeological monitoring would be conducted for any ground disturbing activities within the boundaries of the identified subsurface cultural layers.

5.1.4 Best Management Practices

Best Management Practices (BMPs) for construction operations would be developed to help minimize adverse impacts to coastal water quality and the marine ecosystem. The project specifications would require the Construction Contractor to adhere to environmental protection measures, including, but not limited to, the following:

- The Contractor shall perform the work in a manner that minimizes environmental pollution and damage as a result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of the construction period.
- Any construction related debris that may pose an entanglement hazard to marine protected species must be removed from the project site if not actively being used and/or at the conclusion of the construction work.
- The Contractor shall submit a Best Management/Environmental Protection Plan for approval prior to initiation of construction. The plan shall include, but not be limited to:
    1. Protection of Land Resources
    2. Protection of Water Resources
    3. Disposal of Solid Waste
    4. Disposal of Sanitary Waste
    5. Disposal of Hazardous Waste
    6. Dust Control
    7. Noise Control
- The construction contractor shall be required to employ standard BMPs for construction in coastal waters, such as daily inspection of equipment for conditions that could cause spills or leaks; cleaning of equipment prior to operation near the water; proper location of storage, refueling, and servicing sites; and implementation of adequate spill response procedures, stormy weather preparation plans, and the use of silt curtains and other containment devices.
- No contamination (trash or debris disposal, alien species introductions, etc.) of marine (reef flats, lagoons, open oceans, etc.) environments adjacent to the project site shall result from project related activities.
- The Contractor shall confine all construction activities to areas defined by the drawings and specifications. No construction materials shall be stockpiled in the marine environment outside of the immediate area of construction.
- The Contractor shall keep construction activities under surveillance, management and control to avoid pollution of surface or marine waters. Construction related turbidity at the project site shall be controlled so as to meet water quality standards. All water areas affected by construction activities shall be monitored by the Contractor. If monitoring indicates that the turbidity standards are being exceeded due to construction activities, the

Contractor shall suspend the operations causing excessive turbidity levels until the condition is corrected. Effective silt containment devices shall be deployed where practicable to isolate the construction activity, and to avoid degradation of marine water quality and impacts to the marine ecosystem. In-water construction shall be curtailed during sea conditions that are sufficiently adverse to render the silt containment devices ineffective.

- Underlayer fills shall be protected from erosion with armor units as soon after placement as practicable.
- Waste materials and waste waters directly derived from construction activities shall not be allowed to leak, leach or otherwise enter marine waters.
- Fueling of project related vehicles and equipment should take place away from the water. A contingency plan to control the accidental spills of petroleum products at the construction site shall be developed. Absorbent pads, containment booms and skimmers shall be stored on site to facilitate the cleanup of petroleum spills.
- The project shall be completed in accordance with all applicable State and County health and safety regulations.
- The sand shall be of beach-compatible quality, moderately well sorted with rounded and polished grains composed primarily of calcareous material. The sand shall be dominantly composed of naturally occurring carbonate beach or dune sand. Crushed limestone or other man-made or non-carbonate sands would not be allowed.
- All construction material including sand shall be free of contaminants of any kind including: excessive silt, sludge, anoxic or decaying organic matter, turbidity, temperature or abnormal water chemistry, clay, dirt, organic material, oil, floating debris, grease or foam or any other pollutant that would produce an undesirable condition to the beach or water quality. The sand shall have no discernable odor.
- Sand fill placement shall not be done during storms or periods of high surf.
- Any spills or other contaminations shall be immediately reported to the HDOH Clean Water Branch (808-586-4309).
- BMPs shall be utilized to minimize adverse effects to air quality and noise levels, including the use of emission control devices and noise attenuating devices.
- A dust control program shall be implemented, and wind blown sand and dust shall be prevented from blowing offsite by watering when necessary.
- Public safety best practices shall be implemented, possibly including posted signs, areas cordoned off, and on-site safety personnel.
- Public access along the shoreline during construction shall be maintained so far as practicable and within the limitations necessary to ensure safety.
- The Contractor shall review all BMPs with the project applicant/representative prior to the commencement of beach nourishment activities.

5.1.5 Water Quality Monitoring

Best Management Practices (BMPs) for construction in coastal waters would be employed, such as daily inspection of equipment for conditions that could cause spills or leaks; cleaning of equipment prior to deployment near the water; proper location of storage, refueling, and servicing sites; implementation of adequate spill response, storm weather preparation plans, and the use of silt curtains to minimize potential impacts.

Water quality monitoring will be performed as outlined in the "Applicable Monitoring and Assessment Program" (AMAP) that has been prepared to accompany the Section 401 WQC application to the Hawaii Department of Health (HDOH). The plan has been prepared in accordance with water quality regulations promulgated in Hawaii Administrative Rules (HAR) Chapter 11-54 (HDOH, 2009) and the General Monitoring Guidelines for Section 401 Water Quality Certification Projects (HDOH, 2000). The purpose of the AMAP is:

1. to ascertain that BMPs for the project are adequate to comply with State of Hawaii water quality standards;
2. in the event that the BMPs prove inadequate, to determine such, so that modification of the BMPs can be implemented in a timely manner to bring the activity into compliance; and
3. to serve as a basis for self-compliance, so that construction can proceed within the parameters required by State water quality standards.

Details of the AMAP are provided in Appendix B.

5.2 Post-construction Monitoring and Mitigation

The following subsections outline the required monitoring and mitigation to be performed following construction. All monitoring and mitigation measures presented in the following subsections will be incorporated into the lease agreement and compliance with those measures will be the responsibility of Ford Island Housing (or its successor).

5.2.1 Compensatory Mitigation

The Clean Water Act states that compensatory mitigation may be used as a tool by the U.S. Army Corps of Engineers to offset environmental losses resulting from unavoidable impacts to waters of the U.S. authorized by Department of the Army permits, and that the mitigation must be commensurate with the amount and type of impact (40 CFR 230, Final Rule; see USACE & EPA, 2008). A "Compensatory Mitigation Plan for Impacts to Waters of the U.S." (*AECOS*, 2010) has been prepared for the project, and accepted by the Army Corps of Engineers and made part of the Department of the Army Section 404 permit. The plan includes the following primary components.

<u>Fisheries Management</u> – The rock groins will provide enhanced habitat for fishes; however, this also may result in a fish aggregation effect, making them easier to catch. Fishing in the project area will be restricted to two areas of the property at the eastern and western ends, away from the rock groins (show on figure), in order to prevent over-fishing and adverse impacts to the

expected increased fish population. To promote sustainable fisheries activities in the project area, signs will be installed near the shore at the two fishing areas and at five additional shoreline access locations. The signs will inform users of when and where fishing is allowed, what fishing gear is allowed, and who to call to report fishing violations. Two additional signs that present the State Department of Aquatic Resources fish species and catch size regulations will be installed at areas where fishing is allowed. To promote wise use of marine resources, educational brochures will be distributed to residents and visitors, fishing and marine conservation information will be included in the monthly housing area newsletter, and the State *Hawaii Fishing Regulations* booklet will be provided to fishermen.

Marine Ecosystems Monitoring Program – Monitoring serves two purposes for this project: 1) evaluation of the long-term environmental effects of the project itself, and 2) evaluation of the success of compensatory mitigation. It is anticipated that the new shore and nearshore areas will be enhanced by improvements in water quality, substrata stability, and increased diversity of benthic and demersal life. The project is anticipated to result in the following measurable changes to the nearshore environment: a) improved water quality as a result of reduced turbidity levels; b) increased habitat physical complexity; c) increased fish biomass; d) increased colonization by corals; e) increased colonization by crustose coralline algae; and f) increased colonization by fleshy algae. The primary goals of the marine ecosystem monitoring program are to: 1) assess changes in specific biotic and physical variables caused by the project; and 2) test for correlation between variables. The monitoring plan variables are summarized on Table 5-1. These variables will be monitored in project and reference (control) areas, one time before construction and seven times after construction (immediately post-construction, and one, two, three, five, seven, and ten years post-construction). These intervals have been selected to capture the rate of recovery and maturing of the marine community.

Table 5-1. Monitoring variables

Variable	Rationale	Monitoring Objective	Metric	Proposed Methodology
Turbidity	Water quality improvement by reducing erosion	Measure change in turbidity level in the project area pre- and post-construction.	NTU	Hach 2100P Turbidimeter
Rugosity	Enhancement of habitat complexity in the project area	Used to test correlations among other metrics: coral cover, coral and fish species diversity, and fish abundance/ biomass.	Chain-link rugosity measurement	Index of rugosity for each transect is the length of chain needed to cover the distance divided by the length of the transect.
Fish Biomass	Enhancement of fishery resources and fish assemblage in the project area.	Measure change in fish biomass at reef flat stations in the project area and reference stations before and after project construction.	Kilograms fish biomass per hectare.	Total length of fishes on belt transects will be estimated to the nearest 5 cm. Live wet weight will be calculated from the visually-estimated total length (TL) to calculate kg/ha.
Fish Diversity	Enhancement of fishery resources and fish assemblage in the project area.	Measure change in fish diversity at reef flat stations in the project area and reference stations before and after project construction.	Shannon diversity index	$H' = \Sigma(p_i \ln p_1)$, where p_i is the proportion of all individuals counted that were of species i.
Coral	Enhancement of coral recruitment, and growth in the project area.	Measure change in percent coral cover and colony size at reef flat stations and reference stations before and after project construction.	% Cover (number of points intercepted by each biota type by the total number of points occurring in each of the sampling grids); Colony size	Photoquadrats Analyzed electronically with CPCe; Size class distribution within 0.5 m of each transect
Coralline Algae	Enhancement of colonization by coralline algae in the project area.	Measure change in percent coralline algae at reef flat stations and reference stations before and after project construction.	% Cover (number of points intercepted by each biota type by the total number of points occurring in each of the sampling grids)	Photoquadrats analyzed electronically with CPCe
Fleshy Algae	Enhancement of colonization by fleshy algae in the project area.	Measure change in percent fleshy algae at reef flat stations and reference stations before and after project construction.	% Cover (number of points Intercepted by each biota type by the total number of points occurring in each of the sampling grids)	Photoquadrats analyzed electronically with CPCe

Beach Performance Monitoring Program - A post-construction Beach Performance Monitoring Program (BPMP) will be conducted to evaluate project performance (Sea Engineering, Inc., 2011). The beach monitoring program will provide information to aid in determining the performance and impacts of the project, as well as determining future project maintenance needs.

The monitoring will be accomplished by periodically surveying beach profiles and documenting the characteristics of the shoreline with photographs. Beach profiles are a common measurement technique used to investigate coastal processes and shoreline change. The intent of the BPMP is:

1. to determine if the project is performing as expected by comparing the beach shape over time with the theoretical design beach configuration;
2. to help determine the possible need for periodic re-nourishment by determining the loss of beach sand over time; and
3. to determine whether the project has any impact on adjacent shorelines by comparing historical shoreline changes with the post-construction shorelines.

A total of 28 monitoring profiles representative of the shoreline within and adjacent to the project area will be obtained at intervals of 30 days, 6 months and 12 months post-construction, then annually for the next 3 years, and then at 2 year intervals through year 10 post-construction.

6.0 CONCLUSIONS

The Navy, as the lessor, proposes to grant Ford Island Housing the requisite property interest and accompanying authority to undertake the proposed beach stabilization and improvement project. In the lease, the Navy authorizes nourishment and stabilization along approximately 4,000 feet of shoreline fronting the Iroquois Point housing area. The proposed project would improve and stabilize the sandy beach along the Iroquois Point housing area shoreline in order to reduce the on-going erosion and shoreline recession, to stop the loss of homes and home sites, and to prevent flooding of the backshore area and homes therein by storm wave overtopping of the shore. The project would also remove scattered rocks, concrete and steel debris, and other rubble from the beach and nearshore waters, and improve sandy beach recreation opportunities. The proposed beach nourishment and stabilization plan consists of 9 T-head groin structures extending along the project shoreline, dividing the beach into 8 cells 400 to 450 feet long. Sand fill with appropriate characteristics to match the existing sand would be placed within each cell, with a design slope of 1V:10H up to a crest elevation of +6 feet.

The proposed project would not result in any significant long-term degradation of the environment or loss of habitat. Rather, the project would remove shoreline debris, improve the recreational beach at the site, and improve water quality by reducing erosion of dirt fill. Construction of the groins would cover areas of seafloor; however, impacts to coral growth would be minimal as these areas have very sparse coral cover. The proposed groin structures would provide vertical relief and increase available habitat.

By letter dated May 21, 2008, the NMFS concurred with the determination that the proposed beach nourishment and stabilization project is not likely to adversely affect the Hawaiian Monk seal, the Hawksbill sea turtle, or the Green sea turtle. A comprehensive archeological study has indicated that the proposed project would not adversely impact the scattered remnant deposits found in the area. By letter dated September 21, 2007, the State Historic Preservation Officer concurred that the proposed project would have no adverse impact on historic properties. Impacts to adjacent shorelines are expected to be minimal. Analysis of erosion data suggests that sand transport is primarily to the northeast. The project would reduce the sand deposition in the entrance channel and shoreline to the northeast, and thereby reduce the need for dredging in these areas.

Minor impacts due to construction activity would include localized increase in noise, dust formation, heavy equipment emissions, restricted coastal access in the vicinity of construction, and short-term increases in turbidity during sand placement.

Based on the findings of this environmental assessment, it is reasonable to expect that this project would not result in significant adverse environmental impacts.

7.0 PUBLIC AND AGENCY INVOLVEMENT, REVIEW AND CONSULTATION

7.1 EA Scoping Meeting

An Environmental Assessment preparation scoping meeting for the Iroquois Point Beach Nourishment project was held on October 27, 2005, at the NOAA Pacific Islands Area Office, Honolulu, Hawaii. At the request of Sea Engineering, Inc., the meeting was coordinated by the Regulatory Branch, Honolulu District, U.S. Army Corps of Engineers. Representatives of the following agencies were in attendance:

<u>Federal</u>
U.S. Army Corps of Engineers, Honolulu District, Regulatory Branch
U. S. Environmental Protection Agency
National Oceanic and Atmospheric Administration
National Marine Fisheries Service, Pacific Islands Resources Office
(U.S. Fish & Wildlife Service was invited but did not attend)

<u>State</u>
State Historic Preservation Office
Office of Planning, Coastal Zone Management Program
Department of Health, Clean Water Branch

<u>Other</u>
Ford Island Housing, LLC
AECOS, Inc.
Sea Engineering, Inc.

Sea Engineering, Inc. and *AECOS*, Inc. presented an overview of the project and the environmental setting, after which a wide-ranging discussion of the project and considerations pertinent to EA and permit application preparation, and project implementation, followed.

7.2 Endangered Species Act and Essential Fish Habitat Consultation

A consultation meeting was held on March 4, 2008 in the Honolulu office of the U.S. Fish and Wildlife Service (USFWS) to discuss the proposed Iroquois Point Beach Nourishment and Stabilization project. This meeting was precipitated by letters to the USFWS and NOAA (National Oceanic and Atmospheric Agency) National Marine Fisheries Service (NMFS) from Sea Engineering, Inc. on behalf of Ford Island Housing requesting informal coordination and consultation regarding the Endangered Species Act, the Magnuson-Stevens Fishery Conservation Act, and Essential Fish Habitat. The meeting was organized by the USFWS, and included the following attendees:

U.S. Fish and Wildlife Service
National Marine Fisheries Service, Pacific Islands Regional Office
U.S. Army Corps of Engineers, Honolulu District, Regulatory Branch
U.S. Navy, Navy Region Hawaii, Regional Environmental Office
Ford Island Housing, LLC
AECOS, Inc.
Sea Engineering, Inc.

A Memo for Record of this meeting is contained in Appendix C.

An EFH Assessment has been prepared by the environmental firm *AECOS*, Inc. (see Appendix D). A follow-up meeting was held with NMFS on April 29, 2009, to discuss compensatory mitigation for the unavoidable loss of aquatic habitat which would result from the project (see the Memo for Record in Appendix C). The culmination of the EFH consultation was the preparation of a “Compensatory Mitigation Plan for Impacts to Waters of the U.S.” (*AECOS*, 2010). This plan has been accepted by the Army Corps of Engineers and is included in the Department f the Army Section 404 permit conditions.

7.3 Coordination and Public Notices

The following coordination for the project has been made during the permit review and approval process.

<u>CZM Consistency Review</u> – A notice of the CZM Review action and request for public comment was published on December 23, 2008 in *The Environmental Notice*, the State Office of Environmental Quality Control’s twice monthly publication. No comments were received.

<u>Department of the Army Permit</u> – A Public Notice and request for comments was issued by the Army Corps of Engineers on March 13, 2009. This notice was sent to an extensive mailing list of government agencies (federal, state and county), public interest groups, environmental action groups, the Ewa Beach Neighborhood Board, and interested individuals. No comments were received.

<u>Section 401 WQC</u> – A Notice of Proposed Section 401 Water Quality Certification (WQC) was published in the Honolulu Star-Advertiser newspaper on March 3, 2011, requesting comment from interested persons. No comments were received.

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APPENDIX A

PERMITS and APPROVALS

Department of the Army, Section 10 and Section 404
Coastal Zone Management Federal Consistency Certification
Clean Water Act Section 401 Water Quality Certification

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF:

November 9, 2011

Regulatory Branch
Engineering and Construction Division

File Number POH-2005-00552

DEPARTMENT OF THE ARMY PERMIT

Mr. Thomas Lee
Ford Island Housing, LLC
737 Bishop Street, Mauka Tower, Suite 2750
Honolulu, HI 96813

Dear Mr. Lee:

Enclosed is a Department of the Army permit which authorizes your excavation and placement of fill to construct nine T-groins in the Pacific Ocean at Iroquois Point, Island of Oahu, Hawaii, as described in the attached drawings dated July 22, 2009. You are cautioned that any change in the location or plans of the work will require submittal of revised plans to this office for approval prior to accomplishment. Deviation from the approved plans may result in imposition of criminal or civil penalties.

You may now begin the work. General Condition 1 of the permit specifies that the expiration date for completion of the authorized work is **December 31, 2014**. If you find that you need more time to complete the authorized activity, you must submit a written request for a time extension to our Regulatory Branch for consideration at least one month prior to the expiration date. Upon completion of the authorized work, please fill out and return the enclosed *Certificate of Compliance with Department of the Army Permit* form.

We are interested in your experience with our Regulatory Program and encourage you to complete a customer service survey form. This form and information about our program is available on our website at: www.nws.usace.army.mil (select "Regulatory" and then "Regulatory/Permits").

A copy of this letter (without enclosures) is being sent via e-mail to Mr. Scott Sullivan, Sea Engineering, Inc., 41-305 Kalanianaole Hwy, Makai Research Pier, Waimanalo, Hawaii 96795; Mr. John Nakagawa, Hawaii CZM Program, Office of Planning, P.O. Box 2359, Honolulu, Hawaii 96804; Mr. Alec Wong, Chief, Clean Water Branch, Hawaii State Department of Health, P.O. Box 3378, Honolulu, Hawaii 96801; and (with drawings only) to the NOAA Office of Coast Survey, Marine Chart Division, 1315 East-West Highway, Sta. 7317, Silver Spring, MD 20910-3282.

If you have questions regarding this authorization, please contact Mr. Peter Galloway of my Regulatory Branch via e-mail at peter.c.galloway@usace.army.mil or via telephone at (808) 438-8416. Please cite File No. POH-2005-00552 on all future inquiries regarding this project.

BY AUTHORITY OF THE SECRETARY OF THE ARMY:

0 9 NOV 2011

Douglas B. Guttormsen, P.E.
Lieutenant Colonel, U.S. Army
District Engineer

Enclosures

Certification of Compliance with Department of the Army Permit

FILE NUMBER **POH-2005-00552**
DATE OF ISSUANCE **November 9, 2011**

Name of Permittee: Ford Island Housing, LLC
737 Bishop Street, Mauka Tower, Suite 2759
Honolulu, HI 96813

Upon completion of the activity authorized by this permit and any mitigation required by the permit, please sign this certification and return it to the following address:

Regulatory Branch (CEPOH-EC-R)
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Please note that your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification or revocation.

I hereby certify that the work authorized by the above-referenced Department of the Army permit has been completed in accordance with the terms and conditions of the said permit.

____

Signature of Permittee Date

DEPARTMENT OF THE ARMY PERMIT

Permittee: Ford Island Housing, LLC

737 Bishop Street, Mauka Tower
Suite 2750
Honolulu, HI 96813

Permit No: POH-2005-00552

Issuing Office: Honolulu District

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the U.S. Army Corps of Engineers (Corps) having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: Construct nine T-head groin structures and place approximately 80,000 cubic yards of sand between the groins along 4,200 linear feet of shoreline in waters of the United States (Pacific Ocean) at Edgewater Drive and Iroquois Avenue (Iroquois Point), Island of Oahu. Dredge approximately 60,000 cubic yards of sand that has accreted along the shoreline area at the west side of the Pearl Harbor entrance channel near the Iroquois Lagoon entrance. Remove in-water debris and install sediment and erosion control structures, which will be removed in their entirety upon project completion.

Construction of the project must be in accordance with the plans and drawings dated July 22, 2009 that are attached to and incorporated in and made a part of this permit. The purpose of the project is to provide shoreline stabilization and restore a portion of the historic shoreline for recreational uses.

Project Location: Pacific Ocean at Ewa Beach (Iroquois Point), Island of Oahu, Hawaii

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on December 31, 2014. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least 1 month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in accordance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification to this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

7. After a detailed and careful review of all the conditions contained in this permit, the permittee acknowledges that, although said conditions were required by the Corps, nonetheless the permittee agreed to those conditions voluntarily to facilitate issuance of the permit; the permittee will comply fully with all the terms of all the permit conditions.

Special Conditions:

1. You must provide a copy of the permit transmittal letter, permit form, and permit drawings to each contractor involved in the authorized work.

2. If future operations by the United States require the removal, relocation, or other alteration of the work authorized by this permit, or if, in the opinion of the Secretary of the Army or his authorized representative, the authorized structure or work will cause unreasonable obstruction to the free navigation of navigable waters, you will be required, upon due notice from the U.S. Army Corps of Engineers and without expense to the United States, to remove, relocate, or alter the authorized structure or work or any obstructions caused by the authorized structure or work. No claim may be made against the United States on account of any such removal, relocation, or alteration.

3. You must provide the landowner, the U.S. Navy, with a copy of this permit within 30 days of permit issuance and prior to the commencement of any authorized work. In the event of an unauthorized activity or failure to comply with any term or condition of this authorization, you, the landowner, and any contractors responsible for conducting the work are all potentially liable under federal law.

4. In order to control the introduction and spread of exotic species, the stones used for the construction of the T-head groin structures must be obtained from upland sources.

5. Debris removal must be conducted in accordance with the document entitled *Iroquois Point Beach Restoration and Stabilization Project Marine Debris Removal Plan*, prepared by Sea Engineering, Inc., dated March 2011.

6. Shoreline monitoring must be conducted in accordance with the document entitled, *Beach Performance Monitoring Program Iroquois Point Beach Restoration and Stabilization Project Ewa Beach, Oahu, Hawaii*, prepared by Sea Engineering, Inc., dated December 2010, except as modified below:

a. Profiles will extend from the vegetation line, but not to exceed 100 feet landward of the beach slope crest, to the intersection of the beach slope with the existing natural limestone reef substrate.

b. Profile measurements must be conducted at all locations located west of Groin #1 prior to the commencement of the construction of Groin #1 but not to exceed 14 days prior to its construction.

c. Profile measurements must be conducted at all locations east of Groin #9 prior to the commencement of the construction of Groin #9 but not to exceed 14 days prior to its construction.

d. Profile measurements must be conducted between each groin cell within 14 days of sand fill placement within the respective cells.

e. A complete set of profile measurements at all locations must be taken at each of the following times: one month, 6 months, and 12 months after the project completion date.

f. The project completion date is the date shown on the "Certificate of Compliance," which must be submitted to this office within 30 days of project completion.

g. All subsequent measurements must occur within the specified timeframe from project completion. Note that Year 1 begins 12 months after the project completion date.

h. A complete set of profile measurements at all locations must be conducted again in Years 2, 3, 4, 6, 8, and 10.

i. Profile monitoring reports must be submitted within 45 days of each required monitoring event. Reports must include raw field data without any adjustment for unseasonal or unusual storms, waves, or other oceanographic conditions occurring prior to the scheduled beach monitoring. Any data adjusted for these situations must be submitted as a separate table or list within the report.

j. "Acceptance Criteria" do not apply to the areas west of Groin #1 or east of Groin #9. Any observed shoreline changes in these areas will be evaluated and contingency plans implemented as determined appropriate by this office. Any shoreline changes associated with the authorized project will be your responsibility for the life of the project. Any contingency plans implemented could require annual monitoring until shoreline stabilization is attained.

7. Compensatory mitigation must be conducted in accordance with the mitigation plan entitled, *Iroquois Point Beach Restoration Project – Compensatory Mitigation Plan for Impacts to Waters of the U.S.*, prepared by AECOS, Inc., dated July 19, 2010.

8. If at any time this office determines that the authorized project no longer protects the shoreline as designed or is causing damage to the property of others, you will be required, upon due notice from the U.S. Army Corps of Engineers and without expense to the United States, to remove the project in its entirety and dispose of the material in an approved location as directed by and within the timeframe determined by this office. No claim may be made against the United States on account of any such removal.

NOTE: For Special Conditions 9-16, the term "you" and its derivatives mean the permittee, any future transferee, or any contractor of the permittee or any future transferee.

For Compliance with the Magnuson-Stevens Fishery Conservation and Management Act:

9. In any year this authorization is valid, you may not conduct excavation and fill operations during the peak coral spawning period of May 01 through August 31.

For Compliance with the Endangered Species Act:

10. Every day before starting any authorized work, you must conduct a survey for Green sea turtles (*Chelonia mydas*), Hawksbill sea turtles (*Eretmochelys imbricata*), and Hawaiian monk seals (*Monachus schauinslandi*) (the "protected marine species"). You must establish and maintain a safety zone which includes and extends 150 feet beyond the limits of the planned active work area that will be visually monitored for the protected marine species by qualified observers (persons capable of identifying the protected marine species) 30 minutes prior to, at 30 minute intervals during, and 30 minutes after any project activity. You must record the start and end times of authorized work each day, as well as information on any protected marine species observed, number of individuals of the protected marine species observed, behavior, time of observation, location, sex or age class (when possible), and any disturbances (visual or acoustic) that could have been impacting the observed protected marine species. Work initiation and continuance must be in accordance with numbers 11 and 12 below.

11. If a protected marine species is seen within the safety zone during the initial daily survey, you may not begin work until the individual(s) of the protected marine species voluntarily leave(s) the safety zone (which may be considered to have occurred 30 minutes following the last sighting).

12. If a protected marine species is seen within the safety zone during project activity, you must immediately halt the activity until the protected marine species has left the safety zone (which may be considered to have occurred 30 minutes following the last sighting). In the event a marine protected species enters the safety zone and the project activity cannot be halted, you must conduct observations (recording the information listed above at 9) and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For Hawaiian monk seals, you must contact NOAA's National Marine Fisheries Service (NMFS) Marine Mammal Response Coordinator, currently David Schofield, at (808) 944-2269. Should you need further assistance, you may contact the monk seal hot line at (888) 256-9840. For Green sea turtles or Hawksbill sea turtles, you must contact the turtle hotline at (808) 983-5730.

13. For on-site project personnel that could interact with Green sea turtles (*Chelonia mydas*), Hawksbill sea turtles (*Eretmochelys imbricata*), or Hawaiian monk seals (*Monachus schauinslandi*), you must provide education on the status of those species and the protections afforded to those species under Federal laws. You may contact NMFS staff at (808) 944-2269 to schedule educational briefings to convey information on marine mammal behavior, and training on why and when to call NMFS and other resource agencies. For information about sea turtles, you may contact the NMFS sea turtle Coordinator at (808) 944-2239.

For Compliance with Section 106 of the National Historic Preservation Act:

14. You must place an appropriate barrier on the ground where the dredged sand will be stockpiled.

15. You may only retrieve sand from recently accreted sand that does not contain any archaeological/historical remains.

16. You may not excavate any intact sand or soil landward of the old bulkhead line which lies landward of the Sand Recovery Site as shown on Sheet C-10 of the Iroquois Point Beach Restoration project plans dated July 2009.

17. Emplacement of stabilizing sand over Site -6906, a gun mount, must be non-destructive, and an archaeological monitor must be present during construction activities at Site 6906.

18. Archaeological monitoring must be conducted for all ground-disturbing activities within the boundaries of the identified subsurface cultural layers documented in Figures 9 thru 13 of the *Archaeological Inventory Survey at Iroquois Point Beach Development Parcel, Pu'uloa, O'ahu Island, Hawai'i* (Carson, 2007).

Further Information:

1. Congressional Authorities. You have been authorized to undertake the activity described above pursuant to:

   ☒ Section 10 of the Rivers and Harbor Act of 1899 (33 U.S.C. 403).

   ☒ Section 404 of the Clean Water Act (33 U.S.C. 1344).

   ☐ Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain any other Federal, State, or local authorization required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data. The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of the permit.

b. The information provided by you in support of your application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

CRAIG McGINNIS

Ford Island Housing, LLC

11/7/2011
(DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Douglas B. Guttormsen, P.E.
Lieutenant Colonel, U. S. Army
District Engineer

0 9 NOV 2011
(DATE)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE)

(DATE)

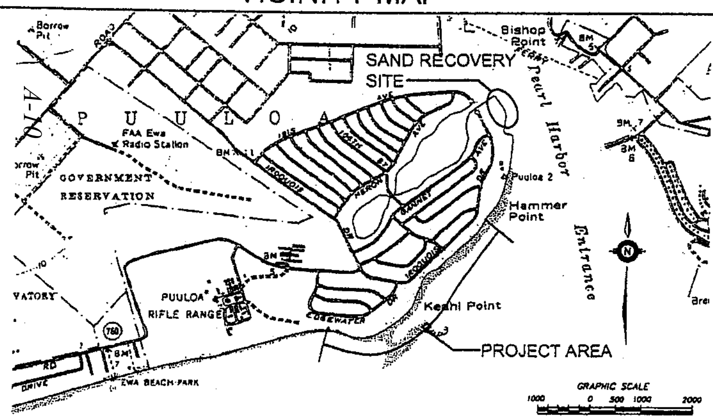
IROQUOIS POINT BEACH RESTORATION AND STABILIZATION PROJECT

EWA BEACH, OAHU, HAWAII

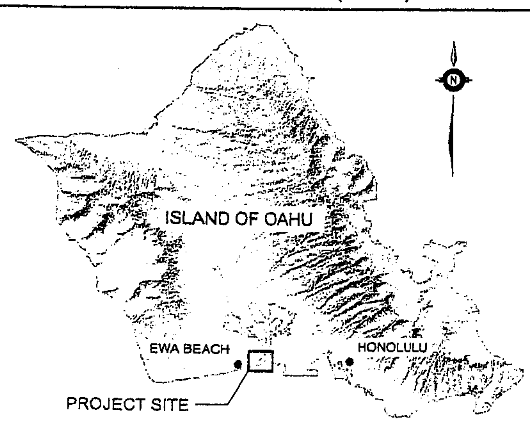
FORD ISLAND PROPERTIES, LLC

60% SUBMITTAL PLANS

VICINITY MAP



PROJECT LOCATION (NTS)



INDEX OF DRAWINGS

RING NO.	SHEET NO.	DESCRIPTION
1	T-1	TITLE SHEET, VICINITY MAP, PROJECT LOCATION
2	C-1	GENERAL NOTES AND ABBREVIATIONS
3	C-2	GENERAL SITE PLAN, SURVEY CONTROLS, SAND SOURCE VICINITY
4	C-3	PROJECT PLAN STA 0+00 TO STA 12+00
5	C-4	PROJECT PLAN STA 12+00 TO STA 25+50
6	C-5	PROJECT PLAN STA 25+50 TO STA 39+24
7	C-6	TYPICAL SECTIONS AND DETAILS
8	C-7	CROSS SECTIONS STA 1+00 TO STA 18+00
9	C-8	CROSS SECTIONS STA 19+00 TO STA 36+00
10	C-9	CROSS SECTIONS STA 37+00 TO STA 39+00
11	C-10	SAND RECOVERY AND STOCKPILE SITES
12	C-11	ENVIRONMENTAL PROTECTION

P04-2005-552
July 22, 2009
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Sea Engineering, Inc.
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FAX 808.259.8143

IROQUOIS POINT BEACH RESTORATION
IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: VARIES
DATE: MARCH 2009

TITLE SHEET, VICINITY MAP, PROJECT LOCATION

SHEET: T-1 RING: 1/12

GENERAL NOTES

1. THE SCOPE OF WORK FOR THIS PROJECT CONSISTS OF THE RECOVERY OF APPROXIMATELY 70,000 CUBIC YARDS OF SAND FROM THE WEST SIDE OF THE PEARL HARBOR ENTRANCE CHANNEL. THE CONSTRUCTION OF NINE ROCK RUBBLEMOUND T-HEAD GROINS ALONG THE PROJECT AREA SHORELINE, AND THE PLACEMENT OF APPROXIMATELY 97,000 CUBIC YARDS OF SAND FILL BETWEEN THE GROINS.
2. TOPOGRAPHIC SURVEYS WERE CONDUCTED BY CONTROL POINT SURVEYING, INC. IN MARCH 2004 AND SEPTEMBER 2008. RECTANGULAR COORDINATES ARE BASED ON NAD83, HAWAII STATE PLANE, ZONE 3. ELEVATIONS ARE REFERRED TO MEAN LOWER LOW WATER (MLLW). AZIMUTHS ARE MEASURED CLOCKWISE AND REFERRED TO TRUE SOUTH.
3. ALL DISTANCES, DIMENSIONS, ELEVATIONS, AND COORDINATES ARE IN FEET.
4. THE CONTRACTING OFFICER IS FORD ISLAND HOUSING, LLC.
5. THE CONTRACTOR SHALL COORDINATE HIS HAUL ROUTE, STAGINGS AREAS, AND ALL ASSOCIATED CONSTRUCTION REQUIREMENTS WITH THE CONTRACTING OFFICER.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CLEARING AND REMOVAL OF ALL SAND AND DEBRIS GENERATED BY HIS CONSTRUCTION WORK AND DEPOSITED AND ACCUMULATED ON ROADWAYS AND OTHER AREAS.
7. ALL EXISTING UTILITIES, ROADWAYS, WALKWAYS, WALLS AND BUILDINGS, WHETHER OR NOT SHOWN ON THE DRAWINGS, SHALL BE PROTECTED FROM DAMAGE AT ALL TIMES DURING CONSTRUCTION. ANY DAMAGES TO THEM SHALL BE REPAIRED BY THE CONTRACTOR AT HIS EXPENSE.
8. NO WORK SHALL BE DONE ON SATURDAYS, SUNDAYS, HOLIDAYS OR AFTER NORMAL WORK HOURS AT ANY TIME WITHOUT PRIOR APPROVAL OF THE CONTRACTING OFFICER. PROJECT WORK SHALL BE IN CONFORMANCE WITH APPLICABLE FEDERAL AND LOCAL LAWS AND REGULATIONS REGARDING COMMUNITY NOISE CONTROL.
9. ALL DEMOLITION, STOCKPILING AND GRADING WORK SHALL BE DONE IN ACCORDANCE WITH APPLICABLE FEDERAL AND LOCAL LAWS AND REGULATIONS.
10. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AREA AND SURROUNDING AREA FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH APPLICABLE FEDERAL AND LOCAL LAWS AND REGULATIONS REGARDING AIR POLLUTION CONTROL.
11. ALL EXISTING TREES, SHRUBS AND SURROUNDING VEGETATION SHALL BE PRESERVED AND PROTECTED SO FAR AS PRACTICABLE. REMOVAL OF ANY TREES SHALL BE APPROVED BY THE CONTRACTING OFFICER.
12. THE CONTRACTING OFFICER SHALL BE INFORMED OF AND APPROVE THE DISPOSAL SITE FOR THE PROJECT PRIOR TO THE COMMENCEMENT OF WORK.
13. ALL PROJECT WORK SHALL BE PERFORMED IN CONFORMANCE WITH APPLICABLE FEDERAL AND LOCAL LAWS AND REGULATIONS REGARDING WATER QUALITY AND WATER POLLUTION CONTROL.
14. THE CONTRACTOR SHALL MAINTAIN THE STREETS, DRIVEWAYS, SIDEWALKS AND OTHER PUBLIC RIGHTS OF WAY IN A CLEAN, SAFE AND USABLE CONDITION. ALL SPILLS OF SAND, ROCK OR CONSTRUCTION DEBRIS SHALL BE REMOVED IMMEDIATELY. ALL ADJACENT PROPERTY SHALL BE MAINTAINED IN A CLEAN, SAFE AND USABLE CONDITION. THE CONTRACTOR SHALL PROVIDE FOR ACCESS TO AND FROM ALL RESIDENCES, DRIVEWAYS, AND COMMUNITY FACILITIES AT ALL TIMES.

SAND AND RECOVERY

1. SAND RECOVERY OPERATIONS WILL BE CONFINED TO THE AREAS SHOWN ON SHEET C-10.
2. DREDGING EQUIPMENT SHALL BE ENTIRELY LAND-BASED, A CRANE WITH CLAM SHELL BUCKET OR EQUIVALENT. NO EQUIPMENT SHALL OPERATE IN THE WATER.
3. THE PRIMARY SAND STOCKPILE AREA SHALL BE FULLY CONTAINED WITHIN A BERM TO PREVENT ANY WATER FLOW FROM DREDGING/STOCKPILING ACTIVITIES INTO COASTAL WATERS.
4. SAND RECOVERY SHALL BE CONFINED TO A WATER DEPTH LESS THAN 30 FEET
5. A SILT CURTAIN SHALL BE DEPLOYED TO COMPLETELY ENCLOSE THE AREA OF ACTIVE DREDGING.
6. ALL SAND STOCKPILE SITES SHALL BE LOCATED WELL BACK FROM THE SHORELINE, ON EXISTING GROUND WITH AN ELEVATION OF APPROXIMATELY +6 FEET.

SAND FILL REPLACEMENT

1. SAND FILL SHALL BE PLACED TO THE LINES AND GRADES SHOWN ON THE DRAWING.
2. SAND FILL SHALL BE PLACED FOLLOWING COMPLETION OF CONSTRUCTION OF ADJACENT GROINS, AND DEPLOYMENT OF A SILT CURTAIN BETWEEN ADJACENT GROIN HEADS AS SHOWN ON SHEET C-11.
3. ALL SAND PLACEMENT SHALL BE DONE USING LAND-BASED EQUIPMENT, PUSHING SAND SEAWARD FROM THE SHORE, AND NO EQUIPMENT SHALL OPERATE IN THE WATER

GROIN CONSTRUCTION

1. GROINS SHALL BE CONSTRUCTED FROM THE SHORELINE PROCEEDING SEAWARD. THE GROIN STEMS AND HEADS MAY BE WIDENED TO PERMIT CONSTRUCTION EQUIPMENT AND MATERIAL ACCESS, HOWEVER THE COMPLETED GROINS SHALL MATCH THE LINES AND GRADES SHOWN ON THE DRAWINGS.
2. LOOSE MATERIAL (SAND, STONE, CORAL RUBBLE) SHALL BE REMOVED TO PLACE THE GROIN STONE ON FIRM CORALLINE ROCK SUBSTRATE.
3. ARMOR STONES SHALL BE UTILIZED WITHIN THE ALLOWABLE SIZE RANGE AS NECESSARY TO MEET THE LINES AND GRADES OF THE GROINS AS SHOWN ON THE DRAWINGS.
4. STONE SHALL BE DENSE, DURABLE, FREE OF CRACKS AND DEFECTS, AND OF A SUITABLE QUALITY TO INSURE PERMANENCE IN THE STRUCTURE. ALL STONE SHALL BE FREE OF SILT, SEDIMENT, EARTHEN MATERIAL AND ANY CONTAMINANTS.
5. SILT SCREENS AS SHOWN ON SHEET C-11 SHALL BE DEPLOYED AND KEPT CONTINUOUSLY IN PLACE THROUGHOUT CONSTRUCTION OF THE GROINS. SHOULD WEATHER OR SEA CONDITIONS PROHIBIT PROPER PLACEMENT AND FUNCTION OF THE SILT SCREENS CONSTRUCTION OF THE GROINS SHALL CEASE UNTIL CONDITIONS IMPROVE AND THE SILT SCREENS CAN BE EFFECTIVELY DEPLOYED. SILT SCREENS SHALL BE MAINTAINED IN PLACE FOLLOWING COMPLETION OF EACH GROIN UNTIL WATER TURBIDITY WITHIN THE CONFINES OF THE SILT SCREENS IS WITHIN ACCEPTABLE LIMITS AS DEFINED BY THE PROJECT SPECIFICATIONS.
6. NO EQUIPMENT SHALL OPERATE DIRECTLY IN THE WATER DURING GROIN CONSTRUCTION.

ABBREVIATIONS

EL	ELEVATION
LB	POUND
MAX	MAXIMUM
MHHW	MEAN HIGHER HIGH WATER
MIN	MINIMUM
MLLW	MEAN LOWER LOW WATER
NTS	NOT TO SCALE
OC	ON CENTER
STA	STATION
TYP	TYPICAL

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July 22, 2009
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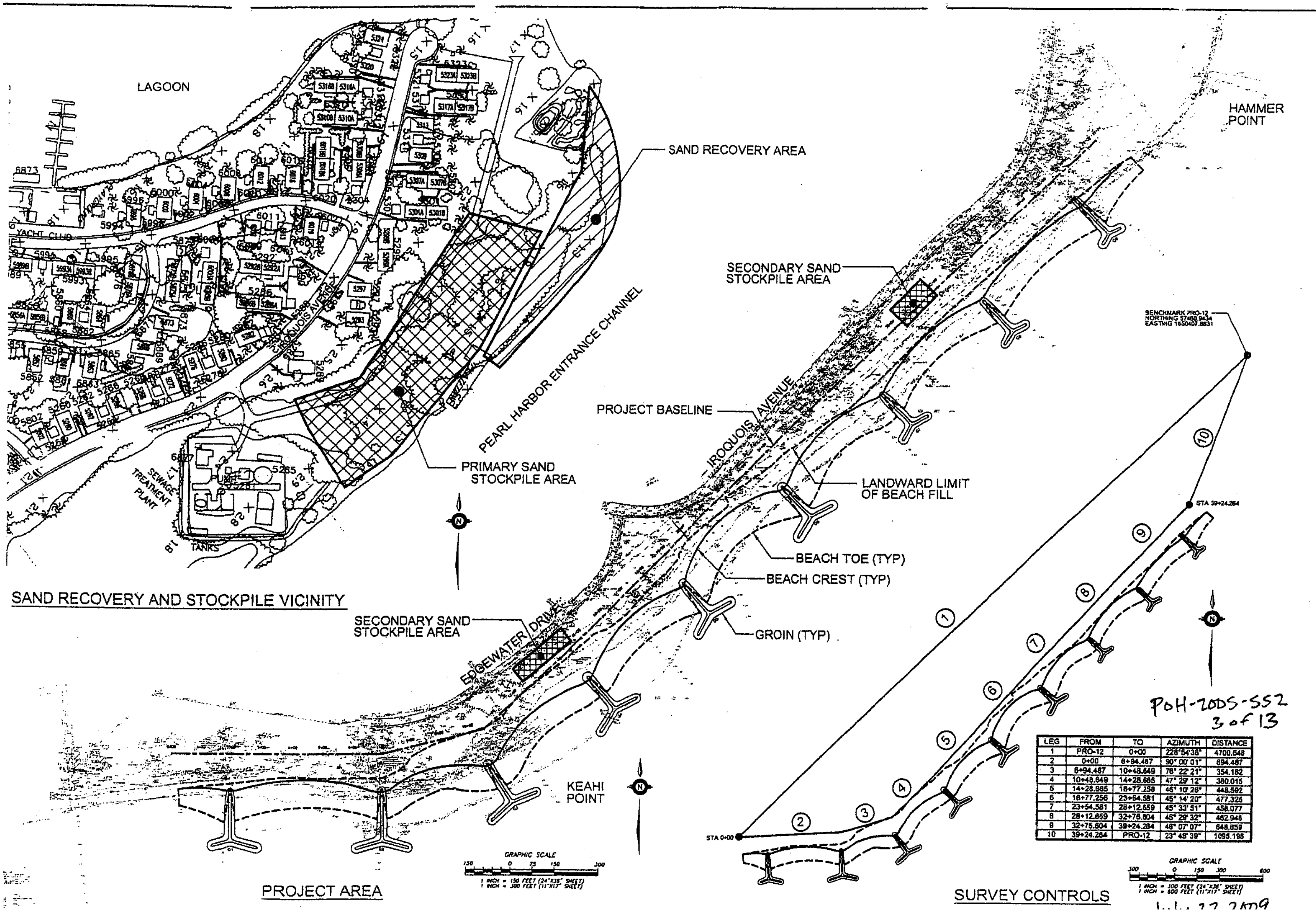
IROQUOIS POINT
BEACH RESTORATION
IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: NONE
DATE: MARCH 2009

GENERAL NOTES
AND
ABBREVIATIONS

SHEET: C-1
DWG: 2



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LEG	FROM	TO	AZIMUTH	DISTANCE
1	PRO-12	0+00	228°54'38"	4700.648
2	0+00	6+94.487	90° 00' 01"	694.487
3	6+94.487	10+48.649	78° 22' 21"	354.182
4	10+48.649	14+28.685	47° 29' 12"	380.015
5	14+28.685	18+77.256	45° 10' 28"	448.592
6	18+77.256	23+54.581	45° 14' 20"	477.325
7	23+54.581	28+12.659	45° 33' 51"	458.077
8	28+12.659	32+75.604	45° 29' 32"	462.946
9	32+75.604	39+24.284	46° 07' 07"	648.659
10	39+24.284	PRO-12	23° 48' 39"	1095.198

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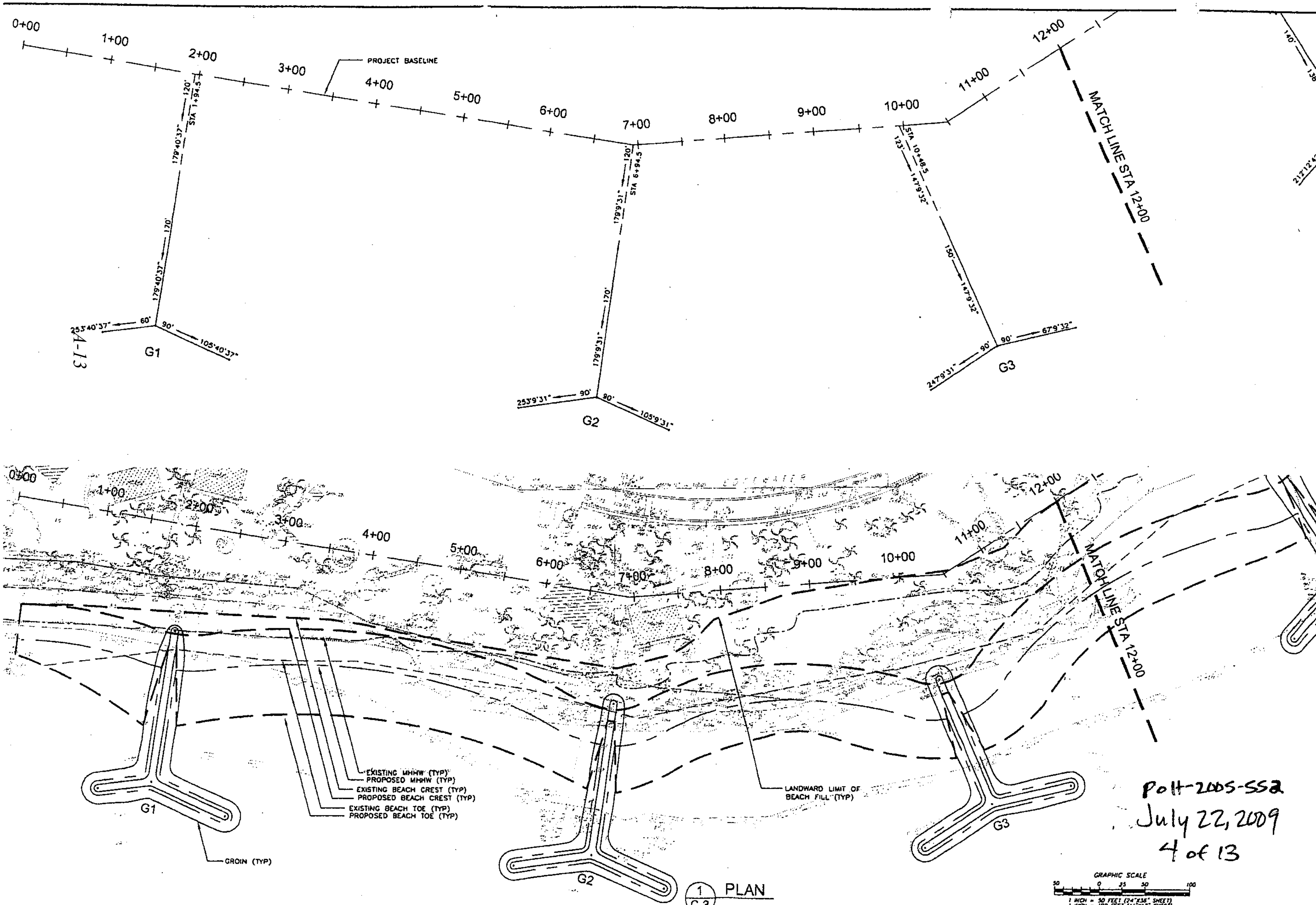
IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: VARIES
DATE: MARCH 2009

GENERAL SITE PLAN, SURVEY CONTROLS, SAND SOURCE VICINITY

SHEET: C-2
RING: 3



1 / C-3 PLAN

A-13

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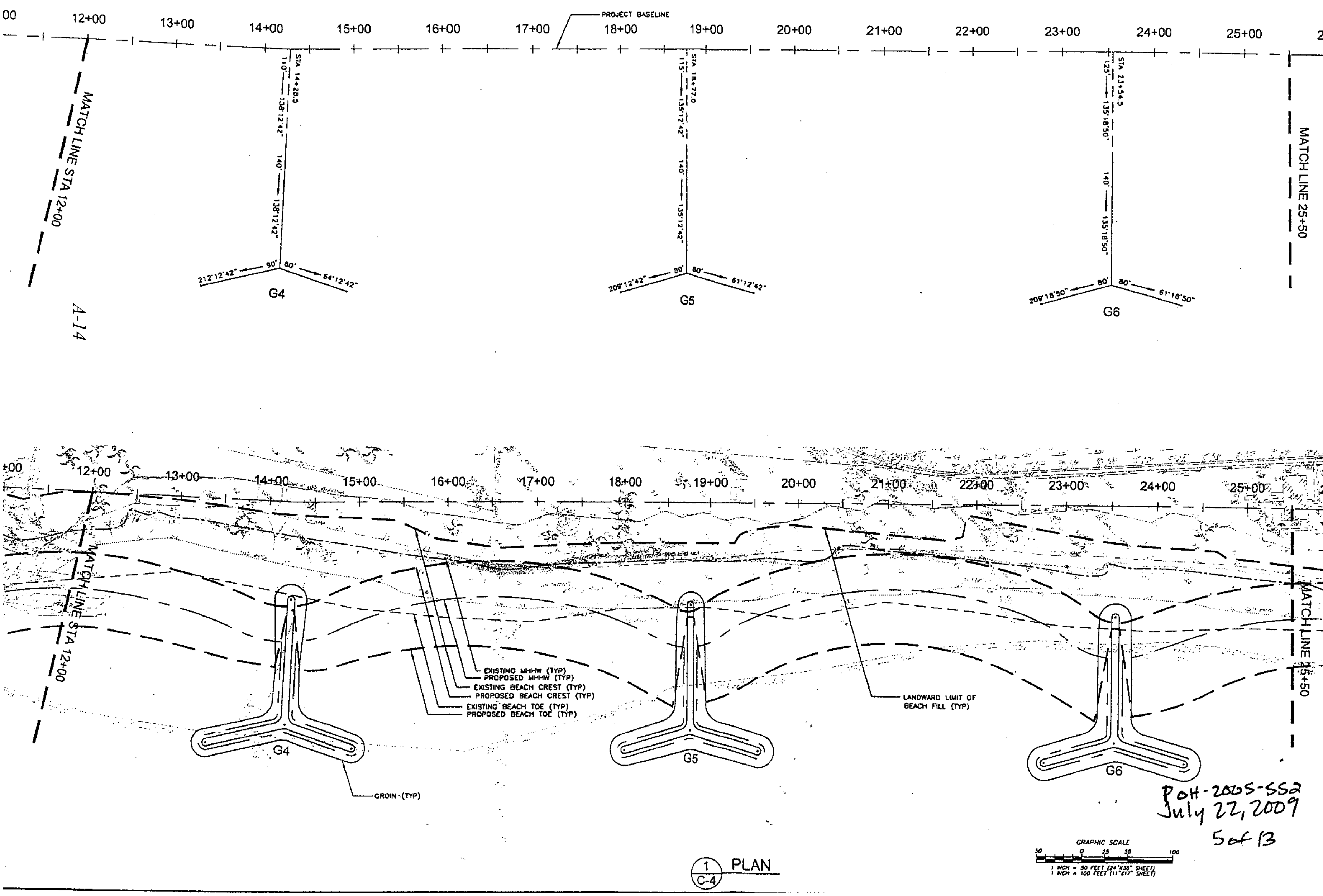
IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER:	25001
PROJECT ENGINEER:	DDH
DRAWN BY:	DDH
CHECKED BY:	SS
SCALE:	1" = 50' (24"X36")
DATE:	JULY 2009

PROJECT PLAN
STA 0+00 TO STA 12+00

SHEET: C-3 RING: 4 / 12



1 / C-4 PLAN

A-14

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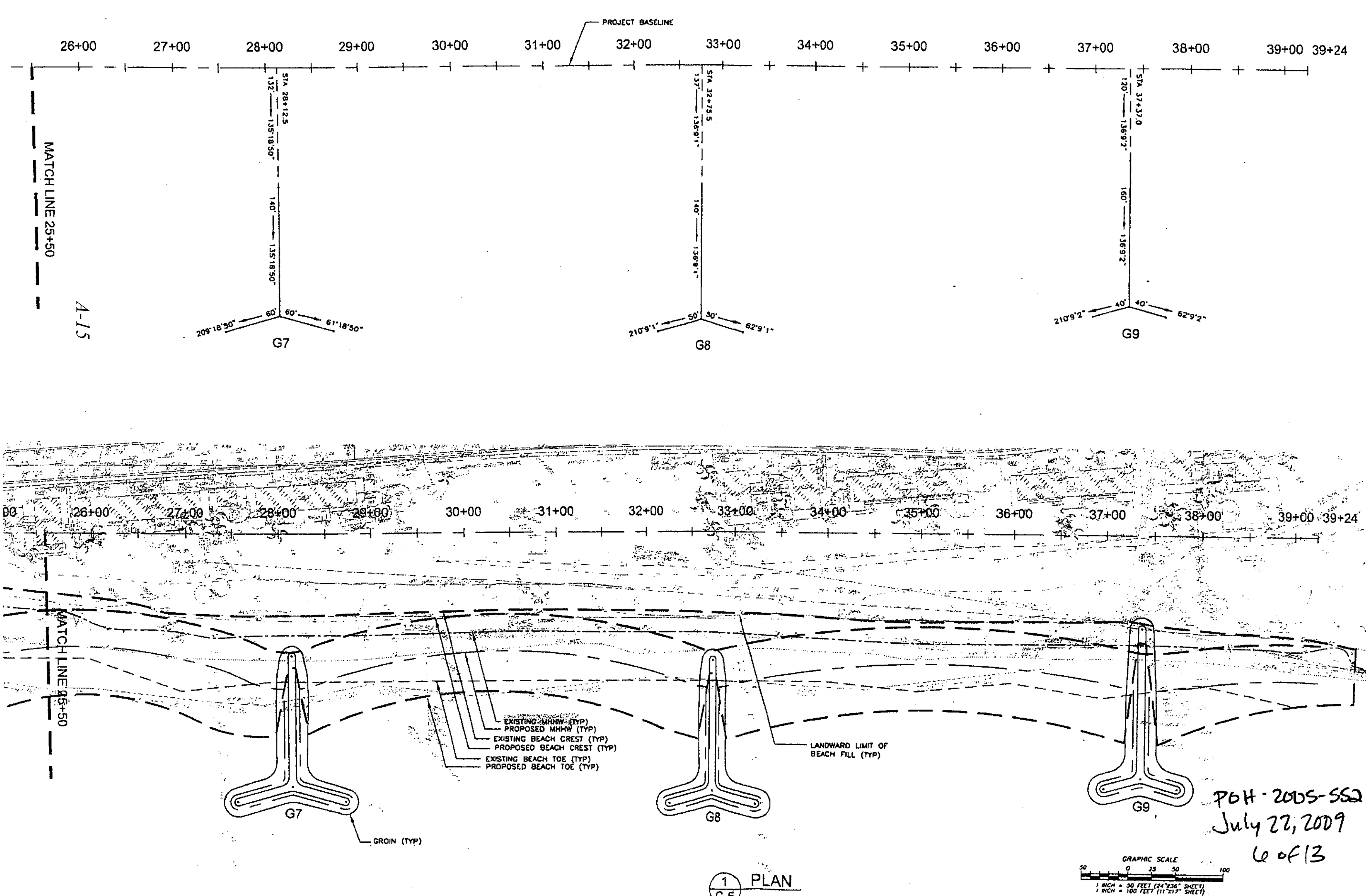
IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: 1" = 50' (24"x36")
DATE: JULY 2009

PROJECT PLAN
STA 12+00 TO STA 25+50

SHEET: C-4
RING: 5 / 12



1 C-5 PLAN

A-15

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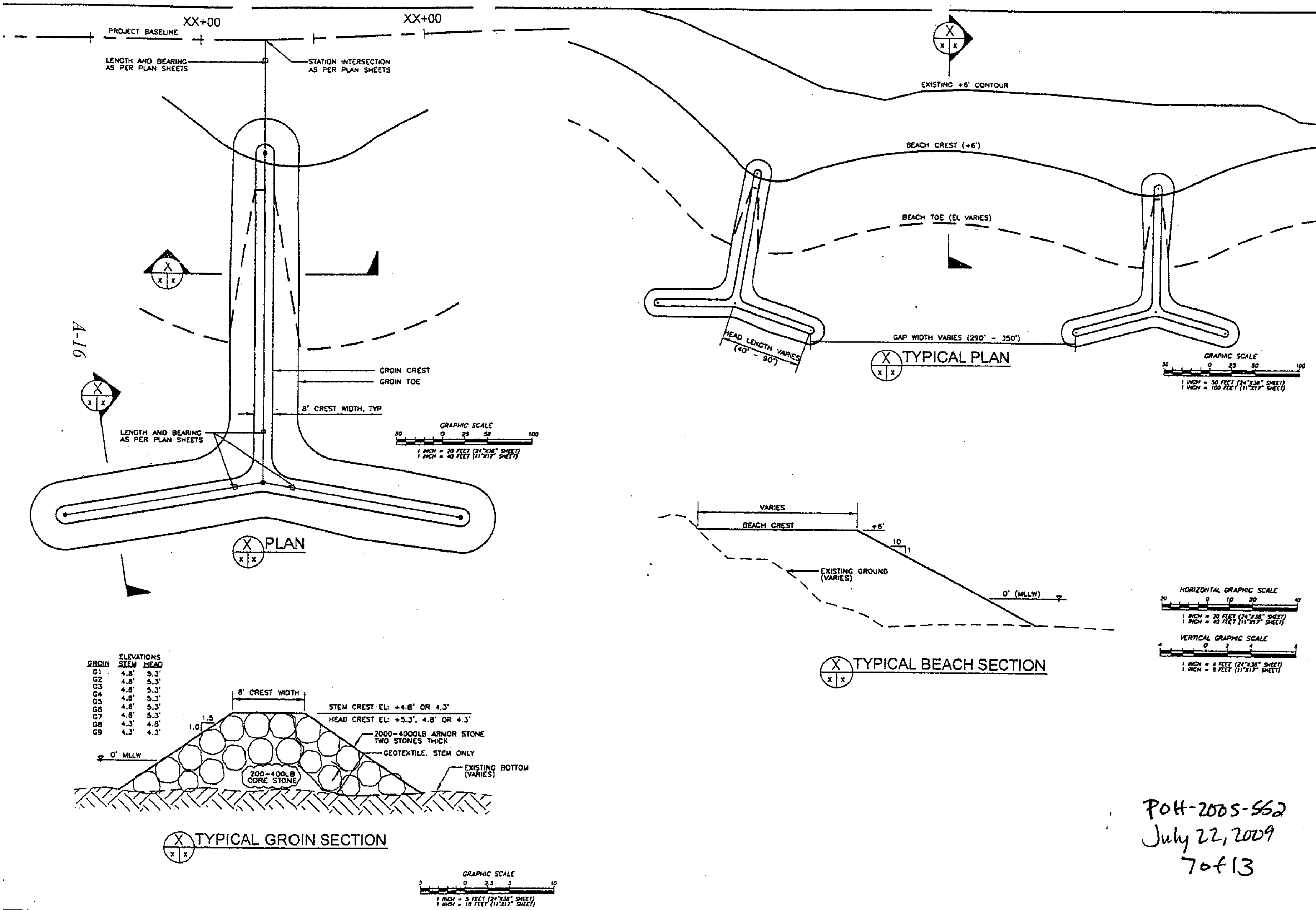
IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: 1" = 50' (24"X36")
DATE: JULY 2009

PROJECT PLAN
STA 25+50 TO STA 39+24

SHEET: C-5
RING: 6 / 12



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IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DOH
DRAWN BY: DOH
CHECKED BY: SS
SCALE: VARIES
DATE: MARCH 2009

TYPICAL SECTION AND DETAILS

SHEET: C-6
RING: 7/13

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July 22, 2009
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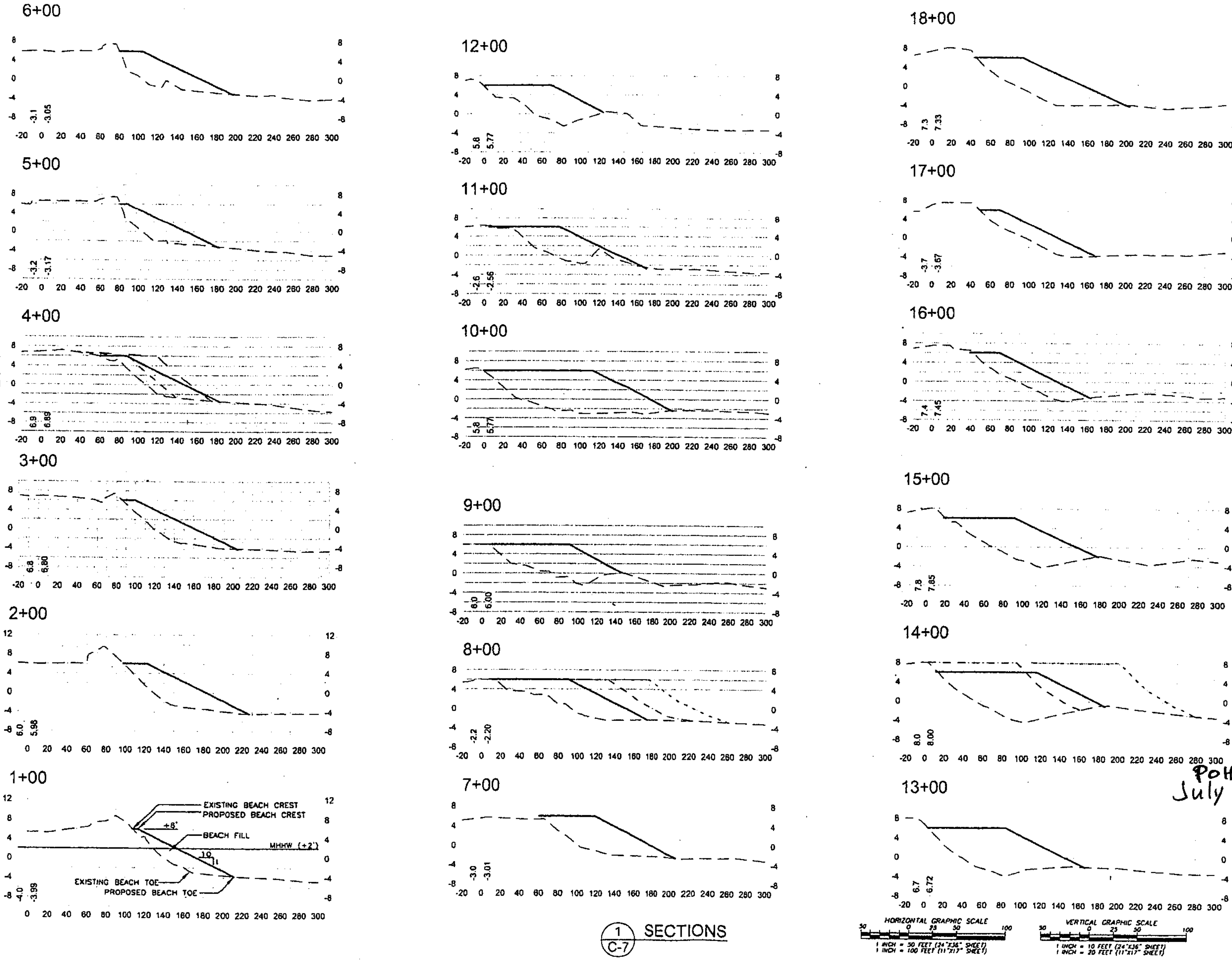

1 / C-7 SECTIONS

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July 22, 2009
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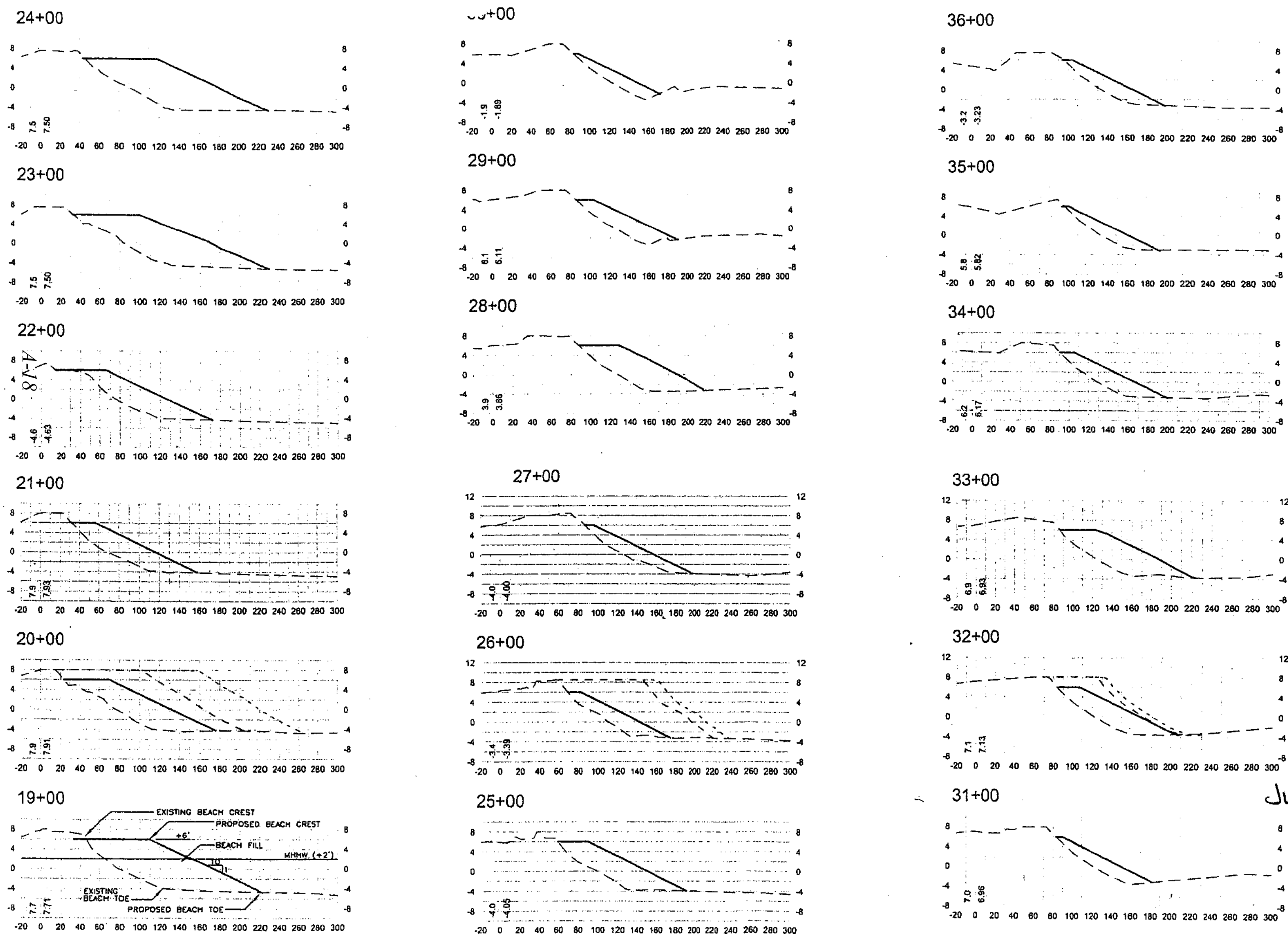
IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: VARIES
DATE: JULY 2009

CROSS SECTIONS
STA 1+00 TO STA 18+00

SHEET: C-7
RING: 8 / 12



1/C-8 SECTIONS

A-18

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July 22, 2009
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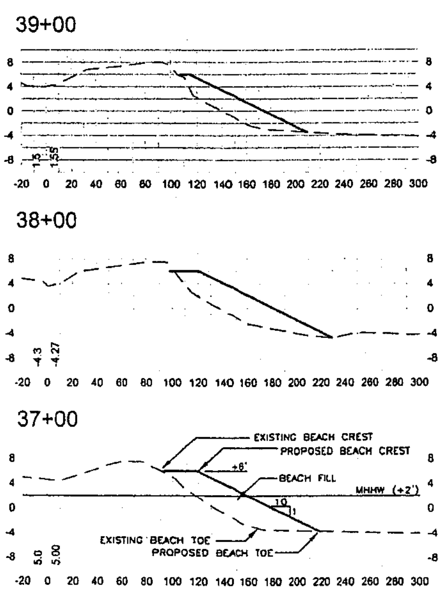
IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: VARIES
DATE: JULY 2009

CROSS SECTIONS
STA 19+00 TO STA 36+00

SHEET: C-8
RING: 9 / 12



1/C-9 SECTIONS

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July 22, 2009
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HORIZONTAL GRAPHIC SCALE
1 INCH = 50 FEET (24"X36" SHEET)
1 INCH = 100 FEET (11"X17" SHEET)

VERTICAL GRAPHIC SCALE
1 INCH = 10 FEET (24"X36" SHEET)
1 INCH = 20 FEET (11"X17" SHEET)

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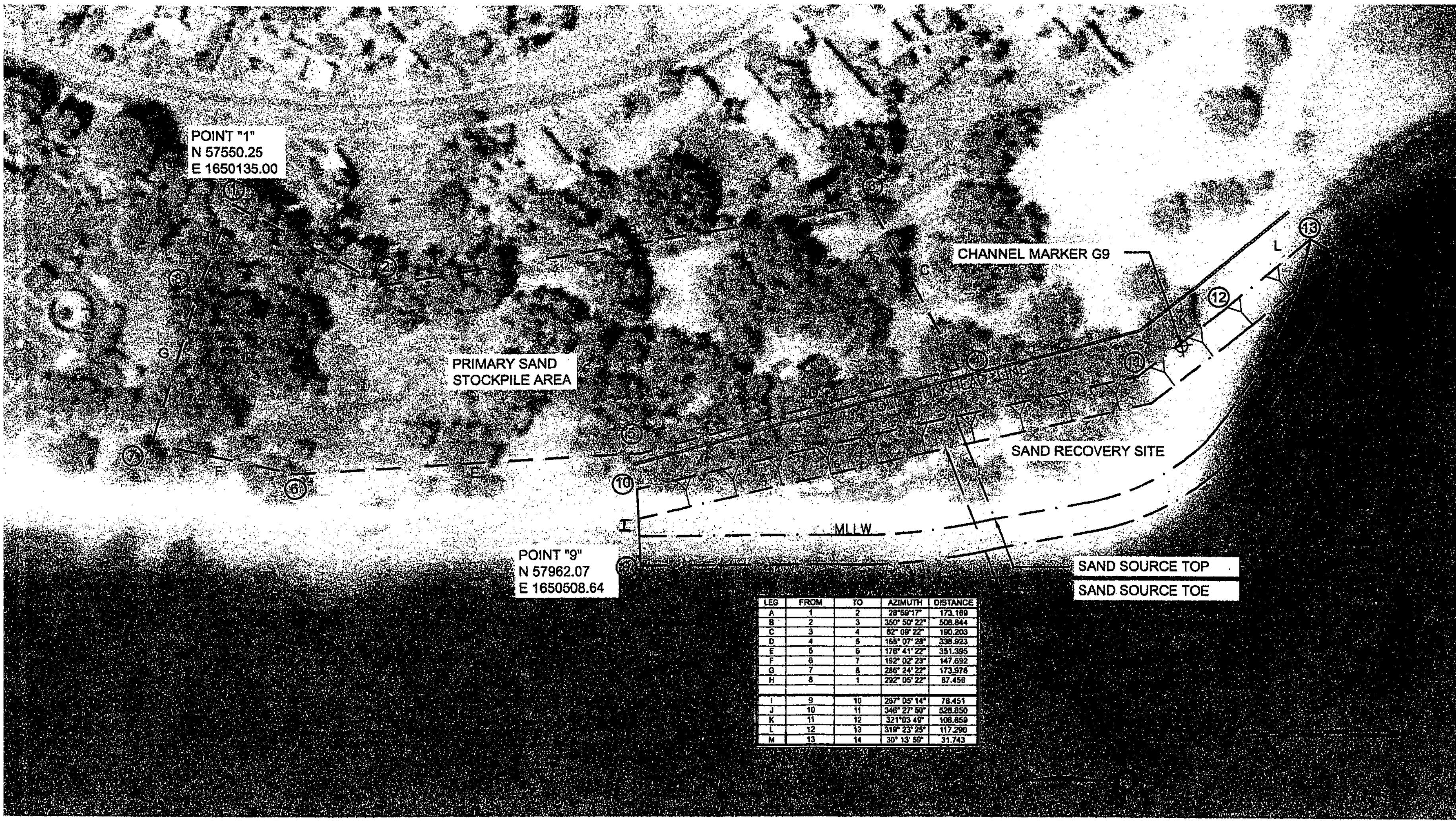
IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: VARIES
DATE: JULY 2009

CROSS SECTIONS
STA 37+00 TO STA 39+00

SHEET: C-9
RING: 10 / 12



LEG	FROM	TO	AZIMUTH	DISTANCE
A	1	2	28°59'17"	173.169
B	2	3	350° 50' 22"	506.844
C	3	4	62° 09' 22"	190.203
D	4	5	165° 07' 28"	338.923
E	5	6	176° 41' 22"	351.395
F	6	7	192° 02' 23"	147.692
G	7	8	286° 24' 22"	173.976
H	8	1	292° 05' 22"	87.456
I	9	10	267° 05' 14"	78.451
J	10	11	346° 27' 50"	526.850
K	11	12	321°03' 49"	108.859
L	12	13	319° 23' 25"	117.290
M	13	14	30° 13' 59"	31.743

SAND RECOVERY AND STOCKPILE

July 22, 2009
POH-2005-552
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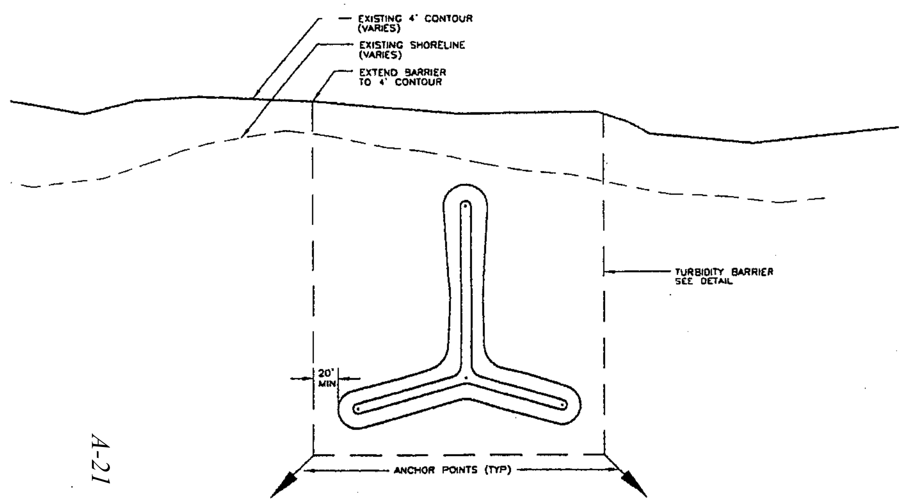
IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: 1"=50' (24"x36")
DATE: JULY 2009

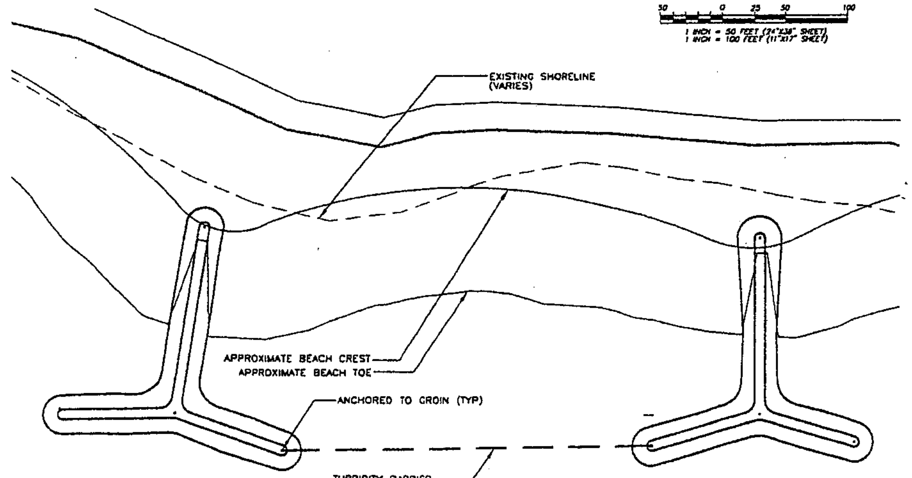
SAND RECOVERY AND STOCKPILE

SHEET: C-10 | RING: 11



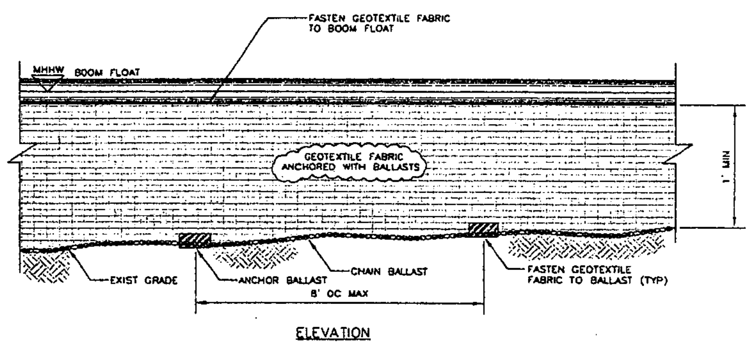
SILT SCREEN DEPLOYMENT
DURING GROIN CONSTRUCTION

GRAPHIC SCALE
1 INCH = 50 FEET (24"x36" SHEET)
1 INCH = 100 FEET (11"x17" SHEET)



SILT SCREEN DEPLOYMENT
DURING SAND PLACEMENT

GRAPHIC SCALE
1 INCH = 50 FEET (24"x36" SHEET)
1 INCH = 100 FEET (11"x17" SHEET)



ELEVATION

TYPICAL SILT SCREEN DETAIL
NTS

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IROQUOIS POINT BEACH RESTORATION

IROQUOIS POINT, OAHU, HAWAII

PROJECT NUMBER: 25001
PROJECT ENGINEER: DDH
DRAWN BY: DDH
CHECKED BY: SS
SCALE: VARIES
DATE: MARCH 2009

ENVIRONMENTAL PROTECTION

SHEET: C-11
RING: 12/12

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July 22, 2009
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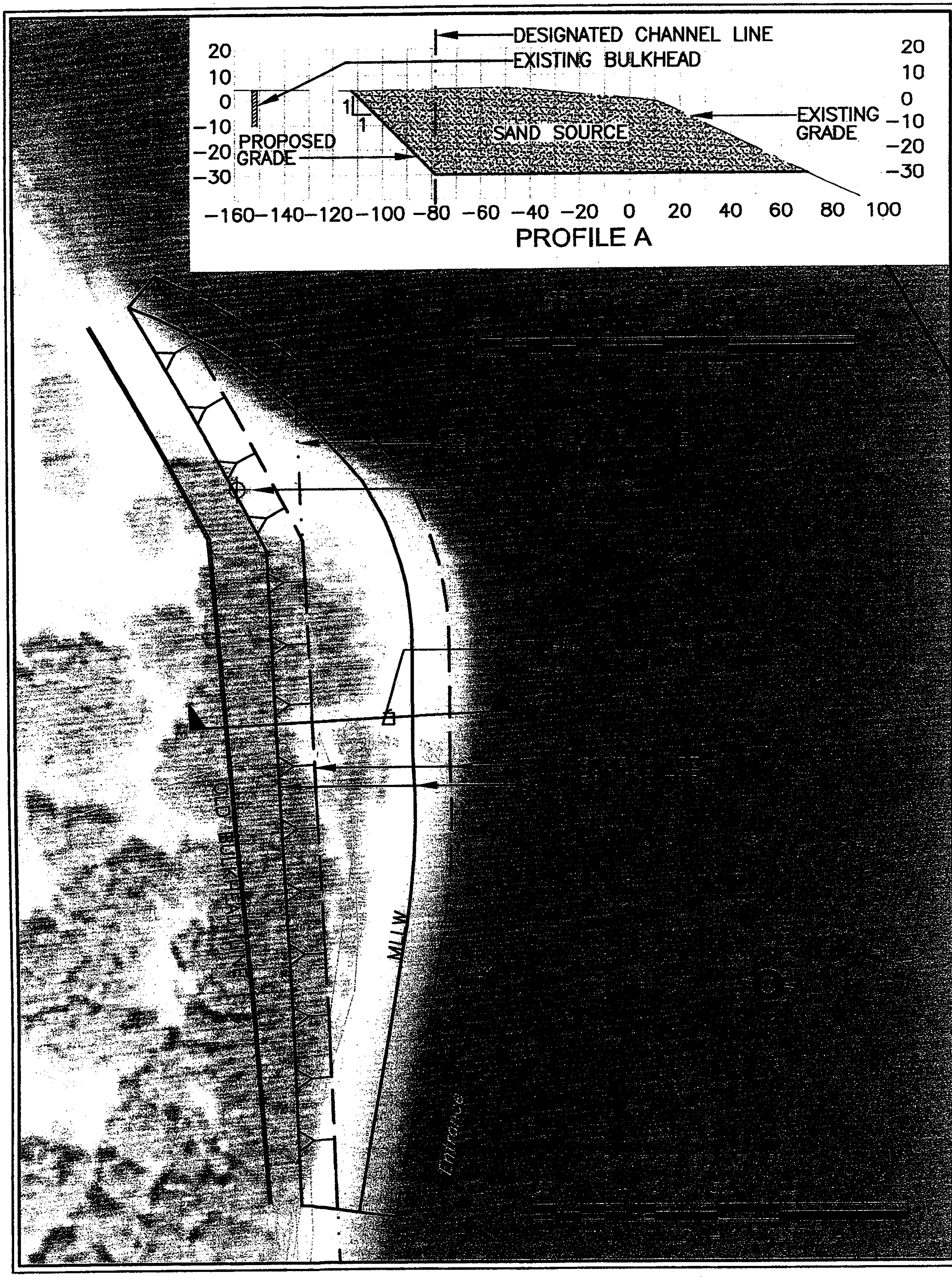

DESIGNATED CHANNEL LINE
EXISTING BULKHEAD
20
10
0
−10
−20
−30
PROPOSED GRADE
1
1
SAND SOURCE
EXISTING GRADE
−160 −140 −120 −100 −80 −60 −40 −20 0 20 40 60 80 100
PROFILE A
OLD BULKHEAD LINE
MLLW
Entrance

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
ABBEY SETH MAYER
DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
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Ref. No. P-13122

September 29, 2010

Mr. Steven Colon
Ford Island Housing, LLC
Mauka Tower, Suite 2750
737 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Colon:

Subject: Hawaii Coastal Zone Management (CZM) Program Federal Consistency Review for the Iroquois Point Beach Restoration and Stabilization Project, Ewa, Oahu; Department of Army Permit File No. POH-2005-552

The proposal to stabilize and restore the sand shoreline along Iroquois Point Beach has been reviewed for consistency with the Hawaii CZM Program. This CZM federal consistency review covers the proposed construction of nine T-head rock groin structures, 140 feet long with heads 100-200 feet long, extending along the project shoreline, dividing the beach into eight cells 400 to 450 feet long, and placement of 80,000 cubic yards of sand to restore the beach. We concur with your certification that the proposed activity is consistent with the enforceable policies of the Hawaii CZM Program, based on the following conditions:

1. Mitigation and Monitoring

The mitigation and monitoring measures proposed in, "Summary of Project Impact Mitigation Measures - Iroquois Point Beach Restoration and Stabilization Project" (January 2010) and "Iroquois Point Beach Restoration Project - Compensatory Mitigation Plan for Impacts to Waters of the U.S." (June 16, 2010, revised July 19, 2010) shall be fully implemented. Mitigation and monitoring measures shall include, but are not limited to, the following:

Construction Mitigation: Impact mitigation during construction shall be accomplished by four primary means (Summary, p. 8):

a. The use of environmental protection specifications and best management practices.

b. A construction plan requirement for turbidity containment barriers to be in place around all active construction areas.
c. A water quality monitoring plan.
d. Endangered species protection measures.

Post-Construction Monitoring:

a. Fully implement all monitoring measures proposed in the "Marine environmental monitoring plan for the Iroquois Point shoreline restoration project, Ewa Beach, Oahu, Hawaii" (AECOS, January 29, 2010; Summary, Appendix B). It is our understanding that the marine ecosystems monitoring program has been designed to determine potential effects of beach restoration and stabilization on the nearshore reef. (Marine Monitoring Plan, p. 7)
b. Fully implement all monitoring measures proposed for the beach performance monitoring program. (Summary, p. 19; and "Beach Performance Monitoring," September 2010) It is our understanding that the beach monitoring program will provide information to determine the performance and impacts of the project, if any, as well as helping to establish possible future project maintenance needs. (Summary, p. 20)
c. Fully implement all monitoring measures proposed in the Compensatory Mitigation Plan. (Section 4)

Additional Mitigation: Fully implement all proposed additional mitigation measures below. (Summary, p. 5)

a. Debris removal.
b. Elimination of point-source stormwater drainage outfalls.
c. Fishing regulations to ensure increase in fish species diversity and mass.

2. Public Beach Access

Public access to and along the project shoreline shall be provided as represented by the applicant in the following documents:

a. CZM federal consistency application letter (November 21, 2008, p. 2) and Draft Environmental Assessment (November 2008, p. 79): "Ford Island Housing has worked with the Navy to be able to provide for public access and use of the beach from sunrise to sunset. Everywhere housing area residents can go the public can go also. Access has been facilitated by providing public parking adjacent to the beach, and the public may use the beach restrooms."
b. Scott Sullivan, Sea Engineering, Inc. (agent for Ford Island Housing, LLC), August 19, 2010 email clarifying the terms of the public beach access: "Any number of the public can walk or ride a bicycle through the gate simply by showing ID and signing a liability waiver. The public can also drive to the beach,

and are given a numbered parking pass for a specific public parking stall number. There are 23 public stalls at the beach. Cars with handicapped placards may park in any available handicap designated stall. The primary rules are: sunrise to sunset; dogs (leashed) are permitted; swimming, kayaking, surfing permitted; shore fishing allowed in designated areas, pole only, no nets or spears; public may use beach restrooms, but not other community facilities; no tents, fires, hibachis, glass bottles."

c. "Public Access Policies," applicant's document provided by Scott Sullivan, Sea Engineering, Inc. (August 19, 2010 email)

3. <u>Public Fishing Access</u>

For fisheries management purposes, fishing will be allowed at only two areas of the project shore as identified in the Compensatory Mitigation Plan (Figure 3-1, p. 3-3). Fishing will be open to the public on a daily basis, from 4:00 a.m. to 10:00 p.m., at the area immediately east of the eastern-most groin, known as "Canoe Hale" (p. 3-2). The second fishing area, known as "Dog Park", is located immediately west of the western-most groin and is proposed to be open once per month from dawn to 10:00 p.m., to only residents of The Waterfront at Puuloa (p. 3-2). It is a condition of this CZM federal consistency concurrence that the eastern fishing area be accessible to the public as proposed, and that the western fishing area be open to the public on an equal basis as to residents, during the specified dates and times.

4. The project shall comply with State of Hawaii water quality standards and requirements, including obtaining the Section 401 Water Quality Certification, as specified in Hawaii Administrative Rules, Chapter 11-54, and Hawaii Revised Statutes (HRS), Chapter 342D, which are federally-approved enforceable policies of the Hawaii CZM Program.

5. The project shall comply with the State Historic Preservation Division requirements of the National Historic Preservation Act Section 106 review (September 21, 2007), and HRS, Chapter 6E - Historic Preservation, which is a federally-approved enforceable policy of the Hawaii CZM Program.

6. Any changes to the proposal, including design, mitigation measures and monitoring measures, shall be submitted to the Hawaii CZM Program for review and approval.

7. Failure to comply with the conditions prescribed above shall render this CZM federal consistency concurrence void.

CZM consistency concurrence is not an endorsement of the project nor does it convey approval with any other regulations administered by any State or County agency. Thank you for your cooperation in complying with Hawaii's CZM Program. If you have any questions, please call John Nakagawa of our CZM Program at 587-2878.

Sincerely,

Abbey Seth Mayer
Director

c: ✓Mr. Scott Sullivan, Sea Engineering, Inc.
U.S. Army Corps of Engineers, Regulatory Branch
U.S. National Marine Fisheries Service, Pacific Islands Regional Office
U.S. Fish and Wildlife Service, Pacific Islands Ecoregion
Dr. Wendy Wiltse, U.S. Environmental Protection Agency
Department of Health, Clean Water Branch
Department of Land and Natural Resources,
Office of Conservation and Coastal Lands
Department of Planning and Permitting, City and County of Honolulu

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
EMD/CWB

WQC764.FNL.11

June 9, 2011

Mr. Craig McGinnis
Vice President
Ford Island Housing, LLC
737 Bishop Street, Mauka Tower, Suite 2750
Honolulu, Hawaii 96813

Attention: Mr. Thomas Lee
Development Manager

Dear Mr. McGinnis:

Subject: Section 401 Water Quality Certification (WQC) for Iroquois Point Beach Restoration and Stabilization Ewa Beach, Island of Oahu, Hawaii File No. WQC 0000764/Army File No. POH-2005-552

In accordance with the provisions of the Clean Water Act, as amended (33 U.S.C. §1251 et seq.; the "CWA"); Hawaii Revised Statutes (HRS), Chapters 91, 92, and 342D; Part 121 of Title 40, Code of Federal Regulations (CFR); and Hawaii Administrative Rules, (HAR), Chapter 11-54, the Department of Health (DOH) has reviewed your revised Section 401 WQC Application and appurtenant data relevant to water quality considerations for the subject proposed construction activities. The discharge activities associated with the construction of the subject project will be authorized under the U.S. Army Corps of Engineers Standard Permit (File No. POH-2005-552) to be issued under the authorization of Rivers and Harbors Act of 1899 (RHA, 33 U.S.C. 403), Section 10, and CWA, Section 404. The processing of this revised Section 401 WQC Application is based on the requirements contained in CWA, Section 401; HRS, Chapters 91, 92, and 342D; 40 CFR Part121; and HAR, Chapter 11-54.

The following is the information of the owner and duly authorized representative:

Owner:

Ford Island Housing, LLC
737 Bishop Street, Mauka Tower, Suite 2750
Honolulu, HI 96813

Contact: Mr. Thomas Lee, Development Manager
Ph.: (808) 585-7900
Fax: (808) 585-7910

The Director of Health (Director) attests to the following statements based on the information contained in the revised Section 401 WQC Application, dated September 15, 2010; and additional information, dated November 16, 2010; and December 23, 2010.

1. The Director has either:

   a. Examined the Application submitted by the owner and its duly authorized representative and bases its certification upon an evaluation of the information contained in such application which is relevant to water quality considerations; or

   b. Examined other information furnished by the owner and its duly authorized representative sufficient to permit the statement described in Item No. 2. below.

2. When all requirements and conditions contained in this proposed Section 401 WQC are fully complied with, there is reasonable assurance that the discharges resulting from the proposed construction activities will be conducted in a manner which will not violate the applicable water quality standards (WQS) and will comply with the applicable provisions of CWA, Sections 301, 302, 303, 306, and 307.

3. The following requirements are deemed necessary and shall constitute part of the Section 401 WQC conditions.

   This Section 401 WQC shall become effective on the date of this letter and expire at midnight **June 7, 2013**, or until the applicable WQS is revised or modified, or when the Department of the Army (DA) Standard Permit (No. POH-2005-552) is modified, revoked, suspended, or expired, or the project construction is completed, whichever is earliest. If the applicable WQS is revised or modified, before **June 7, 2013**, and such that the activity complies with the revisions or modifications to the WQS, the determination of waiving the notification requirements shall continue to be valid until **June 7, 2013**.

   The Director may, upon the written request from Ford Island Housing, LLC, administratively extend the expiration date of this determination if the written request can demonstrate to the Director that the project is in fact under construction and there are no significant changes to the project scope and the changes will not, either individually or cumulatively, cause adverse impact to the receiving water quality. The request shall be accompanied with appropriate color photographs (including the date/time and narrative description) demonstrating that the project is in fact under physical construction and the purpose of extending the expiration date is to allow the contractor to complete the project construction.

In addition, the following standard Section 401 WQC conditions are also deemed applicable to this project:

a. This Section 401 WQC shall become invalid if the project construction activity is found to be controversial after the effective date of this letter. Ford Island Housing, LLC shall cease all discharge activities as specified in Item No. 7.d for the purposes as specified in Item Nos. 7.b and 7.c of the September 15, 2010 revised Section 401 WQC Application. Ford Island Housing, LLC, and the contractor(s), subcontractor(s), if any, shall not hold the DOH responsible for any damages or costs incurred due to the cessation of the discharge activity.

b. May be revoked when:

(1) New State WQS are subsequently established before the activity is completed and/or the Director determines that the activity is violating new State WQS. The Director will notify Ford Island Housing, LLC of the violation. Ford Island Housing, LLC shall cease the violation within 180 calendar days of the date of the notice. If Ford Island Housing, LLC fails within 180 calendar days of the date of the notice to cease the violation, the Director may revoke this waiver determination; or

(2) The Director determines that the discharge(s) from the activity is violating the existing State WQS or any condition specified in this letter. The Director will notify Ford Island Housing, LLC of the violation. Ford Island Housing, LLC shall cease the violation within seven (7) calendar days of the date of the notice. If Ford Island Housing, LLC fails within seven (7) calendar days of the date of the notice to cease the violation, the Director may revoke this waiver determination.

These actions shall not preclude the DOH from taking appropriate enforcement action authorized by law.

Written notification by the Director under this section is complete upon mailing or sending a facsimile transmission of the document or actual receipt of the document by Ford Island Housing, LLC.

4. In accordance with Item No. 7.d. of the revised Section 401 WQC Application, the discharge activities that Ford Island Housing, LLC is seeking coverage under this Section 401 WQC Application are "stone, beach sand, turbidity barriers and associated materials (geotextile filter fabric, anchors, floats etc.)."

5. Ford Island Housing, LLC shall:

   a. Notify the CWB via e-mail cleanwaterbranch@doh.hawaii.gov of the construction activities:

      (1) General contractor information.

      (2) Emergency Contact Information.

      (3) Commencement date within seven (7) calendar days before any work is to begin.

      (4) Completion date within 14 calendar days after the completion of the proposed construction activities (including the disturbed sites restoration activities).

   All communication, including but not be limited to the e-mail, with the CWB shall indicate **File No. WQC 0000764** and the certification statement below.

   b. Comply, and shall also require the contractors and subcontractor(s) to comply, with applicable specifications, schedules, procedures, BMP's (Best Management Practices) Plan contained in the revised Section 401 WQC Application, dated September 15, 2010. This BMPs Plan represents the minimum BMP measures required to be implemented in the construction of the subject project. The general contractor may furnish additional BMP measures as deemed necessary.

   Properly conduct or contract with a qualified laboratory/environmental consultant to conduct the "Applicable Monitoring and Assessment Program" contained in the revised Section 401 WQC Application, dated September 15, 2010.

   Test methods promulgated in 40 CFR Part 136 effective on July 1, 2001, and when applicable, the chemical methodology for sea water analyses (HAR, Section 11-54-10) shall be used. The detection limits of the test methods used shall be equal to or lower than the applicable WQS as specified in HAR, Chapter 11-54. For situations where the applicable WQS is below the detection limits of the available test methods, the test method which has the detection limit closest to the applicable WQS shall be used. If a test method has not been promulgated for a particular parameter, the applicant may submit an application through the Director for approval of an alternate test procedure by following 40 CFR §136.4.

The Director may, at the Director's own discretion or upon written request from Ford Island Housing, LLC and on a case-by-case basis, require Ford Island Housing, LLC to modify the monitoring frequency(ies) or change the sampling locations and/or parameter, as appropriate. If a written request is submitted for the reduction of monitoring frequency(ies), it shall be accompanied by an assessment of monitoring results which shall clearly demonstrate that the project construction activity related discharge has fully complied with the applicable WQS.

Unless otherwise requested by the Director, water quality analytical results and relevant quality assurance/quality control (QA/QC) results shall be submitted to the CWB every two (2) weeks upon receipt of the lab results. Only results from representative samples shall be acceptable. Sampling data shall be submitted to the CWB via Fax No. (808) 586-4352 or by e-mail at cleanwaterbranch@doh.hawaii.gov. All reports shall include **File No. WQC 0000764** and the certification statement below.

Color photographs shall be taken before, during and after completion of the proposed construction activities. Copies of the color photographs taken should note the date and time the photos were taken. Photographs taken before the project construction shall be submitted to the CWB prior to the commencement of the project construction. Photographs taken after the construction shall be submitted to the CWB within two (2) weeks after the completion of the construction project.

Weekly written sampling report with field measurement results shall be submitted to the CWB via e-mail to cleanwaterbranch@doh.hawaii.gov within seven (7) calendar days after the field measurement data are downloaded/collected.

c. Ensure that:

(1) All "discharges" associated with the proposed construction activities are conducted in a manner that will not cause or contribute to a violation to the "Basic Water Quality Criteria Applicable to All Waters" as specified in HAR, Section 11-54-4.

(2) All material(s) placed or to be placed in State waters are free of waste metal products, organic materials, debris, and any pollutants at toxic or potentially hazardous concentrations to aquatic life as identified in HAR, Subsection 11-54-4(b).

d. Ensure that the turbidity barriers and other appropriate and effective silt containment or treatment device(s) and soil erosion control measures will be properly deployed prior to the commencement of the construction work; be properly maintained throughout the entire period of the construction work; and not be removed until the construction work is completed and the condition in the affected area has returned to its pre-construction condition or better, as demonstrated by the monitoring results.

e. Ensure that construction debris, including but not limited to those resulting from the excavation/dredging activity, is contained on land and prevented from entering or re-entering State waters.

f. Ensure that all temporarily constructed structures (including rock access berms to the rock rubblemound T-head groin or turbidity/silt curtains), silt containment device(s) and/or soil erosion control structures, are properly removed immediately after the completion of the construction work and when the affected water body has returned to its pre-construction condition or better, as demonstrated by the monitoring results, including the color photographs.

g. Ensure that the permitted activity will not result in non-compliance or cause violations to the applicable State WQS. Although temporary increases in turbidity level is expected, any visible floating debris, oil, grease, scum, other floating materials, or objectionable color, or turbidity plume, detected outside the confined/isolated areas constitutes a violation to HAR, Subsection 11-54-4(a) requirements.

   Ford Island Housing, LLC shall immediately cease the portion of the construction work which is causing or may cause non-compliance with HAR, Subsection 11-54-4(a), Subsection 11-4-4(b), or the portion of the construction is damaging or will cause damage to the aquatic environment as is indicated through water quality monitoring results or during the daily inspection or observations. The construction activity shall not resume until adequate mitigative measures are implemented and appropriate corrective actions are taken and approved by the Director.

   Ford Island Housing, LLC, contractor(s), and subcontractor(s), if any, shall not hold the DOH responsible for any damages or costs incurred due to the temporary cessation of the construction operation.

   This action shall not preclude the DOH from taking appropriate enforcement action authorized by law.

h. Immediately report any spill(s) or other contamination(s) that occurs at the project to the CWB via telephone number (808) 586-4309 or through e-mail to: cleanwaterbranch@doh.hawaii.gov.

i. Ensure that:

   (1) Erosion and Sediment Control Measures are in place and functional before construction operations begin.

(2) Temporary soil stabilization shall be applied on areas that will remain unfinished for more than 30 calendar days.

Ford Island Housing, LLC shall ensure that the contractor(s) and the subcontractor(s) maintain, at the construction site or in the nearby field office, a record that these requirements have been fully complied with.

j. Not discharge construction site dewatering effluent, hydrotesting effluent, concrete truck wash water, and any other types of effluent without first obtaining the required National Pollutant Discharge Elimination System permit from the DOH.

k. Maintain, or require the contractor(s) and the subcontractor(s), if any, to maintain a copy of the revised Section 401 WQC Application packages and this letter at the construction site or in the nearby field office. Ensure that all areas impacted, either directly or indirectly, by the project construction activities are fully restored.

l. Work shall be discontinued during storm events or during flood condition.

m. Clearing and grubbing shall be held to the minimum, if any.

6. Ford Island Housing, LLC shall review and update the effectiveness and adequacy of the Applicable Monitoring and Assessment Program and the BMPs Plan. Ford Island Housing, LLC shall modify the Applicable Monitoring and Assessment Program, BMPs Plan, and/or environmental protection measures upon request or when instructed by the Director.

   Any change(s) to the implemented site-specific BMPs Plan, the Applicable Monitoring and Assessment Program, and/or correction(s) or modification(s) to information already on file with the DOH shall be submitted to the CWB for review and comment as such change(s), correction(s) or modification(s) arises. Ford Island Housing, LLC shall properly address all comment(s) and/or concern(s) to the Director's satisfaction before such change(s), correction(s) or modification(s) become effective.

7. By applying for and accepting this Section 401 WQC, Ford Island Housing, LLC agrees that the DOH may conduct routine inspection of the construction site, taking color photographs, and to sample any discharges or effluent in accordance with HRS, Section 342D-8.

8. Construction debris, vegetation and/or dredged material removed from the construction site shall be disposed of at the upland State or County approved sites. A Solid Waste Disclosure Form for Construction Sites shall be completed and returned to the DOH, Solid and Hazardous Waste Branch, Solid Waste Section. The form can be downloaded at: http://www.hawaii.gov/health/environmental/waste/sw/pdf/swdiscformnov2008.pdf.
   No construction material or construction activity related materials shall be stockpiled, stored or placed in State waters or in ways that will disturb or adversely impact the aquatic environment.

9. Runoff or return flow or airborne particulate pollutants, if any, from the excavated/dredged material dewatering process or from the stockpiling site shall be contained on land and not be allowed to enter State waters.

10. Ford Island Housing, LLC shall comply with all new State WQS adopted by the DOH after the effective date of this letter.

11. The DOH reserves the right of taking appropriate enforcement action authorized by law against any non-compliance of conditions contained in this letter.

12. Ford Island Housing, LLC is hereby informed that effective as the date of this letter, Mr. Scott P. Sullivan of Sea Engineering, Inc. is no longer recognized as the duly authorized representative. Mr. McGinnis of Ford Island Housing, LLC shall submit all information/documents for compliance with the WQC conditions. A new authorized representative may be appointed by completing Item Nos. 16 and 17 of the CWB-WQC Application.

Please include **File No. WQC 0000764** and the following certification statement in all future correspondence with the DOH for the subject project:

> **"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."**

If you have any questions, please contact Ms. Jamie Tanimoto of the Enforcement Section or Ms. Jiaping Fouse of the Engineering Section, CWB, at 586-4309.

Sincerely,

STUART YAMADA, P.E., CHIEF
Environmental Management Division

JF:np

c: PICO, Region 9, EPA [via fax 541-2712 only]
Regulatory Branch, HED, COE [via fax 438-4060 only]
CZM Program, Office of Planning, DBEDT [via fax 587-2899 only]
Mr. Scott P. Sullivan, Sea Engineering, Inc.
[via e-mail ssullivan@seaengineering.com only]
Mr. Daniel Gavin, Cirrus Asset Management [via fax 203-5012 only]
Mr. Philip Moravcik, University of Hawaii at Manoa [via fax 956-3980 only]

APPENDIX B

APPLICABLE MONITORING AND ASSESSMENT PROGRAM

Applicable Monitoring and Assessment Program for the Iroquois Point Beach Restoration Project. ‘Ewa Beach, O‘ahu, Hawai‘i.

December 17, 2010
revised January 27, 2011

AECOS No. 1044 F

Chad Linebaugh[1] and Scott Sullivan[2]

[1] *AECOS*, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāne‘ohe , Hawai‘i 96744
Phone: (808) 234-7770 Fax: (808) 234-7775
Email: aecos@aecos.com

[2] Sea Engineering, Inc.
41-305 Kalanianaole Hwy. Makai Research Pier
Waimanalo, HI 96795
Phone: (808) 259-7966 Fax: (808) 259-8143
Email: ssullivan@seaengineering.com

Introduction

This Applicable Monitoring and Assessment Program (AMAP) accompanies the Section 401 Water Quality Certification (WQC) application for the proposed Iroquois Point Beach Restoration Project hereinafter referred to as "the project". The project is located along the southern shore of O‘ahu, just west of the Pearl Harbor entrance channel (Fig. 1). This plan has been prepared in accordance with water quality regulations promulgated in Hawaii Administrative Rules (HAR) Chapter 11-54 (HDOH, 2009) and the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH, 2000). The intent of the AMAP is:

1) to ascertain that Best Management Practices (BMPs) for the project are adequate to comply with State of Hawai‘i water quality standards;
2) in the event that the BMPs prove inadequate, to promptly determine such, so that modification’s of the BMPs can be implemented in a timely manner to bring the activity into compliance; and
3) to serve as a basis for self-compliance, so that construction can proceed within the parameters required by State of Hawai‘i water quality standards.

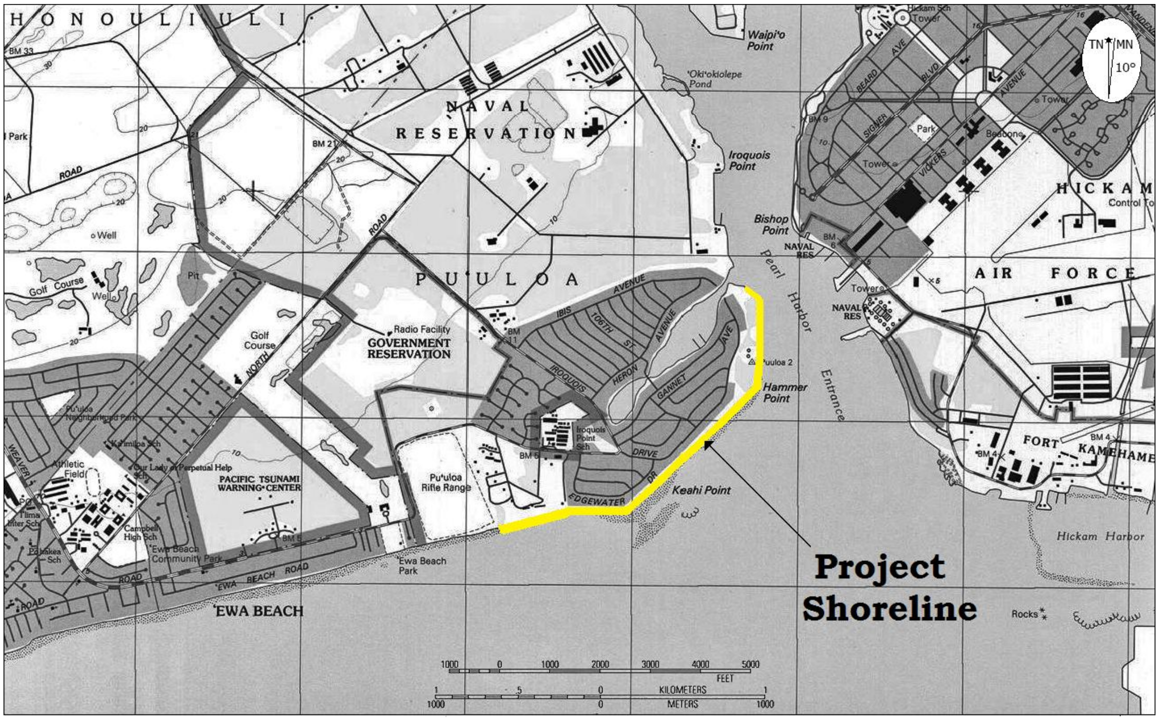


Figure 1. General location of the project site along O'ahu's south shore.

The proposed project will entail construction and placement of fill material (rock and sand) within the jurisdictional waters of the United States, defined as the mean higher high water line (+2 feet MLLW). The proposed project is designed to restore and stabilize the sand beach along the Iroquois Point shoreline. The beach restoration plan consists of nine T-head groin structures, dividing the beach into eight segments 400 to 450 feet long. The groins would be constructed of rock, with shore perpendicular stems 140 feet long and shore parallel heads 100 to 200 feet long. Sand fill will be placed within each beach segment, with a design slope of 1V:10H up to a crest elevation of +6 feet MLLW, and a crest width of 50 feet. The total volume of sand fill required is approximately 80,000 yd^3. 20,000 yd^3 of sand is currently stockpiled along the Pearl Harbor Channel, just north of Hammer Point. The remaining 60,000 yd^3 is to be excavated from the shoreline of the Pearl Harbor Channel, near the existing stockpile, where sand has accreted nearly 200 ft into the channel. Details of design and assessed impacts of the project are presented in the Environmental Assessment (SEI, 2010) prepared to accompany a Department of the Army permit application for construction of the project.

The proposed project sand extraction area is within Pearl Harbor entrance channel. Pearl Harbor is classified as an estuary (HDOH, 2009) and appears in the State of Hawaiʻi, 2006 Water Quality Monitoring and Assessment Report (HDOH, 2008) list of impaired water bodies. The station (Geocode HI00006) is listed as impaired for total nitrogen, total phosphorus, turbidity and chlorophyll. The marine environment fronting the proposed project groin construction and sand placement areas is classified as Class A, open coastal marine waters (HDOH, 2009). The area also appears on the list of impaired water bodies as Iroquois Pt. (Geocode HI412839; coastal waters) but data is listed as unknown for all parameters. A nearby station reported as "Pearl Harbor-Harbor waters and nearshore waters to 30' from Keʻehi Lagoon to Oneʻula Beach" (Geocode HIW00119) is listed as impaired for turbidity, nutrients, suspended solid, PCBs, and fish consumption advisory. A Total Maximum Daily Load (TMDL) study has been deemed a high priority for Pearl Harbor and nearby waters.

Several studies including those on water quality, biology, corals and fishes (see *AECOS*, 2007a, 2007b, 2008) and monitoring and mitigation plans (*AECOS*, 2009, 2010a) for the project, have been already been completed. Pre-construction water quality monitoring was conducted from October 2004 to February 2007 (*AECOS*, 2007a).

Parameters to be Monitored

Receiving water quality parameters to be monitored follow the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH 2000). The parameters to be monitored include temperature, dissolved oxygen, pH, and turbidity. In addition, water quality stations will be monitored by photography.

In addition to monitoring of the parameters stated above, an individual designated by the construction contractor will perform daily visual inspections and take photographs of the project site. Details of the daily inspections will be documented in a field notebook or log book designated for this purpose. Information in the daily inspection log will include, but will not be limited to: description of the current construction activity, date, time, and other ongoing activities; such as weather conditions, precipitation, tidal conditions, surf conditions, and recreational use of the waters near the project site and activities that may or may not be related to construction activities but may affect water quality. Photographs will document the condition of the work area and project BMPs.

Sampling Locations

The project work (and therefore the monitoring) will be conducted in three general areas: T-shaped groin construction areas, sand extraction areas, and sand placement areas. During T-groin construction full depth turbidity containment devices (silt curtains) with full length chain ballasts will be placed surrounding the work areas. Silt curtains will be placed allowing at least a 20 ft (6 m) work area between groin and curtain. Silt curtains will be anchored on seaward corners and extend to the 4-ft (1.2-m) elevation contour on the landward end of the work area. During sand extraction work, a 6-ft deep silt curtain with full length chain ballast will be deployed around the area of active sand extraction. During sand placement work, sand from stockpiles will be placed on the beach and moved to the design profile. During this phase, silt curtains will be extended between the recently built T-groins, and from the landward ends of the groins up to the existing +4-foot shoreline elevation.

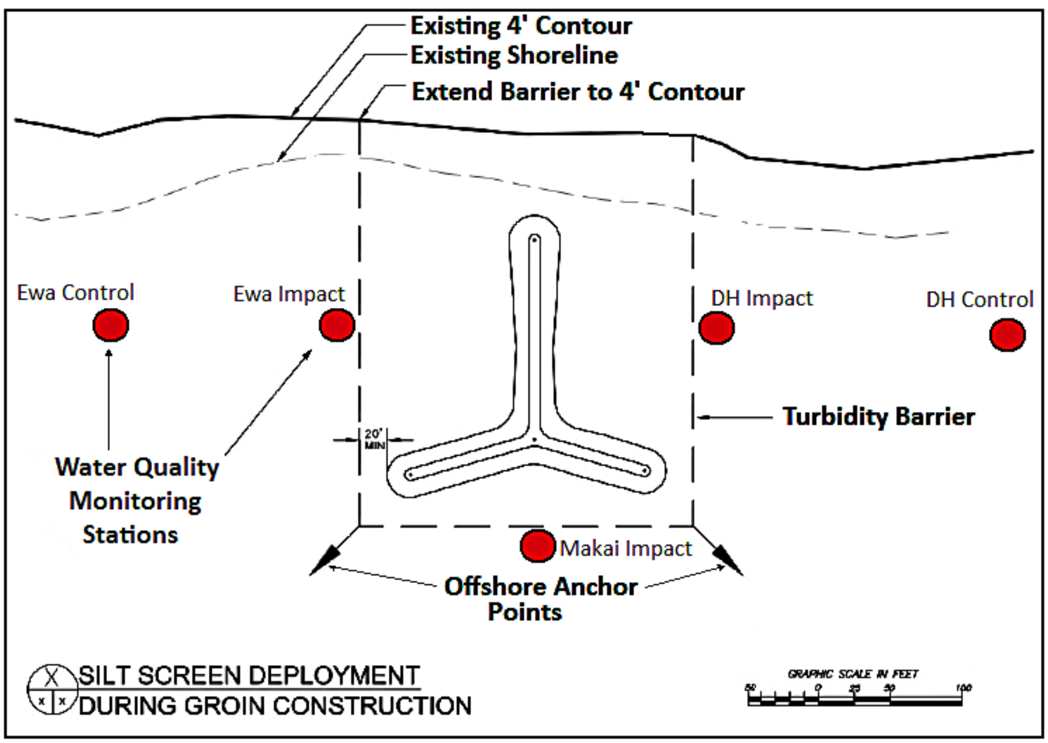


Figure 2. Monitoring station locations for one of the nine groins work areas.

During Construction

During groin construction, monitoring stations will be located in five locations surrounding each of the 9 work areas. Impact stations will be located 3 ft (1m) off the center of the ʻEwa, Diamond Head, and makai sides of each work area. Two control stations, one on the ʻEwa side and one on the Diamond Head side will be located 100 ft (33 m) from each project work area. In the event that groin construction is occurring at two or more consecutive groins, controls stations will be sampled at the furthest ʻEwa control station and furthest Diamond Head station, i.e., only two total control stations will sampled during each sampling event. Figure 2 (see above) depicts water quality station at one of nine groin construction areas.

While sand extraction work is occurring, monitoring stations will be located in five locations surrounding the roaming work area. Impact stations will be located 3 ft (1m) off the north, south, and east sides of the work area. Two control stations will be monitored approximately 50 ft (15 m) north and south of the sand extraction work area. Figure 3 depicts water quality stations at the sand extraction work area.

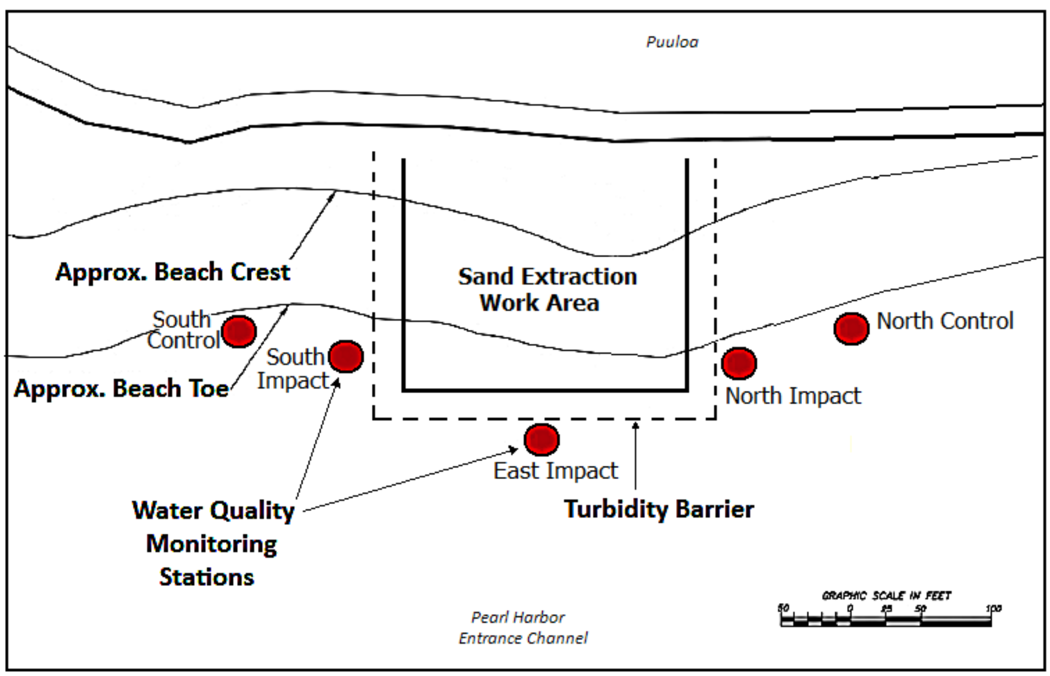


Figure 3. Monitoring station locations for a hypothetical segment of the sand extraction work area.

Monitoring stations during sand placement will be located at five locations surrounding each sand placement area. One impact station will be at each connection between the groin and the silt curtain and one impact station will be centered between the two newly constructed groins (Fig 4). Two control stations (ʻEwa and Diamond Head) will be located on the opposite ends of the newly constructed groins, at least 50 ft (15 m) from the silt curtains. In the event that sand placement is occurring on more than one consecutive beach segment control stations will be collected from the furthest ʻEwa and furthest Diamond Head control stations (i.e., only two total control stations will be sampled).

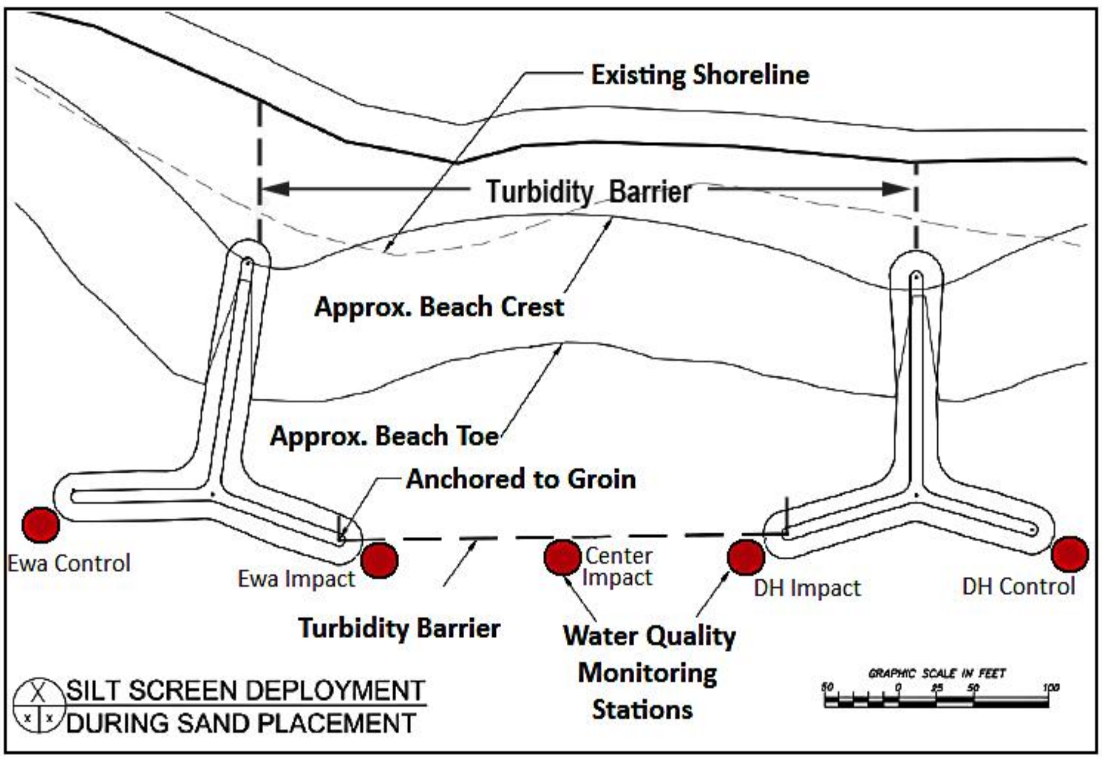


Figure 4. Monitoring station locations for each of eight beach segments to be nourished during sand placement.

Once the monitoring program begins, GPS coordinates of the water quality monitoring stations will be recorded during the first sampling event at that station and provided to HDOH-CWB with the field notes. The sampling locations may change due to natural environmental conditions. If sampling locations need to be changed HDOH-CWB will be notified, new GPS coordinates will be recorded and provided with the field notes. Estimated coordinates of impact stations at anticipated groin construction and sand placement work areas are provided in Tables 1 and 2.

Table 1. Nomenclature and estimated GPS coordinates (Datum WGS84) for groin construction impact monitoring stations.

Station (ID)	Latitude (N)	Longitude (W)
Groin 1 DH Impact (G1DHIS)	21°19.283’	157°58.302’
Groin 1 ‘Ewa Impact (G1EIS)	21°19.267’	157°58.322’
Groin 1 Makai Impact (G1MIS)	21°19.264’	157°58.299’
Groin 2 DH Impact (G2DHIS)	21°19.235’	157°58.364’
Groin 2 ‘Ewa Impact (G2EIS)	21°19.221’	157°58.381’
Groin 2 Makai Impact (G2MIS)	21°19.219’	157°58.361’
Groin 3 DH Impact (G3DHIS)	21°19.183’	157°58.420’
Groin 3 ‘Ewa Impact (G3EIS)	21°19.124’	157°58.495’
Groin 3 Makai Impact (G3MIS)	21°19.167’	157°58.419’
Groin 4 DH Impact (G4DHIS)	21°19.137’	157°58.478’
Groin 4 ‘Ewa Impact (G4EIS)	21°19.124’	157°58.495’
Groin 4 Makai Impact (G4MIS)	21°19.122’	157°58.475’
Groin 5 DH Impact (G5DHIS)	21°19.084’	157°58.539’
Groin 5 ‘Ewa Impact (G5EIS)	21°19.069’	157°58.533’
Groin 5 Makai Impact (G5MIS)	21°19.069’	157°58.553’
Groin 6 DH Impact (G6DHIS)	21°19.026’	157°58.600’
Groin 6 ‘Ewa Impact (G6EIS)	21°19.015’	157°58.619’
Groin 6 Makai Impact (G6MIS)	21°19.013’	157°58.599’
Groin 7 DH Impact (G7DHIS)	21°18.987’	157°58.653’
Groin 7 ‘Ewa Impact (G7EIS)	21°18.973’	157°58.668’
Groin 7 Makai Impact (G7MIS)	21°18.967’	157°58.651’
Groin 8 DH Impact (G8DHIS)	21°18.944’	157°58.740’
Groin 8 ‘Ewa Impact (G8EIS)	21°18.942’	157°58.758’
Groin 8 Makai Impact (G8MIS)	21°18.932’	157°58.749’
Groin 9 DH Impact (G9DHIS)	21°18.945’	157°58.820’
Groin 9 ‘Ewa Impact (G9EIS)	21°18.944’	157°58.842’

Groin 9 Makai Impact (G9MIS)	21°18.930’	157°58.830’

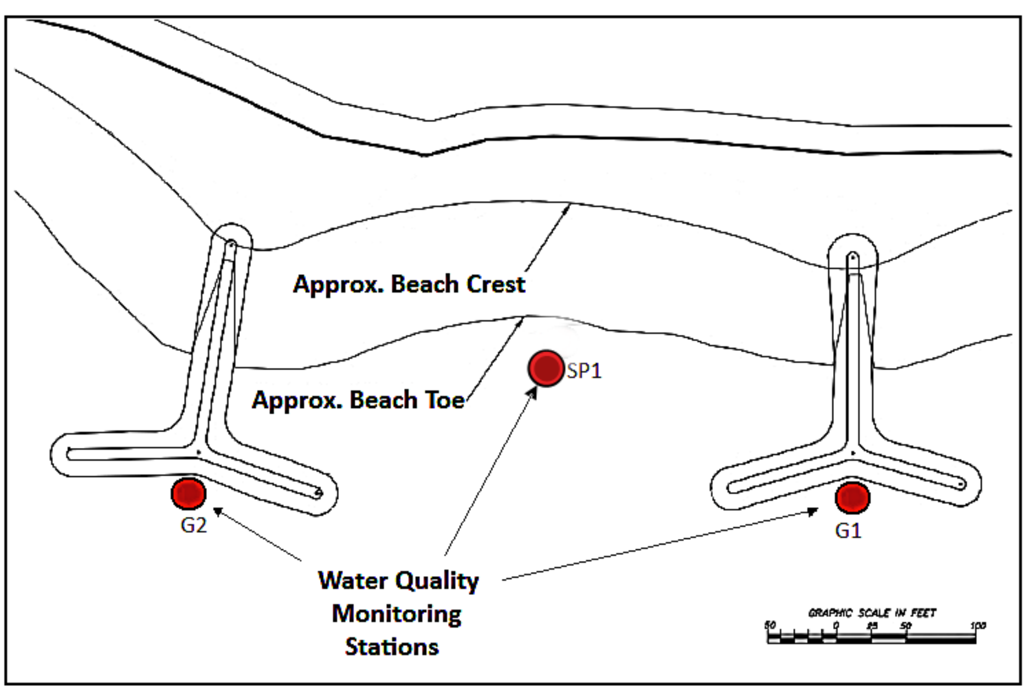
Table 2. Nomenclature and estimated GPS coordinates (Datum WGS84) for sand placement impact monitoring stations.

Station (ID)	Latitude (N)	Longitude (W)
Sand Placement 1 DH Impact (SP1DHIS)	21°19.255’	157°58.316’
Sand Placement 1 ‘Ewa Impact (SP1EIS)	21°19.232’	157°58.346’
Sand Placement 1 Center Impact (SP1CIS)	21°19.245’	157°58.330’
Sand Placement 2 DH Impact (SP2DHIS)	21°19.207’	157°58.375’
Sand Placement 2 ‘Ewa Impact (SP2EIS)	21°19.179’	157°58.409’
Sand Placement 2 Center Impact (SP2CIS)	21°19.196’	157°58.392’
Sand Placement 3 DH Impact (SP3DHIS)	21°19.158’	157°58.430’
Sand Placement 3 ‘Ewa Impact (SP3EIS)	21°19.132’	157°58.464’
Sand Placement 3 Center Impact (SP3CIS)	21°19.147’	157°58.445’
Sand Placement 4 DH Impact (SP4DHIS)	21°19.116’	157°58.485’
Sand Placement 4 ‘Ewa Impact (SP4EIS)	21°19.079’	157°58.529’
Sand Placement 4 Center Impact (SP4CIS)	21°19.101’	157°58.505’
Sand Placement 5 DH Impact (SP5DHIS)	21°19.063’	157°58.544’
Sand Placement 5 ‘Ewa Impact (SP5EIS)	21°19.020’	157°58.592’
Sand Placement 5 Center Impact (SP5CIS)	21°19.041’	157°58.566’
Sand Placement 6 DH Impact (SP6DHIS)	21°19.008’	157°58.611’
Sand Placement 6 ‘Ewa Impact (SP6EIS)	21°18.976’	157°58.646’
Sand Placement 6 Center Impact (SP6CIS)	21°18.994’	157°58.625’
Sand Placement 7 DH Impact (SP7DHIS)	21°18.964’	157°58.663’
Sand Placement 7 ‘Ewa Impact (SP7EIS)	21°18.935’	157°58.737’
Sand Placement 7 Center Impact (SP7CIS)	21°18.950’	157°58.696’
Sand Placement 8 DH Impact (SP8DHIS)	21°18.933’	157°58.759’
Sand Placement 8 ‘Ewa Impact (SP8EIS)	21°18.932’	157°58.818’
Sand Placement 8 Center Impact (SP8CIS)	21°18.931’	157°58.789’

Post Construction

A post construction monitoring station will be centered seaward of each new groin (n=9), each sand placement area (n=8), and at the midpoint of the sand extraction area's new shoreline (n=1). Groin stations will be located 3 ft (1m) off the center of the seaward end of the groin. Sand placement area and sand extraction area stations will be located 33 ft (10 m) from the waterline. The post construction groin and sand placement results will be compared with preconstruction data collected from Stas. *X*-60 and *X*-10, respectively (where *X* = Transects A through F as applicable, *60* = 60 meters from the beach crest and *10* = 10 meters from the water line). The stations are shown in Fig. 2, in *AECOS*, 2007a which is attached as Appendix A. Figure 5 depicts post construction station locations relative to the anticipated typical beach at a sand placement area relative to the two newly constructed groins.

Figure 5. Station locations fronting sand placement areas and new groins for post construction monitoring.



Sampling Frequency

During Construction Sampling

During construction, sampling will occur once per week at all impact and control stations while groin construction is occurring. Sand extraction areas will be monitored at all impact and control stations once per week while sand extraction is ongoing. Sampling will continue until all BMPs at the work area are removed. During sand placement, sampling will occur once per week at all three impact station for each area of sand placement. Two control stations established 50 ft (15 m) northeast and southwest of sand placement areas will also be sampled during each sampling event. Photographs will be taken during sampling of each water quality monitoring station and will show the stations location in relation to the silt curtains.

Post Construction Sampling
All 18 post construction stations will be sampled once a month for six months after the project is completed and all BMPs are removed. Photographs will be taken of each station.

Sampling and Analytical Methods

The construction contractor will assign a representative that will be responsible for a daily log of weather conditions and relevant observations. This individual will also make visual inspections of water quality and project BMPs at a minimum of one time per work day as long as construction is occurring. Any observed physical change in the character of the receiving water, like excessive sedimentation, due to construction will result in modification of construction activities and/or BMP's to correct the problem. Modification to construction activities and existing BMP's will be implemented in a timely manner. HDOH must be notified **immediately** to approve any changes to project BMPs or sampling station locations. Results of the visual inspections and any changes to BMPs or station locations will also be noted in a field notebook or log book.

Table 3. Summary of responsibilities and qualifications for AMAP personnel.

Name	Responsibility	Qualification
Snookie Mello	Project Manager	Project management, laboratory, and field experience.
AECOS personnel	Collect samples for turbidity; perform field measurements of temperature, dissolved oxygen, salinity and pH. Photograph monitoring stations. Take GPS coordinates for all stations upon beginning project. Take GPS coordinates each time a station is relocated.	Trained and experienced in collecting water samples, performing field measurements in aquatic and marine environments, and monitoring construction contractors working in marine and aquatic environments.

Contractor's foreman or representative	Notify samplers and laboratory when in-stream construction will start prior to starting work. Make daily visual observations and take daily photographs of BMPs, and construction activity to be logged in a notebook to be used as part of the assessment process. Photograph any observed impacts to the marine environment.	Knowledgeable of construction activities as they relate to 401 WQC requirements. Familiar with nearshore waters. Knowledgeable of WQC monitoring requirements for this project.

All water quality monitoring will be conducted by *AECOS*, Inc. water quality field technicians experienced in water quality monitoring in Hawaiian marine environments. Field measurements for temperature, dissolved oxygen, salinity and pH will be made *in situ* at the time of sample collection. The samplers will record the sample time and all field measurements in a field book. Additional notes on unusual site conditions, condition of any silt curtain at the time of sample collection, construction activity, weather conditions, and non-construction activity that may be impacting water quality in the nearshore environment will be recorded. Photographs of each monitoring station will be taken. Photographs must include date/time stamp or that information must be embedded in the metadata associated of digital photograph files. Description of photos must be included with photos for submittal to DOH-CWB.

A 250-ml plastic bottle will be used at each monitoring station to collect samples for turbidity. The samples will be collected right below the ocean surface by facing the bottle up-current to fill. The samples will analyzed for turbidity at the project site following the collection of samples from all stations. Table 4 lists the analytical methods, references, units, typical instrumentation, analytical hold times and field preservation for each parameter to be monitored.

Table 4. Analytical methods, typical instrumentation, analytical hold times and field preservation for each parameter monitored in this monitoring program.

Parameter	**Units**	**Method (Reference)**	**Typical Instrument**	**Hold Time**	**Field Preservation**
Dissolved Oxygen	mg/l	4500-O G (SM, 1998)	YSI 85 or 550A meter	measured in situ	none
pH	standard units	4500H+ (SM, 1998)	Hanna pocket pH meter	15 minutes	none

Salinity	ppt	Conductivity calculation or refractive index (YSI Manual)	YSI 85 meter or field refractometer	measured in situ	none
Temperature	° C	2550 B (SM, 1998)	YSI 85 or 550A meter calib. to NIST cert. thermometer	measured in situ	none
Turbidity	ntu	180.1, Rev. 2.0 (EPA, 1993)	2100 /P HACH Turbidimeter	48 hrs	none for field analysis (chill on ice to 4°C for lab. analysis)

Quality Assurance

The water sampling and field measurements in this monitoring plan will be performed by personnel trained to perform these tasks. In the event the company awarded the construction contract chooses a laboratory other than *AECOS*, Inc. to conduct the monitoring program, this AMAP must be revised to conform to the chosen entity's qualifications, standard operating procedures, field and laboratory instrumentation then resubmitted for review by DOH-CWB.

Once samples have been collected, site conditions noted and field measurements have been properly documented in the field notebook, a written record of the chain of custody of the samples must be made for the laboratory analyses. A chain-of-custody (COC) form (Appendix B) accompanies the samples to the laboratory and directs the laboratory on the analyses to be performed. The form also identifies the sample ID and collection times, so the laboratory can report the analytical results by correct sample ID within the allowable hold time. When transferring possession of collected samples, the sampler shall sign and record the date and time on the chain-of-custody record. Each person who subsequently takes custody of the samples shall fill in the appropriate section of the chain-of-custody record. The chain of custody will be filed with the laboratory data and become a part of the permanent record.

All instrument calibration procedures will be undertaken prior to field measurements. The dissolved oxygen meter, pH meter and field turbidimeter will be maintained and calibrated according to manufacturer instructions and

Standard Operating Procedures (SOPs) (AECOS, Inc. 2005, 2010a, 2010b; HACH 2008, Hanna Instruments 2005; YSI Incorporated 2007, 2009). Operation and calibration will only be performed by personnel who have been properly trained in these procedures. Documentation of calibration and any maintenance information will be maintained in appropriate field or log books. All calibrations will be made prior to analyzing the samples.

Any item of field equipment that has shown by calibration or otherwise to be defective is to be taken out of service until it has been repaired. The equipment is placed back in service only after verifying by calibration that the equipment performs satisfactorily. If at any time calibration and maintenance is beyond the capability of the trained personnel, the Project Manager will be notified. An attempt will be made to solve the problem. If the equipment or instrument still cannot be repaired, the equipment will be taken out of service and sent for repair and replacement equipment will be obtained at the laboratory.

AECOS, Inc. participates in Environmental Protection Agency (EPA) certified provider's quality assurance (QA) programs available for all analyses conducted as part of this monitoring program. This includes EPA Water Supply performance evaluations and EPA Water Pollution performance evaluation programs. Relevant quality assurance/quality control (QA/QC) results will be provided to HDOH upon request.

The laboratory will retain in its records, the analytical procedures used, any relevant QA/QC information, and instrument calibration information pertaining to the specific analysis. All analytical results and field notes will be entered into a notebook or file established for this purpose, and provided in a final report prepared for the monitoring program. This file will be available for inspection by HDOH-authorized personnel during normal business hours.

Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements developed through a seven-step process based on EPA guidance for developing DQOs (USEPA, 2006). The project-specific DQOs below describe each step and how it pertains to the applicable monitoring and assessment program (AMAP).

Step 1: State the Problem

The existing shoreline at Iroquois Point suffers from chronic erosion. The eroding shoreline has caused the loss of several residences and threatens existing residences, roadways, and other structures near the project site. The construction of nine T-shaped groins and placement of sand along the shoreline included in the project has the potential to impair marine water quality.

The team of planners and scientists involved in this applicable monitoring program include construction contractors (tbd), ocean engineers (Sea Engineering, Inc.), marine biologists/water quality specialists (AECOS, Inc.), and state and federal regulators (ACOE, HDOH-CWB).

The primary pollutants of concern are suspended sediments. Construction activities associated with groin construction, sand extraction, and sand placement along the project shoreline have the potential to temporarily suspend fine particulates in the water column affecting water clarity.

Step 2: Identify the Goal of the Study

The intent of this monitoring and assessment program is to:

1) ascertain that the BMPs for the project are adequate to ensure that the marine water quality outside of the work area is unaffected by the construction;
2) promptly determine if BMPs prove inadequate so that modification of the BMPs can be implemented in a timely manner to bring the activity into compliance;
3) serve as a basis for self compliance, so that activities associated with the proposed action can proceed within the parameters required by State water quality standards; and
4) assess any short-term or long-term impacts construction may have had on marine water quality at the project site.

If monitoring indicates that the project is having an effect on the water quality then project BMPs will require modification and HDOW-CWB must be notified immediately.

Step 3: Identify Information Inputs

Temperature, salinity, dissolved oxygen, pH, and turbidity will be monitored once per week by *AECOS*, Inc. personnel that are trained and experienced in water quality monitoring. These water quality parameters follow the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH, 2000) and are the best available methods to monitor sediment load and other effects due to construction. Total suspended solids (TSS), another method commonly used to monitor suspended sediment, was not selected as a monitoring parameter for the project. Correlation studies between TSS and turbidity at in project waters (*AECOS*, 2007) indicate that turbidity accounts for 65% of the variability in TSS readings. Furthermore, TSS is not a parameter with established criteria specific to the Pearl Harbor estuary or open, coastal marine waters in the State of Hawaiʻi, water quality standards (HDOH, 2009).

AECOS, Inc. personnel will also photograph and visually inspect project BMPs and water quality at the project site. A representative designated by the construction contractor will also inspect water quality, project BMPs, and photograph observed impacts to water quality and biota on a daily basis. The numerical data and visual observations collected as a part of this monitoring program will allow the construction contractor, *AECOS*, Inc., Sea Engineering Inc., and HDOH-CWB to determine whether the objectives listed above are being met.

Preconstruction monitoring over a two year period throughout the project site has been completed and the results are presented in Appendix A. The data collected establish a baseline of conditions present in project waters and were used to establish action levels for turbidity. The action level (AL) for turbidity will be set at the geometric mean plus one standard deviation (AL = geomean + st. dev) based on the baseline data for that parameter at the project site. Table 5 includes a statistical summary of the preconstruction monitoring results for pH and turbidity.

Table 5. Statistical summary of preconstruction monitoring data and action levels for selected monitoring parameters.

Parameter	**pH**	**Turbidity**
n	*35*	*152*
min	7.90	0.92
max	8.99	25.0
geomean	8.13	3.38
st. dev	0.09	4.72
Action Level (AL)	**< 7.6 or >8.6†**	**8.10††**

† based on State of Hawaiʻi water quality standards

†† based on statistical analysis of preconstruction monitoring data

During construction and post construction data will be evaluated against the statistics and action levels presented in Table 5. During construction data will be used to determine whether BMPs are effective and post construction data will be used to assess whether the project impacted water quality on a short-term or long-term basis.

Step 4: Define the Boundaries of the Study

Data collection for the project is limited both spatially and temporally and these limitations define the boundaries of the decision units. Spatially, the data collection in the monitoring program will extend the length of the entire project area but be limited to 27 total groin construction impact stations, 24 sand placement impact stations, and an undetermined amount of sand extraction impact stations. Groin impact stations will monitor the quality of waters 3 ft (1 m) from the groin work areas and sand placement and sand extraction impact stations will monitor the quality of waters 33 ft (10 m) from the sand work areas. Control stations 50 ft (15 m) on either side of work areas will also be monitored. Thus monitoring will spatially extend the entire length of the project work area including an additional 50 ft (15 m) on each end for controls stations.

Temporally, data collection is limited to three monitoring phases for the project. Baseline (preconstruction) monitoring events were conducted at 2 to 6 month intervals from Oct. 19, 2004 to Feb. 23, 2007. Construction monitoring data will be collected once per week for the duration of the project. Post construction monitoring will be conducted at 18 stations once per month for six months following the completion of all work and removal of project BMPs. Monitoring will temporally extend from Oct. 19, 2004 to six months after the project's completion.

Each groin construction work area and sand extraction work area have one station on each side exposed to marine waters. Each sand placement area has three stations fronting the beaches to be enlarged. All groin construction, sand extraction, and sand placement work areas have two control stations to be monitored as well. Data collected will monitor the effects of the project construction on water quality at each station allowing a determination on the effectiveness of project BMPs to be made.

Step 5: Develop the Analytical Approach

The results of this construction monitoring will be evaluated against the decisions outlined during Step 2 of the DQO process. If the measured parameters at the impact stations exceed the action level and the exceedance is not related to ambient conditions, it will necessary to modify construction activities or the project BMPs.

The following numerical references for turbidity were established following the analysis of all pre-construction data to establish baseline geometric mean and standard deviation. The following numerical reference for pH was established based on State of Hawaiʻi water quality standards for open coastal waters (HDOH, 2009).

If the turbidity at the construction or sand placement impact stations at any time:

- exceeds the action level of 8.10 ntu, or
- exceeds the control stations by more than 4.72 ntu (st dev. of preconstruction turbidity values) , or

If pH results at the construction or sand placement impact stations at any time:

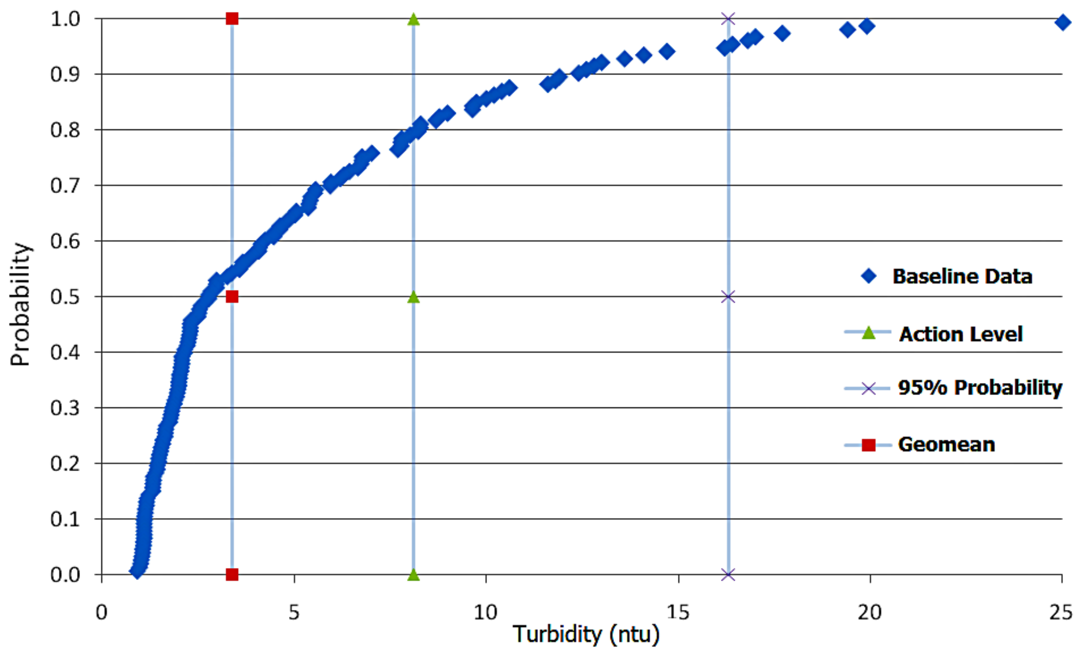
- fall outside of the range of 7.6 to 8.6,
- deviate more than 0.5 units from the control stations,

then a determination must be made whether the cause is attributable to construction. Upon obtaining field results that exceed the limits set for turbidity or pH the field samplers will notify the contractor's representative or on-site foreman/manager and the *AECOS*, Inc. project manager. The contractor's representative or on-site manager will attempt to track the cause of the exceedance. If it is determined that construction is causing the problem, then the activity responsible should cease until the problem is corrected.

Baseline conditions at the project site were established from preconstruction monitoring data. 152 measurements ranging from 0.92 to 25.0 ntu were taken for turbidity. In order to ensure water quality is not degraded an action level was set at the geomean plus one standard deviation, a level that is exceeded naturally approximately 20% of the time at the project site (Fig. 6).

The occurrence of construction impact station turbidity readings in excess of the action level does not alone indicate that water quality is being degraded by the project work. But it does require notification of the construction contractor's representative or on-site manager/foreman so that immediate investigation by the contractor as to the cause of the exceedance can be undertaken.

Figure 6. Probabilities of turbidity levels, geomean, and action level based on preconstruction monitoring data.



Step 6: Specify Performance of Acceptance Criteria

Environmental decisions are variable. Some uncertainty will be the result of sample design errors and some uncertainty will be the result of measurement errors. When examining the data against the decision rules (Step 5), a decision must be made whether the data show the water quality is within the range of ambient conditions (null hypothesis) or if the water quality is affected by construction activities. Two potential decision errors exist, Type I—false rejection of the null hypothesis (conclude a water quality impact has occurred where one has not) or Type II—false acceptance of the null hypothesis (conclude no water quality impact has occurred where one has). The tolerable limit on decision errors is set at >80%. It is assumed that differences in the percent change can be negative or positive (two-sided t-test), and the α significance level is set at 0.05.

To address decision errors that are the result of measurement errors, quality controls will be conducted on field measurements. During each sampling event, one station will be collected and analyzed for turbidity in duplicate. Acceptable relative percent differences for field duplicates are 75% or less. Replicate analysis of in situ field measurements for temperature, salinity, pH, and dissolved oxygen will be performed at this station as well. *AECOS* will submit quality control (QC) data to the permit holder and HDOH-CWB as it becomes available.

Step 7: Develop the Plan for Obtaining Data

Directed sampling will be employed in the study area. The sampling locations and sampling frequency were developed in accordance with water quality regulations promulgated in Hawaiʻi Administrative Rules (HAR) Chapter 11-54 (HDOH, 2009) and the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH, 2000). Modifications to optimize the sampling design may be necessary if construction is found to be consistently impacting water quality. Any notifications to sampling design must be approved by HDOH-CWB.

Reports/Assessment

All correspondence of monitoring data with HDOH-CWB concerning the Iroquois Point Beach Restoration Project must include file number (File No. WQC 0000764) and a signed standard certification statement (Appendix B). Draft results of construction monitoring results, which includes field measurements and turbidity (and QC data), will be sent via fax or email in Adobe Portable Document Format (.pdf) to HDOH-CWB from the permittee or *AECOS* Inc. by the close of the business day following the date of sampling. A brief report for submittal to HDOH will be prepared within two weeks of completion of all analyses of construction monitoring. In addition to analytical results, the report will include time and date of sampling, name of the person who collected the samples, date each analysis was conducted, and identification of the laboratory and analyst(s) that conducted the work. The report will have a running statistical summary for each construction phase of the project.

A final report and water quality assessment will be prepared upon completion of the monitoring program. This report will be submitted to HDOH within 60 days following completion of post-construction monitoring and analysis. If post-construction monitoring is not required, the report will be submitted 60 days following completion of construction monitoring and analysis. The final report will identify the methods and procedures for analytical measurements and include all data collected as well as statistical summaries of results by station and activity phase (pre-construction, construction, and post-construction). This report will also assess whether water quality was affected by the construction activity. Upon completion of the monitoring program, the contract laboratory will retain the original data and field notebook for a minimum of five years.

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APPENDIX C

ENDANGERED SPECIES ACT and ESSENTIAL FISH HABITAT CONSULTATION

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, Hawaii 96814-4700
(808) 944-2200 • Fax (808) 973-2941

Mr. Scott P. Sullivan
Vice President
Sea Engineering, Inc.
Makai Research Pier
41-305 Kalanianaole Hwy
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MAY 2 1 2008

Dear Mr. Sullivan:

This letter responds to your January 22, 2008 letter regarding the proposed beach stabilization of Iroquois Point on Oahu, received electronically on the same day by the National Marine Fisheries Service (NMFS). In your letter, you determined that the proposed action may affect, but is not likely to adversely affect Hawaiian monk seals, hawksbill sea turtles, and green sea turtles under NMFS's jurisdiction, and requested our concurrence under Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. §1531 *et seq.*). The U.S. Navy has retained Sea Engineering, Inc. as the contractor for engineering, design, and environmental assessment of the project and for conducting necessary environmental coordination. AECOS, Inc., has also been contracted by the Navy to conduct water quality and marine flora and fauna investigations for this project. NMFS began early coordination with Sea Engineering in mid-February, and on May 2, 2008, we received an e-mail from the Navy designating Ford Island Housing, LLC and Sea Engineering, Inc. as their non-Federal representatives for this proposed project. In addition to completing Section 7 consultation with NMFS for ESA-listed marine species, the Navy is also consulting with the United States Fish and Wildlife Service (USFWS) for ESA-listed terrestrial species, as well as applying for a Department of the Army (DA) permit from the Army Corps of Engineers under Section 404 of the Clean Water Act for in-water work.

Proposed Action/Action Area: The Navy and Ford Island Housing propose to restore and stabilize the sandy Iroquois Point shoreline in order to eliminate the on-going erosion and shoreline recession. The project will also remove scattered rocks, concrete and steel debris, and other rubble from the beach and nearshore waters, thereby improving sandy beach recreation opportunities. The Iroquois Point housing area is located on the south central shore of Oahu, immediately west of the Pearl Harbor entrance channel. The project area extends along 4,200 feet (ft) of shoreline (see draft EA p. 1).The proposed beach stabilization plan consists of multiple construction operations. The 9 T-head groin structures would divide the beach into 8 cells, each 400 to 450 ft long. The groin stems (perpendicular to shore) would be 140 ft long and extend seaward from the low water line. The head of the groin structures (parallel to shore) vary in total length from 100 to 200 ft. The crest elevation of the groin stem and head would be +4.5 ft mean low water, and the crest width would be approximately 7.5 ft. The groins would be constructed of 1,800 to 3,200 pound armor stone (see draft EA p. 13-14). The dredging of sand includes maintenance dredging of approximately 40,000 cubic yards (cy), obtained from accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois

Lagoon entrance. Dredging would be accomplished by positioning a crane on the shore and then using either a clamshell bucket to scoop up the sand, or simply dragging an open bucket up the sandy channel slope to scoop up the sand. A silt curtain would be used during dredging to prevent sediment from degrading marine water quality. The sand would be stockpiled along the back shore within the project area. An additional 22,000 cy of accreted sand has already been acquired from a 2006 maintenance dredge of the Pearl Harbor entrance channel. Actual in-water dredging work is anticipated to last approximately 60 days.

Sand fill would be accomplished after completion of adjacent groins. The sand would be pushed seaward from shore, with no equipment working in the water or below the water line. A silt curtain or turbidity barrier would be deployed between the groin heads to minimize water turbidity, and maintained in place until turbidity decreased to baseline conditions. Sand fill with appropriate characteristics to match the existing sand would be placed within each cell up to a crest elevation of +6 ft. The final construction operation includes creating a backshore earth berm or flood wall. Work on the shoreline and in the water to construct the groins and place sand to complete the entire project is expected to last 9 to 12 months. The work along the 4,200 ft stretch of beach would be done sequentially, moving from one end to the other. Active construction work would only involve about 800 ft of shoreline or 20% of the project area at any given time.

Listed Species/Critical Habitat: ESA-listed marine species under NMFS's jurisdiction that may be affected by the proposed action include the endangered Hawaiian monk seal (*Monachus schauinslandi*), the endangered hawksbill sea turtle (*Eretmochelys imbricata*), and the threatened green sea turtle (*Chelonia mydas*). There is no designated critical habitat for any of these listed species on Oahu.

The Hawaiian monk seal was listed as endangered on November 23, 1976 (41 CFR 51611). The biology, habitat, and conservation status of this species are described in the NMFS Hawaiian Monk Seal Recovery Plan (NMFS 2007a). This species is endemic to the Hawaiian Archipelago, with an estimated total population of 1,200 individuals, the majority of which occur in the Northwestern Hawaiian Islands. An estimated 80-100 individuals occur in the main Hawaiian Islands (MHI) (NMFS 2007a). Preliminary results from a 2005 satellite-linked radio transmitter study of Hawaiian monk seals showed that dives are primarily within the 200 meters (m) (656 ft) isobath and remain close to shore (Littnan *et al.* 2006). Hawaiian monk seals are known to use Pearl Harbor and Iroquois Point. In total, 72 documented Hawaiian monk seal sightings have been reported at Iroquois Point since 1993 (NMFS 2008a). Nineteen of the reported sightings are attributed to six known individual seals: four are adult males, and the other two are adult females.

The hawksbill sea turtle was listed as endangered on June 2, 1970, under the Endangered Species Conservation Act of 1969 (35 CFR 8490). The biology, habitat, and conservation status of this species are described in a recent status review (NMFS & USFWS 2007c). Although hawksbill sea turtles occur around all of the MHI, they are uncommon and occur in much lower numbers than green sea turtles. They are only known to nest on beaches in the MHI, primarily along the south coast of the Island of Hawaii and on the east end of Molokai. Nesting has been documented on the eastern/southeastern coast of Oahu, but not near Pearl Harbor or Iroquois Point.

The green sea turtle was listed as threatened on July 28, 1978 (43 CFR 32800), except for breeding populations found in Florida and the Pacific coast of Mexico, which were listed as endangered. The biology, habitat, and conservation status of this species are described in a recent status review (NMFS & USFWS 2007b). Green sea turtles are the most common sea turtle in the Hawaiian Archipelago, with some of the major foraging and resting areas along the coastlines of Oahu, Molokai, Maui, Lanai, and Hawaii. Some nesting does occur in the MHI, though no nesting has been documented at Iroquois Point or Pearl Harbor. Foraging and resting green sea turtles are frequently sighted in the nearshore areas of south central Oahu. In addition, since 1999, at least five green sea turtles have stranded in Iroquois Lagoon. All five strandings were attributed to tumors.

Analysis of Effects: NMFS used the following information to determine effects of the proposed action: Sea Engineering's January 22, 2008 consultation request letter and draft environmental assessment, multiple emails from Sea Engineering, emails from a NMFS Hawaiian monk seal researcher and a NMFS sea turtle researcher, and other literature cited in this letter. In order to concur that a proposed action is not likely to adversely affect listed species, NMFS must find that the effects of the proposed action are expected to be insignificant, discountable, or beneficial as defined in the joint USFWS-NMFS Endangered Species Consultation Handbook: (1) insignificant effects relate to the size of the impact and should never reach the scale where take occurs; (2) discountable effects are those that are extremely unlikely to occur; and (3) beneficial effects are positive effects without any adverse effects (USFWS & NMFS 1998). This standard, as well as consideration of the probable duration, frequency, and severity of potential interactions between the marine listed species and the proposed action, were applied in the following analysis of effects of the proposed action on ESA-listed marine species. Our analysis considered potential impacts or stressors to the Hawaiian monk seal and the hawksbill and green sea turtle. We believe that the most likely potential impacts/stressors are temporary noise/physical disturbance, exposure to turbidity and sedimentation, and changes in forage habitat.

Green sea turtle sightings are common near the Pacific Ocean/Pearl Harbor entrance channel interface, while hawksbill turtle sightings are relatively uncommon. During an 8-week field survey in 1999 in the vicinity of the Pearl Harbor entrance channel, a total of 141 green turtles were sighted underwater while 36 green turtles were observed from the boat. No hawksbill turtles were sighted. Total green turtle occupancy in/near Pearl Harbor was estimated at 32 turtles. In addition, no turtles were sighted in less than 20 ft of water; most sightings occurred between 25 and 40 ft; turtles were seen resting on and swimming over both the sand and rubble bottom areas, though most were seen in or adjacent to grottos and undercut ledges that provided adequate shelter/resting habitat; and the majority of turtles appeared to be located on the west side of the channel in the morning and move to the east side of the channel in the afternoon (Smith 1999).

According to Sea Engineering, the best sand for the renourishment is found along the Iroquois Point/Pearl Harbor channel edge at depths shallower than 30 ft. Divers report that when diving on the slope of the channel edge, which is the preferred dredging area, no undercuts or ledges were noted. The proposed sand recovery area is also landward of the turtle study area. To minimize any interactions with turtles, sand recovery will be restricted to less than 20 ft, where possible. The T-head groin structures will also be placed in waters less than four feet deep. As for noise disturbance, hearing for sea turtles is not well studied, although sea turtles are able to hear low frequencies. As ambient noise from construction and dredging activities in the nearshore environment is heavily weighted toward a low frequency sound, noise generated from dredging and placement of the T-head groin structures and sand fill may be heard by animals in the vicinity. However, given the minimal spatial and temporal overlap of construction/dredging activities and sea turtles, along with monitoring of the area for the potential presence of turtles before and during construction/ dredging activities, and ceasing activities when detected, any noise disturbance would be temporary and insignificant.

Since monk seals are frequently seen hauled out on Iroquois Point beach, and sea turtles are known to occur in the vicinity, we have recommended best management practices (BMPs) to which the Navy and associated personnel have agreed to adhere to, and to which we recommend the Army Corps of Engineers to require in their DA permit. The commitment to abide by NMFS's BMPs will reduce the likelihood of disturbance from human activities to marine protected species during project activities. The BMPs include:

1. Conduct a survey for marine protected species before any work starts, and postpone or halt all work if a marine protected species is seen in the area. If a marine protected species is in the area, either hauled out onshore or in the nearshore waters, a 150 ft buffer must be observed with no humans approaching them. If a monk seal mother/pup pair is seen, a minimum 300 ft buffer must be observed.
2. Establish a safety zone around the project area whereby observers will visually monitor this zone for marine protected species 30 minutes prior to, during, and 30 minutes post project activity. Record information on the species, numbers, behavior, time of observation, location, start and end times of project activity, sex or age class (when possible), and any other disturbances (visual or acoustic).
3. Conduct activities only if the safety zone is clear of monk seals or sea turtles.
4. Upon sighting of a monk seal or turtle within the safety zone during project activity, immediately halt the activity until the animal has left the zone. In the event a marine protected species enters the safety zone and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals, we recommend contact with our Marine Mammal Response Coordinator, David Schofield, at (808) 944-2269, as well as the monk seal hot line at (888) 256-9840 should further assistance be required for this species. For turtles, please contact the turtle hotline at 983-5730.
5. For on-site project personnel that may interact with a listed species potentially present in the action area, provide education on the status of any listed species and the protections afforded to those species under Federal laws. NMFS staff may be contacted for scheduling educational briefings to convey information on marine mammal behavior, and questions and answers on why and when to call NMFS and other resource agencies.

Based on the prescribed measures, we expect any noise/physical disturbance to Hawaiian monk seals and hawksbill and green turtles to be temporary and insignificant and not result in adverse behavioral changes.

In order to address turbidity and sedimentation effects, the project will employ a list of BMPs, including the use of silt curtains or turbidity barriers to isolate the construction activity and limit off-site movement of suspended sediment, the use of dust screens, and ceasing work that generates turbidity and sedimentation during adverse tidal and weather conditions. As for turbidity near the dredging site, only clean and recently accreted unconsolidated sand will be recovered from the west side of the entrance channel, well away from where turtles are normally observed. Below the sandy-slope dredge site, the area transitions into sediment and rubble below 30 ft. Again, no turtles were seen in this area over the course of eight weeks of survey dives in 1999. In addition, turtles are known to occur in turbid areas yet because they are an air-breathing species, turbidity does not impact their respiration or feeding. Based on the in-water work being conducted in relatively shallow water with silt-curtains confining the sediment, along with the minimal tidal flux in the area, the dearth of occurrence of sea turtles in or near the immediate dredge area, as well as the BMPs listed above, we expect any exposure to turbidity and sedimentation to marine protected species to be temporary and insignificant and not result in adverse behavioral changes.

With respect to monk seal and sea turtle foraging resources at the project site, minimal suitable sea grass beds or foraging resources occur near Iroquois Point. Recently a green turtle stranded at Iroquois Point after sustaining a fatal boat strike injury. During the necropsy, the turtle had a gastrointestinal tract full of *Gracilaria salicornia*, a known up-and-coming exotic food source (invasive alien algae) for green turtles (NMFS 2008b). Although turtle foraging areas present in or near the action area may be affected during dredging, mostly *G. salicornia*, other suitable foraging sites beyond the project site will not be affected. The effective use of a silt curtain, as appropriate, at the project site may further protect potential available sea turtle foraging resources outside the project area for future turtle use. Non-ESA listed invertebrates, corals, or fish species beyond the site may also be protected via a silt curtain from potential burial or stress. As for monk seal foraging habitat, monk seals typically head offshore to search for crustaceans, fish, mollusks, etc. Therefore, based on the limited suitable forage resources in the area and the minimal impact to forage resources that may occur in the area, coupled with the likelihood that turtles and monk seals forage elsewhere, we expect any changes in forage habitat to be insignificant.

Completion of the beach stabilization at Iroquois Point will likely provide a few benefits to marine listed species. For instance, the project will retain, and even expand the beach area for seal haul out. The area will also be clear of scattered rocks, concrete and steel debris, and other rubble from the beach and nearshore waters. The groins are also likely to result in a greater diversity and biomass of fishes and crustaceans, which may provide nearshore forage resources for monk seals.

Given the insignificant probability of exposure of protected species to the construction and dredging activities, the anticipated insignificant effects to sea turtles and monk seals from turbidity, sedimentation, noise disturbance, and changes to forage habitat, coupled with the BMPs previously described, we do not expect the proposed action to result in adverse behavioral effects to Hawaiian monk seals or hawksbill and green sea turtles.

Conclusion of Analysis: NMFS concurs with the determination that the proposed beach stabilization project is not likely to adversely affect the Hawaiian monk seal, the hawksbill sea turtle, or the green sea turtle. Our concurrence is based on the finding that the effects of the proposed action are expected to be insignificant, discountable, or beneficial as defined in the joint USFWS-NMFS Endangered Species Consultation Handbook (USFWS& NMFS 1998) and summarized at the beginning of the Analysis of Effects section above.

This concludes your consultation responsibilities under the ESA for species under NMFS's jurisdiction. Consultation must be reinitiated if: 1) a take occurs; 2) new information reveals effects of the action that may affect marine listed species or designated critical habitat in a manner or to an extent not previously considered; 3) the identified action is subsequently modified in a manner causing effects to marine listed species or designated critical habitat not previously considered; or 4) a new species is listed or critical habitat designated that may be affected by the identified action.

Thank you for working with NMFS to protect our nation's living marine resources. Should you have any other questions regarding this project or the consultation process, please contact Krista Graham on my staff at (808) 944-2238, or at the email address Krista.Graham@noaa.gov.

Sincerely,

William L Robinson

William L. Robinson
Regional Administrator

Cc: Gerry Davis – ARA HC, PIRO

Commander
Navy Region Hawaii
Attn: ARE1
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Pearl Harbor, HI 96860-5101

Mr. Dev A. Braganza
Ford Island Housing, LLC
737 Bishop Street
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Mr. George P. Young, P.E.
Chief, Regulatory Branch
Honolulu Engineer District
Building 230
Fort Shafter, HI 96858-5440

NMFS File No. (PCTS): I/PIR/2008/00228
PIRO Reference No.: I-PI-08-655-CY

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2008-FA-0066
2008-TA-0104

FEB 21 2008

Mr. Scott P. Sullivan, Vice President
Sea Engineering, Inc.
Makai Research Pier
41-305 Kalanianaole Highway
Waimanalo, Hawaii 96795-1820

Dear Mr. Sullivan:

The U.S. Fish and Wildlife Service (Service) has reviewed the working draft of the Draft Environmental Assessment (DEA) for the Iroquois Point Beach Restoration Project provided by your office on January 22, 2008. These comments are provided in accordance with the National Environmental Policy Act of 1969 [42 U.S.C. 4321 *et seq*.; 83 Stat. 852] (NEPA);]; and other authorities mandating Federal oversight of environmental resources including the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq*.; 48 Stat. 401], as amended (FWCA); the Federal Clean Water Act [33 U.S.C. 1251 *et seq*.; 62 Stat. 1155], as amended (CWA); and the Endangered Species Act of 1973 [16 U.S.C. 1531 *et seq*.; 87 Stat. 884], as amended (ESA).

The overall goal of the proposed project is to prevent the current active erosion of the shoreline between Keahi Point and Hammer Point, Ewa Beach, Hawaii through the installation of nine T-groin structures backfilled with sand. The beach will be widened between 50 and 100 feet along 4,200 feet of shoreline, resulting in approximately 4.2 acres of lost coral reef. Sixty thousand cubic feet of sand for this project will be obtained by dredging accumulated material from the west side of the Pearl Harbor channel.

We are concerned that coordination with our office did not begin at an earlier point in the development of this proposed action. In accordance with the FWCA, as amended in 1964, federal agencies are required to take into consideration the affect that water-related projects would have on fish and wildlife resources; take action to prevent loss or damage to these resources; and provide for the development and improvement of these resources through consultation with our office. The constructing, licensing, or permitting federal agency is to consider the recommendations of our office and incorporate into project plans such justifiable means and measures as it finds should be adopted to obtain maximum overall project benefits. As per our phone conversation with Mr. Scott Sullivan (Sea Engineering, Inc.) on February 13, 2008, and subsequent emails, we appreciate your willingness to initiate this coordination at this time.

Based on the information provided in the DEA, we disagree with the conclusion that this project "will not result in any significant long-term degradation of the environment or loss of habitat." (pg. 102). This project will result in the permanent loss of approximate 4.2 acres of coral reef habitat. The draft EA fails to adequately consider the ecological function of the reef flat and instead focuses on losses of individual coral. Coral reef flats are important ecological habitat for a diversity of marine life, including algae, fish, and other non-coral invertebrates. Many of these species are also culturally and economically important. We believe that these resources have been devalued in the analysis and the conclusion that reefs within the project area "are not functioning ecologically as a coral reef" is not supported. Regardless of the number, density, or cover of living coral individuals, our office, in concurrence with Army Corps of Engineers (ACE) guidelines[1], considers the reefs within the project to be coral reef, and as such are afforded special aquatic site status[2].

Furthermore, we disagree with the assessment that the habitat provided by the groin structures will compensate for lost federal trust resources. While minimization and avoidance are desirable, the nature of this project makes it unlikely that the optimal outcome of no permanent loss can be achieved. The T-groins may provide suitable settlement substrate for coral colonies, but they are unlikely to compensate for the lost ecological function of the coral reef flat, as required under ACE guidelines for issuance of 404(b) permits. We recommend that you begin coordination with our office, National Marine Fisheries Service (NMFS), Environmental Protection Agency (EPA), ACE, and appropriate state agencies to develop a viable compensatory mitigation plan for inclusion in the draft EA.

The DEA does not present sufficient information upon which we can support a determination that the proposed action poses no significant impact to fish and wildlife resources at the project site. In order for us to concur with a Finding of No Significant Impact (FONSI) for this project, we recommend that our comments be considered and addressed in the DEA.

We have reviewed the information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program as it pertains to ESA listed species and designated critical habitat. The federally threatened green sea turtle (*Chelonia mydas*) and the endangered Hawksbill sea turtle (*Eretmochelys imbricate*) are found within the proposed project area and the Hawaiian monk seal (*Monachus schauinslandi*) has been observed at the proposed project location.

We offer the following guidance to assist you with project analysis. Under section 7 of the ESA, it is the federal agency's (or non-federal designee) responsibility to determine whether or not the proposed project "may affect" federally listed species or critical habitat. Projects that are determined to have "no effect" to federally listed species and/or critical habitat do not require additional coordination or consultation with the Service. A "may affect, not likely to adversely affect" determination is appropriate when effects to federally listed species are expected to be discountable (*i.e.*, unlikely to occur), insignificant (minimal in size), or completely beneficial.

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[1]CFR 40 Part 230 Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material. Available online at http://www.usace.army.mil/cw/cecwo/reg/40cfr230.pdf.

[2]CFR 40 Part 230 Section 404(b)(1). Sec. 230.44(a)

This conclusion requires written concurrence from the Service. Formal consultation is required when an action may affect and is likely to adversely affect listed species or critical habitat. Your letter indicates you have determined that formal consultation will not be necessary to address project impacts to proposed or listed threatened or endangered species, or proposed or designated critical habitats. However, based on the process described above, should you determine the project may affect but is not likely to adversely affect sea turtles occurring on the beach, contact our office to complete an informal section 7 consultation. We recommend that you contact the NMFS regarding potential impacts to seals and to sea turtles occurring in the water near the proposed construction project as these species are under their jurisdiction.

If you have questions regarding these comments, please contact Dwayne Minton or Aaron Nadig of my staff (phone: 808-792-9400, fax: 808-792-9581).

Sincerely,

for Patrick Leonard
Field Supervisor

CC:
Commander, Navy Region Hawaii
Mr. Dev A. Braganza, Ford Island Housing LLC
EPA Region 9, Honolulu
NMFS – PIRO, Honolulu
Hawaii DAR
Hawaii DOFAW

	Sea Engineering, Inc. Makai Research Pier 41-305 Kalanianaole Hwy. Waimanalo, Hawaii 96795-1820 Ph: (808) 259-7966 Fax: (808) 259-8143 Email: sei@seaengineering.com Website: www.seaengineering.com	**Memo**

DATE:	July 8, 2010
TO:	Don Hubner NOAA/NMFS/PIRO
FROM:	Scott Sullivan
SUBJECT:	Iroquois Point Beach Restoration and Stabilization, Endangered Species Act Consultation NMFS File No. I/PIR/2008/00228, PIRO Ref. No. I-PI-08-655-CY

This is to follow-up a telephone discussion with Don Hubner at NMFS/PIRO regarding the history of the Iroquois Point Beach Restoration and Stabilization Project (project) Endangered Species Act (ESA) consultation.

In 2003 the Iroquois Point housing area was leased by the U.S. Navy to Ford Island Housing, LLC (FIH), to maintain and operate for 99 years. The Navy continues to be the landowner, and the nearshore waters below the high water line are in the Pearl Harbor Naval Defensive Sea Area, and remain under the jurisdiction and control of the Navy. The chronic shoreline erosion problem was noted during the lease negotiations, and a lease "credit" was given by the Navy to FIH in recognition of their need to remedy the erosion problem. The Navy, as the lessor, has granted FIH the requisite property interest and accompanying authority to undertake the proposed beach restoration and stabilization project.

The project is following a two-step review and approval process, 1) review and approval by the Navy, and 2) the Department of the Army permit process (section 10 and section 404, plus section 401 WQC by the State Department of Health and CZM consistency Review by State Office of Planning). Sea Engineering, Inc. (SEI) is the project consultant retained by FIH, and has been designated by FIH to be their agent. The Navy approval process was initiated first, and included preparation of a Draft Environmental Assessment (DEA). An initial DEA scoping meeting was held on October 27, 2005, at the NOAA Pacific Islands Area Office, Honolulu. As part of the DEA preparation the Navy requested that various consultations be conducted, including ESA coordination with NOAA/NMFS. By letter dated January 22, 2008 to NMFS SEI requested informal coordination and consultation for Endangered Species Act Section 7 Coordination and Magnuson-Stevens Fishery Conservation and Management Act Consultation for the project. The Commander, Navy Region Hawaii, ARE1 was copied on this letter. A DEA was included with the letter, and served as supporting information for our belief that the proposed project would not significantly affect endangered species, and that formal consultation under section 7 of the ESA is not required. On March 11, 2008, an ESA and Essential Fish Habitat (EFH) coordination meeting was held in the Honolulu office of the U.S. Fish and Wildlife Service (FWS), which was attended by NMFS personnel (Alan Everson, Krista Graham and Matt Perry). This meeting was also attended by Joy Anamizu of the USACE Honolulu District, Regulatory Branch. On May 21, 2008, we received a response from NMFS to our

January 22 letter, which concluded with the following: “NMFS concurs with the determination that the proposed beach stabilization project is not likely to adversely affect the Hawaiian monk seal, the hawksbill sea turtle, or the green sea turtle….This concludes your consultation responsibilities under the ESA for species under NMFS’s jurisdiction.” The Navy was copied on this letter.

In October 2008 review of the DEA was completed by Navy Region Hawaii, and the DEA was finalized in November 2008. On November 14, 2008, an application for a Department of the Army (DA) Permit was submitted to the USACE, Honolulu District, and the DEA accompanied the application. In the application cover letter it was explained that ESA consultation had been accomplished, as well as EFH coordination. The application designates SEI as FIH’s agent.

The proposed project plan is the same today as was initially proposed in 2008. The same general scope and scale, the same size and number of beach stabilizing rock groins, the same sand recovery source, and the same construction methodology. Because the shoreline is continuing to erode as we endeavor to work through the permit process, some minor adjusting of the groin location/alignment and the volume of sand fill is necessary in order to not expand the scale of the project beyond what was initially proposed. In fact, during the DA permit review process we have made small adjustments to the groins and actually reduced the volume of sand fill required.

	Sea Engineering, Inc. Makai Research Pier 41-305 Kalanianaole Hwy. Waimanalo, Hawaii 96795-1820 Ph: (808) 259-7966 Fax: (808) 259-8143 Email: sei@seaengineering.com Website: www.seaengineering.com	**Memo**

DATE:	April 29, 2009
TO:	Memo for Record
FROM:	Scott Sullivan
SUBJECT:	Iroquois Point Beach Restoration, Habitat Loss Mitigation Meeting with NOAA Fisheries/PIRO

A meeting was held on April 22, 2009 with NOAA Fisheries/PIRO staff at their office, for the purpose of discussing compensatory mitigation for the loss of aquatic habitat which would result from the proposed Iroquois Point Beach Restoration and Stabilization project. The following persons were in attendance:

NOAA/PIRO:	Danielle Jayewardene	Danielle.Jayewardene@noaa.gov
	Alan Everson	Alan.Everson@noaa.gov
Project Team:	Scott Sullivan	ssullivan@seaengineering.com
	Monte Hansen	dhansen@seaengineering.com
	Katie Laing	katie@aecos.com

Danielle and Alan had the opportunity to visit the site and swim the area several days prior to this meeting, and thus had first-hand knowledge of the general site conditions and characteristics. The aquatic habitat shows evidence of the effects of chronic erosion and nearshore transport of sand which scours the bottom, and the chronic water turbidity resulting from the erosion of red clay material which has been exposed by the eroding beach. In general, the proposed project has the potential to improve the nearshore aquatic environment by eliminating these sources of adverse impacts, and the rock groin structures and new submerged beach area is likely to provide additional habitat and other aquatic resources. (See attached Mitigation for Losses of Aquatic Resources) However, given that the project will occupy and alter some area that is currently open-water nearshore fish habitat, additional mitigation measures are warranted. Suggested mitigation measures include the following.

1. Post-construction monitoring of water quality and marine biota would be conducted. Emphasis would be placed on marine biota in the vicinity of representative rock groin and reef flat areas, with suitable reference control stations outside of the immediate project area for comparison. Monitoring would be conducted immediately post-construction, then after 1, 3 and 5 years. This would provide quantitative information on the impacts of the project, and would generate data for the evaluation of future similar project impacts.

2. Post-construction monitoring of the beach (beach profiles) should also be done to evaluate project performance.
3. Removal of undesirable nearshore debris (concrete rubble, abandoned sewer and drain pipe, steel remnants etc.). A demolition plan could be developed with PIRO assistance with the identification of undesirable material versus material that provides habitat. Debris removal would be by land-based equipment only, no equipment operating in the water. The demolition plan will map the debris to be removed, then a determination made as to what is practical/possible to remove using land-based equipment.
4. Development of a stormwater drainage plan that eliminated direct discharge into coastal waters, i.e. on-land containment/settling ponds and water elimination by percolation and evaporation rather than rebuilding the drain pipe shoreline discharge system. (It is recognized that runoff from the housing area is a "drop in a bucket" in terms of both volume and deleterious content compared to what drains out of Pearl Harbor.)
5. Continue to regulate fishing so that the improved fish habitat provided by the rock groins, and thus the increased fish population, is not offset by increased fishing and removal of fish from the area.

Other suggestions by PIRO include quantifying bottom types (hard rock, sand, rubble) within the project footprint, and quantify the typical areal extent of the turbidity plume emanating from the shoreline, which could be considered as improved habitat area with implementation of the project.

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Memorandum

DATE:	March 11, 2008
TO:	Meeting Attendees
FROM:	Scott Sullivan
SUBJECT:	Iroquois Point Beach Stabilization/Restoration Project Endangered Species Act and Essential Fish Habitat Coordination Meeting

1. A coordination meeting was held on March 4, 2008 in the Honolulu office of the U.S. Fish and Wildlife Service (FWS) to discuss the proposed Iroquois Point Beach Stabilization/Restoration project. This meeting was precipitated by letters to the FWS and NOAA National Marine Fisheries Service (NOAA Fisheries) from Sea Engineering, Inc. on behalf of the project sponsors/permit applicants, the U.S. Navy and Ford Island Housing, LLC. The purpose of the letters was to request informal coordination and consultation regarding the Endangered Species Act and Magnuson-Stevens Fishery Conservation and Management Act, and their application to the project. The meeting was organized by the FWS. Meeting attendees were as follows:

FWS

Dwayne Minton, Marine Ecology Specialist	792-9445 / Dwayne_Minton@fws.gov
Jeff Newman	792-9442 / Jeff_Newman@fws.gov

NOAA Fisheries, Pacific Islands Regional Office

Alan Everson, Essential Fish Habitat	944-2212 / Alan.Everson@noaa.gov
Krista Graham, Protected Resources	944-2238 / Krista.Graham@noaa.gov
Matt Parry, Restoration Center	944-2211 / Matthew.Parry@noaa.gov

US Army Corps of Engineers (COE)

Joy Anamizu, Regulatory Branch	438-7023 / joy.n.anamizu@usace.army.mil

Ford Island Housing

Steve Colon	585-7900/steve.colon@huntcompanies.com
Dev Braganza	585-7900/dev.braganza@huntcompanies.com

U.S. Navy

John Muraoka (Regional Environmental Office)*	473-4137x239 / john.muraoka@navy.mil

Sea Engineering

Scott Sullivan, Project Manager	259-7966x22/ssullivan@seaengineering.com
Monte Hansen	259-7966x28/dhansen@seaengineering.com

AECOS (Marine Biology Consultant)

Katie Laing	277-6987 / Katie@aecos.com

* John Muraoka participated by telephone and was disconnected part way through the meeting.

2. Sea Engineering, Inc. (SEI) presented an overview of the project purpose and objectives, the alternatives considered, and the proposed project plan. A Working Copy of the Draft Environmental assessment (DEA) had been provided to the respective agencies in January 2008. SEI also discussed the project status and work accomplished since the initial agency scoping meeting held in October 2005. The general project purposes are to:

   - Stabilize the shoreline to stop erosion and sand transport into the Pearl Harbor entrance channel (chronic erosion since 1928)
   - Prevent further shoreline recession and protect existing homes and coastal infrastructure and facilities (shoreline has receded up to 150 feet since 1961, 16 homes have been lost, 3 more home are in immediate danger)
   - Eliminate existing adverse water quality impacts resulting from soil erosion (turbidity chronically exceeds State WQ Standards)
   - Restore and improve a public recreation sand beach (the Iroquois Point housing area is now open to the public as well as the military)

The proposed project consists of:

- Construction of 9 rock T-head groins to divide the beach into eight cells 400 to 450 feet long
- Recovery of 60,000 cubic yards of sand from the Pearl Harbor entrance channel to be placed between the groins (20,000 cy have already been stock-piled)

3. NOAA Fisheries explained various aspects of the Essential Fish Habitat (EFH) requirements of the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996.

   - EFH are those waters and their associated physical, chemical, and biological properties, and substrate including sediment, hard bottom, and associated biological communities, necessary to fish for spawning, breeding, feeding or growth. By virtue of being a shallow reef flat habitat, the project site is considered an EFH. The project site is not, however, a designated Habitat Area of Particular Concern (HAPC).
   - An EFH Assessment must be prepared by the project proponents to evaluate the possible effects of the proposed project on the EFH, both beneficial and adverse. The Assessment will then be reviewed by NOAA Fisheries and FWS who will provide EFH conservation recommendations to minimize adverse effects of any proposed action. (Reference – *Preparing Essential Fish Habitat Assessment: A Guide for Federal Action Agencies*, Version 1, February 2004). The project site water quality and biological investigations completed to-date for the EA are considered sufficient for preparation of the EFH Assessment. This data will form the basis of and tie into the EFH Assessment, e.g. quantify direct habitat loss by the footprint of the groins and sand fill, estimate habitat gained by hard substrate provided by the groins, quantify habitat water quality improvement by reducing turbidity etc. Although difficult to quantify, an assessment of the "ecological function" of the habitat should be made. To some extent, value is tied to age – i.e. older habitat typically has more value than newer habitat. There is on-going discussion within the FWS and NOAA as to the ability of man-made structures to functionally replace lost natural habitat (e.g the ecological value/function of artificial reefs or rock structures).

- If there is a net negative effect of loss of habitat, mitigation measures/mitigation plans need to be suggested by the applicant to offset the loss. This could include monitoring of the completed project to determine its success, habitat enhancement measures (e.g. removing invasive species, transplanting corals) within, or even outside, the project area, and improvements to water quality.

4. The presence of endangered species in the project area was discussed, including green sea turtles and Hawaiian monk seals. NOAA Fisheries provided information and reports on turtle and seal studies and sightings in the area. It was noted that although no turtles were sighted during the biological field work for this project, prior studies in the Pearl Harbor entrance channel had found significant turtle activity in deeper depths (>20 ft) along the somewhat irregular (silt/sand) channel edge. Although the proposed project would not directly affect the area where turtles were observed, they are clearly present in the nearby waters. Monk seals are also occasionally present in the project area, particularly one or two tagged seals who periodically show up and haul out for brief periods. A mitigation plan, as required by The Endangered Species Act, will be in place to minimize any disturbance to endangered species during construction and following construction, when more people can be expected to utilize the improved beach recreational resources.

5. The characteristics of the sand recovery site were discussed. Only recently accreted (last 30 years or so) unconsolidated beach sand would be recovered from the west side of the entrance channel, well inland from the shoreline at Hammer Point. No hard substrate would be removed. Grain size analysis shows the material to be medium sized sand with a median grain size of 0.5 to 0.8 mm and less than 0.2% fine material. It is nearly identical to the existing sand on the project shoreline, where the sand originated from. Because there is virtually no fine (less than sand size) sediment in the material to be recovered, it is not deemed necessary to test for chemical contaminants.

6. The agency staff emphasized the importance of early coordination and discussion of the project impacts, possible mitigation, etc. in order to have the issues and concerns resolved and informally agreed on prior to formal permit application to the Corps of Engineers. This will help expedite permit review and processing. Both FWS and NOAA Fisheries said they would huddle internally and with each other in order to be able to provide the applicant with a more complete and unified position on the project. However, at this time, there do not seem to be any irresolvable issues.

7. A general discussion of permit requirements was held, the primary permits being Department of the Army Section 10 and Section 404 permits, a Section 401 Water Quality Certification from the State DOH, and a State CZM Program consistency determination. It was explained that because the project site is in the Pearl Harbor Defensive Sea Area, a Conservation District Use Permit from the State DLNR is not required. However, during permit application review the FWS may include the DLNR/DAR in the review process.

8. Other Issues
   - It needs to be made clear who the applicant is. If it's the Navy, then the Navy should deal directly with the federal permitting agencies or SEI needs to be authorized to act as the Navy's agent. If the applicant will be Ford Island Housing, then the COE will need proof from the Navy, as the landowner, that they approve of and support the project.
   - Permit conditions and requirements are typically considered to be "in perpetuity", thus the COE

needs assurances that the applicant has the ability to be responsible for the project essentially forever.

9. Next Steps
    - FWS and NOAA Fisheries will discuss internally and with each other, and provide the applicant with any additional information they feel is important
    - Applicant will prepare a Draft EFH Assessment and submit it to FWS, NOAA and the COE for their review and recommendations

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January 22, 2007

Mr. Chris Yates
Administrator, Protected Resources Division
National Marine Fisheries Service
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814-4700

Dear Mr. Yates:

Subject: Endangered Species Act Section 7 Coordination and Magnuson-Stevens Fishery Conservation and Management Act Consultation for the Iroquois Point Beach Stabilization Project, Ewa, Island of Oahu, Hawaii

On June 30, 2003, under special legislation enacted by Congress, the Iroquois Point housing area was leased by the U.S. Navy to Ford Island Housing, LLC to maintain and operate for 65 years. The Iroquois Point shoreline is undergoing chronic erosion and is in a degraded condition. The Navy and Ford Island Housing desire to restore and stabilize the sandy shoreline in order to eliminate the on-going erosion and shoreline recession, and the resultant migration of sand into the Pearl Harbor entrance channel. Sea Engineering, Inc. has been retained as a contractor for engineering design and environmental assessment of the project, and for conducting necessary environmental coordination. A detailed project description and evaluation is contained in the enclosed working draft of the project Environmental Assessment (EA). This letter is to request informal coordination and consultation for the subject environmental considerations for the proposed project.

The Iroquois Point housing area is located on the central south shore of Oahu, immediately west of the Pearl Harbor entrance channel. The housing area is built on a coralline limestone reef, with a layer of earthen fill placed over coral rubble reef deposits. The existing nearshore ground elevation is +5 to +7 feet above mean lower low water (mllw). The shoreline along the entire 4,200 foot long project reach consists of a sandy beach. Chronic erosion and shoreline recession, coupled with backshore flooding due to wave overtopping of the low-lying shore, has resulted in the abandonment and demolition of 16 shoreline homes to-date. Several more homes are threatened by shoreline recession, and emergency shore protection for these homes was constructed in February 2004. Sewer lines running along the shore were abandoned and relocated in the 1980's, and now the old concrete sewer pipe lies exposed and broken on the beach. Analysis of aerial photographs and other information shows that the beach in the project area receded as much as 130 feet between 1928 and 1961, and an additional 150 feet between 1961 and 2003. This is considered one of the most unstable beaches on Oahu. Sand eroded from the beach is transported east and into the Pearl

Harbor entrance channel, necessitating periodic dredging to remove sand from the side of the channel.

The proposed beach stabilization plan consists of 9 T-head groin structures extending along the project shoreline, dividing the beach into eight cells 400 to 450 feet long. The groin stems would be 140 feet long, extending seaward from the approximate existing low water line, and would have heads varying in total length (both sides of the stem) from 100 to 200 feet. The crest elevation of the groin stem and head would be +4.5 feet mllw, and the crest width would be about 7.5 feet. The groins would be constructed of 1,800 to 3,200 pound armor stone. Sand fill with appropriate characteristics to match the existing sand will be placed within each cell, with a design slope of 1V:10H up to a crest elevation of +6 feet. The total volume of sand fill required is approximately 60,000 cubic yards. The sand will be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance.

Our consultant, AECOS, Inc., has conducted water quality and marine flora and fauna investigations for preparation of the EA for this project. Four species of marine animals that occur in Hawaiian waters have been declared threatened or endangered by Federal jurisdiction. The threatened green sea turtle (*Chelonia mydas*) occurs commonly throughout the island chain, and is known to feed on selected species of macroalgae. The endangered hawksbill turtle (*Eretmochelys imbricate*) also occurs, but is considered rare in comparison to the green turtle. While turtles are known to exist in the waters surrounding Iroquois Point, no turtle nesting is known to occur within the project site, and no turtles were observed during the field work conducted for preparation of the EA. Of the many benthic marine algae and plants considered as food resources of the Hawaiian green sea turtle, the project area supports growth of *Codium* sp., *Pterocladia* sp., *Aconthophora spicifera*, and *Hypnea musciformis*. However, these species are low in quantity for most of the project area, and are not likely a substantial foraging resource for green sea turtles.

The endangered Hawaiian monk seal also habits the waters in the project vicinity, and one was sighted on the beach in the middle of the project site during field investigations. There have been 47 documented monk seal sightings at Iroquois Point since 1993, and five of the reported sightings can be attributed to two known adult male seals (National Marine Fisheries Service, Pacific Islands Fisheries Science Center, Internal Report IR-07-001, 5 January 2007). The project will retain, and even expand, the beach area for seal haul out. The groins are likely to result in a greater diversity and biomass of fishes and crustaceans, which are potential food sources for monk seals. Therefore, the project is likely to benefit monk seals in the long term.

Although the project area is not known as an endangered species habitat, the project Environmental Protection Plan will contain procedures to be followed to mitigate any possible impact to endangered species, including:

1. all on-site personnel will be apprised of the status of any listed species potentially present in the project area and the protections afforded to those species under Federal laws, and
2. a daily site manager will be trained to look for turtle and monk seal presence, and this person will have the authority to halt work until the animal voluntarily leaves the area.

Appropriate best management practices (BMPs) will also be implemented to minimize water turbidity, minimize species disturbance, and to avoid the release of pollutants into the water.

The project site has not been designated as critical habitat for endangered species by the Federal Government or the State of Hawaii. Based on the findings in the EA as summarized above, we believe that the proposed project will not impact endangered species, and that formal consultation with your office, under Section 7 of the Endangered Species Act, is not required.

The sea floor under the proposed groins consists primarily of coarse sand and unstable rubble. The large armor stones to be used for the groins will provide hard and stable substrate which is likely to increase the successful recruitment of both corals and algae. The large armor stones are also likely to improve micro-habitat for fishes, particularly juveniles. It is our belief that this project will compliment the artificial reef being constructed by the State of Hawaii, approximately offshore of the Iroquois Point project area. For these reasons we believe that neither Essential Fish Habitat nor coral reef consultations are required or appropriate. We request your review and concurrence with our determinations.

Should you have any questions or desire additional information please contact Scott Sullivan at Sea Engineering, Inc., by phone at 259-7966, ext. 22 or email at ssullivan@seaengineering.com. We would like to request that you also send copies of correspondence to the Navy and Ford Island Housing at the addresses shown below.

Very truly yours,

Scott P. Sullivan
Vice President

Enclosure

Cc: Commander
Navy Region Hawaii
ATTN: ARE1
850 Ticonderoga Street, Suite 810
Pearl Harbor, HI 96860-5101

Mr. Dev A. Braganza
Ford Island Housing LLC
737 Bishop Street
Mauka Tower, Suite 2750
Honolulu, HI 96813

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January 22, 2007

Mr. Patrick Leonard
Field Supervisor
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
P.O. Box 50088
Honolulu, HI 96850

Dear Mr. Leonard:

Subject: Endangered Species Act Section 7 Coordination and Magnuson-Stevens Fishery Conservation and Management Act Consultation for the Iroquois Point Beach Stabilization Project, Ewa, Island of Oahu, Hawaii

On June 30, 2003, under special legislation enacted by Congress, the Iroquois Point housing area was leased by the U.S. Navy to Ford Island Housing, LLC to maintain and operate for 65 years. The Iroquois Point shoreline is undergoing chronic erosion and is in a degraded condition. The Navy and Ford Island Housing desire to restore and stabilize the sandy shoreline in order to eliminate the on-going erosion and shoreline recession, and the resultant migration of sand into the Pearl Harbor entrance channel. Sea Engineering, Inc. has been retained as a contractor for engineering design and environmental assessment of the project, and for conducting necessary environmental coordination. A detailed project description and evaluation is contained in the enclosed working draft of the project Environmental Assessment (EA). This letter is to request informal coordination and consultation for the subject environmental considerations for the proposed project.

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Harbor entrance channel, necessitating periodic dredging to remove sand from the side of the channel.

The proposed beach stabilization plan consists of 9 T-head groin structures extending along the project shoreline, dividing the beach into eight cells 400 to 450 feet long. The groin stems would be 140 feet long, extending seaward from the approximate existing low water line, and would have heads varying in total length (both sides of the stem) from 100 to 200 feet. The crest elevation of the groin stem and head would be +4.5 feet mllw, and the crest width would be about 7.5 feet. The groins would be constructed of 1,800 to 3,200 pound armor stone. Sand fill with appropriate characteristics to match the existing sand will be placed within each cell, with a design slope of 1V:10H up to a crest elevation of +6 feet. The total volume of sand fill required is approximately 60,000 cubic yards. The sand will be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance.

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The endangered Hawaiian monk seal also habits the waters in the project vicinity, and one was sighted on the beach in the middle of the project site during field investigations. There have been 47 documented monk seal sightings at Iroquois Point since 1993, and five of the reported sightings can be attributed to two known adult male seals (National Marine Fisheries Service, Pacific Islands Fisheries Science Center, Internal Report IR-07-001, 5 January 2007). The project will retain, and even expand, the beach area for seal haul out. The groins are likely to result in a greater diversity and biomass of fishes and crustaceans, which are potential food sources for monk seals. Therefore, the project is likely to benefit monk seals in the long term.

Although the project area is not known as an endangered species habitat, the project Environmental Protection Plan will contain procedures to be followed to mitigate any possible impact to endangered species, including:

1. all on-site personnel will be apprised of the status of any listed species potentially present in the project area and the protections afforded to those species under Federal laws, and
2. a daily site manager will be trained to look for turtle and monk seal presence, and this person will have the authority to halt work until the animal voluntarily leaves the area.

Appropriate best management practices (BMPs) will also be implemented to minimize water turbidity, minimize species disturbance, and to avoid the release of pollutants into the water.

The project site has not been designated as critical habitat for endangered species by the Federal Government or the State of Hawaii. Based on the findings in the EA as summarized above, we believe that the proposed project will not impact endangered species, and that formal consultation with your office, under Section 7 of the Endangered Species Act, is not required.

The sea floor under the proposed groins consists primarily of coarse sand and unstable rubble. The large armor stones to be used for the groins will provide hard and stable substrate which is likely to increase the successful recruitment of both corals and algae. The large armor stones are also likely to improve micro-habitat for fishes, particularly juveniles. It is our belief that this project will compliment the artificial reef being constructed by the State of Hawaii, approximately offshore of the Iroquois Point project area. For these reasons we believe that neither Essential Fish Habitat nor coral reef consultations are required or appropriate. We request your review and concurrence with our determinations.

Should you have any questions or desire additional information please contact Scott Sullivan at Sea Engineering, Inc., by phone at 259-7966, ext. 22 or email at ssullivan@seaengineering.com. We would like to request that you also send copies of correspondence to the Navy and Ford Island Housing at the addresses shown below.

Very truly yours,

Scott P. Sullivan
Vice President

Enclosure

Cc: Commander
Navy Region Hawaii
ATTN: ARE1
850 Ticonderoga Street, Suite 110
Pearl Harbor, HI 96860-5101

Mr. Dev A. Braganza
Ford Island Housing LLC
737 Bishop Street
Mauka Tower, Suite 2750
Honolulu, HI 96813

APPENDIX D

ESSENTIAL FISH HABITAT ASSESSMENT

Essential Fish Habitat Assessment

Iroquois Point Beach Restoration and Stabilization Project

Prepared by:
AECOS, Inc.
45-939 Kamehameha Hwy., Suite 104
Kaneohe, HI 96744-3221

Prepared for:
Sea Engineering, Inc.
Makai Research Pier
Waimanalo, HI 96795-1820
and
Ford Island Housing, Inc.

September 26, 2008

Essential Fish Habitat Assessment
Iroquois Point Beach Restoration and Stabilization Project

Synopsis:

Potential Adverse Effects

— Boulders and sand fill would bury a small portion of the existing subtidal benthic habitat
— Sand and boulders would bury some benthic and sessile invertebrates
— Adult and juvenile fish are expected to avoid construction area, however some fishes may be lost
— Some coral colonies (<0.1% coral cover) would be buried
— Temporary increases in turbidity may occur during construction phase
— Temporary reduction in endangered species habitat availability may occur during construction phase

Potential Improvements

— Groins would provide additional benthic habitat complexity
— Groins would create new splash zone and intertidal zone habitat
— Groins would provide additional habitat for benthic and sessile biota (algae, crustaceans, sponges and other invertebrates)
— Groins would provide stable and elevated substrata for corals
— Sand would provide additional habitat for infauna (foraging resources for bottom feeding fishes)
— Project design would eliminate locally generated sediment plumes
— Water clarity would be improved
— Endangered species habitat in the form of increased sand beach area for monk seal haul-out would be increased

Essential Fish Habitat Assessment for Iroquois Point, Ewa Beach, O‘ahu, Hawai‘i[1]

September 26, 2008 | *DRAFT* | *AECOS* No. 1044C

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Introduction

Project description and purpose

Iroquois Point Beach is located on the central south shore of O‘ahu, immediately west of the Pearl Harbor Entrance Channel. The beach restoration and stabilization project area extends along 4,200 ft (1,280 m) of shoreline, from the western boundary of the housing area at the Pu‘uloa rifle range to the east along Keahi Point and on to Hammer Point adjacent to the Pearl Harbor Entrance Channel (Fig. 1). The project site is bordered on all sides by military reservation land, and the offshore waters are part of the Naval Defensive Sea Area.

Iroquois Point Housing, built in 1960, lies on a fossil reef platform, with a layer of earthen fill placed over coral rubble reef deposits. The existing nearshore ground elevation is +5 to +7 ft (+1.5 to +2.1 m) above mean lower low water (MLLW). The shoreline along the entire 4,200-foot (1,280-m) project reach consists of a sand beach. Chronic erosion with shoreline recession, coupled with backshore flooding due to wave overtopping of the low-lying shore, have resulted in the abandonment and demolition of 16 homes to-date. Several more homes are threatened by shoreline recession, and emergency shore protection for these homes was constructed in February 2004. Sewer lines constructed originally well inland from the shore were abandoned and relocated in the 1980’s, and now the old concrete sewer pipes lie exposed and broken on the beach and nearshore reef flat. Analysis of aerial photographs and other information shows that the beach in the project area receded as much as 130 ft (40 m) between 1928 and 1961, and an additional

[1] This document has been prepared for Sea Engineering Inc. and Ford Island Housing, Inc. for inclusion in an Environmental Assessment (EA) of the project and will, therefore, become part of the public record.

150 ft (46 m) between 1961 and 2003 (SEI, 2008). Boulders were dumped along the shore to try and halt the erosion. Sand berms, wooden walls, and CMU (concrete masonry unit or concrete block) walls were constructed behind the beach crest to prevent flooding. All of these measures have ultimately failed, some failing almost immediately, as a result of the on-going erosion. Scattered boulders, concrete rubble, and steel debris on the shore are all that remain of these efforts. The eroding sand is transported to the east and into the Pearl Harbor Entrance channel, resulting in a need for maintenance dredging by the Navy due to infilling of the ship channel.

Figure 1. Iroquois Point vicinity

The purpose of the proposed Iroquois Point Beach project is to restore and stabilize the sand fronting the Iroquois Point housing area in order to halt the shoreline recession, to stop the loss of homes and home sites, and to prevent flooding of the backshore area and homes by storm waves overtopping the beach crest. The project will also remove scattered boulders, concrete and steel debris, and other rubble from the beach and nearshore reef, and improve beach recreational opportunities. Stabilization of the shoreline will prevent sand transport into the Pearl Harbor Entrance Channel and greatly reduce the need for future maintenance dredging at this location.

The proposed beach restoration plan consists of nine T-head groin structures extending seaward from the project shoreline, dividing the beach into eight cells 400 to 450-ft (122 to 140-m) long (SEI, 2008). The groin stems would be 140-ft

(43-m) long, extending seaward from the approximate existing low water line, and would have heads varying in total length from 100 to 200 ft (30 to 60 m) long. The crest elevation of the groin stem and head would be +5 ft (1.5 m) MLLW, and the crest width would be 7.5 ft (2.3 m). The groins would be constructed of 1,800 to 3,200 pound (817 to 1452 kg) armor stone, two stones thick, over a 150 to 300 pound (68 to 136 kg) stone core, with a 1.5H:1V (where H is horizontal and V is vertical) side slope. Sand fill with appropriate characteristics to match the existing sand would be placed to the design beach plan and section within each cell, with a design slope of 1V:10H up to a beach crest elevation of +6 ft (2 m). The total volume of sand fill required is approximately 97,000 yd^3 (74,160 m^3). The sand will be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor Entrance Channel in the vicinity of the Iroquois Lagoon entrance.

Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (16 U.S.C. 1802(10); NOAA, 1996). All nearshore waters of the Hawaiian Islands including the shallow reef platform and associated waters along the coast of Iroquois Point are protected by federal law (Executive Order 13089, Clinton, 1998) and provide essential fish habitat for coral reef fish species.

Coral reef fish ecology

Coral reef fishes forage in and around coral reefs. Typically, these fishes are small with small home ranges and have life spans ranging from several years up to a decade or more. Coral reef fishes live close to benthic substrata in shallow seas generally with clear waters and coral growth (Sale, 1991). Reefs are important fish habitats used by all fish life stages including: egg, larval, juvenile, and adult.

The four basic reef fish trophic guilds are: 1) algae-eating herbivores (e.g., surgeonfishes, damselfishes, parrotfishes); 2) fish- and invertebrate-eating carnivores (e.g., wrasses, goatfishes, pufferfishes), 3) plankton-eating planktivores (e.g., chromis and damselfishes); and 4) coral-eating corallivores (e.g., butterflyfishes). Fish require specific food resources as well as suitable shelter. For example, a medium-sized surgeonfish (Acanthuridae) needs ample algal cover as well as appropriately-sized holes and crevices in the reef structure for shelter. Wrasses on the other hand, forage for small fishes and invertebrates among the hard reef structure, but many require sand for shelter (Breder, 1952).

Reef fish reproduction is most often by release of spawn into the water column and sometimes by laying demersal eggs that are fertilized *in situ*. Egg brooders like damselfishes require small reef patches free of invertebrate or algal growth where eggs can be deposited. Nearly all reef fish species have a pelagic larval stage that can disperse a species far and wide (Sale, 1991). Certain larvae settle quickly and repopulate the parent reef, while others will disperse with ocean currents and populate distant reefs months later. Recruitment to a given reef is dependent on many factors including: parent stock availability, ocean currents (Hixon et al., 2008), viability of larvae, presence or absence of settlement cues, ability of larvae to postpone metamorphosis (McCormick, 1999), water quality, weather patterns, and predation. Survival and retention of fishes that have successfully recruited to a reef will depend on factors such as predation levels, water quality, foraging resources, and habitat complexity.

The value of a given reef to reef fishes depends on many variables including its ability to provide shelter, foraging resources, egg laying surfaces, clean water and even larval settlement cues. High value reefs tend to support high coral cover and a diverse assemblage of reef fishes, algae, and other invertebrates, whereas low value reefs often experience poor water quality conditions, have low habitat complexity, high algal cover, or extreme fishing pressure. A major concern on reefs worldwide is sediment loading. Constant, irregular, or even one-time sedimentation events can greatly alter seascapes leading to reduced coral, algae, and fish densities (Rogers, 1990).

Existing conditions at Iroquois Point

<u>Benthic habitat</u>

The coastal plains and shallow nearshore environments of Iroquois Point (and the Pearl Harbor area) lie atop a broad limestone reef platform that developed during the last interglacial period of the late Pleistocene (UHCGG, 2008). The shore of this south southeast facing coastline is composed of limestone rock and sand. A fringing reef platform extends seaward to the reef slope, the reef narrowing from west to east (*AECOS*, 2007b). Towards the west end, the depth between shore and 120 ft (60 m) from shore ranges from 3 to 6 ft (1 to 2 m). Beyond 120 ft the reef becomes slightly shoaler, then drops off very gradually into deep water across a sloping shelf. The seaward margin of this reef shelf is some 750 ft (230 m) from shore at the west end of the project area (*AECOS*, 1979a,b; ACOE, 1980) and roughly 300 ft (100 m) from shore at the east end of the project area.

Limestone outcrops dot the sand field at the west end of the project area and at the east end of the project area a low relief reef flat with minimal habitat complexity is present. The eastern end reef flat ends abruptly at a drop-off into the Pearl Harbor Entrance Channel. Although habitat complexity is low off Iroquois Point, areas with even slight habitat complexity host elevated species diversity and abundance (*AECOS*, 2007b).

Fishes

Few fishes were observed during surveys of Iroquois Point's nearshore waters and coral cover was estimated at less than a tenth of one percent (*AECOS*, 2007a). A list of fish species was compiled from surveys of Pearl Harbor Entrance Channel (Coles et al., 1997), three areas (west end, middle, east end) along the Iroquois Point shoreline (*AECOS*, 2007a, 2007b), and the Inner and Outer Lagoons of Iroquois Point (*AECOS* Consult., 2006). This list identifies about 45 reef fish taxa likely to occur in the project area; ten of these are endemic and one is an introduced species (Table 1). The best represented fish families at Iroquois Point are the surgeonfishes (Acanthuridae) with nine taxa, the butterflyfishes (Chaetodontidae) with six taxa, and the wrasses (Labridae) with five taxa. Fishes at Iroquois Point are attracted to and associate with derelict metal debris, limestone outcrops, coral heads, and small overhangs, all of which are sparse here but, where found, provide shelter from predators (*AECOS*, 2007a).

Corals

Corals observed in the project area exist in a dynamic, shallow subtidal zone and show signs of recurrent damage and stunted growth forms (*AECOS*, 2007a). Only three species of coral (*Pocillopora damicornis*, *Pocillopora meandrina*, and *Porites lobata*) were observed in the project area—all of which are common corals of Hawai'i (Fenner, 2005). Coral cover is sparse with less than 0.1 percent coral cover. The most common coral is lace coral, *Pocillopora damicornis*. Large colonies of *P. damicornis* can provide shelter for small reef fish, however *Poc. damicornis* colonies at Iroquois Pt. are quite small, with less than 10 percent over 4 in^2 (10 cm^2) and therefore provide minimal shelter. *Poc. meandrina* colonies off Iroquois Pt. are larger and provide shelter to reef fishes, but are rare. The only sizeable *Poc. meandrina* colonies grow on errant metal debris and reef structures which elevate coral colonies above the shifting sand and rubble (*AECOS*, 2007a).

The lack of large coral heads is evidence that the Iroquois Point environment is not particularly favorable to coral growth. Coral settlement and growth are limited by impinging waves, scour by rubble and sand, reduced light conditions associated with sedimentation events, and burial with fine sediment. A large proportion of the bottom is covered in rubble and sand (*AECOS*, 2007b), which have a tendency to move with waves and currents and thereby abrade or topple small coral heads. The numerous small *Poc. damicornis* colonies suggest recruitment is not a limiting factor. However, low survivorship of recruits is likely a consequence of the adverse physical conditions.

Table. 1. Fish species observed within the project area and proximal to Iroquois Pt (*AECOS*, 2007a and b; *AECOS* Consultants, 2006; Coles et al. 1997).

CHORDATA, ACTINOPTERYGII, PERCIFORMES,	FISHES	Mid Shore	East Shore	Inner Lagoon	Outer Lagoon	P.H. Entrance Channel
MURAENIDAE						
Echidna nebulosa	snowflake moray		x	x		
Gymnothorax undulata	undulated moray, *puhi lau milo*				x	
ENGRAULIDAE						
Encrasicholina purpurea	Hawaiian anchovy				x	
CHANIDAE						
Chanos chanos	milkfish, *awa*	x			x	
SYNODONTIDAE						
Saurida sp.	lizardfish		x			
Saurida gracilis	slender lizardfish				x	
Synodus sp.	lizardfish				x	x
HOLOCENTRIDAE						
Sargocentron diadema	crown squirrelfish					x
AULOSTOMIDAE						
Aulostomus chinensis	trumpetfish					x
CARANGIDAE						
Scomberoides lysan	leather back	x			x	
LUTJANIDAE						
Lutjanus fulvus (I)	blacktail snapper			x		
MUGILIDAE						
Mugil cephalus	striped mullet or *`ama`ama*			x		
MULLIDAE						
Mulloidichthys vanicolensis	yellowfin goatfish				x	x
Parupeneus porphyreus (E)	whitesaddle goatfish					x
CHAETODONTIDAE						
Chaetodon sp.	butterflyfish		x	x		
Chaetodon auriga	threadfin butterflyfish					x
Chaetodon lunula	raccoon butterflyfish					x
Chaetodon miliaris(E)	milletseed butterflyfish		x		x	x
Chaetodon ephippium	saddleback butterflyfish			x		
Forcipiger flavissimus	forcepsfish					x
POMOCENTRIDAE						
Abudefduf abdominalis (E)	Hawaiian sergeant, *mamo*		x		x	x
Abudefduf sordidus	blackspot sergeant, *kupipi*		x		x	
Dascyllus albisella (E)	Hawaiian dascyllus	x				x
LABRIDAE						
Coris flavovittata (E)	yellowstriped coris					x
Coris venusta (E)	elegant coris		x			

Table 1 (continued).

CHORDATA, ACTINOPTERYGII, PERCIFORMES,	FISHES	Mid Shore	East Shore	Inner Lagoon	Outer Lagoon	P.H. Entrance Channel
LABRIDAE (continued)						
Labroides phthirophagus (E)	Hawaiian cleaner wrasse					x
Stethojulis balteata (E)	belted wrasse		x			x
Thalassoma duperrey (E)	saddle wrasse		x			x
SCARIDAE						
Scarus sp.						x
Scarus psittacus	palenose parrotfish				x	
BLENNIDAE						
Asterropteryx semipunctatus	half-spotted goby				x	
Cirripectus vanderbilti (E)	scarface blenny					x
Omobranchus rotundiceps	roundhead blenny				x	
GOBIIDAE						
Eviota epiphanes	divine dwarf goby					x
ZANCLIDAE						
Zanculus cornutus	Moorish idol		x			x
ACANTHURIDAE						
Acanthurus blochii	ring-tail surgeonfish		x		x	
Acanthurus dussumieri	eye-stripe surgeonfish		x			
Acanthurus leucopareius	white-bar surgeonfish		x			
Acanthurus triostegus	convict tang, *manini*		x		x	x
Acanthurus nigrofuscus	lavender tang					x
Acanthurus xanthopterus	yellowfin surgeonfish					x
Ctenochaetus strigosus	goldring surgeonfish					x
Naso unicornis	bluespine unicornfish					x
Zebrasoma flavescens	yellow tang				x	x
SPHYRAENIDAE						
Sphyraena barracuda	great barracuda				x	
OSTRACIIDAE						
Lactoria fornasini	thornback cowfish					x
Ostracion meleagris	spotted boxfish					x
TETRAODONTIDAE						
Arothron hispidus	stripbelly puffer					x
DIODONTIDAE						
Diodon hystrix	spotted porcupinefish		x			x

KEY TO SYMBOLS AND SURVEY AREAS:

x = taxon present
East: East end of Iroquois Point by Pearl Harbor Entrance Channel (*AECOS*, 2007b)
Mid: Middle of Iroquois Point, half way between East and West ends (*AECOS*, 2007b)
West: West end of Iroquois Point, by military firing range (no fishes observed) (*AECOS*, 2007b)
Inner and Outer Lagoons: Pu'uloa Lagoons of Iroquois Point (*AECOS* Consult., 2006)
P.H. Entrance Channel: Pearl Harbor Entrance Channel (Coles et al., 1997)

<u>Water quality</u>

High turbidity levels are present, especially near the middle of the project area where the shoreline has eroded into a layer of volcanic soil fill material (*AECOS*, 2007b). Mild surf conditions and high tides are responsible for shoreline erosion causing siltation events that regularly exceed State water quality criteria for turbidity (*AECOS*, 2007b). Wave conditions are generally low in winter and somewhat elevated in summer, with 1 to 4 ft (0.3 to 1.2 m) typical wave heights nearshore. Nitrogen nutrient levels are elevated at the north end of the project area by Pearl Harbor Entrance Channel and regularly exceed state water quality criteria regulations. Chlorophyll α levels, which are a measure of phytoplankton abundance, exceed State water quality criteria at all stations. The high chlorophyll α concentrations in the survey area can be attributed to the continuing supply of nutrients associated with shoreline erosion and nutrient inputs from water exiting Pearl Harbor.

Algal cover on the reef flat is highest at the east end of the project area near the Pearl Harbor Entrance Channel where nitrogen nutrient levels are elevated and water motion reduced. The dominant alga in this area is the invasive *ogo* (*Gracilaria salicornia*), which was not observed along other transects to the southwest, despite availability of growing surfaces (*AECOS*, 2007b).

<u>Endangered species</u>

The Hawaiian monk seal (*Monachus schauinslandi*) sometimes uses the beach along Iroquois Point for hauling out (*AECOS*, 2007b). Over a 17 year period, between 1989 and 2006 there were 47 monk seal sightings along the Iroquois Point shoreline (NMFS/PIFSC, 2007).

Green sea turtles (*Chelonia mydas*) have been reported from Pearl Harbor Entrance Channel area. An in-depth sea turtle survey was conducted within the Channel which included 50 sea turtle data collecting dives, in addition to surface observations (PACDIV, 1999). Only green sea turtles were observed during the survey; no hawksbill sea turtles (*Eretmochelys imbricata*) were observed. The primary use of Pearl Harbor Entrance Channel by green sea turtles occurs over 1.5 km seaward from the dredge site for resting. Turtles in this area almost exclusively occur between 25 and 40-ft (8 to 12-m) depths where they are either resting amid protective reef structures or transiting through the area, but not foraging (PACDIV, 1999).

No avian or plant species listed as endangered, threatened, proposed or candidate species by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended (ESA), or by the State of Hawai'i under it's endangered species program (Federal Register, 1999a and 1999b; DLNR, 1998) were detected during the course of a 2001 survey of Iroquois beach strand or upland habitats (*AECOS*, 2001).

Assessment of adverse effects

Benthic substrata and associated biota

The shallow subtidal zone of Iroquois Point is marginal fish habitat due to the low habitat complexity and poor water quality found there. Boulders and sand fill will bury a portion of the existing subtidal environment, which is primarily low relief habitat: sand, rubble and consolidated limestone reef. The footprint of the boulder groins and sand fill below mean lower low water will be approximately 4.6 acres (1.9 ha). It should be noted, however that much of the footprint area is relatively new sea bottom created by the erosion and recession of the shore, and thus does not have a long-established benthic flora and fauna. It is also an area of active sand movement, which results in scour and stress on benthic organisms. Placement of boulders and sand will result in the temporary loss of some benthic organisms (fish foraging resources) including algae, crustaceans, sponges, and other invertebrates. Benthic invertebrates will repopulate from surrounding habitat after construction is completed and sessile organisms will colonize new hard surfaces.

Fishes

A short-term reduction in fish habitat will occur during project construction. Adult and juvenile fishes are mobile and are expected to avoid the area during construction activities. However, some adult fish such as eels could be buried. There is potential for demersal fish eggs to be buried, however new hard substrata created would provide greater surface area for these species to lay eggs in the future. No rare or endangered fish species would be lost in this already disturbed environment. After construction, fishes are expected to repopulate newly provided habitat.

Corals

Placement of boulders and sand on the nearshore reef may bury some coral colonies. These corals provide minimal ecological services to the coral reef ecosystem: minimal shelter, reef consolidation, food for corallivores, or coral gametes.

Water quality

High turbidity levels that characterize the project waters result from erosion of the shoreline. The proposed project would stabilize the shore and eliminate this source of turbidity.

There exists potential for short-term impacts on the water quality resulting from increases in suspended solids in the water during the construction phase. The project construction specifications will require the use of clean material free of earthen material or any contaminants, and clean beach-compatible calcareous sand.

Suspended sediment resulting from the construction will be contained with silt curtains. Sand will only be placed following completion of the groins, which will reduce wave energy at the shore and allow more effective containment by the silt curtains. The temporary increases in turbidity and suspended solids as a result of construction activities will cease once the project is complete.

Best Management Practices (BMPs) for construction in coastal waters will be employed, such as daily inspection of equipment for conditions that could cause fuel or oil spills or leaks; cleaning of equipment prior to deployment near the water; proper location and containment of storage, refueling, and servicing sites; implementation of adequate spill response plans; stormy weather preparation plans; and the use of silt curtains to minimize potential impacts.

A Water Quality Monitoring Plan (WQMP) will be implemented during construction in accordance with State of Hawaii water quality regulations. The purpose of water quality monitoring is: 1) to ascertain that BMPs for the project are adequate to insure compliance with State water quality standards; and 2) in the event that a BMP proves inadequate, to promptly determine such, so that modification of the BMP can be implemented in a timely manner and bring the activity into compliance.

<u>Endangered species</u>

Endangered Species Act (ESA) consultation under Section 7 has been conducted with the National Marine Fisheries Service (NMFS), Pacific Islands Regional Office, and the United States Fish and Wildlife Service (USFWS). Best Management Practices (BMPs) for the project have been recommended by NMFS and these will be incorporated into and become a requirement of the project construction plans and specifications. ESA analysis by NMFS concluded the following (NMFS/PIRO, 2008):

> Given the insignificant probability of exposure of protected species to the construction and dredging activities, the anticipated insignificant effects to sea turtles and monk seals from turbidity, sedimentation, noise disturbance, and changes to forage habitat, coupled with the BMPs previously described, we do not expect the proposed action to result in adverse behavioral effects to Hawaiian monk seals or hawksbill and green sea turtles.

By letter dated May 21, 2008 the NMFS concurred with the determination that the proposed beach stabilization project is not likely to adversely affect the Hawaiian monk seal, the hawksbill sea turtle, or the green sea turtle, and stated that this concludes the consultation responsibilities under the ESA for species under NMFS's jurisdiction.

Assessment of improvements

Benthic habitat

The shoreline restoration project at Iroquois Point will create new reef fish habitat in the form of boulder groins and sand beach fill. Approximately 0.4 acres (0.16 ha) of intertidal (between mean higher high water [MHHW] and mean lower low water [MLLW]) boulder habitat, and 0.7 acres (0.28 ha) of shallow subtidal (below MLLW) boulder habitat, will be created. Boulder groins will provide bare, stable surfaces for recruitment of corals, algae and other invertebrates. The boulder groins are porous structures, with approximately 37 percent interstitial void space between boulders. Approximately 86,000 cubic feet (2,435 m^3) of interstitial space between the stones below MLLW will be created. The interstitial spaces will provide additional habitat for cryptic benthic (crabs, shrimps, and worms) and sessile (sponges and tunicates) organisms which will provide additional foraging resources for fishes. Areas of greater reef habitat complexity generally host greater species diversity (Rogers, 1990), and this interstitial space represents physically complex habitat.

Approximately 1.7 acres (0.7 ha) of intertidal sand habitat and 2.9 acres (1.2 ha) of subtidal sand habitat will be created. Additional sand will provide additional habitat for infauna such as small worms, crustaceans and echinoderms (Randall, 2002). It is likely that these would be foraged by goatfishes (Mullidae) and other bottom feeding fishes. The proportion of infauna eaten by fishes that feed over sand is not known for the area. Most infaunal organisms are in the 0.02 to 0.4 in (0.5 mm to 1 cm) size range. The time it will take for infauna to recover is unknown, but anticipated to be rapid due to the small size and rapid regeneration time of infauna (J. Brock, pers. comm.).

Fishes

Obligate reef dwellers are often limited by the availability of suitable shelter, especially juveniles (Pickering and Whitmarsh, 1997). Reef fishes prefer reef holes and crevices commensurate with the size of the fish, smaller fishes preferring smaller crevices. Topographically complex reefs have significantly more fish associated with them than simple structure reefs (Clark and Edwards, 1994). The boulder groin structure and associated interstitial spaces will provide habitat for many fishes, invertebrate, and algal taxa (fish foraging resources). Fish and invertebrate densities within the project area will likely increase after initial work is complete.

An increase in available sand bottom will provide additional foraging for fishes such as carnivorous goatfishes, spotted eagle rays, and jacks. Also, additional sand shelter will be provided to wrasses, many of which bury in the sand to rest and escape predators (Breder, 1952).

Corals

The basalt boulders that will be used for groin construction are not ideal for coral larvae settlement, however basalt boulders are used by corals as observed at other locations in Hawaiʻi: at Hana (*AECOS*, 2007c) and at Kahe Point (Coles, 1984), for examples. Corals that recruit to the groin structure will likely benefit from being elevated above shifting sand and rubble. *Poc. damicornis*, the most common coral species at the site, is fast growing and planulates (reproduces) monthly throughout the year in Hawaiʻi (Richmond and Hunter, 1990). The oldest colonies in Hawaiʻi are estimated to be less than 10 years old (branch lengths < 20 cm; Richmond and Hunter, 1990). *Poc. meandrina*, which occurs at the site, but is uncommon, spawns in April and/or May, five days after the full moon (Fiene-Severns, 1998).

Water quality

Shoreline stabilization will reduce sediment plumes that plague the nearshore environment. Siltation events are problematic to fishes, corals, and sessile invertebrates. Fish rely on their gills for oxygen exchange and are compromised by high levels of gill-clogging silt (Alabaster, 1972). Fine sediments are well known to inhibit settlement of coral larvae (Hodgson, 1990; Te, 1992) and to smother established colonies (Jokiel and Brown, 2004). Elevated turbidity reduces light penetration to the benthos, further reducing productivity of corals and algae (Rogers, 1990). The present adverse turbidity conditions at Iroquois Point will be improved by the shoreline stabilization proposed. Reduction in terrigenous inputs to the marine environment is a management priority identified in Executive Order 13089 (Clinton, 1998) for protection of coral reefs.

Endangered species

The NMFS ESA analysis included the following anticipated benefits to endangered species which would be provided by the project (NMFS, 2008):

> Completion of the beach stabilization at Iroquois Point will likely provide a few benefits to marine listed species. For instance, the project will retain, and even expand the beach area for seal haul out. The area will also be clear of scattered rocks, concrete and steel debris, and other rubble from the beach and nearshore waters. The groins are also likely to result in a greater diversity and biomass of fishes and crustaceans, which may provide nearshore forage resources for monk seals.

MITIGATION

Long-term mitigation

The proposed project will not result in any significant long-term degradation of the environment or loss of habitat. Rather, by the construction of T-head groins, the project will improve the shoreline condition, restore a recreational beach at the site, improve water quality by eliminating erosion of terrigenous fill, and increase potential biological habitat in a relatively barren reef flat area. Ecological services of reef flat habitat will be lost under the project footprint (sand and groin), but will recover over time as the benthic community reestablishes. A biological and water quality monitoring program will be implemented to minimize project construction impacts.

A monitoring plan will be implemented that addresses water quality, benthic biota, and fishes before and after construction. Preconstruction water quality monitoring was conducted for turbidity levels and similar methods will be followed during and after construction for comparability of data. Also a water quality monitoring plan will be prepared and followed as required by the CWA 404 and 401 permits. Three areas proposed for groin placement (groin 1 - at east end of project area, groin 5- in the middle, and groin 9 - at the west end) were previously surveyed and will be surveyed before and after construction for benthic biota, fish diversity, and fish biomass. These sites will be monitored once before construction and three times after construction (immediately after groin completion, one year after initial post construction survey, and two years after initial post construction survey). At each interval the following surveys will be conducted;

1. a survey of marine biota for compilation of a species list with DACOR (Dominant, Abundant, Common, Occasional, and Rare) abundance categories,
2. a survey of benthic cover using the point-intercept quadrat method or photoquadrats and Coral Point Count with Excel Extension (CPCE; Kohler and Gill, 2006), to include the following categories: sand, bare hard substrata, turf algae, fleshy algae, crustose coralline algae, coral, and other macroinvertebrates,
3. a survey of coral recruitment using a quadrat count-and-measure method with the following size class categories: 0-1, 1-5, and 5-10 cm (NMFS/PIFSC, 2008).
4. a survey of fishes using the belt transect method (Brock, 1982).

In addition, habitat complexity will be determined for the three groin sites once before and once after groin placement using the chain-link rugosity measurement method (McCormick, 1994).

Deliverables:

1. Before, during, and after water quality data
2. Before and after species list of marine biota with DACOR abundance
3. Before and after habitat complexity for groin sites
4. Before and after benthic cover data for natural substrata (before construction) and groins (after construction)
5. Coral recruitment data for groins

6. Before and after fish diversity and biomass

Endangered species mitigation during construction

The following endangered species BMPs as recommended by NMFS (2008) will be adhered to during construction of the project.

A. Conduct a survey for marine protected species before any work starts, and postpone or halt all work if a marine protected species is seen in the area. If a marine protected species is in the area, either hauled out onshore or in the nearshore waters, a 150-ft buffer must be observed with no humans approaching them. If a monk seal/pup pair is present, a minimum 300-ft buffer must be observed.

B. Establish a safety zone around the project area whereby observers will visually monitor this zone for marine protected species 30 minutes prior to, during, and 30 minutes post project activity. Record information on the species, numbers, behavior, time of observation, location, start and end times of project activity, sex or age class (when possible), and any other disturbances (visual or acoustic).

C. Conduct activities only if the safety zone is clear of monk seals and turtles.

D. Upon sighting of a monk seal or turtle within the safety zone during project activity, immediately halt the activity until the animal has left the zone. In the event a marine protected species enters the safety zone and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals contact the Marine Mammal Response Coordinator, David Schofield at (808) 944-2269, as well as the monk seal hotline at (888) 256-9840. For turtles, contact the turtle hotline at 983-5730.

E. For on-site project personnel that may interact with a listed species potentially present in the action area, provide education on the status of any listed species and the protections afforded to those species under Federal laws. NMFS may be contacted for scheduling educational briefings to convey information on marine mammal behavior, and explain why and when to call NMFS and other resource agencies.

Construction best management practices

Best Management Practices (BMPs) for construction operations are being developed to help minimize adverse impacts to coastal water quality and the marine ecosystem. The project specifications will require the construction contractor to adhere to environmental protection measures, including, but not limited to, the following:

1. The contractor shall perform the work in a manner that minimizes environmental pollution and damage as a result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of the construction period.

2. Any construction related debris that may pose an entanglement hazard to marine protected species must be removed from the project site if not actively being used and/or at the conclusion of the construction work.

3. The contractor shall submit a Best Management/Environmental Protection Plan for approval prior to initiation of construction. The plan shall include, but not be limited to:

    a) Protection of Land Resources
    b) Protection of Water Resources
    c) Disposal of Solid Waste
    d) Disposal of Sanitary Waste
    e) Disposal of Hazardous Waste
    f) Dust Control
    g) Noise Control

4. The construction contractor shall be required to employ standard BMPs for construction in coastal waters, such as daily inspection of equipment for conditions that could cause spills or leaks; cleaning of equipment prior to operation near the water; proper location of storage, refueling, and servicing sites; and implementation of adequate spill response procedures, stormy weather preparation plans, and the use of silt curtains and other containment devices.

5. No contamination (including but not limited to trash or debris disposal and alien species introductions) of marine environments (such as shorelines, reef flats, lagoons, open ocean) at the project site shall result from project related activities.

6. The contractor shall confine all construction activities to areas defined by the drawings and specifications. No construction materials shall be stockpiled in the marine environment outside of the immediate area of construction.

7. The contractor shall keep construction activities under surveillance, management and control to avoid pollution of surface or marine waters. Construction related turbidity at the project site shall be controlled so as to meet water quality standards. All water areas affected by construction activities shall be monitored by the contractor. If monitoring indicates that the turbidity standards are being exceeded due to construction activities, the contractor shall suspend the operations causing excessive turbidity levels until the condition is corrected. Effective silt containment devices shall be deployed where practicable to isolate the construction activity, and to avoid degradation of marine water quality and impacts to the marine ecosystem. In-water construction shall be curtailed during sea conditions that are sufficiently adverse to render the silt containment devices ineffective.

8. Underlayer fills will be protected from erosion with armor units as soon after placement as practicable.

9. Waste materials and waste waters directly derived from construction activities shall not be allowed to leak, leach or otherwise enter marine waters.

10. Fueling of project related vehicles and equipment should take place away from the water. A contingency plan to control the accidental spills of petroleum products at the construction site should be developed. Absorbent pads, containment booms and skimmers will be stored on site to facilitate the cleanup of petroleum spills.

11. The project shall be completed in accordance with all applicable state and county health and safety regulations.

12. The sand shall be of beach-compatible quality, moderately well sorted with rounded and polished grains composed of primarily calcareous material. The sand shall be dominantly composed of naturally occurring carbonate beach or dune sand. Crushed limestone or other man-made or non-carbonate sands are not allowable.

13. All construction material including sand shall be free of contaminants of any kind including: excessive silt, sludge, anoxic or decaying organic matter, turbidity, temperature or abnormal water chemistry, clay, dirt, organic material, oil, floating debris, grease or foam or any other pollutant that would produce an undesirable condition to the beach or water quality. The sand shall have no discernable odor.

14. Sand fill placement shall not be done during storms or periods of high surf.

15. Any spills or other contaminations shall be immediately reported to the DOH Clean Water Branch (808-586-4309).

16. Best management practices shall be utilized to minimize adverse effects to air quality and noise levels, including the use of emission control devices and noise attenuating devices.

17. A dust control program shall be implemented, and wind blown sand and dust shall be prevented from blowing offsite by watering when necessary.

18. Public safety best practices shall be implemented, possibly including posted signs, areas cordoned off, and on-site safety personnel.

19. Public access along the shoreline during construction shall be maintained so far as practicable and within the limitations necessary to ensure safety.

20. The contractor shall review all best management practices with the project applicant/representative prior to the commencement of beach nourishment activities.

Conclusions

Essential Fish Habitat is expected to improve upon implementation of this project with improved water quality, increased fish shelter and increased fish foraging resources. Project groins will provide additional benthic habitat complexity (fish shelter), will create new splash and intertidal zone habitat, will provide additional habitat for benthic and sessile biota (algae, crustaceans, sponges, and other invertebrates; fish foraging resources), and provide a stable substratum for corals to grow. Project sand will provide additional foraging and resting habitat for fishes as well. The enlarged project sand beach will provide additional resting habitat for endangered species, the Hawaiian monk seal and the green sea turtle. Furthermore, stabilizing the shoreline will improve water quality through the reduction of terrigenous inputs to the marine environment, a management priority for protection of coral reefs and their inhabitants identified in Executive Order 13089 (Clinton, 1996), as well as by the 2008 Coral Reef Task Force. Based on the project design and the habitat improvements it will provide, Ford Island Housing believes there will be no long-term adverse effects to Essential Fish Habitat.

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APPENDIX E

NATIONAL HISTORIC PRESERVATION ACT CONSULTATION

FORD ISLAND PROPERTIES, LLC
737 Bishop Street, Mauka Tower Suite 2750 · Honolulu, Hawaii 96813 · 808 585-7900 · FAX 808 585-7910

September 28, 2007

Ms. Laura H. Thielen
State Historic Preservation Officer
State of Hawaii
Department of Land and Natural Resources
Post Office Box 621
Honolulu, Hawaii 96809

Dear Ms. Thielen:

Subject: National Historic Preservation Act (NHPA) Section 106 Review
Iroquois Point Beach Restoration
Honouliuli Ahupua`a, `Ewa District, Island of O`ahu
TMK: (1) 9-1-001

Thank you for your response to our request for a NHPA Section 106 review of the proposed Iroquois Point Beach Restoration project as contained in your letter dated September 21, 2007. Please be assured that the project will be accomplished in accordance with the discussion as contained in the documents submitted with out Section 106 review request, particularly those pertaining to historical and archaeological aspects of the project and as stipulated in your response letter. In addition, should any historical resources or human skeletal remains be identified during the construction process, work will stop in the vicinity of the find and the find protected from further disturbance, and all applicable laws and rules will be followed.

Very truly yours,
FORD ISLAND PROPERTIES, LLC

Steve Colón
Vice President

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

September 21, 2007

Steve Colón, Vice President
Ford Island Properties, LLC
737 Bishop Street, Mauka Tower, Suite 2750
Honolulu, Hawai'i 96813

LOG NO: 2007.2581
DOC NO: 0709ED17
Archaeology

Dear Mr. Colón:

SUBJECT: **National Historic Preservation Review (NHPA) Section 106 Review – Iroquois Point Beach Restoration**
Honouliuli Ahupua'a, 'Ewa District, Island of O'ahu
TMK: (1) 9-1-001

Thank you for the opportunity to comment on the aforementioned project, which we received on July 25, 2007. We apologize for the delay in responding. The proposed undertaking involves constructing nine T-head groin structures to restore and stabilize the eroding shoreline in the vicinity of the Iroquois Point Housing Area. The groins, which will be constructed of rock, will be 140 feet long (perpendicular to the shore) and 100 to 200 feet long (parallel to the shore). Sand to restore the shoreline will be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor entrance channel.

We have reviewed the submitted archaeological inventory survey (AIS) report which provides an excellent assessment of the presence of historic properties in and around the area of potential effect (APE) (Carson. 2007. *Archaeological Inventory Survey at Iroquois Point Beach Development Parcel, Pu'uloa, O'ahu Island Hawai'i*). Six historic properties were identified during the AIS. Sites -5878 and -6906 are post-contact structural remnants. Sites -5875, -6905, -6907, and -6908 are buried pre-historic and historic cultural layers which are located 20 centimeters or more below the current surface. Three sites located outside the current survey areas, Site -3703 and -5874 (subsurface cultural layers) and Site -5877 (a post-Contact wharf), were identified during previous archaeological surveys.

The submitted documents state that: (1) an appropriate barrier will be place on the ground where the dredged sand will be stockpiled, (2) the stabilizing sand will be retrieved from recently accreted sand that does not contain any archaeological/historic materials, (3) no intact sand-soil landward of the old bulkhead will be excavated, (4) emplacement of stabilizing sand over site -6909, a gun mount, will be non-destructive and an archaeological monitor will be present during construction activities in the vicinity of Site -6906, and (5) archaeological monitoring will be conducted for all ground-disturbing activities within the boundaries of the identified subsurface cultural layers, although no ground disturbing activities are expected to occur as part of this undertaking.

According to our conversation with Mr. Scott Sullivan of Sea Engineering, Inc., no subsurface excavation is planned for this undertaking. The proposed T-head groins will not be constructed on any of the identified archaeological/historic sites. Furthermore, we believe that the restoration and stabilization of this area of shoreline may in fact help to preserve these sites.

Therefore, provided that the five stipulations are followed accordingly, then we believe that the proposed undertaking will have **no adverse effect on historic properties**.

If historic resources, including human skeletal remains, are identified during proposed construction activities, all work needs to cease in the immediate vicinity of the find, the find needs to be protected from additional disturbance, and all applicable laws and rules must be followed.

Please contact Ms. Teresa Davan (O'ahu Archaeologist) at (808) 692-8015 if you have any questions or concerns regarding this letter.

Aloha,

Laura H. Thielen
State Historic Preservation Officer

ED:jen

FORD ISLAND PROPERTIES, LLC

737 Bishop Street, Mauka Tower, Suite 2750 · Honolulu, Hawaii 96813 · 808 585-7900 · FAX 808 585-7910

September 28, 2007

Mr. Clyde W. Nāmu'o,
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd., Suite 500
Honolulu, HI 96813

Dear Mr. Nāmu'o:

Subject: National Historic Preservation Act (NHPA) Section 106 Review
Iroquois Point Beach Restoration
Honouliuli Ahupua'a, 'Ewa District, Island of O'ahu
TMK: (1) 9-1-001

Thank you for your response to our request for NHPA Section 106 review of the proposed Iroquois Point Beach Restoration project as contained in your letter dated September 13, 2007.

We share your concern about the potential impact of sea level rise on Hawaii's shorelines, and agree that recent information points to possible significant long term impacts to our shores.

The proposed project to restore and nourish the beach at Iroquois Point will provide recreational and aesthetic benefit for area residents and other beach users, as well as providing protection from storm wave attack for the backshore homes and other facilities. The design of the project is based on modern coastal engineering techniques and methodology, and the groin layout and configuration is designed to stabilize the beach fill and prevent its movement away from where it is placed on the shore. We recognize the potential for adverse impacts should the sand migrate away from the project area, and that is why we are using the T-head groins to prevent sand movement. The T-head groin system has been used with considerable success for other projects in similar coastal environments.

Numerical modeling and aerial photographic erosion analysis indicates that sand transport is predominantly to the east, toward the Pearl Harbor entrance channel. As Iroquois Point has eroded, sand has accreted in the entrance channel, necessitating maintenance dredging of the channel. Our analysis does not indicate significant or predominant sand transport to the west, thus down drift erosion to the west is not expected as a result of this project. Instead, it is expected that groins and sand fill will stabilize Keahi Point and prevent erosion from progressing westward. The project will also stop sand from moving eastward and depositing in the Pearl Harbor channel.

The sand to be used for beach nourishment will be recovered from the Pearl Harbor channel, and as it originally came from the Iroquois Point shoreline it matches the existing beach sand extremely well in terms of composition and grain size.

Monk seals are known to occasionally haul out along the beach in the project area. The proposed project will retain, and even expand, the beach area available for haul out. The groins are also likely to resulting a greater diversity and biomass of fishes, crabs and possibly lobsters, all of which are potential food sources for monk seals. Therefore, the project is likely to benefit monk seals in the long term.

A detailed archaeological inventory survey has been conducted in the area of potential effect, and based on this and considering the project design, we do not anticipate any adverse effect on historic properties. Please be assured however, that should any historical, cultural or archaeological resources, or human skeletal remains, be uncovered or identified during the construction process, work will stop in the vicinity of the find and the find protected from further disturbance, and all applicable laws and rules will be followed.

Ford Island Properties, LLC is working with State agencies and the community to develop appropriate procedures for public access to the Iroquois Point shoreline. It is anticipated that the restored beach will provide increased recreational opportunities for residents and the general public, will improve the appearance of the shoreline by removing existing debris resulting from the ongoing erosion, and will improve nearshore water quality by eliminating the ongoing erosion of earthen material. Consideration will be given to landscaping of the backshore area with native flora so far as practicable once it is stabilized and protected by the beach restoration project.

Very truly yours,
FORD ISLAND PROPERTIES, LLC

Steve Colón
Vice President

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD07/282C

September 13, 2007

Steven W. Colon, Vice President
Ford Island Properties, LLC
737 Bishop Street, Mauka Tower, Suite 2750
Honolulu, Hawai'i 96813

RE: Draft Environmental Assessment and National Historic Preservation Act-Section 106 Consultation, Proposed Construction of a Retaining Wall, Iroquois Point housing Development, 'Ewa, O'ahu, TMK 9-1-01.

Dear Mr. Colon,

The Office of Hawaiian Affairs (OHA) is in receipt of your request for written comments regarding the applicant's Draft Environmental Assessment and (DEA) and National Historic Preservation Act (NHPA)-Section 106 Consultation for the proposed construction of a retaining wall, for the Iroquois Point housing development in 'Ewa on O'ahu. OHA apologizes for the lateness of the comments and sincerely hopes that no inconvenience results.

OHA realizes that the shoreline is receding not just in that area, but statewide. According to the Third Assessment Report issued by the Intergovernmental Panel on Climate Change in 2001, the global average surface temperature has increased over the 20th century by approximately 1.1°F. Globally, the last two decades have been the warmest decades in at least the past 1000 years and 2005 was the warmest year in the instrumental record for the Northern Hemisphere. Human influences will continue to change atmospheric composition throughout the 21st century and this has caused an increase in concern over the effects, including sea level rise, in this state.

OHA is concerned over the construction of nine T-head groins that extend into the nearshore environment and divide the beach into cells. Such activities have less to do with beach nourishment and more to do with protecting existing shoreline development. The cells and sand fill placed within them leaks out into the marine environment as it is exposed to wave action over time and can harm the marine environment. This is acknowledged in the DEA on page 90. T-head groins are controversial and not always able to retain the sand fill placed within their cells. Further, these groins can produce alluvion due to accretions or erosion caused by the structure itself in conjunction with tidal and wave action over time. Evidence indicates that armoring may increase the rate of erosion of adjacent beaches and is, therefore, not a preferred management tool.[1]

As such, OHA recommends a landward retreat of existing structures from dynamic shorelines and, if this is not possible, placement of clean sand of appropriate composition and grain size. The Native Hawaiian worldview also requires that the sand should also be blessed if ashes have been spread over the water from which it has been dredged so that the area and the people that use it can enjoy it freely.

OHA is also concerned about the effect that the t-head groins and the cells will have on endangered species, particularly the haul out areas for the Hawaiian monk seal, which is known to use the area. OHA appreciates that consultation and permitting are being done with both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service.

OHA notes that the project will take place in an area which is favored for human burial in the traditional Hawaiian context. As such, it is possible that human remains will be encountered during construction. Further, the project may unearth other cultural deposits and artifacts as the area was used by traditional Hawaiians. OHA requests that the applicant cease all work and also contact the Department of Land and Natural Resources Historic Preservation Division in the event that any iwi kūpuna or other cultural artifacts are uncovered. We also the expect Native American Graves Protection and Repatriation Act (NAGPRA) provisions relating to inadvertent discoveries will be adhered to, in the event such sites or items are discovered on any Federal Lands. OHA seeks clarification for how any cultural sites or discoveries will be handled during ground disturbing activities and what laws will be applied.

Finally, and as you know, state law requires all beaches to remain accessible to the public, and counties must make sure the public can reach the beach where private property dominates. OHA realizes that Iroquois Point is leased from the Navy; however, once the land was leased to a private developer, there cannot be a beach access policy that discriminates between civilian residents and nonresidents. OHA understands that a plan is being formalized now with a December initiation expected.[2] OHA appreciates this cooperative effort and only recommends that the plan include ample parking and that the access not be procedurally burdensome or inconvenient.

OHA would like to suggest that the area be restored to its original, not existing condition with native flora. Doing so would not only serve as practical landscaping and water-

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[1] Kalo, Hildreth, Rieser, and Christie, Coastal and Ocean Law, 2007, page 304.
[2] Honolulu Advertiser, September 11, 2007 and September 10, 2007 articles.

saving choices, but also serve to further the traditional Hawaiian concept of mālama ʻāina.

OHA appreciates being brought into this early consultation and looks forward to further commenting on this project as it develops. Thank you for the extended opportunity to comment. If you have any further questions or concerns please contact Grant Arnold at (808) 594-0263 or granta@oha.org.

Sincerely,

Clyde W. Nāmuʻo
Administrator

FORD ISLAND PROPERTIES, LLC
737 Bishop Street, Mauka Tower, Suite 2750 · Honolulu, Hawaii 96813 · 808 585-7900 · FAX 808 585-7910

July 17, 2007

Mr. Allan A. Smith
Acting Chairperson and State Historic Preservation Officer
Department of Land and Natural Resources,
State Historic Preservation Division
Kakuhihewa Building
601 Kamokila Boulevard, Room 555
Kapolei, HI 96707

Re: Iroquois Point Beach Restoration

Dear Mr. Smith:

Pursuant to Section 106 of the National Historic Preservation Act (NHPA), we are requesting your review of the proposed restoration of the sandy beach along the shoreline of the Iroquois Point housing development. In accordance with the implementing regulations for Section 106 of NHPA, we have reviewed the project and determined that it is an undertaking as defined in 36 CRR 800.16(y).

The project area is located along the eroding sandy shoreline at the Iroquois Point housing development in `Ewa, O`ahu Island, State of Hawai`i, portion of O`ahu Island Tax Map Key (TMK) 9-1-01. Please refer to the enclosed Draft Environmental Assessment (DEA) and Archaeological Inventory Survey report for detailed project location maps.

Background and Project Description

The Iroquois Point housing area is located immediately west of the Pearl Harbor entrance channel, along approximately 4,200 feet of sandy shoreline. Analysis of aerial photographs and other information shows that the beach and shoreline has receded as much as 280 feet between 1928 and 2003. The erosion and backshore flooding has resulted in the abandonment and demolition of 16 shoreline homes to-date, and several more homes are threatened. Failed attempts to stem the erosion have resulted in hazardous rocks and concrete and steel debris littering the shoreline. The proposed project is designed to restore and stabilize the sandy beach along the housing area shoreline. The beach restoration plan consists of nine T-head groin structures extending along the project area shoreline, dividing the beach into eight cells 400 to 450 feet long. The groins would be constructed of rock, with stems (perpendicular to shore) 140 feet long, and heads (parallel to shore) 100 to 200 feet long. Sand fill will be placed within each cell, with a minimum crest width of 30 feet, a 1V on 10H beach slope, and a crest elevation of +6 feet. The total volume of sand fill required is approximately 60,000 cubic yards. The sand will be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance, north of Hammer Point.

Area of Potential Effect

The area of potential effect (APE) includes the footprint of the groin structures and the beach sand fill, and its immediate surroundings for access, the sand stock-piling area, staging area, and other work in support of construction. The project would be constructed entirely seaward of the existing shoreline, and would require no excavation landward of the existing beach face. The nature of the work will affect the exposed ground surface, without subsurface intrusion.

Identification of Historic Properties

An archaeological inventory survey recently was conducted throughout the APE (Draft Report: *Archaeological Inventory Survey at Iroquois Point Beach Development Parcel, Pu'uloa, O'ahu Island, Hawai'i*, Carson 2007), except for a portion of the stock-piling area covered by a prior archaeological testing effort (Final Report: *Archaeological Subsurface Testing at Navy Family Housing, Iroquois Point/Puuloa, O'ahu, Hawai'i*, Magnuson, Athens, and Tuggle 2002). A copy of the most recent draft report is enclosed. The inventory survey entailed complete surface survey and intensive subsurface testing.

As shown in the enclosed project area map, the archaeological investigations documented two partially submerged offshore structural ruins (50-80-13-6906 and 5878), one surface-visible remnant of a wharf (5877), and six subsurface cultural deposits (6905, 5875, 6907, 6908, 3703, and 5874). Of these, Site 3703 is outside the APE. The enclosed draft report provides details about these sites and the investigations undertaken to document them as thoroughly as possible.

Sites 6905, 5875, 6907, 6908, and 5874 are subsurface midden deposits, containing scattered charcoal, non-human animal bones and shells, small pits and postmolds, and remnants pf pebble pavings. Sites 6905, 5875, 6907, and 5874 are general habitation areas of pre-Contact and post-Contact age. Site 6908 is a dispersed set of short-term camping spots of post-Contact age. Site 3703 is outside the APE and will not be discussed further for this consultation letter.

The subsurface site remains are beneath 20 cm depth, and they will not be affected by activities on the existing ground surface or above 20 cm depth. The upper layers of the project area include imported topsoil and artificial construction fill in landward areas, devoid of archaeological or historical material. The seaward areas contain natural beach sand in the active beach front, also devoid of archaeological or historical material.

Site 6906 is an early 20th century U.S. military gun mount, at present partially submerged offshore. This feature appears to be a significant contributing element in the Pearl Harbor National Historic Landmark, because it was part of a network defending Pearl Harbor during WW II. In addition, Site 6906 is diagnostic of a site type used between 1932 and 1950 as part of the coastal defense of Fort Weaver. The site location, boundary, form, and context have been documented in detail.

Site 5878 is the ruined remnant of a post-Contact survey marker, now displaced from its original location and partially submerged offshore. Although this feature has been documented in detail, it is not considered eligible for nomination in the National Register of Historic Places (NRHP).

Site 5877 comprises the surface-visible ruins of a post-Contact wharf dated at least as early as 1888 but perhaps a decade or so earlier, and it served as an active wharf until 1950.

Determination of Affect

It is our determination that the proposed beach restoration will have no adverse effect on historic properties. Per CFR 800.4(d) (1), we will proceed with the proposed construction if we receive no response from your office by the end of the 30-day review period, and if other consulting parties have not objected. We currently are consulting with the O'ahu Council of Hawaiian Civic Clubs (OCHCC) and Office of Hawaiian Affairs (OHA).

Our determination of no adverse effect is based on the thorough documentation and testing of the sites, as well as the following stipulations:

1) a tarp, wood, geotextile fabric, or other appropriate barrier will be placed on the ground where the dredged sand will be stockpiled and eventually retrieved;

2) the stabilizing sand will be obtained by maintenance dredging of recently accreted sand, not containing any archaeological or historical materials;

3) no intact sand/soil inside landward of the old bulkhead on the beach will be excavated;

4) emplacement of stabilizing sand over the gun mount of Site 6906 will non-destructive, and archaeological monitoring will occur during planned construction work in the vicinity of Site 6906;

5) archaeological monitoring will occur during ground-disturbing activities in landward areas within the boundaries of subsurface cultural deposits, although currently no such ground-disturbing activities are expected to occur as part of this undertaking.

Should you have any questions regarding the project plan and the DEA please contact Scott Sullivan at Sea Engineering, Inc., 259-7966, ext. 22. For questions regarding cultural and archaeological aspects of the project please contact Dr. J. Stephen Athens, Principal Investigator, at International Archaeological Research Institute, Inc., 946-2548, ext. 104.

Sincerely,
Ford Island Properties, LLC

Steven W. Colón
Vice President

Enclosures:
(1) Draft Environmental Assessment
(2) Archaeological Inventory Survey Report w/ Addendum Letter

FORD ISLAND PROPERTIES, LLC
737 Bishop Street, Mauka Tower, Suite 2750 · Honolulu, Hawaii 96813 · 808 585-7900 · FAX 808 585-7910

July 17, 2007

Mr. Jesse Yorck
Office of Hawaiian Affairs
711 Kapi`olani Blvd., Ste. 500
Honolulu, HI 96813

Re: Iroquois Point Beach Restoration

Dear Mr. Yorck:

Pursuant to Section 106 of the National Historic Preservation Act (NHPA), we are requesting your review of the proposed restoration of the sandy beach along the shoreline of the Iroquois Point housing development. In accordance with the implementing regulations for Section 106 of NHPA, we have reviewed the project and determined that it is an undertaking as defined in 36 CRR 800.16(y).

The project area is located along the eroding sandy shoreline at the Iroquois Point housing development in `Ewa, O`ahu Island, State of Hawai`i, portion of O`ahu Island Tax Map Key (TMK) 9-1-01. Please refer to the enclosed Draft Environmental Assessment (DEA) and Archaeological Inventory Survey report for detailed project location maps.

Background and Project Description

The Iroquois Point housing area is located immediately west of the Pearl Harbor entrance channel, along approximately 4,200 feet of sandy shoreline. Analysis of aerial photographs and other information shows that the beach and shoreline has receded as much as 280 feet between 1928 and 2003. The erosion and backshore flooding has resulted in the abandonment and demolition of 16 shoreline homes to-date, and several more homes are threatened. Failed attempts to stem the erosion have resulted in hazardous rocks and concrete and steel debris littering the shoreline. The proposed project is designed to restore and stabilize the sandy beach along the housing area shoreline. The beach restoration plan consists of nine T-head groin structures extending along the project area shoreline, dividing the beach into eight cells 400 to 450 feet long. The groins would be constructed of rock, with stems (perpendicular to shore) 140 feet long, and heads (parallel to shore) 100 to 200 feet long. Sand fill will be placed within each cell, with a minimum crest width of 30 feet, a 1V on 10H beach slope, and a crest elevation of +6 feet. The total volume of sand fill required is approximately 60,000 cubic yards. The sand will be obtained by maintenance dredging of accreted sand along the west side of the Pearl Harbor entrance channel in the vicinity of the Iroquois Lagoon entrance, north of Hammer Point.

Area of Potential Effect

The area of potential effect (APE) includes the footprint of the groin structures and the beach sand fill, and its immediate surroundings for access, the sand stock-piling area, staging area, and other work in support of construction. The project would be constructed entirely seaward of the existing shoreline, and would require no excavation landward of the existing beach face. The nature of the work will affect the exposed ground surface, without subsurface intrusion.

Identification of Historic Properties

An archaeological inventory survey recently was conducted throughout the APE (Draft Report: *Archaeological Inventory Survey at Iroquois Point Beach Development Parcel, Pu'uloa, O'ahu Island, Hawai'i*, Carson 2007), except for a portion of the stock-piling area covered by a prior archaeological testing effort (Final Report: *Archaeological Subsurface Testing at Navy Family Housing, Iroquois Point/Puuloa, O'ahu, Hawai'i*, Magnuson, Athens, and Tuggle 2002). A copy of the most recent draft report is enclosed. The inventory survey entailed complete surface survey and intensive subsurface testing.

As shown in the enclosed project area map, the archaeological investigations documented two partially submerged offshore structural ruins (50-80-13-6906 and 5878), one surface-visible remnant of a wharf (5877), and six subsurface cultural deposits (6905, 5875, 6907, 6908, 3703, and 5874). Of these, Site 3703 is outside the APE. The enclosed draft report provides details about these sites and the investigations undertaken to document them as thoroughly as possible.

Sites 6905, 5875, 6907, 6908, and 5874 are subsurface midden deposits, containing scattered charcoal, non-human animal bones and shells, small pits and postmolds, and remnants pf pebble pavings. Sitcs 6905, 5875, 6907, and 5874 are general habitation areas of pre-Contact and post-Contact age. Site 6908 is a dispersed set of short-term camping spots of post-Contact age. Site 3703 is outside the APE and will not be discussed further for this consultation letter.

The subsurface site remains are beneath 20 cm depth, and they will not be affected by activities on the existing ground surface or above 20 cm depth. The upper layers of the project area include imported topsoil and artificial construction fill in landward areas, devoid of archaeological or historical material. The seaward areas contain natural beach sand in the active beach front, also devoid of archaeological or historical material.

Site 6906 is an early 20th century U.S. military gun mount, at present partially submerged offshore. This feature appears to be a significant contributing element in the Pearl Harbor National Historic Landmark, because it was part of a network defending Pearl Harbor during WW II. In addition, Site 6906 is diagnostic of a site type used between 1932 and 1950 as part of the coastal defense of Fort Weaver. The site location, boundary, form, and context have been documented in detail.

Site 5878 is the ruined remnant of a post-Contact survey marker, now displaced from its original location and partially submerged offshore. Although this feature has been documented in detail, it is not considered eligible for nomination in the National Register of Historic Places (NRHP). Site 5877 comprises the surface-visible ruins of a post-Contact wharf dated at least as early as 1888 but perhaps a decade or so earlier, and it served as an active wharf until 1950.

Determination of Affect

It is our determination that the proposed beach restoration will have no adverse effect on historic properties. Per CFR 800.4(d) (1), we will proceed with the proposed construction if we receive no response from your office by the end of the 30-day review period, and if other consulting parties have not objected. We currently are consulting with the O'ahu Council of Hawaiian Civic Clubs (OCHCC) and Office of Hawaiian Affairs (OHA).

Our determination of no adverse effect is based on the thorough documentation and testing of the sites, as well as the following stipulations:

1) a tarp, wood, geotextile fabric, or other appropriate barrier will be placed on the ground where the dredged sand will be stockpiled and eventually retrieved;

2) the stabilizing sand will be obtained by maintenance dredging of recently accreted sand, not containing any archaeological or historical materials;

3) no intact sand/soil inside landward of the old bulkhead on the beach will be excavated;

4) emplacement of stabilizing sand over the gun mount of Site 6906 will non-destructive, and archaeological monitoring will occur during planned construction work in the vicinity of Site 6906;

5) archaeological monitoring will occur during ground-disturbing activities in landward areas within the boundaries of subsurface cultural deposits, although currently no such ground-disturbing activities are expected to occur as part of this undertaking.

Should you have any questions regarding the project plan and the DEA please contact Scott Sullivan at Sea Engineering, Inc., 259-7966, ext. 22. For questions regarding cultural and archaeological aspects of the project please contact Dr. J. Stephen Athens, Principal Investigator, at International Archaeological Research Institute, Inc., 946-2548, ext. 104.

Sincerely,
Ford Island Properties, LLC

Steven W. Colón
Vice President

Enclosures:
(1) Draft Environmental Assessment
(2) Archaeological Inventory Survey Report w/ Addendum Letter

FORD ISLAND PROPERTIES, LLC
737 Bishop Street, Mauka Tower, Suite 2750 · Honolulu, Hawaii 96813 · 808 585-7900 · FAX 808 585-7910

July 17, 2007

Shad Kane
O'ahu Council of Hawaiian Civic Clubs
1767 Mahani Loop
Honolulu, HI 96819

Re: Iroquois Point Beach Restoration

Dear Mr. Kane:

Pursuant to Section 106 of the National Historic Preservation Act (NHPA), we are requesting your review of the proposed restoration of the sandy beach along the shoreline of the Iroquois Point housing development. In accordance with the implementing regulations for Section 106 of NHPA, we have reviewed the project and determined that it is an undertaking as defined in 36 CRR 800.16(y).

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Steven W. Colón
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