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LAND
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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

ref:OCCL:BR

CDUA-MA-3663



Genevieve Salmonson
Office of Environmental Quality Control
Department of Health, State of Hawai'i
235 S. Beretania Street, Room 702
Honolulu, Hawai'i 96813

Dear Ms. Salmonson,

With this letter, the Office of Conservation and Coastal Lands (OCCL) hereby transmits the final environmental assessment and finding of no significant impact (FEA-FONSI) for the proposed Permanent Shore Protection of the Hololani Resort Condominiums located at TMK TMK: (2) 4-3-010:009, located at Kahananui, Lahaina district, Maui for publication in the next available edition of the Environmental Notice.

The Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) for CDUA MA-3663 was published in OEQC's June 23, 2012 *Environmental Notice*. The FEA includes copies of public comments and the corresponding responses from the applicant that were received during the 30-day public comment period on the DEA-AFONSI.

We have determined that this project will not have significant environmental effects, and have therefore issued a FONSI. The FONSI does not constitute approval of the CDUA; authority to grant or deny the final permit lies with the Board of Land and Natural Resources.

The applicant's preferred alternative is a hybrid structure that combines a vertical seawall with a sloping rock rubble mound revetment. Though a FONSI is being issued, OCCL identifies several major concerns with this project:

- The structure footprint will encroach on the State Conservation District beach, resulting in loss of that area of the public beach.
- Coastal armoring has been shown to contribute to beach narrowing and loss in Hawaii and elsewhere through "passive erosion" (recession of the beach toe or water line toward the foot of a structure) and may contribute to further loss of public beach fronting the subject property.
- The structure may contribute to temporary (episodic) or long-term accelerated erosion on adjacent, unarmored portions of beach ("end effects" or "flanking erosion").

Enclosed is a completed OEQC Publication Form, a copy of the FEA-FONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to your office.

If there are any questions, please contact Sam Lemmo at 587-0377.

Sincerely,

SAMUEL J. LEMMO, Administrator
Office of Conservation and Coastal Lands

Enclosures: *Final EA, OEQC Pub Form*
Disc: *FEA, OEQC Pub Form*

# APPLICANT ACTIONS
# SECTION 343-5(C), HRS
# PUBLICATION FORM (JANUARY 2013 REVISION)

| | |
|---|---|
| **Project Name** | **Permanent Shore Protection of the Hololani Resort Condominiums, Kahananui, Lahaina, Maui, Hawaii** |
| **Island:** | **Maui** |
| **District:** | **Lahaina** |
| **TMK:** | **(2) 4-3-010:009** |
| **Permits:** | **Conservation District Use Application** |
| **Approving Agency:** | **Department of Land and Natural Resources** |
| *Address,* | *1151 Punchbowl Street, Honolulu, Hawaii 96813* |
| *Contact Person* | *Sam Lemmo* |
| *Telephone* | *808.587.0377* |
| **Applicant:** | **AOAO of the Hololani Resort Condominiums** |
| *Address,* | *4401 Lower Honoapiilani, Lahaina, Maui, Hawaii 96761* |
| *Contact Person,* | *Mr. Stewart Allen, President* |
| *Telephone* | *425.454.3605, ext. 1205* |
| **Consultant:** | **Sea Engineering, Inc.** |
| *Address,* | *Makai Research Pier, 41-305 Kalanianaole Highway, Waimanalo, HI 96795* |
| *Contact Person,* | *James Barry, Coastal Engineer* |
| *Telephone* | *808.259.7966, ext. 24* |



**Status (check one only):**

| | |
|---|---|
| __DEA-AFNSI | Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day comment period ensues upon publication in the periodic bulletin. |
| _X_FEA-FONSI | Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov; no comment period ensues upon publication in the periodic bulletin. |
| __FEA-EISPN | Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day consultation period ensues upon publication in the periodic bulletin. |
| __Act 172-12 EISPN | Submit the approving agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov. NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin. |
| __DEIS | The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin. |
| __FEIS | The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin. |
| __ Section 11-200-23 Determination | The approving agency simultaneous transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the applicant. No comment period ensues upon publication in the periodic bulletin. |
| __Statutory hammer Acceptance | The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it failed to timely make a determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and that the applicant's FEIS is deemed accepted as a matter of law. |
| __Section 11-200-27 Determination | The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin. |
| __Withdrawal (explain) | |

**Summary** (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page):

Hololani Resort Condominiums, located along the Kahana Coast in West Maui, consists of twin 8-story buildings with 63 apartments. The shoreline is chronically eroding, with an average annual erosion rate of approximately 0.8 feet per year, and is prone to high seasonal variability in beach width.

Since the lot was originally partitioned in 1959, it has eroded almost 40 feet, moving the active erosion scarp to within 15 feet of the northern building's corner in 2007. Nearly 5,000 square feet of property has been lost.

Temporary shoreline stabilization structures have been authorized by County and State agencies since 1988. The most recent temporary structure, a combination of geotextile sandbags and rock mattresses, was permitted in 2007 to protect the habitable structures on the property.

The preferred alternative for permanent shore protection at the subject property is a "hybrid" structure consisting of a sloping rock revetment that rises to a crest at +6 ft MSL, backed by a vertical seawall that rises to grade at +12 ft. The hybrid structure design is intended to limit wave reflection compared to a typical (non-hybrid) vertical seawall and provide a reduced footprint compared to a typical sloping rock revetment.

# FINAL ENVIRONMENTAL ASSESSMENT FOR PERMANENT SHORE PROTECTION OF THE HOLOLANI RESORT CONDOMINIUMS

## KAHANANUI, LAHAINA, MAUI

## July, 2013

ARTIST'S RENDITION OF COMPLETED PROJECT


***Prepared for:***
Association of Apartment Owners of
Hololani Resort Condominiums
4401 Lower Honoapiilani Road
Lahaina, Hawaii 96761

***Prepared by:***
Sea Engineering, Inc.
Makai Research Pier
Waimanalo, HI 96795


SEI Job No. 25291

***Accepting Authority:***
State of Hawaii Department of Land and Natural Resources, Land Division – Office of Conservation and Coastal Lands
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

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## PROJECT SUMMARY

| | |
|---|---|
| **Project:** | Hololani Shore Protection |
| **Owner:** | Association of Apartment Owners of the Hololani Resort Condominiums<br>4401 Lower Honoapiilani Road<br>Lahaina, Hawaii 96761 |
| **Consultant:** | Sea Engineering, Inc.<br>Makai Research Pier<br>41-305 Kalanianaole Highway<br>Waimanalo, HI 96744<br><br>Contact: James H. Barry, Phone (808) 259-7966 ext. 24<br>Email: jbarry@seaengineering.com |
| **Location:** | Kahana, Maui, Hawaii |
| **Tax Map Keys:** | (2) 4-3-010:009 |
| **State Land Use District:** | Urban |
| **County Zoning:** | H-2 (Hotel) |
| **FIRM:** | Zone AE (15 ft), Zone VE (15 &14 ft) |
| **Proposed Action:** | Construction of hybrid rock rubble mound revetment and seawall shore protection |
| **Required Permits:** | |
| **Federal**<br>Department of the Army | Rivers and Harbors Act, Section 10<br>Clean Water Act, Section 401 |
| **State of Hawaii**<br>Department of Land and Natural Resources | Conservation District Use Permit |
| **State of Hawaii**<br>Department of Health | Clean Water Act, Section 404 |
| **County of Maui**<br>Department of Planning / Planning Commission | 1. SMA (Special Management Area)<br>2. SSV (Shoreline Setback Variance) |
| **Actions Requiring Environmental Assessment:** | Work within the Shoreline Setback Zone, and within the State Conservation District |
| **Anticipated Determination:** | Finding of No Significant Impact (FONSI) |
| **Estimated Cost:** | $2.1M (construction) |

| | |
|---|---|
| **List of Preparers:**<br>1. Coastal Engineering Design and Primary Preparer: | Sea Engineering Inc. |
| 2. Structural Engineering: | Arnold Okubo & Associates |
| 3. Geotechnical Engineering: | Island Geotechnical Engineers, Inc. |
| 4. Biology and Water Quality: | Marine Research Consultants, Inc. |
| 5. Property Boundary History: | Valera, Inc. (Surveyors) |
| **Consulted Organizations/ Individuals** | <u>Federal</u><br>U.S. Army Corps of Engineers, Honolulu District<br><br><u>State</u><br>Department of Land and Natural Resources<br>- Office of Conservation and Coastal Lands<br>University of Hawaii SeaGrant<br><br><u>County of Maui</u><br>Department of Planning<br>Department of Public Works<br>Planning Commission<br><br><u>Others</u><br>Pohailani Condominiums<br>contact: Mr. Doug Jorg<br>Royal Kahana Condominium<br>contact: Mr. Patrick Kelley<br>Allana Buick & Bers, Inc.<br>contact: Mr. Joe Higgins |

# 1. INTRODUCTION AND SUMMARY

## 1.1 Executive Summary

Hololani Resort Condominiums, located along 400 feet of the Kahana Coast in West Maui, consists of twin 8-story buildings with 63 apartments. The shoreline is dominated by a tall erosion scarp within the native volcanic clay substrate[1]. The sand beach fronting the property is seasonally dynamic, with summer seasonal waves and Kona storms causing sand accretion, and winter seasonal waves eroding the beach. The shoreline is chronically eroding, with an average annual erosion rate of around 0.8 feet per year.

Since the lot was originally partitioned in 1959, it has eroded almost 40 feet, moving the active erosion scarp to within 15 feet of northern building's corner in 2007. Nearly 5,000 square feet of property has eroded between the two buildings and the shoreline. This has significantly reduced the buffer area between the inhabited structures and the shoreline that affords protection from potential damage due to large wave events.

The need to stabilize this coastline has been apparent for some time. Temporary shoreline stabilization structures were authorized by County and State agencies as far back as 1988. The most recent temporary structure, a combination of geotextile sand bags and rock mattresses, has not shown any apparent impacts on the seasonal behavior of the beach, though it has helped in slowing the ongoing, chronic erosion and has provided a more durable coastline for mitigating coastal natural hazards. However, the temporary measures are not an adequate long-term solution, as highlighted in the winter of 2010/2011 when wave damage to the temporary structure resulted in repairs costing nearly 1/3 of the total structure's value. In addition, failure of any individual sand bag has the ability and a history at this location, for destabilizing entire sections of the structure.

Three general options exist:

1. Continue to maintain the temporary structure;
2. Design and build a well engineered and appropriately sized permanent structure, or,
3. Remove the existing structures and allow on-going erosion to undermine and destabilize the inhabited buildings.

While beach nourishment is also a regional option, it cannot ensure the safety of the building or its inhabitants without additional protective measures, and is not feasible at this time because it

[1] Note: in this report the term "clay" is used to describe the predominant silt, silty sand, silty gravels as well as clay of the Pulehu clay loam that appears to form most of the substrate at the project site (see Section 4.1.14).

requires a suitable sand source, which is not currently available, and participation, approval and funding of all of the regional shoreline property owners, which is not presently forthcoming.

The preferred alternative proposed as a solution to protect the condominium buildings is a hybrid structure that consists of a sloping rock revetment that rises to a crest at +6 ft MSL[2], backed by a vertical seawall that rises to grade at +12 ft. The structure would protect 372 ft of the 400-ft shoreline. The north end would terminate at the County drainage easement, but, with concurrence and assistance from neighbors and the County, it could be constructed to extend across the easement. The south end would terminate before the property line, leaving space as a buffer to minimize end-effect related erosion.

The preferred option would protect the structure and the inhabitants with minimal influence on the seasonal beach dynamics along the coastline. As there is no inland sand mauka of the structure, but rather a clay bank, there will not be any impoundment of beach quality sand. In addition, replacing an eroding clay bank with an engineered revetment may reduce reflected wave energy and will eliminate the turbidity issues associated with bank erosion.
Environmental consequences of the preferred alternative include:

- Increased erosion forces at the south boundary (Royal Kahana Resort) due to end effects from the preferred alternative. Mitigative actions include design options that stop the new structure before the property line and minimize excavation near the property boundary. Temporary protection measures in place at the Royal Kahana are recommended to be continued and extended to at least 50 ft from the property line. The existing measures have been in place for approximately 5 years and have proven effective and environmentally benign.

- Loss of beach plan area ("placement loss") due to the footprint of the new structure. This loss will vary with seasonal sand accretion, but will mostly vary between 5 ft and 12.5 ft. Nevertheless, most of the structure will be within the footprint of the existing temporary shore protection.

- Significant negative effects on beach processes are not expected. The irregular and porous revetment slope of the preferred alternative should help reduce the reflection characteristics of the shoreline, especially when compared to the vertical and impermeable native clay shoreline escarpment, and assist with sand accretion. Temporary shore protection

[2] All elevations in this report are referenced to the Mean Sea Level (MSL) datum.

has been in place since 2007, and beach process have not been notably affected, with seasonal sand accretion occurring as before. Beach loss through passive erosion is not expected to be significant because the natural shoreline is a vertical clay embankment which is not conducive to beach formation. Planform effects are limited by an armored shoreline to the north and limited accommodation space for erosion to the south.

- The existing temporary protection has improved the water quality conditions at the Hololani and beyond. The new permanent structure will likewise improve water quality by preventing the erosion of turbidity-causing clay along the shoreline.

The project will also benefit the public by stabilizing a public drainage easement and protecting an important public highway, Lower Honoapiilani Road. A design option is presented that will permanently improve the drainage.

## 1.2 Project Location and General Description

The Hololani Resort Condominiums (the Hololani) consist of twin 8-story buildings with 63 apartment units, a 1-story commercial building, and minor structures that include a swimming pool and pool deck. The complex is located on the Kahana coast of West Maui, approximately 7 miles north of Lahaina (Figure 1-1). The project shoreline is approximately 400 feet in length and is at the north end of an 1,800-ft reach of sand beach that fronts six condominium resort properties (see Figure 3-1). The Pohailani Condominiums north of and adjacent to the Hololani are fronted by a grouted stone seawall. A Maui County drainage easement and storm drain separate the Hololani and Pohailani properties. The storm drain and surroundings are in an extreme state of disrepair (see Section 2.5.1). Shoreline hardening extends north from the storm drain for at least 600 feet across three properties. The adjacent property to the south is the Royal Kahana Resort.

The Hololani has a long history of shoreline erosion problems. Currently, the erosion has been arrested by placement of temporary protection, but the erosional escarpment is within 15 ft of the north building. An aerial photographic analysis completed by SEI in 2001 showed 14 ft of erosion and 28 ft of erosion of the vegetation line at the center and northern parts of the property, respectively, between 1949 and 1997, with an average erosion rate of about 0.8 ft per year (see Section 4.1.12). The erosion analysis of the University of Hawaii Coastal Geology Group (UHCGG) also found a long term erosion rate of about 0.8 feet per year, which was typical for that region (Fletcher *et al*, 2003). They also show a 22% reduction in beach width.

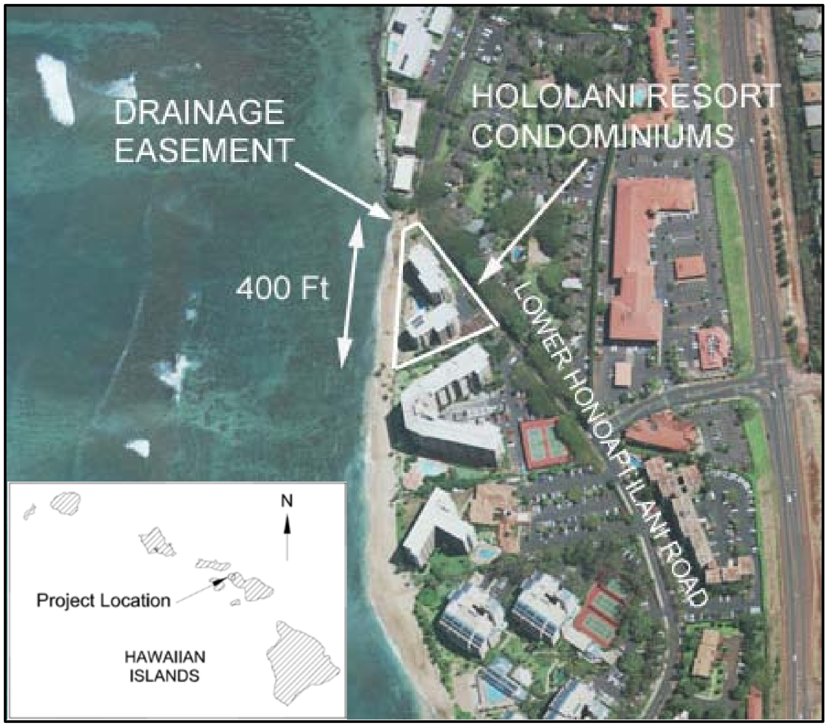


**Figure 1-1. Project site location**

The Hololani property was originally part of the Bechert Estate. The estate was partitioned in 1959 into five lots, with Lot 1 then sub-divided into Lots 1-A, 1-B, and 1-C, with the Hololani property being Lot 1-A (see Appendix C, Valera, Inc. 2011). Assuming the original subdivision boundary was close to what would now be considered a legal definition of the shoreline (a reasonable assumption based on the 1949 aerial photograph), shoreline surveys show that the property eroded approximately 25 ft between the time of the partitioning and Certified Shoreline documentation in 1972. The present shoreline is approximately 17 ft mauka from the 1972 shoreline. Although there have been intermittent periods of accretion – notably in 1961 and 1987, it appears that the shoreline has receded close to 40 ft since the partitioning in 1959.

The west-facing shoreline is subject to waves from the south, west, and north, with seasonal and short term effects on the sand beach. Very generally, waves from the south during the summer season tend to push sand north so that a beach is created in front of the Hololani. Winter waves and strong trade wind waves from the north tend to transport the sand south and denude the beach. However, large volumes of sand accretion have occurred due to Kona storm waves during the winter season – these waves are generally from the southwest.

While the seasonal changes are pronounced, there appears to have been a net loss of sand from the overall system, so that the protective sand beach has been lost with increasing frequency, leaving the red clay shoreline embankment increasingly exposed.

Long-time Hololani residents identify the construction of the drainline in the easement at the north end of the property as a factor contributing to the onset of serious coastal erosion at the north end of the property. However, the history of the easement area is complicated (see Appendix C, Shoreline Survey History, and Appendix E, Comments from the County of Maui Department of Public Works), and a cause and effect relationship is difficult to establish. There are likely multiple factors underlying erosion at the site, including an over-all loss of sand resources. Efforts to combat the erosion have been on-going since construction of a sand bag wall in 1988. Typical fabric sand bags are a time-honored method of erosion control, but they quickly degrade in the tropical sun and will not stand up to forces caused by waves of any appreciable size. The sand bag efforts that occurred in 1988 and later years were somewhat effective in slowing the erosion, but the trend continued. During the winter of 2006-2007, the erosion problem became dire, with large sections of the shoreline calving in to the sea. Figures 1-2 and 1-3 are photographs taken in January of 2007 that show the extreme erosion that was taking place at the time. The erosion posed a significant threat to the Hololani buildings and caused significant turbidity in nearshore waters. The boulders in the photograph are the remnants of non-engineered shore protection that was only temporarily effective. The boulders became a safety hazard and were removed soon after.

The erosion in 2007 progressed to the point where the buildings and possibly the underground parking structure were threatened. At its closest approach, the erosion scarp was only 15 feet from the north building (Figure 1-3). A site visit by staff of the State Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL) on January 11, 2007 determined that the north building was at risk without immediate shore protection. Sea Engineering, Inc. (SEI), designed a temporary geotextile sand bag and rock mattress structure that met requirements set by the DLNR-OCCL for an emergency protection structure. The structure was constructed in November and December 2007 under an authorization for an emergency request (DLNR File No. Emergency-OA-07-08). The temporary structure was also authorized under Special Management Area emergency provisions (SM3) by the Maui County Planning Department. The understanding contained in the DLNR-OCCL authorization was that the structure was intended to be temporary until the required permits were obtained for a permanent solution that was likely to be a rock revetment. The County SM3 authorization (SM3 2007/0001) recommended a rock revetment for the permanent solution.
Figure 1-4 is a view of the temporary structure soon after completion. Materials and construction costs were in excess of $400,000.

SEI has monitored the shoreline conditions at the Hololani since emplacement of the temporary structure in December, 2007. The following trends have been observed:

- Sand accretion occurs when winds and waves have a southerly component, such as during southern swell or Kona storm conditions;
- Accretion of sand does not appear to have been inhibited by the presence of the temporary shore protection;
- Erosion is pronounced when incident waves have a strong northerly or northeasterly component.

The 2009-2010 winter wave season was one of the more energetic on record, and the presence of the temporary structure certainly prevented continued shoreline erosion and saved the Hololani from potential structural damage. Although a robust structure, the temporary emergency revetment has suffered damage. The 2010-2011 winter wave season was particularly damaging, and repairs to the temporary structures totaled $140,000. Some of the damage is shown in Figure 1-5.

The ability of temporary shore protection structures to withstand severe conditions is limited by the size and types of materials used to construct them – for example, by the size of the geotextile sand bags used at the Hololani. The design lifetime is difficult to predict as the structures do not have accepted engineering design guidelines, and unexpected occurrences – such as damage from wear of the geotextile material that causes some of the bags to lose their sand fill and deflate – can have major debilitating effects on the structure. The open coast wave climate of West Maui can produce prolonged high wave conditions that will eventually destroy any under-engineered coastal structure. It is clear that an engineered shore protection structure is necessary for the survival of the Hololani buildings and the safety of the inhabitants.

In April of 2010, Sea Engineering was contracted by the Hololani Association of Apartment Owners (AOAO) to design permanent shore protection to replace the existing geotextile sand bags. A Basis of Design Report was submitted to the Hololani with the design for two suitable design alternatives - a rock rubble mound revetment and a hybrid seawall/revetment.

The hybrid seawall/revetment structure was chosen as the preferred design alternative. It has numerous advantages, including:

1. A reduced design footprint that can be placed within the original (1972) property limits for the Hololani;

2. Preservation of lateral shoreline access for able-bodied persons along the lowered height of the revetment crest portion of the structure;

3. A potential reduction of reflected wave energy when compared to the native clay embankment, the existing temporary emergency structure, and a seawall alternative, and a resulting improvement in the sand accretion process.

Permanent engineered shore protection will allow the Hololani to prevent future erosion damage and avoid the recurring efforts at expensive, messy and often ineffective temporary emergency protection measures.

Lower Honoapiilani Road, a vital component of the West Maui transportation infrastructure, closely approaches the coast at the north end of the Hololani. The property is a buffer between the road and the sea, and protection of the Hololani also serves to protect the road. The drainage easement between the Hololani and Pohailani properties is in an extreme state of disrepair due to the lack of protection from years of coastal erosion, and the drain line sometimes functions poorly, allowing water to pool on the roadway (note: improvements were made in late Summer, 2012 to open the drain line). Although the proposed structure ends at the drainage easement, a design alternative is presented in Section 2.4.1that will protect the easement area and portions of the Pohailani property, and require improvements to the drain line (Figure 2-8). This alternative requires cooperation and assistance from the Pohailani and Maui County Department of Public Works. However, even if the structure terminates at the drainage easement, it will be designed to facilitate future improvements to the easement area.

**Figure 1-2. Severe erosion, January 2007**

**Figure 1-3. Erosion conditions threatening the north building in January 2007**

**Figure 1-4. Freshly installed temporary shore protection, January 2008**

**Figure 1-5. Extensive damage caused by high waves, January 2011**

### 1.3 Project Purpose and Objectives

The purpose of the project is to provide the Hololani with permanent shore protection that will protect the condominium buildings from wave damage and alleviate the necessity of implementing non-engineered emergency measures. The selected design alternatives should have the following characteristics:

- The design will protect the valuable shorefront property without causing degradation to the sand beach;
- The structure will be unobtrusive when the beach is healthy (i.e. beach sand volume is high);
- The protection will withstand an extreme storm event without failure or damage.

### 1.4 Summary Description of the Project

The proposed action is a hybrid shore protection structure that combines a vertical seawall with a sloping rock rubble mound revetment. The proposed layout of the structure is shown in Figure 1-6, and the design cross-section is shown in Figure 1-7. The structure will protect approximately 370 feet of the approximately 400 feet of shoreline that fronts the Hololani. The remainder will be left as a buffer to minimize end-effect related erosion of the neighboring property to the south. The north end of the structure will stop and return at the edge of the drainage easement, although an alternative is presented in Section 2.4.1 that will improve the easement area as well. The hybrid structure has the following benefits:

1. The structure footprint has been minimized in order to fit within the original (1972) property boundary and have the least excursion into the Conservation District and navigable waters of the United States;

2. The rock rubble mound revetment that forms the seaward projection of the structure will minimize wave reflection and help to allow for seasonal sand accretion;

3. The crest of the rock rubble mound revetment is 5 ft in width, and will provide lateral shoreline access for able-bodied persons when seasonal conditions prevent the formation of a sand beach.

4. The structure offers long-term erosion protection for the Hololani property.

5. Preventing erosion of the native clay embankment will help prevent the formation of turbidity in nearshore waters during high wave conditions.

The top of the toe of the rock revetment will be at an elevation of -0.5 ft MSL, and the crest of the revetment will be at an elevation of +6 ft. The rock revetment has been designed for a 50-year wave event.

The wall will be constructed of vinyl sheet pile, with a concrete cap at an elevation of approximately +12 ft, and driven to a depth of -10 ft or rock refusal. The sheet pile wall will have a line of soil anchors spaced at 5-ft centers for reinforcement. The vinyl product will not corrode, is resistant to degradation from ultra-violet sunlight, and is typically guaranteed for 50 years. The product is new to Hawaii, but has been used on mainland projects for over 20 years with good results.

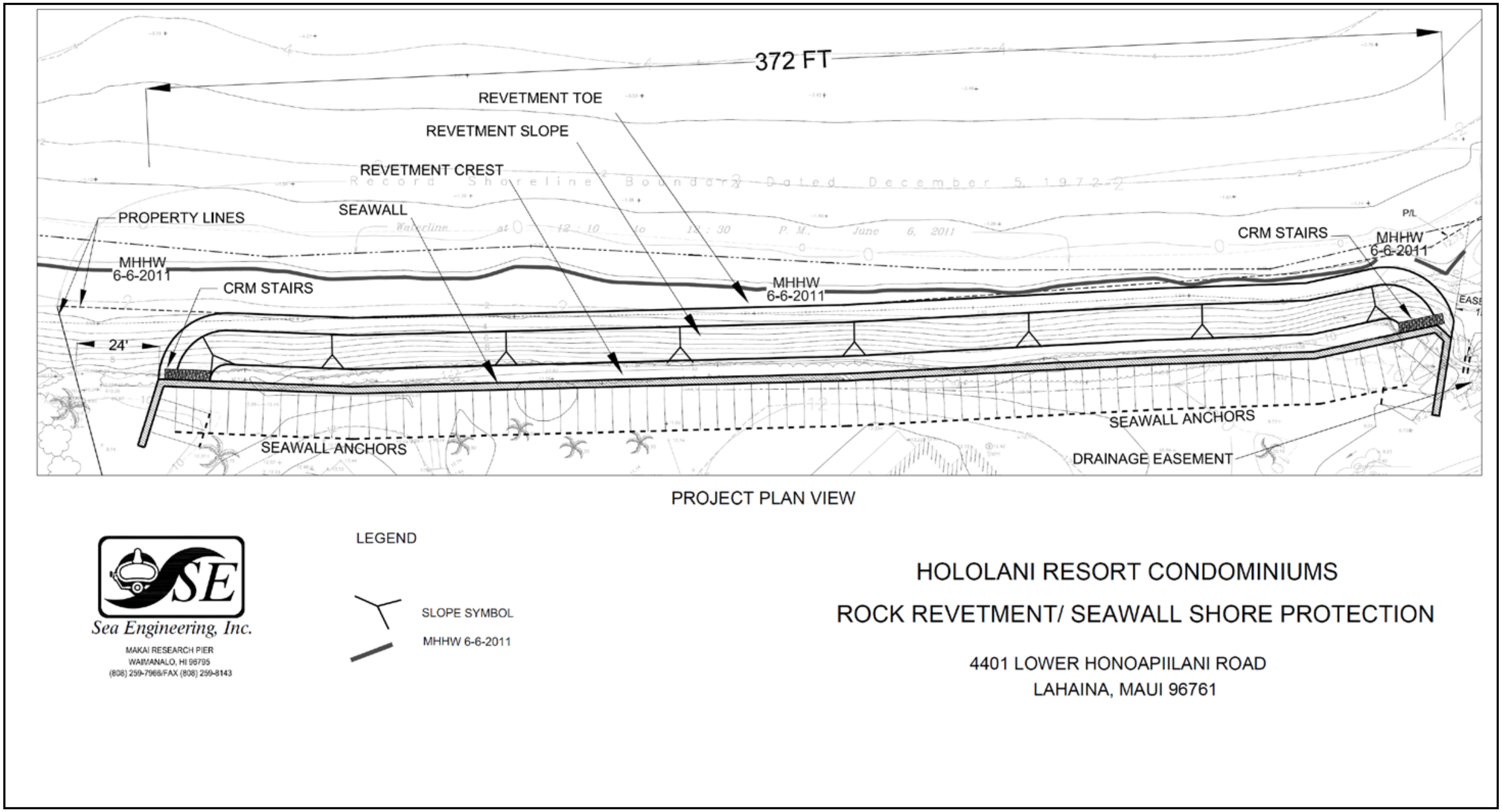


**Figure 1-6(a). Layout of proposed hybrid revetment and seawall**

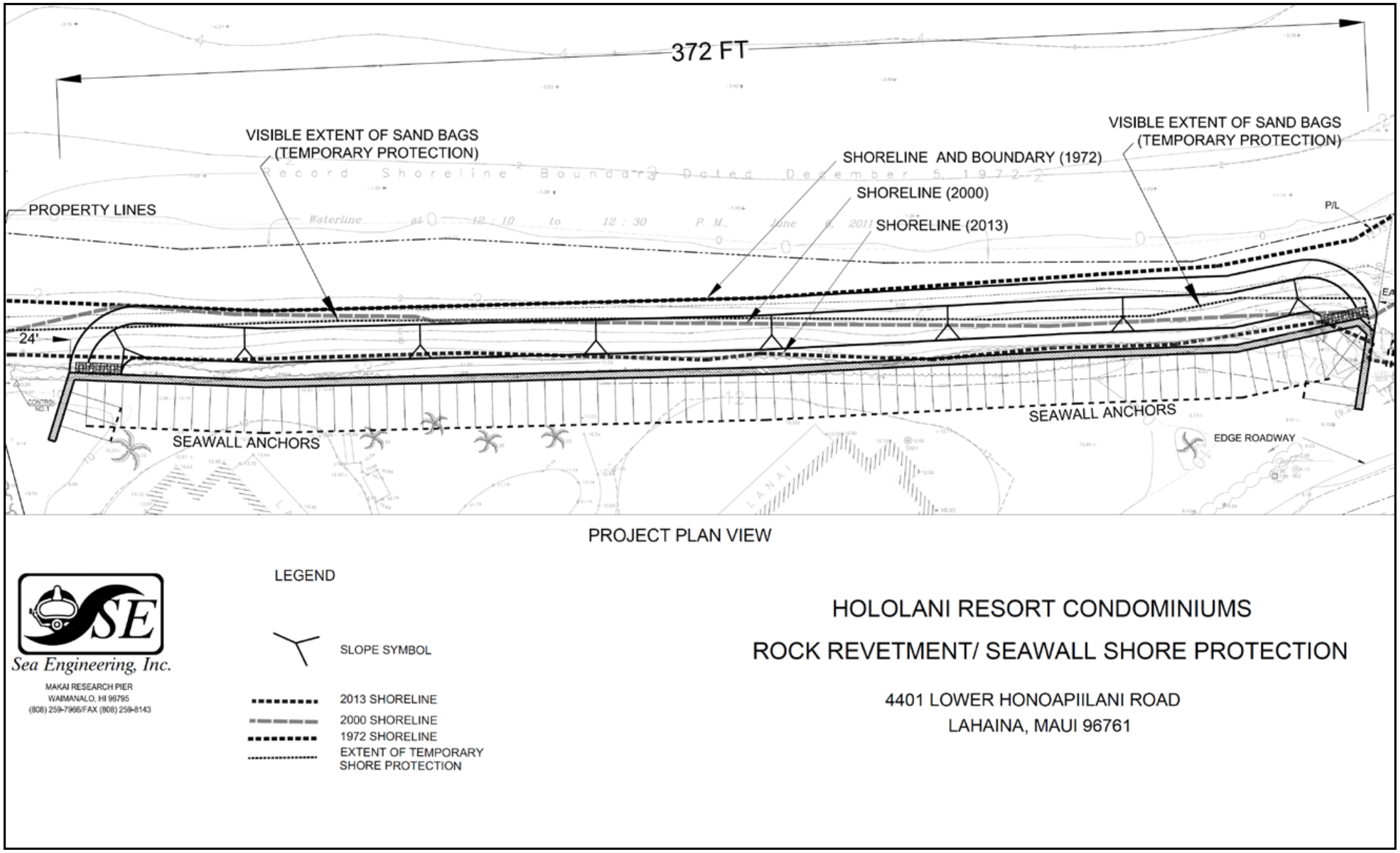


**Figure 1-6 (b) Layout of proposed hybrid revetment and seawall with existing (2013) and previous shorelines**

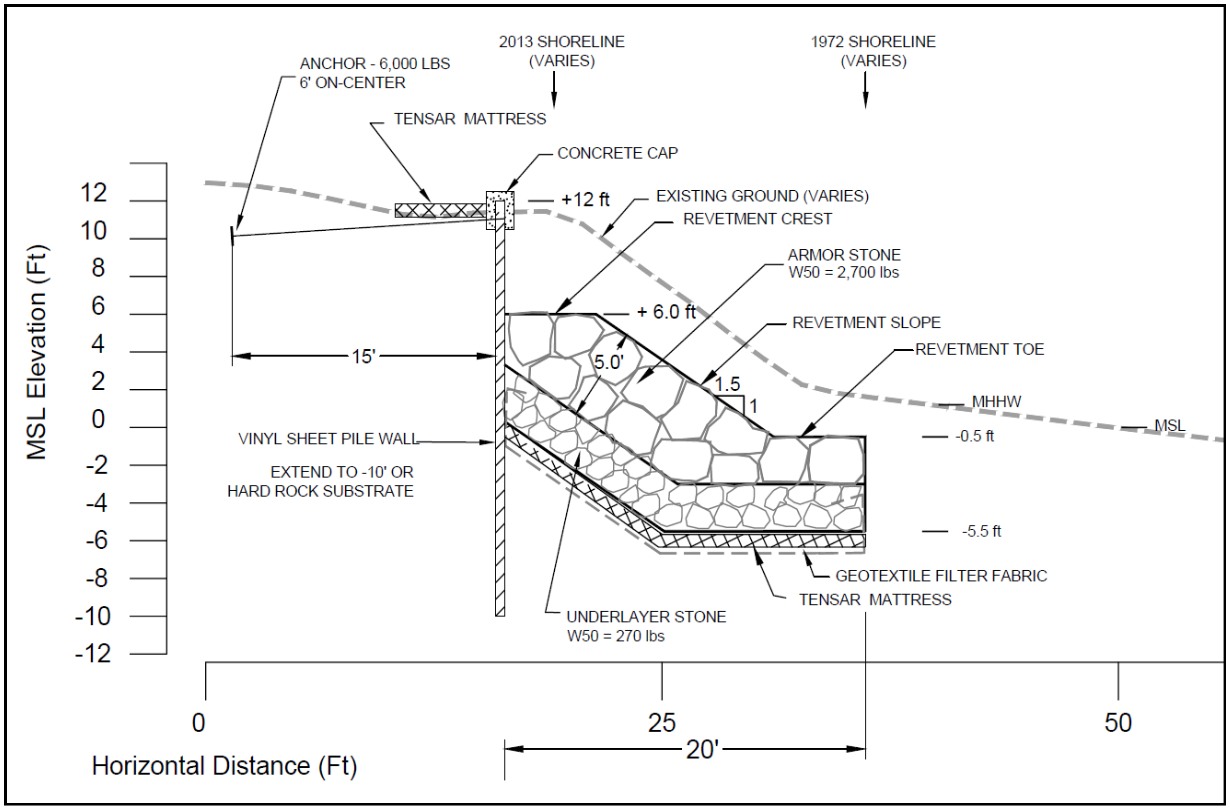


**Figure 1-7. Cross-section of the proposed shore protection structure**

## 1.5 Relationship to Governmental Plans, Policies and Control

### 1.5.1 Summary of Government Permits Required

Potential government permit requirements for a beach improvement project include the following:

**Federal**

- Section 10, Work in Navigable Waters of the U.S. (U.S. Army Corps of Engineers)
- Section 404, Clean Water Act, for Fill in Waters of the U.S. (U.S. Army Corps of Engineers)

**State of Hawaii**

- Conservation District Use Permit (DLNR-OCCL)
- Coastal Zone Management Consistency Review (DBEDT, Department of Planning, CZM Program)

- Clean Water Act, Section 401 Water Quality Certification (DOH-CWB)

**County of Maui**

- Special Management Area (SMA-Major)
- Shoreline Setback Variance (SSV)

### 1.5.2 Environmental Assessment and Accepting Agency

Three of the required permits, the State CDUP, and County SMA and SSV, require the environmental review process that is detailed in Chapter 343 of the Hawaii Revised Statutes. The process requires the submission of an Environmental Assessment (EA) to be reviewed by interested parties and decision makers to ensure that environmental concerns are given appropriate consideration.

Upon inquiry to both DLNR-OCCL and the County of Maui Planning Department, it was agreed that DLNR-OCCL should be the accepting agency for the EA (see Appendix A).

#### *1.5.2.1 Environmental Assessment Significance Criteria*

Chapter 343, Hawaii Revised Statutes (HRS), and Hawaii Administrative Rules (HAR) §11-200, establish certain categories of action that require the agency processing an applicant's request for approval to prepare an environmental assessment. HAR §11-200-11.2 established procedures for determining if an environmental assessment (EA) is sufficient or if an environmental impact statement (EIS) should be prepared for actions that may have a significant effect on the environment. HAR §11-200-12 lists the following criteria to be used in making such a determination. Based on the analysis presented in the DEA and this document, a Finding of No Significant Impact (FONSI) is anticipated, and an EIS would therefore not be required for the proposed action.

*1. Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.*

The native shoreline consists of a vertical clay escarpment that is subject to erosion. It is a highly reflective, naturally hardened shoreline that is difficult to access during low sand conditions. The preferred alternative will result in a shoreline that is effectively similar to the native shoreline but will likely be less reflective, provide improved lateral access, and will eliminate turbidity associated with erosion of the native material. The project will not in itself cause the destruction of any natural resource and no significant cultural resources have been identified at the project site. Some loss of useable shorefront area may take place due to the footprint of the proposed structure (known as "placement loss"). This will likely vary between 5 and 12.5 ft, depending on seasonal sand accretion. However, the structure will be mostly contained within the footprint of the existing temporary structure, and will be placed landward of the original (1972) property line.

*2. Curtails the range of beneficial uses of the environment.*

The proposed project will allow removal of existing temporary structures and improve the appearance, accessibility, and physical features of the shoreline. No adverse significant long term impacts to the environment are anticipated to result from this project. There may be temporary short-term impacts during construction; however these are not anticipated to be significant, and will be mitigated to the maximum extent practicable by use of the Best Management Plans (BMP) and monitoring procedures.

*3. Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.*

The proposed project provides for the safety of 63 housing units, has a minimal footprint in the shoreline area, and has the least environmental impact of all alternatives presented. Failure to protect the Hololani would result in a potentially catastrophic condition, causing severe encroachment on the eroding shoreline due to undermined and threatened condominium buildings.

*4. Substantially affects the economic or social welfare of the community or State.*

The project will facilitate protection of a portion a public roadway as well as repair of a community drainage outlet. The Hololani offers substantial revenue to the County of Maui and the State of Hawaii through taxes and tourism. Failure to properly protect the Hololani buildings will likely result in as-yet unknown costs to the public.

*5. Substantially affects public health.*

The proposed project will have some temporary, minor impact on air, noise and water quality during construction, however these will be mitigated to the maximum extent practicable by BMPs and monitoring procedures. The project will not result in any post-construction or long-term effects on public health. The project will facilitate repair of a community drainage outlet.

*6. Involves substantial secondary impacts, such as population changes or effects on public facilities.*

The project will not alter the existing land use pattern.

*7. Involves a substantial degradation of environmental quality.*

Other than temporary, short-term environmental impacts during construction, which are generally not considered significant, the proposed project would not result in impacts which can be expected to degrade the environmental quality in the project area. In fact, the opposite would be true - the project will help prevent nearshore turbidity due to erosion of the red clay shoreline embankment.

*8. Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.*

The proposed project will protect the Hololani shoreline. Effects on adjacent properties are expected to be minor and can be addressed by limited temporary protection similar to that already in place. A larger action – regional beach nourishment – is recommended for general protection and enhancement of Kahana Beach. Although the proposed project is compatible with regional beach nourishment, it does not involve a commitment to the larger action.

*9. Substantially affects a rare, threatened, or endangered species, or its habitat.*

Green sea turtles have been seen foraging in the nearshore waters off the Hololani. Hawaiian monk seals are not common in the area. Turtle protection procedures as recommended by the NOAA, National Marine Fisheries Service, will be in place during construction.

*10. Detrimentally affects air or water quality or ambient noise levels.*

There will be some temporary, short-term impacts to air and water quality, and noise levels, during construction. However, these impacts will be limited to the construction period and will not be significant. BMP's, water turbidity controls, and a water quality monitoring program will be in effect to help minimize the construction impacts. The contractor will be required to submit a Best Management/ Environmental Protection Plan for approval prior to the start of construction, which will include provisions for reducing air, water, and noise impacts. Once construction is complete there will be no activity or mechanism for further air, water or noise impacts.

*11. Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.*

The proposed project will not change the shoreline elevation, and will not change the existing tsunami flood hazard. It is engineered for a 50-year wave event. The proposed project will result in a shoreline that is effectively similar to the native shoreline but will likely be less reflective, provide improved lateral access, and will eliminate turbidity associated with erosion of the native material. The proposed project will allow removal of existing temporary structures and improve the appearance and physical features of the shoreline. The proposed project has a minimal footprint in the shoreline area, and has the least environmental impact of all alternatives presented.

*12. Substantially affects scenic vista and view planes identified in county or state plans or studies.*

The proposed project has a minimal footprint in the shoreline area, and will be minimally visible from the roadway. The project footprint does not extend perpendicular from the shoreline.

*13. Requires substantial energy consumption.*

Other than energy expended during construction operations, the project would require no additional energy consumption.

### 1.5.3 Federal Permits Required

A request for jurisdictional determination was made to the Regulatory Branch of the U.S. Department of the Army, Corps of Engineers, Honolulu District (USACE). A June 6, 2011 topographic survey by the project surveyors, Valera, Inc., showed that the project extents were behind the Mean Higher High Water Mark (MHHWM) demarcated at 1.2 ft MSL. The USACE agreed that under the circumstances shown, the Department of the Army (DA) permits were not required but might be advisable for ease of construction. The correspondence is part of Appendix A.

It is known that the beach profiles are subject to seasonal change and the MHHWM may be further inland when the project undergoes construction. There may be significant excavation and shoring for the construction process that requires incursion seaward of the MHHWM (see Section 2.5). Also, if beach sand is excavated, it will likely be placed on the makai side of the shored excavation to ensure that all beach sand is conserved. In this location it would be considered fill in waters of the U.S.

Obtaining the DA permits is recommended to ensure that construction of the project structures can be done in the best possible manner without imposition of undue constraints on the contractor or delays to the project.

Assuming that some work will be done seaward of the high tide line, and that fill (i.e. sand, sand bags or other shoring) will be placed seaward of the MHHW line (elevation 1.2 ft from MSL), two permits are required from the U.S. Army Corps of Engineers:

1. Section 10 of the Rivers and Harbors Act of 1889, which pertains to work in Navigable Waters of the United States.
2. Section 404 of the Clean Water Act, which pertains to placing fill into waters of the U.S.

The Federal Section 404 permit in turn triggers the Section 401 of the Clean Water Act permit which calls for compliance with State water quality standards. This permit is administered by the State Department of Health, Clean Water Branch (DOH-CWB). The Federal permits also require that the project be consistent with the policy objectives of the State Coastal Zone Management (CZM) program.

Notifications of the USACE permit applications are sent out to interested parties, and a 30-day comment period ensues. Other federal laws that may affect the project include:

- Endangered Species Act
- Magnuson-Stevens Fisheries Conservation and Management Act
- National Historic Preservation Act.

### 1.5.4 Property Boundaries and Shoreline Certification (State/County Jurisdictional Determination)

The following property history has been researched by Valera, Inc., and is included in a letter report contained in Appendix C (Valera, Inc. 2011). The Hololani property was originally part of the Bechert Estate. The estate was partitioned in 1959 into five lots, with Lot 1 then sub-divided into Lots 1-A, 1-B, and 1-C, with the Hololani property being Lot 1-A. A certified shoreline was established on December 5, 1972. The property was conveyed to Lokelani Construction Co. in December 1972, and the certified shoreline was adopted as the seaward boundary of the property. In 1980, approval was given for a certified shoreline over a portion of the Hololani Property – approximately 90 ft at the northern end - as well as portions of the adjacent Pohailani property. The survey showed 5 to 10 ft of shoreline erosion for about 30 ft at the northern edge (along the drainage easement), and a similar amount of accretion for the next 60 ft south. The survey map also shows a 3-ft wide concrete swale and headwall in the easement area. These features no longer exist. The County of Maui Department of Public Works commented on the history of the easement area (see Appendix E), noting that the drainage easement is shown in favor of the County of Maui in a 1972 shoreline map. In mid-1975, the road fronting the easement and condominiums, then known as Honoapiilani Highway, was transferred from State to County ownership and re-named Lower Honoapiilani Road.

In addition,

- A 1990 shoreline certification application was approved for shoreline protection purposes. A total of 2,729 sq ft was shown as eroded since 1972.

- A 1995 application was disapproved due to lack of documentation of the presence of sand bags, concrete sidewalk, and stairs from the swimming pool to the ocean. The application indicated 1,888 sq ft of erosion.

- A 2001 shoreline certification application was approved for shoreline protection purposes. A total of 3,321 sq ft was eroded.

- Two applications submitted in April and June of 2007 for shoreline protection purposes were disapproved. The applications showed 5,519 sq ft and 4,412 sq ft of erosion respectively. Reasons given for disapproval are 1) because of sand bags placed makai of the seaward property line (April), and 2) a lack of documentation for a concrete walkway and boulder shore protection existing at the time (June).

*1.5.4.1 Shoreline Certification for the Proposed Project*

A Shoreline Certification survey was originally conducted in November 2011. A letter response from the State Surveyor's office dated March 6, 2012 stated that recent changes in interpretation of the law had resulted in modification of the rules pertaining to ownership of lands makai of the Certified Shoreline, regardless of existing property line designations. As a result, the permitted temporary shore protection structure was initially regarded as an encroachment. The Hololani AOAO was not certain how to proceed under the new circumstances.

A new shoreline survey was conducted in October, 2012, submitted by the project surveyor, Valera, Inc., and approved in January 2013, The Certified Shoreline location is shown in Figure 1-6(b).

### 1.5.5 State of Hawaii Permits Necessary for the Proposed Project

State permits consist of the Conservation District Use Permit (CDUP), the Clean Water Act Section 401 Water Quality Certification (WQC), and the Coastal Zone Management (CZM) consistency determination.

The CDUP is required for all projects that are located in the State Conservation District. For shoreline projects, the Conservation District includes all lands seaward of the Certified Shoreline

("Submerged Lands"). The permit is administered through the State Department of Land and Natural Resources, Land Division (DLNR). County SMA permits must be in place prior to issuance of a CDUP.

The 401 Water Quality Certification is administered by the State Department of Health, Clean Water Branch (DOH-CWB). The permit requires submission of an *Applicable Monitoring and Assessment Program* (AMAP) with the permit application. The AMAP details the program that will be used during construction to monitor construction Best Management Practice (BMP) activities and conduct water quality testing to ensure compliance with State regulations.
The CZM consistency review ensures that the project is consistent with State coastal policies as much as possible. The CZM program is administered by the State Department of Business, Economic Development, and Tourism (DBEDT), Office of Planning.

*1.5.5.1 Relationship of the Project to the State Conservation District Rules*

The Board of Land and Natural Resources (BLNR) regulates uses of the State Conservation District by issuing Conservation District Use Permits for approved activities.

Much of the proposed project will be built on Conservation District land under the jurisdiction of the DLNR-OCCL. Statutes governing use and administration procedures of the Conservation District are written in Hawaii Revised Statutes, Chapter 183C (HRS183C Conservation District). Administration is further clarified by the Hawaii Administrative Rules, Title 13, Chapter 5 (HAR §13-5 Conservation District). The project area in the Conservation District is classified as a Resource Sub-Zone. The identified land use for the project is *Shoreline Erosion Control* (§13-5-22) and will require a "D-1" (Board) Conservation District Use permit. The use requirements are that:

> *…the applicant shows that (1) the applicant would be deprived of all reasonable use of the land or building without the permit; (2) the use would not adversely affect beach processes or lateral access along the shoreline, without adequately compensating the State for its loss; or (3) public facilities critical to public health, safety, and welfare would be severely damaged or destroyed without a shoreline erosion control structure, and there are no reasonable alternatives...*

Documentation of the severity and at-risk nature of the shoreline erosion conditions at the Hololani are found throughout this document. The hardship criterion, including the loss of all reasonable use (1) and the purpose and need for the project are detailed in Section 2.1. The project area is dominated by longshore sand transport processes that have consistently allowed sand accretion in front of temporary shore protection during favorable seasonal conditions. The project is not likely to have significant adverse effects on beach processes, as it will be replacing the natural eroding clay embankment and the temporary shore protection with a structure that is likely to be less reflective. The design elements that address lateral access along the shoreline are shown in Section 2.3, and additional shoreline access is discussed in Appendix E. Criterion (3) is also met for this project due to the proximity of Lower Honoapiilani Road, a vital coastal thoroughfare that is potentially threatenedif the erosion at the Hololani is not stopped, and the public drainage outlet on the north end of the property that is at times almost non-functional due to deterioration of the drainage easement area from coastal erosion. The general public will also benefit from enhanced water quality at the site due to the reduced erosion of turbidity-causing clay.

Under HRS 205A (Coastal Zone Management), structures in the shoreline area are prohibited without a variance (§205A-44 (b)). Section §205A-46 (Variances), (9), determines that a variance may be granted for:

> *Private facilities or improvements that may artificially fix the shoreline; provided that the authority also finds that shoreline erosion is likely to cause hardship to the applicant if the facilities or improvements are not allowed within the shoreline area, and the authority imposes conditions to prohibit any structure seaward of the existing shoreline unless it is clearly in the public interest;*

The conditions imposed by HAR §13-5 for a CDUP, are discussed above. Conditions for County of Maui SSV and SMA permits are discussed in Section 1.4.6.

Pursuant to the CDUP and the preferred alternative that places the structure partially seaward of the existing shoreline, the project is in the public interest for the following reasons:

- The eventual damage and loss of use of the Hololani buildings is a certainty in the absence of engineered shore protection. In that event, the 400-ft of coastline fronting the Hololani would almost certainly be closed to the public due to safety concerns.

- The existing temporary protection is near the end of its useful life. It is unsightly to the point of being a nuisance. Replacing the temporary protection with permanent engineered shore protection will improve the appearance and functionality of the shoreline.

- The project will protect a vulnerable portion of a public highway, Lower Honoapiilani Road.

- The project will facilitate much-needed improvements to the drain line at the north end of the Hololani property.

- The project will improve regional water quality conditions by preventing erosion of the existing red clay shoreline escarpment.

- The preferred alternative is the alternative that has the least environmental effects, including the minimization of impacts to neighboring properties and adverse effects on the entire beach or littoral cell.

All conservation district projects must meet the following criteria as outlined in HAR §13-5-30:

1. **The proposed land use is consistent with the purpose of the conservation district;**

*Discussion:* The purpose of the Conservation District is to conserve, protect, and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public's health, safety, and welfare (HAR §13-5-1). As shown in this EA, the proposed project will prevent the deterioration of the shoreline that would occur without the project. It is important to note that the native shoreline condition is a steep, hard clay escarpment that is highly reflective to incident waves – a naturally hardened shoreline. Construction of a potentially less reflective rock rubble mound revetment will help reduce wave reflection and may assist the sand accretion characteristics of the shoreline, thus promoting beach recovery when seasonal conditions are favorable. The project will likely not have a negative impact on the native beach, but may actually help beach stabilization.

In addition, it should be noted that the temporary shore protection that is in place has improved the water quality in the area by preventing the erosion of the red clay substrate and suspension of the resulting fine particulates in the water column. Damage inflicted on the temporary protection since December 2007 is indicative of the severe shoreline erosion that would have occurred if the protection were not in place. Looking forward, there is no doubt that serious erosion and property damage will occur if the proposed project is not implemented. A dangerous shoreline escarpment would migrate mauka, and eventually both buildings would be structurally threatened and would probably need to be abandoned and condemned. All of these things would entail serious and negative impacts on the shoreline and cause loss of use. A portion of Lower Honoapiilani Road is already threatened by coastal erosion near the drainage easement, and this condition will become worse if the shoreline erosion is allowed to continue.

2. **The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;**

*Discussion:* The proposed project is in the Resource Subzone of the Conservation District, and consists of land use activities consistent with uses *P-15 Shoreline Erosion Control* (HAR §13-5-22). As specified in HAR §13-5-24(a), these uses are permitted in this Subzone with the acquisition of a Land Board-approved Conservation District Use Permit. The applicant is seeking this permit coverage for the project.

3. **The proposed land use complies with provisions and guidelines contained in chapter 205A, HRS, entitled "Coastal Zone Management," where applicable;**

*Discussion:* The Hawaii Coastal Zone Management Program Consistency Review confirms the consistency of the project with the Coastal Zone Management Act and the objectives outlined in Chapter 205A, HRS (see Section 1.5.5.3).

4. **The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region;**

*Discussion:* No significant adverse impacts due to the proposed project have been identified. Some erosion effects on the adjoining property to the south are expected, but a mitigation plan is part of the project. The preferred alternative is the alternative that has the least environmental effects. Construction of a rock rubble mound revetment may reduce wave reflection and thereby assist the sand accretion characteristics of the shoreline.

The proposed project will have beneficial environmental effects by preventing shoreline erosion of turbidity-causing red clay, and thereby maintain or improve water quality in the vicinity. The proposed project will also help protect vital infrastructure – a public drain line and coastal roadway.

5. **The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels;**

*Discussion:* The proposed project will replace existing temporary shore protection with a permanent engineered structure similar in size and appropriate for the existing wave environment. It is designed to protect both of the major buildings on the property.

6. **The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable;**

*Discussion:* The proposed structure is engineered to be long-lasting and visually neutral. It will allow the natural beauty of the shoreline to be preserved, and will remove unattractive temporary shore protection items that are close to, or have exceeded, their design life.

7. **Subdivision of land will not be utilized to increase the intensity of land uses in the conservation district;**

*Discussion:* No property subdivision is needed for the proposed project.

8. **The proposed land use will not be materially detrimental to the public health, safety and welfare.**

*Discussion:* The proposed project will help preserve infrastructure vital to public health, safety and welfare by protecting Lower Honoapiilani Road and facilitating potential drainage improvements. Detrimental impacts to public health, safety and welfare have not been identified.

### *1.5.5.2 Relationship of the Project to the State Department of Health - Clean Water Branch*

The Clean Water Act (CWA) is the key legislation governing surface water quality protection in the United States. Sections 401, 402, and 404 of the Act require permits for actions that involve wastewater discharges or discharge of dredged or fill material into waters of the United States. In Hawaii, the U.S. Environmental Protection Agency has delegated responsibility for implementing the Act to the State. The Section 401 Water Quality Certification permit application was submitted to the State Department of Health on November 30, 2012.

While the proposed structure will be built landward of the MHHW line as surveyed on June 6, 2011, the location of that line is subject to change with accretion or erosion of the beach sand substrate. Actions that may constitute fill into waters of the United States include:

- Placement of revetment materials (geotextile, Tensar mattresses, underlayer stone, or armor stone) if the MHHW line moves landward from the June 6, 2011 location.
- Excavation of beach sand during construction and placement of sand on the shoreline below the MHHW line. Actual construction methodology will be determined by the contractor.
- Temporary placement of geotextile sand bags or other materials seaward of the excavation for purposes of shoring or protection from wave action.

The Water Quality Certification will require submission to the DOH of an Applicable Monitoring and Assessment Plan (AMAP) which will detail the water quality sampling and testing necessary during construction, and outline the Best Management Practices (BMP's) that will be used to prevent contamination of coastal waters.

*1.5.5.3 Relationship of the Project to the Coastal Zone Management Program*

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. The CZM area encompasses the entire state, including all marine waters seaward to the extent of the state's police power and management authority, as well as the 12-mile U.S. territorial sea and all archipelagic waters.

Under Section §205A-44 **(**Prohibitions), (b), structures in the shoreline area are prohibited without a variance. Under Section §205A-46 (Variances), (9), a variance may be granted for:

> *Private facilities or improvements that may artificially fix the shoreline; provided that the authority also finds that shoreline erosion is likely to cause hardship to the applicant if the facilities or improvements are not allowed within the shoreline area, and the authority imposes conditions to prohibit any structure seaward of the existing shoreline unless it is clearly in the public interest;*

The hardship requirement is defined by both State and County authorities, and is addressed for this project in Section 2.1.1. The conditions imposed by the State DLNR in reference to §205A-44 (b) are listed as the requirements for the P-15 permit for the usage category *Shoreline Erosion Control* (§13-5-22 – see Section 1.5.5.1) .

The relationship of the project to the objectives and policies of the CZM program listed in 205A-2, HRS, are as follows:

**1. Recreational Resources**

*Objective:* Provide coastal recreational opportunities accessible to the public.

*Policies:*

A. Improve coordination and funding of coastal recreational planning and management; and
B. Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

i. Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

ii. Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;

iii. Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

iv. Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

v. Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

vi. Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

vii. Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

viii. Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the Land Use Commission, Board of Land and Natural Resources, and county authorities.

*Discussion:* The project will stabilize the shoreline and prevent foreseeable hazards due to uncontrolled erosion, thus promoting public use. Lateral shoreline access may be improved for able-bodied persons during seasonal low sand conditions when access can be significantly limited on the native coastline. The project may improve seasonal beach accretion when compared to the native clay escarpment or a vertical seawall alternative due to a reduction in reflection characteristics. The project will reduce the non-point source of turbidity by removing the native clay shoreline escarpment from exposure to wave action.

**2. Historic Resources**

*Objective:* Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

*Policies:*

A. Identify and analyze significant archaeological resources;

B. Maximize information retention through preservation of remains and artifacts or salvage operations; and

C. Support state goals for protection, restoration, interpretation, and display of historic resources.

*Discussion:* No historic or archaeological sites or resources are known or likely to exist at the site and which would be affected by the project. The construction specifications will contain provisions to protect any historic resources and alert the proper agencies should any be found during the construction activities.

**3. Scenic and Open Space Resources**

*Objective:* Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

*Policies:*

A. Identify valued scenic resources in the coastal zone management area;

B. Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

C. Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and

D. Encourage those developments that are not coastal dependent to locate in inland areas.

*Discussion:* The proposed structure is engineered to be long-lasting and visually neutral. It will allow the natural beauty of the shoreline to be preserved, and will remove unattractive temporary shore protection items that are close to, or have exceeded, their design life. During periods of seasonal beach accretion, much of the structure will likely be buried in the sand. The project will also prevent the release of the clay substrate, thereby preventing highly turbid plumes in coastal waters.

**4. Coastal Ecosystems**

*Objective:* Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

*Policies:*

A. Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

B. Improve the technical basis for natural resource management;

C. Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

D. Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

E. Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

*Discussion:* The proposed project will enhance local nearshore water quality by preventing the erosion of the red clay substrate at the site. The project will assist in amelioration of the drain line condition at the north end of the property.

**5. Economic Uses**

*Objective:* Provide public or private facilities and improvements important to the State's economy in suitable locations.

*Policies:*

A. Concentrate coastal dependent development in appropriate areas;

B. Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

C. Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

   i. Use of presently designated locations is not feasible;

ii. Adverse environmental effects are minimized; and

iii. The development is important to the State’s economy.

*Discussion:* The project area is a recognized coastal development area and is an important contributor to the island economy.

**6. Coastal Hazards**

*Objective:* Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

*Policies:*

A. Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;

B. Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;

C. Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

D. Prevent coastal flooding from inland projects.

*Discussion:* The proposed project is engineered to prevent damage to the shoreline in the event of storm waves. Stabilization of the shoreline, where coastal erosion has drastically reduced the natural buffering capacity, is a significant improvement for coastal natural hazard mitigation. The project will not cause additional development, but will protect and enhance existing development. The project will assist in amelioration of the drain line condition at the north end of the property to reduce nonpoint source runoff. The project will not increase coastal flooding due to high waves or tsunami.

**7. Managing Development**

*Objective:* Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

*Policies:*

A. Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;

B. Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and

C. Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

*Discussion:* The proposed project permitting and approval process will provide an opportunity for public participation in the plan formulation process.

**8. Public Participation**

*Objective:* Stimulate public awareness, education, and participation in coastal management.

*Policies:*

A. Promote public involvement in coastal zone management processes;

B. Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and

C. Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

*Discussion:* The public will have an opportunity to review and comment on this EA as part of the public review process. Public hearings will be scheduled before the Maui Planning Commission as well as the State Board of Land and Natural Resources. A public outreach meeting was held at the Hololani on September 10, 2012.

**9. Beach Protection**

*Objective:* Protect beaches for public use and recreation.

*Policies:*

A. Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

B. Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

C. Minimize the construction of public erosion-protection structures seaward of the shoreline.

_Discussion:_ The project has been engineered to prevent further coastal erosion and has been designed to minimize the horizontal footprint seaward of the shoreline, and also minimize wave reflection in order to promote accretion of a sand beach. No beach quality sediment will be impounded landward of the project.

**10. Marine Resources**

_Objective:_ Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

_Policies:_

A. Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

B. Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

C. Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

D. Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

E. Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

_Discussion:_ The proposed project will not significantly affect marine and coastal resources. The project plan will be coordinated with federal and state marine resource agencies. The project will improve nearshore water quality by preventing release of the turbidity inducing native clay substrate into the water.

*1.5.5.4 Coastal Zone Management Program Federal Consistency Review*

As the project will require federal permits from the USACE, the project will undergo a review and certification by the State of Hawaii DBEDT to ensure that the project is consistent with the polices and objectives of the CZM program.

### 1.5.6 County of Maui Permits Necessary for the Proposed Project

The proposed project is in the shoreline setback zone and is part of a Special Management Area and will therefore require Shoreline Setback Variance (SSV) and the Special Management Area (SMA) permits administered by the Maui County Department of Planning. The permits are granted by the Maui County Planning Commission.

*1.5.6.1 Shoreline Setback Variance*

The Shoreline Setback Zone is a demarcation based on the location of the Certified Shoreline and either 1) average lot depth, or 2) the Average Erosion Hazard Rate (AEHR), whichever is greater. The Hololani has an average lot depth of approximately 160 ft, which gives a setback distance of 40 ft. The setback based on the AEHR is approximately 65 ft. Construction activity in this zone is limited by statute to minor structures. The proposed project will therefore need a variance.

The rules pertaining to a variance are listed in the *Shoreline Rules for the Maui Planning Commission* (§12-203). As the proposed project will artificially fix the shoreline, the variance may be granted if the commission finds that shoreline erosion will cause hardship to the applicant if the improvements are not allowed in the shoreline area.

The grounds of hardship are:

- The applicant would be deprived of reasonable use of the land if required to fully comply with the shoreline setback rules;
- The applicant's proposal is due to unique circumstances and does not draw into question the reasonableness of the shoreline setback rules; and
- The proposal is the practicable alternative which best conforms to the purpose of the shoreline setback rules.

A statement of hardship is contained in Section 2.1.1 of this document.

The variance requires the following conditions (from §12-203-15):

1. To maintain and require safe lateral access to and along the shoreline for public use or adequately compensate for its loss;

*Discussion:* Lateral access on the beach varies seasonally with the volume of sand present. During seasons with low beach sand, Lateral access is difficult due to the rough terrain and wave action. The proposed project will improve lateral access for able-bodied persons during these times by providing a potentially viable access surface on the revetment crest at the +6 ft elevation. However, the usefulness of the crest for this purpose will depend on the skill of the stone-setters. During seasonal high sand conditions, much of the proposed structure will be buried beneath the sand and will not impact beach access.

2. To minimize risk of adverse impacts on beach processes;

*Discussion*: The proposed structure is designed to have a minimum horizontal footprint and to absorb wave action as much as possible. A hardened temporary structure has been in place since December, 2007, and it has not noticeably interfered with the accretion of beach sand. The rough, sloping, and porous rock rubblemound revetment will absorb wave energy, thereby reducing wave reflection, and will promote percolation of sediment-laden waters – especially when compared to the native condition consisting of an erosion scarp in the native clay substrate.

3. To minimize risk of structures failing and becoming loose rocks or rubble on public property;

*Discussion*: The proposed structure is engineered to modern coastal engineering design standards.

4. (N/A – relating to buildings exceeding height limitations)

5. To comply with chapters 19.62 ("Flood Hazard Areas") and 20.08 ("Soil Erosion and Sedimentation Control"), Maui County Code, relating to flood hazard districts. And erosion and sedimentation control respectively;

*Discussion*: The project will not increase the Base Flood Elevation of the property (see Section 4.1.11.2), nor have a detrimental effect on the adjoining drainage. The project plans and specifications will comply with the rules and Best Management Practices contained in Chapter 20.08.

The Shoreline Rules further state:

*Notwithstanding the above conditions or grounds of hardship, the commission may consider granting a variance for the protection of a legal habitable structure or public infrastructure; provided that, the structure is at risk of damage from coastal erosion, poses a danger to the health, safety and welfare of the public, and is the best shoreline management option in accordance with relevant state policy on shoreline hardening.*

*1.5.6.2 Special Management Area*

As portions of the project are landward of the presumed Certified Shoreline and in the proximity of the shoreline, a Maui County SMA permit is therefore required. As the project cost will likely be in excess of $500,000, the permit will be a major permit and require a public hearing before the Maui County Planning Commission in compliance with the Maui County SMA Rules (MC-12-02, Chapter 202.

Special Management Area designations are required by Chapter 205A (HRS) to promote the CZM policies and objectives for coastal areas that are in county jurisdiction (see Section 1.4.4. 3). The project should therefore comply with the objectives and policies contained in 205A-2, HRS and the review guidelines contained in 205A-26, HRS.

### 1.5.7 Relationship of the project to the Hawaii State Planning Act

The Hawaii State Planning Act (Chapter 226, Hawaii Revised Statutes, as amended) outlines themes, goals, guidelines, and policies for statewide planning. The proposed project relates to the following objectives stated in §226-13, *Objectives and policies for the physical environment--land, air, and water quality*:

- Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters.
- Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

<u>*Discussion*</u>*:* The project will help to maintain the water quality in nearshore waters that become degraded by coastal erosion of the red clay substrate, as well as protecting the Hololani property from chronic erosion that threatens structural integrity of habitable structures. Stabilizing a chronically eroding shoreline when it approaches habitable structures is a significant and necessary step in coastal natural hazard mitigation. The proposed project will aid in maintaining a buffer of land between the Hololani buildings and incident coastal hazards.

### 1.5.8 Relationship of the project to the Maui County General Plan

The Maui County General Plan (1990 update) sets broad objectives and policies to guide the long-range development of the County. Under the subject of Public Safety, it is the policy of the General Plan to:

- Maintain a state of preparedness for man-made or natural disasters, and;
- Encourage industries to provide for themselves protection services to meet their special needs.

### 1.5.9 Relationship of the project to the West Maui Community Plan

The West Maui Community Plan is one of nine community plans for Maui County. The community plans detail desired land use patterns and goals, objectives, policies and implementing actions for various functional areas. The Hololani is located on lands designated "Hotel", with the drainage easement area designated "Public or Quasi-Public". The "Hotel" designation is for primarily transient accommodations. The "Public or Quasi-Public" designation for the drainage easement is for public utilities.

No specific implementing actions are listed for the environs of the Hololani Property.

Following are sections of the plan that are applicable to the proposed project:

***B. Goals, Objectives, Polices and Implementing Actions***

***Environment – Objectives and Policies***
*(3) Protect the quality of nearshore and offshore waters. Monitor outfall systems, streams and drainage ways and maintain water quality standards*.

The Maui County drain line at the north end of the Hololani property has been problematical, as the outlet structure was not designed to withstand the erosion conditions at the site (see Section 4.1.13.1, Figure 4-20, and Appendix E, *Response to Comments from the County of Maui Department of Public Works*). The proposed project will, at minimum, facilitate repairs or reconstruction of the drainage outlet. The alternative design configuration, supported by DPW, will include reconstruction.

*(11) Prohibit the construction of vertical seawalls and revetment except as may be permitted by rules adopted by the Maui Planning Commission governing the issuance of Shoreline Management Area (SMA) emergency permits, and encourage beach nourishment by building dunes and adding sand as a sustainable alternative.*

Despite the discouragement of shoreline armoring in the plan, the verbiage clearly gives the MPC latitude to permit the construction of shoreline armoring structures when emergency conditions such as those at the Hololani are present.

The use of beach nourishment is encouraged in this EA as a regional solution involving all of the regional property owners, as well as the State and the County. It is not, however, feasible for the immediate, urgent need of protecting the Hololani. The beach nourishment option is further discussed in Section 3.4.

***Social Infrastructure – Recreation and Open Space – Objectives and Policies***

(7) *Ensure adequate public access to shoreline areas, including lateral access to establish the continuity of public shorelines.*

The proposed project will facilitate lateral shoreline access by able-bodied persons during periods of low sand accretion. Additional shoreline access has been agreed to by the Hololani with approval of the proposed action (see Appendix E – Response to Comments from the County of Maui Planning Commission).

**C. Planning Standards**

**(6) Environmental Aspects**

c. *Prohibit the construction of vertical seawalls, except as approved by the planning commissions of the County of Maui*

The proposed project consists of a sloping rock revetment built to an elevation of +6 ft MSL, backed by a vertical seawall built to an elevation of +12 ft MSL. The project is being submitted to the County of Maui Planning Commission for approval of SMA and SSV permits.

# 2. DETAILED DESCRIPTION OF THE PROPOSED ACTION

## 2.1 Purpose and Need for the Proposed Action

The purpose of the project is to provide an engineered shore protection structure that both meets the needs of the condominium association for long-term protection of their buildings, and is responsible to the public by helping to maintain a healthy sand beach during periods of seasonal sand accretion, and by providing lateral access for able-bodied persons during periods of erosion.

The need for the project is perhaps best shown by the extensive erosion shown in Figures 1-2 and 1-3, photographs of the dire conditions that existed before the existing temporary protection was put in place. The north building is within 15 feet of the shoreline erosional escarpment and will inevitably need abandonment if not adequately protected. The erosion shown in the photographs is a result of years of chronic erosion coupled with significant individual erosion events.

The proposed action is a hybrid shore protection structure that combines a vertical seawall with a sloping rock revetment. The proposed alignment of the structure is shown in Figure 1-6, and the design cross-section is shown in Figure 1-7. An artists rendition of the completed project is shown on the cover of this document.

The Hololani AOAO has a long history of efforts to combat erosion at the property. Robust but temporary emergency shore protection consisting of geotextile sand bags and gravel-filled marine mattresses has been in place since December, 2007. Authorization for placement of the emergency shore protection was given by the County of Maui Planning Department and the State of Hawaii DLNR-OCCL because the severe erosion that took place during the winter of 2006-2007 threatened the buildings with collapse. Authorization was given under the condition that the Hololani AOAO seek a permanent shore protection solution.

The temporary shore protection is not engineered to withstand prolonged exposure to winter wave conditions, and is expensive to maintain. After four winter high wave seasons, the temporary protection is nearing the end of its design life (see Figure 1-5). Deterioration of the structure is unsightly and some of the damage, such as deflated sand bags, can be a public nuisance.

The hybrid wall and revetment structure is designed to withstand extreme wave conditions, be minimally reflective and hence enable beach sand accretion, provide lateral coastal access, reduce turbidity in nearshore waters, and minimize the amount of material placed in Navigable Waters of the United States and the State Conservation District.

### 2.1.1 Statement of Hardship

From HAR §13-5-22:

> *…the applicant shows that (1) the applicant would be deprived of all reasonable use of the land or building without the permit; (2) the use would not adversely affect beach processes or lateral access along the shoreline, without adequately compensating the State for its loss; or (3) public facilities critical to public health, safety, and welfare would be severely damaged or destroyed without a shoreline erosion control structure, and there are no reasonable alternatives...*

From *Shoreline Rules for the Maui Planning Commission* (§12-203):
The grounds of hardship are:

- The applicant would be deprived of reasonable use of the land if required to fully comply with the shoreline setback rules;
- The applicant's proposal is due to unique circumstances and does not draw into question the reasonableness of the shoreline setback rules; and
- The proposal is the practicable alternative which best conforms to the purpose of the shoreline setback rules.

The Hololani Resort Condominiums is a set of two 8-story buildings containing 63 residential apartment units and one 1-story commercial building used as office space and a community center. An underground parking garage is located underneath the main buildings. Minor structures on the property include a swimming pool and paved pool deck. The property was developed in 1974.

The shoreline in the vicinity of the Hololani has been shown to be eroding at an average rate of approximately 0.8 ft per year, but the erosion is also highly dynamic (see Section 4.1.10) and can erode at an accelerated rate in some areas (see Figure 1-2).

The Hololani shoreline is an escarpment of red volcanic clay with an elevation that ranges between 10 ft and 12 ft MSL. When exposed to wave action, it is highly susceptible to erosion, and erodes by calving along more or less vertical planes. The material is not compatible with beach building processes as the clay is composed of particles that remain in suspension and are transported offshore as turbid plumes. In the absence of sand, the shoreline does not adjust to form morphologies commonly associated with sand beaches, such as a planar swash zone, berm crest and backshore zone, but remains an escarpment cut from the volcanic clay. Ultimately, the existing beach will not be improved by leaving a steep clay embankment along the shoreline.

The Hololani AOAO has been fighting erosion of their shoreline since 1988, when they armored their shoreline with sand bags. The sand bags were maintained at various levels until 2001, when they were replaced in part with large geotextile bags (“seabags”) at the north end of the property. During the winter of 2006-2007, the erosion became a dire situation (see Figure 1-2), with erosional escarpment approaching within 15 ft of the north building. During this time, the erosion line in some places advanced several feet in a matter of days. It became apparent to all who were closely monitoring the situation – the Hololani AOAO, the DLNR-OCCL representatives, and the Maui Planning Department representatives – that the situation was an emergency and the Hololani buildings were threatened with a potentially catastrophic situation. In response, the Hololani constructed a $400,000 temporary seabag structure over the length of the property (see Figure 1-4).

Damage inflicted on the temporary protection since December 2007 is indicative of the severe shoreline erosion that would have occurred if the protection were not in place. Looking forward, there is no doubt that serious erosion and property damage will inevitably occur if the proposed project is not implemented. A dangerous shoreline escarpment would migrate mauka, and eventually both buildings would likely be structurally threatened, and would probably face abandonment. Without shore protection, the owners would suffer the loss of all reasonable use of the property.

The Hololani erosion problem has been recognized by county and state agencies since the implementation of temporary shore protection in 1988. An engineered permanent solution to the problem has been mandated by DLNR-OCCL in letters of permission for emergency temporary protection since 2007 (see Appendix A). The Hololani AOAO has a long record of working with State of Hawaii and County of Maui agencies to implement the best solution to the erosion problem according to established rules and regulations. The long-standing coastal erosion emergency at the Hololani is unique and does not call into question the reasonableness of the shoreline setback regulations or CZM policies and objectives.

Alternative actions have been investigated (see Section 3), and the proposed action has the following characteristics that conform to the purpose of the shoreline rules:

1. The proposed structure has been designed to reduce wave reflection and thereby minimize the effect on normal coastal process.

2. The proposed structure has been designed to enable lateral coastal access for able-bodied persons.

3. The proposed structure will not impound beach quality sand.

4. The proposed structure has been designed to modern coastal engineering standards for a 50-year return period event and will be visually neutral.

5. The proposed structure has been designed with a minimal footprint in Conservation District Land and navigable waters of the United States.

6. The proposed structure will help to protect vital public infrastructure consisting of a drainage line and a roadway (Lower Honoapiilani Road).

## 2.2 Design Conditions and Armor Stone Size

Coastal engineering structures that protect life and property are generally designed for a "worst case" wave condition. Such conditions occur during hurricanes and other large storms which are extreme events with a low statistical probability of occurrence. A 50-year recurrence interval wave event is typically used for coastal engineering design criteria.

The Hawaiian Islands are annually exposed to severe storms and storm waves generated by passing low-pressure systems, tropical storms including hurricanes, and large swell waves generated by distant North Pacific or South Pacific storms. Table 2-1 lists various recurrence wave heights for wave approach to West Maui from the North, West and South. The values in the table are derived from an 11-year hindcast of oceanographic conditions.

**Table 2-1. Recurrence interval wave heights**

| Recurrence Interval: | 2-Year | 5-Year | 10- Year | 25-Year | 50-Year | 100-Year |
|---|---|---|---|---|---|---|
| North Sector | 15.6 ft | 17.6 ft | 19.0 ft | 21.0 ft | 22.5 ft | 24.0 ft |
| West Sector | 9.2 ft | 11.0 ft | 12.4 ft | 14.3 ft | 15.7 ft | 17.1 ft |
| South Sector | 75.6 ft | 5.9 ft | 6.1 ft | 6.4 ft | 6.6 ft | 6.8 ft |

Shore protection structures are designed for waves that break nearshore, close to the toe of the structure. These waves are physically limited in their size by the water depth. Various phenomena add to the nearshore water level and this contributes to the wave size. The large deepwater waves such as those in Table 2-1 cause a super-elevation in water level known as wave set-up, and low atmospheric pressure and high wind conditions contribute to the phenomenon known as storm surge. Other water-level contributors include global sea level rise and mesoscale eddies, a phenomenon identified locally in Hawaii that can last several weeks and contribute as much as an additional 0.5 ft of sea level. Table 2-2 lists the water level parameters used to calculate the project design wave height.

Based on offshore profiles, an average MSL water depth of 3 ft is used for calculation of nearshore design wave heights. Adding a stillwater level rise of 4.0 ft to this yields a design water depth of 7.0 ft. A water depth to breaking wave height (d/Hb) ratio of 0.78 is used for breaking wave criteria, giving a design wave height of 5.5 ft at the structure toe.

The median armor stone weight (W50) based on the design wave height is 2,700 lbs, and the nominal stone diameter is 2.5 ft. Two layers of armor stone are used in the design (see Figure 1-7).

**Table 2-8. Combined Stillwater Level Rise for 50-year Conditions**

| Parameter | Stillwater Rise (ft - MSL) |
|---|---|
| Tide (MHHW) | 1.2 |
| Storm Surge | 0.5 |
| Wave Setup | 1.5 |
| Other Phenomena (Mesoscale Eddies, Sea Level Rise) | .8 |
| Total Stillwater Level Rise | 4.0 |
| Nominal Water Depth | 3.0 |
| Design Water Depth (d) | 7.0 |
| Design Wave Height (d/Hb = 0.78) | 5.5 |

## 2.3 Design Cross-Section

Figure 1-7 is a cross-section of the hybrid seawall and revetment structure. The hybrid design section has a footprint approximately 7 to 10 ft less wide than that of a full revetment design.

The narrow footprint allows the structure to be built with less excursion from the existing coastal bluff and entirely within the original property limits. The structure is composed of two primary elements: a vinyl sheet pile seawall and a uniform armor rock rubble mound revetment.

The revetment armor stone size and profile, including the revetment toe, is designed according to the criteria in Table 2-2. The revetment crest is at +6 ft and is two stone diameters in width (approximately 5 ft). While the revetment protects the foundation of the seawall, it also helps to reduce wave reflection and allow percolation of wave uprush, both of which are helpful in promoting the accretion of sand. The sand movements at the Hololani are complicated, and are probably caused by a seasonal variation in wave approach direction. The addition of an absorptive rubble mound revetment at the base of the seawall will not guarantee the presence of a beach, but it will facilitate the formation of a beach when oceanographic conditions allow.

The seawall portion of the structure is composed of vinyl sheet pile. Earlier design phases considered the use of 1) a reinforced concrete wall, and 2) a cemented rock masonry (CRM) wall. Both of these structures would be free standing ("gravity") walls, which rely on a strong substrate for support. However, geotechnical engineering calculations indicate that the southern portion of the property has weak soil conditions that will not support gravity structures (Section 4.1.14). The sheet pile design was chosen as it is stable under the existing site conditions.

### 2.3.1 Armor Rock Revetment Section

The armor rock is allowed to range in weight from 0.75 x W50 to 1.25 x W50 (2025 lbs to 3375 lbs). The stones are placed on a slope of 1.5 Horizontal to 1 Vertical, and the section is two stones in thickness, as shown in Figure 1-7. The armor layer is placed on an underlayer of smaller stone with a nominal weight of 10% of the armor stone. The underlayer stone is a critical component of the revetment as it supports and evenly spreads the weight of the armor layer, and acts to further dissipate hydraulic loads due to wave action. Table 2-2 summarizes the design stone weights and layer thicknesses for the revetment portion of the project. The underlayer stone range is somewhat expanded to improve stone interlocking and assist in sourcing.

**Table 2-2. Armor unit weight and nominal diameter**

| | $W_{50}$ (lbs) | Stone Size Range (lbs) | Armor Unit Diameter (ft) | Layer Thickness (ft) |
|---|---|---|---|---|
| Armor Layer | 2,700 | 2025 - 3375 | 2.5 | 5.0 |
| Underlayer | 270 | 100 - 340 | 1.2 | 2.4 |

The revetment is placed on a prepared slope at 1.5 Horizontal to 1 Vertical. Geotextile filter fabric is laid on the slope below the underlayer stone to stabilize the soil by preventing the migration of fine sediments. An additional layer of Tensar rock mattresses or geogrid will be used to strengthen the substrate where the soil conditions may be too weak to support the revetment structure (see IGE 2011).

### 2.3.2 Structure Toe

The revetment toe is the revetment section at the base of the structure. The toe design is dependent on the substrate type. Substrate conditions, based on the geotechnical report by Island Geotechnical Engineering, Inc, are discussed in Section 4.1.14. Most of the structure will require a toe designed for soft substrate conditions, with excess stone contained in a 5-ft apron for protection from scour (see Figure 1-7). The top of the toe is located at an elevation of -.5 ft MSL. The geometry of the armor stone and underlayer stone size requires excavation to a depth of -5.5 ft MSL in order to properly place the toe. Another foot of excavation will be necessary in areas where Tensar mattresses are used to reinforce the soil. The presence of rock shown in some of the boring results (see Section 4.1.14), may allow an alternative toe configuration. If the substrate is competent rock, the revetment can be keyed into it for protection and stability. Figure 2-1 illustrates the toe design for a hard bottom.

### 2.3.3 Revetment Crest

The revetment has a horizontal crest two nominal stone diameters in width (approximately 5 ft – see Figure 1-7). The crest is designed to help dissipate wave forces during high wave conditions. It will also allow lateral access for able-bodied persons during seasonal conditions when the beach is absent. Pedestrian access to jetties and revetments is not typically encouraged, but it is difficult to control and is an invariable result of the construction of such structures. As the rubble mound structures are meant to be flexible and have some movement when stressed, it is not feasible to construct a walkway on the surface of the revetment crest that would be stable under design wave conditions. The best alternative to facilitate pedestrian use is to specify tightly packed stone placement and to use stone with flat, horizontal surfaces on the crest. These instructions can be noted in the construction documents.

The design wave runup elevation is 13.25 ft (see Table 2-3). The revetment would need to built to that elevation in order to prevent wave overtopping. While the revetment will attenuate a significant amount of wave energy, the seawall will also be impacted by breaking waves, and the 12 ft crest elevation will occasionally be overtopped. Spray can also be a significant wetting factor when winds turn on-shore. The existing Tensar rock mattresses used for the temporary emergency protection can be used for scour protection behind the seawall to protect the wall and the anchor system.

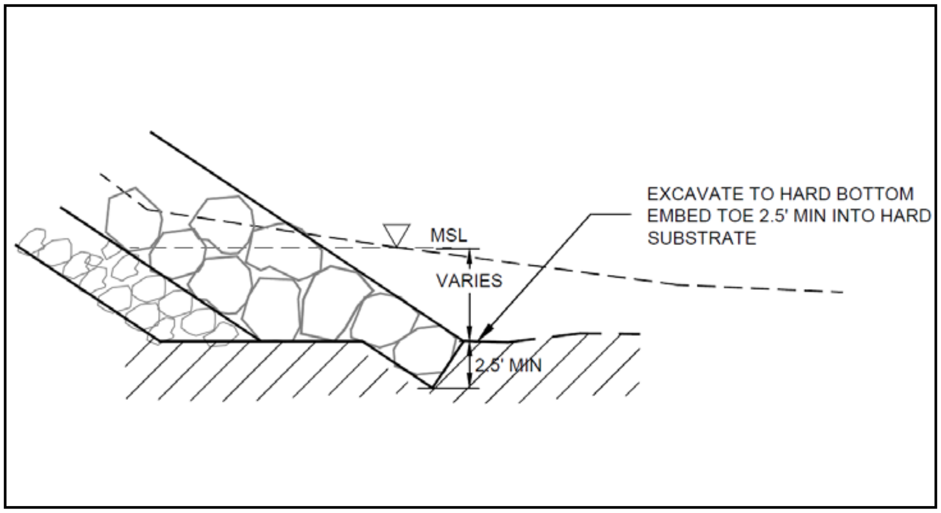


**Figure 2-1. Toe configurations for hard substrate**

**Table 2-3. Wave runup**

| Structure Slope | Design Wave Height (ft) | Wave Runup (ft) | Design Water Level (ft) | Runup Elevation (ft) |
|---|---|---|---|---|
| 1V : 1.5H | 5.5 | 9.3 | 4.0 | 13.3 |

### 2.3.4 Vinyl Sheet Pile Wall

The seawall portion of the structure will be constructed of vinyl sheet pile. The sheet pile is formed from interlocking "z" sheets of vinyl that are driven to an elevation of -10 ft or until hard substrate is found. The interlocking sheets form a durable impervious wall. The wall will be visible as it rises from behind the rock revetment at +6 ft to the wall crest at +12 ft. The sheet pile will be capped with a formed concrete block. Figure 2-2 is a photograph from the manufacturer's website that shows an example vinyl sheet pile wall with a concrete cap. The sheet pile is supported laterally by the placement of deadman anchors at 5-ft intervals at a distance 15 ft landward of the wall. The anchors are connected to the sheet pile with stainless steel cable or solid rod (see Figure 1-7). The use of vinyl sheet pile is a relatively recent innovation, but coastal structures have now been in place for over 20 years. It has proven to be a durable and effective product that is relatively low cost. Although it is being specified for this project due to the geotechnical site conditions (see Section 4.1.14), it is also advantageous because it:

- Requires less excavation than gravity wall structures
- Minimizes the disturbance of existing ground in front of the wall
- Does not corrode in the marine environment.

Further information on vinyl sheet pile wall construction is contained in Appendix E (Comments and Responses).

The six-foot vertical drop from the top of the seawall to the revetment crest will require accident prevention measures such as appropriate landscaping or a safety rail with a minimum height of 42-inches.

**Figure 2-2. Example of vinyl sheet pile wall with a concrete cap (from manufacturer's website)**

## 2.4 Revetment Alignment and Footprint

Figures 1-6 (a &b) are plan views of the concept design that shows the alignment of the revetment with the toe set against the original (1972) property line. The crest of the structure will fall close to the existing vegetation line for most of the alignment. The entire structure is landward of the MHHW line (+1.2 ft) as mapped on June 6, 2011. At the south end of the structure, abutting the adjacent property of the Royal Kahana Condominiums, the sheet pile wall is returned landward to protect against flanking of the revetment by continued erosion (Figure 2-3).

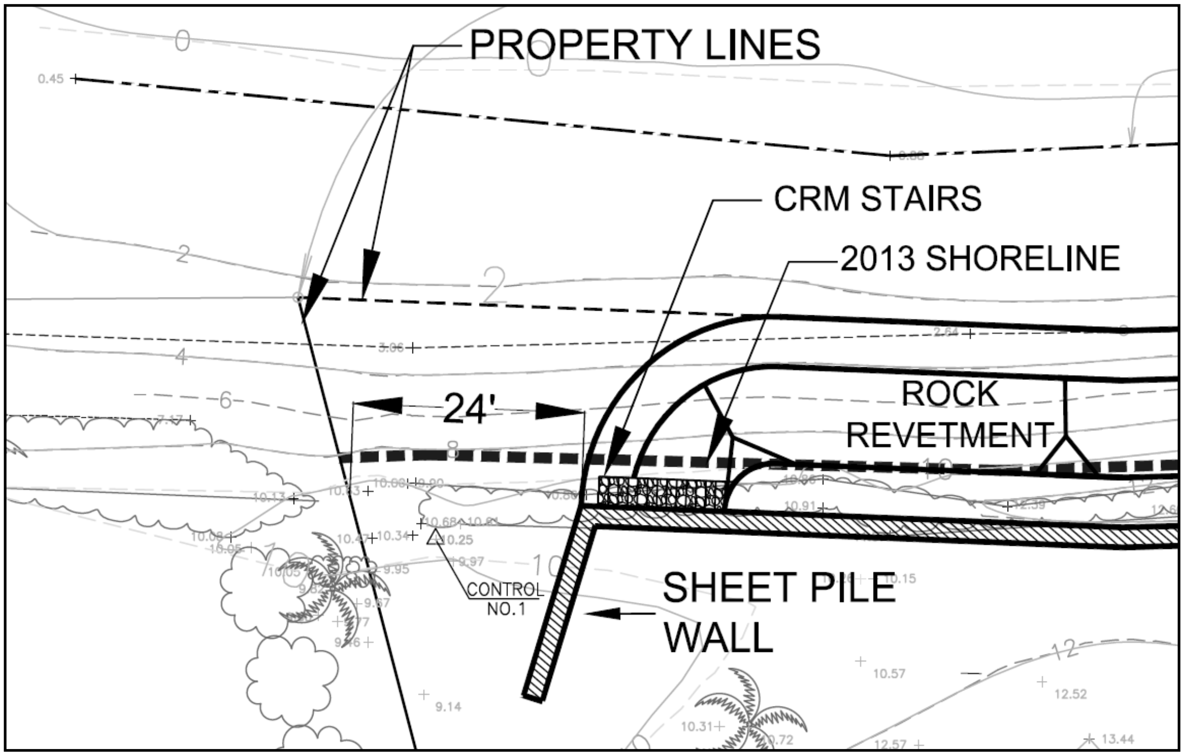


**Figure 2-3. Proposed structure alignment at the south boundary**

The revetment is stopped 24 ft from the property line to minimize adverse effects on the adjoining Royal Kahana property. Cement Rubble Masonry (CRM) stairs will be used to help provide lateral access to the revetment crest.

### 2.4.1 Drainage Easement at the North End

The north end of the Hololani property contains a Maui County drainage easement that borders with the Pohailani condominium property line. The easement area has been severely eroded, and the CRM seawall that protects the Pohailani is undermined and in poor condition (Figure 2-4). The drainline has been progressively cut back, and becomes blocked by sand and debris (Figure 2-5). The area contains power poles, a HECO manhole, and a transformer for the Pohailani; all are at risk from a severe storm event.

The present alignment design of the proposed seawall/revetment structure is contained within the Hololani property line and outside of the drainage easement (Figure 2-6). The revetment is ended at the edge of the easement, and the seawall portion turns and proceeds along the easement boundary to the mauka property line. The wall can be used as an abutting surface for future improvements of the drain line and easement area.

An alternative north end configuration, shown in Figure 2-7, would extend the structure to intersect a new or repaired seawall at the Pohailani property. This alternative would be a reasonable way to rebuild the drainage system and protect the utilities, the Pohailani property, and the nearby highway. However, the alternative would require the close cooperation of the Pohailani AOAO, and the County of Maui Department of Public Works (DPW) for the installation of a new drainpipe. Both entities have received letters of intent and a preliminary report discussing shore protection options (see Appendix A). Representatives of the Pohailani have indicated that they would prefer this design alternative for the easement area and have asked to have it retained as an option in this EA. In comments on the DEA, the DPW indicated that they would support the alternative configuration (see Appendix E).

**Figure 2-4. Photograph of the drainage easement showing utilities and seawall undermining**


**Figure 2-5. Photograph of the drainage easement showing buried drain line**

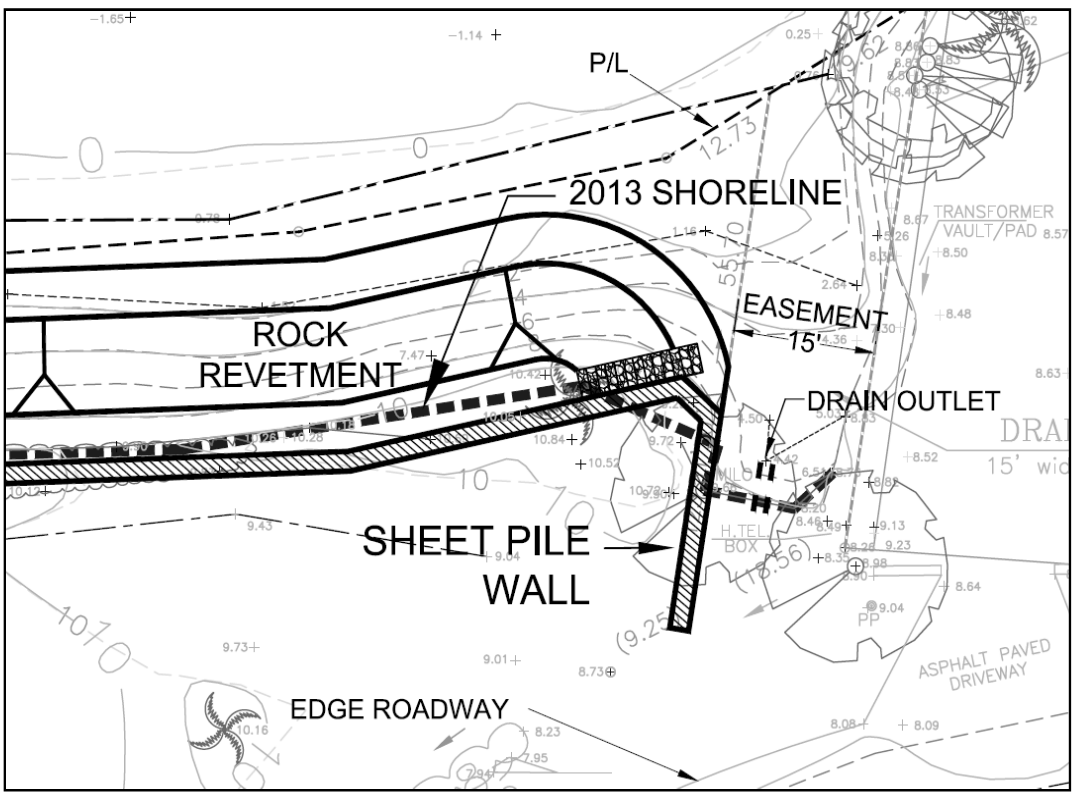


**Figure 2-6. North end configuration for the proposed structure**

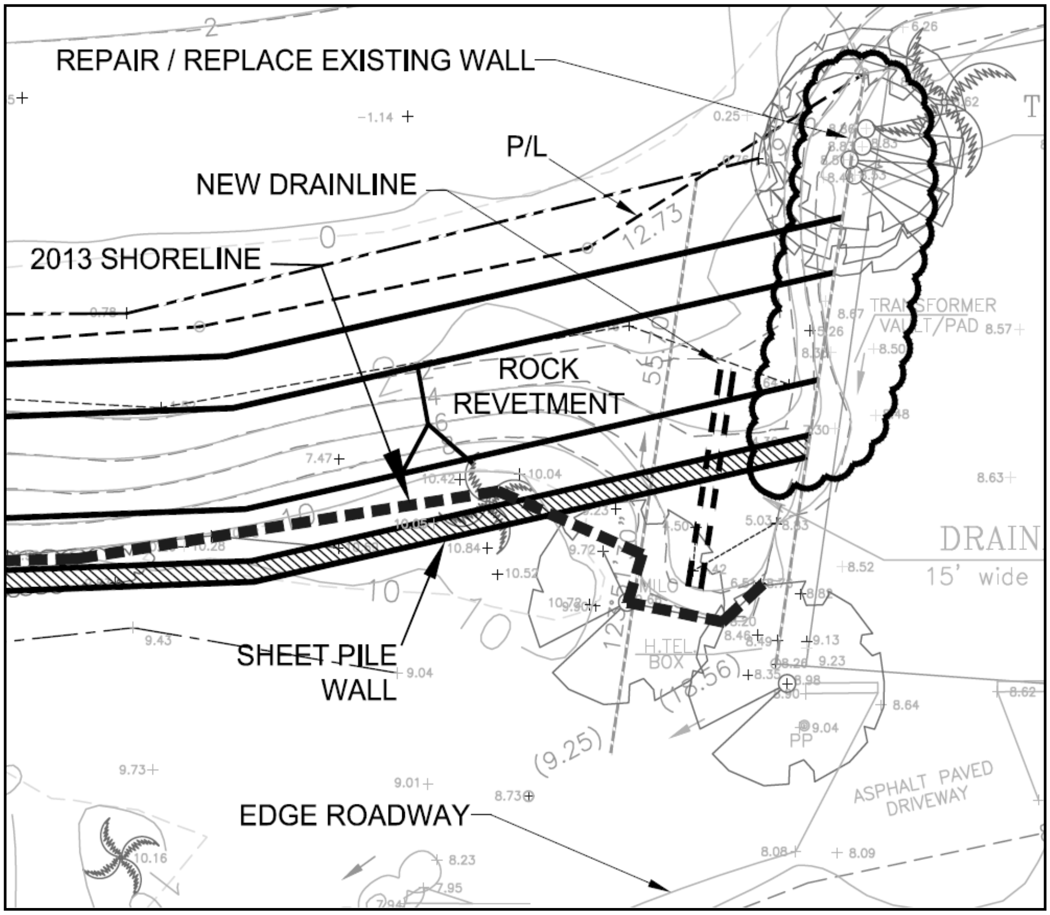


**Figure 2-7. Alternative configuration for the north end, with new drain line**

## 2.5 Construction Method

A possible construction method is shown in Figures 2-8 and 2-9, which illustrate a two-phase operation. In Phase 1, an excavator or back-hoe accesses the shoreline from the drainage easement and works progressively south by excavating and constructing the revetment toe, and building a temporary road bed. The toe excavation is protected by cantilevered steel sheet pile. In Phase 2, the machinery works back north, dismantling the road, building the rest of the revetment, and removing all remaining temporary shoring. The construction sequence is:

1. (Phase 1) Shore the excavation area with steel sheet pile or road plates in a section sized according to the reach of the equipment. Excavate top at 2H:1V slope; excavate toe behind shoring and place geotextile filter, Tensar

mattresses, underlayer stone and armor stone. Construct roadway on top of revetment toe using underlayer stone and road plates to an elevation of +2 ft.

2. Use existing sand bags to construct a berm inside of the temporary shoring on the makai side before removing temporary shoring sheet pile. Place vinyl sheet pile wall and anchors before removing temporary shoring sheet pile on the mauka side.

3. Move forward on the road bed and emplace shoring for the next section.

4. (Phase 2) When the south end is reached, build armor stone slope and crest. Move back north – remove roadbed (excess underlayer stone) and progressively complete revetment. Remove geotextile sand bag berm before moving north to new section. Back-fill and compact top surface excavation, install Tensar mattress and landscaping.

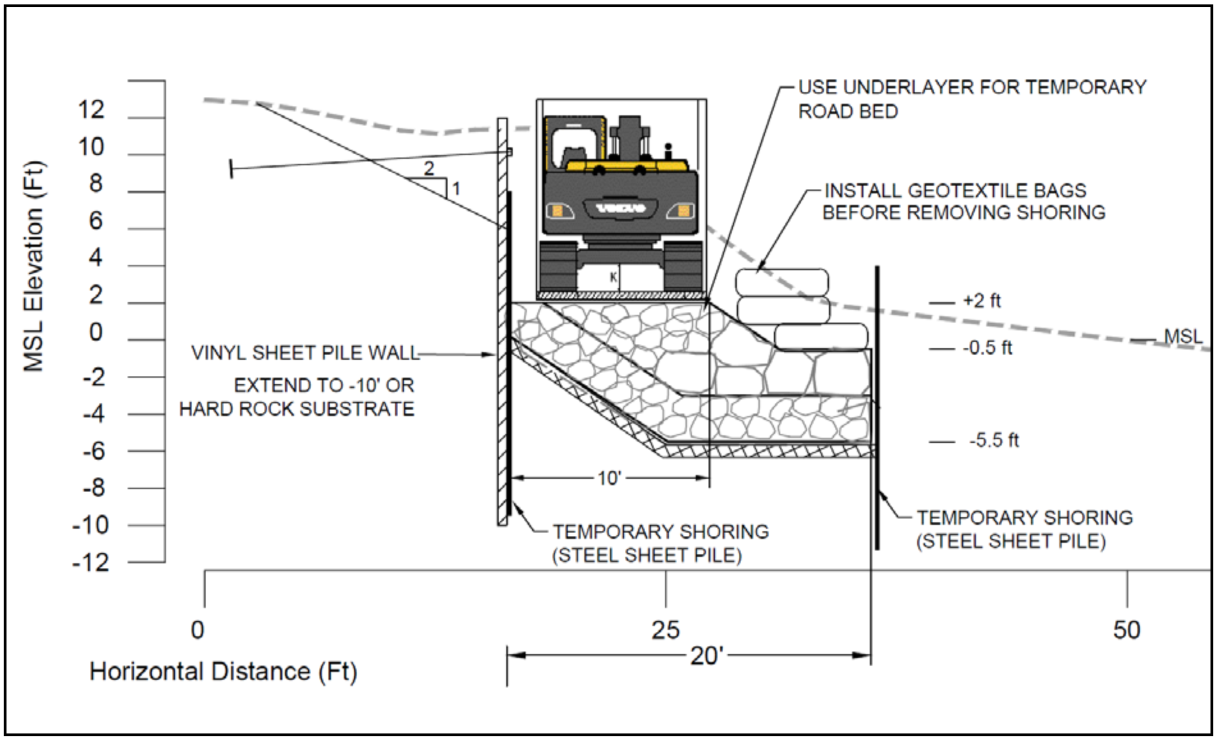


**Figure 2-8. Construction of temporary road bed and structure toe – Phase 1, construction moving south.**

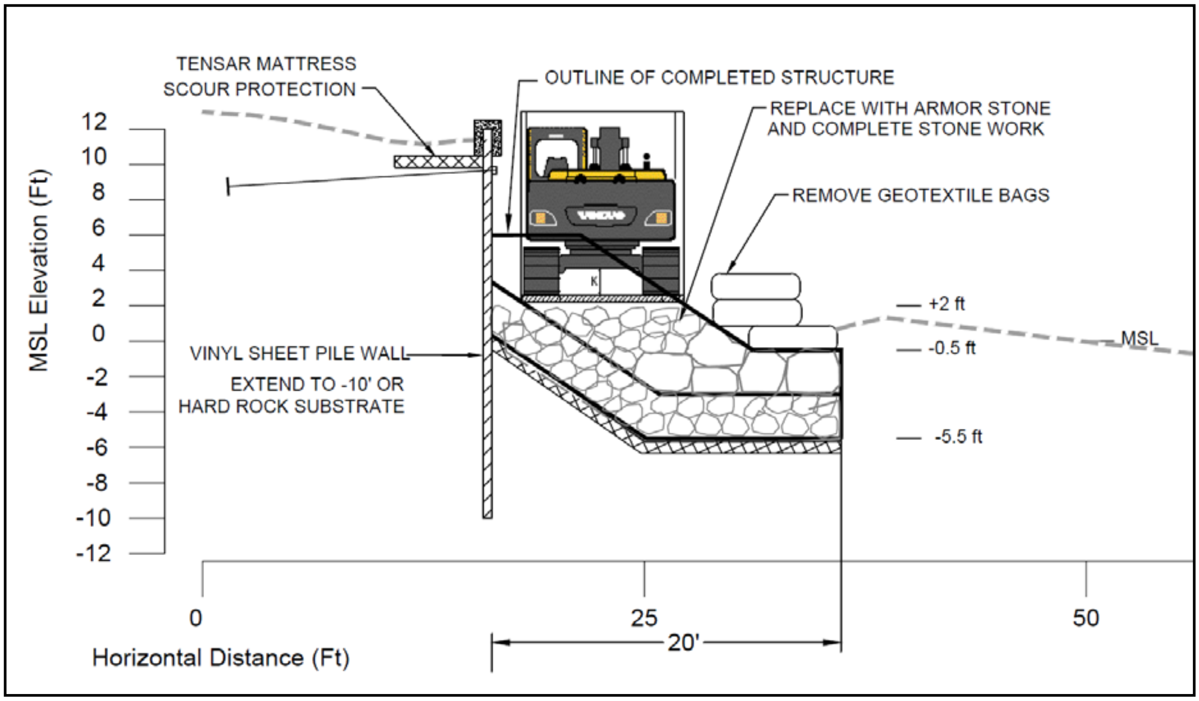


**Figure 2-9. Construction of remainder of structure, removal of temporary shoring – Phase 2, construction moving north.**

## 2.6 Estimate of Material Quantities

The following material quantities (Table 2-4) are based on the dimensions in Figures 1-6 and 1-7. The quantities are conservative estimates. Quantities below MHHW are based on elevation rather than the high water mark, and therefore represent the maximum quantities that could be placed in federal jurisdiction (see Section 1.5.3)

**Table 2-4. Material Quantities**

| | Total Quantity | Quantity below MHHW |
|---|---|---|
| Armor Stone | 1,785 tons | 800 tons |
| Underlayer Stone | 1,150 tons | 1,080 tons |
| Vinyl Sheetpile | 9,300 sq ft | 4,740 sq ft |
| Tensar Mattress | 8,170 sq ft<br>(76 x 21.5’ x 5’) | 8,170 sq ft |
| Seabags | 145 bags (approx.)<br>2.5 cu yds per bag<br>(362.5 cu yds) | 145 bags (approx.)<br>2.5 cu yds per bag<br>(362.5 cu yds) |
| Excavation (seawall) | 475 cu yds | None |
| Excavation (revetment) | 2,600 cu yds | 1,475 cu yds |

## 2.7 Cost Estimate

Cost estimates in Table 2-4 are approximate and based on existing available information, including manufacturers' quotations and previous cost estimates made for the Hololani.

**Table 2-4. Cost Estimate**

| Major Items | Cost | Ancilliary Items | Cost |
|---|---|---|---|
| Sheet Pile Wall ($60/sq ft) | $528,000 | Landscaping | $30,000 |
| Revetment Construction<br>Armor Stone: $550 cu yd<br>Underlayer: $350 cu yd | $900,000 | Safety Railing | $40,000 |
| Geotextile | $50,000 | Beach Access Stairs | $18,000 |
| Tensar Mattresses ($35/sq ft) | $290,000 | | |
| Excavation/Shoring/Dewatering | $150,000 | | |
| Mobilization | $50,000 | | |
| Water Quality Monitoring and Miscellaneous Environmental | $75,000 | | |
| **Total** | **$2.04M** | | **$88,000** |

# 3. ALTERNATIVES CONSIDERED

Coastal engineering alternatives to the proposed action included:

- No Action
- Rock rubble mound revetment
- Seawall
- Beach nourishment
- Alternative temporary solutions

In response to comments on the DEA (see Appendix E), additional alternatives are discussed in Section 3.6. In response to further discussions with DLNR-OCCL, an additional alternative has been added in Section 3.7, keeping the preferred alternative (hybrid seawall and revetment structure) but placing it behind the January 2013 Certified Shoreline.

Table 3.1, located at the end of this chapter, is a summary of alternatives as requested in comments on the DEA by the County of Maui Department of Planning.

## 3.1 No Action

A 2001 erosion analysis by SEI, and a 2006 study by the UHCGG found similar long term erosion rates of about 0.8 ft per year along the Hololani reach. The 1972 Certified Shoreline (the currently recognized property boundaries – the "boundary of record" - of the Hololani) is 25 ft mauka from the original property boundary determined at the 1959 partitioning of the Bechert Estate. The present inferred shoreline at the top of the temporary emergency shore protection is approximately 17 ft mauka of the 1972 shoreline. Therefore, approximately 40 ft of shoreline erosion is surmised to have occurred since 1959.

Attempts to stabilize the shoreline have been on-going since 1988. However, erosion during the 2006/2007 winter reached within 15 ft of the north building (see Figure 1-3) and the threat to the structural integrity of the building became clear to both the Maui County Department of Planning and the State of Hawaii DLNR-OCCL. A site visit by staff of the DLNR-OCCL on January 11, 2007 determined that the north building was in danger without immediate shore protection.

At that time, SEI designed the temporary geotextile sand bag and marine mattress structure that was constructed in December 2007, and remains in place today.

The temporary shore protection was damaged during both the winters of 2009/2010 and the winter of 2010/2011.

During the winter of 2010/2011 the substrate in front of the temporary shore protection was scoured and eroded. The marine mattress toe protection for the temporary structure articulated down as designed to protect the integrity of the structure (Figure 3-1). The structure was repaired in January, 2011 at a cost of $140K. Repairs to the temporary structure are not only expensive, they are difficult to do, requiring significant on-site mobilization of pumps and fill material for the sand bags and marine mattresses.

**Figure 3-1. Articulation of marine mattresses in response to erosion of the substrate: April 2008 (top), January 2011 (bottom)**

The experience of the last five years has shown that erosion at the Hololani is likely to continue, and perhaps accelerate. Without the existing temporary shore protection, it is likely that at least the north building would not now be habitable, and would be a danger to the public. The temporary emergency structure will not withstand repeated winters with the strong wave conditions typical of West Maui. Removal of the temporary emergency structure would not improve either the condition of the beach or lateral public access, as the native coastline is a steep erosion scarp in clay substrate, with a wet rocky beach at its toe. In addition, both the County and State agencies have a history of identifying and supporting the need for coastal stabilization at this location.

The No Action alternative would likely result in the eventually condemnation of one or both of the Hololani buildings.

### 3.2 Rock Rubble Mound Revetment

A rock rubble mound revetment is a sloping uncemented structure built using boulder-sized rock. 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 filter designed to distribute the weight of the armor layer and to prevent loss of fine shoreline material through voids in the revetment. The armor layer and underlayer are typically two stone diameters in thickness. Figure 1-9 is a typical design cross section that would be used for a revetment structure constructed at the Hololani.

One major advantage of a revetment is that the rough porous rock surface and relatively flat slope of the structure will tend to absorb wave energy, reduce wave reflection, and help to promote accretion of sand on a sandy beach. Revetments in Hawaii are typically built on a slope of 1.5 to 2 horizontal to 1 vertical to ensure stability.

Toe scour protection can be provided by excavating to place the toe on solid substrate where possible, constructing the foundation as much as practical below the maximum depth of anticipated scour, or extending the toe to provide a scour apron of excess stone.

Properly designed and constructed rock revetments are durable, flexible, and highly resistant to wave damage. Should toe scour occur, the structure can settle and readjust without major failure. Damage from large waves is typically not catastrophic, and the revetment can still function effectively even if damage occurs. From a coastal engineering perspective, a rock rubblemound revetment is a reasonable shore protection alternative.

Figure 3-2 is a design cross-section of a rock revetment using the design criteria from Section 2. The revetment portion of the project is extended to the +12 ft elevation. The revetment crest shown in Figure 3-2 is a somewhat truncated design, but is a reasonable response to minimize the structure footprint. Nevertheless, the footprint is increased in horizontal extent by 9 ft in comparison with the selected design alternative. The 9-ft increase in footprint would have to be accommodated by either placing the toe of the structure further onto State Land or by moving the crest landward and effectively shrinking the already sparse buffer space between the habitable dwellings and natural coastal hazards.

The hybrid seawall/rock revetment structure chosen as the preferred alternative has the following advantages:

- The reduced footprint allows construction within the original property lines while maintaining buffer space between the buildings and the shoreline,
- The hybrid revetment crest at +6 ft allows lateral shoreline access;
- Shoreline excavation and material volume is reduced.

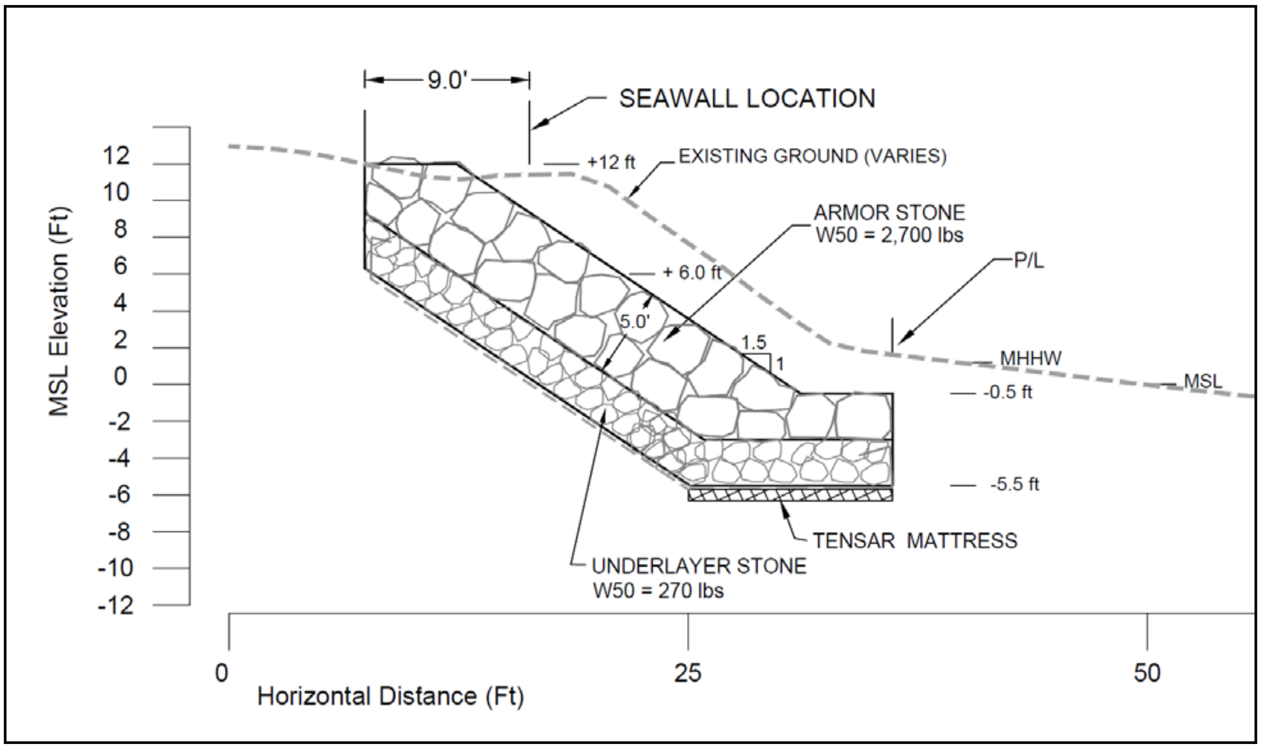


**Figure 3-2. Design cross-section for full revetment structure**

### 3.3 Seawall

A seawall is a vertical or sloping concrete, cement-rubble-masonry (CRM), cement-masonry-unit (CMU), or sheet pile wall used to protect the land from wave damage and erosion. A seawall, if properly designed and constructed, is a proven, long lasting, and relatively low maintenance shore protection method. Seawalls also have the advantage of having a relatively small footprint on the shore. Figure 3-3 is a typical design cross-section for a seawall structure at the Hololani.

The impervious and vertical face of a seawall results in very little wave energy dissipation. Hence, wave energy is deflected both upward and downward, and also a large amount of wave energy is reflected seaward. Reflected wave energy can inhibit accretion of sand in front of the wall, so that seawalls are not a suitable alternative if maintaining a beach is desired.

The downward energy component can cause scour at the base of the wall - therefore the foundation of a seawall is critical for its stability, particularly on a sandy and eroding shoreline. Ideally, a seawall should be constructed on solid, non-erodible substrate. Seawalls are not flexible structures, and their structural stability is dependent on the stability of their foundations.

If the foundation of the seawall is breached, hydraulic action can erode fill material behind the wall. With the loss of enough fill, the ground surface behind the seawall will collapse into a sink hole. When a sink hole is observed, repairs should be made as soon as possible or the wall will eventually fail. Repairs are usually done by excavating behind the wall, reinforcing the foundation with concrete, and replacing the fill with appropriately graded material. To avoid foundation problems, the seawall foundation should be well below the potential scour level, and this typically requires extensive excavation.

A seawall would be effective at preventing further shoreline erosion at the Hololani. However, while sand will likely still come and go with changing wave conditions, the reflective properties of the seawall will at times interfere with the accretion process. The coastal bluff along the shoreline fronting the Hololani has an elevation ranging between 10 and 12 ft MSL. Construction of a seawall will result in a significant vertical drop in front of the property. During periods when the beach sand is low and the water level (e.g. due to waves and tide) is high, lateral access will be difficult along the beach.

Another difficulty specific to the project site are weak soil conditions that will not support the concentrated weight of a seawall (see Section 4.1.14, Geotechnical Site Conditions). A foundation can be engineered for the soil condition, but it will likely require the use of bearing piles driven deep into the weak soils.

Summarizing, a seawall structure is not recommended for the Hololani shore protection:

- The vertical wall face will increase wave reflection, which inhibits sand accretion and degrades the beach;
- During conditions of low sand, the vertical seawall face will be an imposing edifice with a potentially dangerous vertical drop;
- A properly designed and built seawall will require extensive excavation and a pile-supported foundation.

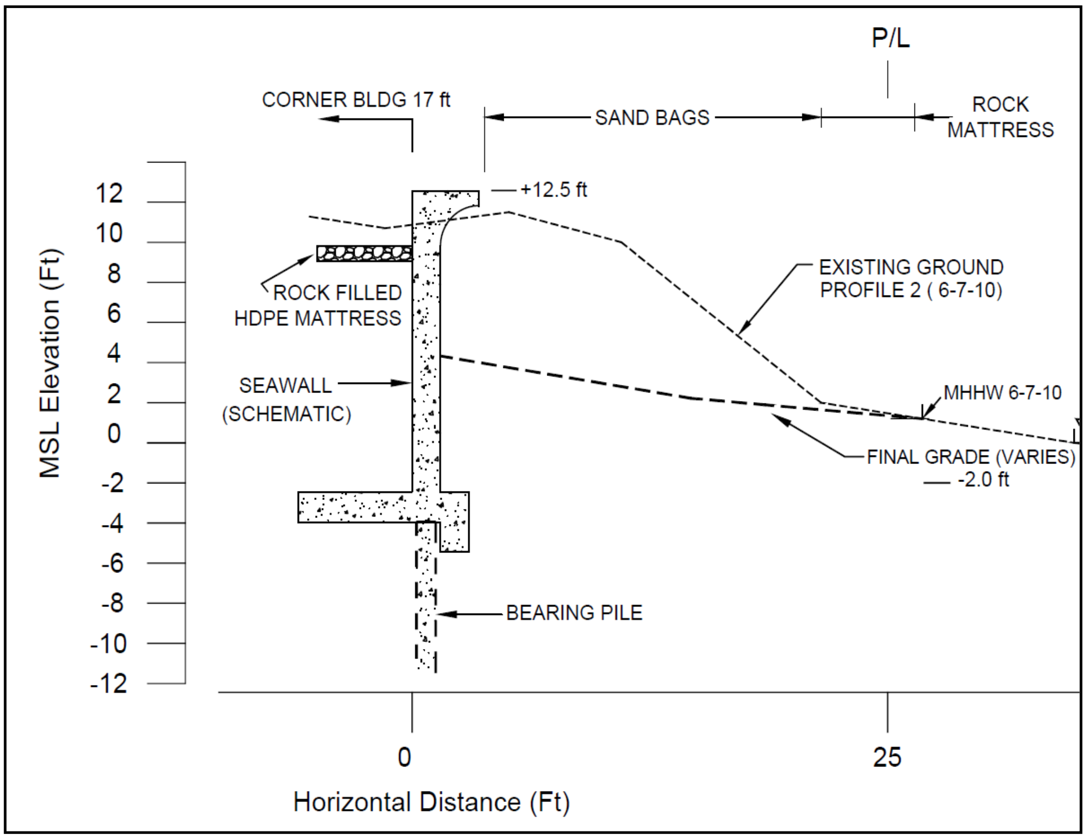


**Figure 3-3. Cross-section for a typical seawall structure at the Hololani**

## 3.4 Beach Nourishment

When sand loss is gradual and the beach has a high economic value for recreation and tourism, it is often good coastal management policy to replenish the littoral cell with sand from offshore or other sources. Historical aerial photographs indicate a regional loss of sand in the Kahana area, particularly along the reach between the Hololani and the Kahana Stream mouth, and virtually all of the properties south of the Hololani show some indications of erosion. On a regional level, there is no doubt that the coast would benefit from a large scale beach nourishment project.

There is seasonal and episodic transport of sand at Kahana Beach in general, and the Hololani reach in particular. South swells and Kona storms occasionally produce a high volume of sand in front of the Hololani. However, this is a seasonal or transient phenomena, and opposing forces (i.e. waves from the north) can quickly diminish this beach sand (see Section 4.1.11). The amount of sand that accumulates in front of the Hololani is in part due to the salient formed by the Pohailani seawall that blocks northward longshore movement of sand (see Figure 4.13). Pushing the beach further seaward would require distribution of sand all the way to the Kahana Stream mouth (See Figure 4-1). The Kahana littoral cell is an approximate 3,000-ft reach from S-Turns to the mouth of the Kahana Stream. Based on profiles and beach characteristics at the Hololani, and using a nominal beach crest elevation of +5 ft, a relatively modest beach nourishment effort to widen the beach by 20 ft would require approximately 20,000 cy of sand[3].

Beach nourishment along the Hololani reach alone would require the use of stabilization structures such as "T" groins and a more modest sand requirement of about 3,000 cy. A schematic for the layout of potential stabilizing structures for the Hololani reach is shown in Figure 3-4. While they are generally highly effective, these kinds of structures are also highly visible and constitute a major change in the character of the shoreline.

Beach nourishment requires a supply of sand that is ideally similar in character to the native beach sand. While sand may seem like a plentiful commodity, the reality is that good quality beach sand is in short supply in the Hawaiian Islands. Appropriate onshore sources of sand are limited in supply, and overseas sources have proven elusive. Inland dune deposits have been used for some nourishment efforts, but the process of transport by wind preferentially selects a naturally fine grain size, and dune sand therefore tends to be composed of grains that are too fine for many beach applications. Although offshore sand deposits also tend to have grain sizes that are finer than many beaches, the use of offshore sand is technically feasible. Potential borrow sources require exploration using marine geophysical survey techniques to characterize deposit size, and extensive sampling to ensure adequate grain size characteristics. Recovery can be done using clamshell or hydraulic dredging methods. Both the exploration and dredging efforts are expensive.

[3] Note: a project of similar size at Kuhio Beach in Waikiki was constructed at a cost of $2.3M (April 2012).

If a suitable sand source were found, beach nourishment applied to the entire littoral cell would greatly benefit the regional Kahana community and it should therefore be seriously considered for long-term beach management in this area. Beach nourishment of a 3,000-ft reach has not been done in Hawaii to date, and it would probably be a difficult construction task involving multiple beach access points. The project would ideally be cost-shared by the entire community with assistance and project leadership from the State.

If the Kahana littoral cell were replenished with sand, it is not clear how stable the sand would be, once placed. The volume of sand would likely slowly diminish with time, but with an unknown rate of attrition. It is known, however that individual storm events or other weather conditions can cause rapid beach changes, and dynamic areas such as the Hololani shoreline can lose their beach in a short time even if it is widened with beach nourishment. Although the beaches may eventually recover, such events can cause severe coastal erosion. With the present lack of buffer space between the buildings and the shoreline, beach nourishment is not a stand-alone solution to the coastal erosion hazard present at the Hololani.

Beach nourishment is not recommended as an immediate coastal engineering solution to the Hololani coastal erosion problem:

- Due to the advanced and critical erosion condition of the Hololani shorefront, a coastal protection structure would be recommended as a back-stop even if a regional beach nourishment project were implemented;

- Appropriate sand resources are difficult to find, and have not been identified in the area. A comprehensive prospecting effort consisting of geophysical surveying and sampling will be necessary;

- An appropriate beach nourishment project will affect the entire littoral cell from the Kahana Stream to S-Turns unless retention structures are used;

- Beach nourishment of the entire Kahana littoral cell is recommended as a regional beach management project.

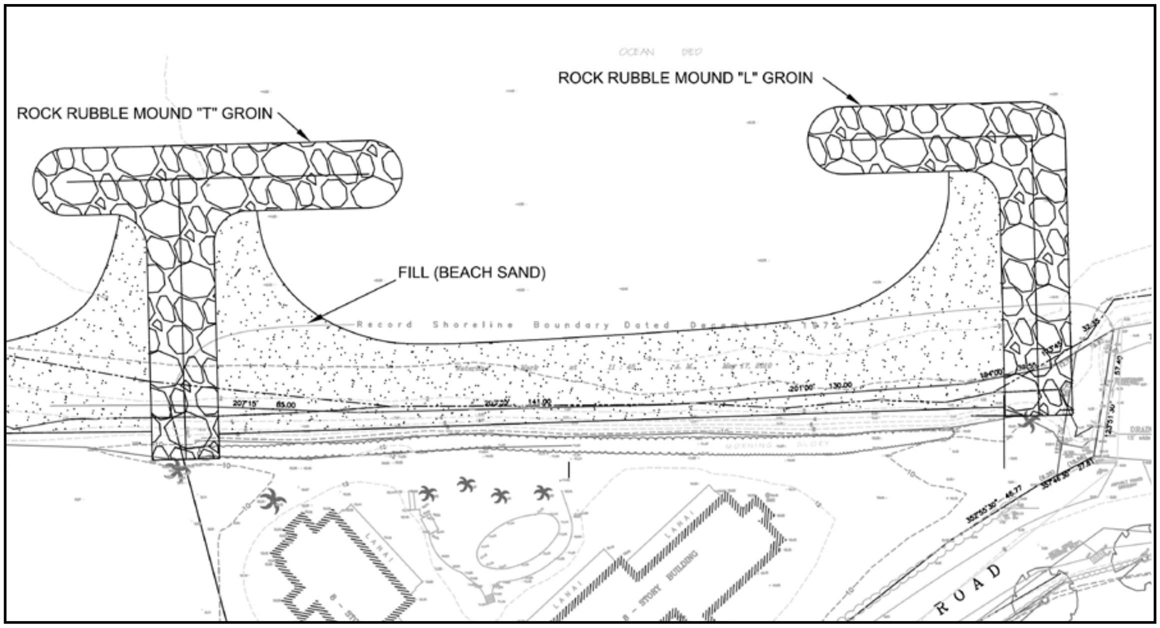


**Figure 3-4. Schematic of possible groin structures for use in the stabilization of sand fill**

### 3.5 Alternative Temporary Structures and Artificial Reefs

Alternative temporary structures include the type of sand bag revetment and articulating mattress bank protection that are currently in place at the Hololani. They are intended as temporary measures for stabilizing the shoreline while the design and permit process for a permanent structure proceeds. These structures do not meet engineering standards for long-term design for the kind of wave conditions that occur in West Maui. As such, they cannot be recommended for long-term coastal protection. The design life for these structures is difficult to predict with any certainty. The experience of the Hololani has been that maintenance of temporary structures is both difficult and expensive.

Various forms of man-made reef or shoaling structures have been proposed for beach protection. Reefs can act as mechanisms for wave energy dissipation through breaking, and can alter the direction of wave approach through the processes of wave refraction and diffraction. Although some success has been reported in these efforts, man-made shoals have not been designed, or even proposed, as structures engineered to protect infrastructure or property for extreme events, and do not meet coastal engineering design standards for that kind of protection. Such structures are also difficult to construct, as they are inherently shallow water features, yet require a substantial marine platform for placement.

Figure 3-5 is a photograph of an existing artificial reef in Queensland, Australia. The reef is constructed of large geotextile sand bags. Despite the large footprint of the structure, positive effects of the reef on shoreline stability have not been conclusively demonstrated.

In coral reef environments such as exist in Hawaii and offshore of the Hololani, the placement of offshore reef structures would probably cause the destruction of a large number of coral communities, and require substantial and expensive mitigation efforts. The probability of being granted a Federal or State permit for a man-made reef to be constructed over existing substrate off the Hololani is considered remote.

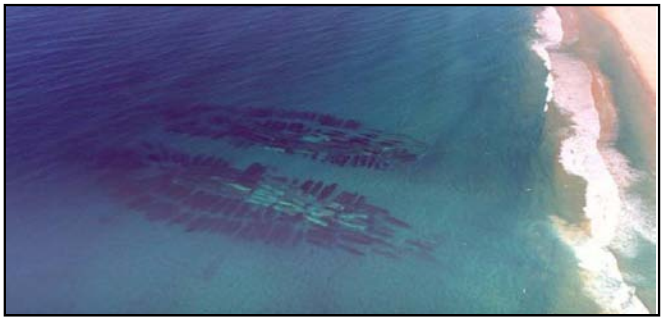

**Figure 3-5. Narrowneck Reef, Queensland, Australia (photo from ASR - www.asrltd.com)**

## 3.6 Consideration of Appropriate Alternatives

### 3.6.1 Introduction

The following section is modified from *Introductory Comments* contained in Appendix E. It is a generalized response to comments on the DEA by State and County agencies, and refers to the consideration of additional alternatives. A prevailing theme in the comments from the DLNR-OCCL, MDP, UH-Sea Grant and the MPC was the need to equally consider every possible alternative to the highest degree possible – and that alternative solutions had not been thoroughly explored in the DEA.

The preferred alternative has been brought to approximately a 60% level for design drawings in order to expedite the permitting process. This level is the combined product of both a coastal engineer, a structural engineer, and a geotechnical engineer, and is necessary for some permit considerations. The DEA discussed the following options in Sections 3.1 through 3.5:

- Hybrid seawall and rock revetment (the preferred alternative)
- Rock rubble-mound revetment (a satisfactory alternative)

- Seawall (not satisfactory)
- Beach nourishment with groin retention structures (not satisfactory)
- Regional beach nourishment (a preferred alternative for regional erosion)
- Use of artificially constructed offshore reefs (not satisfactory)

Agency comments asked the project to consider the following alternatives:

- Use of a groin system with no beach nourishment (DLNR-OCCL, MDP)
- Use of a groin system with nourishment (Sea Grant, MDP, MPC)
- Construction of an offshore breakwater (MDP, MPC)
- Construction of submerged breakwaters (MPC)
- Offshore reef enhancement by stimulating coral growth (MPC)
- Offshore reef construction using *Reef Balls* (MPC)

The objective of the present project has been clear since early 2007, when the Hololani was granted permits to implement temporary shore protection. SEI has been tasked to design engineered, permanent shore protection to ensure the safety of two eight-story condominium buildings and their inhabitants. The project must adhere to sound coastal engineering practice, and be able to meet appropriate oceanographic design criteria. For the preferred alternative, for example, SEI designed the structure for a 50-year return period wave height. Alternatives that are not part of accepted engineering practice, or are temporary or experimental in nature, can be explored as government or educational facility research projects, regional management programs, or dive club activities, but are not appropriate as permanent, engineered solutions to be advanced by professional engineers for a potentially catastrophic condition.

Although only the preferred alternative in the DEA was brought to a 60% level of design, that does not mean the other options were not fully considered. However, in all cases, there are compelling reasons for not bringing them past a concept design level.

In most respects, the additional alternatives that have been mentioned are variations on the alternatives presented in the DEA. For example, whether a design calls for two groins or four, with beach nourishment or without, the essential problems inherent with groin systems are the same. The adequacy of beach nourishment to protect the Hololani, with or without containment structures such as groins, is independent of the level of design considered, the number or nature of containment structures, or the volume of beach nourishment. The inherent problems with the use of an artificial offshore reef to protect the Hololani is mostly independent of whether the reef is composed of artificial structures such as reef balls, transplanted coral fragments, or is a submerged rubblemound breakwater.

First among considerations is whether the alternative is sound coastal engineering practice. In evaluating project alternatives, the primary objective of the project is of most importance. There are two modes of protection, shoreline armoring, and shoreline stabilization. *Shoreline armoring* is the use of seawalls, bulkheads, or revetments to "draw the line", or ensure that no further erosion takes place. Its use is justified when erosion threatens substantial development or human life. *Shoreline stabilization* is the use of breakwaters, groins, sills or reefs to moderate the coastal sediment transport processes. Shoreline stabilization may reduce, but will not eliminate the local erosion rate. The stabilization structures are often used in conjunction with beach nourishment.

The Hololani erosion situation is properly viewed as an emergency, with habitable structures being imminently threatened by shoreline erosion. At present, the north building is 15 ft from the shoreline escarpment. It is a potentially catastrophic condition. During the 2007 erosion event that preceded implementation of emergency shore protection, residents reported up to 10 ft of localized erosion in one area occurring in a single day. It is likely that the Hololani buildings would have been damaged and perhaps condemned if the emergency shore protection had not been installed.

The presence of a wide beach in front of the Hololani, whether natural or nourished, is no guarantee of safety. Tremendous amounts of beach sand can be transported during extreme events. Every year, beaches over 200 ft in width are drastically diminished or disappear at island beaches such as Kaanapali Beach and Oahu's North Shore. During the 1980 Kona Storm, the wide beaches at Wailea disappeared within hours, according to eyewitnesses.

It is the opinion of Sea Engineering that shoreline armoring – holding the line – is the proper course of action to ensure the safety of the Hololani buildings.

The preferred action must also minimize environmental impacts to the extent possible. Impacts may be viewed differently by different levels of government. For example, while the use of offshore structures may be appealing on a County level, these are outside of County jurisdiction and are generally viewed unfavorably by Federal agencies concerned with habitat issues and who exert influence on the federal permit process.

### 3.6.2 Groins

Groins, whether a single structure or a field of two or more structures, are meant to sequester beach sand and slow the longshore transport rate. However, by sequestering beach sand, a groin field will interrupt the natural longshore flow of sand and may have significant far-field and down-drift effects. For example, placing a groin field along the 400-ft reach of the Hololani will slow or prevent sand from being transported to the southern reaches of Kahana Beach under north swell conditions, and may cause beach narrowing far from the Hololani. Even with additional beach nourishment, the groins will alter wave patterns and have potentially damaging down-drift effects. These effects are well documented in the field of coastal engineering design, and are why the use of groins must be approached with care.

Modern groin design incorporates the use of “T-heads” in order to reflect a portion of incoming wave energy, cause spreading of the wave crests inside the groin to form crenulate-shaped beaches, and to help prevent the formation of dangerous currents (see DEA, Figure 3-4). T-head groins effectively compartmentalize the shoreline, and are usually used in conjunction with beach nourishment.

A groin field at the Hololani will permanently divide the Kahana littoral cell. At present, the cell effectively ends at the north end of the Hololani property due to the salient formed by the Pohailani seawall offset that inhibits sand from moving further north. However, if a regional beach nourishment project were initiated for the entire cell with a sufficient quantity of sand, the minor salient of the Pohailani seawall would be overwhelmed and sand could move up to the Kahana Stream (Kahea Point). A groin field at the Hololani would interrupt that flow and change the dynamics of the littoral cell forever. Such changes constitute major environmental impacts that need to be carefully reviewed and understood before being implemented.

Under existing federal regulations, the federal permit process for the construction of groins or other offshore structures as shore protection for the Hololani is difficult. Stakeholder agencies (U.S. Fish & Wildlife Service, NOAA Marine Fisheries) are extremely protective of marine habitat. All coastal waters in Hawaii are designated as Essential Fish Habitat, and structures placed in the water are considered to impact and potentially result in alteration or loss of marine habitat. Adverse impacts to, or loss of habitat require compensatory mitigation. Thus it is desirable to limit the use of structures in the water to the maximum extent practicable while still meeting the project purpose and objectives. Sea Engineering has recently been involved with two beach stabilization projects that include beach nourishment and T-head groins for stabilization. The Iroquois Point project is currently under construction, but took nine years from inception to receive all the necessary permits. The recently proposed Grays Beach project fronting the Waikiki Sheraton Hotel, which included three groins and sand fill, was abandoned due to difficulties with the federal permit process. The proposed shoreline revetment for the Hololani results in the absolute least impact to the marine environment; any of the other alternatives presented in the DEA or agency comments, such as sand fill or the use of offshore structures would result in significant marine habitat impacts.

Any kind of groin field built at the Hololani will have a profound regional environmental impact. It may well be that a future beach nourishment project, with or without groins, will be implemented at Kahana Beach. However, that project will require the participation of all shorefront land owners, as well as the State and the County. It will also require an extensive sand prospecting effort. It is beyond the capabilities of a single property to organize and fund such a project, and would likely result in a severe delay to the important goal of preserving the safety of the Hololani buildings.

### 3.6.3 Offshore reefs and breakwaters

The subject of using offshore reefs for coastal protection was developed in Section 3.5. Further expansion is required as both the MDP and the MPC requested additional information concerning offshore reefs, breakwaters, and submerged breakwaters.

#### *3.6.3.1 Offshore reefs*

In theory, offshore reefs can be used to help focus wave crests by the process of refraction, and help dissipate wave energy by the processes of wave breaking and turbulent drag due to friction. However, there has not yet been an artificial reef constructed in open coastal water for shore protection purposes. There are enormous difficulties involved with constructing these reefs, and their ability to work as desired is limited. And as previously discussed, they would potentially have a significant impact to marine habitat which would have to be mitigated in order to obtain the necessary approvals and permits. A natural fringing reef already exists offshore, and the existing water depths cause significant wave energy attenuation by breaking. Raising the reef by one or two feet may help induce additional wave breaking, however, in a high wave or storm condition, the combination of storm surge and wave setup will cause a water elevation rise and significant wave energy will still move over the raised reef and be transmitted to the shore. The phenomena of wave refraction and diffraction allow the wave crests to bend around the reefs and propagate in their lee. In the chaos of a severe storm, nearshore waves are extremely irregular, and depth-limited waves will be able to attack an unprotected shoreline escarpment even with an enhanced reef.

The promotion of coral growth by planting live coral fragments using epoxy glue or by “nestling” the fragments is being encouraged by some agencies for remediation purposes at damaged reef areas or for mitigation in some construction activities. However, trying to artificially farm coral in a wave zone has tremendous difficulties for a dive operation, and for the ability of the transplants to remain immobile long enough to generate a solid attachment.

### *3.6.3.2 Detached breakwaters*

Detached breakwaters are offshore breakwaters not connected to the land by a groin or other stem feature. The breakwaters reduce the amount of wave energy that reaches the shoreline and are used for beach stabilization. Wave diffraction around the ends of the breakwater causes waves to bend into patterns that favor the formation of a salient in the beach planform. If the salient extends out to the breakwater, it is termed a tombolo. Segmented breakwaters use several shore-parallel breakwaters in a line to change the wave patterns and sculpt the beach into useful crescent forms (see Figure 3-6 (a)). Use of structures of this type requires an adequate supply of beach sand to be effective. As with groins, a segmented breakwater system will tend to sequester the sand supply and may have negative effects on down-drift beaches. Breakwaters can cause currents to form near the structure and may cause localized areas of scour. Figure 3-6 (b) is a segmented breakwater off Sand Island in Honolulu. Detached breakwaters have a substantial viewplane impact.

Submerged breakwaters allow partial wave transmission over the crest of the breakwater. While submerged breakwaters have been used for beach stabilization, they are not common and are not particularly effective. Submerged breakwaters become less effective as the water level rises due to tides, high waves, or storm surge.

Offshore breakwaters and submerged breakwaters are used to shape beaches and enhance their stability. However, they are not used to protect substantial development, and have limited effectiveness during storm events with high waves and raised water levels.

Acquiring federal permits for placing offshore structures – groins as well as breakwaters - in a coral reef environment would likely be extremely difficult. It is doubtful that federal stakeholder agencies will approve the replacement of the natural offshore substrate with an artificial one of rock, geotextile tubes, or man-made objects.

In summary, in addition to being less effective than the preferred alternative put forward in the DEA, offshore and submerged breakwaters will occupy a significantly larger footprint, will have greater impacts to both coastal processes and the offshore marine environment, and will have greater negative visual impacts. There will also be significantly less chance of acquiring federal permits.

(a) (b)

**Figure 3-6 (a) Segmented breakwater and tombolos in Italy, and (b) breakwaters at Sand Island, Honolulu**

### 3.7 Design Alternative Placed Landward of the Certified Shoreline

Figure 3-7 shows a cross-section of the preferred alternative (hybrid revetment and seawall) with an alignment placed landward of the January, 2013 Certified Shoreline. A plan view is shown in Figure 3-8. This alignment places the toe of the structure between 14 and 21 ft further landward than the alignment shown in Figure 1-6. The options available for this alternative alignment are limited. A full revetment can not be constructed in the limited space between the buildings and the shoreline. The sheet pile portion of the hybrid structure cannot be properly anchored. A vertical wall can be built behind the shoreline with some difficulty due to poor foundation conditions, but it will have a greater negative effect on beach processes.

Following are legal, design, and environmental issues associated with a revised project alignment landward of the shoreline. The hybrid alternative is hypothetically considered as a viable alternative for these purposes. The vertical wall alternative will require less offset and has been examined in Section 3.3.

#### 3.7.1 Legal implications for design alternative landward of the Certified Shoreline

The Certified Shoreline is the legal demarcation between State and County jurisdictions. Placing the shore protection structure landward of the shoreline effectively removes it from the conservation district. The alignment would be wholly within the jurisdiction of the County of Maui. Placement outside of the conservation district would also remove any obligation to acquire an easement from the State and pay associated lease fees.

Depending on construction techniques, the project might not need to venture seaward of the MHHW mark, and in this case would not need to acquire a Section 404 permit from the USACE, or a Section 401 Water Quality Certification from the State of Hawaii DOH (see Section 1.5.3).

Removal of the need to acquire State and possibly Federal permits would greatly simplify the initial legal requirements for the project. There is a catch, however. While the proposed structure would be constructed behind the shoreline, the construction process itself would result in the excavation and removal of most seaward material. The shoreline would effectively migrate landward due to the construction. Any future actions by the Hololani that would trigger the need for a County of Maui SSV would require a new shoreline certification. The Certified Shoreline would then be located on the structure at the high wash of the highest wave (see Figure 3-7). As part or most of the structure would then be located in the conservation district, an easement and lease would be required from the State in order to process the new Certified Shoreline.

### 3.7.2 Design and construction implications for design alternative landward of the Certified Shoreline

The preferred alternative design is a hybrid structure consisting of a rock revetment and sheet pile wall. Rock revetment design will not be appreciably modified by the alternative alignment. The sheet pile design is complicated by the need for an earth anchoring system deployed a minimum of 15 ft landward of the sheet pile. The distance requirement is driven by the geotechnical properties of the soil. The simple earth anchor design is incompatible for some reaches of the new alignment due to the proximity of both the north and south buildings and the existing swimming pool (see Figure 3-8). According to the project structural engineer, there are no design options available to anchor the sheet piles in those problem areas. It may be possible to use steel sheet pile (a stronger element) and cantilever the piles without anchors. This approach is not recommended, and the steel sheet pile would eventually have corrosion issues.

Construction of the alternative alignment will require significant additional excavation. Approximately 6,500 cy of material will need to be excavated and disposed of, about 3,400 cy more than the preferred alternative (see Figure 3-7). Using compacted fill to replace the material after construction is not a realistic option. The fill would need to be emplaced behind a temporary containment wall, and would result in an erodible shoreline escarpment that would likely cause an increase in regional turbidity.

A vertical seawall (see Section 3.3) is a design option that could be constructed landward of the Certified Shoreline. The design is complicated by poor foundation conditions (see Section 4.1.14), and a stone or concrete wall would likely need to be pile-supported over much of the reach. A vinyl sheetpile wall is not considered a viable option without the support of a fronting rock revetment (i.e. the preferred alternative).

### 3.7.3 Environmental implications for design alternative landward of the Certified Shoreline

While the preferred alternative maintains the existing alignment of the shoreline, the design alternative landward of the Certified Shoreline would result in a modified shoreline position 15 to 20 ft landward of the existing shoreline. Excavation of all material seaward of the structure would be necessary in order to construct the toe of the structure. Using an erosion rate of 0.8 ft per year, this shoreline change would represent 19 to 25 years of natural erosion (note: this rate is based on historical data (see Section 4.8); a contemporary rate may differ).

The modified shoreline position would result in a recessed planform along the Hololani shoreline reach that would likely affect coastal processes at the site and nearby properties. Figure 3-9 is a schematic representation of the new +6 ft MSL topographic contour that would result from the alternative alignment. The effects of the recessed planform would be:

- The shallow embayment caused by the excavation might enhance the volume and stability of seasonal sand accretion at the site. The groin effect of the Pohailani salient would be increased due to the added offset, and a similar effect would initially be in place at the southern boundary with the Royal Kahana. However, additional sand or increased residence time of sand in front of the Hololani would come from a net decrease of sand elsewhere in the littoral cell.

- A new salient created at the Royal Kahana boundary would be unstable. Without armoring, the area will rapidly erode. This erosion will tend to progress to the south until sand is redistributed and a new, uniform shoreline alignment is achieved.

### 3.7.4 Summary for a design alternative landward of the Certified Shoreline

- A design alternative placing the entire structure landward of the 2013 shoreline is possible if a vertical seawall option is pursued. A vertical seawall would have greater negative impacts on beach processes than the preferred alternative.

- The hybrid structure with vinyl sheet pile can not be built due to the lack of offset distance for sheet pile earth anchors.

- If a hybrid type structure could be designed (for example, with cantilevered steel sheet pile), the plan form of the shoreline would be recessed in front of the Hololani. Sand resources might be more stable in the reach, at the expense of other portions of the littoral cell. The north boundary of the Royal Kahana would become an erosion hot spot and experience rapid loss of property. A recessed planform would require extensive additional excavation and move the shoreline 15 to 20 ft landward.

## 3.8 Summary Table

Table 3.1 is a summary and comparison of available shore protection options for the Hololani shoreline. The pros and cons of each option and approximate cost are listed.

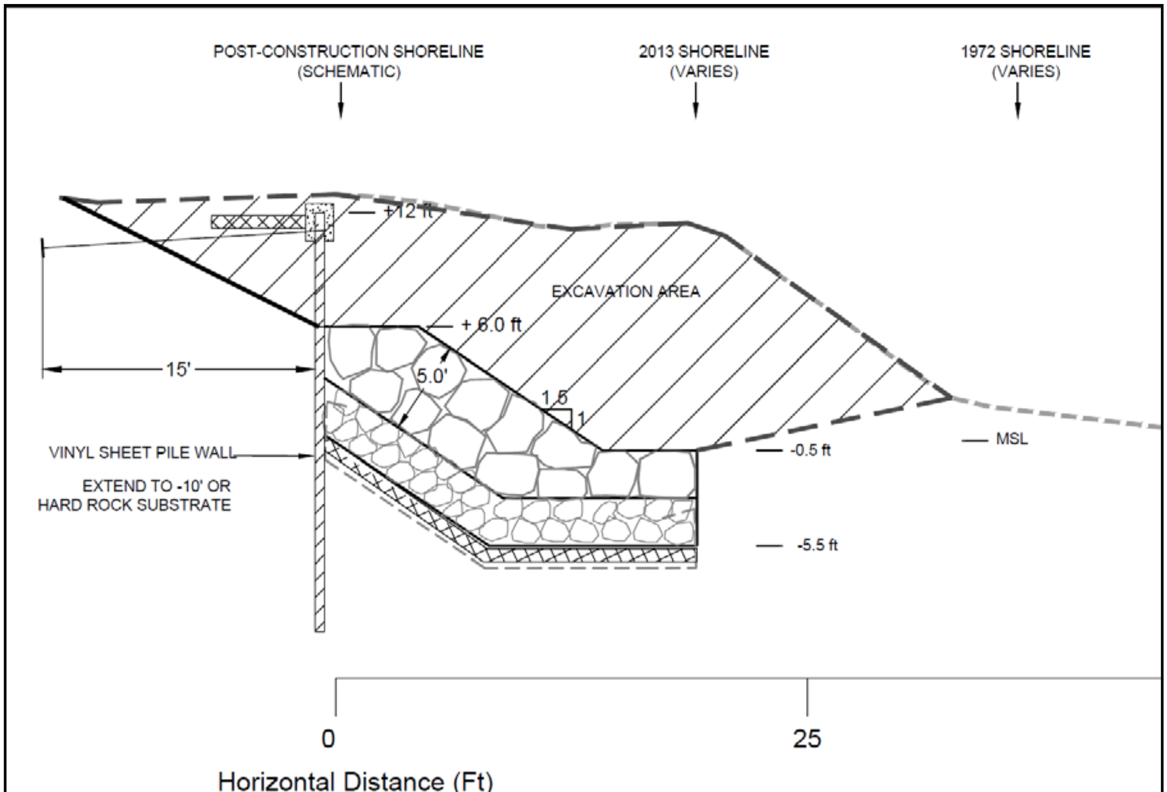


**Figure 3-7. Cross-section of hybrid design placed behind 2013 shoreline**

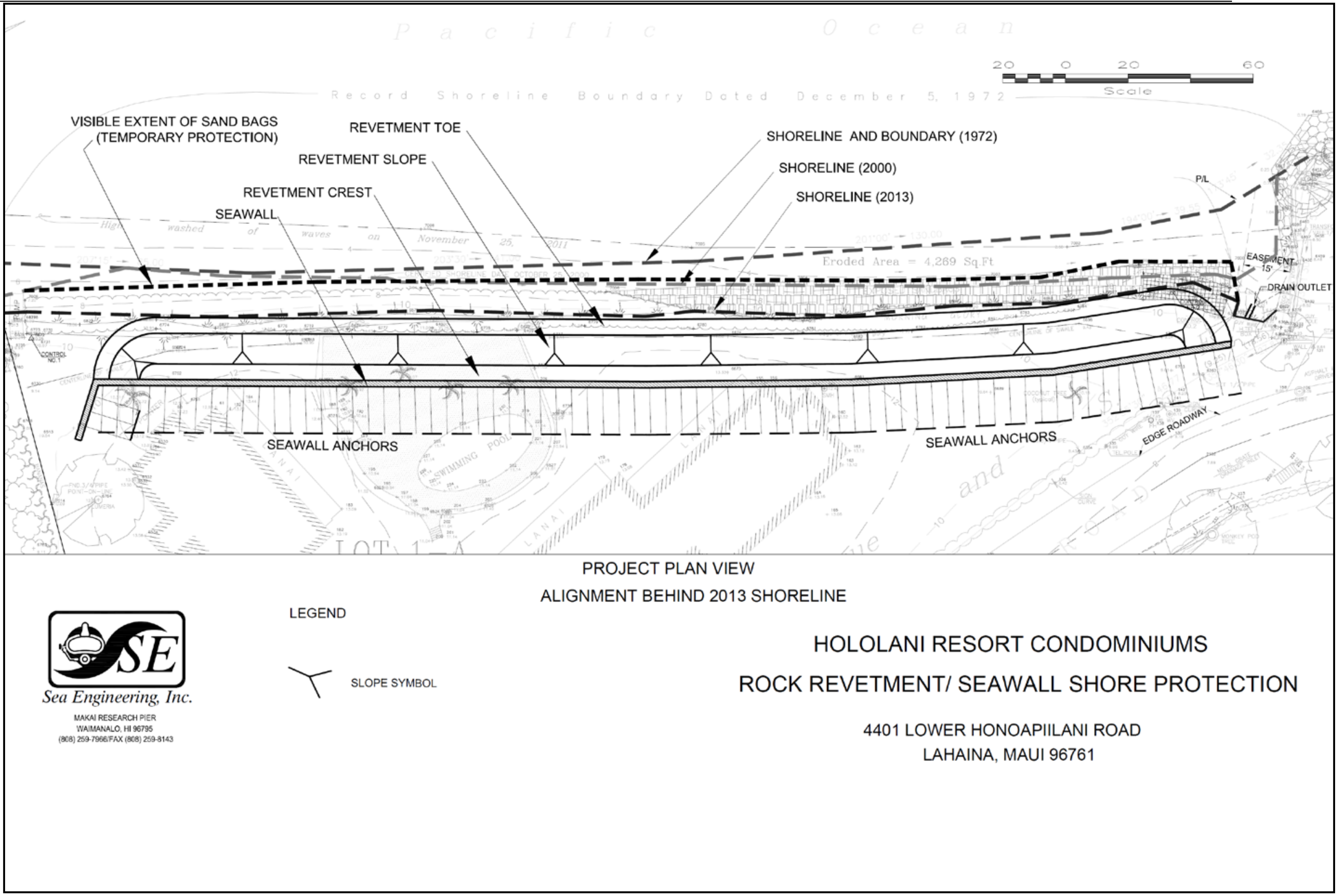


**Figure 3-8. Alternative alignment: plan view of hybrid design placed landward of 2013 shoreline**

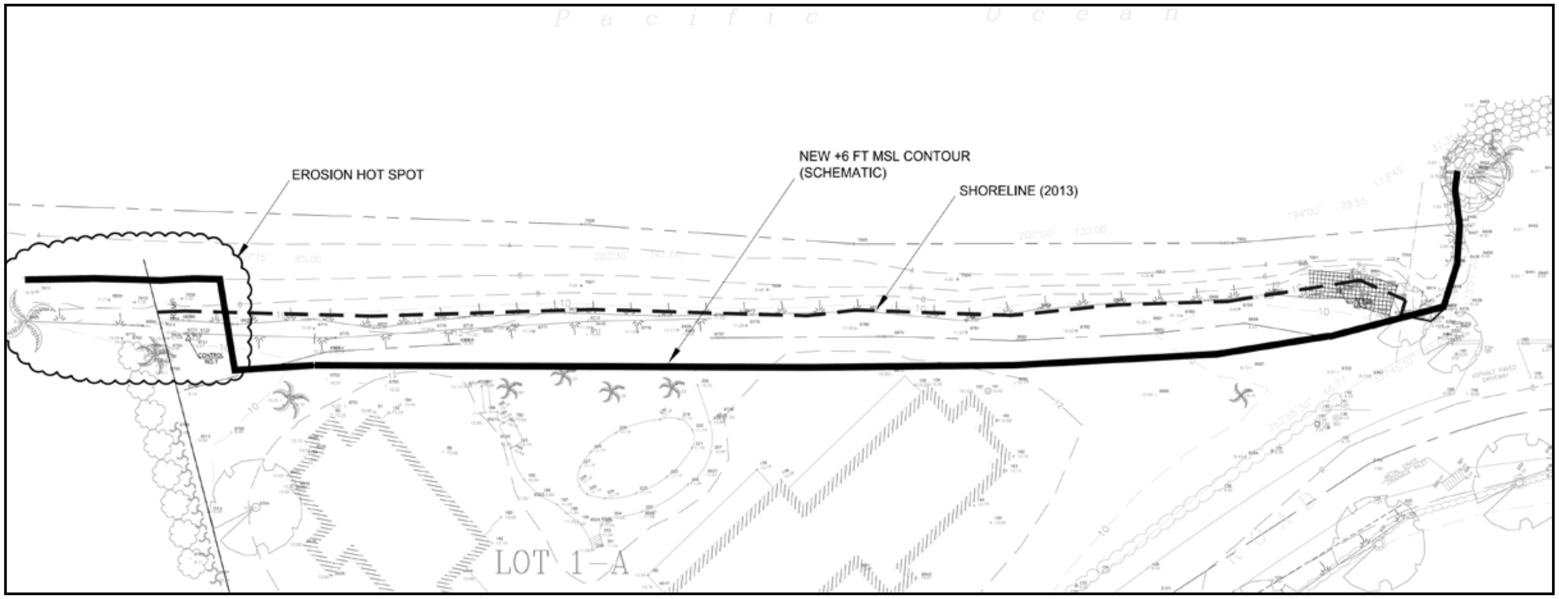


**Figure 3-9. Alternative alignment: approximate +6 ft MSL contour and erosion hot spot at southern property boundary**

**Table 3.1. Comparison of Alternatives**

| Alternative | SEI Rating | Pros | Cons | ROM Costs |
|---|---|---|---|---|
| 1. Hybrid Seawall/Revetment | Preferred | • Combines qualities of revetment and seawall:<br>• Shoreline armoring (maximum protection);<br>• Minimize reflection;<br>• Minimize coastal footprint;<br>• Minimal impact on coastal processes;<br>• Rugged, adaptable structure<br>• Provides lateral access<br>• Least impact on marine environment | • May have minor erosion effect on neighboring property | $2M |
| 2. Revetment | Second Preferred | • Shoreline armoring (maximum protection);<br>• Minimize reflection;<br>• Minimal impact on coastal processes;<br>• Rugged, adaptable structure | • 30% greater footprint than (1);<br>• May have minor erosion effect on neighboring property<br>• lateral access | $1.8M |
| 3. Seawall | Not Appropriate | • Minimum footprint<br>• Shoreline armoring (maximum protection) | • Weak soils will not support gravity wall – bulkhead style only;<br>• Maximum reflection;<br>• May have minor erosion effect on neighbor property;<br>• Large vertical drop | $1M - $2M |
| 4. Beach Nourishment | Not Appropriate (regional solution only) | • Will improve beach quality;<br>• Regional application will solve regional problems | • Shoreline stabilization only – will allow additional erosion at Hololani; does not ensure adequate protection<br>• Will require sand source;<br>• Must be regional: local application will spread over entire littoral cell; Requires participation of all stakeholders including County and State agencies. | $3M - $5M |
| 5. Beach Nourishment w/ Structures | Not Appropriate (requires study) | • Will create semi-permanent beach cells | • Shoreline stabilization only – will allow additional erosion at Hololani;<br>• High impact on marine environment;<br>• Will require sand source;<br>• Will have profound far-field effects – needs detailed study;<br>• Will change beach aesthetics and viewplane;<br>• Difficult federal permit process<br>• Most appropriate as a regional solution. | $10M |
| 6. Offshore Breakwater | Not Appropriate | • None | • Shoreline stabilization – will allow additional erosion at Hololani;<br>• High impact on marine environment;<br>• Will require sand source (if used with beach nourishment);<br>• Will have profound far-field effects – needs detailed study<br>• Will change beach aesthetics and viewplane;<br>• Difficult federal permit process;<br>• May cause localized current formation (safety hazard) | Unknown ($1.5M - $3M) |
| 7. Artificial Reef | Not Appropriate | • None | • Unproven as shore protection – will allow additional erosion at Hololani;<br>• High impact on marine environment;<br>• Far-field effects unknown– needs detailed study;<br>• Difficult federal permit process | Unknown ($1M - $5M) |

| Alternative | SEI Rating | Pros | Cons | ROM Costs |
|---|---|---|---|---|
| 8. Alignment Behind 2013 Shoreline | Not Appropriate | • Reduces permitting requirements | • Vertical seawall is the only viable design for this alternative<br>• Other options (if possible) would require a recessed planform that would increase the erosion rate of adjoining property to the south<br>• Recessed planform would require extensive additional excavation and move shoreline 15 to 20 ft mauka | $2M |

# 4. NATURAL ENVIRONMENTAL SETTING

## 4.1 General Physical Environment

The physical geography of project site area is dominated by the ancient West Maui Volcano, which has collapsed and eroded into the West Maui Mountains. The nearly circular shape of the volcano has generated a similarly curved shoreline. The area is part of the Maui Nui complex, that includes the islands of Maui, Lanai, Molokai, and Kahoolawe. The islands form a ring of protection that limits wave exposure (see Figure 4-8). The channels between the islands shape the tide-generated currents, and the prominent land masses, especially Haleakala volcano, greatly affect the local wind conditions. The Kahana area borders the Pailolo channel, which runs between Maui and Molokai.

### 4.1.1 Climate

As with the rest of the Hawaiian Islands, the climate of West Maui is characterized by two seasons: generally dry summers influenced predominately by trade winds, and more inclement winters that see the occasional passage of mid-latitude storm systems accompanied by regional rainfall events. Winter months are also characterized by shifting wind patterns, including the south and west winds known as Kona conditions, and light and variable conditions that can transform into mid-day sea breezes and night-time land breezes due to diurnal heating and cooling of the inland mountains.

Air temperatures and rainfall follow the seasonal cycle, with cooler temperatures and most rainfall occurring during the winter months of December, January, and February. Average monthly rainfall is 3 to 4 inches during the winter, and less than 0.5 inches in the summer. Orographic (elevation-based) precipitation occurs year-round in the higher mountain elevations and can produce flash floods at lower elevations. Winter temperatures vary from about 65°F to about 80°F (typically in the 70's), and warm to the mid-70's to high 80's in the summer months.

### 4.1.2 Air Quality

The air quality in West Maui is good. Local sources of pollution include vehicle exhaust from Lower Honoapiilani Road, and windblown dust from fields and other open areas during dry periods. These effects are temporary and usually cleared by typical prevailing wind conditions. Occasional high levels of fine particulate matter (popularly known as *"Vog"*) may occur due to the confluence of activity of Kilauea volcano and light wind conditions

### 4.1.3 Noise

The Kahana area is relatively quiet. Vehicular traffic on Lower Honoapiilani Road generates some road and engine noise, but it is a slow moving highway and levels are low. Probably the most noticeable noise in the area is due to the ambient wind and sea conditions. “White noise” – low level, but broad spectrum sounds due to breaking waves – will actually help mask other sound sources.

### 4.1.4 Wind Conditions

The predominant winds in the Hawaiian Islands are the northeast tradewinds. During the summer months of April through October, the tradewinds occur 80-95 percent of the time with average speeds of 10-20 mph. The tradewind frequency decreases to 50-60 percent of the time during the winter months, when southerly or “Kona” winds may occur. Kona winds are generally associated with local low pressure systems. Kona conditions occur about 10 percent of the time during a typical year, with winds ranging from light and variable to gale strength. A severe, relatively long duration Kona storm which occurred in January 1980 produced sustained wind speeds of 30 mph, with gusts in excess of 50 mph, from the southwest. Winds of hurricane strength occur infrequently in Hawaii, but they are important for design purposes because of their intensity.

The blocking effect of the West Maui mountains decreases the influence of tradewinds in the Kahana area, and causes the winds that occur to come from a more northerly directions (following the land contours). A land-sea breeze condition caused by the diurnal heating and cooling of the land often predominates in coastal areas. However, wind speeds in the channels between Maui, Molokai, and Lanai can be significantly faster due to the funneling effect caused by the land masses.

### 4.1.5 Coastal Morphology and Geography

The shoreline along the coast is governed by the underlying volcanic rock formations. The coastal processes along the regional shoreline are complicated by the bay and headland morphology, the presence of offshore fringing reefs, and a seasonal wave climate with two opposing wave approach directions.

Figure 4-1 is an aerial photograph showing geographic features near the Kahana area, and the condominium resorts and hotels along the reach. Kahana Beach extends north from the Kahana Beach Resort to the Pohailani Condominiums, a distance of approximately 1,500 feet. The sand beach is reliably in place between the Kahana Beach and Royal Kahana structures, although the width of the beach may vary seasonally. In front of the Hololani, the beach presence varies more dramatically. Southern swell during the summer, and Kona conditions during the winter tend to move sand from the southern reaches of Kahana Beach, constructing a beach in front of the Hololani. Conversely, waves from the north tend to move the sand to the south, at time completely removing the beach and causing shoreline erosion. Sand is now rarely, if ever, present in front of the Pohailani Condominiums, although older aerial photographs show that beaches were not uncommon there in the past.

The shoreline is hardened with seawalls from the Pohailani north for about 650 ft. The mouth of Kahana Stream is about 1,500 ft north of the Hololani property. Alluvial cobbles and boulders have built a broad delta formation at the stream mouth that tends to focus nearshore waves and trap sand. There are no engineered shore protection structures south of the Hololani except for a seawall fronting the Kahana Beach hotel. The shoreline is composed of hard rock outcrops south of the Kahana Beach hotel, and becomes a prominent salient south of S-Turns.

### 4.1.6 Bathymetry and Nearshore Bottom Conditions

The bathymetric and nearshore conditions at the Hololani are typical for the region, with a fringing offshore reef interrupted by pockets of sand. A complete survey of the offshore biological conditions was conducted by Marine Research Consultants and is included as an appendix to this report (MRC, 2010 see Appendix D). Figure 4-2 is a photograph of the project shoreline that shows the existing temporary shore protection, including rock-filled Tensar mattresses used for toe protection, and the geotextile sand bag revetment. The amount of sand on the beach is highly variable, and depends in part on the local wave climate. Waves from the south during the summer tend to bring sand to the Hololani from the more southern reaches of Kahana Beach. Conversely, waves from the north and northeast tend to strip the sand away (see Section 4.1.11).

During conditions when the beach sand has migrated away from the area fronting the Hololani, the substrate is littered with stony plates ("shingle") of beach rock (Figure 4-3, also 4-13(a), Section 4.1.11). Beach rock is formed by weakly cemented beach sand, and there are linear outcrops visible in many nearshore areas of West Maui. The presence of the beach rock fragments – and the apparent onshore migration of these fragments during high surf conditions – are an indication of offshore sources. The beach rock fragments are difficult and uncomfortable to walk on, and have been destructive to the existing temporary emergency shore protection. The substrate underlying the sand and beach rock, and also existing behind the temporary shore protection structure is red clay that is typical of much of the Maui shoreline (Figure 4-4). The red clay is easily suspended in the water column when eroded, and can lead to significant turbidity issues when exposed (see Figure 4-5).

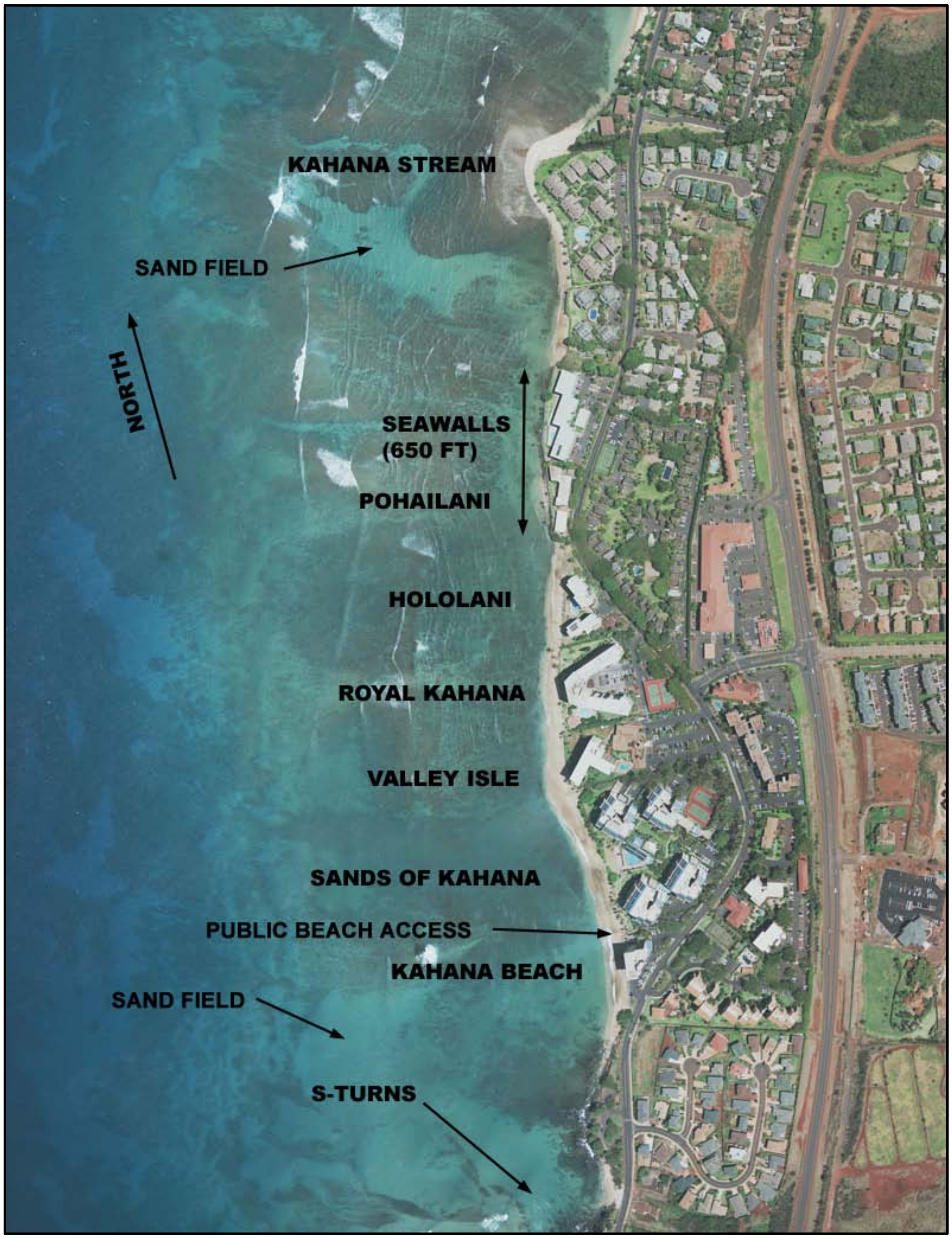


**Figure 4-1. Condominiums and geographic features near Kahana Beach**

According to the MRC report, the nearshore area within 50 ft of the shoreline and water depths of 1 to 5 ft consists of a pitted and eroded limestone platform covered with a veneer of calcareous sand and rubble (Figure 4-6). This area is devoid of living corals, but covered with a invasive red alga.

Past the nearshore intertidal area, the bottom substrate is a limestone reef platform covered with sand and rubble that extends offshore for about 300 ft to about 25 ft of water depth and transitions to a sandy plain.  Aerial photographs indicate that hard reef bottom is re-established further offshore, past the limits of the MRC survey.

Figure 4-6 is a set of bathymetric profiles at the Hololani that show the shoreline escarpment (including elements of the temporary shore protection), and the nearshore bottom configuration. Much of the area that will be excavated for placement of permanent shore protection is now occupied by geotextile sand bags.

Offshore sand fields appear to exist to the north near the Kahana Stream mouth, and to the south near S-Turns (see Figure 4-1).  The sand thickness in these areas has not been investigated.

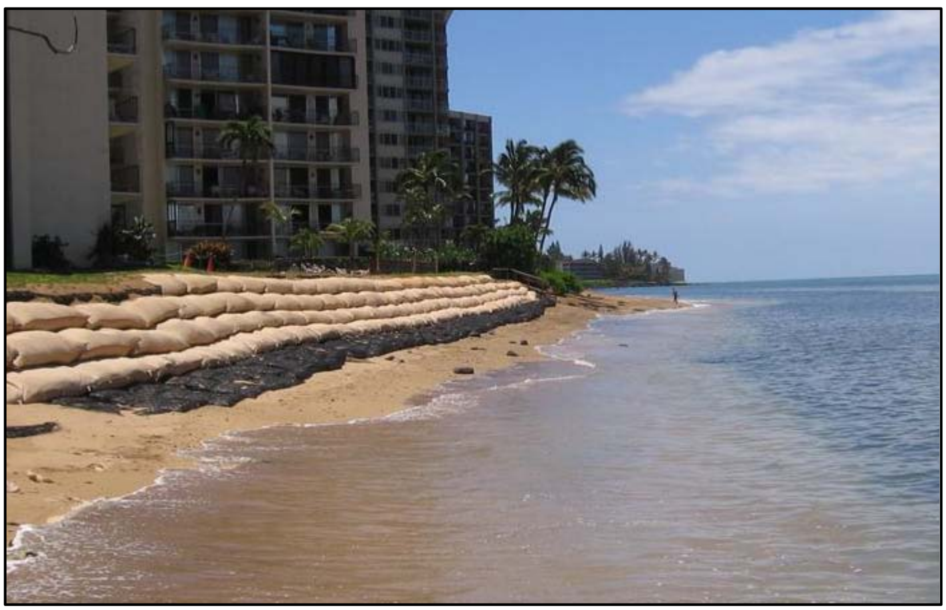

**Figure 4-2.  Shoreline at Hololani showing the existing shoreline bluff with temporary shore protection**

**Figure 4-3. Beach rock fragments exposed during low sand conditions; note draped rock mattress shore protection at adjoining Royal Kahana property**

**Figure 4-4 Native substrate at Hololani showing red clay layer**

**Figure 4-5. Turbidity caused by erosion of red clay substrate**

**Figure 4-6. Sand, rubble and red alga in the nearshore zone**

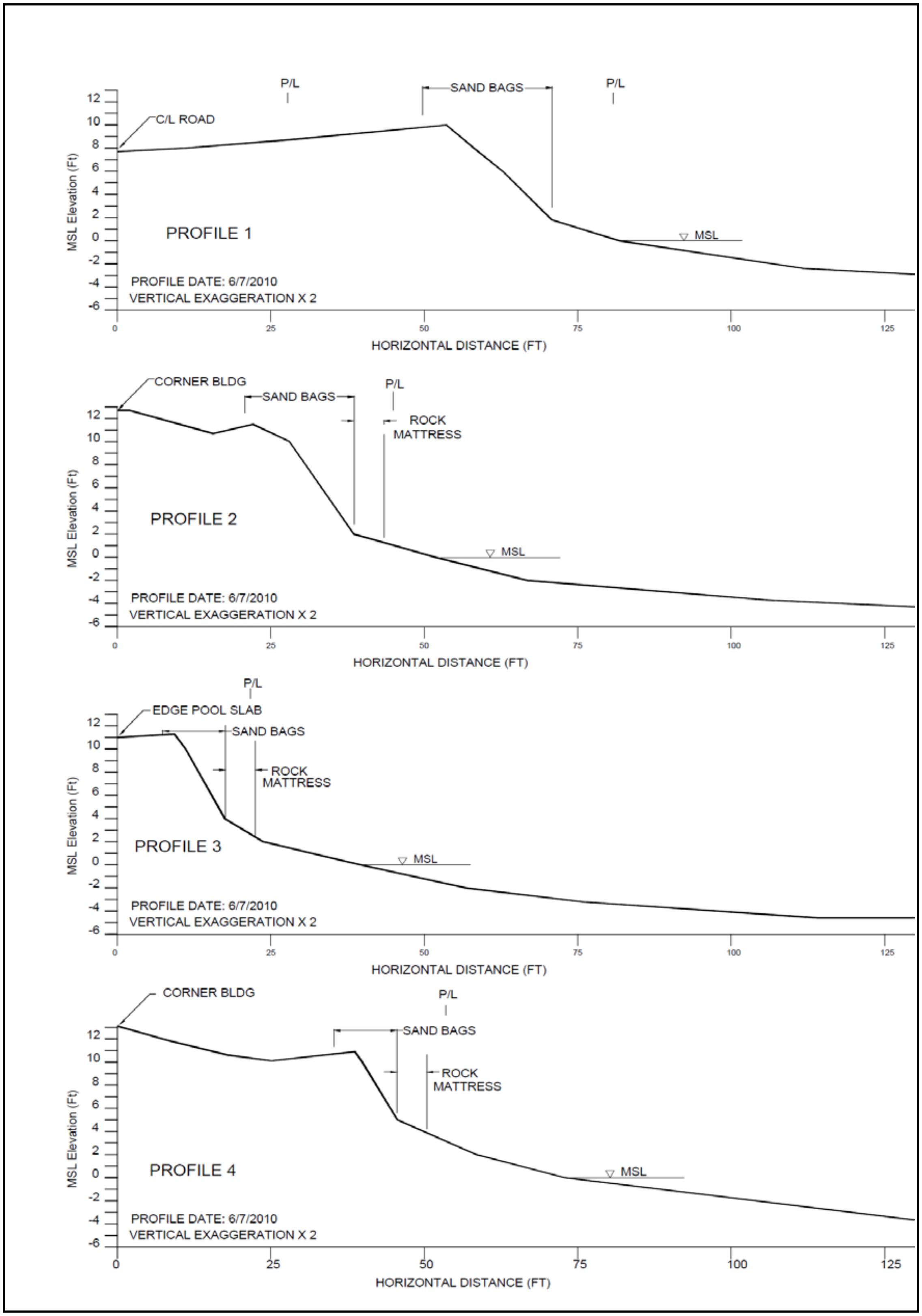


**Figure 4-7. Shoreline profiles from June, 2010**

### 4.1.7 Wave Conditions

*4.1.7.1 Waves in Hawaii*

Surrounded by the Pacific Ocean, the Hawaiian Islands are subject to wave approach from all directions. The general Hawaiian wave climate can be described by four primary wave types: 1) trade wind waves generated by the prevailing northeast trade winds; 2) North Pacific swell produced by mid-latitude low pressure systems; 3) southern swell generated by mid-latitude storms of the southern hemisphere; and 4) Kona storm waves generated by local low pressure storm systems. In addition, the islands are occasionally affected by waves generated by tropical storms and hurricanes.

Tradewind waves may be present in Hawaiian waters throughout the year and typically have periods of 6 to 8 seconds and deepwater wave heights of 4 to 8 feet.

Southern swell is generated by southern hemisphere storms and is most prevalent during the months of April through October. These long, low waves typically approach from the south with periods of 12 to 20 seconds and typical deepwater wave heights of 1 to 5 feet.

Kona storm waves are generated by mid-latitude low-pressure system and occur at random intervals throughout the year, especially during the winter months. They approach from the south through west directions. Some winter seasons have several Kona storms; others have none. Kona storm waves typically have periods raging from 6 to 10 seconds; wave heights are dependent upon the storm intensity, but deepwater heights can exceed 15 feet.

North Pacific swell is produced by severe winter storms in the Aleutian area of the North Pacific, and by other mid-latitude low-pressure systems. North swell may arrive in Hawaiian waters throughout the year, but is largest and most frequent during the winter months of October through March. North swell approaches from the west through north, and occasionally from the north-northeast, with periods of 12 to 20 seconds, and typical deepwater heights of 5 to 10 feet. However, deepwater wave heights of over 20 feet - with breaking wave heights of over 30 feet - are not uncommon.

Although statistically rare, large waves generated by the close passage of hurricanes can be extremely destructive. Hurricane Iwa (1982) and Hurricane Iniki (1992) each caused serious damage to beaches and property on Kauai, as well as at locations on Oahu and Maui.

The Kahana shoreline is at the center of the Maui Nui complex, which consists of the islands of Maui, Lanai, Molokai, and Kahoolawe. These islands shelter the Kahana area from direct exposure to northeast trade wind generated waves and North Pacific swell from the northwest. However, the area is exposed to southern swell, North Pacific swell from the north, and occasional swell from the west. Figure 4-8 shows the direct wave exposure at the Hololani.

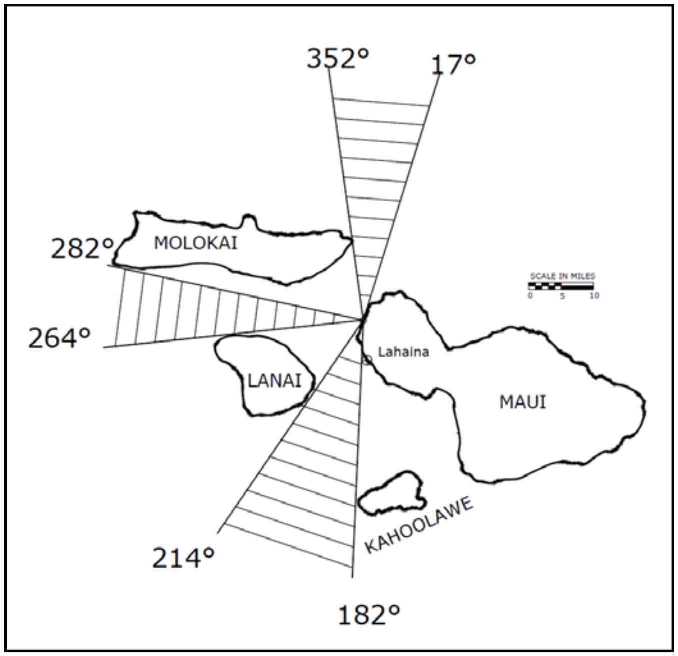


**Figure 4-8. Wave exposure at Kahana**

### *4.1.7.2 Extreme Wave Heights*

As discussed above, the Hawaiian Islands are annually exposed to severe storms and storm waves generated by passing low-pressure systems, tropical storms including hurricanes, and large swell waves generated by distant North Pacific or South Pacific storms.

Wave hindcast data were generated by SEI using the WaveWatchIII (WW3) wave generation model and 11 years of meterological data for the North and South Pacific oceans. Data were hindcast at three locations (or "virtual buoys") in the Maui Nui complex at locations designed to best capture ocean swell from the North, West, and South.

The hindcast data produces hourly records of wave and wind conditions for the 11-year period from 1997 through 2008. The data were used as a statistical basis for generating 50-year return period wave information.

Recurrence interval wave heights are listed in Table 4-1. For the north sector, the 50-year deepwater wave height is 22.5 feet with a period of 15 seconds. For the west sector, the 50-year deepwater wave height is 15.7 feet with a wave period of 16 seconds. For the south sector, the 50-year deepwater wave height is 6.6 feet with a wave period of 16 seconds.

The SEI data set does not include the effects of Hurricane Iniki, which occurred in 1992. Hurricanes are rare in Hawaii, but the effects are severe. The U.S. Army Corps of Engineers (USACE) also has a network of virtual buoys for forecast and hindcast purposes as part of their Wave Information Studies (WIS) program. Station 81114 showed a maximum significant wave height of 18.9 feet from the Southwest during Hurricane Iniki.

**Table 4-1. Recurrence interval wave heights**

| Recurrence Interval: | 2-Year | 5-Year | 10- Year | 25-Year | 50-Year | 100-Year |
|---|---|---|---|---|---|---|
| North Sector | 15.6 ft | 17.6 ft | 19.0 ft | 21.0 ft | 22.5 ft | 24.0 ft |
| West Sector | 9.2 ft | 11.0 ft | 12.4 ft | 14.3 ft | 15.7 ft | 17.1 ft |
| South Sector | 75.6 ft | 5.9 ft | 6.1 ft | 6.4 ft | 6.6 ft | 6.8 ft |

*4.1.7.3 Transformation of Waves in Shallow Water*

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. As waves slow down with decreasing depth, the process of *wave shoaling* steepens the wave and increases the wave height. *Wave breaking* occurs when the wave profile shape becomes too steep to be maintained. This typically occurs when the ratio of wave height to water depth is about 0.78, and is a mechanism for dissipating the wave energy. Wave energy is also dissipated due to bottom friction. The phenomenon of *wave refraction* is caused by differential wave speed along a wave crest as the wave passes over varying bottom contours, and will cause wave crests to converge or diverge and may locally increase or decrease wave heights. Not strictly a shallow water phenomenon, w*ave 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.

Two numerical wave models were used to analyze the transition of waves from deepwater to the project site. The *SWAN* (Simulating Waves Nearshore) model was used to calculate the propagation of waves from deepwater to a nearshore zone offshore of the Kahana area. The numerical wave model *CGWave* was then used to model the refraction, diffraction, and shoaling characteristics near the project site. Figure 4-9 is an example of the SWAN modeling, and shows the effects of waves approaching Maui from the Southwest. Figure 4-10 is an example of CGWave modeling showing waves approaching the project site from the North. Figure 4-11 is the CGWave wave modeling result overlaid on an aerial photograph. The figure shows wave convergence areas overlying images of wave breaking, illustrating the accuracy of the modeling.

The wave models allow the calculation of wave transformation from deep water to the breaking point. Three wave approach directions were modeled, with wave height parameters from Table 4-1. Waves from both the north and south directions are at high angles to the project shoreline and are therefore highly refracted as they move to the project site. Waves from the west have a direct approach to the shoreline and refraction effects are minimal.

Table 4-2 lists the combined diffraction, refraction and shoaling coefficients as a transmission coefficient, and resulting breaking wave heights for the three incident directions and wave parameters. The largest breaking wave height of 13.1 ft is derived from a 50-year wave from the northwest.

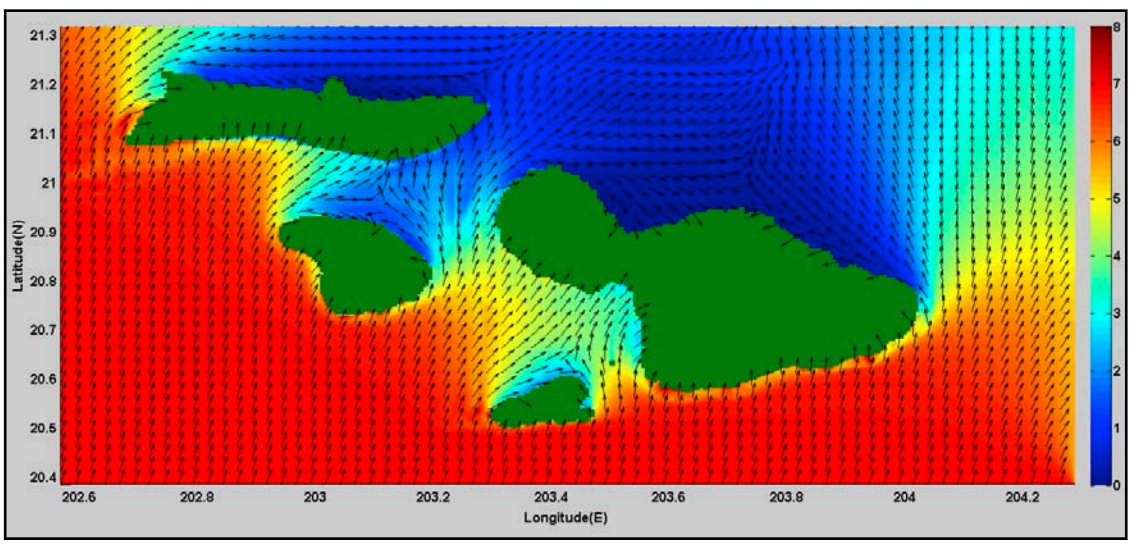


**Figure 4-9. SWAN model for southern swell**

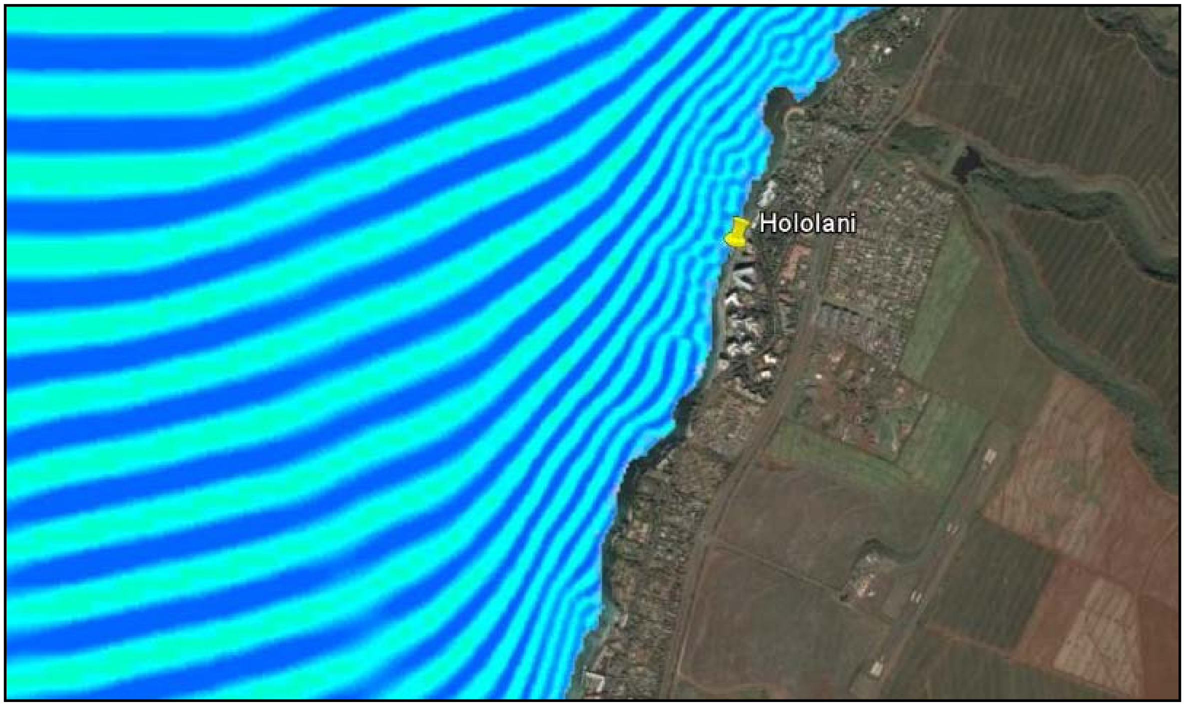


Figure 4-10. North swell wave approach at Kahana (background image from Google Earth)

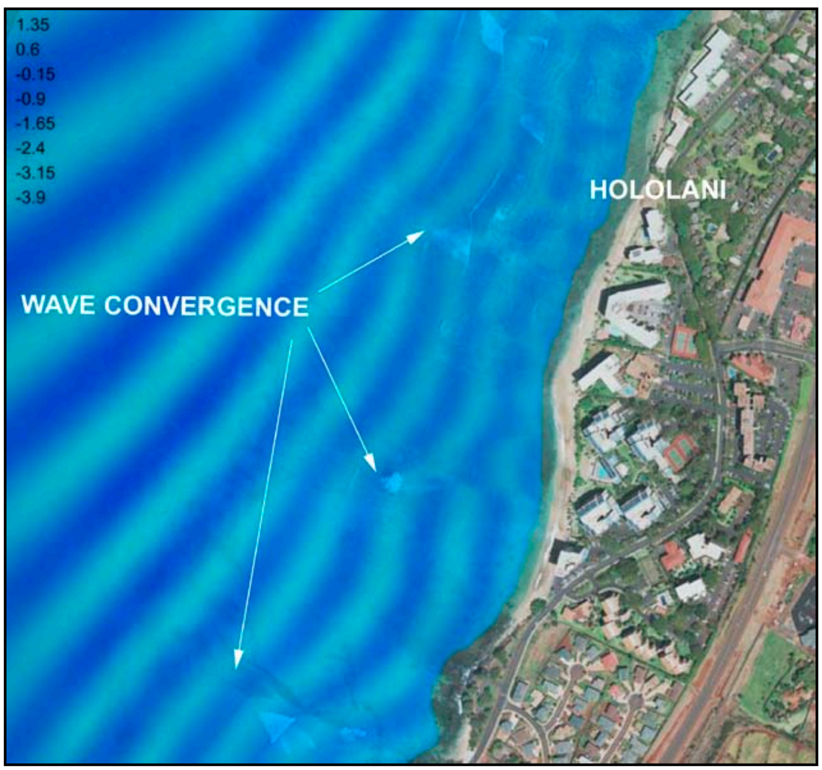


Figure 4-11. North swell with nearshore convergence at breaking points

**Table 4-2. Breaking Wave Heights for 50-year waves**

| | Wave Period | Transmission Coefficient (Kt) | 50-Year Deepwater Wave Height ($H_0$) | Breaking Wave Height ($H_b = H_0 \times K_t$) |
|---|---|---|---|---|
| North Sector (315°) | 14s | 0.57 | 22.4 ft | 12.8 ft |
| | 16s | 0.585 | 22.4 ft | 13.1 ft |
| North Sector (360°) | 14 s | 0.55 | 22.4 ft | 12.3 ft |
| | 16 s | 0.56 | 22.4 | 12.5 ft |
| West Sector (270°) | 14 s | 0.59 | 15.7 ft | 9.3 ft |
| | 16 s | 0.61 | 15.7 ft | 9.6 ft |
| South Sector (200°) | 14 s | 0.61 | 6.6 ft | 4.0 ft |
| | 16 s | 0.61 | 6.6 ft | 4.0 ft |

*4.1.7.4 Depth Limited Wave Heights*

Because waves break in water depths proportional to their height, waves in shallow water are necessarily limited in size. Wave heights are generally highest at the offshore breaking point and gradually diminish in size as the bottom depths decrease. Attenuation of wave height in the on-shore direction is due to the combination of wave breaking and friction. Large storm waves will initially break offshore in deep water, then reform and continue shoreward as progressively smaller waves, with wave breaking occurring several times before reaching the shore. The wave height at the shoreline is therefore dependant on the water level at the shoreline. To determine the actual design wave height at the shoreline, the design stillwater level must be determined.

Large breaking waves contribute to a phenomenon known as *wave setup*, which is a super-elevation of the water level that adds to the stillwater level rise during storms and other high surf conditions. Water level rise is also caused by wind, pressure levels, tides, and other oceanographic phenomena.

### 4.1.8 Tides and Stillwater Level Rise

*4.1.8.1 Tides at Lahaina*

The tides in the Hawaiian Islands are semi-diurnal in nature, with pronounced diurnal inequalities (i.e. two tidal cycles per day with the range of water level movement being unequal). The nearest official tide station to the project site is at Lahaina. The National Oceanic and

Atmospheric Administration, National Ocean Service (NOS) tide levels at Lahaina are shown in Table 4-3:

**Table 4-3. Lahaina Tides**

| | |
|---|---|
| Highest Tide (estimated) | 1.6 feet |
| Mean Higher High Water | 1.2 feet |
| Mean High Water | 0.7 feet |
| Mean Tide Level | 0.0 feet |
| Mean Low Water | -0.7 feet |
| Mean Lower Low Water | -1.0 feet |

*4.1.8.2 Stillwater Level Rise*

In coastal engineering analysis, the total stillwater level rise for a storm event is considered is a linear combination of:

1) Astronomical tide (Sa),
2) Sea level rise due to atmospheric pressure reduction (Sp),
3) Wind tide caused by wind stress component perpendicular to the coast line (Sx),
4) Wind tide caused by wind stress component parallel to the coast line (Sy), and
5) Wave set-up on the beach as a result of the breaking waves (Sw).

or,

$$S = Sa + Sp + Sx + Sy + Sw$$

The combination of Sp, Sx and Sy is defined as storm surge. Outside of the breaking surf zone, the stillwater level is composed of storm surge added to the tide level. Wave setup (Sw) is a phenomenon caused by wave breaking, and occurs only inside the surf zone.

The total water level rise is therefore a combination of astronomical tide, storm surge and wave setup. In Hawaii, wave setup is typically the largest contribution to the stillwater level rise

For design purposes, an astronomical tide (Sa) of 1.2 feet (Mean Higher High Water) is considered appropriate due to the frequency of occurrence of this level of high tide.

The design water level rise due to the drop in pressure (Sp) is considered to be 0.3 feet. This is the case for a very strong winter low pressure system, or a hurricane approach at some distance from the project site, similar to conditions during Hurricanes Iniki.

Wind setup (Sx + Sy) is calculated analytically using methodology presented by C. L. Bretschneider (1967). A maximum wind setup of 0.2 feet at the project site is due to a 50-year wind speed of 34.2 kts from the West.

The storm surge for design is therefore 0.5 feet, which is a combination of pressure setup and wind setup.

Wave setup (Sw) was determined by using methodology described in the U.S. Army Corps of Engineers Shore Protection Manual (1984). Based on the initial breaker heights of 13.1 feet for a 50-year wave from the north (Table 4-2), the wave setup is calculated to be 1.5 feet.

#### *4.1.8.3 Other Stillwater Level Rise Phenomena*

**Mesoscale Eddies**

Hawaii is subject to periodic extreme tide levels due to large oceanic eddies that have recently been recognized and that sometimes propagate through the islands. These eddies, termed *mesoscale eddies* (Merrifield, 2004) produce tide levels that can be on the order of 0.5 ft higher than normal for periods up to several weeks.

It is now accepted among Hawaii coastal scientists and engineers that a 2003 erosion event that damaged the shoreline at Kaanapali, south of the project site, was caused by the vigorous and sustained occurrence of southern swell in combination with pronounced short-term increases in sea level due to the presence of mesoscale eddies (SEI 2003, Vitousek 2007). The highest sustained sea level measurements recorded at the Honolulu Harbor tide gauge occurred during September of 2003 (Firing and Merrifield, 2004). Comparison and analysis of tide level, satellite altimetry, and hydrographic measurements around the Hawaiian Islands suggest that the 2003 extreme water levels were largely due to an anti-cyclonic eddy with an offshore water level rise of about 0.5 ft and a diameter of roughly 186 miles. Figure 4-12 is a graph of measured and predicted tide at Honolulu Harbor during June of 2003. The figure shows a sustained super-elevation of water level of at least 0.5 ft throughout the month.

Nearshore waves are typically depth limited, meaning that the amount of wave energy that reaches the shoreline is directly tied to the water level at the shoreline. As wave energy increases exponentially with wave height, a water level increase of 0.5 ft can dramatically change the coastal processes at a particular shoreline. The existing equilibrium can be suddenly modified and large amounts of beach and shoreline sediment can be transported away in a relatively short period of time.

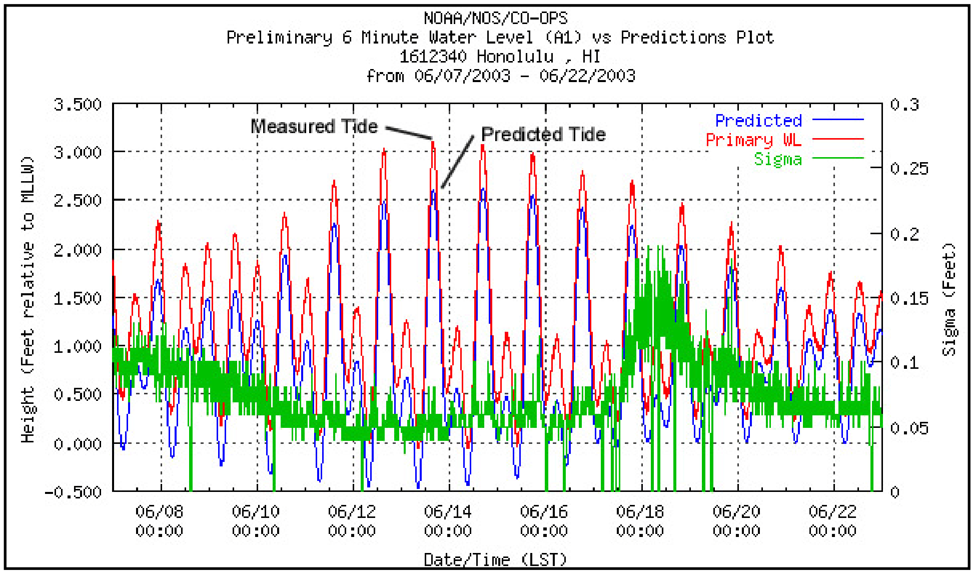


**Figure 4-12. NOS tide record for June, 2003 showing influence of a mesoscale eddy**

## Global Sea Level Rise

It is also widely recognized that global warming has caused a world-wide acceleration in sea level rise. Estimates vary widely, but a 3-foot rise by the end of the present century is in use as a reasonable figure (Fletcher, 2009). However, sea level rise predictions in the Hawaiian Islands are not clear, and the state-of-the-science is in early stages. For example, there are indications that the effect in the islands will be delayed due to the remote location of the archipelago.

Given the uncertainties in stillwater elevation due to these short-term and long-term phenomena, and the need for a long term coastal engineering design, an extra 0.75 ft of stillwater level rise was added for the project design.

Table 4-4 shows the total project stillwater level rise of 3.95 feet to be a combination of astronomical tide (1.2 feet), storm surge (0.5 feet), wave setup (1.5 feet), and an extra 0.75 (say 0.8) feet to account for miscellaneous oceanographic phenomena including global warming induced sea level rise.

**Table 4-4. Combined Stillwater Level Rise for 50-year Conditions**

| Parameter | Stillwater Rise (ft - MSL) |
|---|---|
| Tide (MHHW) | 1.2 |
| Storm Surge | 0.5 |
| Wave Setup | 1.5 |
| Other Phenomena | 0.8 |
| Total Stillwater Level Rise | 4.0 |

### 4.1.9 Design Wave Height

As waves shoal and their forward speed is reduced, they tend to become higher and steeper. Waves break when the waveform becomes too steep to be maintained. This occurs at ratios of water depth to wave height (d/Hb) that range from 0.5 to 1.4, and depends on wave steepness and bed slope. An accepted value, based upon solitary wave theory, is a ratio of 0.78. In effect, wave heights over a reef flat are depth-limited, meaning there is a maximum wave height that can occur for a given depth of water. The bottom conditions at the project site are highly variable, with numerous patch reefs, holes, and sand bars. Based on offshore profiles, an average MSL water depth of 3 ft is used for calculation of nearshore design wave heights, and a d/Hb ratio of 0.78 is used for breaking wave criteria.

Table 4-5 shows the calculation of the design water depth and the design wave height given a d/Hb ratio of 0.78:

**Table 4-5. Design wave heights**

| Parameter | Design Conditions (ft) |
|---|---|
| Total Stillwater Level Rise | 4.0 |
| Nominal Water Depth (MSL Datum) | 3.0 |
| Design Water Depth | 7.0 |
| Design Wave Height | 5.5 |

### 4.1.10 Currents and Circulation

Local currents in the Hawaiian Islands are generally driven by the semi-diurnal tides. Surface currents can also be driven by the wind, and currents nearshore are predominately affected by the presence of reefs and breaking waves. Current measurements conducted by SEI off Kaanapali in

1986 showed prevailing currents to be reversing in nature with ebb tide currents flowing to the north and flood tide currents directionally inconsistent, flowing both north and south. The change in current direction lags the tide change by one to two hours. North flowing currents are stronger than south flowing currents with average speeds of about 0.25 knots. Flood tide currents flow at about half the speed of ebb tide currents.

Storlazzi and Jaffe (2006) found that vigorous tradewind conditions that prevail during the summer season caused relatively strong downwind currents. During periods of calm, termed “relaxation events”, currents were tide-dominated and skewed to the northeast. Large wave conditions prevalent during winter months induced offshore flows.

#### 4.1.11 Shoreline Characteristics and Coastal Processes

The Hololani is at the approximate center of the Kahana littoral cell, a 3,000-ft reach from S-Turns north to the mouth of the Kahana Stream (see Figure 4.1). As is typical of west-facing beaches, coastal processes on the Kahana shoreline are heavily influenced by waves that approach at high angles from opposing directions, and beach characteristics are dominated by the longshore transport of sand as a result. The shoreline is subject to waves from the south, west, and north, with seasonal and short term effects on the sand beach. Very generally, waves from the south during the summer season tend to push sand north so that a beach is created in front of the Hololani. Winter waves and strong trade wind waves from the north tend to transport the sand south and denude the beach. However, large volumes of sand accretion have also occurred due to Kona storm waves during the winter season – these waves are generally from the southwest.

Figure 4-13 (a) is a photograph taken in July, 2006 that shows the natural condition of the beach during a denuded period before the installation of temporary shore protection. Some of the geomorphological features discussed in Section 4.1.5 are illustrated on the figure, including the vertical shoreline escarpment, the prevalent beach rock shingle, and an exposed layer of clay. Figure 4-13 (b) shows the beach in December, 2007 with an abundance of sand that had accreted due to a Kona storm that occurred the day after the installation of temporary protection was completed.

While the seasonal changes are pronounced, there appears to have been a net loss of sand from the overall system, so that the protective sand beach has been lost with increasing frequency, leaving the red clay shoreline embankment increasingly exposed. The erosion of the reach fronting the Hololani has caused a recession of the Hololani shoreline relative to the adjoining property to the north (the Pohailani Condominiums), as their shoreline is fixed by protective structures. As a result of the offset planform, sand tends to accumulate at the north end of the Hololani during south swell or Kona storm conditions, and sand transport to the north past the

Pohailani is inhibited.  At the present time, these conditions make the north end of the Hololani the effective terminus of the Kahana littoral cell.  If sand resources were to increase, from a beach nourishment effort, for example, sand could be expected to regularly fill the fillet created by the Pohailani offset, and once again be transported north to Kahana Stream.

A corollary to the above postulation of an on-going slow regional depletion of sand resources is that, despite the extreme beach changes, the longshore transport is balanced and the total amount of active sand in the littoral cell over a relatively short (i.e. one-year) time interval is a constant, limited quantity.  This balance was shown by Eversole (2003) in a study of beach processes at Kaanapali, a similar west-facing littoral cell.  In effect, when sand accretion occurs in front of the Hololani, the same volume of sand is depleted from elsewhere in the littoral cell and vice versa.

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After the construction of the temporary emergency shore protection in December 2007, the shoreline was qualitatively monitored for sand accretion, erosion and damage to the structure, with the following observations:

- The temporary structure did not appear to interfere with the sand accretion process.  Kona conditions (winds and waves from the south and southwest) brought high volumes of sand to the Hololani reach (see Figure 4-13(b));

- The Pohailani seawall forms a salient that helps retain sand on the Hololani reach.

- Southern swell appears to move sand to the Hololani, however the site is sheltered from that swell direction.  During seasons with lower than normal wave heights (such as summer, 2010), the beach may accrete little sand.  Conversely, the summer of 2011 had strong southern swell activity late in the summer, and an unusually wide beach was established as a result.

- Waves from the north and northeast have a highly detrimental effect on the beach, transporting sand away and to the south.  The winter of 2010/2011 had a high frequency of large wave events from that direction, with resulting erosion of the shoreline, scour of the nearshore substrate, and damage to the structure.

The sand that accretes in front of the Hololani appears to be carbonate sand – the most common type of sand on Hawaiian beaches.  However, the remainder of the beach south of the Hololani contains a high percentage of olivine sand.  Olivine is a dense mineral with a specific gravity of 3.2 to 3.4 (versus carbonate sand that is less than 2.7).  Its small grain size and high density cause olivine sand to be resistant to transport processes. In effect, the carbonate sand acts as a mobile layer on top of the more stable olivine.

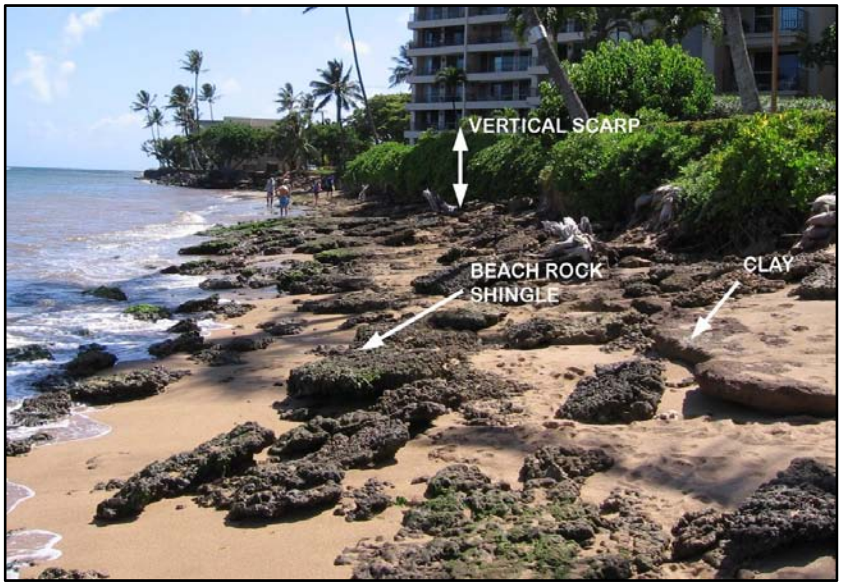



**Figure 4-13 (a). Denuded beach condition, July 2006**


**Figure 4-13(b). Accretion of sand due to the occurrence of a Kona storm soon after construction of the temporary emergency structure**

Figure 4-14 is a compilation of shoreline photographs showing various stages of sand accretion and depletion at Hololani between 2007 and 2011. Winter photographs show both accretion and depletion episodes that are likely responses to favorable Kona storms or north swell conditions, respectively. Spring photographs (e.g. April 2009) are likely to show depleted conditions, while late Summer shows beach accretion due to southern swell (e.g. September 2009, September 2011).

The next section (Section 4.1.12) discusses the shoreline history at Hololani, and shows an apparent depletion of sand resources between 1949 and the present. The erosion problems along the Kahana Beach shoreline, including the Hololani, are very likely due to the combination of the dynamic north-south seasonal transport and the regional depletion of sand resources.

In response to agency comments, Appendix E contains an additional treatment of coastal processes at Hololani in the *Introductory Comments*. Section headings include:

- Regional Loss of Sand and Shoreline Erosion
- Coastal Armoring and Beach Loss
- The Domino Effect

**January 2007**

**January 2008**

**January 2009**

**April 2009**

**September 2009**

**January 2011**

**September 2011**

**Figure 4-14. Variations in sand accretion at Hololani, 2007 - 2011**

### 4.1.12 Shoreline History

Sea Engineering, Inc., and Makai Ocean Engineering (SEI and MOE, 1991) conducted an aerial photographic analysis of beach erosion at West Maui and other locations. The study included the Hololani property and evaluated changes of the vegetation line as shown on aerial photographs from 1949, 1961, 1975, and 1988. The aerial photographs were ortho-rectified to remove scale and distortion errors, and the beach vegetation lines were digitized for comparison. Selected discrete transects were then used to represent the behavior of the beach.

Figure 4-14 shows an updated version of the study done in 2001 and incorporating a 1997 aerial photograph. The vegetation line changes are measured relative to the first available aerial photograph (1949). Seaward excursions of the vegetation line are shown positive, landward excursions are shown negative. The erosion/accretion trends are consistent across Kahana Beach, and show a maximum accretion in 1961. By 1975, the vegetation line had moved back inland past the 1949 position to a position of maximum erosion. The beach apparently stabilized and grew between 1975 and 1987, but sand bags were emplaced in 1988 in response to a new threat of erosion. The trend that led to the emergency sand bag shore protection can be seen in the 1987 and 1988 data, where recession of between 3 ft and 9 ft of the vegetation line occurred. Between 1988 and 1997 the shoreline was relatively fixed, with minor excursions of the vegetation line probably caused by wave overtopping and localized damage to the sand bags.

Analysis of the vegetation line position shows the results of long term erosion or accretion trends or extreme erosional events. Short term beach changes that may be misleading are avoided using this methodology. However, using the vegetation line as a reference does not necessarily show changes in the beach itself. While the vegetation line can be fixed or recede, the sandy beach can grow wider or narrower in response to wave conditions or sand supply conditions that may not necessarily immediately affect the vegetation line. The 1975 aerial photograph shows that, while the vegetation line was in its most receded position at that time, the beach itself was wider relative to its present condition. Comparison of the 1975 photograph with later photographs show that the sand beach continued to narrow although the vegetation line moved seaward until 1987 and was then fixed by sand bag shore protection in 1988. In particular, the 1975 photograph shows a wide beach in front of the seawall that fronts the Pohailani condominium, adjacent to and north of the project site. This beach is completely absent in the 1997 photograph.

The 30-year erosion trends are shown in Figure 4-15 as the year 2027 shoreline position, as estimated from the 1997 position. The erosion rate was calculated only using data to 1988, as the shoreline became relatively fixed at that time (note: the sand bags deteriorated or were removed after completion of the study). Projected shoreline positions, assuming an absence of shore protection, vary from –38 ft to –12 ft, with the average for all transects being -24 ft, or 0.8 ft per year. The high standard deviations associated with these numbers give uncertainty to the projected values and are also indicative of the dynamic nature of the beach over the period of the study.

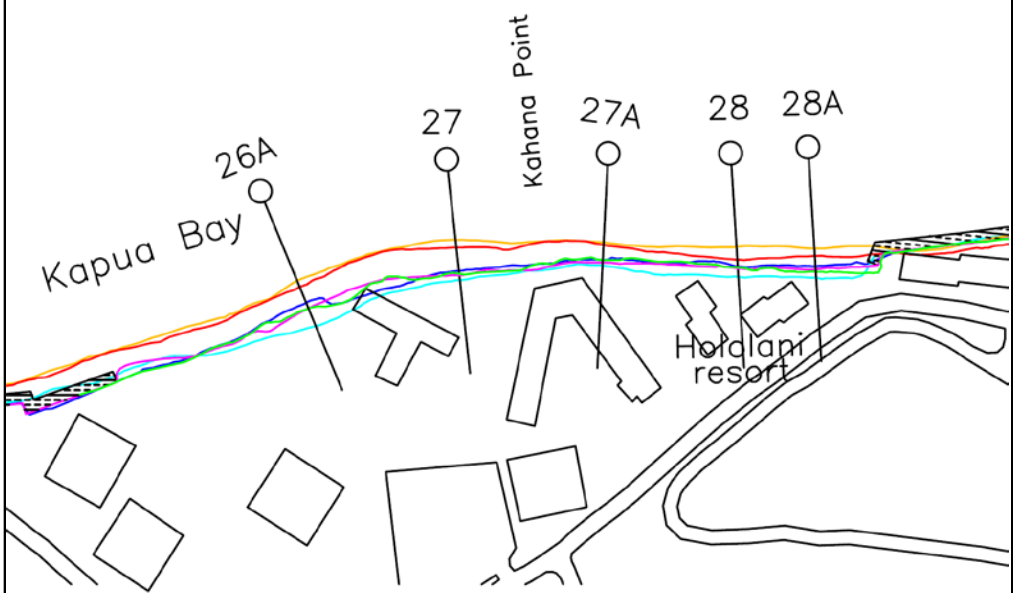
The conclusions of the 2001 study were:

- The shoreline has been dynamic in the 48 years of the study, showing episodes of both strong erosion and accretion, with erosion dominating in recent years
- Aerial photographs reveal beach narrowing and an apparent loss of sand volume in the beaches in front of and adjacent to the Hololani resort
- Due to the prevailing erosion trend and loss of beach width, the shoreline will likely continue to erode in the absence of shore protection.

The University of Hawaii Coastal Geology Group (UHCGG) conducted a similar study in 2006. They used the low water mark for reference rather than the vegetation line, so the results of the study are somewhat different. They also show an erosion rate of approximately 0.8 ft per year near the Hololani (Figure 4-16).

The averaging induced in both studies by measuring “snapshots in time” does not adequately reproduce the extreme erosional events such as occurred at the Hololani during the winter of 2006/2007, or the kind of erosion that would likely have occurred during the winters of 2009 - 2010 and 2010-2011. However, the high standard deviation shown in the SEI study is indicative of the dynamic and unstable qualities of the shoreline.

What is striking when comparing the 1949 aerial photograph (Figure 4-17) with those of more recent years is the apparent change in the volume of sand. The 1949 photograph shows a healthy ribbon of sand offshore and adjacent to the beach along all of the Kahana coast all the way to Kahana Stream. It is possible that the loss of beach sand is the primary factor driving the erosion at Hololani in the Kahana area in general. The actual mechanism for the beach sand loss is difficult to quantify.




VEGETATION LINE CHANGES (FT)

| | Trans26A | Trans27 | Trans27A | Trans28 | Trans28A |
|---|---|---|---|---|---|
| 1949 | 0 | 0 | 0 | 0 | 0 |
| 1961 | 12 | 14 | 5 | 23 | 13 |
| 1975 | -75 | -58 | -37 | -30 | -39 |
| 1987 | -30 | -41 | -27 | -12 | -18 |
| 1988 | -41 | -49 | -31 | -15 | -23 |
| 1997 | -41 | -47 | -27 | -14 | -28 |
| 2027 Estimate (Relative to 1997) | -30 | -38 | -24 | -12 | -18 |
| Standard Dev. | 36 | 27 | 15 | 21 | 21 |

**Figure 4-15. SEI 2001 study of shoreline erosion at Kahana**


**Figure 4-16. University of Hawaii Coastal Geology Group erosion rates at the Hololani**

**Figure 4-17. 1949 aerial photograph showing sand from Kahana beaches to Kahana Stream**

### 4.1.13 Natural Hazards

A comprehensive report by the UH Coastal Geology Group and the U. S. Geological Survey gave a regional Overall Hazard Assessment for the project area as “ moderate to high” (Fletcher *et al* 2002). The regional assessment is shown in cartographic form in Figure 4-18, taken from the report. The high tsunami hazard is due to the 1946 tsunami inundation of 15 ft (reported as 24 ft by Loomis, 1976). Other hazards include flash flooding caused by the steep terrain of the West Maui Mountains and the potential for heavy precipitation, as well as the chronic erosion conditions that are prevalent along the coast. Exposure to storms (in particular Kona storms), and moderately high wave conditions is intensified by projected global sea level rise. The region is also seismically active and is classified as a seismic hazard zone 2.

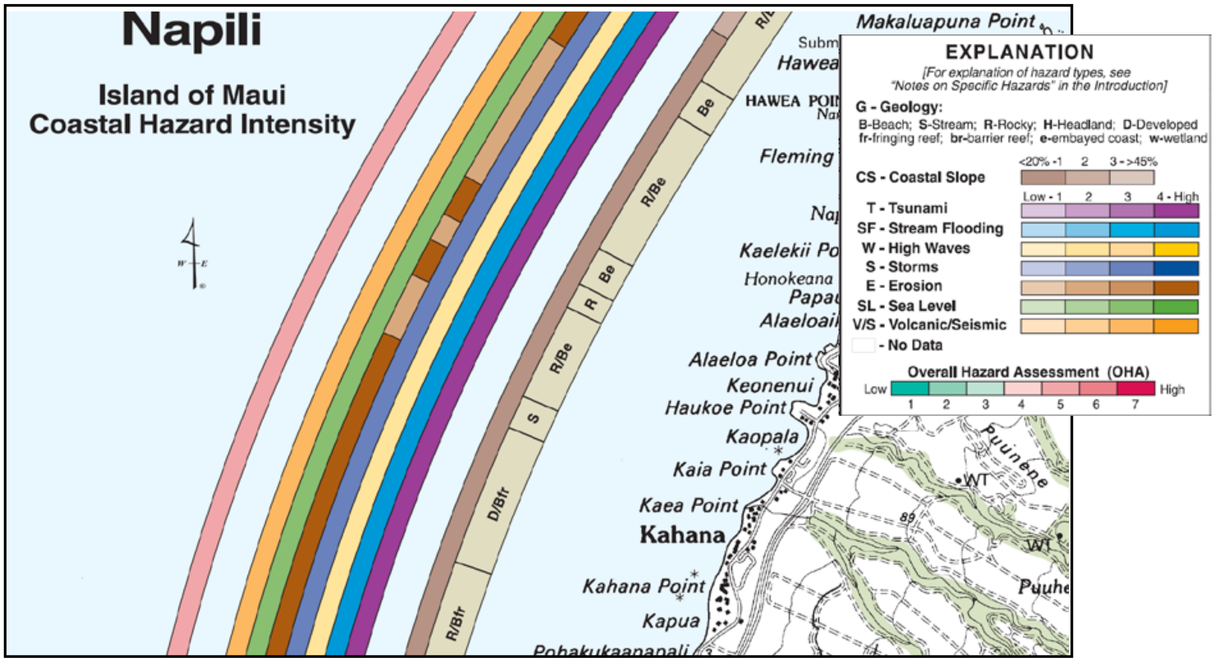



**Figure 4-18. Coastal Hazards in the Kahana to Napili region of West Maui (modified from Fletcher *et al*, 2002)**

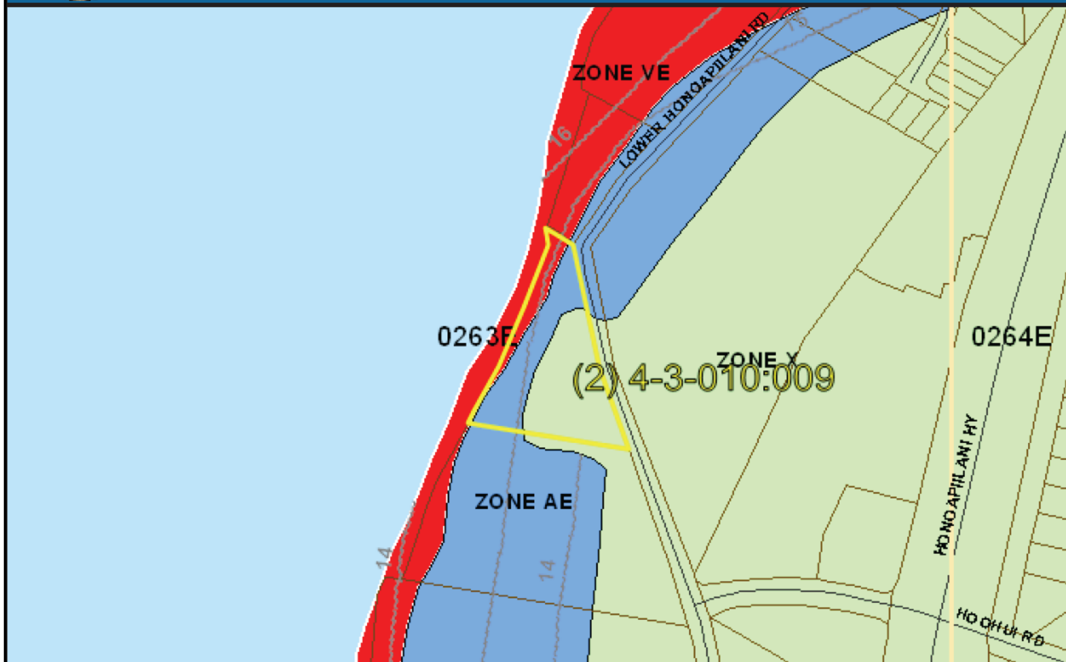
### *4.1.13.1 Flooding*

Flood hazards for the portion of Kahana in which the project is located are depicted on Flood Insurance Rate Map (FIRM) Flood Sheet 1500030263E (Figure 4-19). That map indicates that there are no threats of flooding from streams but that the shoreline is exposed to flooding caused by storm waves and tsunami. The shoreline area where the proposed action will take place has portions in both the Zone VE (coastal flood zone with velocity hazard, 15 and 14-ft Base Flood Elevation) and Zone AE (Base Flood Elevation 14 ft). The hybrid revetment/seawall structure will have an elevation that it is at or close to existing grade for the site (see Figure 1-7). It will not significantly divert or otherwise affect coastal flooding. However, the revetment portion of the structure will tend to dissipate wave energy and reduce wave runup when compared to the steep clay embankment of the native substrate.

Roadway flooding can occur on the Honoapiilani Highway in the vicinity of the Hololani (Figure 4-20) during heavy rain events. In part this is due to restriction of the drainline north of the Hololani.

State of Hawaii

**FLOOD HAZARD ASSESSMENT REPORT**




**NATIONAL FLOOD INSURANCE PROGRAM**

FLOOD ZONE DEFINITIONS

**SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD –** The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- **Zone A:** No BFE determined.
- **Zone AE:** BFE determined.
- **Zone AH:** Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- **Zone AO:** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- **Zone V:** Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE:** Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF:** Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

**NON-SPECIAL FLOOD HAZARD AREA –** An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded):** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X:** Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D:** Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

| | |
|---|---|
| COUNTY: | MAUI |
| TMK NO: | (2) 4-3-010-009 |
| PARCEL ADDRESS: | 4401 LOWER HONOAPIILANI RD |
| FIRM INDEX DATE: | SEPTEMBER 25, 2009 |
| LETTER OF MAP CHANGE(S): | NONE |
| FEMA FIRM PANEL(S): | 1500030263E |
| PANEL EFFECTIVE DATE: | SEPTEMBER 25, 2009 |

| | |
|---|---|
| PARCEL DATA FROM: | JUNE 2011 |
| IMAGERY DATA FROM: | MAY 2005 |

IMPORTANT PHONE NUMBERS

| | |
|---|---|
| County NFIP Coordinator | |
| County of Maui | |
| Francis Cerizo, CFM | (808) 270-7771 |
| State NFIP Coordinator | |
| Carol Tyau-Beam, P.E., CFM | (808) 587-0267 |

*Disclaimer: The Department of Land and Natural Resources assumes no responsibility arising from the use of the information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the Department of Land and Natural Resources from any liability, which may arise from its use.*

*Preliminary DFIRM Disclaimer: If this map has been identified as "PRELIMINARY", please note that it is being provided for commenting purposes only and is not to be use for official/legal decisions or regulatory compliance.*

**Figure 4-19. Hololani flood zone information**


**Figure 4-20. Flooding of Honoapiilani highway during heavy rain**

*4.1.13.2 Tsunami*

Tsunami are sea waves that result from large-scale seafloor displacements. They are most commonly caused by an earthquake (magnitude 7.0 or greater) adjacent to or under the ocean. If the earthquake involves a large segment of land that displaces a large volume of water, the water will travel outwards in a series of waves, each of which extends from the ocean surface to the sea floor where the earthquake originated. Tsunami waves are only a foot or so high at sea, but they can have wave lengths of hundreds of miles and travel at 500 miles per hour. When they approach shore, they feel the bottom and slow down, increase greatly in height and then push inland at considerable speed. The water then recedes, also at considerable speed, and the recession often causes as much damage as the original wave front itself.

Most tsunamis in Hawaii originate from the tectonically active areas located around the Pacific Rim (e.g., Alaska, Chile, Japan). Waves originating with earthquakes in these areas take hours to reach Hawaii, and the network of sensors that is part of the Pacific tsunami warning system are able to give Hawaii several hours advance warning of tsunami from these locations. Less commonly, tsunamis originate from seismic activity in the Hawaiian Islands, and there is much less advance warning for these. The 1975 Halape earthquake (magnitude 7.2) produced a wave that reached Oahu in less than a half hour, for example.

Fletcher, *et al*. (2002) report that 10 of the 26 tsunamis with flood elevations greater than 3.3 feet (1 m) that have made landfall in the Hawaiian Islands during recorded history (as of 2002) have had "significant damaging effects on Oahu". This means that, on average, one damaging tsunami reaches Oahu every 19 years. The recent record (1946 to the present) has seen five tsunami cause damage on Oahu, a rate that is very close to the longer term average. The most recent damaging tsunami is the Tohoku Tsunami, generated off Japan on March 11, 2011. Preliminary damage estimates by the State Civil Defense was $30.6 million. Residents of the Hololani report that it may have damaged the existing geotextile sand bag revetment.

The proposed hybrid revetment/seawall structure will be built at or close to existing grade, and will not divert or otherwise have a significant effect on floodwaters caused by tsunami.

#### *4.1.13.3 Storm Waves*

Waves and extreme wave heights are covered extensively in Section 4.1.3 of this report.

### 4.1.14 Geotechnical Site Conditions

Geotechnical borings were conducted by Island Geotechnical during the month of August, 2010. The borings were done at five locations along the shoreline crest. The complete geotechnical report and an addendum for structural analysis is included in Appendix B. According to the soils report, the USDA Soil Conservation Service lists the project site as being located in an area characterized by Pulehu Clay Loam and Jaucas Sand formations.

The Pulehu series is developed from alluvium washed from basic igneous rock – the volcanic foundation of the island, while the Jaucas series are calcareous soils derived from wind and water deposited sand from coral and sea shells. Both series are likely interbedded at this coastal site, but most of the substrate appears to be Pulehu type soils derived from terrigenous sources. In this report, the term “clay” is used to describe the very fine grained cohesive silt and silty sands and gravels as well as clay that form much of the substrate at the Hololani.

Figure 4-21 is a simplified schematic drawing of the foundation conditions. There is significant lateral variation in soils characteristics with depth and between borings. Borings 1 through 3 encountered moderately hard rock at elevations ranging from -9.3 ft to -4.8 ft. Hard rock is a desirable substrate condition for the revetment toe as it presents durable scour resistance and can be keyed into for revetment toe stability. Borings 4 and 5 at the southeast end of the property were done using portable equipment due to limited access. No hard substrate was found in either of these borings, and both showed very soft silty sand with high moisture content (approx. 35% to 40%), and low blow counts at a depth of -7 ft.

During a previous design effort in 1990, test pits were dug a five locations along the shoreline. Discontinuous lenses of beach rock were found in some areas. Beach rock is made from weakly cemented sand grains and is therefore easy to break apart.

The weak substrate found at Borings 4 and 5 at the southern end of the property have necessitated design revisions with the use of sheet pile and stabilization of the substrate with Tensar mattresses. The allowable bearing capacity of 1,500 lbs per sq ft (see Appendix B) is deemed by the project structural engineer as not enough to support a CRM retaining wall.

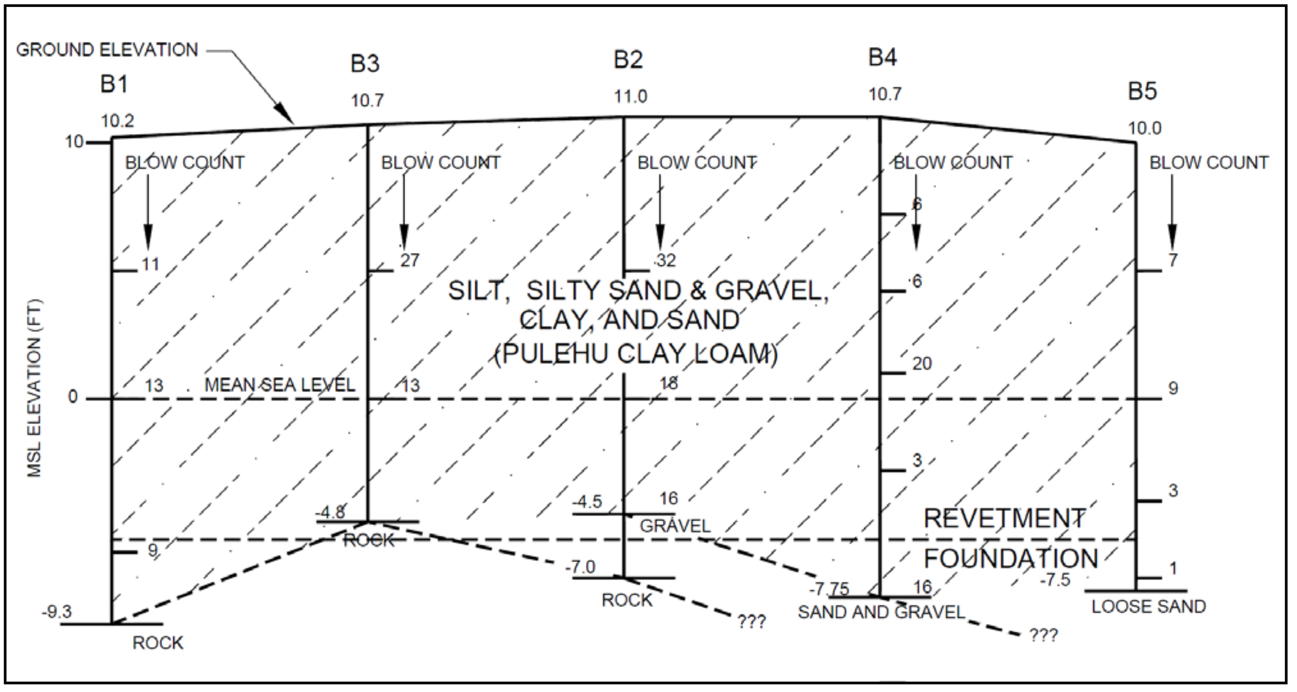



**Figure 4-21. Schematic of foundation conditions (note: B1 is at the north end of the property)**

### 4.1.15 Marine Water Quality

A baseline water quality study at the project site was conducted by Marine Research Consultants, Inc. (MRC) on August 15, 2010. The MRC report, *Baseline Assessment of Marine Water Chemistry And Marine Biotic Communities, Hololani Resort Condominium, West Maui, Hawaii* is in Appendix D. Seven stations were sampled along a transect perpendicular to the shoreline, with samples collected at 1, 5, 10, 25, 50, 150, and 300 meters from the water line (Figure 4-22). Two samples, surface and bottom samples, were collected at each station, except the extreme shallow water stations at 1 and 5 meters.

The site at Kahana is classified as Class A Open Coastal Waters by the State of Hawaii Department of Health (DOH), Hawaii Administrative Rules (HAR) 11-54, Section 6 (b).

The marine bottom type is classified as Subtype (A) – sand beaches; the marine bottom ecosystem is Class II.


**Figure 4-22. Approximate location of water sampling stations off the Hololani**

Water quality parameters measured were those designated for Class A Open Coastal Waters including:

1. Total dissolved nitrogen (TDN), nitrate + nitrite nitrogen ($NO_3^-$ + $NO_2^-$, hereafter referred to as $NO_3^-$),
2. Ammonium nitrogen ($NH_4^+$),
3. Total dissolved phosphorus (TDP),
4. Chlorophyll a (Chl *a*),
5. Turbidity,
6. Temperature,
7. pH
8. Salinity
9. Silica (Si) and
10. Orthophosphate phosphorus ($PO_4^{-3}$)

Silica and $PO_4^{-3}$ were also reported because these parameters are sensitive indicators of biological activity and the degree of groundwater mixing.

The only nutrient constituents to exceed State of Hawaii water quality standards are nitrate-nitrogen ($NO_3^-$) within 25 m from shore and turbidity within 10 m of shore. The elevated concentration of $NO_3^-$ near the shoreline is likely a result of mixing of groundwater with ocean water. The elevated concentration of turbidity is likely due to the suspension of sediment due to wave action in the surf zone. Beyond 50 m, all turbidity values were well below the standards.

Horizontal gradients in Si and $NO_3^-$ (elevated concentrations) and salinity (lowered concentration) were found as nearshore samples displayed the effects fresh groundwater input. Low salinity groundwater percolates into the ocean at the shoreline and results in a nearshore zone of mixing.

The MRC reports further explains the small fresh ground water mixing zone at the site:

*… the sampling site off the Hololani Resort is an open coastal area exposed to wind and wave, the zone of groundwater-ocean water mixing is small, extending only to distances of several meters from shore. These gradients are far less pronounced than at other areas of West Maui where either semi-enclosed embayments occur or mixing processes are less vigorous.*

Horizontal gradients of other parameter indicate they are not derived from on-land sources at the site:

*Water chemistry parameters that are not associated with groundwater input ($NH_4^+$, DON, DOP) do not show a sharp gradient of decreasing concentration with respect to distance from the shoreline. Rather, $NH_4^+$ showed a weak horizontal pattern of lower concentrations near the shoreline with higher values at the greatest distances from shore. TON and TOP showed no distinct gradients with respect to distance from the shoreline. Such patterns indicate that the concentrations of these chemical constituents are not a result of input of materials emanating from land.*

Also,

*Similar to the patterns of dissolved inorganic nutrients (Si and $NO_3^-$), the distribution of Chl a and turbidity also display peaks near the shoreline, with rapidly diminishing values seaward of the shoreline. Overall, values of Chlorophyll a are considered low with all values below 0.16 µg/L. The progressive decrease in values of turbidity with distance from shore is likely a* *response to resuspension of fine-grained particulate material stirred by breaking waves in the nearshore zone. With decreasing wave energy and increasing water depth, turbidity in the water column increases.*

Minor vertical gradients were found:
*. …there was distinct vertical stratification of nutrient concentrations off the Hololani Resort site between distances of 10 to 50 m from shore. Beyond 50 m, the water column was well mixed. Correspondingly, there was a consistent decrease in salinity of surface samples relative to deep samples within the 10-50 m from shore region. Values of turbidity were also slightly higher in all surface samples relative to deep samples at sampling sites 10-50 m from shore, and similar in value at stations farther offshore.*

The vertical gradients are due to the buoyancy of the groundwater input:
*…in areas where mixing processes are not sufficient to homogenize the water column, surface layers of low-salinity, high-nutrient water are often found overlying layers of higher salinity, lower nutrient water*

## 4.2 General Biological Environment

### 4.2.1 Marine Biota Survey

MRC conducted a baseline study of the biological resources at the project site. The investigators swam the transect shown in Figure 4-22 in a zig zag pattern to encompass an approximate 100 yd corridor. The full MRC report, *Baseline Assessment of Marine Water Chemistry And Marine Biotic Communities, Hololani Resort Condominium, West Maui, Hawaii* is attached as an appendix. Italicized excerpts are used in this section to describe the offshore environment.

The sand beach that existed at the site during the survey extended only through the intertidal area. A limestone platform covered with sand and rubble extends approximately 300 ft offshore. A sandy plain extends from the edge of the limestone to the limits of the survey. The shallow nearshore area is subjected to direct wave impact from the typical northerly swell conditions. The occurrence and diversity of corals and other biota is influenced by the concussive effects of wave breaking and bottom scour caused by sand movement due to wave motions. Red algae dominates the nearshore, where wave effects inhibit the establishment of coral.

Reef fish were generally low in abundance. Mixed species of Acanthurids (surgeonfish) were the most common, and found in mid-water near the outer margin of the limestone reef platform. No turtles were observed during the survey, although they are commonly found in the area.

MRC divided the limestone reef platform into three zones based on bottom cover: the nearshore algae zone, the mid-reef algal-coral zone, and the outer reef coral zone.

### 4.2.2 Nearshore algae zone

The nearshore area within 50 ft of the shoreline and water depths of 1 to 5 ft consists of a pitted and eroded limestone platform covered with a veneer of calcareous sand and rubble. This area is devoid of living corals, but covered with a invasive red alga *Acanthophora specifera*. Other red alga were also found (*Hypnea musciformis* and *Halymenia formosa*).

The sand, rubble, and algal cover that typifies the nearshore zone are shown in Figure 4-6 of Section 4.1.4.

### 4.2.3 Mid-reef algal-coral zone

Further offshore, the algal cover remains dominant, but wave-resistant corals begin to appear:

*With slightly increasing depth and distance from shore, dense algal coverage of the bottom persists, although isolated living coral heads begin to occur, primarily on the upper surfaces of rocky projections that are elevated above the limestone platform. Elevation of the reef surface increases the resiliency of these coral from the effects of sediment scour, and the competitive abilities of these corals is apparently sufficient to prevent them from being completely overgrown by algae. The predominant coral species occurring within the mid-reef area are* Porites lobata *and* Montipora patula*. Within both the nearshore algal zone and the mid-reef algal-coral zone motile macrobenthos, particularly sea urchins, were extremely scarce, likely as a result of the force of breaking waves which is sufficient to prevent these unattached organisms to remain stable on the reef surface.*

Figure 4-23 shows the still-abundant red alga and encrusting corals that dominate the mid-reef zone.

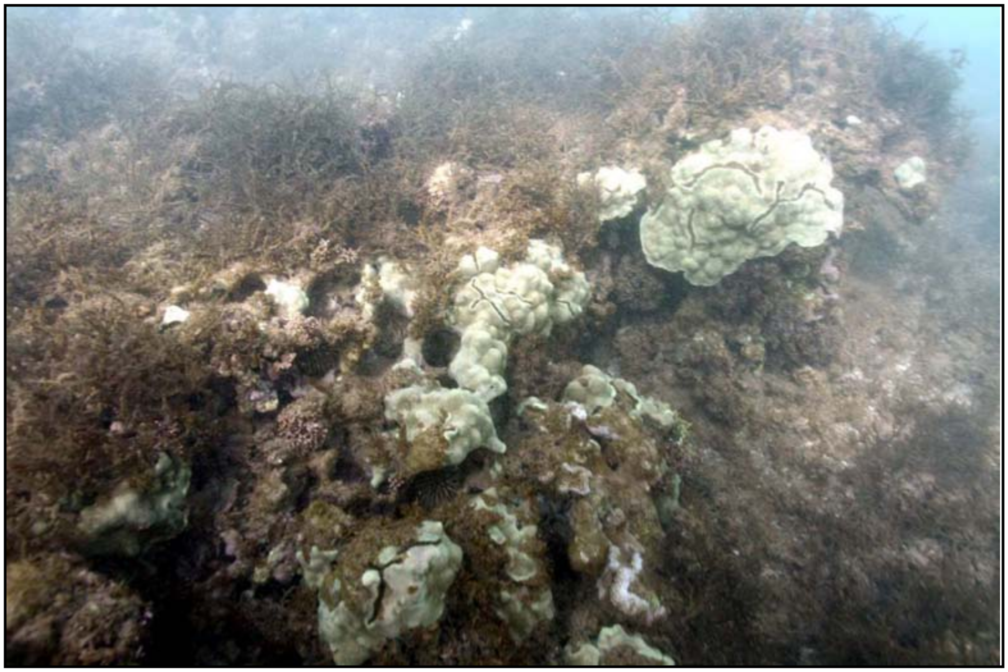


**Figure 4-23. Red alga and encrusting coral on elevated surfaces in the mid-reef zone.**

### 4.2.4 Outer reef coral zone

Approximately 200 ft offshore, the extensive algal cover diminishes and coral coverage increases (Figure 4-24):

*The seaward boundary of the mid-reef algal-coral zone and the inshore boundary of the outer reef zone is demarcated by the boundary where extensive beds of algae no longer occur, and the bottom consists of either living corals or relatively bare turf-covered limestone. This zone extends across the reef platform from a distance of approximately 200 feet from shore to the seaward edge of the reef platform, and spans the depth range of approximately 10 to 25 feet. The primary coral species occurring in the outer reef zone were* Pocillopora meandrina*, commonly called "cauliflower coral",* Porites lobata*, commonly called "lobe coral", and* Porites compressa*, commonly called "finger coral". Many of these colonies were up to several feet in diameter indicating that they are on the order of several decades old. The growth form of Porites compressa consists of elongated fingers, which are substantially more delicate and susceptible to breakage compared to the other corals. Hence, P. compressa is not found in areas that are routinely subjected to wave energy. The occurrence of large, intact colonies of P. compressa in the outer reef zone off of Hololani indicates that the outer reef zone has not sustained wave stress substantial enough to destroy these coral colonies over at least a decadal time interval.*

*The outer reef zone terminates at a depth of approximately 25 feet in a margin between the limestone platform and sand plain. Seaward of the outer reef margin bottom composition consisted of a flat, gently sloping sand plain. In many areas of West Maui, the sand plains beyond the reef platform are colonized with vast pastures of the calcareous green alga Halimeda. No such pastures of Halimeda were observed during the present study off of the Hololani area.*

*Other macro-invertebrates that were observed on the surface of the outer reef were several species of sea urchins (*Echinometra matheai, Echinothrix diadema, Tripneustes gratilla, *and* Heterocentrotus mammilatus*). None of these urchins were particularly abundant, but were found most commonly on the bare limestone reef platform rather than on living corals. It is well known that these urchins graze on benthic algae, and may be responsible for the absence of dense algae in the outer reef zones where wave energy is not sufficient to remove the urchins from the reef.*

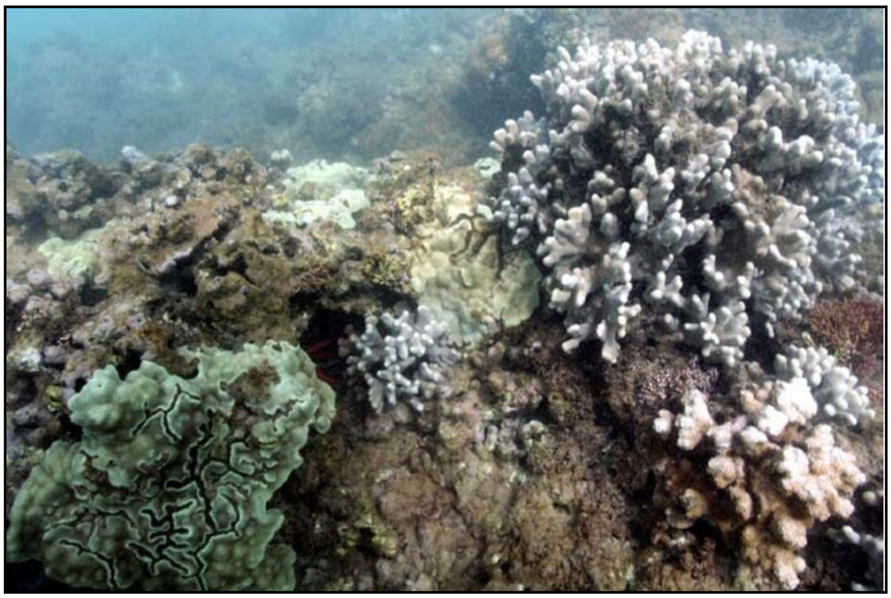


**Figure 4-24. Outer reef zone, showing the presence of finger coral and encrusting coral**

# 5. HUMAN ENVIRONMENTAL SETTING

## 5.1 Socio-Economic Environment

Maui County has a population of 154,834 according to the 2010 U.S. Census, up 21% since the year 2000. West Maui has a population of 20,890 between Lahaina town and Napili. The five major hotels and condominiums that front Kahana Beach – Hololani, Royal Kahana, Valley Isle, Sands of Kahana, and the Kahana Beach Resort (see Figure 4-1) - have a minimum of 652 units between them, and represent a significant part of the economy for Maui County. While these five are the beach front hotels, many other condominium and resort industry destinations occur between Lower Honoapiilani Road and Honoapiilani Highway, and also make use of Kahana Beach.

Since the closure of Lahaina's Pioneer Mill in 1999, the economy of West Maui has become increasing reliant on the visitor industy. Historically, pineapple and sugar cane were the two major crops in West Maui, but these have mostly been discontinued or are harvested at greatly reduced amounts. Coffee plantations have replaced some of the pineapple and sugar cane acreage, and are also popular tourist destinations of interest.

## 5.2 Historic, Cultural, and Archaeological Resources

Land use in the coastal area of West Maui in pre-contact and early historic times likely involved the use of coastal resources and small gardening plots. Industrial agriculture began with sugarcane cultivation in 1859 with the formation of the Lahaina Sugar Company. The Pioneer Mill Company bought Lahaina Sugar Company in 1863. They initiated the Pioneer Railroad line in 1882, but this was not extended to Kahana until 1919. Commercial and residential development of the coastal strip between Lower Honoapiilani Road and Honoapiilani Highway began in the 1960's. A 1975 aerial photograph shows extensive grading of the Hololani property during construction of the condominium buildings.

The extensive agricultural, and later commercial development likely destroyed any archaeological sites on the flat lands, and archaeological surveys generally concentrated on the incised gulch areas cut by streams.

A study conducted by Xamanek Researches (1999) as part of an Environmental Assessment for a County of Maui project found no archeological sites in the vicinity of the Hololani. Three sites, two previously known and one found by the authors on the shoreline, were found north of Kaea Point (mouth of the Kahana Stream ).

Due to the extensive grading and construction at the Hololani, as well as the significant shoreline erosion that has occurred, it is unlikely that any historical or culturally significant features exist on the property.

## 5.3 Public Infrastructure and Services

### 5.3.1 Transportation

Access to the Hololani is provided by Lower Honoapiilani Road, a two-lane County-owned road that runs just mauka of the shorefront developments such as the Hololani that characterize the area. The road has a meandering character, and has its closest local approach to the shoreline on a tight curve near the drainage easement between the Hololani and Pohailani condominiums (see Figure 4-18).

The State-owned Honoapiilani Highway lies less than 1,000 feet inland from the shoreline and conducts most of the the through traffic in the region.

A federally sponsored project to widen Lower Honoapiilani Road is presently undergoing design and permitting processes by the County of Maui Department of Public Works. The project is called *Lower Honoapiilani Road Improvements Phase IV (Hoohui Rd. to Napilihau St.)*, and also involves improvements to the drain line between the Hololani and Pohailani (Munekiyo & Hiraga, 2002).

The Kapalua/West Maui Airport is about one mile distant from the Hololani.

### 5.3.2 Police

The Kahana area is served by the Maui Police Department's Lahaina patrol district. There is also a police sub-station in Napili.

### 5.3.3 Fire

Fire stations are located in Lahaina and Napili. The Napili station is closest to the Hololani. The Lahaina station includes a ladder company and has a boat for ocean rescues.

### 5.3.4 Water

Water is provided to the Hololani by pipelines buried under Lower Honapiilani Road.

### 5.3.5 Wastewater

Wastewater from the Hololani is treated at the Lahaina Wastewater Reclamation Facility.

### 5.3.6 Drainage

The Hololani shoreline is characterized by a drainage swale approximately 10 ft mauka of the shoreline escarpment. Runoff is to the north and south where it can percolate into the soil or flow mauka off the property into the storm drain. The storm drain outlet at the easement between the Hololani and Pohailani properties is termed "Outlet No. 1" in the County project "*Improvements to Lower Honoapiilani Road, Phase IV*" and is meant to be improved when the project moves forward.

### 5.3.7 Electrical

Electrical service is provided by Maui Electric Company (MECO). Poles and overhead lines run on the mauka side of the highway near the Hololani, and one is located on the north corner of the drainage easement. The poles accommodate telephone and cable television and internet as well as electrical. An electrical transformer on the Pohailani property was recently dismantled due to its proximity to an undercut wall. A new concrete vault was built closer to the roadway inside the drainage easement.

## 5.4 Recreation

The Hololani is both a resort destination for visitors and permanent home for many of the owners. Ocean based recreation is of primary importance, and includes typical swimming, sunbathing, and walking activities that are standard for most beach areas. The outer reef areas are good for snorkeling, with generally clean water and good coral growth. Although there are no named surf sites near the Hololani, surfing is possible during both the north and south swell seasons. The nearest named surf sites are "S-Turns" at the south end of Kahana Beach and "Little Makaha" at Napili Bay. Other sites may exist, but are not well known except by local inhabitants.

Strong trade winds blow through the Pailolo Channel, especially during the afternoon, and wind surfing and kite surfing are other popular sporting activities. Small watercraft such as kayaks are launched off Kahana Beach, and offer quick access to the offshore reefs for snorkelers.

## 5.5 Scenic and Aesthetic Resources

The oceanfront viewplane of West Maui is one of the finest in the world, and is one of the major attractions for visitors and permanent residents alike. The scenery includes views of the islands of Molokai and Lanai. The Pailolo Channel is famous for humpback whale activity.

Kahana Beach is an uninterrupted ¼-mile reach of sand that exists year-round between the Royal Kahana and the Kahana Beach hotels. The beach is extended in front of the Hololani during seasons and years when conditions are favorable. The beach is safe as the wave climate is mild and the fringing reef offers additional protection. The water is generally clear except during periods of heavy rain.

### 5.6 Coastal Access

The only official public coastal access point along the Kahana shoreline is a the Sands of Kahana complex (Figure 4-1). A little further south, there is coastal access at Pohaku Beach Park (S-Turns). The drainage easement at the north end of the Hololani property is also used.

At present, access along the beach varies with the amount of sand present. During seasons with little or no sand present, lateral access along the coastline is difficult.

# 6. ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

## 6.1 Impacts On the Physical Environment

### 6.1.1 Impacts On Noise and Air Quality

Noise and air quality impacts will occur only during construction. The project will require the operation of heavy machinery for excavation and installation of rock armor and sheet pile. Heavy equipment used will depend on the selected contractor, but may include pile driving equipment, bulldozer, and excavator.

Methodology for calculating noise levels is given in the 2006 Federal Transit Administration manual, *Transit Noise and Vibration Impact Assessment* (Hanson *et al*, 2006). The descriptor for noise levels is *Leq*, the equivalent noise level. It is calculated by modifying the acoustic emission level of the equipment for the amount of time in use (Usage Factor – *UF*), attenuation from topography (*G*) and distance (*D*). Noise levels are given in logarithmic units, dBA, which are decibels weighted to characteristics of the human ear. The equivalent noise level is given as:

$$Leq = EL + 10\log(UF) - 20\log(D/50) - 10G\log(D/50)$$

Pile drivers have an emission level of 101 dBA and a usage factor of 20%, dozers and excavators have an emission level of 85 dBA and a usage factor of 40%. Ground factors (*G*) were not considered.

Table 6-1 lists calculated noise levels at different distances, and the combined equivalent levels of two pieces of equipment. Due to the exponential nature of sound level perception, the source with the higher emission level dominates the noise field.

The noise levels in Table 6-1 are conservative, as a ground factor was not used and there will be some acoustic shielding from the Hololani buildings and the shoreline escarpment. Nevertheless, the levels are potentially significant.

**Table 6-1. Equipment Equivalent Noise Levels (*Leq*)**

| Distance (ft) | Pile Driver (dBA) | Excavator (dBA) | Total (dBA) |
|---|---|---|---|
| 50 | 96 | 81 | 96.1 |
| 100 | 90 | 75 | 90.1 |
| 200 | 84 | 69 | 84.1 |
| 500 | 76 | 61 | 76.1 |

*Noise Level Mitigation*

Construction noise levels can be mitigated to some extent by the following practices:

- Conduct operations on a set schedule during daylight hours only;
- If possible, conduct two or more high noise level operations simultaneously;
- Use vibratory versus impact equipment if possible;
- Make sure all equipment is in good working order and equipped with proper muffling;
- Enhance ground factors by stockpiling equipment and materials between the source area and the public.

Although none of the construction activities should cause excessive dust, air quality at the site may be reduced somewhat. Residual moisture levels in the soils should prevent or reduce dust production during excavation. Rock dumping and placement may cause intermittent dust production.

*Air Quality Mitigation*

Air quality impacts can be reduced by the following practices:

- Cover excavation spoil or wet it down periodically;
- Wash excessive dirt off armor stone;
- Make sure all engines are in proper working order.

If air quality impacts become significant, the contractor may be required to put up screening material.

### 6.1.2 Impacts On Shoreline Characteristics and Coastal Processes

#### *6.1.2.1 Sand Accretion*

Shoreline hardening is perceived as inevitably leading to beach narrowing and beach loss, especially on beaches that are undergoing long term retreat (OEQC, 1998). Shoreline hardening may also cause sediment impoundment when beach quality sand is trapped mauka of a coastal structure.

The proposed project does not impound beach quality sand as the eroding substrate at the Hololani is composed of red clay that is held in suspension as a turbid plume and does not contribute to beach building.

The existing temporary shore protection (a form of shoreline hardening) has been in place at the Hololani for approximately five years. During that time, numerous episodes of erosion and accretion of the sand beach have occurred. To all appearances, the temporary shoreline hardening that is in place has not affected the beach processes responsible for the sand movement.

The Hololani is at the approximate center of a littoral cell that includes all of Kahana Beach up to the mouth of Kahana Stream. However, the salient at the north boundary (Pohailani Condominiums) caused by shoreline recession at the Hololani inhibits movement of sand to the north, and forms the present-day effective terminus of the Kahana cell. Sand movement responds to the seasonal wave climate. Waves from the south during the summer (and during Kona storms) tend to bring sand to the Hololani from the more southern reaches of Kahana Beach. Conversely, waves from the north and northeast tend to strip the sand away (see Section 4.1.9). In each case, the sand is moving laterally along the beach versus in an onshore-offshore direction. The Hololani beach appears to be dominated by the longshore transport processes caused by waves from the north and south, and less by cross-shore transport.

Wave reflection from vertical escarpments, whether natural or man made, has a tendency to flatten sand beaches and move sand offshore. However, once sand accretion has removed the reflecting surface from coastal processes, it is no longer a factor unless water levels and wave heights increase so that the wall is again in reach. Nevertheless, the initial process of sand accretion is important. The existing temporary protection includes a scour apron constructed from Tensar marine mattresses. Filled with cobble-size rock, the mattresses allow wave uprush to percolate through the cobbles and deposit sand on top of the mattress. In this way they act much like a natural beach and help to “seed” sand accretion. Attenuating wave reflection and allowing percolation are key elements to beach building.

The proposed project is designed with a rock rubblemound revetment fronting a seawall. The slope and porosity of the revetment will help to reduce wave reflection and allow percolation and deposition, and thereby help the sand accretion process when seasonal wave patterns are favorable.

The proposed project is replacing a natural vertical escarpment with a high amount of wave reflection and low porosity with a sloping, permeable structure that will absorb wave energy, reduce wave reflection, and allow percolation through the structure. Compared to the naturally hardened native shoreline, it is thought that the proposed structure will not have a significant negative effect on coastal processes.

In response to agency comments on the DEA, Appendix E contains a detailed treatment of coastal processes at Hololani in the *Introductory Comments*. Section headings include:

- Regional Loss of Sand and Shoreline Erosion
- Coastal Armoring and Beach Loss
- The Domino Effect

In response to comments from the DLNR-OCCL, three case studies of beach accretion in front of engineered coastal structures are presented in Appendix E. These include revetment construction at the Mahana Condominiums at North Beach Kaanapali in 1985, accretion of a sand beach in front of a geotube structure at Anaehoomalu Bay, Hawaii in 2011, and sand accretion in front of a section of seawalls at Lanikai Beach, Oahu between 1963 and 2012.

#### *6.1.2.2 Placement Loss*

Placement loss is the term used to describe the loss of beach due to the footprint of a structure encroaching on the beach area. The amount of placement loss depends on the structure type and where it is located. A vertical seawall placed landward of the shoreline would result in no placement loss, for example.

The preferred alternative has an alignment the places a vertical wall mostly behind the shoreline and a rock revetment that slopes at 1V to 1.5H from +6 ft MSL to +0.5 ft MSL. The sloping nature of the revetment means that placement loss will vary with beach conditions. Topographic surveys during low sand (January 25, 2011) and high sand conditions (August 16, 2011) show beach elevations along the structure footprint between +1 ft MSL and +6 ft MSL. At the higher sand levels, the revetment can be expected to be mostly buried in sand, with little or no placement loss. At low sand level, the placement loss will be approximately 12.5 ft, including the 5-ft wide revetment crest. Any sand level less than +6 ft will result in exposure of the crest, so a minimum placement loss of 5 ft is considered reasonable. As the sand accretion in front of the Hololani is often discontinuous along the reach, the placement loss will vary accordingly.

Figure 1-6(b) shows that the line of sand bags of the existing temporary structure is more or less aligned on the buried toe of the proposed permanent structure. The new structure will therefore be mostly mauka of the temporary structure and have generally less placement loss than the existing condition.

### *6.1.2.3 Passive Erosion*

Passive erosion describes long-term net erosion, such as has been taking place at the Hololani and the Royal Kahana at an average rate of about 0.8 ft per year. It may also describe the net long-term loss of sand resources that is postulated as an underlying reason for erosion at Hololani an other areas within the littoral cell. Fixing the Hololani shoreline with shore protection and allowing erosion of the adjacent Royal Kahana shoreline could change the geometry of the shoreline, with a potential change in beach equilibrium characteristics. If the Royal Kahana shoreline were allowed to drastically erode (say 20 ft, for example), the change in planform might alter the seasonal erosion and accretion characteristics, and may decrease the average sand width in front of the Hololani. However, both historically and at present, the sand width at the Hololani is often close to nil due to seasonal longshore transport to the south. The natural shoreline, a near vertical clay embankment, is also not conducive to sand beach formation. Unless shoreline planform changes become extreme – an unlikely occurrence due to the limited accommodation for erosion at the Royal Kahana, the existing beach width variations are likely to be of greater significance than those from passive erosion.

While geometry effects are important in coastal processes (mostly due to changes in incident wave angle), there are many other factors involved. For example, a decrease in beach width at Hololani would probably be accompanied by an increase in beach stability at the Royal Kahana (again due to the geometry), with a consequent decrease in erosion rate.

Efforts to prevent the erosion of the Royal Kahana property are the best way to prevent negative effects due to passive erosion. Section 6.1.2.5 discusses ways to mitigate erosion at the north end of the Royal Kahana.

### *6.1.2.4 Effect of the Pohailani Seawall*

The Pohailani property has been protected by a seawall since at least 1988 (based on aerial photographs). With the recession of the Hololani shoreline, the Pohailani structure forms a salient thatacts as a barrier to the northward flow of sand. Two alternatives have been presented for terminating the proposed structure at the north end:

1. Terminating the structure at the easement boundary (see Figure 2-7) , and
2. Extending the structure to the Pohailani seawall (see Figure 2-8).

The second option may reduce the barrier effect of the Pohailani seawall and allow more sand to be transported north. It is possible, under this scenario, that some beach narrowing may occur in front of the Hololani as a result. However, transport processes are complex, and beach behavior at the intersection of the revetment and the wall is difficult to predict with certainty. Negative effects are not likely to be significant.

*6.1.2.5 End Effects at the Southern Boundary*

For the south termination, the sheet pile wall is extended mauka at an angle for 20 ft from the termination such that it will fully protect the south building and keep the revetment from being flanked (Figure 6-1). The wall will be exposed at the shoreline escarpment, but will be quickly buried as it extends mauka. The design will minimize excavation and leave the existing ground on the exterior face of the wall mostly undisturbed and therefore more resistant to erosion.

"End effects", or excess scour or erosion of adjacent shorelines due to additional wave reflection and turbulence from the end of coastal armoring, are accepted by coastal engineers as potentially negative side effects of coastal armoring. There is really no method available to accurately predict the effects of the revetment termination on the adjacent shoreline. As a crude estimate, end effects are not likely to extend beyond a wavelength from the structure. Half a wavelength, or somewhere between 50 and 100 ft is probably a more realistic estimate, with effects decreasing with distance. The primary consideration in the termination design was to fully protect the south building and yet leave room
for potential erosional effects to be contained as much as possible on the Hololani property. The 24-ft gap between the revetment termination and the property line was the result of adjustments to the angle and length of the sheet pile wall extension. Figure 6-1 shows a schematic representation of what the end effect erosion might look like. The 10-year and 20-year erosion lines are based on an average of 0.8 ft per year erosion rate from a 2001 Sea Engineering study (see DEA, Section 4.1.12).

Some erosion can be tolerated in this area, but additional protection will be favored using the flexible Tensar rock mattresses, and extending them at least 50 ft into the Royal Kahana property. The property line area is has been effectively protected by Tensar mattresses since 2007 as part of the temporary shore protection installation (see Figures 4-3 and 6-2). The undisturbed gap between the property line and the buried sheet pile wall will be used as a shoreline access point.

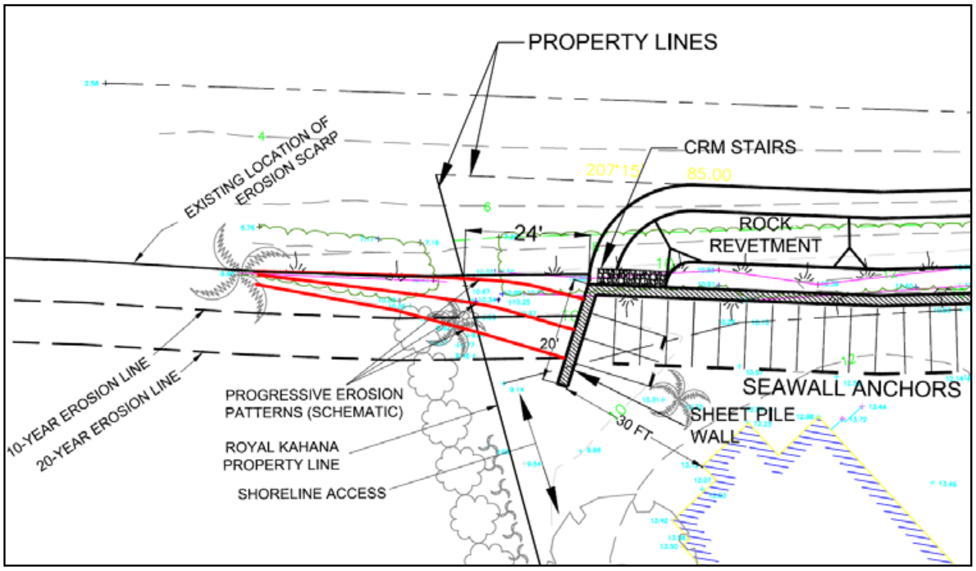



**Figure 6-1. South end termination and schematic of end effect erosion**

*Mitigation of End Effects at the Southern Boundary*

To minimize effects on the neighboring property, the proposed structure has been terminated 24 ft from the property line (see Figure 2-4). The native soil in this area will be disturbed as little as possible to keep it in its natural state of compaction. The existing shoreline in the termination area is presently protected by draped Tensar mattresses (see Figures 6-2 and 4-3). These have worked well to protect the shoreline and it is recommended to keep them in place.

Recommendations to minimize or mitigate potential end effects include:

- The revetment is stopped 24 ft from the property line in order to keep as much of the turbulence associated with end effects within the property of the Hololani, yet still protect the south building.

- The combination of the revetment returning to the face of the sheet pile wall, and the sheet pile extending inland at an angle minimizes disturbance of native ground.

- Under an existing verbal agreement with the MDP, the Royal Kahana AOAO has protected their property adjacent to the Hololani with temporary Tensar mattress shore protection. The temporary measures have been robust and effective. It is the intent of project to have these temporary measures included in the Hololani permits and extended to at least 50 ft from the property line to ensure that localized damage at the Royal Kahana due to the new permanent structure does not occur.

**Figure 6-2. Tensar mattresses at Royal Kahana near the property boundary obscured by Naupaka vegetation**

### 6.1.3 Impacts On Marine Water Quality

#### *6.1.3.1 Long-Term Impacts on Water Quality*

The proposed project will seal off the red clay substrate at the project site and prevent erosion from wave action. When eroded, the red clay forms highly visible turbidity plumes that can linger in the nearshore waters, and eventually settle in deeper water offshore. The long-term effects of the project will likely be to improve the water quality in the vicinity.

#### *6.1.3.2 Impacts on Water Quality During Construction*

While long term effects on water quality due to the project are not likely, there will probably be short term elevations in turbidity and total suspended solids (TSS) during the construction phase of the project, as construction of the will occur at the shoreline. A Water Quality Certification (WQC) from the State Department of Health is being applied for. The WQC requires completion and acceptance of an Applicable Monitoring and Assessment Program (AMAP) that will detail water quality monitoring during construction. Impacts can be reduced using Best-Management-Practices (BMP's), and limited in areal extent by the use of silt curtains. The monitoring program will require regular measurement of water quality parameters in the vicinity of the project.

The following BMP's are typical for this type of project:

1. An effective turbidity barrier (e.g. silt curtain) shall be deployed as necessary to isolate the construction activity, to avoid degradation of marine waters and prevent migration of fine material and suspended solids during the construction operations. Barriers shall extend to the ocean bottom and be weighed down. The barriers shall remain in place during construction and until post-construction water quality monitoring results show water quality inside the barrier to be equivalent to ambient conditions as shown by control stations outside of the turbidity barriers.

2. Excavated material that is stockpiled on-site will be contained by barrier systems to prevent run-off into marine waters.

3. Fueling of equipment shall take place away from the water. Fuels, oils and waste materials shall be properly contained and not be allowed to leak, leach or otherwise enter marine waters. The Contractor shall have established procedures for immediate clean up of fuel or oil spills.

4. The contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface or marine waters. Shoreline construction activities shall cease when ocean conditions become severe enough that containment devices (i.e. silt curtains) become ineffective. Environmental resources outside the immediate area of material removal shall be protected.

5. A dust control program will be implemented, and wind blown sand and dust shall be prevented from blowing.

6. Material delivery and storage shall take place in designated areas.

7. The work shall be completed in accordance with all applicable State and County health and safety regulations.

8. Concrete truck wash water shall be contained in pits or other containment devices provided with impermeable liners for evaporative dissipation. Spoil shall be disposed of at an appropriate landfill site.

9. Stockpiled material for use or reuse in construction shall not be co-mingled with concrete truck wash water, equipment washdown effluent or other spoil.

## 6.2 Impacts On The Biological Environment

The project is expected to have no significant impact on the biological environment. No biological habitats will be significantly affected.

### 6.2.1 Impacts On Threatened and Endangered Species

The project area is not known as an endangered species habitat. The most likely endangered animals that may be encountered are sea turtles and monk seals. The project will have no long-term significant impacts on endangered species. However, care will be taken during construction to ensure that listed species are not disturbed.

The following procedures will be followed to mitigate any possible impact to endangered species:

- A survey of the project area will be performed just prior to commencement or resumption of construction activity to ensure that no protected species are in the project area. If protected species are detected, construction activities will be postponed until the animals voluntarily leave the area.

- If any listed species enter the project area during the conduct of construction activities, all activities will cease until the animals voluntarily depart the area.

- 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.

## 6.3 Impacts On the Human Environment

The project is expected to have no significant negative effects on the human environment. However, the project will have significant positive effects:

- The engineered structure will be attractive and visually neutral. Unsightly seabags will be removed.
- Permanent protection of the Hololani will remove a significant potential threat to the well-being of the residents and the local community.
- The project will protect or stabilize vital public infrastructure, including Lower Honoapiilani Road and the drainage easement.
- Lateral shoreline access will be improved.

### 6.3.1 Impacts On Historic, Cultural, and Archaeological Resources

Historic, cultural, or archeological sites have not been identified in the vicinity of the project. The project is therefore not likely to have any significant impacts.

### 6.3.2 Impacts On Public Infrastructure

The project will help to protect Lower Honoapiilani Road from coastal erosion. The project will dress the shoreline in the drainage easement in a fashion that will assist in future improvements. The alternative design presented (see Section 2.4.1) will permanently improve the easement area and drainage.

### 6.3.3 Impacts On Recreational Use

The project will have long-term postive impacts on recreational use in the vicinity. Use of nearshore waters (swimming, diving, surfing) will improved due to improved water quality. Lateral shoreline access will improved. The beach will be more user-friendly with removal of the temporary protection (seabags and mattresses).

The project will cause beach access restrictions during construction.

### 6.3.4 Impacts on Scenic and Aesthetic Resources

The project will improve the scenic and aesthetic resources in the area. The efforts to protect the shoreline at the Hololani have resulted in various unsightly non-engineered shoreline constructions, including sand bags, seabags, and boulder protection. The deteriorating temporary protection will be removed and replaced by an engineered and visually neutral structure.

### 6.3.5 Impacts on Coastal Access

Designated public access for Kahana Beach exists now only at the Sands of Kahana condominiums. The drainage easement between the Hololani and Pohailani is an unofficial access point. Coastal access will remain unchanged with the existing design as shown in Figure 2-7. The alternative design (Figure 2-8) will improve the easement area. A coastal access stairway can be designed into the alternative upon approval by the Department of Public Works.
Lateral coastal access will be improved by the proposed project. A 5-ft wide revetment crest at the +6 ft elevation (Figure 1-7) will allow lateral shoreline access during periods of high water and low beach sand volume.

## 6.4 Impacts and Significance Criteria

Chapter 343, Hawaii Revised Statutes (HRS), and Hawaii Administrative Rules (HAR) §11-200, establish certain categories of action that require the agency processing an applicant's request for approval to prepare an environmental assessment. HAR §11-200-12 lists the following criteria to be used in making such a determination.

*Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.*

The native shoreline consists of a vertical clay escarpment that is subject to erosion. It is a highly reflective, naturally hardened shoreline that is difficult to access during low sand conditions. The preferred alternative will result in a shoreline that is effectively similar to the native shoreline but will likely be less reflective, provide improved lateral access, and will eliminate turbidity associated with erosion of the native material. The project will not in itself cause the destruction of any natural resource and no significant cultural resources have been identified at the project site. Some loss of useable shorefront area may take place due to the footprint of the proposed structure (known as "placement loss"). This will likely vary between 5 and 12.5 ft, depending on seasonal sand accretion. However, the structure will be mostly contained within the footprint of the existing temporary structure, and will be placed landward of the original (1972) property line.

*Curtails the range of beneficial uses of the environment.*

The proposed project will allow removal of existing temporary structures and improve the appearance, accessibility, and physical features of the shoreline. Long term changes to the regional shoreline are inevitable, and erosion of un-armored areas of the Kahana littoral cell will likely continue. Erosion of the north end of the Royal Kahana may be influenced by "end effects" of the proposed alternative, but a mitigation plan is part of the project. The proposed alternative is the most environmentally benign of all alternatives considered, and no adverse significant long term impacts to the environment are anticipated to result from this project. There may be temporary short-term impacts during construction, however these are not anticipated to be significant, and will be mitigated to the maximum extent practicable by use of the Best Management Plans (BMP) and monitoring procedures.

*Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.*

The proposed project provides for the safety of 63 housing units, has a minimal footprint in the shoreline area, and has the least environmental impact of all alternatives presented. Failure to protect the Hololani would result in a potentially catastrophic condition, causing severe encroachment on the eroding shoreline due to undermined and threatened condominium buildings.

*Substantially affects the economic or social welfare of the community or State.*

The project will facilitate protection of a portion a public roadway as well as repair of a community drainage outlet. The Hololani offers substantial revenue to the County of Maui and the State of Hawaii through taxes and tourism. Failure to properly protect the Hololani buildings will likely result in as-yet unknown costs to the public.

*Substantially affects public health.*

The proposed project will have some temporary, minor impact on air, noise and water quality during construction, however these will be mitigated to the maximum extent practicable by BMPs and monitoring procedures. The project will not result in any post-construction or long-term effects on public health. The project will facilitate repair of a community drainage outlet.

*Involves substantial secondary impacts, such as population changes or effects on public facilities.*

The project will not alter the existing land use pattern.

*Involves a substantial degradation of environmental quality.*

Other than temporary, short-term environmental impacts during construction, which are generally not considered significant, the proposed project would not result in impacts which can be expected to degrade the environmental quality in the project area. In fact, the opposite would be true - the project will help prevent nearshore turbidity due to erosion of the red clay shoreline embankment.

*Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.*

The proposed project will protect the Hololani shoreline. Effects on adjacent properties are expected to be minor and can be addressed by limited temporary protection similar to that already in place. As discussed in this EA, there is likely an on-going regional diminishing of sand resources that is the root cause of many of the erosion problems in the Kahana littoral cell. A larger action – regional beach nourishment – is recommended for general protection and enhancement of Kahana Beach. The proposed project is compatible with regional beach nourishment, but it does not involve a commitment to the larger action.

*Substantially affects a rare, threatened, or endangered species, or its habitat.*

Green sea turtles have been seen foraging in the nearshore waters off the Hololani. Hawaiian monk seals are not common in the area. Turtle protection procedures as recommended by the NOAA, National Marine Fisheries Service, will be in place during construction.

*Detrimentally affects air or water quality or ambient noise levels.*

There will be some temporary, short-term impacts to air and water quality, and noise levels, during construction. However, these impacts will be limited to the construction period and will not be significant. BMP's, water turbidity controls, and a water quality monitoring program will be in effect to help minimize the construction impacts. The contractor will be required to submit a Best Management/ Environmental Protection Plan for approval prior to the start of construction, which will include provisions for reducing air, water, and noise impacts. Once construction is complete there will be no activity or mechanism for further air, water or noise impacts.

*Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.*

The proposed project will not change the shoreline elevation, and will not change the existing tsunami flood hazard. It is engineered for a 50-year wave event. The proposed project will result in a shoreline that is effectively similar to the native shoreline but will likely be less reflective, provide improved lateral access, and will eliminate turbidity associated with erosion of the native material. The proposed project will allow removal of existing temporary structures and improve the appearance and physical features of the shoreline. The proposed project has a minimal footprint in the shoreline area, and has the least environmental impact of all alternatives presented.

*Substantially affects scenic vista and view planes identified in county or state plans or studies.*

The proposed project has a minimal footprint in the shoreline area, and will be minimally visible from the roadway. The project footprint does not extend perpendicular from the shoreline.

*Requires substantial energy consumption.*

Other than energy expended during construction operations, the project would require no additional energy consumption.

## 7. CONCLUSIONS

Construction of permanent shore protection consisting of a hybrid rock rubble mound revetment and seawall is necessary to protect the twin habitable structures of the Hololani Resort Condominiums. Emplacement of an engineered structure will allow removal of the existing temporary protection, and will protect the Hololani buildings for the foreseeable future. Protection of the buildings is critical for all reasonable use of the property, and to maintain public safety and welfare. Ancillary benefits to protection of the Hololani include improvements to the nearshore water quality and protection of vital public infrastructure that includes Lower Honoapiilani Road and an important drainage line.

Negative effects of the proposed structure include additional erosion forces on the adjoining southern property due to end effects of the new structure, and some loss of use of beach area due to encroachment of the structure. The area lost is at a maximum when the beach is degraded during low sand conditions, and at a minimum during seasonal accretion periods. However, most of the footprint of the new structure is contained within that of the existing temporary protection.

Viable alternatives include a revetment on the same alignment as the proposed revetment/seawall hybrid and seawall landward of the certified shoreline. The revetment is a larger structure with a wider footprint than the preferred alternative. Ending the revetment at the southern boundary will likely require greater excavation and consequent de-stabilization of the soil when compared to the termination of the preferred alternative. Soft foundation conditions make seawall construction difficult, and it would likely require a pile-supported foundation. The seawall will have a greater negative effect on coastal processes.

Relocation of the proposed structure entirely behind the certified shoreline is not feasible as there is not room to construct earth anchors for the sheet pile tie-backs.

The proposed project will result in no long-term degradation of the environment or loss of habitat.

The project area is not known as an endangered or threatened species habitat. There are no known or identified historical or cultural resources at the immediate project site.

Minor impacts due to construction activity will include localized increase in noise, dust formation, equipment emissions, and restricted coastal access.

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

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## APPENDIX A. GOVERNMENT AGENCY AND RELATED COMMUNICATIONS

1. Letter from DLNR Hololani Emergency Permit 2-06-07
2. Letter from DLNR Hololani Emergency Permit 2-07-07
3. Letter from DLNR 2 YR Permit Extension 5-03-10
4. Letter from DLNR Sand Bag Repair Approval 9-28-10
5. Letter to DLNR 3-24-11 Hololani Shore Protection
6. Letter from DLNR 5-01-11
7. Letter from Maui County Planning Department 6-22-07
8. Letter to Maui County Planning Department 3-24-11
9. Letter from Maui County Planning Dept 8-16-11
10. Letter to USACE Jurisdictional Inquiry 11-30-11
11. Letter from USACE Approved Jurisdictional Determination 1-27-12
12. Letter to Maui County Department of Public Works 3-24-11
13. Letter to Royal Kahana 3-24-11
14. Letter to Pohailani 3-24-11

1. Appendix A: Letter from DLNR Hololani Emergency Permit 2-06-07

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809



DLNR.OCCL:DE

File No.: Emergency-OA-07-08

February 6, 2007

John C. Henry
Hololani Resident Manager
4401 L. Honoapiilani Rd
Lahaina, HI 96761

Mr. Henry:

SUBJECT: Emergency Erosion Control (Sandbags), Hololani Condominiums
4401 L. Honoapiilani Rd Lahaina, HI. TMK (2) 4-3-010:09.

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) has received your letter dated January 24, 2007 regarding an emergency request for a sand bag revetment fronting the property. Based on the information presented and a site visit by our staff on January 11, 2007 the large multi-story structure is in danger of collapse without immediate shore protection and justifies a temporary emergency response (Figure 1).

On February 2, 2007, the Department approved an emergency request of behalf of the Hololani Condominium landowners to place additional boulders and fabric on the shoreline in order to prevent a portion of the facility from being undermined by erosion. This authorization allowed Hololani to place boulders in the shoreline area for thirty (30) days. After this period, the boulders must be removed to the satisfaction of the Department.

As an interim measure (subsequent to the boulder removal), the landowner(s) would like to install a temporary engineered structure. The proposed sandbag and Tensar structure consists of approximately 380 linear feet of shoreline fronting the subject property. The revetment will be installed at elevation +2.5 ft to +10.0 (ft sl) and will consist of a combination of 144 Tensar units (0.75' X 5' X 10') (160 cubic yards of rock filled in a plastic mattress) as scour pad and splash apron and approximately 144 (5' X 10' X 1.5' ) Bulklift S.E.ABAG sandbags ( 360 cubic yards of sand). These will be installed in a sloping formation and built primarily seaward of the shoreline defined by the active erosional scarp. This authorization is for the referenced design presented in Figure 2 of the January 24, 2007 request letter (Figure 2).

The DLNR understands that during time the temporary sandbag/Tensar structure is in place, the landowner(s) intend to apply for a shoreline setback variance for an engineered rock revetment placed landward of and to replace the proposed sandbag structure, the installation of the bags is intended to be temporary until the required permits are obtained for a more permanent rock revetment.

**Mitigation Measures (Best Management Practices)**

Typical Best Management Practices shall be implemented to ensure that water quality and marine resources are protected and preserved. Mitigation measures involve the use of sand that is free of contaminants and low in silt content (to be determined). The applicant proposes to place the sandbags seaward of the shoreline at and will ensure silt is contained during construction activities. Excessive silt and turbidity shall be contained or otherwise minimized through the use of silt containment devices and barriers. Silt containment should be practiced for the duration of construction activities. The sandbag installation should occur during low tide to ensure activities do not discharge silt into state waters. Visual monitoring of the nearshore water quality condition should be practiced during sand placement; and if excessive turbidity occurs, sand placement shall stop and more effective silt containment measures utilized.

**Sand Quality**

Due to the contained use of the proposed sand, Best Management Practices, low silt content, limited duration of exposure and the high rate of flushing and circulation at the site, potential turbidity impacts from the proposed activities are estimated to be negligible. Near-shore turbidity associated with the use of this sand is not expected to impact marine life and will be quite short-lived in the nearshore waters and is not expected to exceed existing background levels.

**Based on the information provided, the Department has made the following determinations:**

1. There is an imminent threat to the existing dwelling with active erosion threatening the structure.
2. This berm is approximately defined by the active scarping and fallen vegetation. Erosion appears to have accelerated landward recently.
3. The proposed structure will provide temporary protection to the threatened structures until a more permanent solution is designed and approved.
4. There is no known beach-quality sand source stored behind the berm, it appears the area is composed a clay and weathered basalt that would not provide a useful source of sediment to the littoral system if were allowed to erode.
5. The area is largely armored with a large number of shoreline structures to the north and south of the property, specifically immediately to the north.
6. The applicant is developing a long-term plan for erosion control that may include stabilizing structures. This plan will be implemented before the 3 year expiration date of the emergency permit.

**DEPARTMENT ACTION**
**Terms and Conditions**

**The Chairperson of the Department of Land and Natural Resources hereby authorizes your emergency request for temporary sandbag and Tensar mattress structure fronting the subject property. This authorization includes, but is not limited to the following terms and conditions:**

1. This authorization will become valid upon the approval by the DLNR of:
   a. A sand source for the installation of the sand bags.
   b. A Best Management Practices (BMP's) Plan
   c. Installation sequence and work plan for the proposed structure.

2. The project includes the installation and replacement of approximately 144 (5' X 10' X 1.5' ) Bulklift S.E.ABAG sandbags ( 360 cubic yards of sand) in conjunction with 114 Tensar rock-filled units (160 cubic yards of rock).

3. This authorization is valid for three (3) years from the date of acceptance, at which time, the authorization shall expire.

4. The applicant shall ensure that excessive siltation and turbidity is contained or otherwise minimized to the satisfaction of the DLNR, DOH or other agency, through silt containment devices or barriers, high sand quality and selective sand placement;

5. Any work or construction authorized by this letter shall be initiated within six (6) months of the approval of such use, and, unless otherwise authorized, shall be completed within twelve (12) months of the approval of such use. The applicant shall notify the Department before construction activity is initiated and when it is completed.

6. Sand utilized for the project will be from an approved commercial sand source. No sand shall be extracted from the beach fronting the property for any purpose.

7. Authorization of the sand used for the bags is contingent upon review and approval of the sand by the Department. **Please submit sediment grain size analysis report** and specify the source to the DLNR for review to ensure the proposed sand meets minimum standards. The sand shall meet the following State quality standards:

   a) The proposed fill sand shall not contain more than six (6) percent fines, defined as the #200 sieve (0.074 mm).

   b) The proposed beach fill sand shall not contain more than ten (10) percent coarse sediment, defined as the #4 sieve (4.76 mm) and shall be screened to remove any non-beach compatible material and rubble.

c) No more than 50 (fifty) percent of the fill sand shall have a grain diameter less than 0.125 mm as measured by #120 Standard Sieve Mesh.

d) Beach fill shall be dominantly composed of naturally occurring carbonate beach or dune sand. Crushed limestone or other man made or non carbonate sands are unacceptable.

8. Transfer of ownership of the subject property includes the responsibility of the new owner to adhere to the terms and conditions of this authorization.

9. This action is temporary to alleviate the emergency until long-term measures can be implemented. The DLNR reserves the right to terminate this authorization if it is determined the structure is having an adverse impact on the environment or if other shore protection alternatives are available.

10. At the conclusion of work, the area shall be clean of all construction material, and the site shall be restored to a condition acceptable to the Chairperson.

11. The activity shall not adversely affect a federally listed threatened or endangered species or a species proposed for such designation, or destroy or adversely modify its designated critical habitat.

12. The activity shall not substantially disrupt the movement of those species of aquatic life indigenous to the area, including those species, which normally migrate through the area.

13. When the Chairperson is notified by the applicant or the public that an individual activity deviates from the scope of an application approved by this letter, or activities are adversely affecting fish or wildlife resources or their harvest, the Chairperson will direct the applicant to undertake corrective measures to address the condition affecting these resources. The applicant must suspend or modify the activity to the extent necessary to mitigate or eliminate the adverse effect.

14. When the Chairperson is notified by the U.S. Fish and Wildlife Service, the National Marine Fisheries Service or the State DLNR that an individual activity or activities authorized by this letter is adversely affecting fish or wildlife resources or their harvest, the Chairperson will direct the applicant to undertake corrective measures to address the condition affecting these resources. The applicant must suspend or modify the activity to the extent necessary to mitigate or eliminate the adverse effect.

15. To avoid encroachments upon the area, the applicant shall not use artificially accreted areas due to nourishment or hardening as indicators of the shoreline.

16. Where any interference, nuisance, or harm may be caused, or hazard established by the activities authorized under this authorization , the applicant shall be required to take measures to minimize or eliminate the interference, nuisance, harm or hazard.

17. No contamination of the marine or coastal environment (trash or debris) shall result from project-related activities authorized under this authorization .

18. No motorized construction equipment is to be operated in the water at any time.

19. In the event there is any petroleum spill on the sand, the operator shall promptly remove the contaminated sand from the beach and immediately contact the DLNR/OCCL staff at 587-0377, to conduct a visual inspection and to provide appropriate guidance.

20. For projects authorized by this letter, the applicant, its successors and assigns, shall indemnify and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, and death arising out of any act or omission of the applicant, its successors, assigns, officers, employees, contractors, and agents under projects authorized under this permit.

21. The DLNR reserves the right to impose additional terms and conditions on projects authorized under this letter, if it deems them necessary.

22. The applicant shall comply with all applicable statutes, ordinances, rules, and regulations of the federal, state, and county governments for projects authorized under this letter.

23. In the event that historic sites, including human burials are uncovered during construction activities, all work in the vicinity must stop immediately and contact the State Historic Preservation Division at 692-8015.

24. The applicant shall obtain a right-of-entry permit or other land disposition approval from the State of Hawaii, Land Division prior to the inception of project work.

25. Failure on the part of the applicant to comply with any conditions imposed under this authorization shall render the authorization null and void.

26. The applicant shall take measures to ensure that the public is adequately informed of the project work once it is initiated and the need to avoid the project area during the operation and shall notify all abutting property owners and community organizations that may be affected by the proposed action.

27. The applicant shall implement standard Best Management Practices (BMPs), including the ability to contain and minimize silt in nearshore waters and clean up fuel; fluid or oil spills immediately for projects authorized by this letter. Equipment must not be refueled in the shoreline area. If visible petroleum, persistent turbidity or other unusual substances are observed in the water as a result of the proposed operation, all work must cease immediately to ascertain the source of the substance. The DLNR/OCCL staff shall be contacted immediately at 587-0377, to conduct a visual inspection and to provide appropriate guidance.

**Additional Monitoring:**

28. The applicant must submit a written completion report to the OCCL within two months of completion of the project. The completion report must include, as appropriate, descriptions of the construction activities, discussion(s) of any deviations from the proposed project design and the cause of these deviations, results of any environmental monitoring (primarily sand movement observations and turbidity observations), discussion(s) of any necessary corrective action(s), and photographs documenting the progress of the permitted work before, during and after sand placement.

29. As a temporary emergency project, the applicant shall provide an initial completion report and follow-up summary reports ***annually*** to the Department for three (3) years from the date of acceptance or until a permitted permanent structure is completed describing the condition of the sandbags and any impacts to the local nearshore processes.

**Authorization Expiration:**

30. This authorization shall expire three (3) years from the date of this letter. At that time, all activities authorized by the authorization shall be removed and the shoreline shall be returned to its original condition, unless a long-term plan has been approved. Failure to comply with these terms and conditions shall constitute a violation of Chapter 183C, Hawaii Revised Statutes and fines of $2,000 per day shall accrue for each day that the landowner fails to comply with the terms and conditions of this authorization.

**Please acknowledge receipt of this authorization, with the above noted conditions, in the space provided below. Please sign two copies. Retain one and return the other within fifteen (15) days.** Please notify the OCCL in advance of the anticipated construction dates and notify the OCCL immediately if any changes to the scope or schedule are anticipated.

Should you have any questions on any of these conditions, please contact the Office of Conservation and Coastal Lands (OCCL) at (808) 587-0377.

Sincerely,

**PETER T. YOUNG**, Chairperson
Department of Land and Natural Resources

Attachments (Figures 1, 2)

Maui Board Member
DAR/HPD
Maui County Planning Dept
OHA/DOH, Clean Water
USFWS/NMFS/USACE
Jim Barry Sea Engineering Makai Research Pier Waimanalo, Hawaii 96795-1820

I concur with the conditions of this letter:

____________________________________
Applicant's Signature

Date__________________

*Note: transfer of ownership (Title) conveys all terms and conditions of this authorization to the new owner.*

**Figure 1. Site Conditions**
January 31, 2007

**Figure 2. Proposed Plan**

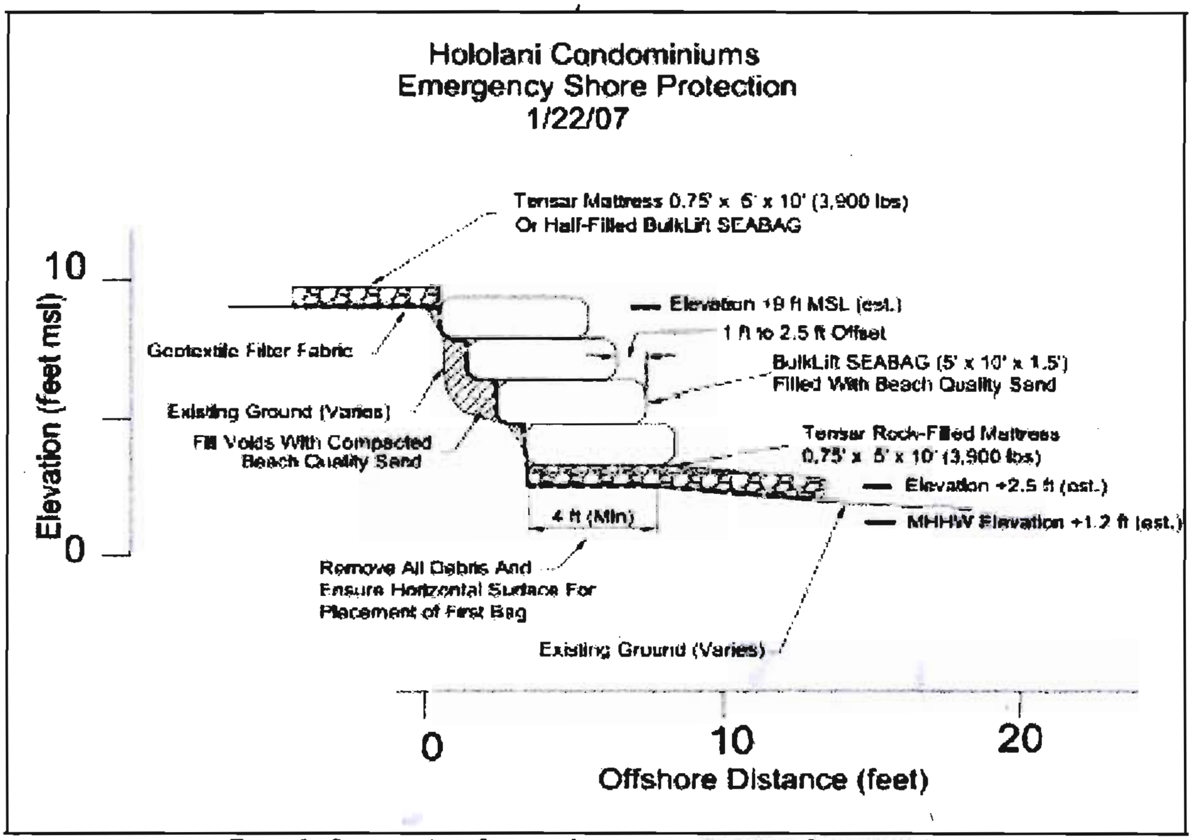


Figure 2. Cross-section of proposed temporary emergency shore protection.

2. Letter from DLNR Hololani Emergency Permit 2-07-07

LINDA LINGLE
GOVERNOR OF HAWAII

**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR

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

File No.: Emergency-OA-07-08

February 2, 2007

John C. Henry
Hololani Resident Manager
4401 L. Honoapiilani Rd
Lahaina, HI 96761

FEB - 2 2007

Mr. Henry:

SUBJECT: Emergency Erosion Control, Hololani Condominiums
4401 L. Honoapiilani Rd Lahaina, HI. TMK (2) 4-3-010:09.

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) has reviewed Refugio Gonzales' February 2, 2007 request to place boulders in front of one of the buildings that is being threatened by erosion. The recent Kona storms have caused a sudden recession of the shoreline from 3-8 feet on a portion of the Hololani property. You are currently planning emergency erosion control measures (sandbags) for the entire property, but this project will not commence for a few weeks as the materials are currently on order. The erosion currently threatens a large multi-story building and it may be in danger of collapse without immediate shore protection. The DLNR understands the landowner(s) intend to apply for a shoreline setback variance for an engineered rock revetment placed landward of the shoreline. You are seeking our approval to place rocks and fabric on the shoreline as an interim measure until the sandbag revetment can be completed.

**Based on the information provided, the Department has made the following determinations:**

1. There is an imminent threat to the existing building with active erosion threatening the structure.
2. This berm is approximately defined by the active scarping and fallen vegetation. Erosion appears to have accelerated landward recently.
3. The proposed structure will provide temporary protection to the threatened structures until a more permanent solution is designed and approved.
4. There is no known beach-quality sand source stored behind the berm, it appears the area is composed a clay and weathered basalt that would not provide a useful source of sediment to the littoral system if were allowed to erode.

5. The area is largely armored with a large number of shoreline structures to the north and south of the property, specifically immediately to the north.
6. The are no other reasonable alternatives.
7. The applicant is developing a long-term plan for erosion control that may include stabilizing structures.

**DEPARTMENT ACTION**
**Terms and Conditions**

**The Chairperson of the Department of Land and Natural Resources hereby authorizes your emergency request for temporary boulders fronting the subject property. This authorization includes, but is not limited to the following terms and conditions:**

1. This authorization is valid for one month from the date of acceptance, at which time, the authorization shall expire;

2. The applicant shall ensure that excessive siltation and turbidity is contained or otherwise minimized to the satisfaction of the DLNR, DOH or other agency, through silt containment devices or barriers;

3. Transfer of ownership of the subject property includes the responsibility of the new owner to adhere to the terms and conditions of this authorization;

4. This action is temporary to alleviate the emergency until long-term measures can be implemented. The DLNR reserves the right to terminate this authorization if it is determined the structure is having an adverse impact on the environment or if other shore protection alternatives are available;

5. At the conclusion of work, the area shall be clean of all construction material, and the site shall be restored to a condition acceptable to the Chairperson;

6. The activity shall not adversely affect a federally listed threatened or endangered species or a species proposed for such designation, or destroy or adversely modify its designated critical habitat;

7. The activity shall not substantially disrupt the movement of those species of aquatic life indigenous to the area, including those species, which normally migrate through the area;

8. When the Chairperson is notified by the applicant or the public that an individual activity deviates from the scope of an application approved by this letter, or activities are adversely affecting fish or wildlife resources or their harvest, the Chairperson will direct the applicant to undertake corrective measures to address the condition affecting these resources. The applicant must suspend or modify the activity to the extent necessary to mitigate or eliminate the adverse effect;

9. When the Chairperson is notified by the U.S. Fish and Wildlife Service, the National Marine Fisheries Service or the State DLNR that an individual activity or activities authorized by this letter is adversely affecting fish or wildlife resources or their harvest, the

Chairperson will direct the applicant to undertake corrective measures to address the condition affecting these resources. The applicant must suspend or modify the activity to the extent necessary to mitigate or eliminate the adverse effect;

10. Where any interference, nuisance, or harm may be caused, or hazard established by the activities authorized under this permit, the applicant shall be required to take measures to minimize or eliminate the interference, nuisance, harm or hazard;

11. No contamination of the marine or coastal environment (trash or debris) shall result from project-related activities authorized under this permit;

12. In the event there is any petroleum spill on the sand, the operator shall promptly remove the contaminated sand from the beach and immediately contact the DLNR/OCCL staff at 587-0377, to conduct a visual inspection and to provide appropriate guidance;

13. For projects authorized by this letter, the applicant, its successors and assigns, shall indemnify and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, and death arising out of any act or omission of the applicant, its successors, assigns, officers, employees, contractors, and agents under projects authorized under this permit;

14. The DLNR reserves the right to impose additional terms and conditions on projects authorized under this letter, if it deems them necessary;

15. The applicant shall comply with all applicable statutes, ordinances, rules, and regulations of the federal, state, and county governments for projects authorized under this letter;

16. In the event that historic sites, including human burials are uncovered during construction activities, all work in the vicinity must stop immediately and contact the State Historic Preservation Division at 692-8015;

17. The applicant shall obtain a right-of-entry permit or other land disposition approval from the State of Hawaii, Land Division prior to the inception of project work;

18. Failure on the part of the applicant to comply with any conditions imposed under this letter shall render the permit null and void;

19. The applicant shall take measures to ensure that the public is adequately informed of the project work once it is initiated and the need to avoid the project area during the operation and shall notify all abutting property owners and community organizations that may be affected by the proposed action; and

20. The applicant shall implement standard Best Management Practices (BMPs), including the ability to contain and minimize silt in nearshore waters and clean up fuel; fluid or oil spills immediately for projects authorized by this letter. Equipment must not be refueled in the shoreline area. If visible petroleum, persistent turbidity or other unusual substances are observed in the water as a result of the proposed operation, all work must cease immediately to ascertain the source of the substance. The DLNR/OCCL staff shall be

contacted immediately at 587-0377, to conduct a visual inspection and to provide appropriate guidance.

**Authorization Expiration:**

21. This authorization shall expire one month from the date of this letter. At that time, all boulders authorized by this letter shall be removed. Failure to remove the boulders within thirty (30) days shall constitute a violation of Chapter 183C, Hawaii Revised Statutes and fines of $2,000 per day shall accrue for each day that the landowner fails to comply with the terms and conditions of this authorization.

**Please acknowledge receipt of this authorization, with the above noted conditions, in the space provided below. Please sign two copies. Retain one and return the other within fifteen (15) days.** Please notify the OCCL in advance of the anticipated construction dates and notify the OCCL immediately if any changes to the scope or schedule are anticipated.

Should you have any questions on any of these conditions, please contact the Office of Conservation and Coastal Lands (OCCL) at (808) 587-0377.

Sincerely,

**PETER T. YOUNG**, Chairperson
Department of Land and Natural Resources

Attachments (Figures 1, 2)

cc: Chairperson
Maui Board Member
DAR/HPD
Maui County Planning Dept
OHA/DOH, Clean Water
USFWS/NMFS/USACE
Jim Barry Sea Engineering Makai Research Pier Waimanalo, Hawaii 96795-1820

I concur with the conditions of this letter:

____________________________
Applicant's Signature

Date________________

*Note: transfer of ownership (Title) conveys all terms and conditions of this authorization to the new owner.*

3. Letter from DLNR 2 YR Permit Extension 5-03-10

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
POST OFFICE BOX 621
HONOLULU, HAWAII 96809



DLNR.OCCL:DE File No.: Emergency-MA-07-08

May 3, 2010

Ms. Lisa Howard
C/O Hawaii First
75 Kupuohi St. #205
Lahaina, HI 96761

Ms. Howard:

SUBJECT: Emergency Erosion Control (Sandbags), Request for Extension.
Hololani Condos 4401 L. Honoapiilani Rd Lahaina, HI. TMK (2) 4-3-010:09.

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) has received your April 22, 2010 request for extension for the subject emergency erosion control measures. Based on the information supplied, it is clear your client (Hololani Condominiums) is making an effort to develop a long-term solution to eventually replace the subject temporary emergency erosion control structure. Temporary emergency authorization MA-07-08 was issued February 6, 2007 allowing Hololani to place Geobags and erosion blankets in the shoreline area for up to 3 years. After this period, the material must be removed to the satisfaction of the DLNR. Your request for an extension to emergency permit MA-07-08 is granted for a period of 2 additional years. The new expiration for emergency permit MA-07-08 is May 1, 2012. This extension is based on the understanding that your client is working towards a permitted long-term erosion control measure and will require additional time to process the necessary plans and permit applications.

In order to consider your request for maintenance and repairs to the existing emergency sandbags and Tensar® mattresses the DLNR requires more information. Please supply the following information to the DLNR, OCCL within 60 days:

1. Please provide a detailed site plan identifying the sandbags and Tensar® mattresses that require repair and or replacement.
2. Please provide a detailed repair plan with a description of the method of replacement and the sequence or construction. For example how will the displaced bags and fabric be replaced (filled in place or overlying bags removed first).
3. Scaled Cross-section and plan view of proposed actions with volume, quantities and type of material.

a. Material list with size, type and quantity of all proposed material.
b. Sand source and volume. Include sediment grain size analysis of proposed sand source.
c. Installation/ removal method, anchoring system and estimated construction timeframe.
d. Best Management Practices (BMPs) to minimize environmental disturbance of surrounding areas and prevent discharge into state waters.
e. Estimated time the activities will need to be in place and anticipated construction date.
f. Proposed access plan for equipment and materials.
g. Timetable for development of a long-term plan for erosion control and mitigation.

Should you have any questions on any of these conditions, please contact the Office of Conservation and Coastal Lands (OCCL) at (808) 587-0377.

Sincerely,

**SAM LEMMO, Administrator**
Office of Conservation and Coastal Lands
Department of Land and Natural Resources

cc: Chairperson
Maui Board Member
Maui County Planning Dept- Jim Buika
Danny Lentz Hololani Resident Manager 4401 L. Honoapiilani Rd Lahaina, HI 96761
Joseph Higgins Allana, Buik & Bers, Inc. 75 Kupuohi St. #207 Lahaina, HI 96761

4. Letter from DLNR Sand Bag Repair Approval 9-28-10

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAII 96809



DLNR.OCCL:CC

File No.: Emergency-MA-07-08

September 28, 2010

Mr. Joseph Higgins, PE
Allana Buick & Bers, Inc
707 Richards Street, Suite 635
Honolulu, HI 96813

Mr. Higgins:

SUBJECT: Emergency Erosion Control (Sandbags), Repair and Maintenance Request for Emergency Authorization MA-07-08. Hololani Condos 4401 L. Honoapiilani Rd Lahaina, HI. TMK (2) 4-3-010:09.

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) has received your August 11, 2010 request for maintenance and repairs to the existing emergency sandbags, geotextile cloth, and Tensar® mattresses, as approved in the temporary emergency authorization MA-07-08. Temporary emergency authorization MA-07-08 was issued February 6, 2007 allowing Hololani to place Geobags and erosion blankets in the shoreline area for up to 3 years, and has been extended for 2 years. Your request for maintenance and repairs to the existing emergency sandbags, geotextile cloth, and Tensar® mattresses has been approved, provided you adhere to the following conditions:

**Mitigation Measures (Best Management Practices)**

Typical Best Management Practices shall be implemented to ensure that water quality and marine resources are protected and preserved. Mitigation measures involve the use of sand that is free of contaminants and low in silt content (to be determined). The applicant proposes to place the sandbags seaward of the shoreline at and will ensure silt is contained during construction activities. Excessive silt and turbidity shall be contained or otherwise minimized through the use of silt containment devices and barriers. Silt containment should be practiced for the duration of construction activities. The sandbag installation should occur during low tide to ensure activities do not discharge silt into state waters. Visual monitoring of the nearshore water quality condition should be practiced during sand placement; and if excessive turbidity occurs, sand placement shall stop and more effective silt containment measures utilized.

**Sand Quality**

Due to the contained use of the proposed sand, Best Management Practices, low silt content, limited duration of exposure and the high rate of flushing and circulation at the site, potential turbidity impacts from the proposed activities are estimated to be negligible. Near-shore turbidity associated with the use of this sand is not expected to impact marine life and will be quite short-lived in the nearshore waters and is not expected to exceed existing background levels.

**DEPARTMENT ACTION**
**Terms and Conditions**

**Applicant is authorized to conduct repair and maintenance activities for temporary sandbag and Tensar mattress structure fronting the subject property. This authorization includes, but is not limited to the following terms and conditions:**

1. This authorization will become valid upon the approval by the DLNR of:
   a. A sand source for the installation of the sand bags.
   b. A Best Management Practices (BMP's) Plan
   c. Installation sequence and work plan for the proposed structure.

2. The project includes the repair or replacement of approximately 12 (5' X 10' X 1.5' ) Bulklift S.E.ABAG sandbags ( 360 cubic yards of sand), 3 Tensar rock-filled units (160 cubic yards of rock), and replacement of sections of geotextile fabric.

3. The applicant shall ensure that excessive siltation and turbidity is contained or otherwise minimized to the satisfaction of the DLNR, DOH or other agency, through silt containment devices or barriers, high sand quality and selective sand placement;

4. Any work or construction authorized by this letter shall be initiated within six (6) months of the approval of such use, and, unless otherwise authorized, shall be completed within twelve (12) months of the approval of such use. The applicant shall notify the Department before construction activity is initiated and when it is completed.

5. Sand utilized for the project will be from an approved commercial sand source. No sand shall be extracted from the beach fronting the property for any purpose.

6. Authorization of the sand used for the bags was based upon review and approval of the submitted grain size analysis. The sand has met the following State quality standards:

   a) The proposed fill sand does not contain more than six (6) percent fines, defined as the #200 sieve (0.074 mm).

   b) The proposed beach fill sand does not contain more than ten (10) percent coarse sediment, defined as the #4 sieve (4.76 mm) and shall be screened to remove any non-beach compatible material and rubble.

c) No more than 50 (fifty) percent of the fill sand has a grain diameter less than 0.125 mm as measured by #120 Standard Sieve Mesh.

d) Beach fill shall be dominantly composed of naturally occurring carbonate beach or dune sand. Crushed limestone or other man made or non carbonate sands are unacceptable.

7. Transfer of ownership of the subject property includes the responsibility of the new owner to adhere to the terms and conditions of this authorization.

8. This action is temporary to alleviate the emergency until long-term measures can be implemented. The DLNR reserves the right to terminate this authorization if it is determined the structure is having an adverse impact on the environment or if other shore protection alternatives are available.

9. At the conclusion of work, the area shall be clean of all construction material, and the site shall be restored to a condition acceptable to the Chairperson.

10. The activity shall not adversely affect a federally listed threatened or endangered species or a species proposed for such designation, or destroy or adversely modify its designated critical habitat.

11. The activity shall not substantially disrupt the movement of those species of aquatic life indigenous to the area, including those species, which normally migrate through the area.

12. When the Chairperson is notified by the applicant or the public that an individual activity deviates from the scope of an application approved by this letter, or activities are adversely affecting fish or wildlife resources or their harvest, the Chairperson will direct the applicant to undertake corrective measures to address the condition affecting these resources. The applicant must suspend or modify the activity to the extent necessary to mitigate or eliminate the adverse effect.

13. When the Chairperson is notified by the U.S. Fish and Wildlife Service, the National Marine Fisheries Service or the State DLNR that an individual activity or activities authorized by this letter is adversely affecting fish or wildlife resources or their harvest, the Chairperson will direct the applicant to undertake corrective measures to address the condition affecting these resources. The applicant must suspend or modify the activity to the extent necessary to mitigate or eliminate the adverse effect.

14. To avoid encroachments upon the area, the applicant shall not use artificially accreted areas due to nourishment or hardening as indicators of the shoreline.

15. Where any interference, nuisance, or harm may be caused, or hazard established by the activities authorized under this authorization, the applicant shall be required to take measures to minimize or eliminate the interference, nuisance, harm or hazard.

16. No contamination of the marine or coastal environment (trash or debris) shall result from project-related activities authorized under this authorization.

17. No motorized construction equipment is to be operated in the water at any time.

18. In the event there is any petroleum spill on the sand, the operator shall promptly remove the contaminated sand from the beach and immediately contact the DLNR/OCCL staff at 587-0377, to conduct a visual inspection and to provide appropriate guidance.

19. For repair and maintenance projects authorized by this letter, the applicant, its successors and assigns, shall indemnify and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, and death arising out of any act or omission of the applicant, its successors, assigns, officers, employees, contractors, and agents under projects authorized under this permit.

20. The DLNR reserves the right to impose additional terms and conditions on projects authorized under this letter, if it deems them necessary.

21. The applicant shall comply with all applicable statutes, ordinances, rules, and regulations of the federal, state, and county governments for projects authorized under this letter.

22. In the event that historic sites, including human burials are uncovered during construction activities, all work in the vicinity must stop immediately and contact the State Historic Preservation Division at 692-8015.

23. The applicant shall obtain a right-of-entry permit or other land disposition approval from the State of Hawaii, Land Division prior to the inception of project work.

24. Failure on the part of the applicant to comply with any conditions imposed under this authorization shall render the authorization null and void.

25. The applicant shall take measures to ensure that the public is adequately informed of the project work once it is initiated and the need to avoid the project area during the operation and shall notify all abutting property owners and community organizations that may be affected by the proposed action.

26. The applicant shall implement standard Best Management Practices (BMPs), including the ability to contain and minimize silt in nearshore waters and clean up fuel; fluid or oil spills immediately for projects authorized by this letter. Equipment must not be refueled in the shoreline area. If visible petroleum, persistent turbidity or other unusual substances are observed in the water as a result of the proposed operation, all work must cease immediately to ascertain the source of the substance. The DLNR/OCCL staff

shall be contacted immediately at 587-0377, to conduct a visual inspection and to provide appropriate guidance.

**Additional Monitoring:**

27. The applicant must submit a written completion report to the OCCL within two months of completion of the repair and maintenance project. The completion report must include, as appropriate, descriptions of the repair and maintenance activities, discussion(s) of any deviations from the proposed project design and the cause of these deviations, results of any environmental monitoring (primarily sand movement observations and turbidity observations), discussion(s) of any necessary corrective action(s), and photographs documenting the progress of the permitted work before, during and after sand placement.

Should you have any questions on any of these conditions, please contact the Office of Conservation and Coastal Lands (OCCL) at (808) 587-0377.

Sincerely,

LAURA H. THIELEN, Chairperson
Department of Land and Natural Resources

cc: Maui Board Member
Maui County Planning Dept- Jim Buika
Danny Lentz Hololani Resident Manager 4401 L. Honoapiilani Rd Lahaina, HI 96761

5. Letter to DLNR 3-24-11 Hololani Shore Protection

# *Sea Engineering, Inc.*

Makai Research Pier • Waimanalo, Hawaii 96795-1820 • E-mail: sei@seaengineering.com
Phone: (808) 259-7966 / FAX (808) 259-8143 • Website: www.seaengineering.com

March 24, 2011

Mr. Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands,
State of Hawaii, Department of Land and Natural Resources
Post Office Box 621
Honolulu, HI, 96809

Dear Mr. Lemmo,

Subject: Hololani Resort Condominiums Permanent Shore Protection: Project Design and Preliminary Environmental Document

The Hololani Resort Condominiums (the Hololani) are located at 4401 Lower Honoapiilani Road in the Kahana area of Maui (TMK (2) 4-3-010:009), and have had an on-going coastal erosion problem since approximately 1988. During the Winter of 2006-2007, the situation became critical and Sea Engineering, Inc. (SEI) designed emergency temporary shore protection using Bulklift geotextile sand bags and Tensar rock-filled marine mattresses. The temporary shore protection was constructed in November and December of 2007. The structure was authorized by both Maui County Planning Department and the State Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL). The latter authorization was File No. *Emergency-OA-07-08*. As part of this authorization, the Hololani was required to develop the design and aquire the necessary permits for a permanent shore protection solution.

SEI has been actively working with the Hololani to address their needs for robust and permanent shore protection. The document which accompanies this letter, *Environmental and Coastal Engineering Report For Hololani Shore Protection*, presents our preferred alternative for a permanent shore protection solution at the Hololani, as well as background for the project and preliminary environmental documentation.

We anticipate that this project will require Federal, State, and County permits. The most recent shoreline certification was granted in 2001. Two applications in 2007 were denied due to lack of documentation for approval of emergency sand bags that were in place along the shoreline (see Appendix B in the report). Apparently, these bags were part of interim measures for emergency protection taken before the November/December construction of the SEI designed structure.

We have several questions regarding implementation of the permit approval process for this project:

1) The permanent shore protection design will span what we believe would be a reasonable Certified Shoreline, i.e., we anticpate the need for Maui County Special Management Area

(SMA) and Shoreline Setback Variance (SSV) permits, as well as State Conservation District Use Permit (CDUP). Given the anticpated need for both County and State permits, is a Certified Shoreline determination required for the project to proceed? If it is necessary, can the shoreline certification be granted with the legally permitted temporary emergency shore protection in place?

2) Both the County SSV and the State CDUP require implementation of the HRS Chapter 343 environmental process, which requires submission of an Environmental Assessment (EA). With the understanding that the project will be in both State and County jurisdictions, which agency should be the accepting authority for the EA?

3) Please note that the preferred alternative has been selected to minimize the amount of material placed in the Conservation District and Federal Navigable Waters, and to enable construction within the metes and bounds of the Hololani property. However, in the event that crossing the property boundary becomes necessary due to design modifications as we proceed through the approval and permitting process, we would appreciate any information you can provide regarding obtaining an easement for construction on State Lands – what would be the procedure, and what fees or rates would apply?

Additionally, we welcome any comments you may have concerning this project. If you have questions or concerns, please feel free to contact me. I and other representatives of the Hololani AOAO are available to meet with DLNR-OCCL to discuss the project, and we encourage any such interaction that would mediate the intent of the project design with the mission and interests of the agency.

J. Barry

James H. Barry
Coastal Engineer
Sea Engineering, Inc.

Cc: Mr. Stuart Allen, Hololani AOAO
Mr. Joe Higgins, Allan, Buick and Bers, Inc.
Mr. James Buika, Maui County Planning Department
Ms. Lisa Howard, Hawaii First, Inc.

6. Letter from DLNR 5-01-11

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

GUY H. KAULUKUKUI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

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

**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**

**Office of Conservation and Coastal Lands**
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DLNR:OCCL:.CC

Correspondence: MA-11-190

MAY - 3 2011

Mr. James H. Barry
Coastal Engineer
Sea Engineering, Inc.

Dear Mr. Barry,

SUBJECT: Hololani Resort Condominiums Permanent Shore Protection: Project Design and Preliminary Environmental Document. 4401 Lower Honoapiilani Road, Lahaina, Hawaii, TMK (2) 4-3-010:009.

The Office of Conservation and Coastal Lands (OCCL) has received your March 24, 2011 request to review the project design and preliminary environmental document for the Hololani Resort Condominiums, 4401 Lower Honoapiilani Road, Lahaina, Hawaii, TMK (2) 4-3-010:009.

There were three specific questions you posed regarding the proposed project design and supporting document. First of which was the requirement for a certified shoreline for a project that is expected to extend across the jurisdictional boundary into the Conservation District. The OCCL recommends that you pursue a certified shoreline as it will assist both the public and the agencies in evaluating the impact and location of the proposal. As noted in your letter, the previous shoreline applications were rejected based on the presence of an unauthorized structure. A shoreline may be certified along a temporary structure if the structure is legal, there are no encroachments onto State land, and the shoreline is located in the position defined in Hawaii Revised Statute § 205A-1.

The second question is in regard to which agency, Maui County Planning Department or the OCCL, should be the receiving authority for the project's Environmental Assessment (EA). The OCCL and Maui County Planning Department will need to discuss this matter and agree upon who shall be the receiving agency.

The third question requests information regarding a potential application for a State easement in the event that the final structure crosses the makai private property boundary. In the event that the applicant desires to pursue an easement, this matter would be assessed by the Department of Land and Natural Resources (DLNR) as part of the Conservation District Use Application (CDUA) process with input from DLNR Land Division. The Board of Land and Natural Resources (BLNR) will determine if an easement will be granted and how much it will cost.

After reviewing the proposed project, the OCCL has several comments. The OCCL understands that there are limited options available for designing shoreline protection that will sufficiently protect the condominium building. The OCCL recommends that the final structural design be located as far mauka as possible to offset the impact it will have on the coastal resources. The OCCL is supportive of the incorporated coastal access pathway included in the preferred design. The OCCL acknowledges the benefits of the preferred hybrid design as it presents a limited footprint while still acting as an effective wave baffle and shoreline armoring structure.

The OCCL notes that these comments are intended solely to facilitate the permitting process, and give no opinion for or against shoreline hardening, at this time. Approval or disapproval of a project is at the discretion of the BLNR.

Should you have any questions or comments, please email Sea Grant Extension Agent Chris Conger, in the OCCL, at Chris.L.Conger@hawaii.gov.

Sincerely,

SAMUEL J LEMMO, Administrator
Office of Conservation and Coastal Lands

CC: Maui County Planning Department
Maui Land Division Office
Mr. Stuart Allen, Hololani AOAO
4401 Lower Honoapiilani Road
Lahaina, HI 96761

7. Letter from Maui County Planning Department 6-22-07

Received
June 27-2007
R.J.L.

CHARMAINE TAVARES
Mayor

JEFFREY S. HUNT
Director

COLLEEN M. SUYAMA
Deputy Director

COUNTY OF MAUI
**DEPARTMENT OF PLANNING**

June 22, 2007

Mr. David Ferguson
Management Consultants Hawaii
Post Office Box 10039
Lahaina, Hawaii 96761

Dear Mr. Ferguson:

**SUBJECT: SPECIAL MANAGEMENT AREA (SMA) EMERGENCY PERMIT - TEMPORARY SHORELINE HARDENING AT THE HOLOLANI AOAO AT 4401 LOWER HONOAPIILANI ROAD, KAHANA, TMK: (2) 4-3-010:009, LAHAINA, MAUI, HAWAII (SM3 2007/0001) (SSA 2007/0019)**

In response to your application received on January 22, 2007, the Maui Planning Department (Department) finds that the eroded shoreline scarp is less than 20 feet from the nearest edge of the building.

In accordance with the Special Management Area Rules for the Maui Planning Commission, Section 12-202-16, a determination has been made relative to the above project that the proposed action is immediately required to prevent substantial harm to the public health, safety and welfare. As such, the Department finds that the criteria set forth in Sections 205A-22 and 30, Hawaii Revised Statutes (HRS), as amended, have been met, and the granting of an SMA Emergency Permit is justified.

*Site History*

Erosion along the beach that fronts the Hololani is episodic, creating periods of risk to habitable structures followed by periods of beach re-establishment. However, chronic erosion has continued to reduce sand resources at the site causing the beach to profile and sand resources at the site to shrink over time. The existence of chronic erosion exasperates the episodic erosion events, resulting in the shoreline moving closer and closer to the high-rise condominiums each year.

Management at the Hololani contacted the State Department of Land and Natural Resources Office of Coastal and Conservation Lands (DLNR - OCCL), Zoe Norcross-Nu'u and Department staff approximately two years ago to develop a suitable response to erosion crisis at the site. Since that time, the parties have been in close communications with one another, numerous site visits have been conducted, shoreline change has been monitored and documented, and presentations have been made to the Hololani residents and Board of Directors regarding the permitting process and shoreline erosion responses.

Previously, a January 23, 2000 Emergency SMA application was submitted to install shoreline protection using sandbags at the site. The application was approved by the Department on February, 2000, (SM3 2000/0001) (SSA 2000/0001). Geotextile sea-bags are located at the northern end of the property adjacent to a county easement for a storm water outlet on Lower Honopiialani Road. The geotextile bags have remained since 2000 and reduce erosion of the Hololani's property which is caused by the discharge of storm water during heavy downpours.

In addition to the existing geotextile bags at the northern end of the property, the Hololani placed boulders and a number of sandbags along the shoreline during Kona storms in the winter season of 2005 and 2006. Zoe Norcross and Thorne Abbott made presentations to the Hololani Board of Directors and members of the AOAO on May 4, 2006, regarding why erosion was occurring and applicable responses for the site. As a result of this discussion and in compliance with conditions of a subsequent May 11, 2006 emergency permit approval, (SM3 2006/0002) (SSA 2006/0014), the sandbags were subsequently removed from the shoreline once the beach restored itself. However, the geotextile bags remained on the northern end of the property.

Furthermore, as a condition of the emergency approval, the Department required the Hololani to formally apply for all necessary shoreline permits. To comply, the Hololani applied for SMX 2006/0317 on July 5, 2006, for beach replenishment and protection at the site. On July 17, 2006, the Department determined the application required additional information which would be based on forthcoming technical studies paid for by the Hololani. The Department's letter provided a formal determination of the types of studies necessary and actions or "next steps" that the Hololani should take to remedy their circumstances.

Again during the winter 2006/2007 season, Kona storms caused a sudden three to eight feet retreat in the shoreline which formed a precipitous scarp around ten feet in height. Sand resources appeared to be entirely scoured from the beach leaving the rock substrate exposed. The scarp was within 20 feet of one of the Hololani towers, which was determined to be in imminent danger. In response, the Hololani submitted a formal, written SMA emergency permit application on January 22, 2007, which proposed to install geotextile bags along the length of the property.

While the permit application was in process, additional erosion at the site necessitated the placement of boulders along the shoreline for a large (75 feet plus) section of the northern end of the property. On February 2, 2007, the DLNR - OCCL approved emergency control measures initiated by the Hololani at the site. The protective measures included the after-the-fact placement of boulders and the proposed temporary placement of geotextile sea-bags along the majority of the shoreline frontage. The Hololani management also ordered geo-textile bags from the mainland USA which were slated for delivery in two or three weeks.

However, continued severe erosion at the site caused the shoreline to retreat to within 15 feet of the aforementioned tower. A subterranean garage at the building is believed to extend five feet makai of the high-rise tower itself. Immediate approval was granted by the Planning Department for emergency protective measures at the site, and the DLNR - OCCL concurred with the Department's response by letter on February 6, 2007. Subsequently, the Hololani placed geotextile fabric along the scarp and placed a number of boulders along the shoreline primarily in the State's jurisdiction. The boulders are intended to be an interim protective measure until necessary permits, materials and labor are in place. The Department concurred with the DLNR - OCCL's findings and issued a parallel emergency permit (SM3 2007/0002) on February 15, 2007.

The previous January 22, 2007 SMA emergency permit application was revised with new site plans specifying the length, width and depth of the proposed geotextile bag temporary protection measure were submitted to the Department for review. Furthermore, the Hololani concurred that the protective measures were to be temporary until a long-term solution could be devised for the site. Support for the temporary measures was provided by a report on February 2, 2007, from Sea Engineering, Inc. and comments by Zoe Norcross-Nu'u on February 4, 2007.

Clearly, beach resources at the site are severely impaired and the shoreline is retreating towards the Hololani's structures. In order to address the situation, the Hololani must obtain a long-term solution for both chronic and episodic erosion at the site. Permitting options are likely to include a Special Management Area (Major) Use Permit, an Environmental Assessment and a Shoreline Setback Variance. The three permits, obtained concurrently, will take at least six months to obtain.

One long-term resolution to shoreline erosion at the site is to construct a buried revetment within the shoreline setback area, but entirely within County jurisdiction. A structure of this nature would be covered in beach quality sand on its makai portions and existing and proposed temporary protective measures would be removed once the revetment is complete. Given historic trends at the site, the shoreline would naturally retreat to the revetment and would erode the beach quality sand that was placed makai of the revetment. This would ensure the Hololani AOAO had long term protection while letting nature take its course. Furthermore, since the revetment would be entirely within Country jurisdiction, the decision making and/or approval process would not be bi-furcated between agencies. However, comments and recommended conditions of approval would be sought by the Department from all relevant agencies including the DLNR - OCCL.

In summary, the Hololani has worked collaboratively and cooperatively with applicable jurisdictional authorities to develop prudent responses to shoreline erosion at their property. Currently, a long-term solution requires an SMA and Shoreline Setback Variance (SSV) application. The SSV requires compliance with Chapter 343 through the Environmental Assessment process. Overall, the County permitting process will take approximately six months to complete. Hololani management have represented to Department staff that the SMA/SSV/EA process is anticipated to begin subsequent to reporting the issuance of an SMA Emergency permit for the interim protective measures (boulders) that have been completed to date, as well as the proposed temporary placement of geotextile bags along the majority of the properties shoreline as frontage

*<u>Determination of the Application</u>*

Based on the aforementioned, you are hereby granted an SMA Emergency Permit and Shoreline Setback Approval, subject to the following conditions:

1. That all existing protective measures, including boulders and geotextile bags, are temporary and subject to removal at the discretion of the Department of Planning;

2. That all applicable permits shall be obtained from the Department of Land and Natural Resources;

3. That only clean, screened, beach-quality sand will be used to fill geotextile bags. The use of sand from the beach area shall <u>not</u> be used for this project and will be subject the applicant to fines and penalties. Results of any sieve analysis shall be submitted to the DLNR - OCCL and the Department;

4. That pursuant to Section 12-202-16(g) of the SMA Rules, the geotextile bags shall be removed within one-hundred eighty (180) days of this letter, subject to extensions;

5. That appropriate measures shall be taken during construction to mitigate the short-term impacts of the project relative to soil erosion from wind and water, ambient noise levels, and traffic disruptions;

6. That a Shoreline Setback Variance and Special Management Area Use permit shall be applied for within sixty (60) days of this letter (i.e. August 18, 2007) and that all reasonable efforts shall be taken by the Hololani AOAO to obtain approval for a prudent, long-term resolution to shoreline erosion at the site, including but not limited to, a buried revetment located entirely within the County's jurisdiction; and

7. That full compliance with all applicable governmental requirements shall be rendered.

Furthermore, the approval of this SMA Emergency permit shall be reported to the Maui Planning Commission at its next regularly scheduled meeting (July 10, 2007) as part of the Director's Report.

Should you have any questions, please contact Staff Planner Thorne Abbott of this office at 270-7520.

Sincerely,

Jeffrey S. Hunt

JEFFREY S. HUNT, AICP
Planning Director

Attachments

xc: Colleen M. Suyama, Deputy Director of Planning
Clayton I. Yoshida, AICP, Planning Program Administrator
Aaron H. Shinmoto, Zoning and Enforcement Administration (2)
Sam Lemmo, DLNR - OCCL
Daniel Omellas, DLNR, Land Division
Zoe Norcross-Nu'u, Sea Grant Extension Agent
Thorne Abbott, Coastal Resources Planner

JSH:TEA:bv

SM3 File
SSA File
General File

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8. Letter to Maui County Planning Department 3-24-11

**Sea Engineering, Inc.**

Makai Research Pier • 41-305 Kalanianaole Hwy • Waimanalo, Hawaii 96795-1820
Phone: (808) 259-7966 • FAX (808) 259-8143 • E-mail: sei@seaengineering.com • Website: www.seaengineering.com

March 24, 2011

Jim Buika,
County of Maui Department of Planning, Current Division
250 South High Street
Wailuku, HI 9679

Dear Mr. Buika,

Subject: Hololani Resort Condominiums Permanent Shore Protection: Project Design and Preliminary Environmental Document

The Hololani Resort Condominiums (the Hololani) are located at 4401 Lower Honoapiilani Road in the Kahana area of Maui (TMK (2) 4-3-010:009), and have had an on-going coastal erosion problem since approximately 1988. During the Winter of 2006-2007, the situation became critical and Sea Engineering, Inc. (SEI) designed emergency temporary shore protection using Bulklift geotextile sand bags and Tensar rock-filled marine mattresses. The temporary shore protection was constructed in November and December of 2007. The structure was authorized by both Maui County Planning Department and the State Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL). As part of this authorization, the Hololani was required to develop the design and aquire the necessary permits for a permanent shore protection solution.

SEI has been actively working with the Hololani to address their needs for robust and permanent shore protection. The document which accompanies this letter, *Environmental and Coastal Engineering Report for Hololani Shore Protection*, presents our preferred alternative for a permanent shore protection solution at the Hololani, as well as background for the project and preliminary environmental documentation.

We anticipate that this project will require Federal, State, and County permits. The most recent shoreline certification was granted in 2001. Two applications in 2007 were denied due to lack of documentation for approval of emergency sand bags that were in place along the shoreline (see Appendix B in the report). Apparently, these bags were part of interim measures for emergency protection taken before the November/December construction of the SEI designed structure.

The permanent shore protection design will span what we believe would be a reasonable Certified Shoreline, i.e., we anticpate the need for Maui County Special Management Area (SMA) and Shoreline Setback Variance (SSV) permits, as well as State Conservation District Use Permit (CDUP). We have written to DLNR-OCCL requesting their opinion on whether or not a Certified Shoreline is required for this project.

Both the County SSV and the State CDUP require implementation of the HRS Chapter 343 environmental process, which requires submission of an Environmental Assessment (EA). With the understanding that the project will be in both State and County jurisdictions, which agency should be the accepting authority for the EA?

Please note that the preferred alternative has been selected to minimize the amount of material placed in the Conservation District and Federal Navigable Waters, and to enable construction within the metes and bounds of the Hololani property.

We are sending copies of the report to other interested parties, including the neighboring Royal Kahana Resort Condominiums, and the Pohailani Condominiums, as well as the Department of Public works.

Additionally, we welcome any comments you may have concerning this project. If you have questions or concerns, please feel free to contact me. I and other representatives of the Hololani AOAO are available to meet to discuss the project, and we encourage any such interaction that would mediate the intent of the project design with the interests of Maui County.

J. Barry

James H. Barry, P.E
Coastal Engineer
Sea Engineering, Inc.

Cc: Mr. Stuart Allen, Hololani AOAO
Mr. Joe Higgins, Allan, Buick and Bers, Inc.
Mr. Sam Lemmo, DLNR-OCCL
Ms. Lisa Howard, Hawaii First, Inc.

9. Letter from Maui County Planning Dept 8-16-11

ALAN M. ARAKAWA
Mayor

WILLIAM R. SPENCE
Director

MICHELE CHOUTEAU McLEAN
Deputy Director

COUNTY OF MAUI

# DEPARTMENT OF PLANNING

August 16, 2011

Mr. James Barry, Coastal Engineer
Sea Engineering, Inc
Makai Research Pier
41-305 Kalanianaole Highway
Waimanalo, Hawaii 96795

Dear Mr. Barry:

**SUBJECT: COMMENTS ON THE PROPOSED HOLOLANI RESORT CONDOMINIUMS PERMANENT SHORE PROTECTION: PROJECT DESIGN AND PRELIMINARY ENVIRONMENTAL DOCUMENT; TMK: (2) 4-3-010:009 (RFC 2011/0127)**

The Department of Planning (Department) is in receipt of your March 24, 2011 letter regarding the Department's review and permitting for the subject proposed shore protection project. The Department is interested in coordinating as a primary consulting party with Sea Engineering, Hololani Condominiums, and the State on this project.

From the information presented in the preliminary environmental document, the Department does not object to the proposed project alternative (a hybrid seawall and rock rubble mound revetment) at this time, but would highly encourage additional discussion of alternatives with all above-mentioned parties.

This is a landmark project that may determine the future of this particular stretch of coastline. A concern is that a regional approach may not have yet been fully considered or analyzed. A regional approach could result in broader success by protecting multiple assets, including the recreational beach, lateral public access, as well as private development. The Department is interested in further discussing and considering the alternative of beach nourishment in conjunction with stabilizing structures such as groins. The Department believes that this would also be an alternative favored by the State, which suggests using an "erosion control" approach – sand and structures together as a system – where feasible (Hawaii Coastal Erosion Management Plan, DLNR, 2000). The preliminary document seems to suggest that Sea Engineering and Hololani Condominiums would also conceptually support an erosion control approach, except that this approach may be "beyond the scope of what can be reasonably done by an individual condominium". The Department agrees that the erosion control approach would necessitate regional cooperation, but would like to see this option explored.

Additionally, the Department already recognizes a regional erosion problem whereby neighboring properties may soon face similar hazard threats and may also approach the State and County with similar protection requests. In fact, neighboring Royal Kahana Condominiums has recently requested emergency shoreline protection and has been encouraged to develop a long-term erosion control strategy. With the future upon us already, it makes good planning sense to consider the regional opportunities and to assess the collective resources available for those opportunities.

In terms of the proposed alternative, the Department agrees with Department of Land and Natural Resources-Office of Conservation and Coastal Lands (DLNR-OCCL) recommendations dated May 1, 2011, to ensure that the final structural design is located as far mauka as possible to minimize impacts to coastal resources. This would involve Hololani Condominium eliminating any non-essential development in favor of the seawall/revetment. The Department is also very supportive of an incorporated coastal access pathway and would be interested in reviewing more detailed plans for this. Finally, the Department requests photographic renderings of the final proposed alternative since the project will alter the existing nature of this shoreline area and these will be valuable for soliciting public comment.

If any part of the project will be carried out within County jurisdiction, the Department encourages the Applicant to apply for a Special Management Area Assessment Application found on the Maui County web page at http://www.co.maui.hi.us/index.aspx?NID=1354. As previously discussed with Sea Engineering by email for the proposed plan, the Department agrees that DLNR-OCCL should be the accepting authority for the Environmental Assessment (EA). However, it is strongly encouraged to submit the draft EA as a communication item for a hearing at the Maui Planning Commission. Also, the Department requests the opportunity to contribute to the list of agencies that will receive the draft EA for review.

Thank you for your cooperation. If you have any questions, please contact Coastal Resources Planner James Buika at james.buika@mauicounty.gov or at (808) 270-6271.

Sincerely,

CLAYTON I. YOSHIDA, AICP
Planning Program Administrator

*for* WILLIAM SPENCE
Planning Director

xc: William Spence, Planning Director
James A. Buika, Coastal Resources Planner
Tara Miller Owens, UH Sea Grant
Sam Lemmo, DLNR-OCCL
Chris Conger, UH Sea Grant, DLNR/OCCL
Project File
General File

WRS:CIY:JAB:sa
K:\WP_DOCS\PLANNING\RFC\2011\0127_HololaniShoreProtectionComment\Comments.doc

10. Letter to USACE Jurisdictional Inquiry 11-30-11

Sea Engineering, Inc.

Makai Research Pier • Waimanalo, Hawaii 96795-1820 • E-mail: sei@seaengineering.com
Phone: (808) 259-7966 / FAX (808) 259-8143 • Website: www.seaengineering.com

November 30, 2011

Mr. George Young, Chief
Department of the Army
U.S. Army Engineer District, Regulatory Branch
Fort Shafter,
Hawaii 96858

Subject: Jurisdictional Determination for Permanent Shore Protection, Hololani Condominiums, 4401 Lower Honoapiilani Highway, Kahananui, Maui TMK (2) 4-3-10: 09

Dear Mr. Young,

The Hololani Condominium complex is located at 4401 Lower Honoapiilani Highway on the Kahana coastline of West Maui and consists of two eight-story buildings with a total of sixty-three apartments. The complex is ocean front property with a shoreline approximately 400 feet in length. The project location is shown in Figure 1.

Coastal erosion at this site is well documented. In a 1998 aerial photograph study, Sea Engineering, Inc. (SEI) documented an average 30-year erosion rate of 0.8 feet per year, or 24 feet total. This study was conservative, using the vegetation line as the shoreline indicator, and photographs only up to the year 1988 when sand bags were placed. Similar erosion rates were found in studies done by the UH Coastal Geology Group. Figure 2 is a photograph from January, 2007 showing the dire erosion condition that existed at that time. Various temporary shore protection measures – small sand bags, large geotextile sand bags, boulders – were used with poor success until December 2007 when an SEI-designed temporary structure was constructed. The temporary shore protection consisted of large geotextile sand bags ("Seabags") stacked to form a revetment structure, with Tensar rock-filled mattresses used for toe protection and overtopping protection. In response to inquiries dated January 29, 2007, the USACE-Honolulu District determined that the 2007 temporary shore protection was outside of federal jurisdiction (letter dated February 26, 2007; File No. POH-2007-35). The project construction was shown to be well landward of the Mean Higher High Water Line (MHHW). The MHHW Line is the average of the highest predicted daily tide levels, and is generally considered representative of the High Tide Line in Hawaiian waters. A plan view of the existing temporary structure and the MHHW line mapped at that time is shown in Figure 3.

The structure held up well for several years, but was damaged during the 2010-2011 winter wave season and necessitated repairs. The structure was built under State of Hawaii and Maui County emergency authorization, with the condition that the Hololani Association of Apartment Owners (AOAO) proceed with the design for a permanent structure.

SEI has therefore been retained by the Hololani AOAO to design and obtain permits for a permanent shore protection structure. The proposed structure will be a combined seawall and rock rubble mound revetment in roughly the same location as the existing temporary shore protection. A hybrid design was used in order to provide effective protection, yet minimize both the design footprint and wave reflecting characteristics

A cross-section view of the proposed permanent shore protection structure is shown in Figure 4, and a plan view is shown in Figure 5. The new design is aligned to be landward of the MHHW Line as mapped on June 6, 2011 by Valera, Inc., licensed surveyors. The plan view shows the MHHW shoreline from 2007, as well as the more recently surveyed MHHW Line. The project shoreline varies seasonally due to sand movement in response to wave activity. Very generally, summer season waves from the south tend to cause accretion of sand in front of the Hololani shoreline reach, and winter season waves from the north tend to cause depletion of sand down to a rubble substrate. The June survey occurred during the seasonal transition between winter and summer, when the beach tends to be deflated. A recent photograph (Figure 5, November 25, 2011) shows the beach state during the summer to winter transition, with sand accretion occurring after a vigorous southern swell season and before the peak occurrence of winter north swells.

We are requesting a determination from your office for any requirements that fall within the jurisdiction of the U.S. Army Corps of Engineers for construction of new, permanent shore protection. We are primarily concerned with Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. The proposed structure is aligned to be landward of the June 6, 2011 MHHW Line along the entire project reach. The construction work will not affect the course, location, or condition of the water body fronting the construction area. Please feel free to contact me if there are any further questions.

Thank you for the consideration of this project,

J. Barry

James H. Barry, P.E.
Coastal Engineer

Sea Engineering, Inc.

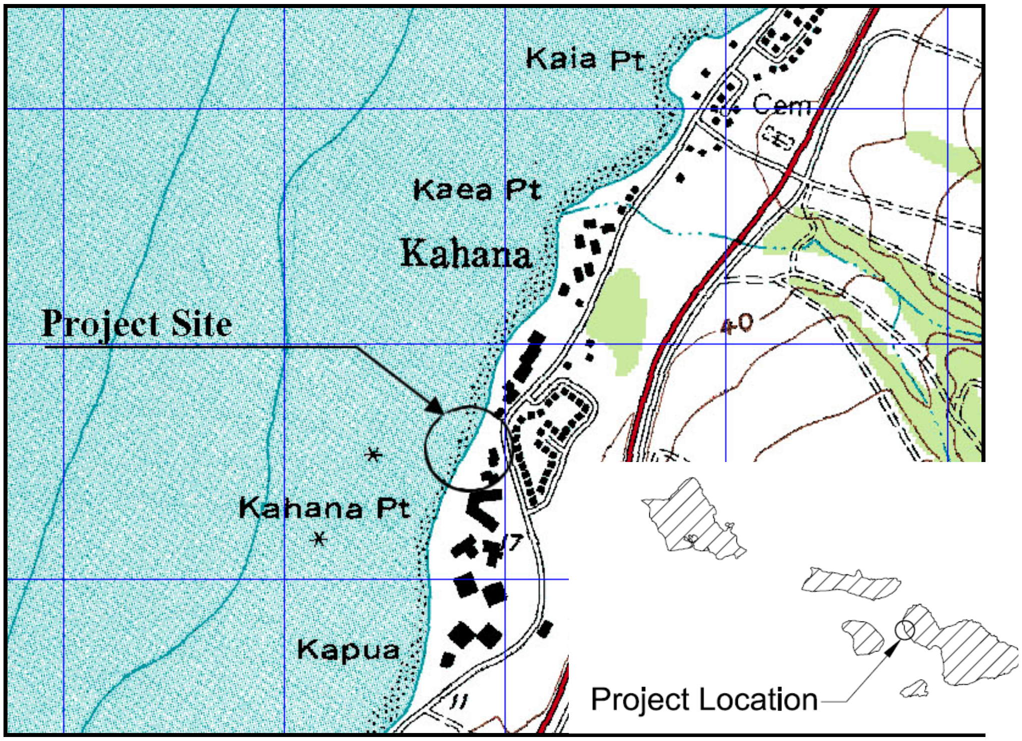


Figure 1. Project site location in West Maui

Figure 2. Project site shoreline, 1-11-07

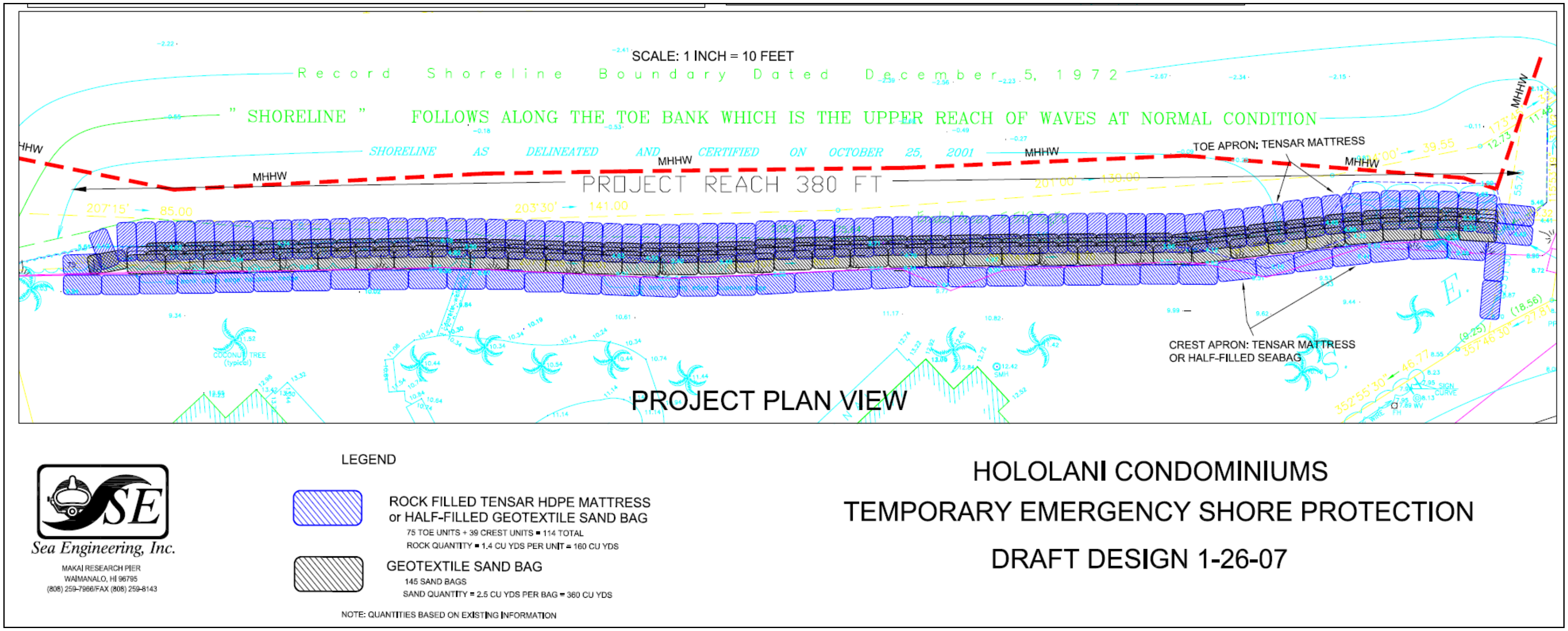


Figure 3. 2007 temporary shore protection plan, showing location of January 2007 MHHW level

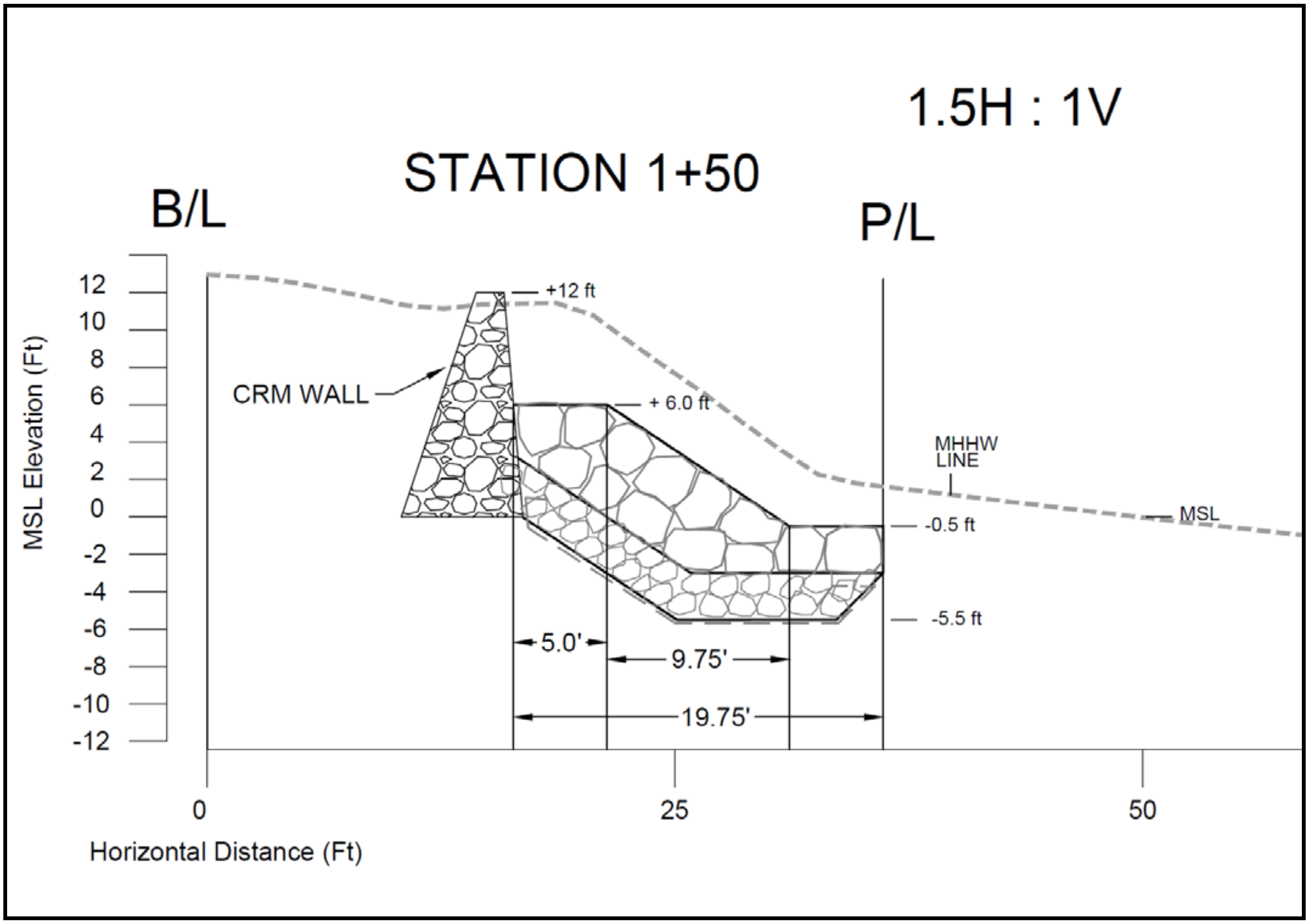


Figure 4. Permanent shore protection section, showing dimensions of the hybrid structure

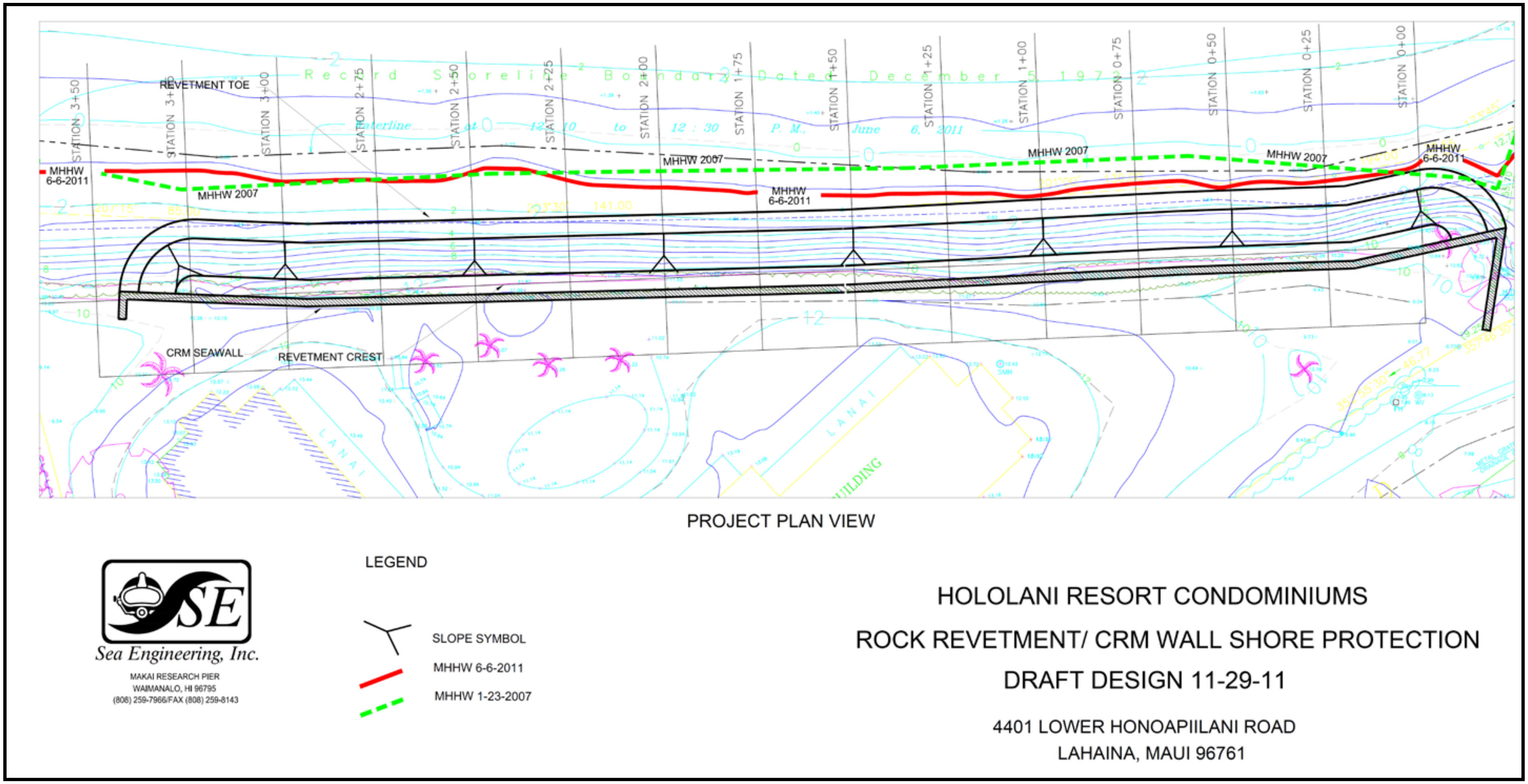


Figure 4. Permanent shore protection plan, with 2007 and 2011 MHHW levels

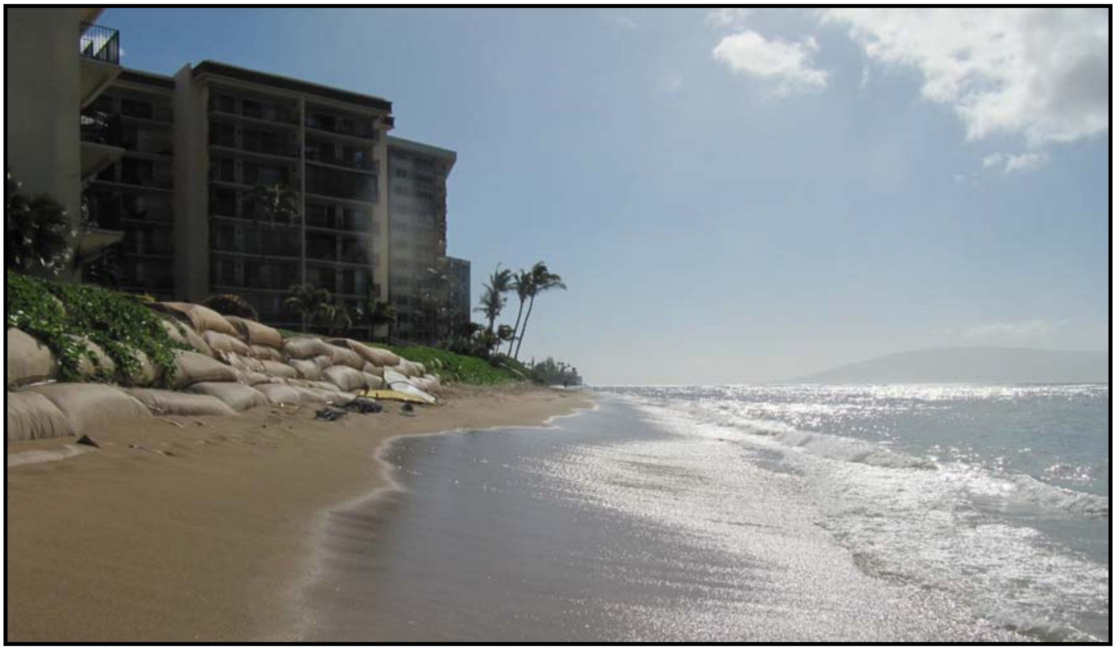

Figure 5. Hololani beach, 11-25-2011

11. Letter from USACE Approved Jurisdictional Determination 1-27-12

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

REPLY TO
ATTENTION OF:

January 27, 2012

Regulatory Branch

File Number POH-2007-00035

Sea Engineering, Inc.
Attention: James Barry
Makai Research Pier
Waimanalo, Hawaii 96795

**APPROVED JURISDICTIONAL DETERMINATION**
**PERMIT REQUIRED**

Dear Mr. Barry:

This is in response to your letter dated November 30, 2011 requesting a Jurisdictional Determination from the Department of the Army (DA) for the proposed Permanent Shore Protection of the Hololani Condominiums at 4401 Lower Honoapiilani Highway, Kahananui, Island of Maui, Hawaii. We have completed our review of the submitted documents pursuant to Section 10 of the Rivers and Harbors Act of 1899 (Section 10) and Section 404 of the Clean Water Act (Section 404) and have determined that the submitted documents, accurately identify a navigable water of the U.S. under the regulatory jurisdiction of U.S. Army Corps of Engineers (the Corps).

Section 10 requires that a DA permit be obtained from the Corps prior to undertaking any construction, dredging, or other activity occurring **in, over, or under or affecting navigable waters of the U.S.** For tidal waters, the shoreward limit of the **Corps' jurisdiction extends to the Mean High Water Mark**. Section 404 requires that a DA permit be obtained for the temporary and/or permanent **discharge (placement) of dredged and/or fill material into waters of the U.S.**, including wetlands. For tidally influenced waters, in the absence of adjacent wetlands, the shoreward limit of the **Corps' jurisdiction extends to the High Tide Line**, which in Hawai'i may be approximated by reference to the Mean Higher High Water Mark. For non-tidal waters, the lateral limits of the Corps' jurisdiction extend to the Ordinary High Water Mark or the approved delineated boundary of any adjacent wetlands.

The approximate 400-foot stretch of shoreline fronting the subject property is a reach of the **Pacific Ocean, a navigable water of the U.S., subject to Corps jurisdiction.** Be advised that positioning of sediment control **structures** such as sheet piles and the **staging and/or the use of equipment and/or machinery** waterward of the MHWM, in accordance with Section 10, **will require a DA permit** prior to commencement of work activity in a navigable water of the U.S.

The MHHWM, as demarcated in Figure 4 of your submittal, was surveyed on June 6, 2011 by Valera, Inc., in support of the proposed shore protection. The Corps concurs with the surveyed line. The submitted documents indicated that the proposed shoreline protection, consisting of a combination seawall and rock rubble revetment approximately 360-feet in length, will be constructed landward of the MHHWM at this location. Therefore, in accordance with Section 404, **a DA permit will not be required** as the proposed **shore protection construction activities will not result in the discharge of fill** material into a navigable water of the U.S. Be advised that the Corps regulates the use of sandbags, as it results in the temporary discharge of fill material and thus will require prior authorization from this office.

We advise your client to submit a DA Permit application and associated drawings that meet our drawing recommendations found at *http://www.poh.usace.army.mil/EC-R/EC-R.htm#Apply_for_a_Permit_* to the Corps. In addition, supporting information submitted with the permit application should include sufficient information concerning the scope of work, including the final construction design and specifications, method, sequence and schedule and use/placement of Best Management Practices, i.e. silt fences and sandbag berms required to construct the proposed shore protection and describe possible impacts of the construction and use of BMPs on the surrounding aquatic environment, should your proposed work be authorized. The Corps will at that time review the application to ensure the proposed work is not contrary to the public interest. Be advised, fill that results in either temporary or permanent loss of waters of the U.S. and/or associated function, may be required of your client to provide compensatory mitigation for any unavoidable impacts to the aquatic environment.

This letter contains an approved JD for the property in question and is valid for a period of five (5) years unless new information warrants revision of the determination before the expiration date. If you object to this determination, you may request an Administrative Appeal under Corps regulations at 33 Code of Federal Regulations (CFR) Part 331. Should you object to this determination, please notify this office and we will provide you with the informational materials required for an appeal and provide suspense dates based upon the date the appeal information is supplied to you.

Thank you for contacting us regarding this project. Should you have any questions, please contact Ms. Jessie Pa'ahana at *808.438.0391* or via email at *Jessie.K.Paahana@usace.army.mil*. You are encouraged to provide comments on your experience with the Honolulu District Regulatory Branch by accessing our web-based customer survey form at *http://www.per2.nwp.usace.army.mil/survey.html*.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

12. Letter to Maui County Department of Public Works 3-24-11

**Sea Engineering, Inc.**

Makai Research Pier • 41-305 Kalanianaole Hwy • Waimanalo, Hawaii 96795-1820
Phone: (808) 259-7966 • FAX (808) 259-8143 • E-mail: sei@seaengineering.com • Website: www.seaengineering.com

March 24, 2011

Mr. Cary Yamashita, Division Chief
County of Maui Department of Public Works,
Engineering Division,
200 South High Street (Kalana O Maui Bldg., 4th floor)
Wailuku, HI 96793

Dear Mr. Yamashita,

Subject: Hololani Resort Condominiums Permanent Shore Protection: Project Design and Preliminary Environmental Document

The Hololani Resort Condominiums (the Hololani) are located at 4401 Lower Honoapiilani Road in the Kahana area of Maui (TMK (2) 4-3-010:009), and have had an on-going coastal erosion problem since approximately 1988. During the Winter of 2006-2007, the situation became critical and Sea Engineering, Inc. (SEI) designed emergency temporary shore protection using Bulklift geotextile sand bags and Tensar rock-filled marine mattresses. The temporary shore protection was constructed in November and December of 2007. The structure was authorized by both the Maui County Planning Department and the State Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL). As part of this authorization, the Hololani was required to develop the design and aquire the necessary permits for a permanent shore protection solution.

SEI has been actively working with the Hololani to address their needs for robust and permanent shore protection. The document which accompanies this letter, *Environmental and Coastal Engineering Report for Hololani Shore Protection*, presents our preferred alternative for a permanent shore protection solution at the Hololani, as well as background for the project and preliminary environmental documentation.

A drainage easement in favor of the County of Maui exists at the north end of the Hololani Property. As discussed in Section 2.5.1 (page 25) of the report, the easement area is severely eroded and the drainline is damaged and blocked. Figure 2-5 in the report shows the present design configuration for shore protection at the north end. The north side of the Hololani property (the south side of the easement) will be protected by a seawall approximately 12.5 ft in elevation (although the final design may vary). A low-crested revetment will front the seawall on the the makai side of the Hololani property, however this will return and end at the south easement boundary, as shown in the figure. The seawall will allow future repairs to the drainline and modifications of the easement area to be done as necessary and on a schedule set by Maui County.

An alternative design is presented in the report that will protect the easement area and allow the construction of a new drainline (Figure 2-6). This design would require the cooperation of the Department of Public Works and the adjacent Pohailani Condominium. Please note that the erosion problem at the Hololani is viewed as a critical situation, and implementation of the shore protection will be done as soon as permits are obtained. We hope to schedule construction during the summer of 2012.

We welcome any comments you may have concerning this project. If you have questions or concerns, please feel free to contact me. I and other representatives of the Hololani AOAO are available to meet to discuss the project, and we encourage any such interaction that would mediate the intent of the project design with the interests of Maui County.

J. Barry

James H. Barry, P.E
Coastal Engineer
Sea Engineering, Inc.

Cc: Mr. Stuart Allen, Hololani AOAO
Mr. Joe Higgins, Allan, Buick and Bers, Inc.
Mr. Jim Buika, Maui County Planning Department, Current Division
Ms. Lisa Howard, Hawaii First, Inc.

13. Letter to Royal Kahana 3-24-11

Sea Engineering, Inc.
Makai Research Pier • 41-305 Kalanianaole Hwy • Waimanalo, Hawaii 96795-1820
Phone: (808) 259-7966 • FAX (808) 259-8143 • E-mail: sei@seaengineering.com • Website: www.seaengineering.com

March 24, 2011

Mr. Patrick Kelley
Royal Kahana Resort Condominiums
4365 Lower Honoapiilani Road
Lahaina, HI 96761

Dear Mr. Kelley,

Subject: Hololani Resort Condominiums Permanent Shore Protection: Project Design and Preliminary Environmental Document

The Hololani Resort Condominiums (the Hololani) are located at 4401 Lower Honoapiilani Road in the Kahana area of Maui (TMK (2) 4-3-010:009), and have had an on-going coastal erosion problem since approximately 1988. During the Winter of 2006-2007, the situation became critical and Sea Engineering, Inc. (SEI) designed emergency temporary shore protection using Bulklift geotextile sand bags and Tensar rock-filled marine mattresses. The temporary shore protection was constructed in November and December of 2007. The structure was authorized by both the Maui County Planning Department and the State Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL). As part of this authorization, the Hololani was required to develop the design and aquire the necessary permits for a permanent shore protection solution.

SEI has been actively working with the Hololani to address their needs for robust and permanent shore protection. The document which accompanies this letter, *Environmental and Coastal Engineering Report for Hololani Shore Protection*, presents our preferred alternative for a permanent shore protection solution at the Hololani, as well as background for the project and preliminary environmental documentation.

The south end of the new shore protection structure will abut the Royal Kahana property. The project layout is shown in Figure 1-7 of the report, and a close-up of the south boundary is shown in Figure 2-2. The design intent is to bury the structure with beach quality sand fill at this end, and let the sand naturally equilibrate to the existing shoreline processes. The natural slope of the beach sand will allow shoreline access in this area. The slight embayment of the structure design should help to capture sand and naturally maintain a beach.

Please note that this design is not finalized. We are in the preliminary phase of obtaining the required Federal, State, and County permits, and the Royal Kahana will have the opportunity to comment on the structure through the HRS Chapter 343 environmental process. However, as the project designer, I am committed to preventing or mitigating any effects of the new structure on the Royal Kahana property, and welcome any comments that you may have concerning the project. If you have questions or concerns, please feel free to contact me. I and other representatives of the Hololani AOAO are available to meet to discuss the project, and we look forward to solving the erosion problems at the site.

J. Barry

James H. Barry, P.E
Coastal Engineer
Sea Engineering, Inc.

Cc: Mr. Stuart Allen, Hololani AOAO
Mr. Joe Higgins, Allan, Buick and Bers, Inc.
Mr. Jim Buika, Maui County Planning Department, Current Division
Ms. Lisa Howard, Hawaii First, Inc.

14. Letter to Pohailani 3-24-11

Sea Engineering, Inc.

Makai Research Pier • 41-305 Kalanianaole Hwy • Waimanalo, Hawaii 96795-1820
Phone: (808) 259-7966 • FAX (808) 259-8143 • E-mail: sei@seaengineering.com • Website: www.seaengineering.com

March 24, 2011

Pohailani Condominiums AOAO
c/o Hawaiiana Management Co.
140 Hoohana Street, Suite 210
Kahului, HI 96732

Attn: Mr. Doug Jorg

Dear Mr. Jorg,

Subject: Hololani Resort Condominiums Permanent Shore Protection: Project Design and Preliminary Environmental Document

The Hololani Resort Condominiums (the Hololani) are located at 4401 Lower Honoapiilani Road in the Kahana area of Maui (TMK (2) 4-3-010:009), and have had an on-going coastal erosion problem since approximately 1988. During the Winter of 2006-2007, the situation became critical and Sea Engineering, Inc. (SEI) designed emergency temporary shore protection using Bulklift geotextile sand bags and Tensar rock-filled marine mattresses. The temporary shore protection was constructed in November and December of 2007. The structure was authorized by both the Maui County Planning Department and the State Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL). As part of this authorization, the Hololani was required to develop the design and aquire the necessary permits for a permanent shore protection solution.

SEI has been actively working with the Hololani to address their needs for robust and permanent shore protection. The document which accompanies this letter, *Environmental and Coastal Engineering Report for Hololani Shore Protection*, presents our preferred alternative for a permanent shore protection solution at the Hololani, as well as background for the project and preliminary environmental documentation.

A drainage easement in favor of the County of Maui exists at the north end of the Hololani Property. As discussed in Section 2.5.1 (page 25) of the report, the easement area is severely eroded and the drainline is damaged and blocked. Figure 2-5 in the report shows the present design configuration for shore protection at the north end. The north side of the Hololani property (the south side of the easement) will be protected by a seawall approximately 12.5 ft in elevation (although the final design may vary). A low-crested revetment will front the seawall on the the makai side of the Hololani property, however this will return and end at the south easement boundary, as shown in the figure. The seawall will allow future repairs to the drainline and modifications of the easement area to be done as necessary and on a schedule set by Maui County.

An alternative design is presented in the report that will protect the easement area and allow the construction of a new drainline (Figure 2-6). This design would require the cooperation of the Pohailani Condominium AOAO as well as the Maui County Department of Public Works. The CRM (cemented rubble masonry) seawall that protects the south boundary of the Pohailani has been undermined by wave action and is in a general state of disrepair. In order to construct the alternative design, the wall at the Pohailani would need to be repaired to prevent flanking of the new Hololani structure.

Please note that the erosion problem at the Hololani is viewed as a critical situation, and implementation of the shore protection will be done as soon as permits are obtained. We hope to schedule construction during the summer of 2012.

We welcome any comments you may have concerning this project. If you have questions or concerns, please feel free to contact me. I and other representatives of the Hololani AOAO are available to meet to discuss the project, and we look forward to solving the erosion problems at the site.

J. Barry

James H. Barry, P.E
Coastal Engineer
Sea Engineering, Inc.

Cc: Mr. Stuart Allen, Hololani AOAO
Mr. Joe Higgins, Allan, Buick and Bers, Inc.
Mr. Jim Buika, Maui County Planning Department, Current Division
Ms. Lisa Howard, Hawaii First, Inc.

**APPENDIX B. GEOTECHNICAL INFORMATION – ISLAND GEOTECHNICAL ENGINEERS, INC.**

1. *Soils Report, Hololani Rock Revetment – August 31, 2010*
2. *Addendum to Soils Investigation Report – December 21, 2011*

# REPORT
# SOILS INVESTIGATION

HOLOLANI ROCK REVETMENT
4401 LOWER HONOAPIILANI ROAD

KAHANA, MAUI, HAWAII
TMK: (2) 4-3-10: 09

for

SEA ENGINEERING, INC.

Project No. 101408-FM
August 31, 2010

ISLAND GEOTECHNICAL ENGINEERING, INC.
*Geotechnical Consultants*

330 Ohukai Road, Suite 119
Kihei, Maui, Hawaii 96753
Phone: (808) 875-7355
Fax: (808) 875-7122

---

August 31, 2010
Project No. 101408-FM

Sea Engineering, Inc.
Attn: Mr. Jim Barry
Makai Research Pier
Waimanalo, Hawaii 96795

The attached report presents the results of a soils investigation at the site of the proposed Hololani Rock Revetment to be located at the Hololani Resort at 4401 Lower Honoapiilani Road in Kahana, Maui, Hawaii.

A summary of the findings is as follows:

1) The subsurface conditions at the site were explored by drilling 5 test borings to depths of 17.5 to 21.5 feet below existing grade. The general subsurface conditions at each test boring location are as follows:

   Boring 1 encountered very stiff sandy SILT with gravel from the surface to a depth of 0.5 feet below existing grade followed by very stiff SILT with sand to a depth of 4 feet below existing grade followed by moderately dense silty SAND to a depth of 8.5 feet below existing grade followed by moderately dense silty GRAVEL with sand to a depth of 9 feet below existing grade followed by moderately dense SAND with silt to a depth of 14.5 feet below existing grade followed by loose SAND with silt to a depth of 19.5 feet below existing grade followed by moderately hard ROCK to the final depth of the test boring at 20.5 feet below existing grade.

   Boring 2 encountered stiff SILT from the surface to a depth of 0.25 feet below existing grade followed by moderately dense silty GRAVEL with sand to a depth of 1 foot below existing grade followed by moderately dense SAND to a depth of 4.5 feet below existing grade followed by moderately dense to dense silty SAND with gravel to a depth of 9.5 feet below existing grade followed by moderately dense SAND with silt to a depth of 10.5 feet below existing grade followed by moderately dense SAND to a depth of 15.5 feet below existing grade followed by moderately dense silty GRAVEL with sand to a depth of 18 feet below existing grade followed by soft to moderately hard ROCK to a depth of 21 feet below existing grade followed by stiff CLAY to the final depth of the test boring at 21.5 feet below existing grade.

   Boring 3 encountered very dense silty SAND with gravel from the surface to a depth of 4.5 feet below existing grade followed by stiff sandy SILT to a depth of 5 feet below existing grade followed by moderately dense SAND with silt to a depth of 8.5 feet below existing grade followed by moderately dense SAND with silt and gravel to a depth of 11 feet below existing grade followed by moderately dense SAND to a depth of 14 feet below existing grade followed by stiff CLAY to a depth of 15.5 feet below existing grade followed by soft to moderately hard ROCK to the final depth of the test boring at 19.5 feet below existing grade.

Boring 4 encountered moderately stiff to stiff SILT with gravel from the surface to a depth of 2.5 feet below existing grade followed by moderately dense SAND with gravel to a depth of 3.5 feet below existing grade followed by very stiff sandy SILT to a depth of 5.5 feet below existing grade followed by loose silty SAND to a depth of 6.5 feet below existing grade followed by moderately stiff SILT to a depth of 8.5 feet below existing grade followed by moderately dense silty SAND with gravel to a depth of 9.5 feet below existing grade followed by very stiff sandy SILT to a depth of 11.5 feet below existing grade followed by moderately dense SAND with silt to a depth of 13 feet below existing grade followed by very loose SAND with silt to a depth of 18 feet below existing grade followed by moderately dense silty SAND with gravel to the final depth of the test boring at 19.75 feet below existing grade.

Boring 5 encountered stiff to very stiff SILT with sand from the surface to a depth of 3.5 feet below existing grade followed by loose silty SAND to a depth of 6 feet below existing grade followed by soft SILT to a depth of 6.5 feet below existing grade followed by loose silty SAND to a depth of 7.5 feet below existing grade followed by COBBLE to a depth of 8 feet below existing grade followed by loose silty SAND to a depth of 9 feet below existing grade followed by loose to moderately dense SAND with silt to a depth of 12 feet below existing grade followed by loose to very loose silty GRAVEL with sand to a depth of 13 feet below existing grade followed by loose to very loose silty SAND to the final depth of the test boring at 17.5 feet below existing grade.

2) Groundwater was encountered at 8.1 to 8.7 feet below existing grade.

Details of the findings and recommendations are presented in the attached report.

This investigation was made in accordance with generally accepted engineering procedures and included such field and laboratory tests considered necessary for the project. In the opinion of the undersigned, the accompanying report has been substantiated by mathematical data in conformity with generally accepted engineering principles and presents fairly the design information requested by your organization. No other warranty is either expressed or given.

Respectfully submitted,

ISLAND GEOTECHNICAL ENGINEERING, INC.

Charles K. Biegel, P.E.
President

CHARLES K. BIEGEL
LICENSED PROFESSIONAL ENGINEER
NO. 7568-C
HAWAII, U.S.A.

This work was prepared by me or under my supervision.

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## INTRODUCTION

This investigation was made for the purpose of obtaining information on the subsurface conditions from which to base recommendations for design for the proposed Hololani Rock Revetment in Kahana, Maui. The location of the site, relative to the existing streets and landmarks, is shown on the Vicinity Map, Plate 1.

## SCOPE OF WORK

The services included drilling 5 test borings to depths of 17.5 to 21.5 feet below existing grade, obtaining samples of the underlying soils, performing laboratory tests on the samples, and performing an engineering analysis from the data gathered. In general, the following information is provided for use by the Architect and/or Engineer:

1. General subsurface conditions, as disclosed by the explorations.
2. Physical characteristics of the soils encountered.
3. Special considerations.

## PLANNED DEVELOPMENT

From the information provided, a new rock revetment will be constructed along the makai property line of the Hololani Resort. A cross-section of the proposed revetment is shown on the attached Plate A.

## SITE CONDITIONS

### Surface

The property, designated by Tax Map Key (2) 4-3-10: 09, is located at 4401 Lower Honoapiilani Road in Kahana, Maui, Hawaii. At the time of the field investigation, the ground cover at the site consisted of manicured lawn.

### Subsurface

Five (5) test borings were drilled to depths of 17.5 to 21.5 feet below existing grade to determine the subsurface conditions at the site. The locations of the explorations are shown on the Plot Plan, Plate 2. Detailed logs of the explorations are presented in the Appendix to this report.

Boring 1 encountered very stiff sandy SILT with gravel from the surface to a depth of 0.5 feet below existing grade followed by very stiff SILT with sand to a depth of 4 feet below existing grade followed by moderately dense silty SAND to a depth of 8.5 feet below existing grade followed by moderately dense silty GRAVEL with sand to a depth of 9 feet below existing grade followed by moderately dense SAND with silt to a depth of 14.5 feet below existing grade followed by loose SAND with silt to a depth of 19.5 feet below existing grade followed by moderately hard ROCK to the final depth of the test boring at 20.5 feet below existing grade.

Boring 2 encountered stiff SILT from the surface to a depth of 0.25 feet below existing grade followed by moderately dense silty GRAVEL with sand to a depth of 1 foot below existing grade followed by moderately dense SAND to a depth of 4.5 feet below existing grade followed by moderately dense to dense silty SAND with gravel to a depth of 9.5 feet below existing grade followed by moderately dense SAND with silt to a depth of 10.5 feet below existing grade followed by moderately dense SAND to a depth of 15.5 feet below existing grade followed by moderately dense silty GRAVEL with sand to a depth of 18 feet below existing grade followed by soft to moderately hard ROCK to a depth of 21 feet below existing grade followed by stiff CLAY to the final depth of the test boring at 21.5 feet below existing grade.

Boring 3 encountered very dense silty SAND with gravel from the surface to a depth of 4.5 feet below existing grade followed by stiff sandy SILT to a depth of 5 feet below existing grade followed by moderately dense SAND with silt to a depth of 8.5 feet below existing grade followed by moderately dense SAND with silt and gravel to a depth of 11 feet below existing grade followed by moderately dense SAND to a depth of 14 feet below existing grade followed by stiff CLAY to a depth of 15.5 feet below existing grade followed by soft to moderately hard ROCK to the final depth of the test boring at 19.5 feet below existing grade.

Boring 4 encountered moderately stiff to stiff SILT with gravel from the surface to a depth of 2.5 feet below existing grade followed by moderately dense SAND with gravel to a depth of 3.5 feet below existing grade followed by very stiff sandy SILT to a depth of 5.5 feet below existing grade followed by loose silty SAND to a depth of 6.5 feet below existing grade followed by moderately stiff SILT to a depth of 8.5 feet below existing grade followed by moderately dense silty SAND with gravel to a depth of 9.5 feet below existing grade followed by very stiff sandy SILT to a depth of 11.5 feet below existing grade followed by moderately dense SAND with silt to a depth of 13 feet below existing grade followed by very loose SAND with silt to a depth of 18 feet below existing grade followed by moderately dense silty SAND with gravel to the final depth of the test boring at 19.75 feet below existing grade.

Boring 5 encountered stiff to very stiff SILT with sand from the surface to a depth of 3.5 feet below existing grade followed by loose silty SAND to a depth of 6 feet below existing grade followed by soft SILT to a depth of 6.5 feet below existing grade followed by loose silty SAND to a depth of 7.5 feet below existing grade followed by COBBLE to a depth of 8 feet below existing grade followed by loose silty SAND to a depth of 9 feet below existing grade followed by loose to moderately dense SAND with silt to a depth of 12 feet below existing grade followed by loose to very loose silty GRAVEL with sand to a depth of 13 feet below existing grade followed by loose to very loose silty SAND to the final depth of the test boring at 17.5 feet below existing grade.

Groundwater was encountered in all of the explorations at depths of 8.1 to 8.7 feet below existing grade.

From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii", the site is located in an area designated as Pulehu clay loam , 0 to 3 percent slopes (PsA) and Jaucas sand, 0 to 15 percent slopes (JaC).

The Pulehu series consist of well-drained soils on alluvial fans and stream terraces and in basins. These soils occur on the islands of Lanai, Maui, Molokai and Oahu. These soils developed in alluvium washed from basic igneous rock. Elevations range from nearly sea level to 300 feet. The shrink-swell potential is moderate to low. Depth to bedrock is greater than 5 feet (USDA, 1972, Plate 92 and pp. 115-116, 164-165).

The Jaucas series consists of excessively drained, calcareous soils that occur as narrow strips on coastal plains, adjacent to the ocean. These soils occur on all the islands of this survey area. They developed in wind and water deposited sand from coral and sea shells. Unified soil classification is SP. They are nearly level to strongly sloping. Elevations range from sea level to 100 feet. Depth to bedrock is greater than 5 feet. (USDA, 1972, pg.48, 158-159 and Plate 92).

Geology

The site is located on the west/northwest flank of the West Maui Mountains. The island of Maui is a volcanic doublet believed to have formed during the late Tertiary (between 1 and 12 million years ago).

The West Maui Mountains were built by lavas flowing from rift zones trending north and south and a central vent. The lava flows which form the mountain have been separated into three groups: Wailuku, Honolua, and Lahaina Volcanic Series (Stearns and MacDonald, 1942). The main lava mass that makes up the West Maui Mountains is known as the Wailuku Volcanic Series which consist of primitive olivine basalts and associated pyroclastic and intrusive rock.

Liquefaction Evaluation

Liquefaction is a common problem in earthquake prone zones where loose saturated soil deposits exist. The 1997 UBC classified Maui as being in earthquake zone 2B. Although the Holokai Resort is not believed to be in an “earthquake prone zone”, a liquefaction evaluation was performed by IGE for general information purposes.

IGE was not provided a hypothetical earthquake magnitude. For the purposes of an analysis, the following assumptions were made: Magnitude = 6.0 Peak Horizontal Ground Acceleration = 0.2g. Based on the above assumptions, the liquefaction potential for the site was determined to be low probability for Borings 1, 2, 3. For Borings 4 & 5, the liquefaction potential was determined to be low to moderate probability with the soil layer at 13 to 18 feet below existing grade having the greatest potential for liquefaction.

It should be noted that a complete liquefaction potential analysis would include test borings to at least 30 feet deep.

Seismically induced ground settlement resulting from the M = 6.0 earthquake (and PGA = 0.2g) is estimated to be less than ½" for the soils north of the existing swimming pool and nearly 2.0 inches for the soils south of the existing swimming pool.

Special Considerations

1. Groundwater was encountered in the borings at depths of 8.1 to 8.7 feet below existing grade. Excavations into the underlying soils are susceptible to caving, especially at or near the groundwater level.

2. Based on the schematic drawing provided on Plate A, the base of the Rock Rubble Mound Revetment will be at elevation -7.25 feet (msl). As shown on Plate 8, that would put the base in (or nearly in) the in-situ ROCK at Borings 1, 2 and 3; this ROCK should provide a good/firm base to construct the Rock Rubble Mound Revetment.

Conversely, the ROCK was not found at Borings 4 and 5 and instead loose to very loose SAND can be anticipated at msl of -7.25 feet. Boring 4 encountered moderately dense silty SAND with gravel at -8' msl which should provide a firm base to construct the Rock Rubble Mound Revetment. Boring 5 did not encountered a firm layer of material to construct the Rock Rubble Mound Revetment; Boring 5 was terminated at -7.5' msl due to the boring collapsed at that depth and the limitations of the portable equipment being used for this boring required the hole to be terminated. During construction of the Rock Rubble Mound Revetment in the area of Boring 5, stabilization of the base of the structure will likely be required.

## ON-SITE OBSERVATION

During the progress of construction, so as to evaluate general compliance with the design concepts, specifications and recommendations contained herein, a representative from this office should be present to observe the following operations:

1. Site preparation.
2. Placement of fill and backfill.
3. Footing excavations and slab subgrade moisture conditioning and compaction.

## REMARKS

The conclusions and recommendations contained herein are based on the findings and observations made at the exploration locations. If conditions are encountered during construction which appear to differ from those disclosed by the explorations, this office shall be notified so as to consider the need for modifications.

This report has been prepared for the exclusive use of Sea Engineering, Inc. and their respective design consultants. It shall not be used by or transferred to any other party or to another project without the consent and/or thorough review by this facility. Should the project be delayed beyond the period of one year from the date of this report, the report shall be reviewed relative to possible changed conditions.

Samples obtained in this investigation will deteriorate with time and will be unsuitable for further laboratory tests within one (1) month from the date of this report. Unless otherwise advised, the samples will be discarded at that time.

The following are included and complete this report:

Rock Rubble Mound Revetment Detail -------- Plate A

Vicinity Map ------------------------------------------ Plate 1

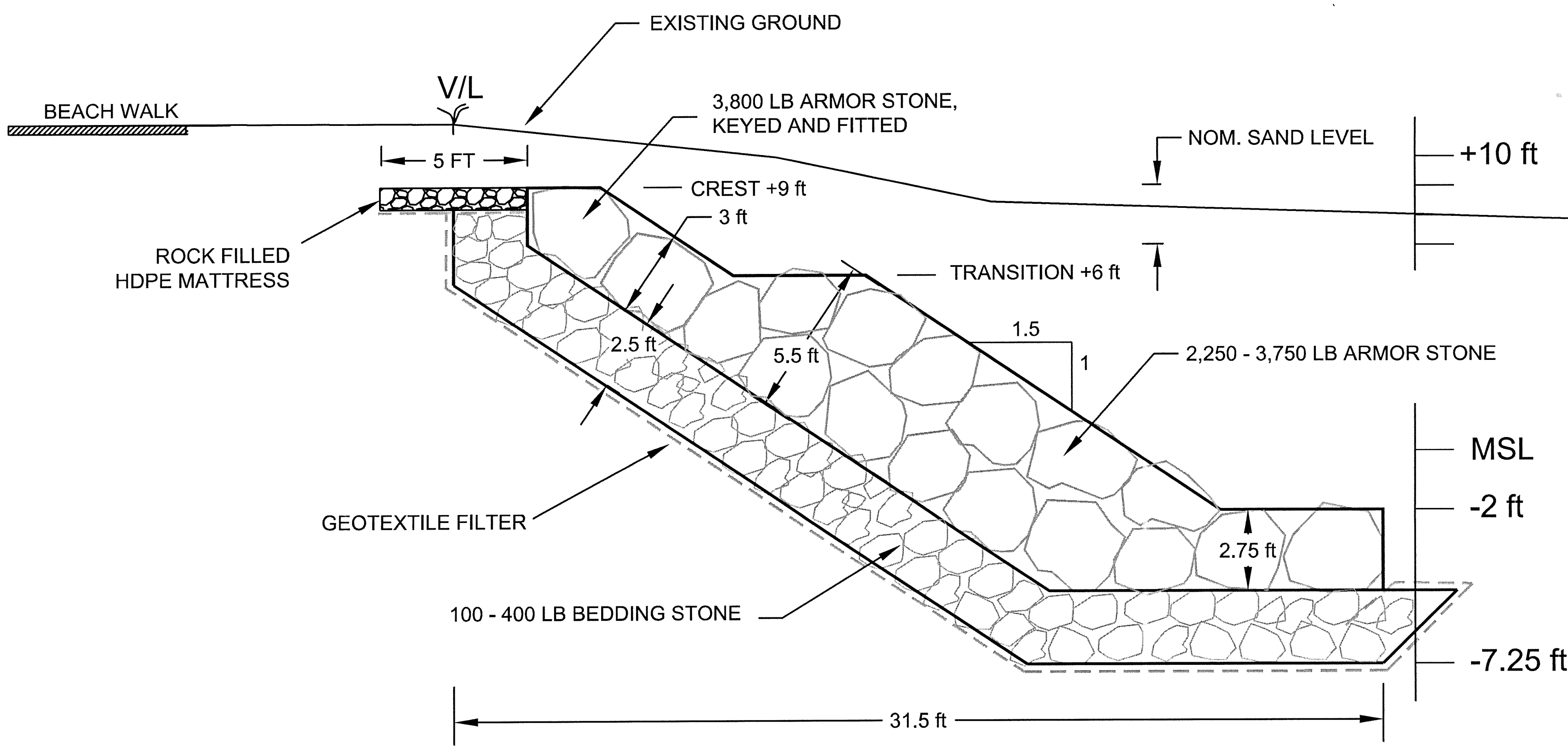
Plot Plan --------------------------------------------- Plate 2

Appendix: Field Investigation and Laboratory Testing

Logs of Test Borings ------------------------------- Plates 3 - 7

Estimated MSL Elevation of Rock ------------ Plate 8

Picture of Drill Rig Drilling Boring 3

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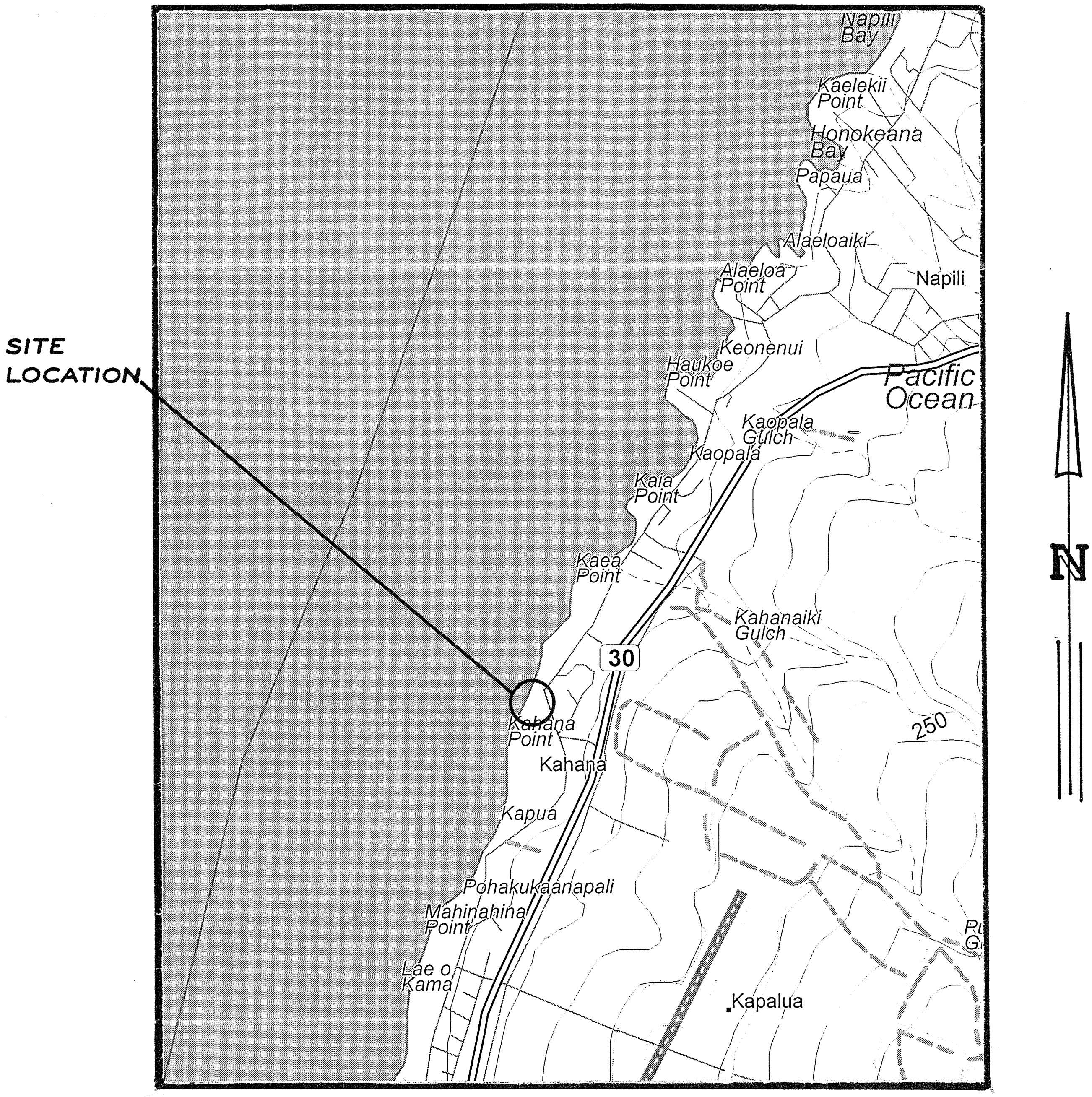
ROCK RUBBLE MOUND REVETMENT

NOTES:
1. ELEVATIONS BASED ON MSL DATUM

Plate A

# VICINITY MAP



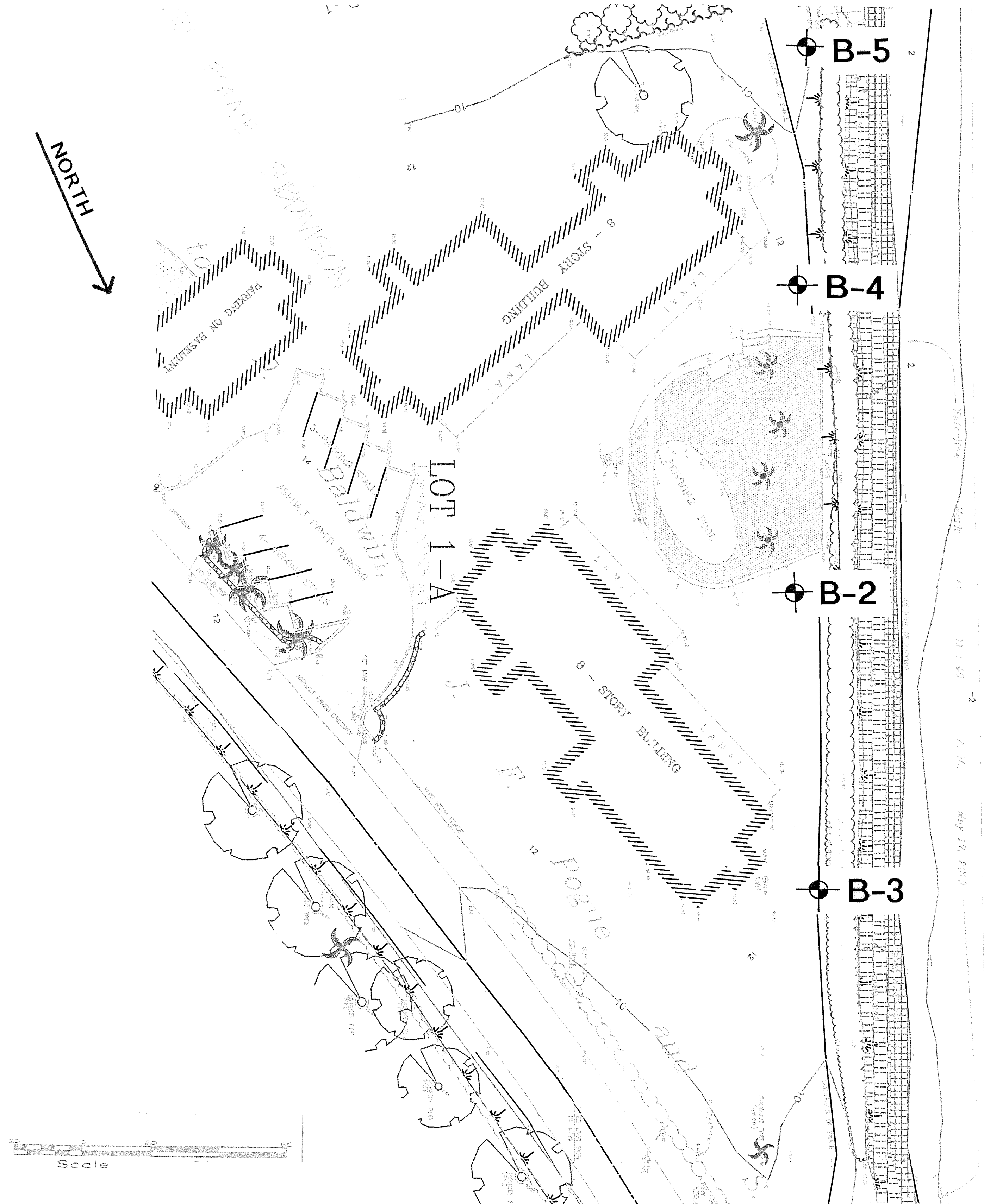

**REFERENCE:**

USGS TOPOGRAPHIC MAP
NAPILI QUADRANGLE

HOLOLANI ROCK REVETMENT

ISLAND GEOTECHNICAL ENGINEERING, INC.
*Geotechnical Consultants*

| | |
|---|---|
| PROJECT NO. | 101408FM |
| DATE | Aug. 2010 |
| SCALE | 1" = 2000' |
| PLATE | 1 |




Plot Plan

Project: HOLOLANI ROCK REVETMENT | Project No.: 101408-FM

**ISLAND GEOTECHNICAL ENGINEERING, INC.** | PLATE 2

# APPENDIX

FIELD INVESTIGATION AND LABORATORY TESTING

## FIELD INVESTIGATION

### General

The field investigation consisted of performing explorations at the locations shown on the Plot Plan. The method used for the exploratory work on this project is shown on the respective exploration log. A description of the various methods are presented below.

### Test Borings Using Truck-Mounted Drilling Equipment

Truck-mounted borings are drilled using a gas-powered drilling rig. The hole is advanced using continuous flight augers, wash boring and/or NX coring.

Auger drilling is used in soils where caving does not occur. The augers are 4-1/2 inch diameter continuous helical flight augers with the lead auger having a head equipped with changeable cutting teeth. Soil cuttings are brought to the surface by the continuous flights. After the bore hole is advanced to the required depth and cleaned of cuttings by additional rotation of the augers, the augers are retracted for soil sampling or in-situ testing.

In soils where caving of the bore hole occurs, the hole is advanced by wash boring or hollow-stem augering. Wash boring consists of advancing steel casing by rotary action and water pressure to flush the soil from the casing. The lead section of the casing is equipped with a carbide or diamond casing bit. After the casing has been advanced to the required depth, soil samples are obtained through the inside of the casing. Hollow-stem drilling consists of advancing the hole with 7-5/8 inch outside diameter and 4-1/4 inch inside diameter augers. The leading drill bit is connected to drilling rods through the central portion of the auger. At the required sampling depth, the interior drill rods and lead bit are removed, and the soil sample is taken by driving a sampler through the “hollow” section of the augers.

Coring is used for hard formations such as rock, coral or boulders. The core barrel, consisting of a 5-foot long double tube, hardened steel barrel with either a carbide or diamond bit, is attached to drilling rods and set on the hard formation. The core barrel is advanced through the formation by rotation of the core barrel. Water is used to flush out the cuttings. Upon completion of the core run, the sample is removed from the core barrel and inspected. The total core recovery length and the sum of all intact pieces over 4-inches in length are measured. The length of core recovery divided by the length of the core run is the recovery ratio. The combined length of the 4-inch or longer pieces divided by the length of core run is the Rock Quality Designation (RQD). The values provide an indication of the quality of the formation.

Test Borings Using Portable Drilling Equipment

In areas inaccessible to truck-mounted equipment, portable drilling equipment is used to drill the test boring. The boring is advanced by either (1) continuous drive sampling, or by (2) using a small gas-powered drill rig with continuous flight augers, wash boring or NX coring.

Soil samples are obtained with a tripod and cathead assembly using soil sampling methods described below.

Test Pits Using Excavators / Backhoes

Test pits are excavated using an excavator or backhoe. Material excavated from the pit and the sides and bottom of the pit are visually inspected and a continuous log of the hole is kept.

Explorations Using Hand Tools

In inaccessible areas requiring only shallow explorations, borings and test pits are made using hand equipment. Borings are drilled using hand augers. Test pits are excavated using hand tools. Cuttings from the boring and/or pit are inspected and visually classified.

Soil Sampling

Relatively undisturbed samples of the underlying soils are obtained from borings by driving a sampling tube into the subsurface material using a 140-pound safety hammer falling from a height of 30 inches. Ring samples are obtained using a 3-inch outside diameter, 2.5-inch inside diameter steel sampling tube with an interior lining of one-inch long, thin brass rings. The tube is driven approximately 18 inches into the soil and a section of the central portion is placed in a close fitting waterproof container in order to retain field conditions until completion of the laboratory tests. Standard Penetration Test (SPT) values and disturbed soil samples are obtained with a 2-inch (outside diameter) split-barrel sampler instead of the 3-inch sampler. The number of blows required to drive the sampler into the ground is recorded at 6-inch intervals. The blow count for the last 12 inches is shown on the boring logs.

From test pit excavations, relatively undisturbed soil samples are obtained by pushing the 3-inch outside diameter sampling tube (mentioned above) into the ground with the backhoe bucket. In addition, undisturbed bulk samples are retained from cohesive type soil formations and disturbed bulk samples are retained from friable and cohesionless soil formations.

The soil samples are visually classified in the field using the Unified Soil Classification System.

Samples are packed in moisture-proof containers and transported to the laboratory for testing.

Dynamic Cone Penetrometer (DCP)

There are two types of DCP tests used in the field. One test is generally used for pavement design and the other test is generally used for foundation design.

The DCP test for pavement design is an in-place test generally performed on the near surface soils. The DCP consists of a steel rod with a steel cone attached to one end which is driven into the soil by means of a sliding hammer. The angle of the cone is 60 degrees. The depth of the cone penetration is recorded at selected penetration or hammer drop intervals. The standard DCP test is designed to penetrate soils to a total depth of 1 meter (39.4 inches), however, extension rods may be used to reach greater depths. The recorded data from the DCP test can be converted to CBR values for use in pavement design.

The DCP test for foundation design (aka Wildcat DCP) is used to evaluate the consistency of the subsurface soils to depths of 25 feet. The test is performed by driving a 1.4-inch diameter (10 square centimeter area) steel cone (cone is connected to 1.1-inch diameter steel rods) into the ground using a 35-pound slide hammer that is dropped from a height of 15 inches. The number of blows required to drive the steel cone 10 centimeters is recorded and the process is continued until the desired depth is reached. Blowcounts from this test can be converted to Standard Penetration Test (SPT) values.

## LABORATORY TESTING

### General

Laboratory tests are performed on various soil samples to determine their engineering properties. Laboratory tests results performed for this project are generally shown on the exploration logs or attached as stand alone documents. Descriptions of some of the various tests (that may or may not have been performed for this project) are listed below.

### Unit Weight and Moisture Content

The in-place moisture content and unit weight of the samples are used to correlate similar soils at various depths. The sample is weighed, the volume determined, and a portion of the sample is placed in the oven. After oven-drying, the sample is again weighed to determine the moisture loss. The data is used to determine the wet-density, dry-density and in-place moisture content.

### Direct Shear

Direct shear tests are performed to determine the strength characteristics of the representative soil samples. The test consists of placing the sample into a shear box, applying a normal load and then shearing the sample at a constant rate of strain. The shearing resistance is recorded at various rates of strain. By varying the normal load, the angle of internal friction and cohesion can be determined.

### Consolidation Test

Consolidation tests are performed to obtain data from which time rates of consolidation and amounts of settlement may be estimated. The test is performed by placing a specimen in a consolidation apparatus. Loads are applied in increments to the circular face of a one-inch (1") high sample. Deformation or changes in thickness of the specimen are recorded at selected time intervals. Water is introduced to or allowed to drain from the sample through porous disks placed against the top and bottom faces of the specimen. The data is then used to plot a stress-volume strain curve which is used in estimating settlement.

Expansion Index Test

Expansion Index of fine-grained soils is determined in accordance with ASTM D 4829 test procedure. The soil specimen is compacted into a metal ring so that the degree of saturation is between 40 and 60 percent. The specimen and the ring are placed in a consolidometer. A vertical confining pressure of 1 psi is applied to the specimen and then the specimen is inundated with water. The deformation of the specimen is recorded for 24 hours. The data is used to determine the expansion potential of the soil.

One-Dimensional Swell Test

Another procedure for determining the expansion of fine-grained soils is ASTM D 4546 (Method B) test procedure. The soil specimen is compacted into a 2.5-inch diameter (1-inch height) metal ring using a 10-pound hammer. The specimen and the ring are placed in an expansion apparatus. A vertical pressure of 155 psi is applied to the specimen and then the specimen is inundated with water. The deformation of the specimen is recorded for 24 hours.

The test is similar in principle to the Expansion Index Test (see above) with the primary difference being the soil specimen in the One-Dimensional Swell Test is usually compacted to a higher dry density than the Expansion Index and, therefore, generally produces a higher degree of expansion.

Classification Tests

The soil samples are classified using the Unified Soil Classification System. Classification tests include sieve and hydrometer analysis to determine grain size distribution, and Atterberg Limits to determine the liquid limit, plastic limit and plasticity index.

California Bearing Ratio Test

California Bearing Ratio (CBR) tests are performed on materials to determine the bearing strength of the soil for determination of pavement sections. The sample is compacted into a 6-inch diameter mold in 5 equal layers. Each layer is compacted with a 10-pound hammer falling from a height of 18 inches, with each layer receiving 56 blows. The mold is then placed in a water bath for 4 days and the vertical swell is measured under a surcharge weight of 10 pounds. After the soaking period, the sample is placed in a CBR apparatus that has a 3-square inch penetrometer. The penetrometer is pressed vertically into the soil at constant strain and the loads required to press the penetrometer are recorded. A plot of the load-strain relationship is made to determine the CBR value.

Maximum Dry Density / Optimum Moisture Content

The maximum dry density and optimum moisture content of the material is determined in accordance with the ASTM D1557 test procedure. The sample is compacted into a mold in 5 equal layers using a 10-pound hammer falling from a height of 18 inches. The diameter of the mold is either 4 inches or 6 inches, depending on the proportion of gravel in the sample. The sample is compacted at various moisture contents to develop a compaction curve for the soil. The curve is usually bell-shaped with a peak indicating the maximum dry density and optimum moisture content.

Penetrometer Test

Penetrometer tests are performed on clayey soils to determine the consistency of the material and an approximate value of the unconfined compressive strength.

Torvane

Torvane tests are used to determine the approximate undrained shear strength of clayey soils. The torvane apparatus consists of a torque device with a small diameter plate that has vanes situated perpendicular to the plate. The vanes are pushed into the soil and torque is applied until failure occurs. The torque required to cause failure is converted to approximate undrained strength of the soil.

# LOG OF BORING NO. 1

**ELEVATION:** see Plate 2

**EQUIPMENT USED:** B-59 Drill Rig

**DEPTH OF BORING (FT.):** 20.5

**DATE DRILLED:** June 9, 2010

**DEPTH OF GROUNDWATER:** 8.4 feet

| DEPTH (FT.) | SOIL CLASSIFICATION | DESCRIPTION | BLOWS/FOOT | COLOR | MOISTURE | CONSISTENCY | DRY DENSITY (PCF) | MOISTURE CONTENT (% OF DRY WT.) | PENETROMETER (TSF) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | ML | sandy SILT with gravel | | brown | moist to very moist | very stiff | | 15.6 | |
| | MH/ML | SILT with sand | 58 | dark brown | | | | 45.8 | |
| 3 | | | | | | | | | |
| | SM | silty SAND | 11 | brown | moist | mod. dense | | 10.6 | |
| 6 | | | | | | | | | |
| | GM | silty GRAVEL with sand | | | sat. | | | | |
| 9 | SP-SM | SAND with silt | | gray | | | | 55.3 | |
| | | | 13 | light yellowish brown | | | | 39.6 | |
| 12 | | | | | | | | | |
| 15 | | | 9 | very dark grayish brown | | loose | | 45.9 | |
| 18 | | | | | | | | | |
| | rock | ROCK | 206 | black | | mod. hard rock | | 18.0 | |
| 21 | | END OF BORING AT 20.5 FEET | | | | | | | |

**PROJECT NAME:** HOLOLANI ROCK REVETMENT

**PROJECT NO.:** 101408-FM

**ISLAND GEOTECHNICAL ENGINEERING, INC.**

*Geotechnical Consultants*

PLATE 3

# LOG OF BORING NO. 2

**ELEVATION:** see Plate 2

**EQUIPMENT USED:** B-59 Drill Rig

**DEPTH OF BORING (FT.):** 21.5

**DATE DRILLED:** June 9, 2010

**DEPTH OF GROUNDWATER:** 8.7 feet

| DEPTH (FT.) | SOIL CLASSIFICATION | DESCRIPTION | BLOWS/FOOT | COLOR | MOISTURE | CONSISTENCY | DRY DENSITY (PCF) | MOISTURE CONTENT (% OF DRY WT.) | PENETROMETER (TSF) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | ML | SILT (topsoil) | | dark brown | moist | stiff | | 29.8 | |
| | GM | silty GRAVEL with sand | | | | mod. dense | | 8.3 | |
| | SP | SAND | 19 | yellowish brown | | | | 9.3 | |
| 3 | SP | cinder SAND | | reddish brown | | | | | |
| | SM | silty SAND with gravel | | brown | | | | | |
| | | | 32 | | | dense | | 18.1 | |
| 6 | | | | | moist to very moist | | | | |
| | | | | | | mod. dense | | | |
| 9 | | | | | sat. | | | | |
| | SP-SM | SAND with silt | | dark gray | | | | 47.1 | |
| | SP | SAND | 18 | olive gray to dark gray brown | | | | 37.7 | |
| 12 | | | | | | | | | |
| 15 | | | | reddish brown | | | | 37.6 | |
| | GM | silty GRAVEL with sand | 16 | | | | | 46.7 | |
| 18 | rock | ROCK, weathered<br>Core Run #1: 19' to 21.5'<br>Rec. = 33% RQD = 30% | 23/0" | dark gray | | soft to mod. hard rock | | | |
| 21 | CL | CLAY | | very dark gray | | stiff | | 38.3 | |
| | | END OF BORING AT 21.5 FEET | | | | | | | |

**PROJECT NAME:** HOLOLANI ROCK REVETMENT

**PROJECT NO.:** 101408-FM

**ISLAND GEOTECHNICAL ENGINEERING, INC.**

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PLATE

4

# LOG OF BORING NO. 3

**ELEVATION:** see Plate 2

**EQUIPMENT USED:** B-59 Drill Rig

**DEPTH OF BORING (FT.):** 19.5

**DATE DRILLED:** June 9, 2010

**DEPTH OF GROUNDWATER:** 8.6 feet

| DEPTH (FT.) | SOIL CLASSIFICATION | DESCRIPTION | BLOWS/FOOT | COLOR | MOISTURE | CONSISTENCY | DRY DENSITY (PCF) | MOISTURE CONTENT (% OF DRY WT.) | PENETROMETER (TSF) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | SM | silty SAND with gravel | | dark grayish brown | mod. moist to moist | very dense | | 6.2 | |
| 3 | | | | | | | | | |
| | MH | sandy SILT | | dark brown | | stiff | | 14.9 | |
| 6 | SP-SM | SAND with silt | 27 | dark yellowish brown | | mod. dense | | 6.4 | |
| | | | | | very moist | | | | |
| 9 | SP-SM | SAND with silt and gravel | | | sat. | | | | |
| | | | 13 | dark gray to grayish brown | | | | 42.4 | |
| 12 | SP | SAND | | | | | | 38.5 | |
| 15 | CL | CLAY | | very dark gray to dark gray | | stiff | | 43.8 | |
| | rock | ROCK: porous | 45/2" | | | soft rock | | 12.4 | |
| 18 | | Core Run #1: 17.5' to 19.5' Rec. = 46% RQD = 33% | | | | mod. hard rock | | | |
| | | END OF BORING AT 19.5 FEET | | | | | | | |
| 21 | | | | | | | | | |

**PROJECT NAME:** HOLOLANI ROCK REVETMENT

**PROJECT NO.:** 101408-FM

**ISLAND GEOTECHNICAL ENGINEERING, INC.**

*Geotechnical Consultants*

PLATE

5

# LOG OF BORING NO. 4

**ELEVATION:** see Plate 2

**EQUIPMENT USED:** Minuteman/Tripod Assembly

**DEPTH OF BORING (FT.):** 19.75

**DATE DRILLED:** August 13, 2010

**DEPTH OF GROUNDWATER:** 8.7 feet

| DEPTH (FT.) | GRAPHIC SYMBOL | SOIL CLASSIFICATION | DESCRIPTION | SAMPLE | BLOWS/FOOT | COLOR | MOISTURE | CONSISTENCY | DRY DENSITY (PCF) | MOISTURE CONTENT (% OF DRY WT.) | PENETROMETER (TSF) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | MH | SILT with gravel | | | very dark grayish brown | moist | mod. stiff | | | |
| | | | | | 15 | | | stiff | | 25.6 | |
| 3 | | SP | SAND with gravel | | | dark reddish brown | | mod. dense | | 23.3 | |
| | | MH | sandy SILT | | 19 | | | very stiff | | 23.1 | |
| 6 | | SM | silty SAND | | | dark yellowish brown | | loose | | 4.6 | |
| | | MH | SILT | | 6 | | | mod. stiff | | 23.8 | |
| | | | | | | | very moist | | | | |
| 9 | | SM | silty SAND with gravel | | | dark grayish brown | sat. | mod. dense | | 26.3 | |
| | | MH | sandy SILT | | 20 | | | very stiff | | 16.2 | |
| 12 | | SP-SM | SAND with silt | | | | | mod. dense | | 36.5 | |
| 15 | | | | | 3 | | | very loose | | | |
| 18 | | | | | | very dark grayish brown | | mod. dense | | 26.7 | |
| | | SM | silty SAND with gravel | | 16 | | | | | 43.6 | |
| 21 | | | END OF BORING AT 19.75 FEET | | | | | | | | |

**PROJECT NAME:** HOLOLANI ROCK REVETMENT

**PROJECT NO.:** 101408-FM

**ISLAND GEOTECHNICAL ENGINEERING, INC.**

*Geotechnical Consultants*

**PLATE** 6

# LOG OF BORING NO. 5

**ELEVATION:** see Plate 2

**EQUIPMENT USED:** Minuteman/Tripod Assembly

**DEPTH OF BORING (FT.):** 17.5

**DATE DRILLED:** August 13, 2010

**DEPTH OF GROUNDWATER:** 8.1 feet

| DEPTH (FT.) | SOIL CLASSIFICATION | DESCRIPTION | BLOWS/FOOT | COLOR | MOISTURE | CONSISTENCY | DRY DENSITY (PCF) | MOISTURE CONTENT (% OF DRY WT.) | PENETROMETER (TSF) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | MH | SILT with sand | | brown | mod. moist to moist | stiff | | | |
| | | | | | | very stiff | | | |
| | | | 41 | | | | | 14.1 | |
| 3 | | | | dark brown | | | | 12.4 | |
| | SM | silty SAND | | | | loose | | | |
| | | | 7 | | | | | 7.2 | |
| 6 | MH | SILT | | very dark grayish brown | | soft | | 26.7 | |
| | SM | silty SAND | | | very moist | loose | | | |
| | | | 7 | | | | | 34.9 | |
| | cob | COBBLE | | | | | | | |
| | SM | silty SAND | | | sat. | | | | |
| 9 | SP-SM | SAND with silt | | dark gray | | | | 53.7 | |
| | | | 9 | | | mod. dense | | 47.2 | |
| 12 | | | | grayish brown | | loose to very loose | | 35.7 | |
| | | | | | | | | 41.2 | |
| | GM | silty GRAVEL with sand | | | | | | | |
| | | | 3 | | | | | 39.5 | |
| | SM | silty SAND | | | | | | | |
| 15 | | | | very dark grayish brown | | | | 31.5 | |
| | | | 1 | | | | | 40.3 | |
| | | END OF BORING AT 17.5 FEET | | | | | | | |
| 18 | | | | | | | | | |
| 21 | | | | | | | | | |

**PROJECT NAME:** HOLOLANI ROCK REVETMENT

**PROJECT NO.:** 101408-FM

**ISLAND GEOTECHNICAL ENGINEERING, INC.**

*Geotechnical Consultants*

**PLATE** 7

## Estimated ROCK Elevations at the Hololani Borings

| Boring | Estimated MSL Elevation of Rock (*) |
|---|---|
| 1 | -9.5' |
| 2 | -8' |
| 3 | -5.5' |
| 4 | ? |
| 5 | ? |

**(*)** Note that actual msl elevations at the borings was not provided to IGE. The elevation information on this table was estimated by interpolating the topographic map that was provided. All borings appear to be at about +10.0' msl.


06/09/2010

ISLAND GEOTECHNICAL ENGINEERING, INC.
*Geotechnical Consultants*

330 Ohukai Road, Suite 119
Kihei, Maui, Hawaii 96753
Phone: (808) 875-7355
Fax: (808) 875-7122

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December 21, 2011
Project No. 101408-FM

Sea Engineering, Inc.
Attn: Mr. Jim Barry
Makai Research Pier
Waimanalo, Hawaii 96795

Subject: Addendum to Soils Investigation Report entitled, "Hololani Rock Revetment" dated August 31, 2010 Kahana, Maui, Hawaii

This letter is intended to provide additional information for the design and construction of the proposed Hololani Rock Revetment to be located at the Hololani Resort at 4401 Lower Honoapiilani Road in Kahana, Maui, Hawaii.

The proposed new structure will have a retaining wall integrated into the structure. Sheetpiling may be included in a portion of the structure. The details of the proposed structures that were provided to IGE are attached as the last two pages of this letter. The following are design values for the retaining wall:

Foundations for Retaining Walls
An allowable bearing value of 1,500 pounds per square foot may be used for retaining wall footings bearing on firm on-site soil or properly compacted fill and embedded at least 12 inches below the lowest adjacent compacted grade.

For footings located adjacent to new or existing utility trenches, the bottom of the footing shall be deepened below a 1 horizontal to 1 vertical plane projected upwards from the edge of the utility trench.

For footings located on or adjacent to slopes, the footing shall be deepened such that there is a minimum horizontal distance of 5 feet from the edge of the footing to the slope face.

The bearing values are for dead plus live loads and may be increased by one-third for momentary loads due to wind or seismic forces. If any footing is eccentrically loaded, the maximum edge pressure shall not exceed the bearing pressure for permanent or for momentary loads.

The bottom of all foundations should have a firm/unyielding surface.

Backfill around the perimeter of all foundations should be mechanically compacted to produce a firm/unyielding surface.

<u>Settlement of the Retaining Wall Foundation</u>

Under the fully applied recommended bearing pressure, it is estimated that settlement of continuous footings bearing on firm on-site soils or properly compacted fill will be less than 1 inch.

Differential settlement between footings will vary according to the size, bearing pressure and bearing material of the footing.

<u>Lateral Resistance for the Retaining Wall</u>

For resistance of lateral loads, such as wind or seismic forces, an allowable passive resistance equivalent to that exerted by a fluid weighing 200 pounds per cubic foot may be used for footings, or other structural elements, provided the vertical surface is in direct contact with undisturbed soil or properly compacted fill. For structural elements that are submerged, this value should be reduced to 95 pounds per cubic foot.

Frictional resistance between footings and the underlying materials may be assumed as 0.4 times the dead load for the on-site fine-grained soils and 0.5 times the dead load for the on-site granular soils (or imported granular soils).

Lateral resistance and friction may be combined.

<u>Seismic Considerations</u>

According to the 1997 Uniform Building Code, the site is in zone 2B. Based on the findings of our explorations and our local knowledge of the strata in this area, the soil profile type $S_D$ is recommended for this site.

<u>Slabs-on-Grade</u>

For a concrete sidewalk, it is recommended that the sidewalk be supported with 4 inches of untreated base course gravel (utb).

Prior to placing the utb, the subgrade soil shall be moisture conditioned to within 0 & 3 percent of the optimum moisture content and compacted to a minimum of 95% of the maximum dry density (as determined by the ASTM D 1557 test procedure) if the material is granular or 90% of the maximum dry density (as determined by the ASTM D 1557 test procedure) if the material is fine-grained. Site grading should be designed to prevent ponding of water adjacent to the slab area.

Foundation Preparation

The bottom of the seawall/revetment structure is design to be at elevation -5.5' msl. Geotextile fabric shall be placed in the bottom of all wall foundation excavations prior to placement of any stone; geotextile fabric shall be Mirafi Filterweave 404 or Amoco Propex 2016 or an approved equivalent.

At elevation -5.5' msl, loose soil conditions are anticipated south of Boring 2 (see attached boring locations, Plate 2). In order to stabilize the loose conditions, it is recommended that the loose area be over-excavated by a minimum of 1 foot (to elevation -6.5' msl) and Triton Marine Mattress be placed into the excavation. The mattress shall have a minimum nominal thickness of 12". The construction and placement of the Triton Marine Mattress shall be in accordance with the manufacturer's recommendations. Each individual mattress shall cover the 19.75 feet plan width and each mattress shall be placed perpendicular to the shoreline. The geotextile fabric (mentioned in the previous paragraph) can be attached to the bottom of the mattress prior to placing the mattress into the foundation excavation.

Sheetpile Design

The soils design parameters for sheetpile design are shown on the attached Plate SP.

Site Preparation and Grading

It is recommended that the site be prepared in the following manner:

1. All vegetation, weeds, brush, roots, stumps, rubbish, debris, and other deleterious material shall be removed and disposed of off-site.

2. Fill and Backfill in Structural Areas Structural areas shall be defined as areas beneath, and to 1 feet beyond the edges of the structure.

   Structural fill and backfill material shall consist of untreated base course gravel. The material shall meet the grading requirements as shown on the attached Table 703.06-2.

   Each layer shall be placed in lifts not exceeding 6 inches in compacted thickness. Prior to compacting the soil, the soil's moisture content shall be adjusted to near optimum moisture content. Each layer shall be thoroughly compacted to at least 95 percent of the maximum dry density (ASTM D1557).

3. Fill and Backfill in Non-Structural Areas  Non-structural areas shall be defined as areas beyond 1 feet from the edge of any structure.

   Non-structural fill and backfill material shall consist of material which is free of organics and debris. The material shall be less than 6 inches in greatest dimension.

   Each layer shall be placed in lifts not exceeding 12 inches in loose thickness. Prior to compacting the soil, the soil's moisture content shall be adjusted to near optimum moisture content. Each layer shall be thoroughly compacted prior to placing of any subsequent lifts to at least 90 percent of the maximum dry density as determined by the ASTM D 1557 test procedure.

4. Backfill Behind Retaining Walls  Retaining wall backfill shall be defined as backfill that extends from the stem of the retaining wall to 6 inches beyond the heel of the wall footing or the footing excavation line, whichever is greater.

   All retaining wall backfill material shall consist of material that is in accordance with the project plans and specifications and meets the design criteria of the structural engineer. Granular backfill is recommended.

   Each layer of backfill shall be placed in layers not exceeding 6 inches in compacted thickness. Each layer of backfill shall be thoroughly compacted prior to placing of any subsequent lifts. All retaining wall backfill shall be compacted to at least 90 percent of the maximum dry density as determined by the ASTM D 1557 test procedure.

It is particularly important to see that all fill and backfill soils are properly compacted in order to maintain the recommended design parameters provided in this report.

## ON-SITE OBSERVATION

During the progress of construction, so as to evaluate general compliance with the design concepts, specifications and recommendations contained herein, a representative from this office should be present to observe the following operations:

1. Site preparation.
2. Placement of fabric/mattresses and fill/backfill.
3. Foundation excavation and preparation.

## REMARKS

The conclusions and recommendations contained herein are based on the findings and observations made at the exploration locations. If conditions are encountered during construction which appear to differ from those disclosed by the explorations, this office shall be notified so as to consider the need for modifications.

This report has been prepared for the exclusive use of Sea Engineering, Inc. and their respective design consultants. It shall not be used by or transferred to any other party or to another project without the consent and/or thorough review by this facility. Should the project be delayed beyond the period of one year from the date of this report, the report shall be reviewed relative to possible changed conditions.

This letter was made in accordance with generally accepted engineering procedures considered necessary for the project. In the opinion of the undersigned, the accompanying report has been substantiated by mathematical data in conformity with generally accepted engineering principles and presents fairly the design information requested by your organization. No other warranty is either expressed or given.

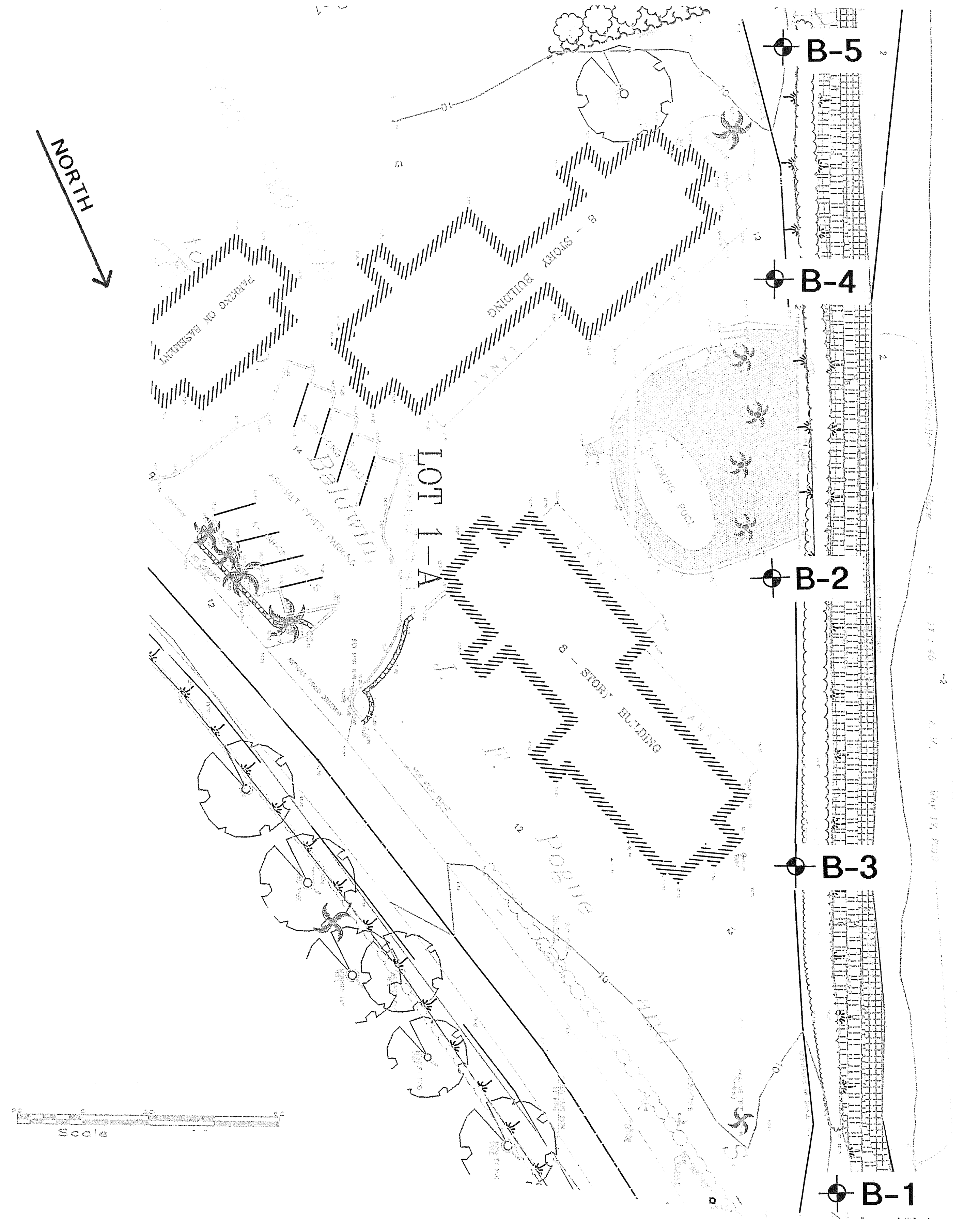
Respectfully submitted,

ISLAND GEOTECHNICAL ENGINEERING, INC.

Charles K. Biegel, P.E.
President

CHARLES K. BIEGEL
LICENSED PROFESSIONAL ENGINEER
NO. 7568-C
HAWAII, U.S.A.

This work was prepared by me or under my supervision.




Plot Plan

| | |
|---|---|
| Project: HOLOLANI ROCK REVETMENT | Project No.: 101408-FM |
| **ISLAND GEOTECHNICAL ENGINEERING, INC.** | PLATE 2 |

| TABLE 703.06-2 - UNTREATED BASE GRADING REQUIREMENTS | | | |
|---|---|---|---|
| Sieve Size | Percent Passing by Weight | | |
| | 2-1/2 Inch Maximum Nominal | 1-1/2 Inch Maximum Nominal | 3/4 Inch Maximum Nominal |
| 3 Inch | 100 | - | - |
| 2-1/2 Inch | 90 - 100 | - | - |
| 2 Inch | - | 100 | - |
| 1-1/2 Inch | 65 - 90 | 90 - 100 | - |
| 1 Inch | - | - | 100 |
| 3/4 Inch | 45 - 70 | 50 - 90 | 90 – 100 |
| No. 4 | 25 - 45 | 25 - 50 | 35 – 55 |
| No. 200 | 3 - 9 | 3 - 9 | 3 – 9 |

## SHEETPILE DESIGN VALUES

---

### SHEETPILE DESIGN VALUES AT BORING 4

| Depth | Unit Weight | Submerged Unit Weight | Ka | Ko | Kp |
|---|---|---|---|---|---|
| EG to -5' EG | 132 pcf | 70 pcf | .32 | .48 | 3.12 |
| -5' EG to -9' EG | 121 pcf | 72 pcf | .36 | .53 | 2.77 |
| -9' EG to -11' EG | 132 pcf | 70 pcf | .29 | .45 | 3.39 |
| -11' EG to -18' EG | 102 pcf | 40 pcf | .36 | .53 | 2.77 |
| Below -18' EG | 119 pcf | 57 pcf | .27 | .43 | 3.69 |

---

### SHEETPILE DESIGN VALUES AT BORING 5

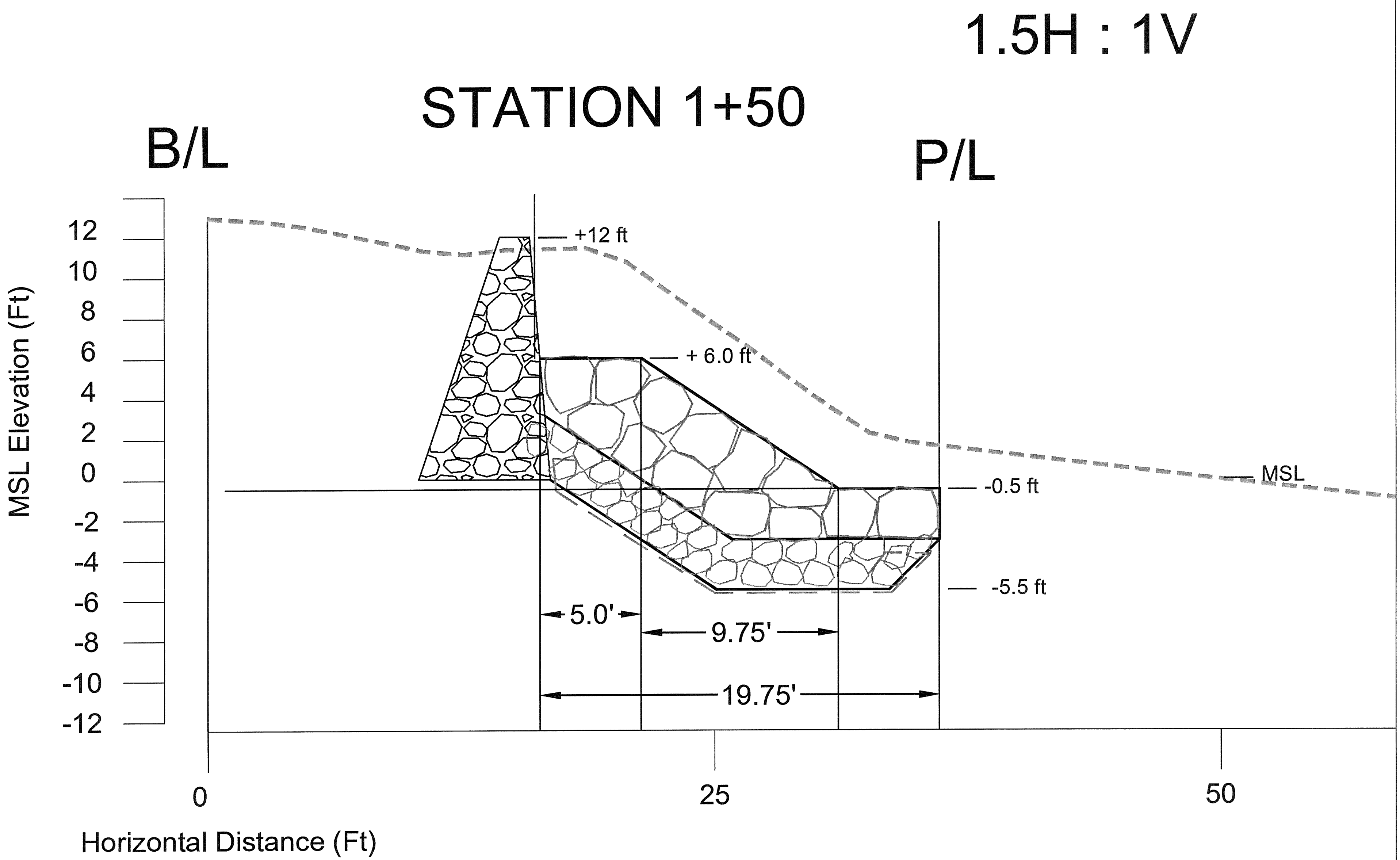
| Depth | Unit Weight | Submerged Unit Weight | Ka | Ko | Kp |
|---|---|---|---|---|---|
| EG to -3' EG | 135 pcf | 73 pcf | .26 | .41 | 3.85 |
| -3' EG to -12' EG | 111 pcf | 49 pcf | .32 | .48 | 3.12 |
| -12' EG to -15' EG | 102 pcf | 40 pcf | .36 | .53 | 2.77 |
| Below -15' EG | 97 pcf | 35 pcf | .39 | .56 | 2.56 |

---

### SHEETPILE DESIGN VALUES FOR IMPORTED GRAVEL (UTB)

| Unit Weight | Submerged Unit Weight | Ka | Ko | Kp |
|---|---|---|---|---|
| 145 pcf | 83 pcf | .26 | .41 | 3.85 |

Note: EG means Existing Grade



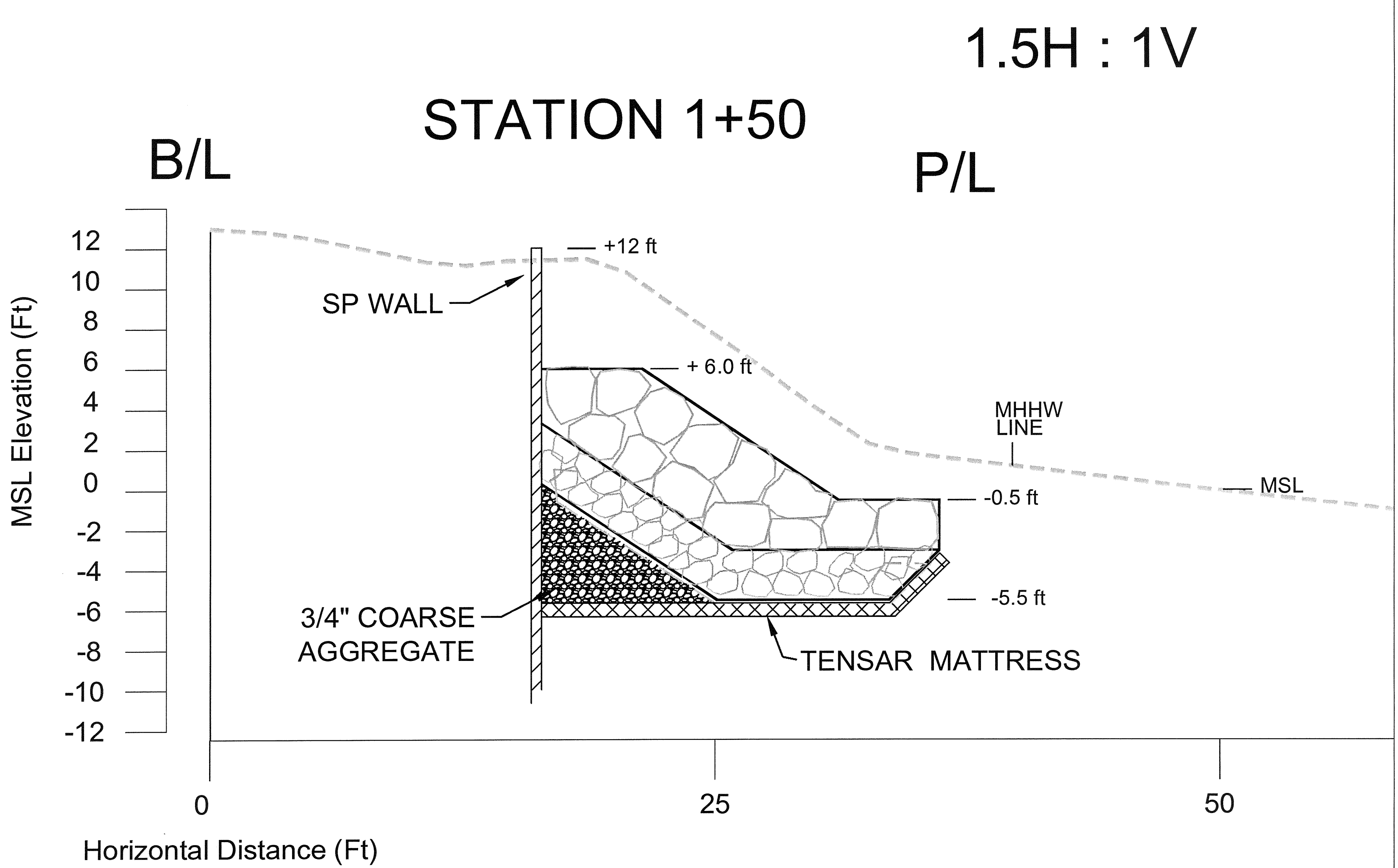

Sea Engineering, Inc.

HOLOLANI

REVETMENT and SEAWALL

NOTES:

1. ELEVATIONS BASED ON MSL DATUM




Sea Engineering, Inc.

HOLOLANI

REVETMENT and SEAWALL

NOTES:

1. ELEVATIONS BASED ON MSL DATUM

**APPENDIX C. SHORELINE SURVEY HISTORY – VALERA, INC.**

*Shoreline History at the Hololani Resort Condominums,*

*Lot 1-A Bechert Partition*

Valera Inc., 2011

**VALERA, INC.**
SURVEYORS

1867-A VINEYARD STREET
WAILUKU, MAUI, HAWAII 96793

MAILING ADDRESS:

P.O. BOX 3173
WAILUKU, MAUI, HAWAII 96793

(808) 244-0985
FAX (808) 244-1982

FILE 7187
February 21, 2011

Shoreline History
Lot 1-A Bechert Partition
Portions Grant 1166 top D Baldwin, J.F. Poque and S.E. Bishop
West of Lower Honoapiilani Highway
Kahananui, Kaanapali, Lahaina, Hawaii
TMK: (2) 4-3-010:009

In 1959 Bechert Estate was partitioned into five (5) lots. See portion of map on Exhibits 1 and 1-A. Thence, Lot 1 was subdivided into Lots 1-A, 1-B and 1-C.

On December 5, 1972, Lot 1-A was granted shoreline certification by the Board of Land and Natural Resources. See Exhibit 2.

During the conveyance of the property in December 1972 to Lokelani Construction, Co., Inc., a California Corporation, by Hawaii Projects, Inc. (formerly known as Kaanapali Hotel Corp.), an Arizona Corporation, by Deed recorded in the Bureau of Conveyance of the State of Hawaii in Liber 8791, page 140, adopted the certified shoreline as the shoreline boundary of subsequent Lot 1-A. Metes and bounds description hereto attached as Exhibit 3

In 1980, a shoreline of Parcel 27 of TMK: (2) 4-3-005 and portion of Lot 1-A of Bechert Estate got approval from the State. Significant erosion was already observed on these small parcels. See Exhibit 4.

In 1990, a shoreline application for shoreline protection purposes was approved following the toe of sand bags and vegetation line criteria. A total of 2,729 square feet was eroded during this application.

In 1995, another shoreline application for shoreline protection purposes was filed but disapproved. The disapproval was due to the lack of documentation of the presence of sand bags and the concrete sidewalk and stairs from the swimming pool to the ocean. A total of 1,888 square feet was eroded in this application.

In 2001, a shoreline application for shoreline protection purposes was granted, using the toe of bank and vegetation line as the criteria. A total of 3,321 square feet was eroded.

In 2007 an attempt to apply for shoreline certification for shoreline protection purposes failed on two (2) occasions (April and June 2007). Erosions are 5,519 and 4,412 square feet respectively. Exhibits 5 and 6 are the reasons of diaapproval.

Edgardo V. Valera,
Principal
Valera, Inc.

Enclosures: Exhibits 1, 1-A, 2, 3 , 4, 5 and 6

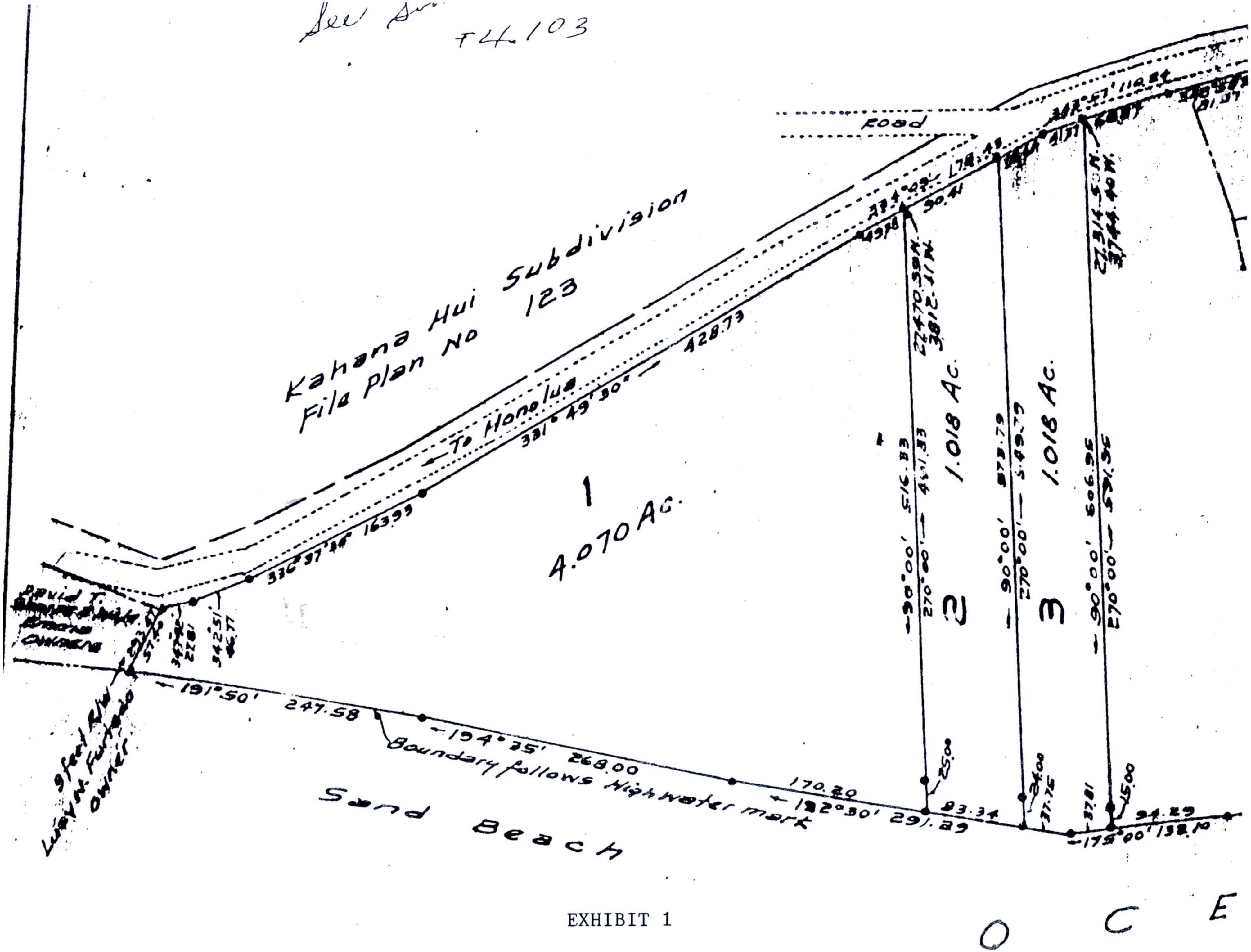
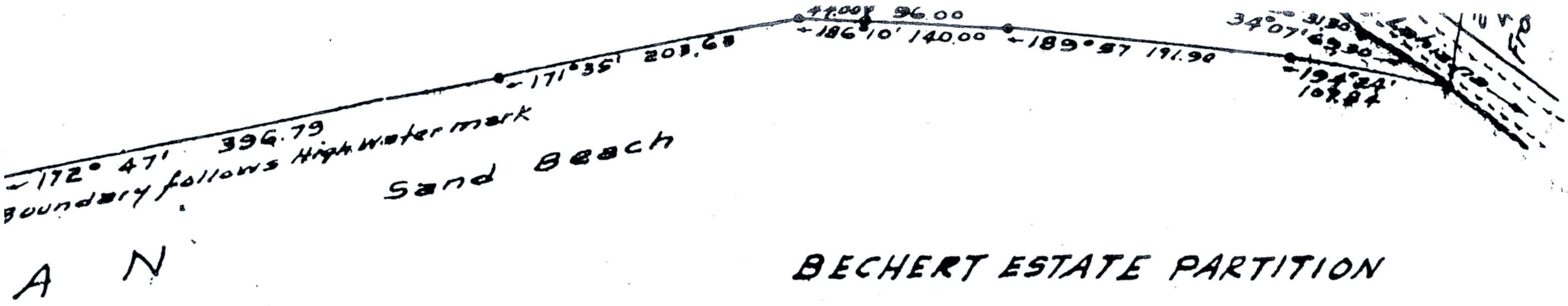

See Sv F4.103
Kahana Hui Subdivision
File Plan No 123
Road
To Honolua
331° 49' 30" 428.73
336° 37' 36" 163.33
1
4.070 Ac.
2
1.018 Ac.
3
1.018 Ac.
90°00' 516.83
270°00' 491.33
90°00' 573.79
270°00' 549.79
90°00' 606.96
270°00' 591.96
178.43
30.41
191°50' 247.58
194°35' 268.00
170.20
192°30' 291.29
83.34
175°00' 138.10
94.29
25.00
24.00
37.75
37.81
15.00
Boundary follows High water mark
Sand Beach
9 feet R/W
David T.
Owners
Owner
O C E

EXHIBIT 1




# BECHERT ESTATE PARTITION

Portion of Grant 1166 to D. Baldwin, J.F. Pogue and S.E. Bishop and all of R.P. 6231 L.C.Aw. 3985-I apanai to pala

Kahananui, Kaanapali, Maui, T.H.

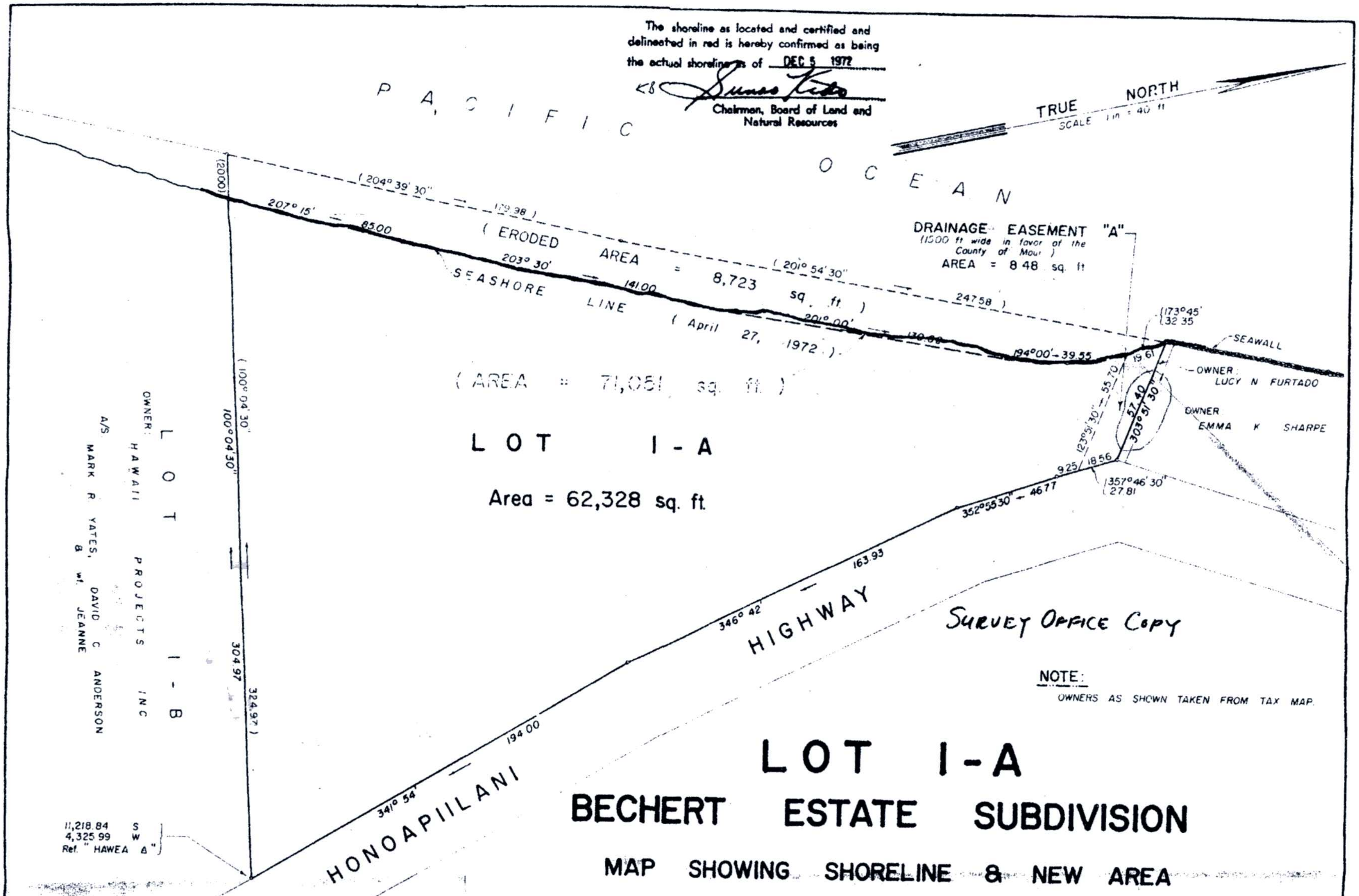
Hyades B. Kiesel
George K. Hasegawa & Wife
Edward B. Watson
Akira Wada & Wife
Amelia B. Horiuchi
Edward B. Watson Jr
} owners

Address George K. Hasegawa
Lahaina, Maui, T.H.

Surveyed By M.R. Souza
Wailuku, Maui, T.H.
May 20, 1958

Item # 12
4.59

EXHIBIT 1-A




# LOT I-A

# BECHERT ESTATE SUBDIVISION

## MAP SHOWING SHORELINE & NEW AREA

BEING A PORTION OF LOT I OF BECHERT ESTATE SUBDIVISION
BEING A PORTION OF GRANT 1166 TO D. BALDWIN, J.F. POGUE AND S.E. BISHOP

## AT KAHANANUI, KAANAPALI, MAUI, HAWAII

THIS MAP IS FROM AN ACTUAL SURVEY ON THE GROUND DONE BY ME OR UNDER MY SUPERVISION.

ROBERT T TANAKA
Registered Prof. Land Surveyor
Certificate No. 1754 E-S

EXHIBIT 2

OWNER: HAWAII PROJECTS INC.
ADDRESS: R.R. I, Box 500
LAHAINA, MAUI, HAWAII

TAX MAP KEY: 4-3-10:9

LAND & CONSTRUCTION CO., INC.
261 Dairy Road
Kahului, Maui, Hawaii

November 29, 1972

LOT 1-A

BECHERT ESTATE SUBDIVISION

BEING A PORTION OF LOT 1 OF
BECHERT ESTATE SUBDIVISION
BEING A PORTION OF GRANT 1166 TO D. BALDWIN,
J. F. POGUE AND S. E. BISHOP

SITUATED ON THE WEST SIDE OF HONOAPIILANI HIGHWAY
AT KAHANANUI, KAANAPALI, MAUI, HAWAII

Beginning at the Southeast corner of this parcel of land on the West side of Honoapiilani Highway, the coordinates of which referred to Government Survey Triangulation Station "Hawea" being 11,218.84 feet South and 4,325.99 feet West and running by azimuth measured clockwise from true South:

1. 100° 04' 30" 304.97 feet along Lot 1-B of this subdivision;

Thence along the seashore for the next five (5) courses, the azimuth and distance being:

2. 207° 15' [16'] 85.00 feet;
3. 203° 30' 141.00 feet;
4. 201° 00' 130.00 feet;
5. 194° 00' [194 - 00] 39.35 feet; [39.55]
6. 175° 45' 32.35 feet;
7. 303° 51' 30" 57.40 feet along land owned by Lucy N. Furtado;
8. 357° 46' 30" 27.81 feet along the West side of Honoapiilani Highway;
9. 352° 55' 30" 46.77 feet along same;
10. 346° 42' [346 - 42] 163.93 feet along same; [163.93]
11. 341° 54' [341° 54] 194.00 feet along same to the point of beginning and containing an area of 62,328 square feet. [194.00]

Being all of the land conveyed to L... Construction Co., Inc., a California corporation, by Hawaii Pro... Inc. (formerly known as Kaanapali ... Corp.), an Arizona corporation, by Deed dated December 7, 1972, recorded in the Bureau of Conveyances of the State of Hawaii in Liber 8761, ...

EXHIBIT

EXHIBIT 3

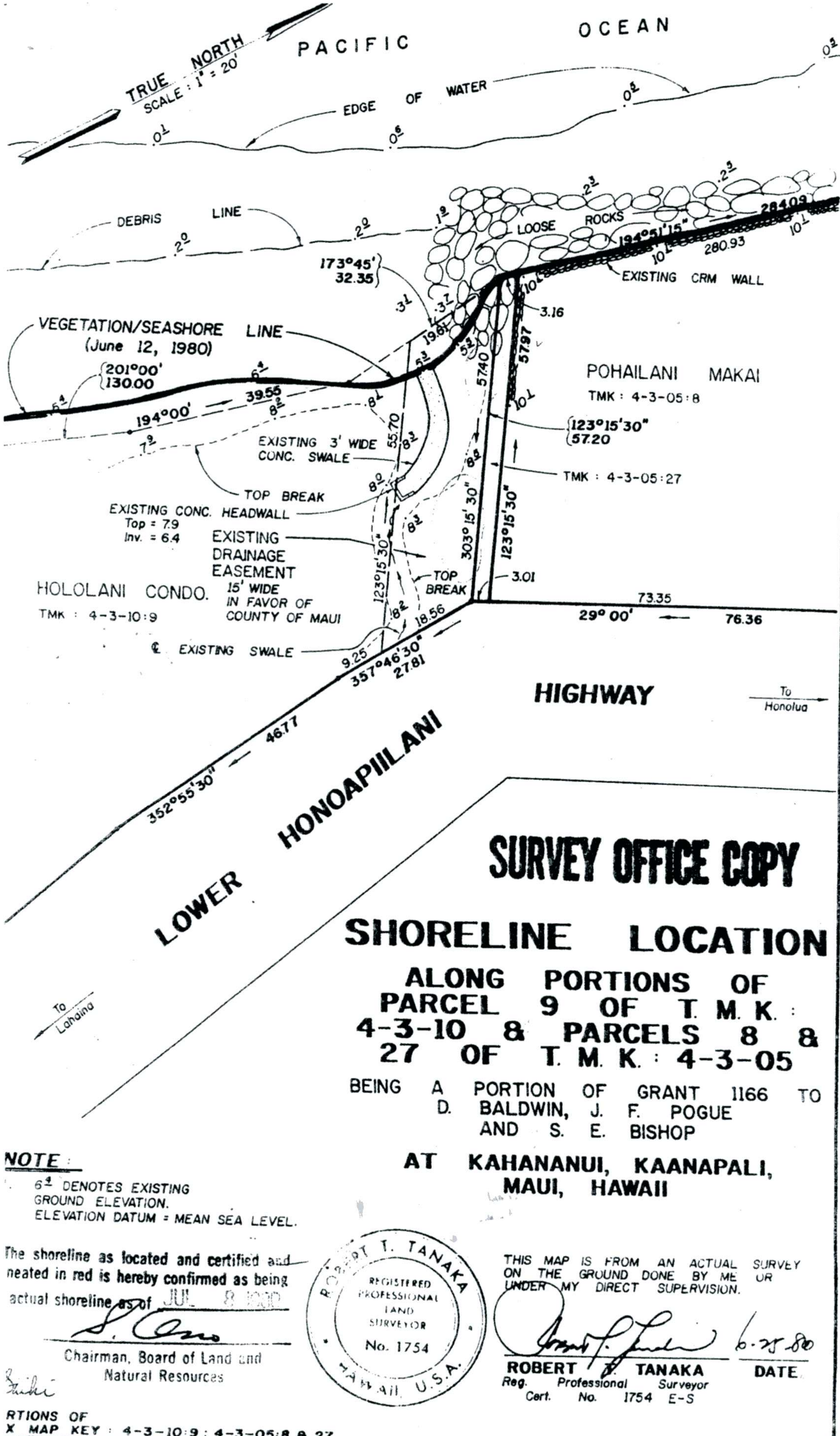

TRUE NORTH
SCALE : 1" = 20'
PACIFIC OCEAN
EDGE OF WATER
DEBRIS LINE
LOOSE ROCKS
194°51'15"
284.09
280.93
EXISTING CRM WALL
173°45'
32.35
VEGETATION/SEASHORE LINE
(June 12, 1980)
201°00'
130.00
39.55
194°00'
19.61
3.16
57.97
57.40
POHAILANI MAKAI
TMK : 4-3-05:8
123°15'30"
57.20
TMK : 4-3-05:27
EXISTING 3' WIDE CONC. SWALE
55.70
TOP BREAK
EXISTING CONC. HEADWALL
Top = 7.9
Inv. = 6.4
EXISTING DRAINAGE EASEMENT
15' WIDE IN FAVOR OF COUNTY OF MAUI
303°15'30"
123°15'30"
123°15'30"
TOP BREAK
3.01
HOLOLANI CONDO.
TMK : 4-3-10:9
73.35
29° 00'
76.36
18.56
℄ EXISTING SWALE
9.25
357°46'30"
27.81
HIGHWAY
To Honolua
46.77
352°55'30"
LOWER HONOAPIILANI
To Lahaina
SURVEY OFFICE COPY
SHORELINE LOCATION
ALONG PORTIONS OF PARCEL 9 OF T. M. K. : 4-3-10 & PARCELS 8 & 27 OF T. M. K. : 4-3-05
BEING A PORTION OF GRANT 1166 TO D. BALDWIN, J. F. POGUE AND S. E. BISHOP
AT KAHANANUI, KAANAPALI, MAUI, HAWAII
NOTE :
6⁴ DENOTES EXISTING GROUND ELEVATION.
ELEVATION DATUM = MEAN SEA LEVEL.
The shoreline as located and certified and delineated in red is hereby confirmed as being actual shoreline as of JUL 8 1980
Chairman, Board of Land and Natural Resources
ROBERT T. TANAKA
REGISTERED PROFESSIONAL LAND SURVEYOR
No. 1754
HAWAII, U.S.A.
THIS MAP IS FROM AN ACTUAL SURVEY ON THE GROUND DONE BY ME OR UNDER MY DIRECT SUPERVISION.
6-25-80
ROBERT T. TANAKA
Reg. Professional Surveyor
Cert. No. 1754 E-S
DATE
RTIONS OF
X MAP KEY : 4-3-10:9 ; 4-3-05:8 & 27

EXHIBIT 4

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR

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**
**LAND DIVISION**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 10, 2007

Mr. Edgardo V. Valera, LPLS
Valera, Inc.
1867 Vineyard Street
Wailuku, Hawaii 96793

Dear Mr. Valera:

Subject: Notice of Incomplete Shoreline Certification Application
Owner: Hololani, Association of Apartment Owners
Tax Map Key: (2) 4-3-010:009

Your application for shoreline certification of the subject property has been found to be incomplete for the following reasons:

Failure to provide documentation that the sand bags makai of the seaward boundary of the property were approved by government agencies or is exempt from such approval (§13-222-17(2)(i), HAR).

We retain one copy of map and photo for our records, and return the rest of the application, including the check, to you. Please resubmit a completed application. We encourage you to use our Shoreline Certification Application Form and refer to Chapter 13-222, HAR, which can both be found at our website: http://www.hawaii.gov/dlnr/lmd/rulesindex.html

If you have any questions, please feel free to contact us at 587-0430. Thank you.

Sincerely,

Barry Cheung
Land Agent

Enclosures

EXHIBIT 5

LINDA LINGLE
GOVERNOR OF HAWAII

ALLAN A. SMITH
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**
**LAND DIVISION**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

June 12, 2007

Mr. Edgardo V. Valera, LPLS
Valera, Inc.
1867 Vineyard Street
Wailuku, Hawaii 96793

Dear Mr. Valera:

Subject: Shoreline Application, TMK (2) 4-3-010:009

Your application for shoreline certification of the subject property received by us on June 5, 2007 has been found to be incomplete for the following reason:

> Failure to provide a document supporting that the concrete walkway and the revetment were approved by the appropriate government agencies or were exempt from such approval (§13-222-7(b)(14), HAR). According to the letter dated February 6, 2007 from the Office of Conservation and Coastal Lands, your client was allowed to place boulders in the shoreline area for 30 days. After this period, the boulders were to be removed to the satisfaction of the Department. We understand the sand bags presently placed on the shoreline also need to be removed. Subsequent to such removal, an engineered structure consisting of sandbag and Tensar structure was to be installed.

We retain one copy of map and photo for our records, and return the rest of the application, including the check, to you. Please resubmit a completed application. We encourage you to use our Shoreline Certification Application Form and refer to Chapter 13-222, HAR, which can both be found at our website: http://www.hawaii.gov/dlnr/lmd/rulesindex.html

If you have any questions on the erosion control project, please contact Dolan Eversole of OCCL at 587-0377. If you have other questions, please feel free to contact us at 587-0430. Thank you.

Sincerely,

Barry Cheung for

Barry Cheung
Land Agent

Enclosures

EXHIBIT 6

c: Dolan Eversole, OCCL

**APPENDIX D. MARINE BIOLOGY AND WATER QUALITY – MARINE RESEARCH CONSULTANTS, INC.**

*Baseline Assessment of Marine Water Chemistry and Marine Biotic Communities,*

*Hololani Resort Condominium, West Maui, Hawaii*;

Marine Research Consultants, Inc., 2010

# BASELINE ASSESSMENT OF MARINE WATER CHEMISTRY AND MARINE BIOTIC COMMUNITIES HOLOLANI RESORT CONDOMINUM WEST MAUI, HAWAII

Prepared for:

Sea Engineering, Inc.
Makai Research Pier
Waimanalo, HI

By:

Marine Research Consultants, Inc.
1039 Waakaua Pl.
Honolulu, HI 96822

December 2010

## *I. INTRODUCTION AND PURPOSE*

The Hololani Resort Condominiums consist of twin 8-story buildings located on the Kahana coast of West Maui, approximately 0.4 miles north of Mahinahina Beach Park (known as S-Turns) (Figure 1). The project shoreline is approximately 400 feet in length and is at the north end of an 1800 foot reach of sand beach that fronts six condominium resort properties. The west-facing shoreline is subject to waves from the south, west, and north, which cause seasonal and short term effects on the sand beach. Waves from the south during the summer season generally tend to push sand north so that a beach is created in front of the Hololani Resort. Winter waves from the north tend to transport the sand south and denude the beach. However, some of the more extreme episodes of sand accretion have resulted from southwesterly Kona Storm waves that occur during the winter season.

As a result of these dynamic processes, the Hololani has a long history of shoreline erosion problems. An aerial photograph analysis completed by Sea Engineering Inc. (SEI) in 2001 showed that during the 48 year interval between 1949 and 1997 14 feet of erosion of the vegetation line occurred at the center of the property, while 28 feet of erosion occurred at the northern end of the property. While the seasonal changes are pronounced, there also appears to have been a net loss of sand from the overall system, so that the protective sand beach has been lost with increasing frequency, leaving the mud and clay shoreline embankment increasingly exposed.

Efforts to combat the erosion have been numerous, beginning with a sand bag wall constructed in 1988. During the winter of 2006-2007, the erosion problem became dire, with large sections of the shoreline calving into the sea. At this point, erosion had progressed to the point where the buildings and possibly the underground parking structure were threatened. It became obvious that shore protection was necessary to preserve the structural integrity of the Hololani buildings. SEI designed a temporary geotextile sand bag and rock mattress structure that met requirements set by the State of Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR-OCCL) for an emergency protection structure. The structure was constructed in November and December 2007.

Although a robust structure, the temporary revetment has suffered damage from the effects of two Hawaiian winter wave seasons (and the beginning of a third), and it is clear that a permanent shore protection structure is required for the safety of the building.

In May of 2010, SEI was contracted by the Hololani AOAO to design permanent shore protection to replace the existing geotextile sand bags. At the present time concept designs are being developed and reviewed.

The purpose of this document is to provide the results of rapid ecological assessments (REAs) of two aspects of the marine ecosystem fronting the Hololani Resort Condominiums. Water chemistry was assessed by collecting a set of samples extending from the shoreline to the open coastal ocean directly fronting the property. Marine community structure, primarily in terms of coral reef assemblages was also described based on rapid surveys. The purpose of these REAs was to provide a description of the existing condition of the marine environment. Evaluation of the existing condition of the water chemistry and marine communities provides an insight into the physical and chemical factors that influence the marine setting. As coral communities are both long-lived and attached to the bottom, they serve as the best indicators of the time-integrated forces that affect offshore reef areas. In addition, algal communities provide an insight into the existing physical/chemical conditions of the area. Understanding the existing physical, chemical and biological conditions of the marine environment that presently occur provides a basis for predicting potential affects that might occur as a result of the proposed shoreline modification.

## *II. METHODS*

### A. Water Quality/Chemistry

Water chemistry field collection was conducted on August 15, 2010. Samples within 10 m of the shoreline were collected by swimmers, while samples farther offshore were collected from a 21-foot boat. Water chemistry was assessed along a survey transect that extended perpendicular to the shoreline originating at the sand-water interface of the beach in the center of the Hololani Resort Condominium property. Water samples were collected at seven locations along a line from the shoreline to approximately 250 meters (m) offshore (samples collected 1, 5, 10, 25, 50,150 and 300 meters (m) from the shoreline) (Figure 1). Such a sampling scheme is designed to span the greatest range of salinity with respect to potential freshwater efflux at the shoreline. Sampling was more concentrated in the nearshore zone because this area receives the majority of groundwater discharge, and hence is most important with respect to identifying the effects of shoreline modification.

Owing to the shallow depth of the near-shore shelf, at stations from the shoreline extending to 5 m from shore, a single sample was collected within 20 cm of the sea surface by swimmers working from shore. At stations 10 to 300 m from the shoreline, samples were collected at two depths; a surface sample was collected within approximately 20 centimeters (cm) of the sea surface, and a bottom sample was collected within 50 cm of the sea floor.

Water quality parameters evaluated included the all specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (b) (Open Coastal waters) of the State of Hawaii Department of Health (DOH) Water Quality Standards. These criteria include: total dissolved nitrogen (TDN), nitrate + nitrite nitrogen ($NO_3^-$ + $NO_2^-$, hereafter referred to as $NO_3^-$), ammonium nitrogen ($NH_4^+$), total dissolved phosphorus (TDP), Chlorophyll a (Chl a), turbidity, temperature, pH and salinity. In addition, silica (Si) and orthophosphate phosphorus ($PO_4^{-3}$) were also reported because these parameters are sensitive indicators of biological activity and the degree of groundwater mixing.

Surface water samples were collected by filling pre-rinsed 1-liter polyethylene bottles. "Deep" water samples were collected using a Niskin-type oceanographic sampling bottle. The bottle is lowered to the desired sampling depth with spring-loaded endcaps held open so water can pass freely through the bottle. At the desired sampling depth, a weighted messenger released from the surface triggers closure of the endcaps, isolating a volume of water.

Subsamples for nutrient analyses were immediately placed in 125-milliliter (ml) acid-washed, triple rinsed, polyethylene bottles and stored on ice. Analyses for Si, $NH_4^+$, $PO_4^{3-}$, and $NO_3^-$ were performed of filtered subsamples with a Technicon Autoanalyzer using standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TDN and TDP were analyzed in a similar fashion following digestion. Dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) were calculated as the difference between TDN and dissolved inorganic N and TDP and dissolved inorganic P, respectively.

Water for other analyses was sub-sampled from 1-liter polyethylene bottles and kept chilled until analysis. Chl *a* was measured by filtering 300 ml of water through glass-fiber filters; pigments on filters were extracted in 90% acetone in the dark at -20° C for 12-24 hours. Fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer. Salinity was determined using an AGE Model 2100 laboratory salinometer with a readability of 0.0001‰ (ppt). Turbidity was determined using a 90-degree nephelometer, and reported in nephelometric turbidity units (NTU) (precision of 0.01 NTU). Vertical profiles of salinity, temperature and depth were acquired using a RBR-620 CTD calibrated to factory standards.

All fieldwork was conducted by Dr. Steven Dollar. All laboratory analyses were conducted by Marine Analytical Specialists located in Honolulu, HI (Labcode: HI 00009). This analytical laboratory possesses acceptable ratings from EPA-compliant proficiency and quality control testing.

### B. Marine Biotic Community Structure

Biotic composition of the survey area was assessed by divers using SCUBA working from a 21-foot boat. Dive surveys were conducted by swimming in a zigzag pattern in a belt fronting the Resort Condominiums from the shoreline across the reef to a water depth of approximately 30 feet. These surveys covered a corridor approximately 100 m wide centered on the transect line used for water chemistry sampling. During these underwater investigations, notes on species composition were recorded, and numerous digital photographs recorded the existing conditions of the area. The baseline assessment was conducted by S. Dollar, accompanied by D. Rice and C. Andrews.

## *III. RESULTS*

### A. Water Quality/Chemistry

#### *1. Distribution of Chemical Constituents*

Tables 1 and 2 show results of all water chemistry analyses on samples collected off the Hololani Resort Condominiums in August 2010. Table 1 shows concentrations of dissolved nutrients in micromolar (µM) units; Table 2 shows concentrations in micrograms per liter (µg/L). Concentrations of eight dissolved nutrient constituents in surface and deep samples are plotted as functions of distance from the shoreline in Figure 2. Values of salinity, Chl *a* and turbidity as functions of distance from shore are shown in Figure 3.

Several patterns of distribution are evident in Tables 1 and 2 and Figures 2 and 3. It can be seen in Figure 2 that the dissolved nutrients Si and $NO_3^-$ display distinctly elevated concentrations in the samples collected within 25 m from the shoreline. Salinity displays the opposite trend, with sharply lower concentrations in the nearshore samples (Figure 3). Beyond 50 m from the shoreline, concentrations of $NO_3^-$ are essentially constant, while concentrations of Si gradually decrease, and salinity increases (Figures 2 and 3). Over the entire sampling range, the gradient in $NO_3^-$ is about 65 $\mu$M (910 $\mu$g/L), while salinity changes by approximately 0.8 ppt.

As there are were no streams discharging to the ocean in the vicinity of the Hololani Resort Condominiums during the sampling, the horizontal gradients of Si, $NO_3^-$ and salinity reflect input of groundwater to the ocean near the shoreline. Low salinity groundwater, which typically contains high concentrations of Si and $NO_3^-$, percolates to the ocean at the shoreline, resulting in a nearshore zone of mixing. In many areas of the Hawaiian Islands, such groundwater percolation results in steep horizontal gradients of increasing salinity and decreasing nutrients with increasing distance from shore, as is evident at the Hololani study site in West Maui. $PO_4^{3-}$ is also generally elevated in groundwater relative to ocean water. However, in the data set collected off the Hololani, there is no consistent gradient in concentration of $PO_4^{3-}$ with respect to distance from the shoreline (Figure 2). Horizontal gradients of TN and TP reflect the patterns of $NO_3^-$ and $PO_4^{3-}$, respectively.

As the sampling site off the Hololani Resort is an open coastal area exposed to wind and wave, the zone of groundwater-ocean water mixing is small, extending only to distances of several meters from shore. These gradients are far less pronounced than at other areas of West Maui where either semi-enclosed embayments occur or physical mixing processes are less vigorous.

Water chemistry parameters that are not associated with groundwater input ($NH_4^+$, DON, DOP) do not show sharp gradients of decreasing concentration with respect to distance from the shoreline (Tables 1-2, Figure 2). Rather, $NH_4^+$ showed a weak horizontal pattern of lower concentrations near the shoreline with higher values at the greatest distances from shore. TON and TOP show no distinct gradients with respect to distance from the shoreline. Such patterns indicate that the concentrations of these organic chemical constituents are not a result of input of materials emanating from land.

Similar to the patterns of dissolved inorganic nutrients (Si and $NO_3^-$), the distributions of Chl *a* and turbidity also display peaks near the shoreline, with rapidly diminishing values seaward of the shoreline (Tables 1-2, Figure 3. Overall, values of Chlorophyll *a* are considered low with all values below 0.16 $\mu$g/L (Figure 3). The progressive decrease in values of turbidity with distance from shore is likely a response to resuspension of fine-grained particulate material stirred by breaking waves in the nearshore zone. With decreasing wave energy and increasing water depth, turbidity in the water column decreases (Figure 3).

In addition to horizontal gradients extending from the shoreline offshore, vertical gradients through the water column are often encountered. As groundwater has a salinity of essentially zero, it is more buoyant than seawater with a salinity of 35‰. Hence, in areas where mixing processes are not sufficient to homogenize the water column, surface layers of low-salinity, high-nutrient water are often found overlying layers of higher salinity, lower nutrient water. Inspection of Figure 2 indicates that there was distinct vertical stratification of nutrient concentrations off the Hololani Resort site between distances of 10 to 50 m from shore. Beyond 50 m, the water column was well mixed. Correspondingly, there was a consistent decrease in salinity of surface samples relative to deep samples within the 10-50 m from shore region. Values of turbidity were also slightly higher in all surface samples relative to deep samples at sampling sites 10-50 m from shore, and similar in value at stations farther offshore (Tables 1-2, Figure 3).

*2. Compliance with DOH Criteria*

Water Quality Standards for that apply to the areas offshore of Hololani Resort Condominiums are listed as "open coastal water" in HRS Chapter §11-54-6(b). Two sets of standards are listed depending on whether an area receives more than 3 million gallons per day (mgd) of freshwater input per shoreline mile ("wet standards"), or less than 3 mgd of freshwater input per shoreline mile ("dry"). As the Hololani shoreline area probably receives less than 3 mgd per mile, dry criteria were used for this evaluation.

It can be seen in Tables 1 and 2 that the only nutrient constituents to exceed State of Hawaii water quality standards are nitrate-nitrogen ($NO_3^-$) at the sampling stations within 25 m from shore, and turbidity within 10 m from shore. As discussed above, the elevated concentration of $NO_3^-$ near the shoreline is likely a result of mixing of groundwater with ocean water. The elevated concentrations of turbidity are likely a result of resuspension of fine-grained naturally occurring sediment by breaking waves in the nearshore zone. Beyond 50 m from shore, all values of turbidity were well below the standards.

B. Coral Reef Community Structure

*1. Physical Structure*

Physical composition of the survey area fronting the Hololani Resort Condominiums consists of a sand beach (at least during the present study) that extends through the intertidal area (Figure 4). The shallow nearshore region is composed of a limestone platform covered with sand and rubble (Figure 4). The limestone platform extends approximately 300 feet offshore, beyond which bottom composition consists primarily of a sandy plain that reaches offshore to the limit of the present survey. An important feature of the offshore area fronting the Hololani Resort is that the reef platform is routinely subjected to direct wave impact from northerly swells that break over the entire reef platform.

The baseline survey was conducted during a period of moderate north swell, and waves of 2-3 feet in face height were breaking at about the midpoint of the reef platform. Breaking waves resulted in substantial resuspension of naturally occurring calcium carbonate sand throughout the water column in the nearshore area. Beyond the area of wave break, resuspension of sand decreased markedly.

*2. Biotic Community Structure*

Composition of the reef communities fronting the Hololani Resort Condominiums property are in direct response to several physical factors. As described above, breaking waves result in concussive forces that prevent settlement and growth of some species, or cause breakage and fragmentation of existing species (primarily corals). In addition, resuspension of sand from wave action also prevents settlement and causes destructive abrasion of corals. These factors associated with wave energy decrease with distance from shore along the limestone reef platform. Coral communities reflect the stresses associated with both the concussive force of wave impacts and the scouring and burying from sand resuspended into the water column. In addition, corals and associated reef organisms require hard bottom for settlement, and area coverage of living corals is a direct function of available hard bottom (as opposed to sand bottom).

For the purposes of this report, coral reef community structure is divided into three zones: the "nearshore algae" zone, "mid-reef algal-coral" zone, and "outer-reef coral" zone. The seaward boundary of the outer-reef coral zone is defined by the termination of the limestone reef platform, beyond which bottom composition consists of a flat, gently sloping sand plain.

a. Nearshore Algae Zone

The physical composition of the nearshore algae zone consists of a pitted and eroded limestone platform of biotic origin covered with a veneer of calcareous sand and rubble. Within a depth range of 1 to 4-5 feet, and within a distance of approximately 50 feet from the shoreline, the limestone platform is devoid of living corals, but rather is covered with dense growth of the invasive red alga *Acanthophora specifera* (Figure 5). While *A. specifera* was by far the dominant alga, several other species of red alga were also noted, primarily *Hypnea musciformis* and *Halymenia formosa* (Figure 6).

b. Mid-reef algal-coral Zone

With slightly increasing depth and distance from shore, dense algal coverage of the bottom persists, although isolated living coral heads begin to occur, primarily on the upper surfaces of rocky projections that are elevated above the limestone platform (Figures 7 and 8). Elevation of the reef surface increases the resiliency of these coral from the effects of sediment scour, and the competitive abilities of these corals is apparently sufficient to prevent them from being completely overgrown by algae. The predominant coral species occurring within the mid-reef area are *Porites lobata* (Figure 7) and *Montipora patula* (Figure 8). Within both the nearshore algal zone and the mid-reef algal-coral zone motile macrobenthos, particularly sea urchins, were extremely scarce, likely as a result of the force of breaking waves which is sufficient to prevent these unattached organisms to remain stable on the reef surface.

c. Outer-reef coral Zone

The seaward boundary of the mid-reef algal-coral zone and the inshore boundary of the outer reef zone is demarcated by the boundary where extensive beds of algae no longer occur, and the bottom consists of either living corals or relatively bare turf-covered limestone (Figures 9-11). This zone extends across the reef platform from a distance of approximately 200 feet from shore to the seaward edge of the reef platform, and spans the depth range of approximately 10 to 25 feet. The primary coral species occurring in the outer reef zone were *Pocillopora meandrina*, commonly called “cauliflower coral” (Figures 9 and 11), *Porites lobata*, commonly called “lobe coral” (Figures 9-11), and *Porites compressa*, commonly called “finger coral” (Figure 10). Many of these colonies were up to several feet in diameter indicating that they are on the order of several decades old. The growth form of *Porites compressa* consists of elongated fingers, which are substantially more delicate and susceptible to breakage compared to the other corals. Hence, *P. compressa* is not found in areas that are routinely subjected to wave energy. The occurrence of large, intact colonies of *P. compressa* in the outer reef zone off of Hololani indicates that the outer reef zone has not sustained wave stress substantial enough to destroy these coral colonies over at least a decadal time interval.

The outer reef zone terminates at a depth of approximately 25 feet in a margin between the limestone platform and sand plain (Figure 12). Seaward of the outer reef margin bottom composition consisted of a flat, gently sloping sand plain. In many areas of West Maui, the sand plains beyond the reef platform are colonized with vast pastures of the calcareous green alga *Halimeda*. No such pastures of *Halimeda* were observed during the present study off of the Hololani area.

Other macro-invertebrates that were observed on the surface of the outer reef were several species of sea urchins (*Echinometra matheai*, *Echinothrix diadema, Tripneustes gratilla,* and *Heterocentrotus mammilatus*) (Figures 9 and 12). None of these urchins were particularly abundant, but were found most commonly on the bare limestone reef platform rather than on living corals. It is well known that these urchins graze on benthic algae, and may be responsible for the absence of dense algae in the outer reef zones where wave energy is not sufficient to remove the urchins from the reef.

Reef fish were low in abundance throughout the study area. The most common, and conspicuous fish were mixed-species of Acanthurids (surgeonfish) occupying mid-water near the outer margin of the reef platform. Green sea turtles (*Chelonia mydas*) are commonly found within the nearshore areas of West Maui. However, no turtles were observed during the present survey, although they undoubtedly occur on the reefs off the Hololani Resort.

## *IV. DISCUSSION and CONCLUSIONS*

The purpose of this assessment is to assemble the information to make valid evaluations of the potential for impact to the marine environment from the proposed beach stabilization fronting the Hololani Resort Condominiums in West Maui, Hawaii. Permanent shore protection will prevent future erosion damage and avoid the recurring efforts at expensive, messy and often ineffective temporary emergency protection measures. The information collected in this study provides the basis to understand some of the important processes that are operating in the nearshore ocean, so as to be able to address any concerns that might be raised in the planning process for the beach stabilization.

Results of this baseline study reveal that the major factor shaping the composition of the marine communities off the project site is the concussive forces associated with breaking surf. Nearshore reef community structure is clearly in response to the degree of wave energy which controls community composition. The documented structure of the algal-coral communities off of the Hololani indicate that within the nearshore area where waves regularly break, the benthic community is dominated by invasive algae, with no corals present. At intermediate distances from shore, corals and algae co-occur. On the outer reef, benthic algae, including invasive species are essentially absent. Such a distinct zonation pattern may be in response to a combination of factors associated with wave energy. At shallower depths, algae can apparently flourish, while corals and motile benthos (sea urchins) are restricted owing to physical damage from concussive forces, and substantial sand scour. Beyond the zones where invasive algae dominates, wave forces are reduced to a level where coral communities can settle and grow, which grazers can proliferate to control algae abundance. The outer reef zones off Hololani are considered in a normal condition relative to other similar Hawaiian ecosystems with typical coral abundance and diversity, and no outward appearance of significant stress.

As corals are long-lived and fixed to the bottom, coral community structure provides an excellent integrator of physical conditions over time-scales of decades to centuries. Hence, the coral communities off Hololani have developed and grown throughout the large fluctuations of seasonal sand dynamics that have re-shaped the beach over the last several decades. As such, large fluctuations in beach structure occurring in the past have not had any apparent negative effects on offshore coral community structure. Thus, it is not likely that the proposed action to stabilize sand on the beach would have any negative effect to existing communities. The only foreseeable change may be if beach stabilization results in a seaward extension of more sand into the intertidal and subtidal areas. As corals do not occur in this region, such a situation does not appear to present any potential for concern as the nearshore is already composed of sand and rubble.

Results of the water quality reconnaissance survey indicate a small component of groundwater entering the ocean near the shoreline. The groundwater input is rapidly mixed to background coastal oceanic values through wave action, and likely only affects the zone presently occupied by dense invasive algae. Turbidity of the water column is peak at the shoreline and decreases steadily with distance from shore as a result of wave resuspension of naturally occurring bottom sediments. None of these factors are likely to be affected to a noticeable extent beyond the range of natural variability by the proposed beach stabilization.

All of these considerations indicate that the proposed shoreline stabilization at the Hololani Resort Condominiums will not have any significant negative or likely even measurable, effect on water quality or marine biota in the coastal ocean offshore of the property.

## REFERENCES CITED

Grasshoff, K. 1983. Methods of seawater analysis. Verlag Chemie, Weinheim, 419 pp.

Strickland J. D. H. and T. R. Parsons. 1968. A practical handbook of sea-water analysis. Fisheries Research Bd. of Canada, Bull. 167. 311 p.


FIGURE 1. Aerial photograph of coastal region of west Maui showing location of Hololani Resort Condominiums in white circle. Yellow circles are approximate water sampling locations. Benthic reconnaissance surveys were conducted along a corridor approximately 50 m wide on either side of yellow line from the shoreline to an offshore depth of approximately 25 feet.

TABLE 1. Results of water chemistry analyses from ocean sampling stations off of the Hololani Resort in West Maui, Hawaii. Nutrient concentrations are shown in micromolar ($\mu$M) units. Samples were collected on August 15, 2010. See Figure 1 for locations of sampling stations. "S" indicates surface samples; "D" indicates deep sample approximately 0.5 m above the ocean floor. Also shown are DOH WQS for "open coastal waters" under "dry" conditions, "not to exceed more than 10% and 2% of the time" criteria. Shaded values indicate exceedance of DOH "not to exceed more than 10% of the time" criteria and "not to exceed more than2% of the time" criteria.

| SAMPLE NUMBER | DFS (m) | DEPTH (feet) | $PO_4^{3-}$ ($\mu$M) | $NO_3^-+NO_2^-$ ($\mu$M) | $NH_4^+$ ($\mu$M) | Si ($\mu$M) | TOP ($\mu$M) | TON ($\mu$M) | TP ($\mu$M) | TN ($\mu$M) | TURB (ntu) | SALT (o/oo) | pH (std. units) | Chl-a ($\mu$g/L) | TEMP deg. C | Diss. $O_2$ % sat. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1-S | 1 | 0.11 | 4.63 | 0.07 | 15.06 | 0.37 | 8.65 | 0.48 | 13.35 | 2.58 | 34.33 | 8.11 | 0.16 | 23.08 | 109.5 |
| 2 | 5-S | 1 | 0.11 | 4.92 | 0.05 | 14.62 | 0.31 | 6.69 | 0.42 | 11.66 | 2.61 | 34.34 | 8.10 | 0.13 | 23.12 | 109.4 |
| 3S | 10-S | 1 | 0.08 | 3.99 | 0.02 | 13.94 | 0.35 | 7.09 | 0.43 | 11.10 | 1.50 | 34.34 | 8.09 | 0.12 | 23.12 | 109.4 |
| 3B | 10-D | 5 | 0.15 | 0.93 | 0.11 | 5.87 | 0.34 | 6.87 | 0.49 | 7.91 | 0.66 | 34.83 | 8.16 | 0.06 | 23.12 | 109.4 |
| 4S | 25-S | 1 | 0.12 | 1.22 | 0.12 | 6.61 | 0.36 | 6.28 | 0.48 | 7.62 | 0.43 | 34.85 | 8.17 | 0.04 | 23.14 | 109.4 |
| 4B | 25-D | 8 | 0.08 | 0.36 | 0.11 | 5.03 | 0.36 | 8.17 | 0.44 | 8.64 | 0.34 | 34.91 | 8.16 | 0.02 | 23.11 | 109.4 |
| 5S | 50-S | 1 | 0.07 | 0.15 | 0.07 | 4.81 | 0.34 | 6.68 | 0.41 | 6.90 | 0.26 | 34.87 | 8.17 | 0.04 | 23.09 | 99.7 |
| 5B | 50-D | 11 | 0.10 | 0.15 | 0.09 | 3.89 | 0.35 | 6.40 | 0.45 | 6.64 | 0.22 | 34.91 | 8.17 | 0.02 | 23.11 | 101.9 |
| 6S | 150-S | 1 | 0.07 | 0.20 | 0.08 | 2.86 | 0.42 | 6.77 | 0.49 | 7.05 | 0.17 | 35.02 | 8.17 | 0.02 | 23.60 | 103.5 |
| 6B | 150-D | 29 | 0.17 | 0.19 | 0.06 | 2.70 | 0.28 | 6.73 | 0.45 | 6.98 | 0.19 | 34.98 | 8.15 | 0.04 | 23.55 | 95.4 |
| 7S | 300-S | 1 | 0.09 | 0.01 | 0.10 | 1.55 | 0.37 | 7.62 | 0.46 | 7.73 | 0.23 | 35.07 | 8.21 | 0.07 | 23.75 | 105.3 |
| 7B | 300-D | 46 | 0.11 | 0.00 | 0.09 | 1.34 | 0.39 | 7.12 | 0.50 | 7.21 | 0.12 | 35.09 | 8.21 | 0.07 | 23.77 | 103.8 |
| DOH WQS NTE 10% (dry) | | | - | 0.71 | 0.40 | | | | 0.87 | 12.80 | 0.50 | * | ** | 0.50 | *** | **** |
| DOH WQS NTE 2% (dry) | | | - | 1.40 | 0.60 | | | | 1.40 | 17.80 | 1.00 | * | ** | 1.00 | *** | **** |

*= Salinity shall not vary more than 10% from natural or seasonal changes considering hydrologic input and oceanographic factors.

**= pH shall not deviate more than 0.5 units from a value of 8.1.

***= Temperature shall not vary more than one degree C. from ambient conditions.

****=Dissolved oxygen shall not be below 75% saturation

ntu= nephelometric turbidity units

bdl = below detection limit

TABLE 2. Results of water chemistry analyses from ocean sampling stations off of the Hololani Resort Condominiums in West Maui, Hawaii. Nutrient concentrations are shown in units of micrograms per liter (µg/L). Samples were collected on August 15, 2010. See Figure 1 for locations of sampling stations. "S" indicates surface samples; "D" indicates deep sample approximately 0.5 m above the ocean floor. Also shown are DOH WQS for "open coastal waters" under "dry" conditions, "not to exceed more than 10% and 2% of the time" criteria. Shaded values indicate exceedance of DOH "not to exceed more than 10% of the time" criteria and "not to exceed more than2% of the time" criteria.

| SAMPLE NUMBER | DFS (m) | DEPTH (feet) | $PO_4^{3-}$ (µg/L) | $NO_3^-+NO_2^-$ (µg/L) | $NH_4^+$ (µg/L) | Si (µg/L) | TOP (µg/L) | TON (µg/L) | TP (µg/L) | TN (µg/L) | TURB (µg/L) | SALT (o/oo) | pH (std. units) | Chl-a (µg/L) | TEMP deg. C | Diss. $O_2$ % sat. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1-S | 1 | 3.41 | 64.82 | 0.98 | 573.79 | 11.47 | 121.10 | 14.88 | 186.90 | 2.58 | 34.33 | 8.11 | 0.16 | 23.08 | 109.5 |
| 2 | 5-S | 1 | 3.41 | 68.88 | 0.70 | 557.02 | 9.61 | 93.66 | 13.02 | 163.24 | 2.61 | 34.34 | 8.10 | 0.13 | 23.12 | 109.4 |
| 3S | 10-S | 1 | 2.48 | 55.86 | 0.28 | 531.11 | 10.85 | 99.26 | 13.33 | 155.40 | 1.50 | 34.34 | 8.09 | 0.12 | 23.12 | 109.4 |
| 3B | 10-D | 5 | 4.65 | 13.02 | 1.54 | 223.65 | 10.54 | 96.18 | 15.19 | 110.74 | 0.66 | 34.83 | 8.16 | 0.06 | 23.12 | 109.4 |
| 4S | 25-S | 1 | 3.72 | 17.08 | 1.68 | 251.84 | 11.16 | 87.92 | 14.88 | 106.68 | 0.43 | 34.85 | 8.17 | 0.04 | 23.14 | 109.4 |
| 4B | 25-D | 8 | 2.48 | 5.04 | 1.54 | 191.64 | 11.16 | 114.38 | 13.64 | 120.96 | 0.34 | 34.91 | 8.16 | 0.02 | 23.11 | 109.4 |
| 5S | 50-S | 1 | 2.17 | 2.10 | 0.98 | 183.26 | 10.54 | 93.52 | 12.71 | 96.60 | 0.26 | 34.87 | 8.17 | 0.04 | 23.09 | 99.7 |
| 5B | 50-D | 11 | 3.10 | 2.10 | 1.26 | 148.21 | 10.85 | 89.60 | 13.95 | 92.96 | 0.22 | 34.91 | 8.17 | 0.02 | 23.11 | 101.9 |
| 6S | 150-S | 1 | 2.17 | 2.80 | 1.12 | 108.97 | 13.02 | 94.78 | 15.19 | 98.70 | 0.17 | 35.02 | 8.17 | 0.02 | 23.60 | 103.5 |
| 6B | 150-D | 29 | 5.27 | 2.66 | 0.84 | 102.87 | 8.68 | 94.22 | 13.95 | 97.72 | 0.19 | 34.98 | 8.15 | 0.04 | 23.55 | 95.4 |
| 7S | 300-S | 1 | 2.79 | 0.14 | 1.40 | 59.06 | 11.47 | 106.68 | 14.26 | 108.22 | 0.23 | 35.07 | 8.21 | 0.07 | 23.75 | 105.3 |
| 7B | 300-D | 46 | 3.41 | 0.00 | 1.26 | 51.05 | 12.09 | 99.68 | 15.50 | 100.94 | 0.12 | 35.09 | 8.21 | 0.07 | 23.77 | 103.8 |
| DOH WQS NTE 10% (dry) | | | - | 10.00 | 5.00 | | | | 30.00 | 180.00 | 0.50 | * | ** | 0.50 | *** | **** |
| DOH WQS NTE 2% (dry) | | | - | 20.00 | 9.00 | | | | 45.00 | 250.00 | 1.00 | * | ** | 1.00 | *** | **** |

*= Salinity shall not vary more than 10% from natural or seasonal changes considering hydrologic input and oceanographic factors.

**= pH shall not deviate more than 0.5 units from a value of 8.1.

***= Temperature shall not vary more than one degree C. from ambient conditions.

****=Dissolved oxygen shall not be below 75% saturation

ntu= nephelometric turbidity units

bdl = below detection limit

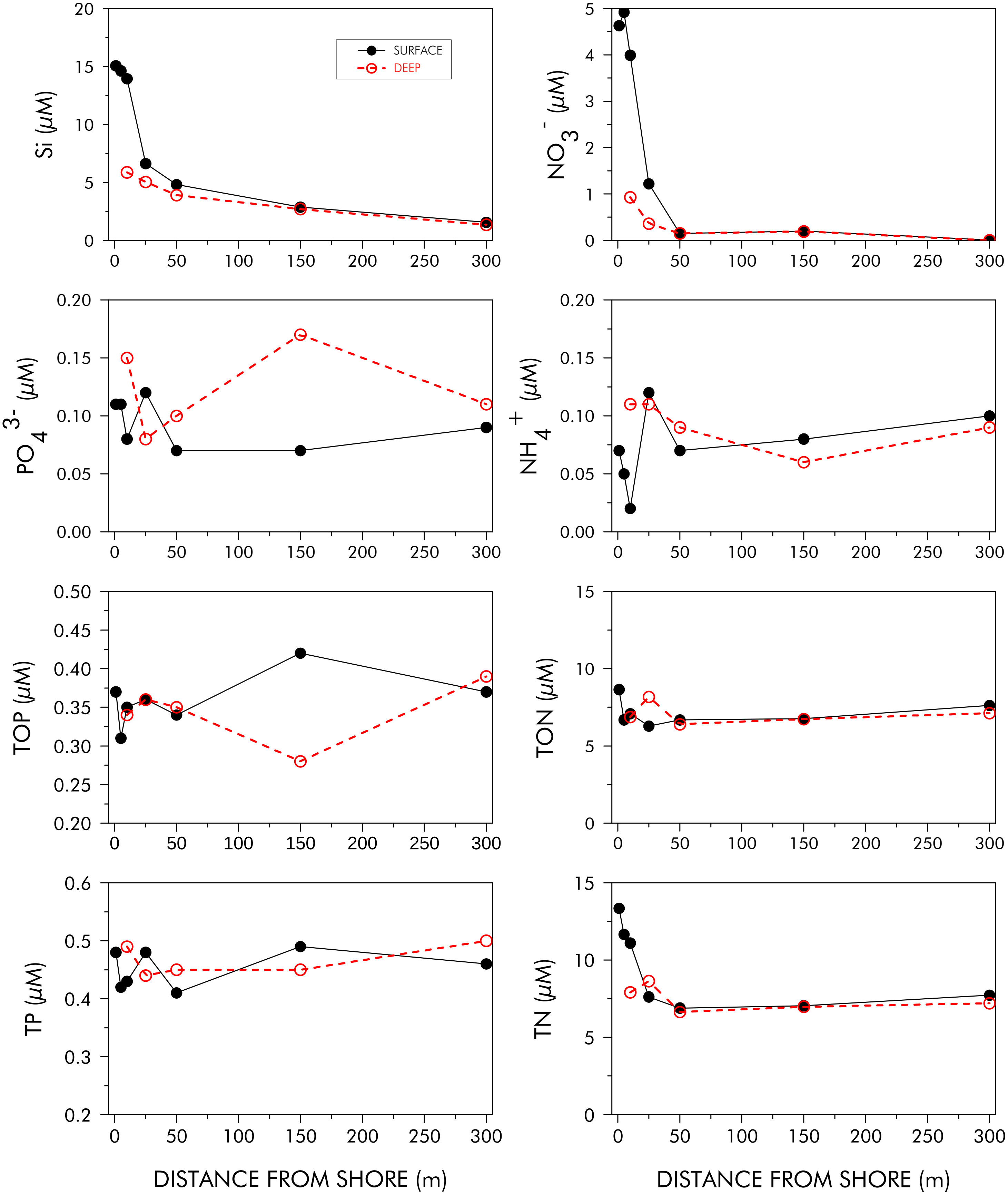



FIGURE 2. Plots of dissolved nutrients in surface (S) and deep (D) samples collected on August 15, 2010 at stations extrending from the shoreline to a distance of 300 m offshore of the Hololani Resort Condominium in West Maui, Hawaii. For sampling site locations, see Figure 1.

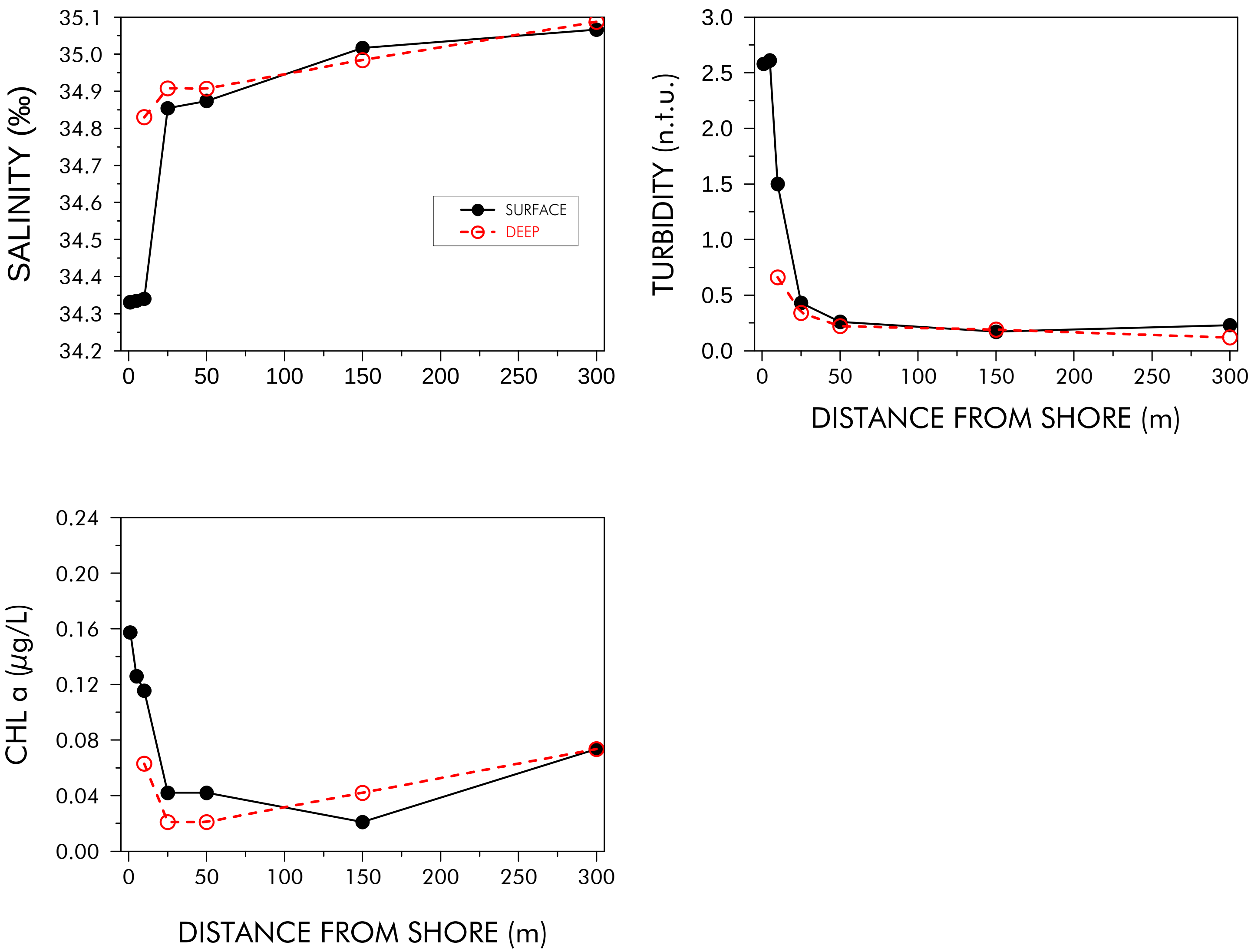



FIGURE 3. Plots of salinity, turbidity and chlorophyll a in surface (S) and deep (D) samples collected on August 15, 2010 at stations along a transect extending from the shoreline to a distance of 300 m offshore of the Hololani Resort Condominium in West Maui, Hawaii.For sampling site locations, see Figure 1.

FIGURE 4. Upper photo shows sand-bags at base of shoreline wall of the Hololani Resort Condominium property. Bottom photo shows sand-rubble bottom in the subtidal zone just off the beach.

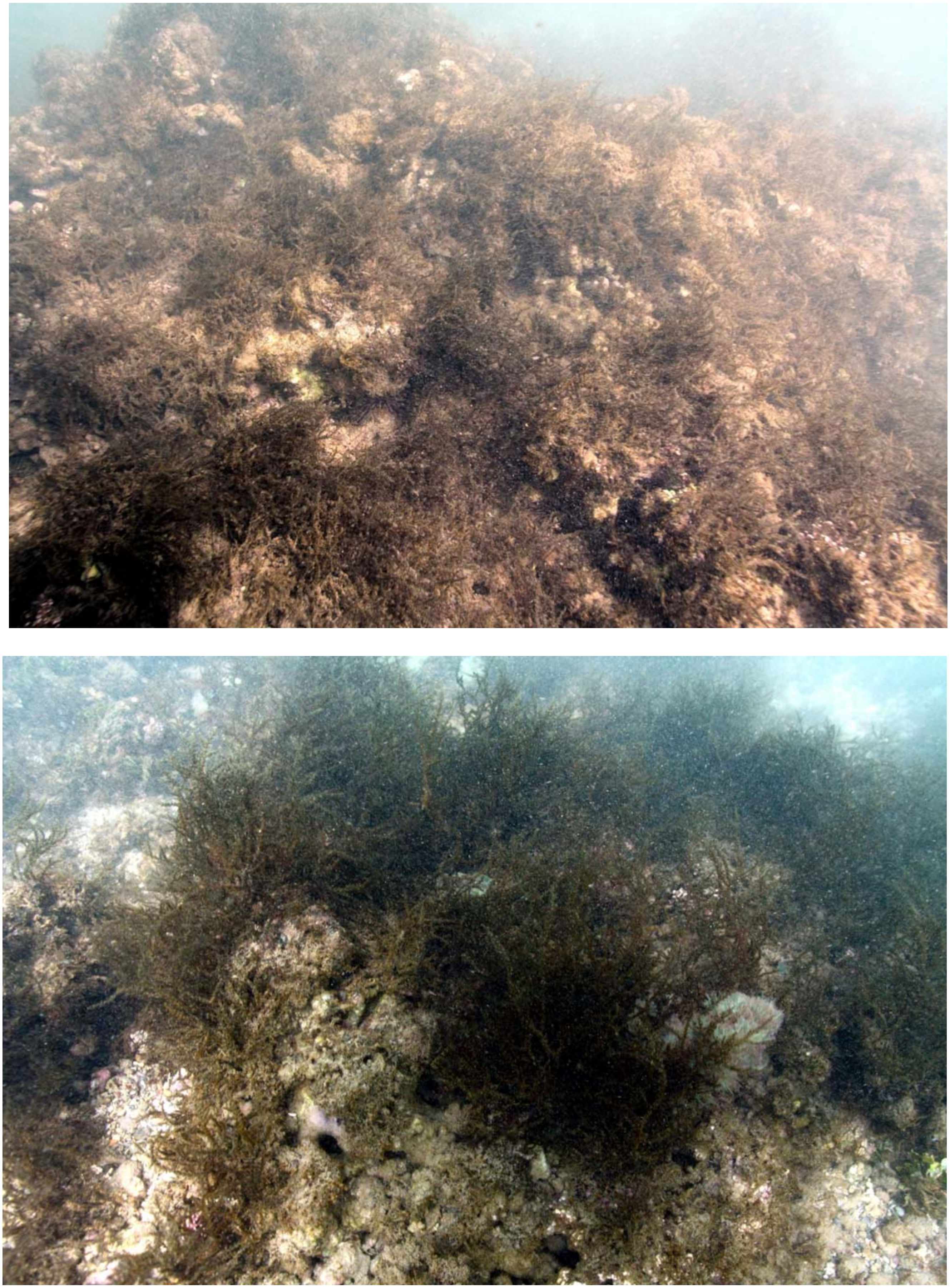


FIGURE 5. Dense growth of red alga *Acanthophora specifera* growing on the limestone reef platform in the nearshore algal zone fronting the Hololani Resort Condominiums, West Maui.

FIGURE 6. Mixed algal communities of red spiny branching alga *Acanthophora specifera*, and red alga *Grateloupia hawaiiana* that has the appearance of translucent pink blades growing on sand and rubble substratum in the nearshore area fronting the Hololani Resort Condominiums. West Maui.

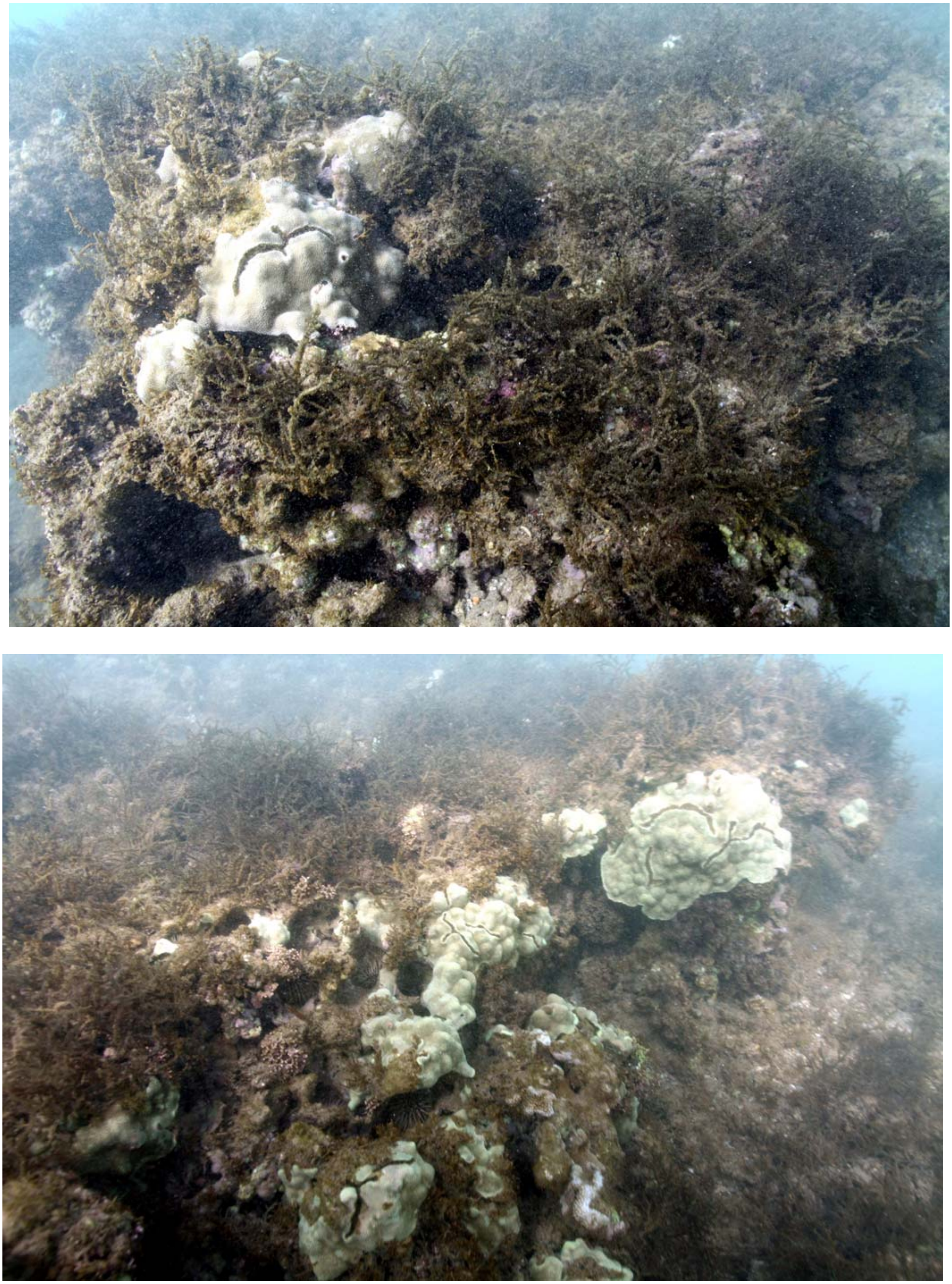


FIGURE 7. Dense growth of red spiny alga *Acanthophora specifera* interspersed with encrusting coral *Porites lobata* growing on limestone substratum in the nearshore area fronting the Hololani Resort Condominiums, West Maui.

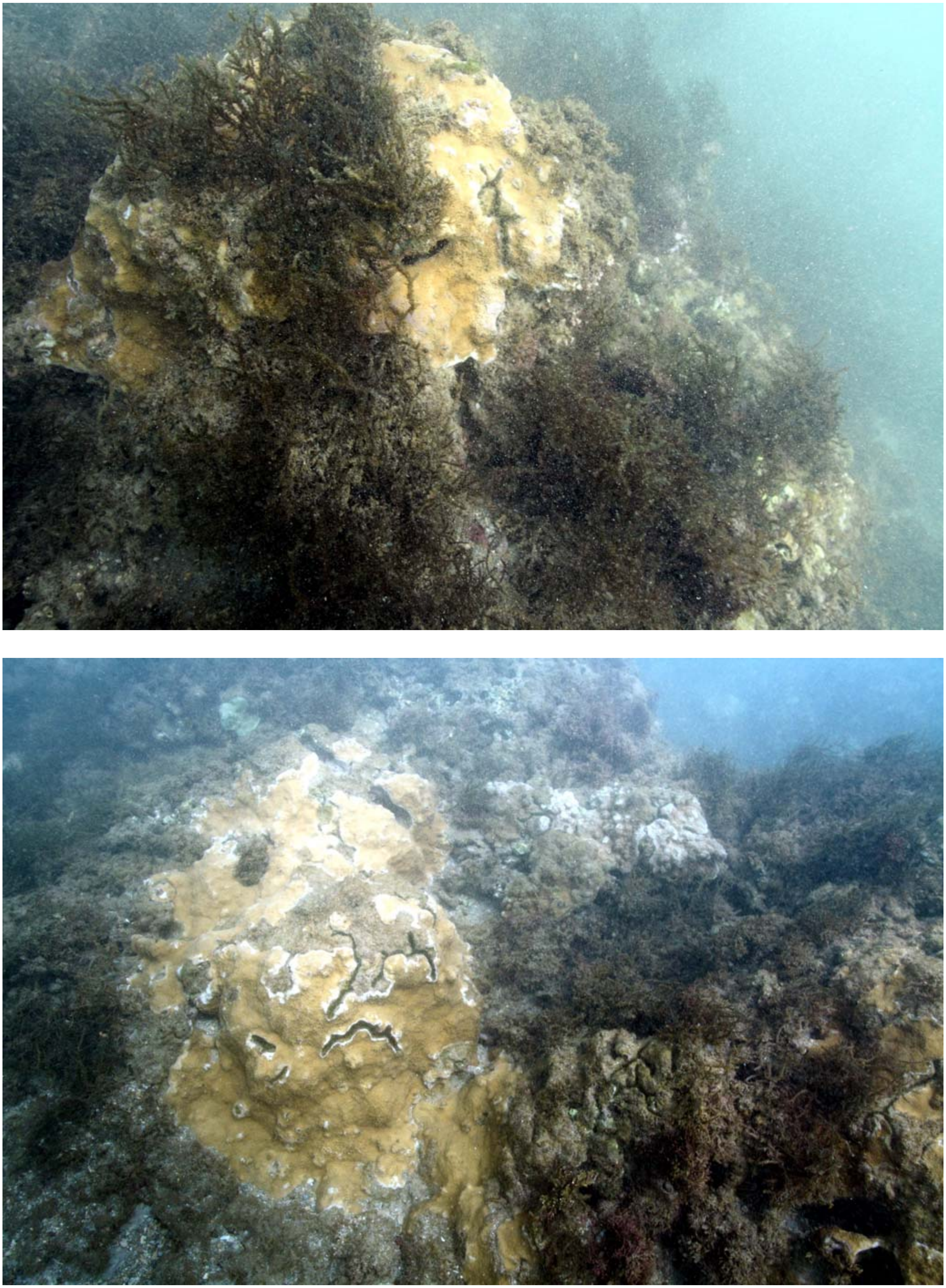


FIGURE 8. Dense growth of red spiny alga *Acanthophora specifera* interspersed with encrusting coral *Montipora patula* growing on limestone substratum in the nearshore area fronting the Hololani Resort Condominiums, West Maui.

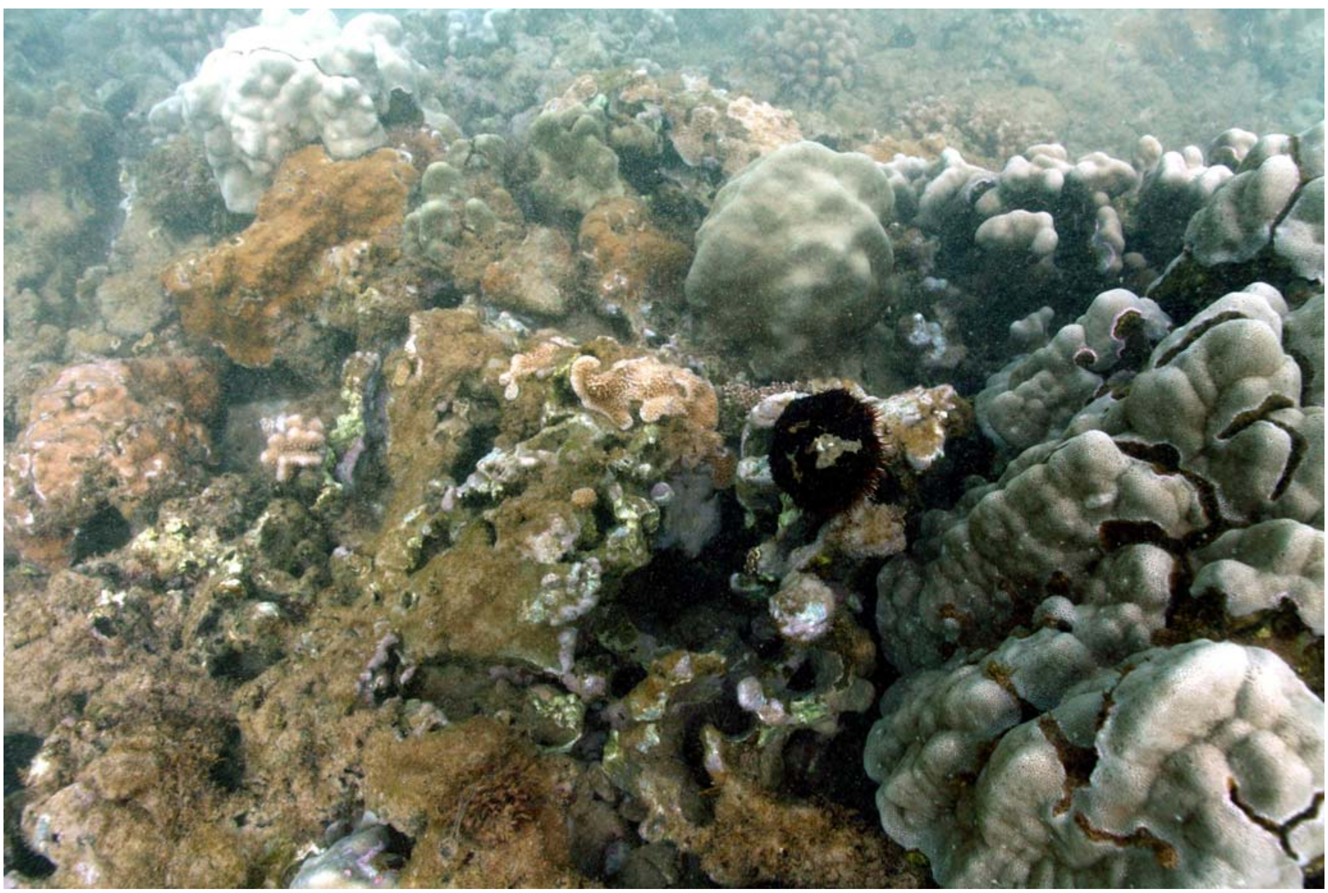


FIGURE 9. Reef corals on limestone platform on outer reef zone fronting the Hololani Resort Condominiums, West Maui. Hemispherical short-branched species in upper photo is *Pocillopora meandrina*. Variegated corals in upper and lower photos are *Porites lobata*. Tan colored encrusting coral in bottom photo is *Montipora patula*. Water depth is approximately 20 feet. Black sea urchin in bottom photo is *Tripneustes gratilla*.

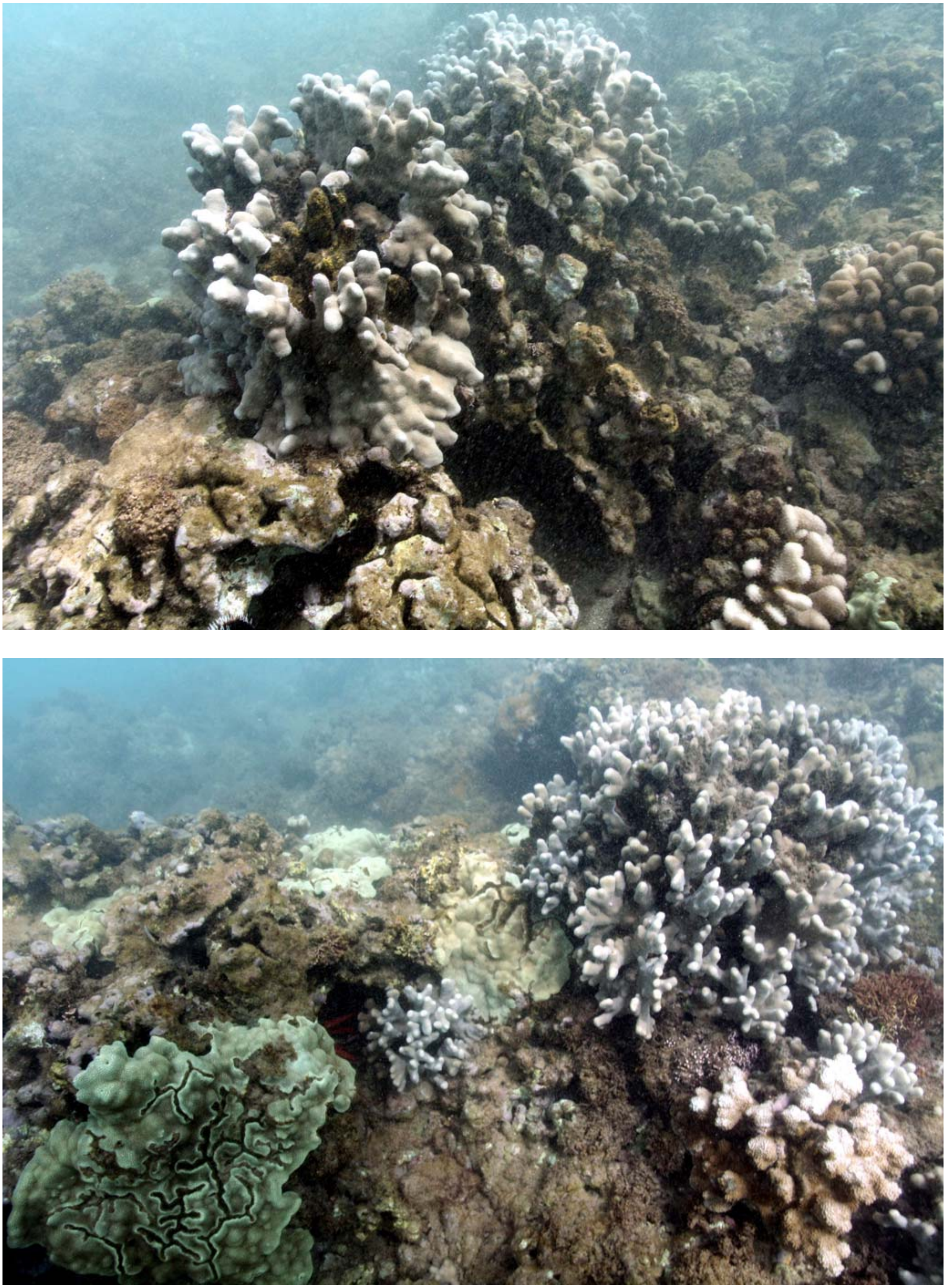
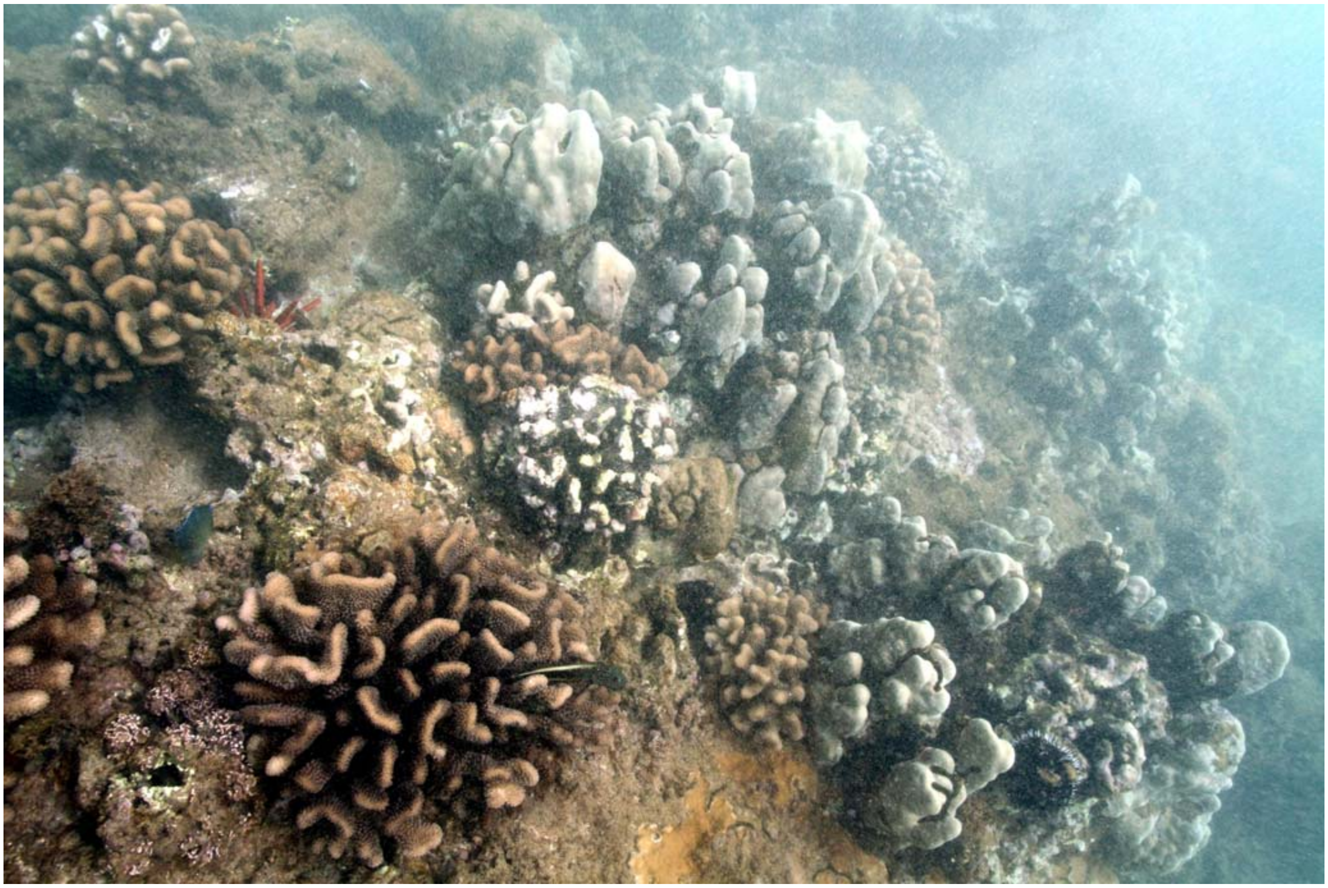


FIGURE 10. Reef corals on limestone platform on outer reef zone fronting the Hololani Resort Condominiums, West Maui. Grey-colored coral with finely branching tips is *Porites compressa*; green variegated coral in lower photo is *Porites lobata*. Water depth is approximately 25 feet.



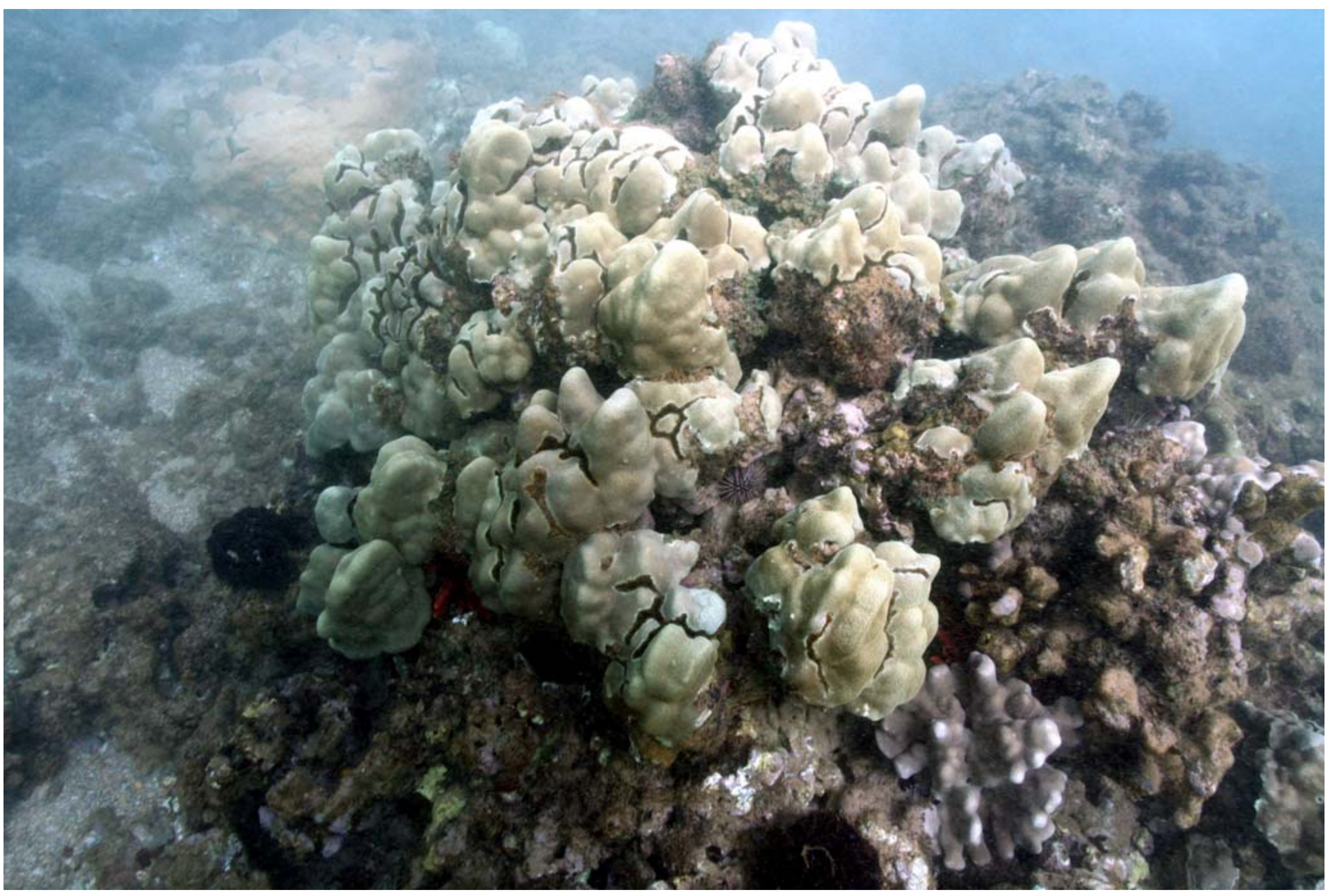


FIGURE 11. Reef corals on limestone platform on outer reef zone fronting the Hololani Resort Condominiums, West Maui. Hemispherical short-branched species in upper photo is *Pocillopora meandrina*. Variegated grey-green corals in upper and lower photos are *Porites lobata*. Water depth is approximately 20 feet.

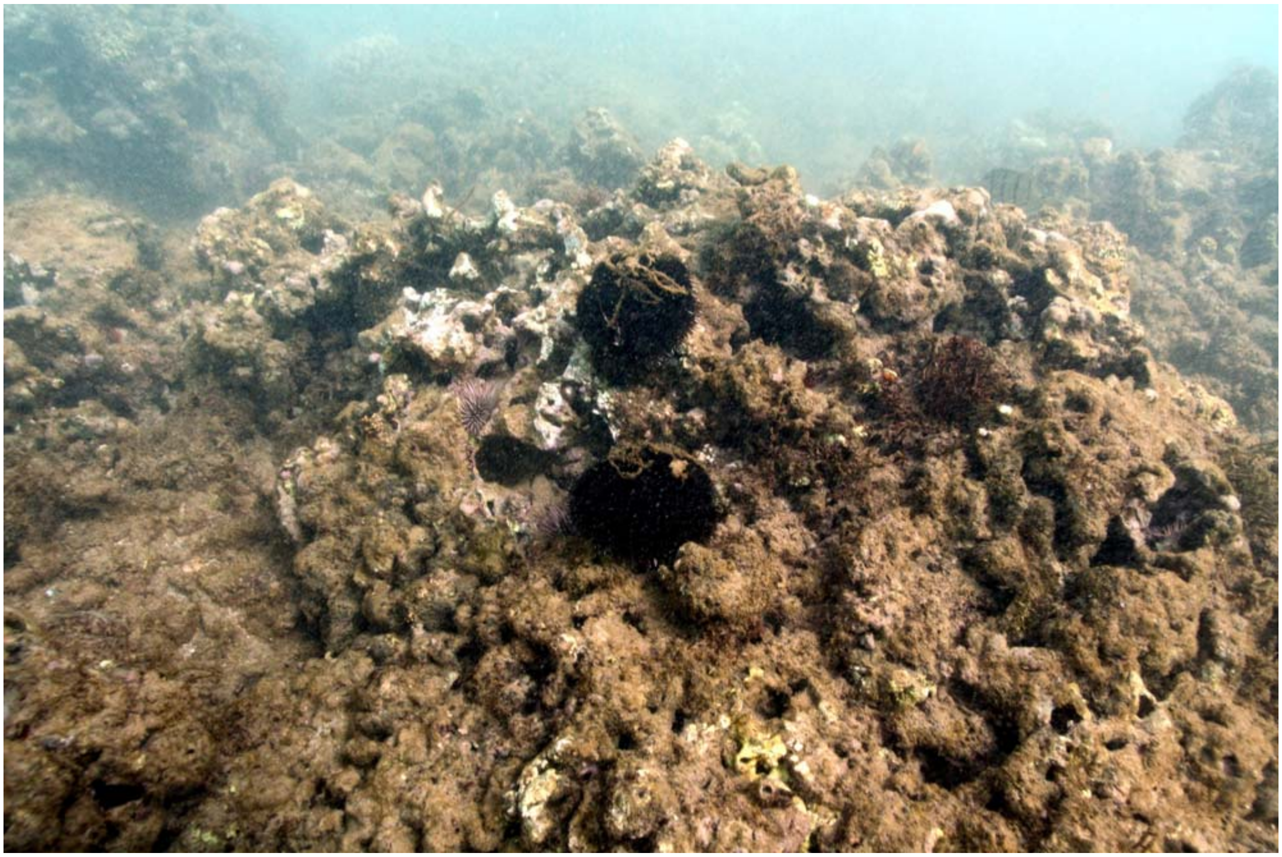


FIGURE 12. Upper photo shows portion of outer reef platform devoid of corals or algae. Bottom photo shows seaward edge of outer reef platform adjacent to sand plain fronting the Hololani Resort Condominiums, West Maui. Black sea urchins in both photos are *Tripneustes gratilla*. Water depth is approximately 25 feet.

## APPENDIX E. COMMENTS ON THE DEA AND FEA AND RESPONSES TO COMMENTS

1. Introductory Remarks
2. Comments from DLNR-OCCL
3. Response to Comments from DLNR-OCCL
4. Comments from UH-SeaGrant
5. Response to Comments from UH-SeaGrant
6. Comments from the County of Maui Department of Planning
7. Response to Comments from the County of Maui Department of Planning
8. Memorandum of meeting with U.S. Army Corps of Engineers, October 25, 2012
9. Comments from the Maui Planning Commission
10. Response to Comments from the Maui Planning Commission
11. Comments from the County of Maui Department of Public Works
12. Response to Comments from the County of Maui Department of Public Works
13. Photograph Log of Kahana Beach, October 16, 2012
14. DLNR-OCCL comments on the FEA (first submission, Januay, 2013)
15. FEA Submittal Letter (July, 2013) and response to DLNR-OCCL comments on the first submission.

## 1. Introductory Remarks

**Sea Engineering, Inc.**

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# Response to Comments on the Draft Environmental Assessment for Shore Protection for the Hololani Resort Condominiums

## INTRODUCTORY REMARKS

Comments on the Draft Environmental Assessment for the Hololani Shore Protection Project were received from the Hawaii Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL), Maui County Department of Planning (MDP), the Maui Planning Commission (MPC), Maui County Department of Public Works (DPW), and the University of Hawaii Sea Grant Program (UH-Sea Grant). Many of the comments were similar in nature. The following sections are an introduction and background material for direct responses to the agencies, and are meant to eliminate redundancy and provide an in-depth review of the subjects being covered.

### 1. Emergency Status of the Hololani and Understanding of Appropriate Shore Protection

The severe erosion of the Hololani Shoreline was given emergency status in January of 2007 when both the Maui County Department of Planning (MDP) and the State of Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR-OCCL) issued emergency permits for the construction of temporary shore protection. A February 2, 2007 letter from DLNR-OCCL gave authorization for the emergency placement of boulders and geotextile filter fabric stating,

> *…The erosion currently threatens a large multi-story building and it may be in danger of collapse without immediate shore protection. The DLNR understands the landowner(s) intend to apply for a shoreline setback variance for an engineered rock revetment placed landward of the shoreline…*
>
> *Based on the information provided, the Department has made the following determinations:*
>
> *1. There is an imminent threat to the existing building with active erosion threatening the structure.*
> *2. The berm is approximately defined by the active scarping and fallen vegetation. Erosion appears to have accelerated recently.*

*3. The proposed structure will provide temporary protection to the threatened structures until a more permanent solution is designed and approved.*

*4. There is no known beach quality sand source stored behind the berm, it appears the area is composed a (sic) clay and weathered basalt that would not provide a useful source of sediment to the littoral system if it were allowed to erode.*

*5. The area is largely armored with a large number of shoreline structures to the north and south of the property, specifically immediately to the north.*

*6. There are no other reasonable alternatives.*

*7. The applicant is developing a long-term plan for erosion control that may include stabilizing structures.*

On February 6, 2007 DLNR-OCCL gave an emergency permit to the Hololani AOAO to implement a temporary revetment constructed of geotextile sand bags on a foundation of Tensar rock mattresses. DLNR-OCCL re-iterated,

> *The DLNR understands… the installation of the bags is intended to be temporary until the required permits are obtained for a more permanent rock revetment.*

It has been the understanding of the Hololani AOAO, Sea Engineering, Inc. (SEI), DLNR-OCCL, and the MDP since February 2007 that the erosion of the Hololani shoreline constituted an imminent threat to the Hololani building, the situation was an emergency, and that SEI and the Hololani AOAO were pursuing permanent shore protection in the form of a rock revetment.

## 2. Regional Loss of Sand and Shoreline Erosion

The Kahana littoral cell stretches approximately 0.75 miles from Pohaku Beach Park ("S-Turns") to the Kahana Stream delta. Examination of aerial photographs shows a dynamic shoreline, but also a dramatic decrease in overall sand volume between 1949 and the present. The nature of the problem at the Hololani was succinctly stated in the June 22, 2007 letter from MPD granting a Special Management Area (SMA) emergency permit:

> *Erosion along the beach that fronts the Hololani is episodic, creating periods of risk to habitable structures followed by periods of beach re-establishment. However, chronic erosion has continued to reduce sand resources at the site causing the beach profile and sand resources at the site to shrink over time. The existence of chronic erosion exacerbates the episodic erosion events, resulting in the shoreline moving closer and closer to the high-rise condominiums each year.*

The letter emphasizes that the chronic disappearance of sand volume from the littoral cell is directly correlated to the increased frequency and severity of episodic events that erode the shoreline.

The erosion at Hololani is defined by the retreat of the shoreline and the vertical erosion scarp in the clay substrate:

> *Again during the winter 2006/2007 season, Kona storms caused a sudden three to eight feet retreat in the shoreline which formed a precipitous scarp around ten feet in height. Sand resources appeared to be entirely scoured from the beach leaving the rock substrate exposed. The scarp was within 20 feet of one of the Hololani towers, which was determined to be in imminent danger.*

A subsequent event brought the erosion scarp to within 15 feet of the north tower.

The shoreline erosion has been halted since that time by construction of the temporary geotextile sand bag and Tensar mattress shore protection.

The reduction in sand resources in the Kahana littoral cell threatens the entire beach, as well as increasing the risk to the Hololani with each passing year. As mentioned in Section 4.1.12 of the DEA, SEI conducted a shoreline erosion study in 2001 for the Hololani AOAO which updated a previous 1991 study by SEI and Makai Ocean Engineering. Conclusions include:

> *Aerial photographs reveal beach narrowing and an apparent loss of sand volume in the beaches in front of and adjacent to the Hololani Resort.*

The University of Hawaii Coastal Geology Group (UHCGG, 2003) also conducted a study of shoreline erosion in the Kahana region, and calculated a 22% reduction in beach width between 1949 and 1997.

Like other west-facing beaches in the area (i.e. Kaanapali Beach), the sand transport within the littoral cell responds to seasonal wave conditions. Sand at Kahana Beach is transported to the north during the summer season due to the influence of southern swell, and south in the winter season due to the influence of north swell. These are very general observations, and are complicated by northward movement during some Kona storm conditions and southward movement during strong tradewind conditions. Such littoral cells with strong longshore dynamics see the most pronounced changes at the ends of the cells, in this case the Kahana Beach Resort to the south, and (at present) the Hololani to the north. However, the northern reaches, from Hololani to Kaea Point, have shown the most pronounced historical effects as most of the reach north of the Hololani is entirely denuded of sand. The most stable part of the beach is a nodal position in front of the Valley Isle Resort.

**3. Coastal armoring and beach loss**

The USACE Coastal Engineering Manual (CEM, 2006) explores existing literature concerning the interaction of coastal structures and their effect on adjacent beaches (CEM-V-3-2c), with little in the way of definitive answers. According to the CEM, many of the initial observations, studies, and concerns about shoreline hardening derived from work on barrier islands of the East Coast. Barrier islands migrate, and it is easy to conceive how a structure a few tens or even hundreds of feet in length will be "left behind" by movement of an entire island in response to geologic forcing.

In discussing the complicated effects of armoring on beaches the problem is often broken down into three manageable concepts (note: the following terminology is from Pilkey and Wright, 1988[1]):

1. Impoundment, or placement loss: placing an armored structure anywhere on the beach profile removes the landward portion of the profile from the active beach system, and thus contributes to immediate beach loss. Placement seaward of dunes or other upland sand resources prevents those resources from contributing to the beach system.

2. Passive erosion: long term net erosion, such as the chronic loss of beach sand at Kahana and the resulting chronic regional erosion of the shoreline, or the large scale migration of a barrier island, are examples of passive erosion or shoreline change that take place regardless of the presence of a structure.

3. Active erosion: the direct effects of an armoring structure on coastal erosion is the subject of controversy in the coastal community. The results of many studies are not conclusive.

It is important to re-state that there are no sand resources mauka of the Hololani shoreline. There are no dunes or other backshore components of a beach system morphology. The escarpment is red volcanic clay, and erosion produces large amounts of turbidity, but no useful beach sediment. Coastal armoring of the Hololani shoreline will not result in impoundment of beach resources.

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[1] Pilkey, O. H., and Wright, H. L. (1988). "Seawalls versus beaches," *Journal of Coastal Research*, Special Issue No. 4, 41-66

Long term shoreline erosion, or passive erosion, is both a regional and statewide issue that will continue unless regional solutions are enacted or shorelines are armored. Within the Kahana littoral cell, passive erosion has been stopped north of the Hololani by shoreline armoring. South of the Hololani erosion will be limited by the presence of valuable developments. As with the Hololani, there is only so far that the shoreline can be allowed to erode before an inhabited structure becomes imminently threatened and a solution must be enacted.

As backshore sand resources do not exist, and the natural offshore supply from the reef is apparently inadequate, the beach at Kahana will continue to narrow as sand resources diminish. This will happen regardless of whether the shoreline is armored or remains in its native state. Without armoring, the regional chronic erosion of 0.7 – 0.8 ft per year will continue, and may accelerate as sand resources diminish. The precipitous escarpment existing at the Hololani will likely propagate along the entire Kahana reach. Beach loss in this littoral cell is a certainty unless pro-active measures are taken to conduct a regional beach nourishment program.

Active erosion, or the effect of coastal armoring on beaches is a complex subject. One of the more cited works in the field are a series of studies by G. Griggs and J. Tait in which numerous profiles were taken along a beach in Monterey Bay, California that included a seawall section well seaward of adjacent sections of beach. The beach profile had pronounced seasonal differences, however, there was no long term, or passive erosion. Summarizing their study on the active erosion component after seven years of profiling, the authors state (Griggs et al, 1994[2]):

> *A comparison of summer and winter beach profiles on beaches with seawalls and on adjacent control beaches show no long term effects or impacts of seawalls in this location during this seven year period.*

The native Hololani reach is properly termed a naturally hardened shoreline. The MDP 2007 letter describes a "precipitous 10-ft scarp" and a beach entirely scoured of sand. This a description of a natural and seasonal beach condition that occurred when the sand moved to the southern reaches of the littoral cell under the influence of waves from the north. The precipitous scarp described will interact with waves in a manner similar to a 10-ft seawall, with the exception that it will continue to erode.

Observations of sand transport at the Hololani have been made since temporary structures were emplaced in December 2007 (see DEA, Section 4.1.11). Large amounts of sand are accreted

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[2] Griggs, G. B., Tait, J. F., and Corona, W. W. (1994). "The interaction of seawalls and beaches: Seven years of monitoring, Monterey Bay, California," *Shore and Beach* 62(3), 21-28.

during sustained southern swell and certain Kona storm conditions, and the shoreline is denuded of sand during sustained north swell and heavy trade wind conditions. The behavior of the shoreline does not appear to have changed appreciably during the past five years due to placement of the temporary structure.

There are many conflicting, and at times counter-intuitive, proposals concerning the effect of shoreline armoring in the existing body of knowledge, sometimes even within the same studies. Resolving those differences is not the purpose of these paragraphs. However, with a notable absence of compelling data or a thoughtful, process-oriented discussion, the unequivocal assertion that armoring the Hololani shoreline will result in inevitable loss of the beach ignores the existing site-specific conditions, and is not supported by the state of the science. The Mahana Condominium, two miles south of the Hololani, is an excellent example of the lack of impact a revetment can have on the beach processes. In the face of a receding shoreline which threatened the building foundation, a sloping rock revetment designed by Sea Engineering, Inc. was constructed on the shoreline fronting the buildings in the mid-1980s. This revetment has essentially been buried by sand ever since.

The key elements for understanding the existing erosion condition at the Hololani are as follows:

1. Beach narrowing caused by an on-going chronic loss of sand has been occurring for many years. This loss will likely continue with or without coastal armoring of the Hololani shoreline.

2. Dynamic north and south directed sand transport occurs in the littoral cell as a result of seasonal changes in wave climate. Sand resources in front of the Hololani disappear under sustained north swell and strong tradewind conditions. Sand resources return to the Hololani under southern swell conditions and certain Kona Storm conditions. This cycle has been monitored and has not appreciably changed since the shoreline was armored with a temporary structure in December, 2007, and is referenced in previous material at least to 1988.

3. The depletion of sand resources has increased the frequency of erosion events by the direct exposure of the Hololani shoreline to wave damage.

Armoring the naturally hardened shoreline at the Hololani will not appreciably change existing coastal processes. There will be no impoundment of valuable sand resources. Passive erosion has been fixed by shoreline armoring to the north, and will ultimately be limited by the need to protect existing development to the south with either a regional beach nourishment solution or shoreline armoring. The active processes – the effect of shoreline armoring – will be little changed from the existing condition with temporary structures, and will likely be little different from the natural condition with a vertical volcanic clay escarpment.

**4. The Domino Effect**

The "domino effect" has been used to describe the proliferation of coastal armoring, with the idea that once a section of shoreline is armored, the effects of the armoring will be such that the adjacent property will inevitably need to armor their shoreline (see *Maui News*, September 15, 2012). There are two key elements in the discussion of a potential domino effect, "end effects" and the chronic regional loss of beach sand.

"End effects", or excess scour or erosion of adjacent shorelines due to additional wave reflection and turbulence from the end of coastal armoring, are accepted by coastal engineers as potentially negative side effects of coastal armoring. However, it has always been a difficult phenomenon to quantify. As a crude estimate, end effects are not likely to extend beyond a wavelength from the structure. Half a wavelength, or somewhere between 50 and 100 ft is probably a more realistic estimate, with effects decreasing with distance. The actual direct effects of Hololani shoreline armoring are not likely to extend more than a short distance into the Royal Kahana property. Recommendations have been made in the DEA to mitigate these potential effects:

- The revetment is stopped 24 ft from the property line in order to keep as much of the turbulence associated with end effects within the property of the Hololani, yet still protect the south building.

- The combination of the revetment returning to the face of the sheet pile wall, and the sheet pile extending inland at an angle minimizes disturbance of native ground.

- Under an existing verbal agreement with the MDP, the Royal Kahana AOAO has protected their property adjacent to the Hololani with temporary protection. The temporary measures have been robust and effective. It is the intent of project to have these temporary measures included in the Hololani permits to ensure that localized damage at the Royal Kahana due to the new permanent structure does not occur.

The effects of the regional depletion of sand resources are likely to have far reaching effects that are independent of Hololani shoreline armoring. The regional erosion of 0.7 ft per year, calculated by the UHCGG (see ftp://soest.hawaii.edu/coastal/webftp/Maui/Posters/Kahana.jpg) using data from 1912 through 1997, is reasonably consistent along the entire littoral cell. However, inspection of recent trends (1975 through 1997) shows erosion rates increasing with distance from a nodal position near the Valley Isle Condominium, south of the Royal Kahana. The Royal Kahana is losing portions of the north part of their property to shoreline erosion, and most of the other properties south of the Hololani show signs of erosion mitigation. The continued loss of sand will likely have consequences in the foreseeable future, with the effects more pronounced at the ends of the effective littoral cell. At this point in time, the effective littoral cell ends at the north end of the Hololani property, as the sand rarely migrates past that point during periods of accretion. With continued loss of beach sand, more southern reaches will become exposed with increasing frequency. The north to south sequence of erosion and shoreline armoring - the domino effect - is a result of the chronic, regional depletion of sand resources. Taking a "no action" approach to the Hololani erosion problem will not prevent the continued erosion of properties to the south.

## 5. Consideration of appropriate alternatives

A prevailing theme in the comments from the DLNR-OCCL, MDP, UH-Sea Grant and the MPC was the need to equally consider every possible alternative to the highest degree possible – and that alternative solutions had not been thoroughly explored in the DEA.

The preferred alternative has been brought to approximately a 60% level for design drawings in order to expedite the permitting process. This level is the combined product of both a coastal engineer, a structural engineer, and a geotechnical engineer, and is necessary for some permit considerations. The DEA discussed the following options:

- Hybrid seawall and rock revetment (the preferred alternative)
- Rock rubble-mound revetment (a satisfactory alternative)
- Seawall (not satisfactory)
- Beach nourishment with groin retention structures (not satisfactory)
- Regional beach nourishment (a preferred alternative for regional erosion)
- Use of artificially constructed offshore reefs (not satisfactory)

Agency comments asked the project to consider the following alternatives:

- Use of a groin system with no beach nourishment (DLNR-OCCL, MDP)
- Use of a groin system with nourishment (Sea Grant, MDP, MPC)
- Construction of an offshore breakwater (MDP, MPC)
- Construction of submerged breakwaters (MPC)
- Offshore reef enhancement by stimulating coral growth (MPC)
- Offshore reef construction using *Reef Balls* (MPC)

The objective of the present project has been clear since early 2007, when the Hololani was granted permits to implement temporary shore protection. SEI has been tasked to design engineered, permanent shore protection to ensure the safety of two eight-story condominium buildings and their inhabitants. The project must adhere to sound coastal engineering practice, and be able to meet appropriate oceanographic design criteria. For the preferred alternative, for example, SEI designed the structure for a 50-year return period wave height. Alternatives that are not part of accepted engineering practice, or are temporary or experimental in nature, can be explored as government or educational facility research projects, regional management programs, or dive club activities, but are not appropriate as permanent, engineered solutions to be advanced by professional engineers for a potentially catastrophic condition.

Although only the preferred alternative in the DEA was brought to a 60% level of design, that does not mean the other options were not fully considered. However, in all cases, there are compelling reasons for not bringing them past a concept design level.

In most respects, the additional alternatives that have been mentioned are variations on the alternatives presented in the DEA. For example, whether a design calls for two groins or four, with beach nourishment or without, the essential problems inherent with groin systems are the same. The adequacy of beach nourishment to protect the Hololani, with or without containment structures such as groins, is independent of the level of design considered, the number or nature of containment structures, or the volume of beach nourishment. The inherent problems with the use of an artificial offshore reef to protect the Hololani is mostly independent of whether the reef is composed of artificial structures such as reef balls, transplanted coral fragments, or is a submerged rubblemound breakwater.

First among considerations is whether the alternative is sound coastal engineering practice. In evaluating project alternatives, the primary objective of the project is of most importance. There are two modes of protection, shoreline armoring, and shoreline stabilization. *Shoreline armoring* is the use of seawalls, bulkheads, or revetments to “draw the line”, or ensure that no further erosion takes place. Its use is justified when erosion threatens substantial development or human life. *Shoreline stabilization* is the use of breakwaters, groins, sills or reefs to moderate the coastal sediment transport processes. Shoreline stabilization may reduce, but will not eliminate the local erosion rate. The stabilization structures are often used in conjunction with beach nourishment.

The Hololani erosion situation is properly viewed as an emergency, with habitable structures being imminently threatened by shoreline erosion. At present, the north building is 15 ft from the shoreline escarpment. It is a potentially catastrophic condition. During the 2007 erosion event that preceded implementation of emergency shore protection, residents reported up to 10 ft of localized erosion in one area occurring in a single day. It is likely that the Hololani buildings would have been damaged and perhaps condemned if the emergency shore protection had not been installed.

The presence of a wide beach in front of the Hololani, whether natural or nourished, is no guarantee of safety. Tremendous amounts of beach sand can be transported during extreme events. Every year, beaches over 200 ft in width are drastically diminished or disappear at island beaches such as Kaanapali Beach and Oahu's North Shore. During the 1980 Kona Storm, the wide beaches at Wailea disappeared within hours, according to eyewitnesses.

It is the opinion of Sea Engineering that shoreline armoring – holding the line – is the proper course of action to ensure the safety of the Hololani buildings.

The preferred action must also minimize environmental impacts to the extent possible. Impacts may be viewed differently by different levels of government. For example, while the use of offshore structures may be appealing on a County level, these are outside of County jurisdiction and are generally viewed unfavorably by Federal agencies concerned with habitat issues.

There are additional reasons why the various alternatives put forward are not appropriate:

**Groins**

Groins, whether a single structure or a field of two or more structures, are meant to sequester beach sand and slow the longshore transport rate. However, by sequestering beach sand, a groin field will interrupt the natural longshore flow of sand and may have significant far-field and down-drift effects. For example, placing a groin field along the 400-ft reach of the Hololani will slow or prevent sand from being transported to the southern reaches of Kahana Beach under north swell conditions, and may cause beach narrowing far from the Hololani. Even with additional beach nourishment, the groins will alter wave patterns and have potentially damaging down-drift effects. These effects are well documented in the field of coastal engineering design, and are why the use of groins must be approached with care.

Modern groin design incorporates the use of "T-heads" in order to reflect a portion of incoming wave energy, cause spreading of the wave crests inside the groin to form crenulate-shaped beaches, and to help prevent the formation of dangerous currents (see DEA, Figure 3-4). T-head groins effectively compartmentalize the shoreline, and are usually used in conjunction with beach nourishment.

A groin field at the Hololani will permanently divide the Kahana littoral cell. At present, the cell effectively ends at the north end of the Hololani property due to the Pohailani seawall offset acting as a stub groin to inhibit sand from moving further north. However, if a regional beach nourishment project were initiated for the entire cell with a sufficient quantity of sand, the minor salient of the Pohailani seawall would be overwhelmed and sand could move up to the Kahana Stream (Kahea Point). A groin field at the Hololani would interrupt that flow and change the dynamics of the littoral cell forever. Such changes constitute major environmental impacts that need to be carefully reviewed and understood before being implemented.

Under existing federal regulations, the federal permit process for the construction of groins or other offshore structures as shore protection for the Hololani is difficult. Stakeholder agencies (U.S. Fish & Wildlife Service, NOAA Marine Fisheries) are extremely protective of marine habitat. All coastal waters in Hawaii are designated as Essential Fish Habitat, and structures placed in the water are considered to impact and potentially result in alteration or loss of marine habitat. Adverse impacts to, or loss of habitat require compensatory mitigation. Thus it is desirable to limit the use of structures in the water to the maximum extent practicable while still meeting the project purpose and objectives. Sea Engineering has recently been involved with two beach stabilization projects that include beach nourishment and T-head groins for stabilization. The Iroquois Point project is currently under construction, but took nine years from inception to receive all the necessary permits. The recently proposed Grays Beach project fronting the Waikiki Sheraton Hotel, which included three groins and sand fill, was abandoned due to difficulties with the federal permit process. The proposed shoreline revetment for the Hololani results in the absolute least impact to the marine environment; any of the other alternatives presented in the DEA or agency comments, such as sand fill or the use of offshore structures would result in significant marine habitat impacts.

Any kind of groin field built at the Hololani will have a profound regional environmental impact. It may well be that a future beach nourishment project, with or without groins, will be implemented at Kahana Beach. However, that project will require the participation of all shorefront land owners, as well as the State and the County. It will also require an extensive sand prospecting effort. It is beyond the capabilities of a single property to organize and fund such a project, and would likely result in a severe delay to the important goal of preserving the safety of the Hololani buildings.

**Offshore reefs and breakwaters**

The subject of using offshore reefs for coastal protection was developed in Section 3.5 of the DEA. Further expansion is required as both the MDP and the MPC requested additional information concerning offshore reefs, breakwaters, and submerged breakwaters.

Offshore reefs

In theory, offshore reefs can be used to help focus wave crests by the process of refraction, and help dissipate wave energy by the processes of wave breaking and turbulent drag due to friction. However, there has not yet been an artificial reef constructed in open coastal water for shore protection purposes. There are enormous difficulties involved with constructing these reefs, and their ability to work as desired is limited. And as previously discussed, they would potentially have a significant impact to marine habitat which would have to be mitigated in order to obtain the necessary approvals and permits. A natural fringing reef already exists offshore, and the existing water depths cause significant wave energy attenuation by breaking. Raising the reef by one or two feet may help induce additional wave breaking, however, in a high wave or storm condition, the combination of storm surge and wave setup will cause a water elevation rise and significant wave energy will still move over the raised reef and be transmitted to the shore. The phenomena of wave refraction and diffraction allow the wave crests to bend around the reefs and propagate in their lee. In the chaos of a severe storm, nearshore waves are extremely irregular, and depth-limited waves will be able to attack an unprotected shoreline escarpment.

The promotion of coral growth by planting live coral fragments using epoxy glue or by "nestling" the fragments is being encouraged by some agencies for remediation purposes at damaged reef areas or for mitigation in some construction activities. However, trying to artificially farm coral in a wave zone has tremendous difficulties for a dive operation, and for the ability of the transplants to remain immobile long enough to generate a solid attachment.

Detached breakwaters

Detached breakwaters are offshore breakwaters not connected to the land by a groin or other stem feature. The breakwaters reduce the amount of wave energy that reaches the shoreline and are used for beach stabilization. Wave diffraction around the ends of the breakwater causes waves to bend into patterns that favor the formation of a salient in the beach planform. If the salient extends out to the breakwater, it is termed a tombolo. Segmented breakwaters use several shore-parallel breakwaters in a line to change the wave patterns and sculpt the beach into useful crescent forms (see Figure 1 (a)). Use of structures of this type require an adequate supply of beach sand to be effective. As with groins, a segmented breakwater system will tend to sequester the sand supply and may have negative effects on down-drift beaches. Breakwaters can cause currents to form near the structure and may cause localized areas of scour. Figure 2(b) is a segmented breakwater off Sand Island in Honolulu. Detached breakwaters have a substantial viewplane impact.

Submerged breakwaters allow partial wave transmission over the crest of the breakwater. While submerged breakwaters have been used for beach stabilization, they are not common and are not particularly effective. Submerged breakwaters become less effective as the water level rises due to tides, high waves, or storm surge.

Offshore breakwaters and submerged breakwaters are used to shape beaches and enhance their stability. However, they are not used to protect substantial development, and have limited effectiveness during storm events with high waves and raised water levels.

Acquiring federal permits for placing offshore structures – groins as well as breakwaters - in a coral reef environment would likely be extremely difficult. It is doubtful that federal stakeholder agencies will approve the replacement of the natural offshore substrate with an artificial one of rock, geotextile tubes, or man-made objects.

In summary, in addition to being less effective than the preferred alternative put forward in the DEA, offshore and submerged breakwaters will occupy a significantly larger footprint, will have greater impacts to both coastal processes and the offshore marine environment, and will have greater negative visual impacts. There will also be significantly less chance of acquiring federal permits.

(a)

(b)

(a) Segmented breakwater and tombolos in Italy, and (b) breakwaters at Sand Island, Honolulu

2. Comments from DLNR-OCCL

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**

OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF:OCCL:BR

Draft EA for MA-12-252
Draft EA Acceptance Date: May 23, 2012
30-Day Comment Exp. Date: July 23, 2012

Mr. James H. Barry
Coastal Engineer
Sea Engineering, Inc.
Makai Research Pier
Waimanalo, HI 96795

SUBJECT: Draft Environmental Assessment (EA) for Permanent Shore Protection of the Hololani Resort Condominiums Located at 4401 Lower Honoapiilani Road, Lahaina, Maui, TMK: (2) 4-3-010:009.

Dear Mr. Barry:

This letter is regarding the Draft EA for Permanent Shore Protection at the Hololani Resort Condominiums (MA-12-252) submitted by Sea Engineering Inc. (the Applicant) on behalf of the Hololani AOAO. The public and agency comment period on this Draft EA has closed (July 23, 2012). Attached to this letter are copies of the comments received by the Office of Conservation and Coastal Lands (OCCL) regarding the Draft EA. Please send copies of your responses to the questions raised in these letters directly to the authoring agency as well as to OCCL. If you have received comments directly, please include a copy of the comments and your response with your correspondence to OCCL. The final copy of this project's Environmental Assessment (EA) needs to include your responses to the queries raised in this and the enclosed letters. These responses can be attached to the end of the Final EA document.

The applicant proposes to install permanent shoreline protection fronting the Hololoni Condominium in response to chronic and episodic (seasonal) coastal erosion, which has threatened the structure. The applicant proposes a hybrid seawall and revetment structure as their preferred design alternative. Based on the proposed site plans submitted by the applicant, the structure would be built makai of the certified shoreline on the existing beach within the State conservation district.

OCCL is concerned about further degradation of the public beach resources and beach environment fronting the Hololani Condominiums and adjacent properties, in the form of continued beach narrowing and eventual loss, should permanent shoreline protection be installed. Installation of shoreline armoring at Hololani is very likely to result in complete loss of the public beach as the water line continues to recede (erode, following the historical trend) toward the base of the fixed shoreline armoring. The Draft EA states (page 95) that "It is unlikely that the proposed structure will have a negative effect on coastal process, and it may well have a long-term beneficial effect by promoting sand accretion."

**In the Final EA please provide observational evidence or case studies from Hawaii beaches where installation of similar structures on an eroding beach has had positive effects on coastal processes and promoted beach accretion.**

The Draft EA explores five alternatives to the applicant's preferred action of installing a hybrid seawall and revetment structure: *No Action*, *Rock Rubble Mound Revetment*, *Seawall*, *Beach Nourishment*, and *Alternative Temporary Solutions*. The Draft EA concludes that "Beach nourishment is not recommended as an immediate coastal engineering solution to the Hololani coastal erosion problem." Figure 3-4 in the Draft EA depicts a schematic of possible groin structures for use in stabilizing of sand fill. The figure depicts two large rubble mound "T" groins at either end of the Hololani property.

OCCL agrees with Maui DPP's and UH Sea Grant's concerns in the enclosed letters that alternative solutions for erosion management have not been thoroughly explored in the Draft EA. OCCL feels that beach and dune nourishment fronting the subject property with construction of a series (3 or more) short "stub" groins has the capacity to preserve both the public beach and the subject property, and may be a preferred alternative to the applicants proposed plan. As stated in the DLNR Coastal Erosion Management Plan (COEMAP), "Groins, breakwaters, and headlands work best in areas where longshore transport is much more dominant than cross-shore transport," as characterizes the beach fronting Hololani. The 1996 West Maui Community Plan discourages the use of seawalls and revetments in favor of alternatives that add sand. A recent demonstration project at Stables Road on the north shore of Maui using short, partially buried sand bag groins has been shown to be effective at retaining the public beach and protecting coastal property in an area characterized by seasonal beach variability and longshore transport.

**Please provide in the Final EA an alternative plan including beach and dune nourishment with construction of multiple (3 or more) partially-buried groins fronting the subject property. The groins should be of optimal length and spacing to retain seasonally-accreted sand while still allowing sand transport around the ends of the groins. This alternative plan should not include shore-parallel armoring.**

These issues and the others raised in the enclosed comment letters must be addressed in the Final Environmental Assessment for the OCCL to make a determination in regards to declaring a Finding of No Significant Impact (FONSI).

Please send 4 hard copies and 1 CD in pdf format of your final EA to the OCCL. In addition, please send an electronic copy of the Office of Environmental Quality Control (OEQC) Publication Form to OCCL staff at Bradley.M.Romine@hawaii.gov. If the project summary has changed, include a new summary. Please include a hard copy of the submitted publication form with the Final EAs. Should OCCL determine a FONSI for the final version of the Environmental Assessment, we shall forward the final EA and publication form to the OEQC.

Should you have any questions regarding matters pertaining to MA-12-252, contact Brad Romine of our Office of Conservation and Coastal Lands at (808) 587-0049.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Land

Cc: DLNR Chairperson
Maui Planning Dept, Planning Director
Maui Planning Dept / Sea Grant, Tara Owens
DLNR – Maui Land Office
U.S. Army Corps of Engineers

3. Response to Comments from DLNR-OCCL

Sea Engineering, Inc.

Makai Research Pier • Waimanalo, Hawaii 96795-1820 • E-mail: sei@seaengineering.com
Phone: (808) 259-7966 / FAX (808) 259-8143 • Website: www.seaengineering.com

December 4, 2012

Mr. Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands,
State of Hawaii, Department of Land and Natural Resources
Post Office Box 621
Honolulu, HI, 96809

Dear Mr. Lemmo,

Subject: Hololani Shore Protection: Response to DLNR-OCCL Comments on the Draft Environmental Assessment

Thank you for your review of the Draft Environmental Assessment for Permanent Shore Protection of the Hololani Resort Condominium (DEA), dated August 27, 2012. Since that time a hearing was held before the Maui Planning Commission on September 11, 2012 to review the DEA. Comments on the DEA were also received from the Maui County Department of Planning (MDP), the Maui Planning Commission (MPC), and the University of Hawaii Sea Grant Program (UH-Sea Grant). Following are responses to your comments on the project. However, attached with this document are introductory remarks and background material (see *Introductory Remarks*) meant to eliminate redundancy and provide an in-depth review of the subjects being covered. The introductory remarks consist of four sections:

1. Emergency Status of the Hololani and Understanding of Appropriate Shore Protection
2. Regional Loss of Sand and Shoreline Erosion
3. Coastal Armoring and Beach Loss
4. The Domino Effect
5. Consideration Of Appropriate Alternatives

Following are detailed responses to comments from the DLNR-OCCL (note: agency comments are in italics).

**1. *Installation of shoreline armoring at Hololani is very likely to result in complete loss of the public beach as the water line continues to recede (erode, following the historic trend) toward the base of the fixed shoreline armoring...***

The extremely dynamic nature of the beach is shown by the occasional complete denudation of beach sand, and also the occasional burial of the existing temporary protection (see Introductory Remarks, Sections 2, 3, and 4). The "water line" moves mauka and makai with seasonal condition of the beach, and is expected to be at the proposed structure during low sand conditions just as it now intersects the existing temporary protection. The low sand conditions are a result of dynamic seasonal transport and a chronic regional loss of sand. Regional beach nourishment is recommended for the regional problem. Five years of observation of the shoreline with temporary protection shows that sand will accrete in front of the hardened structure in response to the local transport processes as long as sand is available.

Within the Kahana littoral cell, recession of the shoreline has been stopped north of the Hololani by shoreline armoring. South of the Hololani, erosion will be limited by the presence of valuable developments. As with the Hololani, there is only so far that the shoreline can be allowed to erode before an inhabited structure becomes imminently threatened and a solution must be enacted.

As backshore sand resources do not exist, and the natural offshore supply from the reef is apparently inadequate, the beach at Kahana will continue to narrow as sand resources diminish. This will happen regardless of whether the shoreline is armored or remains in its native state. Without armoring, the regional chronic erosion of 0.7 – 0.8 ft per year will continue, and may accelerate as sand resources diminish. The precipitous escarpment existing at the Hololani will likely propagate along the entire Kahana reach. Beach loss in this littoral cell is a certainty – again, irrespective of shoreline armoring – unless pro-active measures are taken to conduct a regional beach nourishment program.

**2. *In the Final EA please provide observational evidence or case studies from Hawaii beaches where installation of similar structures on an eroding beach has had positive effects on coastal processes and promoted beach accretion*.**

It is important that the proposed shore protection be compared with the existing shoreline:

- The existing shoreline is a naturally hardened shoreline consisting of a steep vertical volcanic clay escarpment; there is no back shore morphology.

- The steep volcanic clay escarpment interacts with waves in more or less the same way as a vertical sea wall.

- The natural shoreline has a high reflection coefficient.

The proposed structure is a hybrid seawall and rock revetment. The rock revetment has a lower reflection coefficient (approximately 50% by methods in the USACE SPM) than a vertical wall or clay escarpment. However, it is true that the natural shoreline is complicated by an uneven plan form and the presence of beach rock shingle and other substrate irregularities that appear when the sand is stripped away, so that a simple characterization model is not realistic. Trying to assign an accurate reflection coefficient value to either the natural shoreline or the proposed project shoreline is a difficult and uncertain exercise. Nevertheless, one of the major considerations in the selection of a rock revetment structure over a vertical seawall is the reduced reflection characteristics. The favorable energy dissipation and relatively low reflection characteristics of the rock rubblemound section of the proposed design should help promote beach accretion in comparison with a vertical seawall structure, or any other vertical escarpment, including the natural hardened shoreline. However, it is recognized that the interactions between the waves, beach, and structure are complex, and absolute predictions of shoreline response are difficult to make. Nevertheless, in comparison with the existing natural shoreline, the preferred alternative is not expected to have a negative impact.

Erosion of the natural shoreline produces significant red clay turbidity in nearshore waters. The preferred alternative will seal the shoreline and prevent this occurrence.

As indicated in Section 5 of the *Introductory Remarks*, Sea Engineering considers shoreline armoring – holding the line – the proper course of action to ensure the safety of the Hololani buildings, and a seawall, rock rubblemound revetment, or the proposed hybrid are the acceptable engineering solutions.

Following are three examples of beach accretion in front of shoreline armoring.

**Mahana Condominium**

The Mahana Condominiums are two high-rise apartment buildings on North Kaanapali Beach approximately two miles south of the Hololani. Like Kahana Beach, the Kaanapali shoreline is dynamic and responds to seasonal wave forcing. Construction of the Mahana was completed in 1976, but rapid erosion of the beach occurred due to high tides and high southern swell wave conditions during the summer of 1980. The condition of the shoreline at that time was similar in many respects to that of the Hololani (Figure 1). The shoreline was protected with sand bags for several years (see Figure 2) until completion of a rock rubble mound revetment in 1985.

Since completion of the revetment, the structure has been fronted by a sand beach most of the time (Figure 3). Often, the rock armor is obscured by both sand and naupaka vegetation. The sand beach has accreted relative to the conditions shown in Figures 1 and 2, and has remained stable since that time. Claims are not made that the structure actively promoted beach accretion, but the revetment appears to have had positive effects – or at least no negative effects - on the shoreline. The existing beach with shoreline armoring is wider and in generally better condition than the native beach condition in 1980.

Figure 1. Conditions at the Mahana Condominium in July, 1980

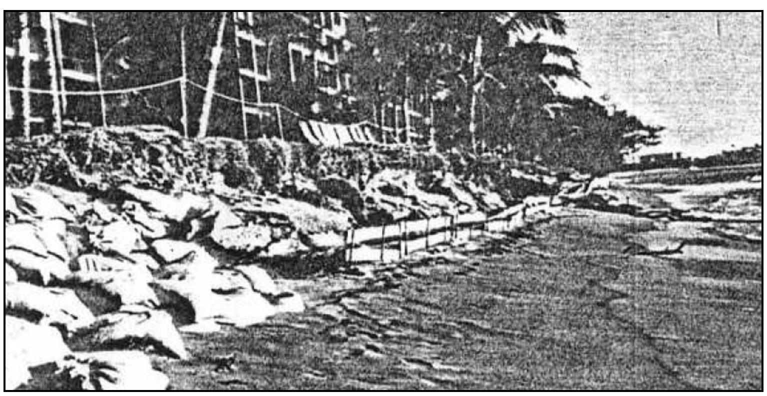

Figure 2. Sand bag shore protection at the Mahana, October, 1980


Figure 3. Mahana Condominium at present (photo: UHCGG website)

**Anaehoomalu Bay Restoration**

The Tohuku Tsunami of March 11, 2011 severely eroded the beach fronting Kuualii pond at Anaehoomalu Bay, Waikoloa, tearing a 100-foot wide gap through the beach and into the pond, and destroying about 220 linear feet of the rock fishpond wall. The gap in the beach resulted in continuing sand infill into the pond by wave action. Various permits issued by the County, State and U.S. Army Corps of Engineers (USACE) during development of the resort required the maintenance and preservation of the pond, and thus a request for emergency repair of the beach was made by the Waikoloa Beach Association to the County Planning Department, the State Department of Land and Natural Resources (DLNR), and the USACE on March 28. Approval was granted on July 7, repair was initiated on July 25, and the work was completed on August 3, 2011.

When emergency repair work was finally able to start, the damage to the beach was considerably greater that it had been immediately after the tsunami. This resulted in the need for geotextile tubes with a total length of 240 feet to completely close the gap. Figure 4 shows the tsunami damage soon after the event, and Figure 5 shows the completed Geotube installation. Four months after installation, a substantial amount of beach sand had accumulated in front of the Geotubes (Figure 6).

Figure 4.  Tsunami damage at Kuualii Pond

Figure 5. Geotube installation to seal the pond

Figure 6. Beach accretion after four months

**Lanikai Beach Seawalls**

Lanikai beach is well-known for erosion problems at the northern and southern ends of the beach, and the apparent proliferation of seawalls. Less well-known is the accretion of sand at the middle portion of the beach, as shown by a study by the University of Hawaii Coastal Geology Group (UHCGG - Figure 7). The sand has accreted in this area despite the presence of seawalls along most of the reach before and during the accretion. Figures 8 through 10 are photographs of the same property (adjacent to a beach access) in 1963, 2005, and 2012, respectively. Close inspection of Figure 8, a 1963 aerial photograph, shows the waterline up against the seawall north of the beach access. The 2005 aerial photograph shows the dramatic sand accretion that has taken place at this location. Figure 9 is a recent photograph of the seawall buried in sand.

The seawalls probably did not have positive effects on coastal processes, and likely did not actively promote beach accretion. However it is also obvious that they did not cause narrowing of the beach, or otherwise prevent the accretion of sand.

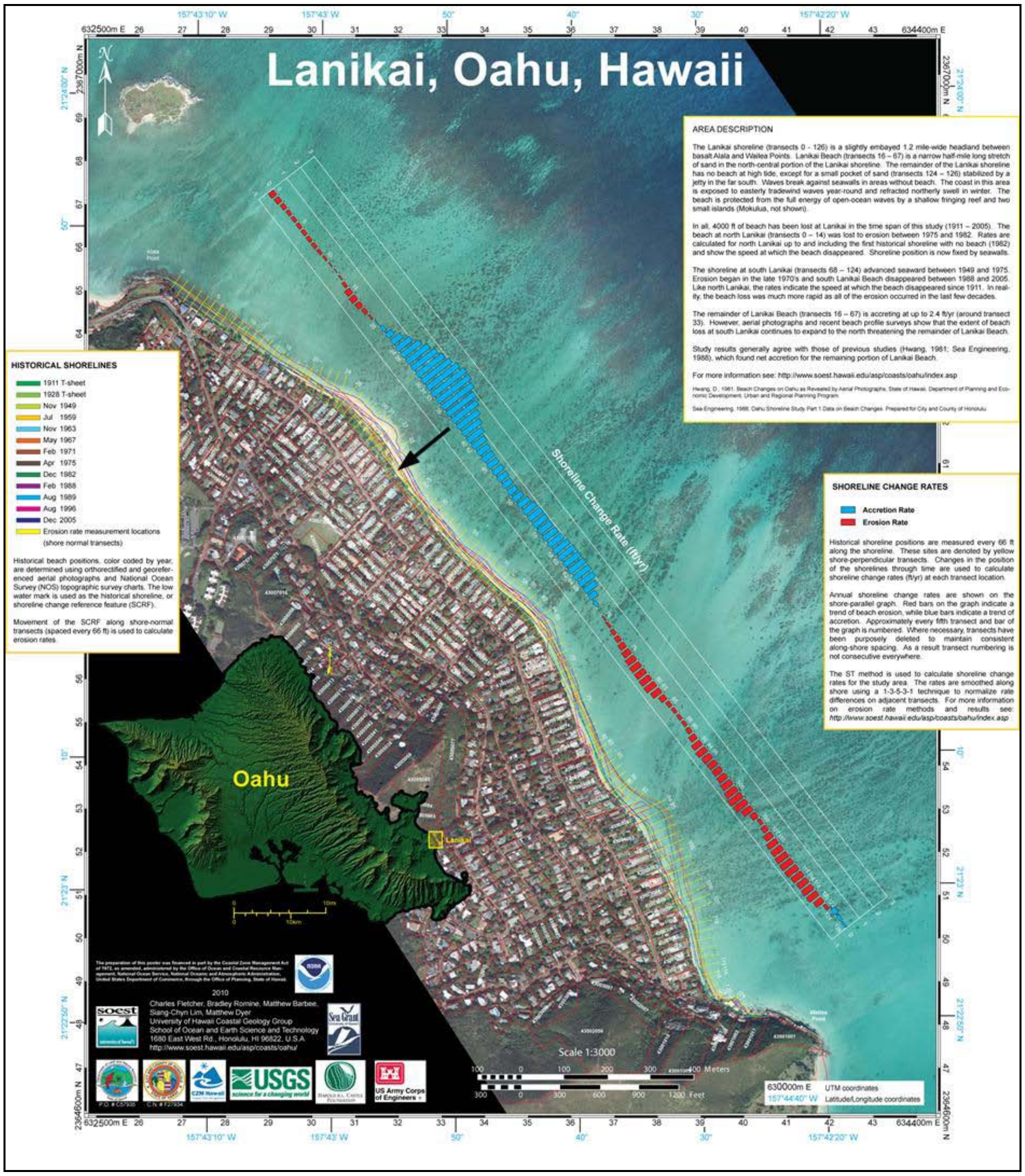


Figure 7. UHCGG Beach erosion study for Lanikai Beach; blue indicates net accretion, arrow shows property location


Figure 7. Lanikai Beach in 1963 with water line at the seawall

Figure 8. Lanikai Beach in 2005

Figure 9. Seawall at beach access location buried in sand

**3.** ***Please provide in the Final EA an alternative plan including beach and dune nourishment with construction of multiple (3 or more) partially-buried groins fronting the subject property. The groins should be of optimal length and spacing to retain seasonally-accreted sand while still allowing sand transport around the ends of the groins. This alternative plan should not include shore-parallel armoring.***

Section 1 and Section 5 of the *Introductory Remarks* establish that:

1. The potential for catastrophe at the Hololani if the property is not protected can not be over-stated. It has been the understanding of the Hololani AOAO, Sea Engineering, Inc. (SEI), DLNR-OCCL, and the MDP since February 2007 that the erosion of the Hololani shoreline constituted an imminent threat to the Hololani building, the situation was an emergency, and that SEI and the Hololani AOAO were pursuing permanent shore protection in the form of a rock revetment.

2. The proper response to the Hololani shoreline condition is shoreline armoring – holding the line. Shoreline stabilization techniques will not ensure the safety of the Hololani buildings.

3. The use of groins or other offshore structures would result in significant marine habitat and coastal processes impacts. Their use is not favorably viewed by federal agencies who have jurisdiction in navigable waters. The proposed shoreline revetment for the Hololani results in the absolute least impact on the marine environment.

The *West Maui Community Plan* (Environment – Objectives and Policies – No. 11, Pg. 22) states:

*Prohibit the construction of vertical seawalls and revetment except as may be permitted by rules adopted by the Maui Planning Commission governing the issuance of Shoreline Management Area (SMA) emergency permits, and encourage beach nourishment by building dunes and adding sand as a sustainable alternative.*

The verbiage clearly gives the MPC latitude to permit the construction of shoreline armoring structures when emergency conditions such as those at the Hololani are present.

The use of geotextile groins to stabilize the shoreline at Stable Road has been presented as a demonstration project to be emulated at the Hololani. The project apparently consists of three groins extending from the shoreline escarpment in front of four properties in the Sprecklesville area of Maui. The property developments consist of single family homes. At least two of the homes are set back 40 to 60 ft from the shoreline (as measured on GoogleEarth). The groin structures are on a long reach of sand shoreline west of Papaula Point, a sand headland with a broad backshore formed by sand and dune features. Between Papaula Point and Kahului Harbor there are 19 groin features including the Stable Road project.

The Stable Road project implemented the use of groins in an area where their use was already widespread. The project has had good results in the last few years in retaining sand provided by local transport processes.

The Stable Road shoreline has its own complexities and history, and is very different from the Kahana shoreline. There are no groins along Kahana Beach. As mentioned in the *Introductory Remarks*, placing a localized groin field in front of the Hololani will inhibit long shore transport and cause retention of sand that is limited in supply, and may cause serious negative far-field impacts on other properties. The federal permitting hurdles are also profoundly difficult.

The value of the Hololani buildings, their size and proximity to the eroding shoreline has resulted in an emergency situation that is not comparable to the problems at Stable Road. As a professional coastal engineering firm, SEI is ethically bound to recommend what is considered sound engineering practice. Shoreline stabilization, including the alternative plan advanced by the DLNR-OCCL, is not an adequate response to the magnitude of the problem at Hololani.

SEI has also solicited opinions from other coastal engineers, including the U.S. Army Corps of Engineers, and Olsen Associates. Every coastal engineer who has reviewed the Hololani project (including the firm of SRK Robinson in 1991) has agreed that shoreline armoring is the proper engineering response to the Hololani problems.

Thank you for your consideration of this project,

J. Barry

James H. Barry, P.E.
Coastal Engineer
Sea Engineering, Inc

4. Comments from UH-SeaGrant

**UNIVERSITY OF HAWAI'I**

Sea Grant College Program
School of Ocean and Earth Science and Technology



July 23, 2012

Mr. Sam Lemmo
DLNR OCCL
1151 Punchbowl Street, Room 131
Honolulu, HI 96813

Dear Mr. Lemmo:

**Subject: Comments on the Draft Environmental Assessment for Permanent Shore Protection of the Hololani Resort Condominiums, TMK (2) 4-3-010:009**

Thank you for the opportunity to comment. In my capacity as the UH Sea Grant Coastal Processes Specialist for Maui and advisor to the County of Maui Planning Department, I have been regularly observing the condition of the shoreline in the Hololani region, as well as many other State and County beach projects. As you consider this current project, I would like to offer my continued technical support to both DLNR and the County of Maui. For your consideration, this letter serves to document some of my observations and concerns related to the project. Overall, the proposed solution has a high potential for impact and alternative solutions, such as sand placement with retention structures, would benefit from further scoping.

The proposed project may be considered a landmark case for Maui since, to my knowledge, there have been no new seawalls erected to protect a private property along a sandy shoreline since the adoption of the Hawaii Coastal Erosion Management Plan (COEMAP) by the Board of Land and Natural Resources in 2000. Additionally, the 1996 West Maui Community Plan discourages the use of seawalls and revetments in favor of alternatives that add sand, such as beach nourishment or dune restoration. Further, the proposed project may influence future decisions of this particular stretch of coastline. A primary concern for the proposed solution is the high likelihood for impacts to neighboring private properties, and the cumulative loss of the public beach resource over time. Therefore, it is of utmost importance to *equally* consider every possible alternative to the highest degree of detail possible.

Identifying any opportunities for collaboration or cost-sharing (for example on a littoral cell basis, such as from Hololani to Kahana Beach) could be an important factor in the consideration of alternative solutions. In fact, neighboring Royal Kahana Condominiums has recently inquired about emergency shoreline protection and has been encouraged by the County of Maui to

Telephone: (808) 956-7031 • Facsimile: (808) 956-3014

develop a long-term erosion control strategy. In my observations, the beach in front of the Royal Kahana Condominiums is currently experiencing a similar type and degree of erosion that triggered Hololani to seek emergency authorization for sandbags in 2007. With the future upon us already, it makes good planning sense to consider the regional opportunities and to assess the collective resources available for those opportunities.

In general, there are four possible consequences of shoreline protection structures, three of which are concerns for the proposed alternative and are explored below:

**Consequence 1: Increased erosion at adjacent properties.**
Protecting Hololani Condominiums may come at the expense of the neighboring properties to the south. This is because the termination of a shore protection structure focuses wave energy on the adjacent properties, which results in increased erosion. This effect is exemplified by the acute erosion along the north end of the Hololani Property and the County drainage easement as a result of the termination of the old Pohailani seawall (north of the drainage easement).

The proposed solution conceptually mitigates the effect of erosion on the adjacent Royal Kahana property to the south by terminating the wall 24 feet before the Royal Kahana property and by using a curved structure footprint.

The following items should be addressed in the final EA to facilitate the consideration of alternatives and determination of impact:

a. Consider providing examples of where this type of mitigation (early termination of wall and curved footprint) has been successful to reduce or eliminate erosion at adjacent properties? Also comment on the significance of the termination distance of 24 feet.
b. Consider providing notification during the EA process to neighbor owners, with solicitation of feedback, regarding the proposed solution and alternatives.

**Consequence 2: Loss of the public beach resource in front of the structure.**
Currently there is a seasonal sandy beach in front of the Hololani Condominiums which tends to be at its widest condition during the late summer months. However, protecting Hololani Condominiums may come at the expense of the public beach resource. This is because waves with high energy that are reflected off of shore protection structures, especially vertical structures, transport sand away from the beach. The apparent loss of beach is showing up already as a possible result of the installation of the temporary sandbag revetment, causing a degraded beach condition at Hololani and possibly

accelerating erosion in front of the Royal Kahana. This is evidenced by comparing photos from 2006 (prior to installation of the sandbag revetment) showing a sandy upper beach that is nearly at grade with Hololani's lawn area to photos from 2012 showing an upper beach that is ~6 feet below the grade of the lawn (figure 1). The photographic evidence suggests that the beach has narrowed and deflated since the installation of the sandbag revetment.


Figure 1. Narrowing and deflation of the beach in front of Hololani Resort, possibly due to installation of the temporary sandbag revetment.

The proposed solution conceptually mitigates this effect by using a hybrid design that includes a vertical component along with a sloped rock revetment. The rock revetment theoretically slows down sand loss, compared to a vertical structure, by disseminating wave energy across a sloped surface and absorbing energy in the openings between the rocks.

The following items should be addressed in the final EA to facilitate the consideration of alternatives and determination of impact:

c. The hybrid seawall/revetment design is the preferred solution over the rock revetment (without a vertical component) due to the smaller horizontal footprint. However, the rock revetment can be accommodated on private property by moving the crest of the structure landward by 9 feet. Since the hybrid design does retain a vertical seawall component and may interact with waves during seasonal high sand conditions, consider providing a comparative assessment of the ability of each design (hybrid versus revetment) to minimize beach loss.
d. Since the report states that the local soils cannot support free-standing concrete or CRM walls, a vinyl material has been selected for the vertical portion of the

hybrid design. I have observed the use of similar vinyl materials for seawall applications in very low-energy environments. Consider providing examples where this material has been used in this application in high-energy environments?

e. The use of sand retention structures, such as groins, is explored in a limited capacity under the beach nourishment option. This "erosion control approach" of structures along with sand has recently been demonstrated on Maui's north shore as a viable option for protecting both private development and public resources. Additionally, groins can be deployed on a temporary basis to assess their ability to retain sand as well as possible impacts, with the eventual option to either remove or make permanent. Fully research and document beach nourishment along with sand retention structures, including multiple design options and costs.

**Consequence 3: Loss of lateral access along the shoreline.**

Under current conditions, access along the shoreline can range from easy during seasonal conditions when the beach is sandy to difficult during seasonal conditions when a sandy beach is not present. The existing sandbag revetment contributes to challenges associated with lateral access. Among County of Maui decision-makers, there is an awareness of and concern for the lack of access to and along the shoreline in the Honokowai region of west Maui. In November 2011, County Council Member Elle Cochran organized a site visit with coastal planners, including Sea Grant, to demonstrate the cumulative loss of access to and along the shoreline in this region due to development and shoreline armoring. Council Member Cochran is seeking solutions to improve coastal access.

The proposed solution conceptually mitigates the loss of lateral access by proposing a revetment crest that utilizes flat stone surfaces.

The following items should be addressed in the final EA to facilitate the consideration of alternatives and determination of impact:

f. With a flat revetment crest, lateral access may still be difficult due large spaces between rocks and occasional submergence of the crest. Consider estimating how often the revetment crest will be submerged under annual tide and wave conditions and with estimates of added sea level.

g. As part of the proposed solution, Hololani could consider providing a public access easement to and along the shoreline behind the structure on private property.

# UNIVERSITY OF HAWAI'I

Sea Grant College Program
School of Ocean and Earth Science and Technology

**Consequence 4: Impoundment of sand.**
Impoundment of sand generally could be a major concern for many Maui beaches if shore protection structures were proposed. In this case, sand impoundment is not a concern since the underlying geology of the area is not sandy and no sand is available inland of the structure to feed the beach.

In light of the possible consequences, please consider opportunities to explore alternative designs where both private development and public resources can be protected. Some of the alternatives may also be more aligned with the west Maui Community Plan and the Hawaii COEMAP, which suggests using "erosion control" approaches – sand and structures together as a system – where feasible.

Should you have any further questions please do not hesitate to contact me at (808) 463-3868.

Sincerely,

Tara Owens
Coastal Processes and Hazards Specialist
University of Hawaii Sea Grant College Program
County of Maui Planning Department

Cc: AOAO of Hololani Resort Condominiums, c/o Stuart Allen
Sea Engineering, c/o James Barry
County of Maui Department of Planning, c/o James Buika

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5. Response to Comments from UH-SeaGrant

**Sea Engineering, Inc.**

Makai Research Pier • Waimanalo, Hawaii 96795-1820 • E-mail: sei@seaengineering.com
Phone: (808) 259-7966 / FAX (808) 259-8143 • Website: www.seaengineering.com

December 4, 2012

Ms. Tara Owens
Coastal Processes and Hazards Specialist
University of Hawaii Sea Grant College Program
County of Maui Planning Department
250 South High Street,
Wailuku, Maui, Hawaii 96793

Dear Ms. Owens,

Subject: Hololani Shore Protection: Response to University of Hawaii Sea Grant College Program Comments on the Draft Environmental Assessment

Thank you for your review of the Draft Environmental Assessment for Permanent Shore Protection of the Hololani Resort Condominium (DEA), dated July 23, 2012. Since that time a hearing was held before the Maui Planning Commission on September 11, 2012 to review the DEA. Comments on the DEA were also received from the Maui County Department of Planning (MDP), the Maui Planning Commission (MPC), the State Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR-OCCL), and the Maui Department of Public Works (DPW). Following are responses to your comments on the project. However, also attached with this document are introductory remarks and background material (see *Introductory Remarks*) meant to eliminate redundancy and provide an in-depth review of the subjects being covered. The introductory remarks consist of four sections:

1. Emergency Status of the Hololani and Understanding of Appropriate Shore Protection
2. Regional Loss of Sand and Shoreline Erosion
3. Coastal Armoring and Beach Loss
4. The Domino Effect
5. Consideration Of Appropriate Alternatives

The concerns of UH-Sea Grant fall into three consequences and some ancillary comments.

***Consequence 1: Increased erosion at adjacent properties.***

**a.** ***Consider providing examples of where this type of mitigation (early termination of wall and curved footprint) has been successful to reduce or eliminate erosion at adjacent properties. Also comment on the significance of the termination distance of 24 ft.***

The curved footprint of the end of the revetment is not specifically designed to mitigate erosion effects, but is a technique known as a "return" used to end the structure in a way that does not leave it vulnerable to damage. The curved design allows the design section to be maintained until it is butted into a sealing surface – in this case the vertical sheet pile wall. However, the design will also help to absorb and dissipate wave energy through turbulence and friction, as well as dissipate reflected wave energy through radiation.

There are no standard design guidelines for ending a structure such as the proposed preferred alternative in order to mitigate erosion to adjacent properties, and Sea Engineering, Inc. (SEI) can provide no similar examples. SEI has designed the structure to provide protection to the Hololani buildings and minimize the effects on the adjacent property to the best of our coastal engineering knowledge.

For the south termination, the sheet pile wall is extended mauka at an angle for 20 ft from the termination such that it will fully protect the south building and keep the revetment from being flanked (Figure 1). The wall will be exposed at the shoreline escarpment, but will be quickly buried as it extends mauka. The design will minimize excavation and leave the existing ground on the exterior face of the wall mostly undisturbed and therefore more resistant to erosion. Some erosion can be tolerated in this area, but additional protection will be favored using the flexible Tensar rock mattresses, and extending them into the Royal Kahana property. The property line area is has been effectively protected by Tensar mattresses since 2007 as part of the temporary shore protection installation (see Figure 2). The undisturbed gap between the property line and the buried sheet pile wall will be used as a shoreline access point (see Figure 1).

There is really no method available to accurately predict the effects of the revetment termination on the adjacent shoreline. As a crude estimate, end effects are not likely to extend beyond a wavelength from the structure. Half a wavelength, or somewhere between 50 and 100 ft is probably a more realistic estimate, with effects decreasing with distance. The primary consideration in the termination design was to fully protect the south building and yet leave room for potential erosional effects to be contained as much as possible on the Hololani property. The 24-ft gap between the revetment termination and the property line was the result of adjustments to the angle and length of the sheet pile wall extension. Figure 1 shows a schematic representation of what the end effect erosion might look like. The 10-year and 20-year erosion lines are based on an average of 0.8 ft per year erosion rate from a 2001 Sea Engineering study (see DEA, Section 4.1.12).

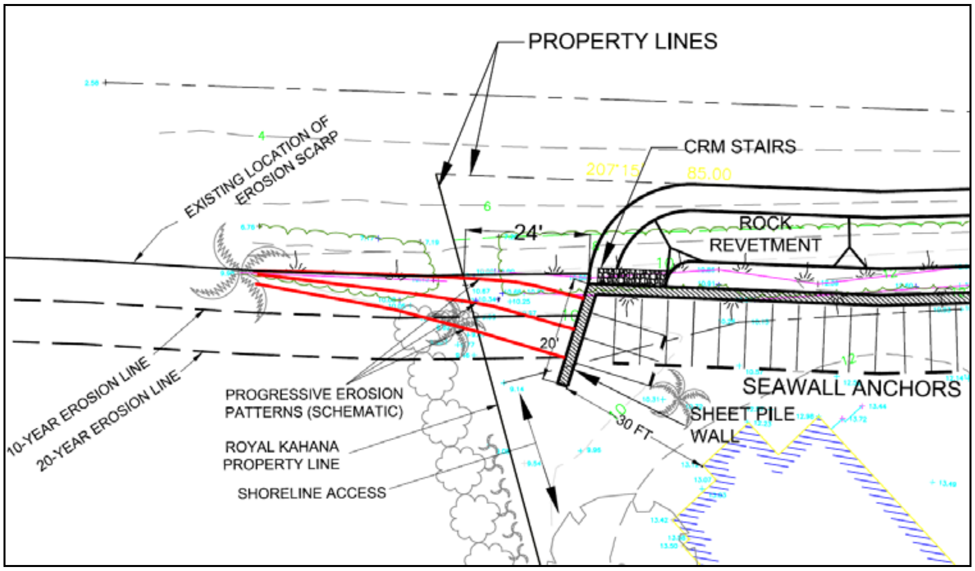


Figure 1. South end termination and schematic of end effect erosion

Figure 2. Tensar mattresses at Royal Kahana near the property boundary obscured by Naupaka vegetation

**b.** ***Consider providing notification during the EA process to neighbor owners, with solicitation of feedback, regarding proposed solutions and alternatives.***

The Hololani AOAO and SEI conducted a community outreach meeting on September 10, 2012 at the Hololani. Notices were sent to all neighboring properties, relevant management companies, and also posted on local community bulletin boards.

***Consequence 2: Loss of public beach resource in front of the structure.***
The *Introductory Comments* contain a substantial discussion on the disappearing sand resources at Kahana Beach, the nature of the erosion, the naturally hardened shoreline, and the effect of the structure on coastal processes. The photographs shown in Figure 1 of the comments are not diagnostic of beach narrowing or deflation. The shoreline is in constant dynamic flux in response to seasonal wave forcing, and the two photographs shown are simply moments in time showing different stages in that dynamic cycle. However, given the on-going regional depletion of sand resources, it is likely that there will be continued loss of beach throughout the area.

**c.** ***The hybrid seawall/revetment design is the preferred solution over the rock revetment (without a vertical component) due to the smaller horizontal footprint. However, the rock revetment can be accommodated on private property by moving the crest of the structure landward by 9 feet. Since the hybrid design does retain a vertical seawall component and may interact with waves during seasonal high sand conditions, consider providing a comparative assessment of the ability of each design (hybrid versus revetment) to minimize beach loss.***

During seasonal high sand conditions the revetment portion of the hybrid structure will likely be buried in sand, and accreted sand will form a wave swash run-up ramp that will allow wave dissipation through turbulent friction and suspension of sand, as well as deposition by percolation through the porous sand substrate. Once a sand beach is "seeded" the accretion process becomes easier. The higher the sand beach, the less interaction will occur with the structure. During low sand conditions, much of the revetment portion will be exposed and will interact with incident waves. Wave action against the vertical portion of the wall will occur primarily during high storm wave conditions. These are the conditions that presently promote denudation of the beach (i.e. typically sand transport to the south). Predictions are difficult due to the many parameters involved – wave height, period, and direction, tidal stage, beach condition – but there will probably be little difference in beach response between the two designs (hybrid and full revetment). It is also thought that the revetment transition to a flat crest at +6 ft will help cause additional dissipation of wave energy and have a tendency to collect wave-borne sand.

d. ***Since the report states that the local soils cannot support free-standing concrete or CRM walls, a vinyl material has been selected for the vertical portion of the hybrid design. I have observed the use of similar vinyl materials for seawall applications in very low-energy environments. Consider providing examples where this material has been used in this application in high-energy environments.***

Vinyl sheet pile has been in use since the late 1980's. The thickness of the material, manufacturing process, and applications evolved through the 1990's. Because of it's low cost and non-corrodible properties, the material has been used for many coastal projects, including bulkheads, seawalls and flood control. The U.S. Army Corps of Engineers conducted extensive review and testing of the material in the early to mid-2000's, including the following papers:

Dutta, P.K. and Vaidya, U., (2003), A study of the longterm applications of vinyl sheet piles, ERDC/CRREL 2003 Report LR-03-19, available through internet:
http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/LR-03-19.pdf

Dutta, P.K., Zabilansky, L.J.m Wright, T.W., Brandstetter, C., and Bivona, J.C. Jr., (2005) *Interim Report, General Design Guide: PVC Sheet Pile*; ERDC/CCRREL Interim Report

Use of vinyl and composite sheet pile in exposed wave environments has gradually increased in the marine construction industry (CMI - Crane Materials International - personal communication). Most open coast applications to date have been on the East Coast and Gulf Coast (i.e. Florida Panhandle) areas. For long-term applications the vinyl material is manufactured using a co-extrusion process, whereby a surface layer of UV-resistant material is bonded to a thicker core. Figure 2 shows the construction of a sheet pile wall in the Florida Panhandle after erosion from the nearby passage of Hurricane Dennis in 2005. A completed wall in the same area is shown in Figure 3. In both of these cases the wall is composed of more rigid composite material (i.e. fiberglass reinforced) rather than vinyl due to the vertical exposure of the sheets. Figure 4 shows a vinyl sheet pile wall in the Seattle area.

The preferred alternative would be the first use of the material on an open coast in Hawaii, although a vinyl wall design will soon be under construction in Kaneohe Bay. The design is therefore conservative, with use of the thickest sheet pile material available, armor rock to buttress and strengthen the sheet pile, and protection to prevent scour behind the wall during wave overtopping conditions.

Figure 2. Sheet pile seawall construction on the Florida Panhandle coast

Figure 3. Completed sheet pile seawall on the Florida Panhandle coast

Figure 4. Vinyl sheet pile seawall in the Seattle area

e. ***The use of sand retention structures, such as groins, is explored in a limited capacity under the beach nourishment option. This "erosion control approach" of structures along with sand has recently been demonstrated on Maui's north shore as a viable option for protecting both private development and public resources. Additionally, groins can be deployed on a temporary basis to assess their ability to retain sand as well as possible impacts, with the eventual option to either remove or make permanent. Fully research and document beach nourishment along with sand retention structures, including multiple design options and costs.***

The *Introductory Remarks* provide background and detail explaining why many of the alternatives suggested by reviewers, including those mentioned, are not favorably viewed from a coastal engineering perspective. Section 1 and Section 5 of the *Introductory Remarks* establish that:

1. The potential for catastrophe at the Hololani if the property is not protected can not be over-stated. It has been the understanding of the Hololani AOAO, Sea Engineering, Inc. (SEI), DLNR-OCCL, and the MDP since February 2007 that the erosion of the Hololani shoreline constituted an imminent threat to the Hololani building, the situation was an emergency, and that SEI and the Hololani AOAO were pursuing permanent shore protection in the form of a rock revetment.

2. The proper response to the Hololani shoreline condition is shoreline armoring – holding

the line. Shoreline stabilization techniques will not ensure the safety of the Hololani buildings.

3. The use of groins or other offshore structures would result in significant marine habitat and far field coastal processes impacts. Their use is not favorably viewed by federal agencies who have jurisdiction or review projects in navigable waters. The proposed shoreline revetment for the Hololani results in the absolute least impact on the marine environment.

While SEI is supportive of a regional beach nourishment project to restore the Kahana littoral cell and head off future erosion problems, shoreline stabilization alone is not an adequate response to the magnitude of the exposure at the Hololani. The value of the Hololani buildings, and their size and proximity to the eroding shoreline has resulted in an emergency situation that is not comparable to the problems existing on the north shore of Maui. As a professional coastal engineering firm, SEI is ethically bound to recommend what is considered sound engineering practice. SEI has further consulted with the USACE and another prominent coastal engineering firm (Olsen Associates, Inc.). All coastal engineers who have reviewed the Hololani project are in agreement that shoreline armoring is the proper response. Further development of shoreline stabilization options such as beach nourishment with retention structures can be pursued in a regional context with the participation of all stakeholders, but does not meet the immediate needs of the Hololani AOAO.

***Consequence 3: Loss of lateral access along the shoreline.***

f. ***With a flat revetment crest, lateral access may still be difficult due to large spaces between rocks and occasional submergence of the crest. Consider estimating how often the revetment crest will be submerged under annual tide and wave conditions and with estimates of added sea level.***

***g. As part of the proposed solution, Hololani could consider providing public access easement to and along the shoreline behind the structure on private property.***

Lateral access along the native shoreline is good when sand is present, and poor as well as potentially dangerous when the beach is denuded. The crest of the structure will let able-bodied persons negotiate lateral access when conditions permit. The difficulties due to voids between armor stones can be minimized by instructing the contractor to place stones with a flat surface facing upward, and to fit the stones to minimize voids along the crest. However, in common with all rocky shoreline access, there may always be an element of danger during high wave conditions, and good judgment should be exercised.

Trying to estimate how often the revetment crest is submerged or affected by wave overtopping is possible as an academic exercise, but would be complex and probably not particularly accurate or useful. Most of the year the nearshore area is quite calm or has small wave heights. The winter season high wave climate can vary dramatically from year to year, as the north facing exposure window is limited in width and is open to particular storm events from the north and northeast that are less in common most years than the typical northwest winter swell direction.

The Hololani has agreed to provide shoreline access along the south property line as the project moves forward. There are some access issues in the immediate area of the south property line due to the parking garage driveway that will either need to be accommodated or alternative routes found around the administration building. Three route alternatives are shown in Figure 5.

Ingress and egress at the south end of the structure is a better option than promoting access along the length of the property:

1. During low sand conditions, the sand often ends near the south property boundary
2. The shoreline north of the Hololani – from Pohailani to Kaea Point rarely has sand and is fronted by seawalls
3. Establishing a pathway near the south boundary will allow the Hololani to keep some privacy and allow outside users to not feel that they are trespassing

During low sand conditions, access on the native beach past the southern boundary will be difficult due to existing rocky conditions. Fishermen and other able-bodied persons can proceed along the revetment crest at +6 ft MSL if so desired. During high sand conditions, the beach will provide lateral access.

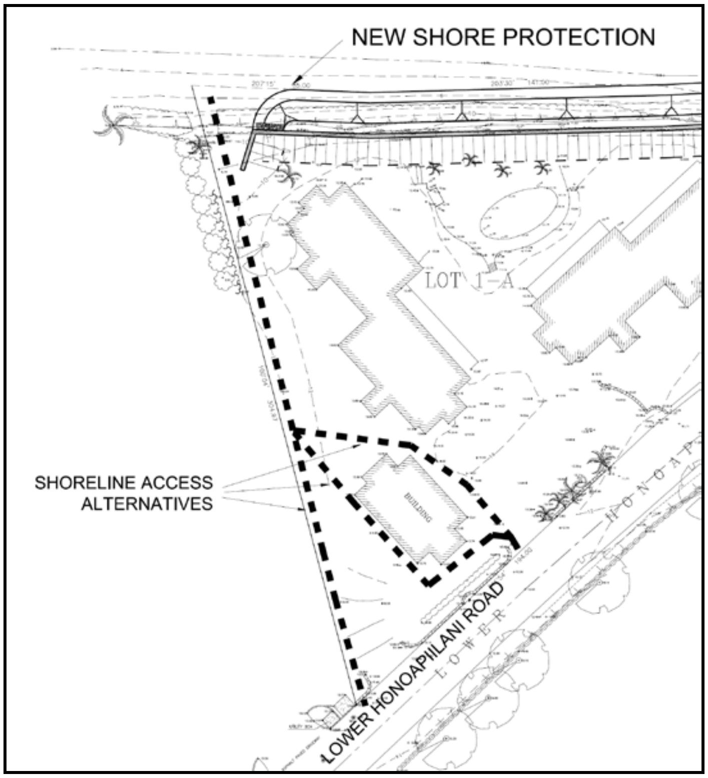


Figure 5. Shoreline access alternatives

Thank you for your review of the DEA, and consideration of this project. Please feel free to contact me should there be further questions.

James H. Barry, P.E.
Coastal Engineer
Sea Engineering, Inc.

Cc: DLNR-OCCL

6. Comments from the County of Maui Department of Planning

ALAN M. ARAKAWA
Mayor

WILLIAM R. SPENCE
Director

MICHELE CHOUTEAU McLEAN
Deputy Director

COUNTY OF MAUI

# DEPARTMENT OF PLANNING

July 23, 2012



Mr. Samuel J. Lemmo, Administrator
Office of Coastal Lands
Department of Land and Natural Resources
Post Office Box 621
Honolulu, Hawaii 96809

Dear Mr. Lemmo:

**Subject: REQUEST FOR COMMENTS ON DRAFT ENVIRONMENTAL ASSEMENT FOR PERMANENT SHORE PROTECTION OF THE HOLOLANI RESORT CONDOMINIUMS, TMK: (2) 4-3-010:009 (Draft EA for MA-12-252) (RFC 20120097)**

Thank you for the opportunity to comment on the Draft Environmental Assessment (EA) for the Permanent Shore Protection of the Hololani Resort Condominiums, received by the Department of Planning (Department) on June 29, 2012.

In 2007, in coordination with the State Department of Land and Natural Resources (DLNR), the Department issued a Special Management Area (SMA) Emergency Permit, SM3 2007/0001, to allow placement of gravel "mattresses" and sand bags as a temporary solution to protect the Hololani shoreline from further erosion, caused by an episodic storm event. In addition, the Department has made periodic site visits to the shoreline since 2007 in regards to additional SMA Permits issued to modify the temporary shoreline protection in order to ensure protection of the two (2) eight (8) story structures. On July 18, 2012, in preparation for these comments, the Department completed a site visit to the Hololani Resort Condominium shoreline to observe and understand the shoreline condition that is the subject of the EA. Included on the site visit were the Deputy Planning Director and the University of Hawaii Sea Grant Agent – Maui. The condition of the beach fronting Hololani was very deflated – there was very limited beach sand present in front of the sand bags. A vertical scarp of approximately six feet to eight feet (6'-8') has been created by the sand bags' temporary protection.

The Department provides the following comments on the Draft EA:

1. The Department agrees that the DLNR is the Accepting Agency for the Hololani EA since most of the alternatives for the proposed project will likely occur at least partially on State Conservation Land, makai of the present shoreline. However, the EA is also a requirement of the *Special Management Area Rules for the Maui Planning Commission*, Subchapter 3, <u>Variances</u>. The Applicant and Applicant's Representative have been working closely with the Department over the past several years and understand that any substantial protection project in the Shoreline Setback Area will require a SMA Major

Use Permit (SM1) and a Shoreline Setback Variance (SSV). Both of these permits require a public hearing that will be scheduled for review by the Maui Planning Commission following completion of the current EA process;

2. In order to brief the Maui Planning Commission (Commission) on the various possible alternatives for shoreline protection, the Department requests that the Applicant present the Draft EA to the Commission as a courtesy at the regularly scheduled meeting on August 28, 2012 in order to gain additional input and to answer Commission questions. **To prepare for this review, the Department requests that 15 hard copies of the Draft EA be sent to the Department no later than August 3, 2012 to be distributed to the Commission two (2) weeks before the scheduled meeting**. This distribution will also include the Department of Public Works (DPW), in an advisory capacity to the Commission, who should be aware of and comment on this project (see no. 3 below). Please coordinate with Mr. Jim Buika, Staff Planner, for this presentation;

3. In addition, the contiguous County drainage easement at the north end of the property boundary is a drainage culvert that passes under Lower Honoapiilani Road and is in need of repair. Repairs to this culvert are the responsibility of the DPW. **Please send the Draft EA to the DPW for review and comment.** Please discuss possible collaborative solutions with DPW for this drainage problem.

4. We would also recommend that you provide copies of the Draft EA to the County of Maui Department of Environmental Management and to Councilmember Elle Cochran for review and comment.

5. The Department notes that DLNR transmitted the Draft EA for comment to only four (4) agencies. For your information, as part of the SMA Permit and SSV process, the Department will distribute the County permit applications more widely to County, State, and Federal agencies, including the Department of Health and US Fish and Wildlife Service.

6. As part of the Final EA, to provide a complete public record, please include every agency comment letter that you received, as well as your responses to each of these letters.

7. Please fully analyze the West Maui Community Plan for project consistency. The West Maui Community Plan was not fully addressed in the Draft EA. In particular, please respond to the Environmental Objectives and Policies regarding prohibiting sea walls and encouraging beach nourishment as an alternative to sea walls. The Department asks that you analyze the impacts of the proposed sea wall and the likelihood that it would cause further erosion to adjacent shoreline properties along the 0.4 miles of sandy beach shoreline directly to the south. The Department notes that there are five (5) or six (6) major condominiums to the south, with limited natural beach shoreline, that could be jeopardized by additional erosion triggered by the addition of the proposed seawall. These additional neighboring structures, to the south, are also built closely to the eroding

shoreline and may be impacted by the proposed Hololani sea wall. The Department observed on July 18, 2012 that the beach profile to the south was very steep, with limited sandy beaches, and with no sand fronting Hololani;

8. The Department asks the Applicant to study methods for building the sand volume in front of the Hololani as the alternative protection method. The Department does not favor the construction of a seawall at Hololani. The Department considers a seawall as a last resort, and asks that the Applicant fully explore additional alternatives. One of the purposes of the draft EA is to describe and document alternatives for the permanent shoreline protection, describe benefits and costs, and to research the environmental impacts of the various alternative proposed solutions;

9. The Department is very interested in exploring at least two (2) additional alternative designs: a system of groins or an offshore breakwater, either of which could initially be temporary in nature, constructed of sand-filled geotubes. Both of these configurations, temporarily deployed for one (1) or two (2) years, would provide a baseline understanding for how Hololani can be protected by redirecting or dissipating damaging wave energy by creating an offshore, lessened, wave-energy environment that promotes sand accretion in front of Hololani, rather than sand erosion. If the temporary solution works, then the Applicant could apply for a permanent structure. The Draft EA does describe that there is adequate sand in the littoral cell system but that it moves substantially with seasonal wave action, leading to only seasonal sand loss in front of Hololani. Thus, sand is present in the system and solutions should be studied to capture and hold sand in front of Hololani as well as solutions to lessen the impact of wave energy on the eroding shoreline. This type of groin system or offshore breakwater solution should be considered in conjunction with additional sand nourishment options;

10. Consult with United States Army Corps of Engineers, Honolulu on possible temporary and permanent groin and offshore breakwater configurations that would satisfy the Department's desired outcome, as described in Comment 9, above. Please document meetings with the US Army Corps of Engineers on these consultations;

11. For the various proposed alternatives, provide an informative table describing the various costs and benefits and pros and cons of each alternative for comparative analysis;

12. For the Final EA, please document any public or community meetings to date. No community meetings or public outreach were documented in the Draft EA. Also, the Department suggests conducting meetings with the several neighboring condominiums to present the proposed project to them, gain their feedback and answer their questions. As part of the Final EA, document the community meeting(s), questions and concerns from the neighbors and community about the project, and your responses; and

13. For both the State permit process and the County permit process, following the Chapter 343 process, the Department encourages the Applicant, in conjunction with the Department, to lead a site visit to the Hololani shoreline for relevant personnel from the State of Hawaii and the Commission to understand the shoreline conditions as well as to understand the potential impact to properties to the south along the shoreline from the proposed seawall.

Please address each of the above requests in the Final EA.

Thank you for your cooperation. If additional clarification is required, contact Staff Planner James A. Buika at james.buika@mauicounty.gov or at (808) 270-6271.

Sincerely,

William Spence
Planning Director

xc: Michele Chouteau McLean, Deputy Planning Director (PDF)
Clayton I. Yoshida, AICP, Planning Program Administrator (PDF)
Aaron H. Shinmoto, Planning Program Administrator (PDF)
James A. Buika, Staff Planner (PDF)
Kathleen Ross Aoki, Planner (PDF)
Carolyn Takayama-Corden, Secretary to Maui Planning Commission (PDF)
Rowena Dagdag-Andaya, Deputy Director, Department of Public Works
The Honorable Council Member Elle Cochran
Tara Owens, University of Hawaii Sea Grant Agent – Maui (PDF)
DLNR Land Division – Maui
US Army Corps of Engineers, Honolulu
Mr. Jim Barry, Sea Engineering, Inc. Honolulu
Project File
General File

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7. Response to Comments from the County of Maui Department of Planning

**Sea Engineering, Inc.**

Makai Research Pier • Waimanalo, Hawaii 96795-1820 • E-mail: sei@seaengineering.com
Phone: (808) 259-7966 / FAX (808) 259-8143 • Website: www.seaengineering.com

December 4, 2012

Mr. William Spence, Director
County of Maui, Department of Planning
250 South High Street,
Wailuku, Maui, Hawaii 96793

Dear Mr. Spence,

Subject: Hololani Shore Protection: Response to County of Maui Department of Planning Comments on the Draft Environmental Assessment for Permanent Shore Protection of the Hololani Resort Condominiums, TMK: (2) 4-3-010:009

Thank you for your review of the Draft Environmental Assessment for Permanent Shore Protection of the Hololani Resort Condominium (DEA), dated July 23, 2012. Since that time a hearing was held before the Maui Planning Commission on September 11, 2012 to review the DEA. Comments on the DEA were also received from the State Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR-OCCL), the Maui Planning Commission (MPC), University of Hawaii Sea Grant Program (UH-Sea Grant) and the Maui Department of Public Works (DPW). Following are responses to your comments on the project. However, attached with this document are introductory remarks and background material (see attached *Introductory Remarks*) meant to eliminate redundancy and provide an in-depth review of the subjects being covered. The introductory remarks consist of four sections:

1. Emergency Status of the Hololani and Understanding of Appropriate Shore Protection

2. Regional Loss of Sand and Shoreline Erosion

3. Coastal Armoring and Beach Loss

4. The Domino Effect

5. Consideration Of Appropriate Alternatives

The County of Maui Department of Planning (the Department) has provide thirteen observations or comments on the project.

1. **The project will need a County Special Management Area Use Permit (SM1) and a Shoreline Setback Variance (SSV). Both permits will require a public hearing and review by the Maui Planning Commission following completion of the EA process.**

The need for both an SM1 and SSV permit are recognized and understood.

2. **Request for presentation of the Draft Environmental Assessment (DEA) before a regularly scheduled meeting of the Maui Planning Commission (MPC).**

The DEA was presented to the Maui Planning Commission as requested on September 11, 2012.

3. **Request for review and comments on the DEA by the County of Maui Department of Public Works (DPW), and possible collaborative solutions to north end drainage problems.**

Both the DEA and a preliminary environmental document were sent to the DPW. Comments were received from the DPW on October 16, 2012. Response to those comments will be included in the Final EA. DPW is in favor of the alternative configuration shown in Figure 2-7 of the DEA. The project will work with DPW on the final design.

4. **Recommendation to provide copies of the Draft EA to the County of Maui Department of Environmental Management and to Councilmember Elle Cochran.**

Copies of the DEA were sent as requested. Councilmember Elle Cochran was invited to a community outreach held at the Hololani on September 10, 2012.

5. **Notes on distribution of the DEA; the County will be distributing SMA and SSV permit applications to other County, State, and Federal Agencies, including the Department of Health (DOH) and the U.S. Fish and Wildlife Service (USFW).**

The comment is duly noted. The project will be coordinating with the DOH as well as federal agencies.

6. **Note to include every agency comment letter and responses in the Final EA.**

The comment is duly noted. All comment letters and responses will be included in the Final EA.

7. ***Please fully analyze the West Maui Community Plan for project consistency. The West Maui Community Plan was not fully addressed in the Draft EA. In particular please respond to the Environmental Objectives and Policies regarding prohibiting sea walls and encouraging beach nourishment as an alternative to sea walls.***

The *West Maui Community Plan* (Environment – Objectives and Policies – No. 11, Pg. 22) states:

*Prohibit the construction of vertical seawalls and revetment except as may be permitted by rules adopted by the Maui Planning Commission governing the issuance of Shoreline Management Area (SMA) emergency permits, and encourage beach nourishment by building dunes and adding sand as a sustainable alternative.*

The verbiage in the Community Plan clearly gives the MPC latitude to permit the construction of shoreline armoring structures when emergency conditions such as those at the Hololani are present.

Beach nourishment is encouraged as a regional solution involving all of the regional property owners, as well as the State and the County. It is not, however, feasible for the immediate, urgent need of protecting the Hololani.

***The Department asks that you analyze the impacts of the proposed sea wall and the likelihood that it would cause further erosion to adjacent shoreline properties along the 0.4 miles or sandy each shoreline directly to the south. The Department notes that there are five (5) or six (6) major condominiums to the south, with limited natural beach shoreline, that could be jeopardized by additional erosion triggered by the addition of the proposed seawall. These additional neighboring structures to the south, are also built closely to the eroding shoreline and may be impacted by the proposed Hololani sea wall.***

A discussion of local and far-field erosion effects is contained in the *Introductory Comments*, Section 4 – The Domino Effect. While some near-field effects on the Royal Kahana shoreline are expected, any far-field effects would likely be caused by the on-going regional problem of diminishing sand resources. Mitigation of near-field "end effects" is integrated into the structure design at the south end.

***The Department observed on July 18, 2012 that the beach profile to the south was very steep, with limited sandy beaches, and with no sand fronting Hololani;***

The Hololani is the effective northern end of the Kahana littoral cell, and is therefore sensitive to different incident wave conditions. The beach is in a constant state of change, and the no-sand condition has been previously documented (see June 22 letter from MDP, SM3-2007/001 and SSA 2007/0019). After sustained southern swell or some Kona storm conditions, the sand in front of the Hololani often becomes abundant.

8. ***The Department asks the Applicant to study methods for building the sand volume in front of the Hololani as the alternative protection method. The Department does not favor the construction of a seawall at Hololani. The Department considers a seawall as a last resort, and asks that the Applicant fully explore additional alternatives. One of the purposes of the draft EA is to describe and document alternatives for the permanent shoreline protection, describe benefits and costs, and to research the environmental impacts of the various alternative proposed solutions.***

Section 1 and Section 5 of the *Introductory Remarks* establish that:

1. The potential for catastrophe at the Hololani if the property is not protected can not be over-stated. It has been the understanding of the Hololani AOAO, Sea Engineering, Inc. (SEI), DLNR-OCCL, and the Department since February 2007 that the erosion of the Hololani shoreline constituted an imminent threat to the Hololani building, the situation was an emergency, and that SEI and the Hololani AOAO were pursuing permanent shore protection in the form of a rock revetment.

2. The proper response to the Hololani shoreline condition is shoreline armoring – holding the line. Shoreline stabilization techniques, including beach nourishment, will not ensure the safety of the Hololani buildings. Beach nourishment is encouraged as a regional solution involving all of the regional property owners, as well as the State and the County. It is not, however, feasible for the immediate, urgent need of protecting the Hololani.

3. The use of groins or other offshore structures would result in significant marine habitat and coastal processes impacts. Their use is not favorably viewed by the federal agencies that have jurisdiction in navigable waters. The proposed shoreline revetment for the Hololani results in the absolute least impact on the marine environment.

Please note that in the June 22, 2007 letter from the Department granting a Special Management Area (SMA) emergency permit the Department suggested a revetment for protection of the Hololani. In the DEA, SEI recommends a regional beach nourishment program to prevent future problems in the Kahana littoral cell. However, beach nourishment alone is not an adequate response to ensure the safety of the Hololani buildings.

9. ***The Department is very interested in exploring at least two (2) additional alternative designs: a system of groins or an offshore breakwater, either of which could initially be***

***temporary in nature, constructed of sand-filled geotubes. Both of these configurations, temporarily deployed for one (1) or two (2) years, would provide a baseline understanding for how Hololani can be protected by redirecting or dissipating damaging wave energy by creating an offshore, lessened, wave-energy environment that promotes sand accretion in front of Hololani, rather than sand erosion. If the temporary solution works, then the Applicant could apply for a permanent structure. The Draft EA does describe that there is adequate sand in the littoral cell system but that it moves substantially with seasonal wave action, leading to only seasonal sand loss in front of Hololani. Thus, sand is present in the system and solutions should be studied to capture and hold sand in front of Hololani as well as solutions to lessen the impact of wave energy on the eroding shoreline. This type of groin system or offshore breakwater solution should be considered in conjunction with additional sand nourishment options;***

The attached *Introductory Remarks* (Section 5 – Consideration of Appropriate Alternatives) describes the use of alternative structures, including groins and offshore breakwaters and why they are not appropriate protection for the Hololani. Not only will these alternatives not ensure the safety of the Hololani buildings, they have potentially great far-field impacts on other properties on Kahana Beach, and have other substantial environmental impacts that make it difficult to receive federal permits. The proposed shoreline revetment for the Hololani results in the absolute least impact on the marine environment.

In addition, the condition of both the County emergency SMA and the State emergency authorization for temporary shore protection was that the Hololani actively pursue a long term design for protection of its property.

Descriptions in the DEA are not meant to imply that there is adequate sand in the littoral cell. The diminishing sand resources are thought to be the underlying cause of the erosion problems at the Hololani and elsewhere along Kahana Beach. The use of retention structures that inhibit long shore transport of sand can potentially cause serious down-drift erosion problems: sand that is retained at the Hololani is done so at the expense of other portions of the beach.

Beach nourishment is encouraged as a regional solution involving all of the regional property owners, as well as the State and the County. However, it is not feasible for the immediate, urgent need of protecting the Hololani. The use of groins or other retention structures would need careful study to determine if their use would be appropriate.

10. ***Consult with United States Army Corps of Engineers, Honolulu on possible temporary and permanent groin and offshore breakwater configurations. that would satisfy the Department's desired outcome, as described in Comment 9, above. Please document meetings***

***with the US Army Corps of Engineers on these consultations;***

SEI met with a coastal engineer from the Unite States Army Corps of Engineers on October 25, 2012. A memorandum for the record is attached and will be included in the Final EA.

11. ***For the various proposed alternatives, provide an informative table describing the various costs and benefits and pros and cons of each alternative for comparative analysis;***

A comparison of alternatives table is presented at the end of this document.

12. ***For the Final EA, please document any public or community meetings to date. No community meetings or public outreach were documented in the Draft EA. Also, the Department suggests conducting meetings with the several neighboring condominiums to present the proposed project to them, gain their feedback and answer their questions. As part of the Final EA, document the community meeting(s), questions and concerns from the neighbors and community about the project, and your responses;***

A Community Outreach meeting was held at the Hololani on September 10, 2012.

13. ***For both the State permit process and the County permit process, following the Chapter 343 process, the Department encourages the Applicant, in conjunction with the Department, to lead a site visit to the Hololani shoreline for relevant personnel from the State of Hawaii and the Commission to understand the shoreline conditions as well as to understand the potential impact to properties to the south along the shoreline from the proposed seawall.***

A site visit was conducted at the Hololani on September 10, 2012, with the invitation extended to relevant personnel.

Thank you for your review of the DEA, and consideration of this project. Please feel free to contact me should there be further questions.

J. Barry

James H. Barry, P.E.
Coastal Engineer
Sea Engineering, Inc.

Cc: DLNR-OCCL

**Table 1. Comparison of Alternatives**

| Alternative | SEI Rating | Pros | Cons | ROM Costs |
|---|---|---|---|---|
| 1. Hybrid Seawall/Revetment | Preferred | • Combines qualities of revetment and seawall:<br>• Shoreline armoring (maximum protection);<br>• Minimize reflection;<br>• Minimize coastal footprint;<br>• Minimal impact on coastal processes;<br>• Rugged, adaptable structure<br>• Provides lateral access<br>• Least impact on marine environment | • May have minor erosion effect on neighboring property | $2M |
| 2. Revetment | Second Preferred | • Shoreline armoring (maximum protection);<br>• Minimize reflection;<br>• Minimal impact on coastal processes;<br>• Rugged, adaptable structure | • 30% greater footprint than (1);<br>• May have minor erosion effect on neighboring property | $1.8M |
| 3. Seawall | Not Appropriate | • Minimum footprint<br>• Shoreline armoring (maximum protection) | • Weak soils will not support gravity wall – bulkhead style only;<br>• Maximum reflection;<br>• May have minor erosion effect on neighbor property;<br>• Large vertical drop | $1M - $2M |
| 4. Beach Nourishment | Not Appropriate (regional solution only) | • Will improve beach quality;<br>• Regional application will solve regional problems | • Shoreline stabilization only – will allow additional erosion at Hololani; does not ensure adequate protection<br>• Will require sand source;<br>• Must be regional: local application will spread over entire littoral cell; Requires participation of all stakeholders including County and State agencies. | $3M - $5M |
| 5. Beach Nourishment w/ Structures | Not Appropriate (requires study) | • Will create semi-permanent beach cells | • Shoreline stabilization only – will allow additional erosion at Hololani;<br>• High impact on marine environment;<br>• Will require sand source;<br>• Will have profound far-field effects – needs detailed study;<br>• Will change beach aesthetics and viewplane;<br>• Difficult federal permit process<br>• Most appropriate as a regional solution. | $10M |
| 6. Offshore Breakwater | Not Appropriate | • None | • Shoreline stabilization – will allow additional erosion at Hololani;<br>• High impact on marine environment;<br>• Will require sand source (if used with beach nourishment);<br>• Will have profound far-field effects – needs detailed study<br>• Will change beach aesthetics and viewplane;<br>• Difficult federal permit process;<br>• May cause localized current formation (safety hazard) | Unknown ($1.5M - $3M) |
| 7. Artificial Reef | Not Appropriate | • None | • Unproven as shore protection – will allow additional erosion at Hololani;<br>• High impact on marine environment;<br>• Far-field effects unknown– needs detailed study;<br>• Difficult federal permit process | Unknown ($1M - $5M) |

8. Memorandum of meeting with U.S. Army Corps of Engineers, October 25, 2012

**_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*

# Memorandum

DATE: November 29, 2012

TO: Memorandum for the Record
Hololani Shore Protection Project

FROM: Jim Barry

SUBJECT: Hololani Shore Protection: Meeting with USACE Coastal Engineer

A meeting was held from 1500 to 1600, October 25, 2012 at the offices of Sea Engineering, Inc. on Makai Research Pier, Waimanalo.

Participants:

Jessica Podoski, U.S. Army Corps of Engineers, Honolulu District

Marc Ericksen, Sea Engineering, Inc.

Scott Sullivan, Sea Engineering, Inc.

Jim Barry, Sea Engineering, Inc.

The purpose of the meeting was to consult with Ms. Podoski, a coastal engineer with the U.S. Army Corps of Engineers - Honolulu District, on the proposed shore protection at the Hololani Resort Condominium. Prior to the meeting, Ms. Podoski had been provided with the Draft Environmental Assessment (DEA) and comments by the State Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR-OCCL), County of Maui Department of Planning (MDP), and the Maui Planning Commission (MPC). The meeting was held in response to Comment 10 on the DEA from the MDP:

> *Consult with United States Army Corps of Engineers, Honolulu on possible temporary and permanent groin and offshore breakwater configurations that would satisfy the Department's desired outcome, as described in Comment 9, above.*

Comment No. 9 states:

> *The Department is very interested in exploring at least two (2) additional alternative designs: a system of groins or an offshore breakwater, either of which could initially be temporary in nature, constructed of sand-filled geotubes. Both of these configurations, temporarily deployed for one (1) or two (2) years, would provide a baseline understanding for how Hololani can be protected by redirecting or dissipating damaging wave energy by creating an offshore, lessened, wave-energy environment that promotes*

*sand accretion in front of Hololani rather than sand erosion. If the temporary solution works, then the Applicant could apply for a permanent structure.*

Ms. Podoski was shown 60% plans of the proposed hybrid seawall/rock revetment structure that is the preferred option of the owners and designer. A wide-ranging conversation concerning Comment No. 9 then ensued. The discussion points were as follows:

- Having an 8-story building within 15 feet of the shoreline is a clear case for either "holding the line" (shoreline armoring) or retreating (moving or demolishing the building).

- Groins and offshore breakwaters alone will not protect the buildings and/or stop erosion in this already critically eroded and relatively short stretch of shoreline. There would still be potential for sand movement and consequent erosion of the shoreline and undermining of the structures. Use of groins or offshore breakwaters for the purpose of ensuring the integrity of the building(s) would require a "backstop" in the form of a revetment or seawall. An offshore breakwater or groin field alone would not be sound coastal engineering practice for protection of the buildings.

- Sea Engineering noted that under existing federal regulations, the federal permit process will probably not allow construction of offshore structures as shore protection for the Hololani. Stakeholder agencies (U.S. Fish and Wildlife, NOAA Fisheries) are extremely protective of offshore habitat. The Iroquois Point project took ten years from inception to construction, and the recent Grays Beach project at Waikiki, which included three groins and sand fill, was abandoned due to difficulties with the federal permit process.

- Groins would block littoral transport of sand and divide the littoral cell.

- Armoring the Hololani shoreline would not preclude implementation of a regional beach nourishment solution at a later date. Sand could be placed seaward of the proposed revetment (as part of a regional nourishment) to widen the existing beach and provide additional shoreline access during seasons when the beach is currently present.

- Sealing the red clay shoreline with the seawall/rock revetment should decrease the local turbidity and could reduce damage being done to the reef by sediment and turbidity.

Of concern to Ms. Podoski were the potential "end effects" on the adjoining Royal Kahana property. An explanation by Sea Engineering of the design considerations for "end effects" ensued:

- The revetment is stopped 24 ft from the property line in order to keep as much of the turbulence associated with end effects within the property of the Hololani, yet still protect the south building.

- The combination of the revetment returning to the face of the sheetpile wall, and the sheet pile extending inland at an angle minimizes disturbance of native ground.

- Under an existing verbal agreement with the MDP, the Royal Kahana AOAO has protected their property adjacent to the Hololani with temporary protection. It is the intent of project to have these temporary measures included in the Hololani permits to ensure that localized damage at the Royal Kahana due to the new permanent structure does not occur.

After evaluating the 60% plans and discussing the alternatives for groin fields and an offshore breakwater with SEI engineers, Ms. Podoski was in agreement with the findings of the DEA: coastal armoring in the form of a rock revetment and/or seawall is necessary to ensure the safety of the Hololani buildings. The proximity of the buildings to the shoreline (15 ft) is an emergency condition, and allowing further erosion could prove catastrophic and is not sound coastal engineering practice. Beach nourishment, or beach nourishment with retaining structures such as groins could be an effective regional management approach encompassing adjacent shorelines, or could be used to enhance the beach at the Hololani during certain times of the year, but is not recommended as a stand-alone solution to the Hololani erosion.

There are inherent design difficulties with a project that includes offshore structures at the Hololani, including a lengthy federal permit process that does not address the emergency nature of the erosion problem, and the likelihood of far-field erosion effects due to beach sand sequestration and the down-drift erosion commonly associated with groin fields. Shoreline armoring is the only coastal engineering solution to effectively ensure the protection of the Hololani buildings from the severe erosion occurring at the site.

9. Comments from the Maui Planning Commission

ALAN M. ARAKAWA
Mayor

WILLIAM R. SPENCE
Director

MICHELE CHOUTEAU McLEAN
Deputy Director

COUNTY OF MAUI

# DEPARTMENT OF PLANNING

October 8, 2012

Mr. James Barry
Sea Engineering, Inc.
Makai Research Pier
41-305 Kalanianaole Highway
Waimanalo, Hawaii 96795

Dear Mr. Barry:

**SUBJECT: TRANSMITTAL OF THE COMMENTS AND QUESTIONS FROM THE MAUI PLANNING COMMISSION (COMMISSION) ABOUT THE DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR PERMANENT SHORE PROTECTION OF THE HOLOLANI RESORT CONDOMINIUMS, LOCATED AT 4401 LOWER HONOAPIILANI ROAD, LAHAINA, MAUI, HAWAII; TMK: (2) 4-3-010:009 (DEPARTMENT OF LAND AND NATURAL RESOURCES FILE MA-12-252) (RFC 2012/0097) (EAC 2012/0024)**

At its regular meeting on September 11, 2012, the Commission reviewed the Draft EA, referenced above. Based upon those discussions and questions to the Applicant and Applicant's representatives, the Commission's seventeen (17) requests for additional information are listed below:

1. Document what other properties may be impacted by the proposed structure and what would be the possible extent of the impacts to other properties? Describe how the proposed structure can impact the coastal littoral cell.

2. Please include current photographs along the shoreline for neighboring properties to the south, to Pohaku Park, showing the current condition of each of the shorelines in front of the properties. [Department of Planning (Department) comment.]

3. Describe what precautions and mitigations will be built into the project to minimize impacts to neighboring properties.

4. Describe the "walkway" incorporated into the proposed structure designed to provide lateral beach access along the revetment and how it would work.

5. Please consider and document any options to create public access to the shoreline from the Honoapiilani Highway across the property.

6. Provide a discussion about an alternative design that would more closely match the natural slope of the beach and shoreline. Would this alternative design be beneficial in preserving a sandy shoreline? What are the costs and benefits to this alternative approach? Add a schematic drawing that would present this alternative design.

7. Explore options for during the revetment similar to the "Hayashi" wall.

8. Provide an explanation of where this structure will be constructed in terms of property boundaries and county and state jurisdictions?

9. Document how the vinyl seawall will be constructed. Also document the history of use of this material for seawall purposes.

10. Please provide options to mitigate the unattractive visual impact of the proposed vinyl wall beyond landscaping. Please include what colors options are available for the vinyl wall.

11. Please explore the option for using sand-filled "geotube" technology as an effective mitigation alternative to the proposed preferred alternative both in terms of an offshore groin configuration and other offshore configurations. Can these temporary technologies be explored first to test out if a permanent offshore solution can be placed in the same location as the geotubes at a future date?

12. Document the mitigation option of deploying T-groins or breakwaters in combination with importing sand to add to the system as an alternative.

13. Explore the option of growing coral offshore as a method to break the wave energy along the shoreline. Explore other artificial reef alternatives, such as reef balls and breakwaters below the surface of the ocean.

14. On page 17 of the Draft EA, #4, The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region, further explain your conclusion that "The project will therefore not have a negative impact on the native beach, but may actually help beach stabilization."

15. Please document exploration of a regional beach nourishment option that would involve all the condominium associations within the defined beach cell system from north at the Kahana River area to the south, extending down to the Pohaku Park (S-turns) area.

16. Please document other possible regional, long-term solutions that would minimize the erosion problems along this shoreline.

17. Please document potential sources of offshore sand in the vicinity.

Please address each of the above comments and questions for more information in the Final EA and please provide a separate letter addressed to the Department that addresses each of the above 17 comments and questions. Once received, your answers will be transmitted by the Department to the Commission.

Thank you for your cooperation. If additional clarification is required, please contact Coastal Resource Planner James Buika at james.buika@mauicounty.gov or at (808) 270-6271.

Sincerely,

WILLIAM SPENCE
Planning Director

xc: Michele Chouteau McLean, Deputy Planning Director (PDF)
Clayton I. Yoshida, AICP, Planning Program Administrator (PDF)
Maui Planning Commission
James A. Buika, Staff Planner (PDF)
Department of Land and Natural Resources-Office of Conservation and Coastal Lands
US Army Corps of Engineers, Honolulu District
Department of Health, Maui
Department of Heath, Honolulu
Office of Planning
EA 2012 File
Project File
General File

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## 10. Response to Comments from the Maui Planning Commission

**Sea Engineering, Inc.**

Makai Research Pier • Waimanalo, Hawaii 96795-1820 • E-mail: sei@seaengineering.com
Phone: (808) 259-7966 / FAX (808) 259-8143 • Website: www.seaengineering.com

December 4, 2012

Mr. William Spence, Director
County of Maui, Department of Planning
250 South High Street,
Wailuku, Maui, Hawaii 96793

Dear Mr. Spence,

Subject: Hololani Shore Protection: Response to County of Maui Planning Commission (Commission) Comments on the Draft Environmental Assessment (DEA) for Permanent Shore Protection of the Hololani Resort Condominiums, TMK: (2) 4-3-010:009

The Commission reviewed the DEA for the Hololani shore protection at a regularly scheduled meeting on September 11, 2012. Comments on the DEA were also received from the State Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR-OCCL), the Maui Planning Commission (MPC), University of Hawaii Sea Grant Program (UH-Sea Grant) and the Maui Department of Public Works (DPW). Following are responses to the Commission comments on the project. However, attached with this document are introductory remarks and background material (see attached *Introductory Remarks*) meant to eliminate redundancy and provide an in-depth review of the subjects being covered. The introductory remarks consist of four sections:

1. Emergency Status of the Hololani and Understanding of Appropriate Shore Protection

2. Regional Loss of Sand and Shoreline Erosion

3. Coastal Armoring and Beach Loss

4. The Domino Effect

5. Consideration Of Appropriate Alternatives

A letter from the County of Maui Department of Planning (MDP) dated October 8, 2012, lists seventeen (17) requests for additional information:

**1. *Document what other properties may be impacted by the proposed structure and what would be the possible extent of the impacts to other properties? Describe how the proposed structure can impact the coastal littoral cell.***

The *Introductory Comments* clarify the potential impacts of the preferred alternative (see Section 2 - *Regional Loss of Sand and Shoreline Erosion*, and Section 4 - *The Domino Effect*). Section 3 – *Coastal Armoring and Beach Loss* discusses the effect of the preferred alternative on coastal processes at the site. The proposed structure will likely have minor near-field (i.e. 50 to 100 ft) impacts on the adjacent property to the south, the Royal Kahana. Mitigation of these impacts is part of the project design and is detailed in the DEA and in the *Introductory Comments*. Far-field (beyond 100 ft) impacts are not likely to occur. The proposed structure for the Hololani (or the rock revetment) results in the absolute least impact on the marine environment of all other alternatives described in the comments.

**2. *Please include current photographs along the shoreline for neighboring properties to the south, to Pohaku Park, showing the current condition of each of the shorelines in front of the properties. [Department of Planning (Department) comment].***

A photograph log of the entire shoreline is included at the end of this document.

**3. *Describe what precautions and mitigations will be built into the project to minimize impacts to neighboring properties.***

North of the Hololani, most properties are protected by shoreline armoring. The Hololani project is not expected to have any negative effect on those properties. Some erosional effects might be felt at the adjacent property to the south, the Royal Kahana due to near field "end effects" caused by the proposed structure. These effects are difficult to quantify, but will likely be minor. End effects and mitigation are described in the DEA in Section 6.1.2.3, and also in the *Introductory Comments*:

> "End effects," or excess scour or erosion of adjacent shorelines due to additional wave reflection and turbulence from the end of coastal armoring, are accepted by coastal engineers as potentially negative side effects of coastal armoring. However, it has always been a difficult phenomenon to quantify. As a crude estimate, end effects are not likely to extend beyond a wavelength from the structure. Half a wavelength, or somewhere between 50 and 100 ft is probably a more realistic estimate, with effects decreasing with distance. The actual direct effects of Hololani shoreline armoring are not likely to extend more than a short distance into the Royal Kahana property. Recommendations have been made in the

DEA to mitigate these potential effects:

- The revetment is stopped 24 ft from the property line in order to keep as much of the turbulence associated with end effects within the property of the Hololani, yet still protect the south building.

- The combination of the revetment returning to the face of the sheet pile wall, and the sheet pile extending inland at an angle minimizes disturbance of native ground.

- Under an existing verbal agreement with the MDP, the Royal Kahana AOAO has protected their property adjacent to the Hololani with temporary protection. The temporary measures have been robust and effective. It is the intent of project to have these temporary measures included in the Hololani permits to ensure that localized damage at the Royal Kahana due to the new permanent structure does not occur.

**4.** ***Describe the "walkway" incorporated into the proposed structure designed to provide lateral beach access along the revetment and how it would work.***

There is no walkway incorporated into the preferred alternative. The revetment will have a crest at +6 ft MSL that will be two armor stones in width, or approximately 5 ft. By selectively placing the stones with a relatively flat face upward and fitting the stones to minimize voids between the top surface, the revetment can be constructed to provide reasonable lateral access along the crest for able-bodied persons.

**5.** ***Please consider and document any options to create public access to the shoreline from the Honoapiilani Highway across the property.***

The Hololani has agreed to provide shoreline access along the south property line as the project moves forward. There are some access issues in the immediate area of the south property line due to the parking garage driveway that will either need to be accommodated or alternative routes found around the administration building. Three route alternatives are shown in Figure 1.

Ingress and egress at the south end of the structure is a better option than promoting access along the length of the property:

1. During low sand conditions, the sand often ends near the south property boundary;

2. The shoreline north of the Hololani – from Pohailani to Kaea Point rarely has sand and is fronted by seawalls;

3. Establishing a pathway near the south boundary will allow the Hololani to keep some privacy and allow outside users to not feel that they are trespassing;

During low sand conditions, access on the native beach past the southern boundary will be difficult due to existing rocky conditions. Fishermen and other able-bodied persons can proceed along the revetment crest at +6 ft MSL if so desired. During high sand conditions, the beach will provide lateral access.

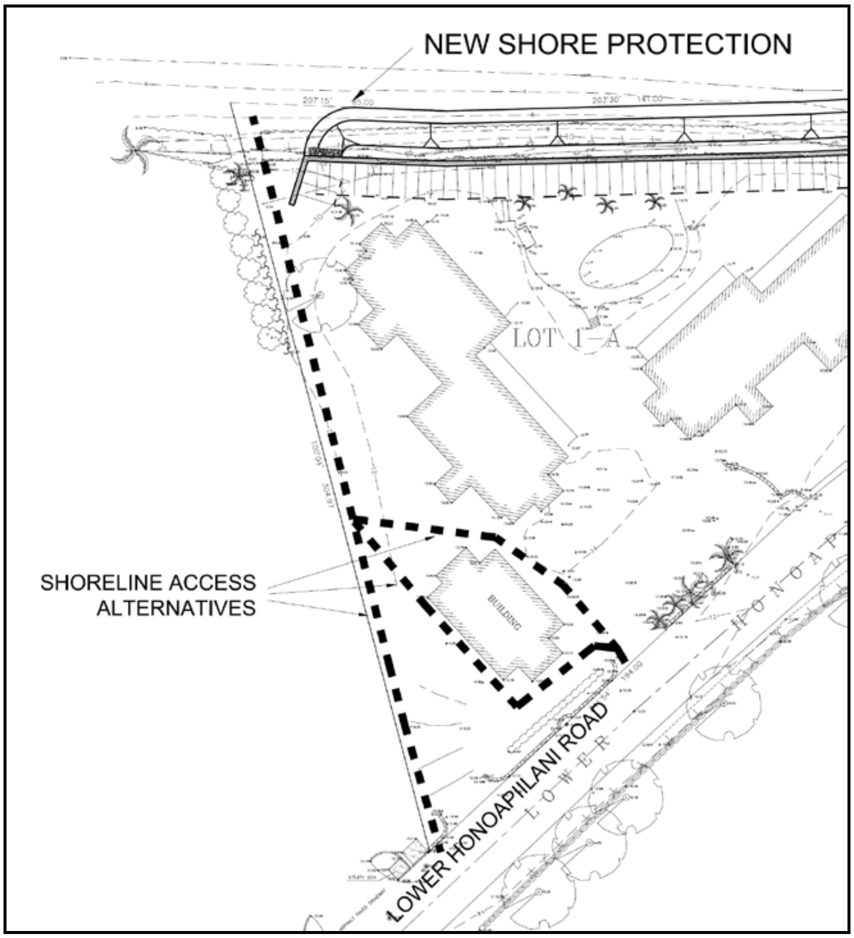



Figure 1. Shoreline access alternatives

**6.** ***Provide a discussion about an alternative design that would more closely match the natural slope of the beach and shoreline. Would this alternative design be beneficial in preserving a sandy shoreline? What are the costs and benefits to this alternative approach? Add a schematic drawing that would present this alternative design.***

A typical beach slope for the Hololani, and many Hawaiian beaches, is 1 vertical to 10 horizontal. A schematic layout (Figure 2) shows the structure would be about 70 ft in length. Such a structure would displace a usable beach. Voids between armor stones would be hazardous for persons trying to walk over such a structure, especially with the addition of wave activity.

It is doubtful that such a structure would preserve a sand shoreline. The structure would more likely replace a sand shoreline with an expansive rock shoreline. Construction would be extremely difficult. No benefits are seen with this approach.

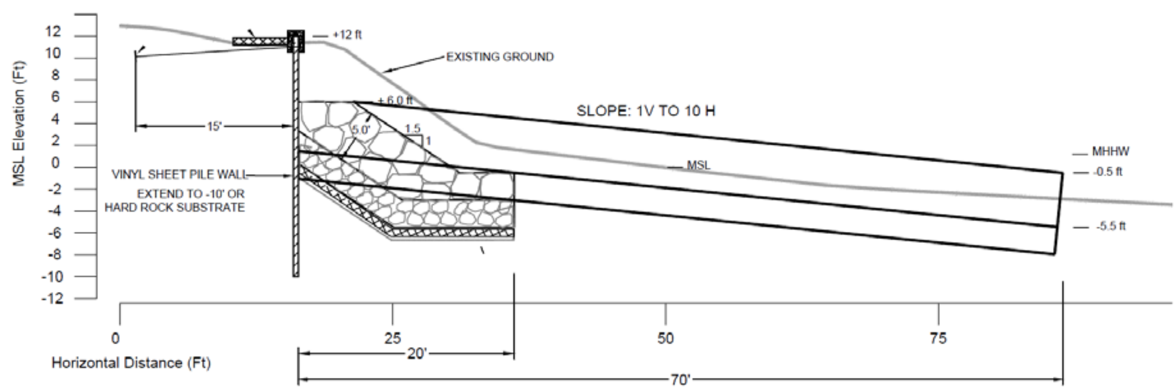



Figure 2. Layout of a 1 vertical to 10 horizontal revetment

**7. *Explore options for doing the revetment similar to the "Hayashi" wall.***

Figure 3 shows a comparative layout of the Hayashi wall with the present design. The Hayashi wall (as implemented at the Mahana Condominiums) has a composite slope that is 1 vertical to 1.5 horizontal from the revetment crest to an elevation of +2.5 ft MSL, and 1 vertical to 5 horizontal slope from there to the top of the revetment toe. Although there may be a minor reduction in reflection coefficient, the wall will be more difficult to construct, require more material, and will place armor rock where it is more likely to be exposed on the beach. The revetment toe is thought to be less effective than the traditional design.

Figure 4 shows the proposed revetment design modified to have a 1 vertical to 2 horizontal slope from the crest to the structure toe. This traditional design will also have a reduced reflection coefficient and increased stability, with a somewhat larger footprint. However, it will be easier to build and have less tendency to outcrop on the beach than the Hayashi design.

Sea Engineering does not recommend the use of a composite slope, Hayashi-style design. However, the 1 vertical to 2 horizontal design shown in Figure 4 is an acceptable alternative.

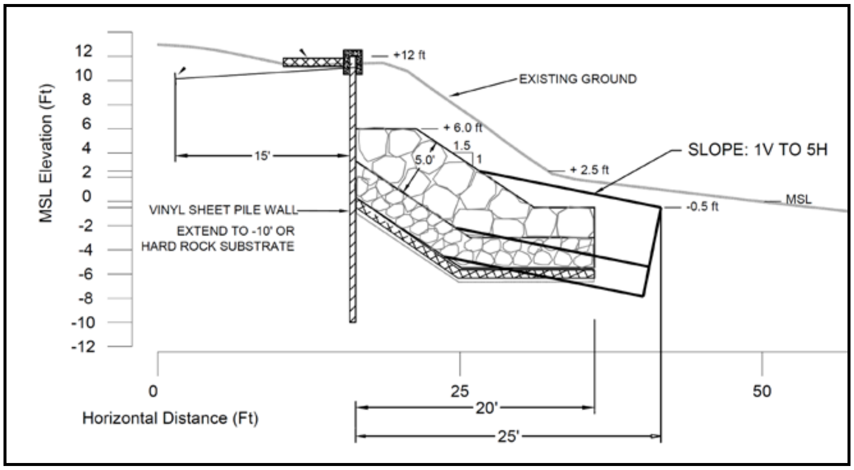



Figure 3. Hayashi-style wall

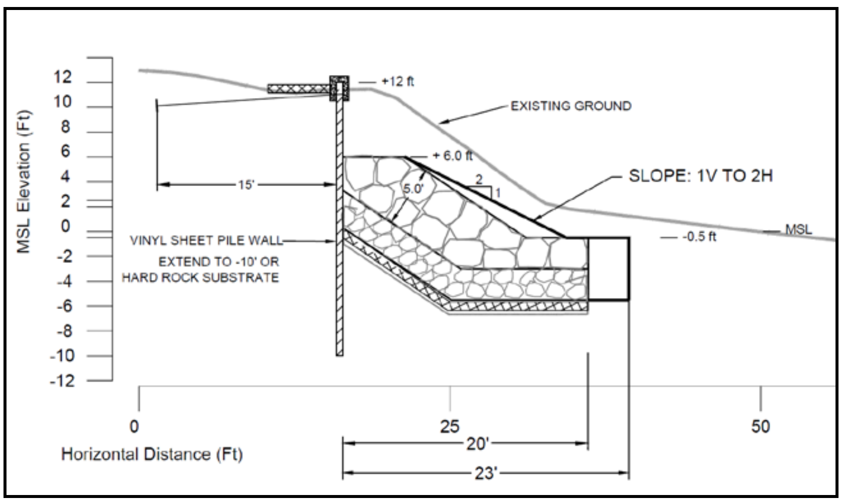



Figure 4. Traditional revetment modification to 1 vertical to 2 horizontal slope

**8.** ***Provide an explanation of where this structure will be constructed in terms of property boundaries and county and state jurisdictions?***

The shoreline certification is in progress, but the preliminary shoreline survey has the shoreline placed at the top of the bank (or top of existing temporary shore protection). The location will mostly intersect the revetment crest of the new structure. The proposed structure will therefore be in both the County and State jurisdictions.

The toe of the structure – the most seaward portion - follows the property boundary of record. Until recently, the entire structure would have been located on property owned by the Hololani AOAO. The following is verbiage from a DLNR letter to the Hololani explaining their new policy concerning the Certified Shoreline and property ownership:

> *In past practice, when dealing with shoreline encroachments, the Department of Land and Natural Resources has* ***utilized solely the boundary of record*** *to determine the presence of any encroachments. However, the Department of Land and Natural Resources has been advised by the Attorney General that, according to the Hawaii Supreme Court in County of Hawaii v. Sotomura, "land below the high water mark, like flowing water, is a natural resource owned by the state subject to, but in some sense in trust for, the enjoyment of certain public rights." In addition, the Attorney General opined that although the State may own land within the shoreline area that does not mean the State owns or is responsible for any structures placed it by others or the abutting landowner. Therefore, any structures located seaward of the proposed shoreline location as determined by staff would be considered encroachments upon State land. Furthermore, shoreline easements should include any structures in the shoreline area, even if the structures are located within the record boundary of the property. Please contact the Maui District Branch of the Department of Land and Natural Resources Land Division at 984-8103 to resolve these encroachments.* (emphasis added)

The Certified Shoreline is now considered a property ownership boundary, and the process of certification is effectively a transfer of title for land makai of the certification line. According to the State's new policy, only the portion of the structure mauka of the Certified Shoreline will be considered to be located on property owned by the Hololani.

**9. *Document how the vinyl seawall will be constructed. Also document the history of use of this material for seawall purposes.***

The Shoreguard vinyl sheet piles will likely be vibrated into place, with the base of the sheet at -10 ft MSL or until hard rock substrate is found. If driven to the base elevation, the sheets will be 22 ft in length. Sheets that hit rock substrate will be cut to the finish elevation. Earth pressures are resisted using "deadman"-style anchors placed at 6-ft intervals at a distance of at least 15 ft from the wall. The anchors are attached to rigid wales that traverse horizontally along the front face of the wall. The exact construction sequence will be determined by the contractor, but the wall will likely be placed before the revetment portion is completed (see Figure 5).

Vinyl sheet pile has been in use since the late 1980's. The thickness of the material, manufacturing process, and applications evolved through the 1990's. Because of it's low cost and non-corrodible properties, the material has been used for many coastal projects, including bulkheads, seawalls and flood control. The U.S. Army Corps of Engineers conducted extensive review and testing of the material in the early to mid-2000's, including the following papers:

> Dutta, P.K. and Vaidya, U., (2003), A study of the longterm applications of vinyl sheet piles, ERDC/CRREL 2003 Report LR-03-19, available through internet: http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/LR-03-19.pdf
>
> Dutta, P.K., Zabilansky, L.J.m Wright, T.W., Brandstetter, C., and Bivona, J.C. Jr., (2005) *Interim Report, General Design Guide: PVC Sheet Pile*; ERDC/CCRREL Interim Report

Use of vinyl and composite sheet pile in exposed wave environments has gradually increased in the marine construction industry (CMI - Crane Materials International - personal communication). Most open coast applications to date have been on the East Coast and Gulf Coast (i.e. Florida Panhandle) areas. For long-term applications the vinyl material is manufactured using a co-extrusion process, whereby a surface layer of UV-resistant material is bonded to a thicker core. Figure 6 shows the construction of a sheet pile wall in the Florida Panhandle after erosion from the nearby passage of Hurricane Dennis in 2005. A completed wall in the same area is shown in Figure 7. In both of these cases the wall is composed of more rigid composite material (i.e. fiberglass reinforced) rather than vinyl due to the vertical exposure of the sheets. Figure 8 shows a vinyl sheet pile wall in the Seattle area.

The preferred alternative would be the first use of the material on an open coast in Hawaii, although a vinyl wall design will soon be under construction in Kaneohe Bay. The design is therefore conservative, with use of the thickest sheet pile material available, armor rock to buttress and strengthen the sheet pile, and protection to prevent scour behind the wall during wave overtopping conditions (Figure 5).

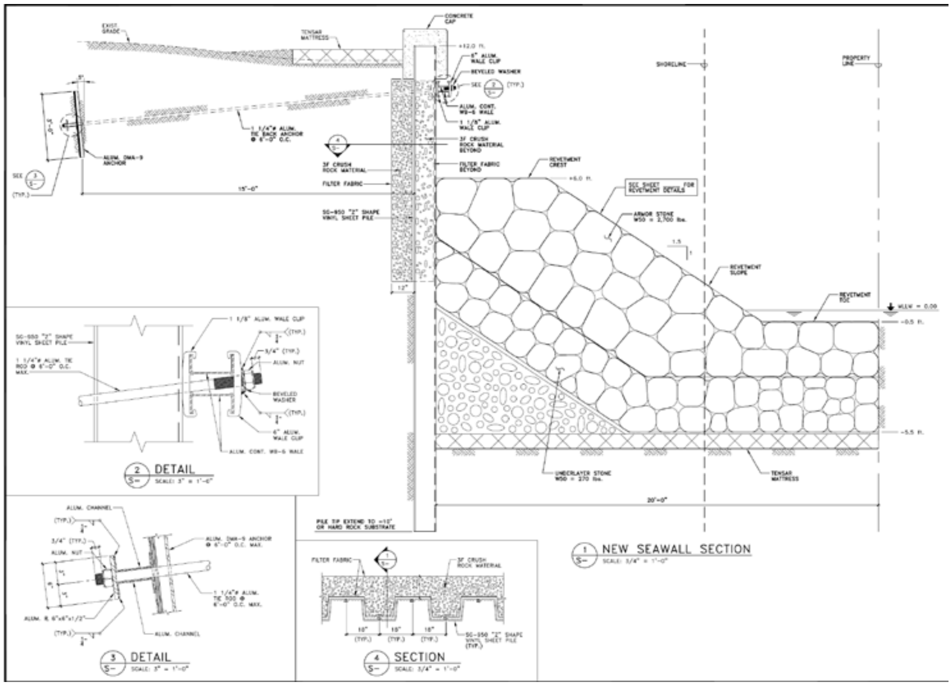



Figure 5. Wall detail (note: some stone details will vary in the final documents)

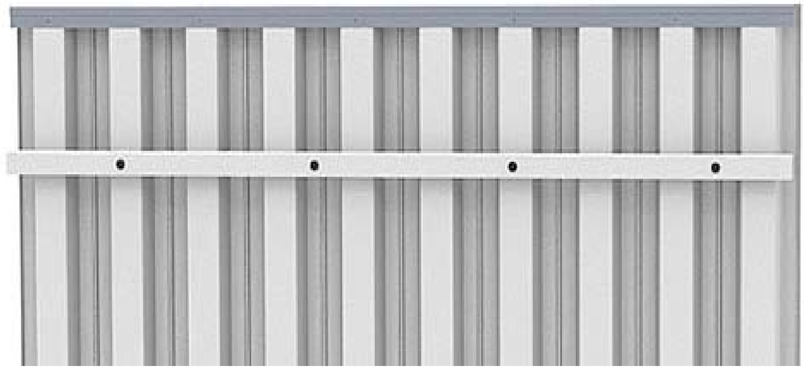
Figure 6. Sheet pile seawall construction on the Florida Panhandle coast

Figure 7. Completed sheet pile seawall on the Florida Panhandle coast

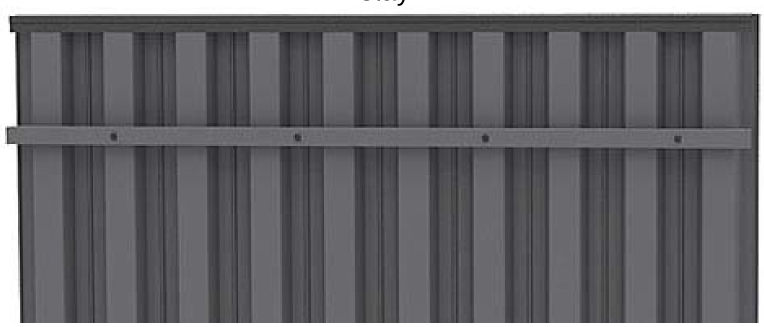
Figure 8. Sheet pile seawall in the Seattle area

**10.** ***Please provide options to mitigate the unattractive visual impact of the proposed vinyl wall beyond landscaping. Please include what colors options are available for the vinyl wall.***

The nature of the vinyl material is such the bonding of facing materials is not possible. However the material has several color options that are shown in Figure 9.


Gray


Clay


Slate


Brown

Figure 9. ShoreGuard color options

**11.** ***Please explore the option for using sand-filled "geotube" technology as an effective mitigation alternative to the proposed preferred alternative both in terms of an offshore groin configuration and other offshore configurations. Can these temporary technologies be explored first to test out if a permanent offshore solution can be placed in the same location as the geotubes at a future date?***

A geotube solution in some form may have been a reasonable option for use in a temporary capacity as an alternative to the existing temporary revetment. However, they are difficult to control and construct, and a geotube alone would likely not have achieved the crest height necessary for protection of the Hololani. The present project is to design a permanent long-term solution to the Hololani erosion problem as required by the County SM3 and State emergency permit.

The idea that geotubes are easy to remove is essentially a popular myth. In fact, geotubes are usually quite difficult to take out as the geotextile fabric can be trapped under tons of sand. They can be more difficult to remove than the modular temporary structure that is in place, and even more difficult than many rock structures.

Modern wave modeling techniques are excellent tools for structure design and placement, and full scale operational models are rarely used due the great expense involved.

Sea Engineering does not recommend the use of groin structures for the Hololani project. The use of geotubes is also not recommended.

**12.** ***Document the mitigation option of deploying T-groins or breakwaters in combination with importing sand to add to the system as an alternative.***

The use of beach nourishment with stabilization structures was presented in the DEA. Groins, T-head groins, and breakwaters are further discussed in the *Introductory Comments*. While regional beach nourishment is recommended in order to prevent further erosion problems in the Kahana littoral cell, it is not adequate protection to ensure the safety of the Hololani buildings. The use of localized beach nourishment with retention structures is not also not recommended for protection of the Hololani because it would have significant impacts on coastal processes that would likely result in down-drift erosion, and would impact the offshore marine environment. The proposed structure for the Hololani (or the rock revetment alternative) results in the absolute least impact on the marine environment of all other alternatives considered, including the T-head groins and breakwaters mentioned in the comment. These structures have high environmental impacts and are not considered “mitigative”, but would in fact require some form of mitigation under 2008 revisions of the Clean Water Act (likely through the Habitat Equivalency Analysis process) in order to be permitted by federal agencies.

**13. *Explore the option of growing coral offshore as a method to break the wave energy along the shoreline. Explore other artificial reef alternatives, such as reef balls and breakwaters below the surface of the ocean.***

Sea Engineering has conducted coral reef reconstruction and rescue projects in Hawaii and Kwajalein Atoll. The magnitude of the operation required to nurture a coral reef off the Hololani large enough to have a protective quality would be unprecedented. Also, only certain corals are resistant to wave impacts, and these tend to be small and grow slowly. Other corals would break in a design storm condition.

Reef balls are modular concrete units used primarily as habitat for fish aggregation and coral colonization. They have also been used to form narrow-crested submerged breakwaters for beach stabilization. Submerged breakwaters have not been particularly successful coastal engineering structures. Depending on water depth over the crest of the breakwater, they transmit over 40% of the wave height in most cases. A submerged breakwater would be difficult to build in the shallow water off Hololani, likely requiring the construction of a temporary causeway from shore. The structure would occupy significant marine habitat and would consequently have high impacts on the marine environment.

A submerged breakwater, whether constructed of reef balls or other materials, would not provide adequate protection to ensure the safety of the Hololani buildings. Federal permits for the structure would likely not be forthcoming due to the high environmental impacts.

**14. *On page 17 of the Draft EA, #4, The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region, further explain your conclusion that "The project will therefore not have a negative impact on the native beach, but may actually help beach stabilization."***

It is important that the proposed shore protection be compared with the existing shoreline:

- The existing shoreline is a naturally hardened shoreline consisting of a steep vertical volcanic clay escarpment; there is no back shore beach morphology.
- The steep volcanic clay escarpment interacts with waves in more or less the same way as a vertical sea wall.
- The natural shoreline has a reflection coefficient greater than the rock revetment.

The proposed structure is a hybrid seawall and rock revetment. The rock revetment has a lower reflection coefficient (approximately 50% by methods in the USACE SPM) than a vertical wall or clay escarpment. However, it is true that the natural shoreline is complicated by an uneven plan form and the presence of beach rock shingle and other substrate irregularities that appear when the sand is stripped away, so that a simple model is not realistic. Trying to assign an accurate reflection coefficient value to either the natural shoreline or the proposed project shoreline is a difficult and uncertain exercise. Nevertheless, one of the major considerations in the selection of a rock revetment structure over a vertical seawall is the reduced reflection characteristics. The favorable energy dissipation and relatively low reflection characteristics of the rock rubblemound section of the proposed design should help promote beach accretion in comparison with a vertical seawall structure, or any other vertical escarpment, including the natural hardened shoreline. However, it is recognized that the interactions between the waves, beach, and structure are complex, and absolute predictions of shoreline response are difficult to make. Nevertheless, in comparison with the existing natural shoreline, the preferred alternative is not expected to have a negative impact.

Erosion of the natural shoreline produces significant red clay turbidity in nearshore waters. The preferred alternative will seal the shoreline and prevent this occurrence.

**15. *Please document exploration of a regional beach nourishment option that would involve all the condominium associations within the defined beach cell system from north at the Kahana River area to the south, extending down to the Pohaku Park (S-turns) area.***

A regional beach nourishment project is recommended to replace the diminished sand resources in the Kahana littoral cell and to head off future problems at the remaining unprotected properties. Such a project would require the participation of all stakeholders, including all the regional property owners and, ideally, County and State agencies. Organizing such a coalition alone would be a difficult, time-consuming, and uncertain task. The DEA presented preliminary figures for a modest beach nourishment effort for 20,000 cy of sand that would widen the beach by approximately 20 ft. However, beach nourishment alone is not adequate protection to ensure the safety of the Hololani buildings.

**16. *Please document other possible regional, long-term solutions that would minimize the erosion problems along this shoreline.***

Beach nourishment of the Kahana littoral cell is recommended. The use of retention structures in addition to beach nourishment would require careful study. Further study of regional sand transport, including possible loss mechanisms and the role of upland sources is also recommended.

**17.** ***Please document potential sources of offshore sand in the vicinity.***

Assessment of offshore sand resources is a complex undertaking, typically requiring side scan sonar surveys to map the bottom substrate, sub-bottom profiling surveys to determine sediment thickness, and core sampling and analysis to assess sand quality. Offshore sand is often too fine grained for use on the beach, and a comprehensive and expensive survey program is not guaranteed to be successful.

No sand resource assessments have been conducted in the vicinity of Kahana Beach. SEI conducted a sand resource assessment off Kaanapali (Figure 10), and the UH Coastal Geology Group conducted an assessment off Napili (Figure 11a). Potential sand deposits visible on aerial photographs off Kahana are shown in Figure 11b, but these have not been investigated.

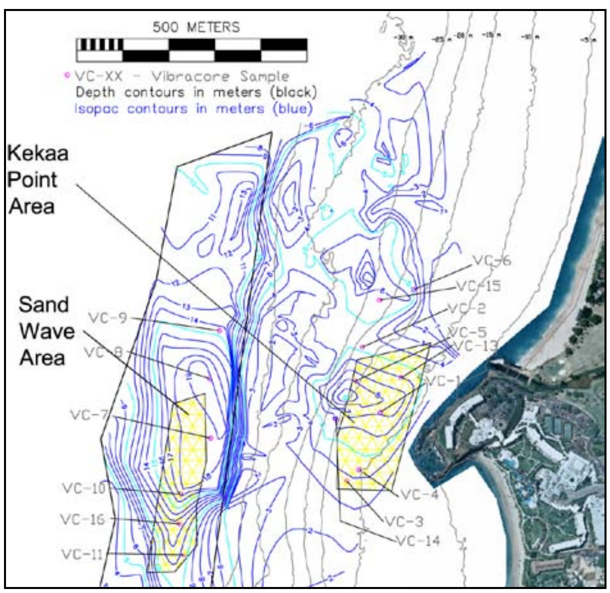
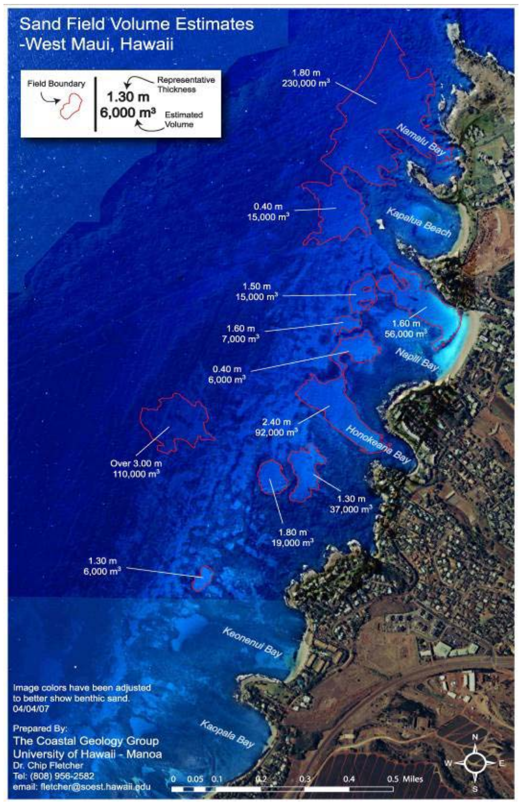
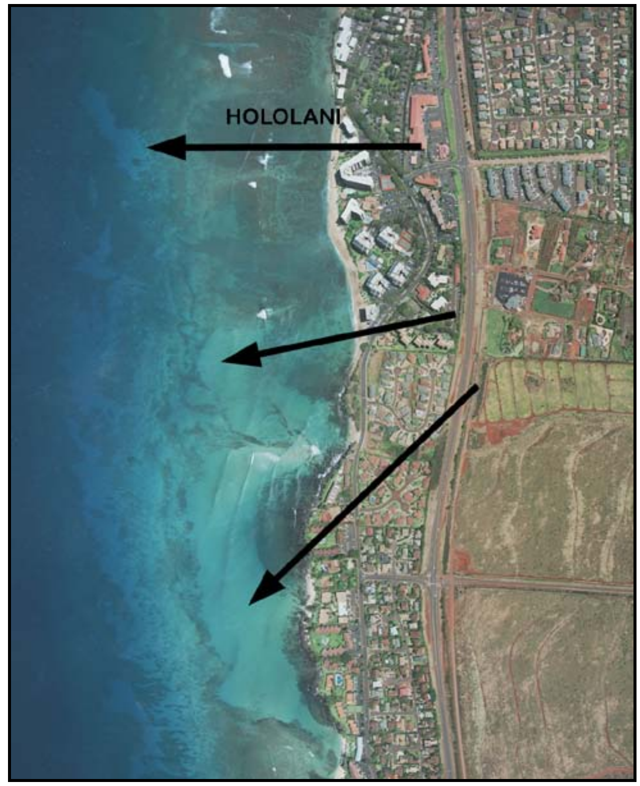



Figure10. Sand deposits off Kaanapali mapped by Sea Engineering, Inc.




(a)




(b)

Figure 11. (a) Napili sand deposits mapped by UHCGG; (b) Potential sand deposits off Kahana

Thank you for your review of the DEA, and consideration of this project. Please feel free to contact me should there be further questions.

James H. Barry, P.E.
Coastal Engineer
Sea Engineering, Inc.

Cc: DLNR-OCCL

11. Comments from the County of Maui Department of Public Works

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7845
Fax: (808) 270-7955

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS**
200 SOUTH HIGH STREET, ROOM NO. 434
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

October 16, 2012

Mr. Samuel J. Lemmo
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Lemmo:

**SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR PERMANENT SHORE PROTECTION OF THE HOLOLANI RESORT CONDOMINIUMS; TMK: (2) 4-3-010:009**

We reviewed the subject application and provide the following comments:

1. The applicant shall be responsible for all required improvements as required by Hawaii Revised Statutes, Maui County Code and rules and regulations.

2. As applicable, construction plans shall be designed in conformance with Hawaii Standard Specifications for Road and Bridge Construction dated 2005 and Standard Details for Public Works Construction, 1984, as amended.

3. We support the seawall north terminus as illustrated in Figure 2-7 on page 40 of the report. Alternative configuration for the north end extending into drainage easement and accommodating County drain line is the preferred alternative.

4. Prior to mid-1975, Lower Honoapiilani Road was known as Honoapiilani Highway and under the ownership and maintenance of the State Department of Transportation (DOT) Highways.

5. In mid-1975, the current Honoapiilani Highway was constructed and the lower road, now known as Lower Honoapiilani Road, was turned over to the County by the State.

6. Figure 4-16 shows a 1949 aerial photograph of the area. At that time, no resorts/condominiums were constructed along Honoapiilani Highway. Shoreline showed a consistent strip of sand along the beach.

7. The Bechert Estate Partition was created in 1959. See Appendix C, Exhibits 1, 1-A, and 3. At that time, the drainage easement at the north end of the Hololani property was not in existence, as it was not shown.

8. A shoreline map from 1972 shows Lot 1-A of the Bechert Estate Subdivision. See Appendix C, Exhibit 2. This Exhibit shows the drainage easement at the northern end of Lot 1-A. It appears that the Hololani Condo project had yet to be constructed as this information was not indicated on the subdivision map. Note also that the drainage easement area is a part of the total Lot 1-A, i.e., the future Hololani Condo Resort property. The 1972 map showed that shoreline erosion had already occurred in the area and identified on this map. Note also that the drainage easement is shown in favor of the County of Maui, however, the road was still under the ownership and maintenance of the State Highways in 1972.

9. Exhibit 4 prepared in June, 1980 showed a Shoreline Location Map in the area of the drainage easement. The drainage easement showed that an existing drainage swale meandered through the easement area, as well as Hololani Condo property. By 1980, the Hololani Condo Resort project would appear to have been constructed. It appears that a drainage headwall was in place with the direction indicating that the drainage culvert was coming from the Hololani Condo property. A concrete swale led from the Hololani Condo drainage culvert headwall to the ocean. From the location of the property line and the location of the vegetation/ seashore line, it appears that erosion may have occurred from the vicinity of the end of the concrete swale. The Hololani Condo culvert can clearly be seen in Figure 2-5 which is a photo of the drainage easement area taken from the oceanside of the property. This photo appears to have been taken sometime after January, 2011, as the temporary geotextile protection was already in place.

10. With regards to the statement made on Page 4 that: "Long-time Hololani residents identify the construction of the County drainline

in the easement at the north end of the property as the catalyst that precipitated the onset of serious coastal erosion", the Department recommends that the applicant research historical shoreline maps and create a historical timeline on the development on the property to identify other possible causes leading up to a coastal erosion in the immediate shoreline area.

11. Although an existing drainage easement is identified in a shoreline map done in 1980, it is unclear as to when the drainpipe highlighted in Figure 2-5 was constructed. See Appendix C, Exhibit 4. The Shoreline Location map does not show the culvert nor its outlet within the drainage easement. So that culvert must have been constructed post-1980, but before January, 2011.

12. The Department encourages the applicant to explore the option of flattening the 1.5:1 revetment slope to something akin to the "Hayashi Seawall" that would mimic the beach slope shown between the MHHW mark to the MSL mark. Flattening out the slope may help to increase the accretion of sand when the southerly swells happen.

Please call Rowena M. Dagdag-Andaya at 270-7845 if you have any questions regarding this letter.

Sincerely,

for DAVID C. GOODE
Director of Public Works

DCG:RMDA:ls
xc: Highways Division
Engineering Division
James Barry - Sea Engineering
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12. Response to Comments from the County of Maui Department of Public Works

**Sea Engineering, Inc.**

Makai Research Pier • Waimanalo, Hawaii 96795-1820 • E-mail: sei@seaengineering.com
Phone: (808) 259-7966 / FAX (808) 259-8143 • Website: www.seaengineering.com

December 4, 2012

Mr. David C. Goode, Director
County of Maui, Department of Public Works
200 South High Street, Room No. 434
Wailuku, Maui, Hawaii 96793

Dear Mr. Goode,

Subject: Hololani Shore Protection: Response to County of Maui Department of Planning Comments on the Draft Environmental Assessment for Permanent Shore Protection of the Hololani Resort Condominiums, TMK: (2) 4-3-010:009

Thank you for the review by the Department of Public Works (DPW) of the Draft Environmental Assessment for Permanent Shore Protection of the Hololani Resort Condominium (DEA), dated October 16, 2012. The DPW had twelve comments on the DEA.

***1. The applicant shall be responsible for all required improvements as required by Hawaii Revised Statutes, Maui County Code and rules and regulations.***

The comment is noted.

***2. As applicable, construction plans shall be designed in conformance with Hawaii Standard Specifications for Road and Bridge Construction dated 2005 and Standard Details for Public Works Construction, 1984, as amended.***

The information is noted.

***3. We support the seawall north terminus as illustrated in Figure 2-7 on page 40 of the report. Alternative configuration for the north end extending into drainage easement and accommodating County drain line is the preferred alternative.***

The alternative configuration is also supported by the Hololani AOAO. The Hololani design team anticipates close cooperation with the DPW for the design and construction of the alternative configuration.

***4. Prior to mid-1975, Lower Honoapiilani Road was known as Honoapiilani Highway and***

***under the ownership and maintenance of the State Department of Transportation (DOT) Highways.***

The information on the history and ownership of Lower Honoapiilani Road is noted.

***5. In mid-1975, the current Honoapiilani Highway was constructed and the lower road, now known as Lower Honoapiilani Road, was turned over to the County by the Stat***e.

The information on the history and ownership of Lower Honoapiilani Road is noted.

***6. Figure 4-16 shows a 1949 aerial photograph of the area. At that time, no resorts/condominiums were constructed along Honoapiilani Highway. Shoreline showed a consistent strip of sand along the beach.***

The information on the coastal history evident in the 1949 aerial photograph is noted.

***7. The Bechert Estate Partition was created in 1959. See Appendix C, Exhibits 1, 1-A, and 3. At that time, the drainage easement at the north end of the Hololani property was not in existence, as it was not shown.***

The information on the partition history is noted.

***8. A shoreline map from 1972 shows Lot 1-A of the Bechert Estate Subdivision. See Appendix C, Exhibit 2. This Exhibit shows the drainage easement at the northern end of Lot 1-A. It appears that the Hololani Condo project had yet to be constructed as this information was not indicated on the subdivision map. Note also that the drainage easement area is a part of the total Lot 1-A, i.e., the future Hololani Condo Resort property. The 1972 map showed that shoreline erosion had already occurred in the area and identified on this map. Note also that the drainage, easement is shown in favor of the County of Maui, however, the road was still under the ownership and maintenance of the State Highways in 1972.***

The information on the drainage easement history is noted.

***9. Exhibit 4 prepared in June, 1980 showed a Shoreline Location Map in the area of the drainage easement. The drainage easement showed that an existing drainage swale meandered through the easement area, as well as Hololani Condo property. By 1980, the Hololani Condo Resort project would appear to have been constructed. It appears that a drainage headwall was in place with the direction indicating that the drainage culvert was coming from the Hololani Condo property. A concrete swale led from the Hololani Condo drainage culvert headwall to the ocean. From the location of the property line and the location***

***of the vegetation/ seashore line, it appears that erosion may have occurred from the vicinity of the end of the concrete swale. The Hololani Condo culvert can clearly be seen in Figure 2-5 which is a photo of the drainage easement area taken from the ocean side of the property. This photo appears to have been taken sometime after January, 2011, as the temporary geotextile protection was already in place.***

The comment on the drainage easement history is noted. However, it is not clear that the drain outlet seen in Figure 2-5 of the DEA drains the same area as the drainage culvert noted in Exhibit 4. The drainage swale mauka of the headwall shown in Exhibit 4 has a pronounced meander, but it is clear that the drainage is primarily derived from the side of the roadway. The concrete swale shown makai of the headwall no longer exists.

***10. With regards to the statement made on Page 4 that: "Long-time Hololani residents identify the construction of the County drain line in the easement at the north end of the property as the catalyst that precipitated the onset of serious coastal erosion", the Department recommends that the applicant research historical shoreline maps and create a historical timeline on the development on the property to identify other possible causes leading up to a coastal erosion in the immediate shoreline area.***

The DEA, and response to comments on the DEA that will be included in the Final Environmental Assessment, strongly suggest that a reduction in regional sand resources is primarily responsible for the shoreline erosion taking place along the project shoreline. However, the subject of coastal erosion is complex, and observations from long-time residents should be honored. Similar observations were noted in a letter to the Hololani from the Maui Department of Planning (June 22, 2007):

> *Geotextile sea-bags are located at the northern end of the property adjacent to a county easement for a storm water outlet on Lower Honoapiilani Road. The geotextile bags have remained since 2000 and reduced erosion of the Hololani's property which is caused by the discharge of storm water during heavy downpours.*

The condition of the drainage easement has deteriorated along with the continued shoreline erosion at the Hololani. The project team anticipates the support of DPW in our efforts to provide a comprehensive solution to these problems.

***11. Although an existing drainage easement is identified in a shoreline map done in 1980, it is unclear as to when the drainpipe highlighted in Figure 2-5 was constructed. See Appendix C, Exhibit 4. The Shoreline Location map does not show the culvert nor its outlet within the***

***drainage easement. So that culvert must have been constructed post-1980, but before January, 2011.***

The information on the drainage easement history is noted.

***12. The Department encourages the applicant to explore the option of flattening the 1.5:1 revetment slope to something akin to the "Hayashi Seawall" that would mimic the beach slope shown between the MHHW mark to the MSL mark. Flattening out the slope may help to increase the accretion of sand when the southerly swells happen.***

The Hayashi wall was designed for the Mahana Condominium by Sea Engineering. Figure 1 shows the layout of a Hayashi style wall overlaid on the preferred design alternative. Although a reduction in reflection coefficient is a desirable design consideration, it is likely a negligible effect in this case that is outweighed by the potential exposure of low angle armor rock on the beach, increased footprint and volume of material, difficulty of construction, and a less stable toe configuration.

Figure 2 shows the proposed revetment design modified to have a 1 vertical to 2 horizontal slope from the crest to the structure toe. This traditional design will also have a reduced reflection coefficient and increased stability, with a somewhat larger footprint. However, it will be easier to build and have less tendency to outcrop on the beach than the Hayashi-style design.

Sea Engineering does not recommend the use of a composite slope, Hayashi-style design. However, the 1 vertical to 2 horizontal design shown in Figure 2 is an acceptable alternative.

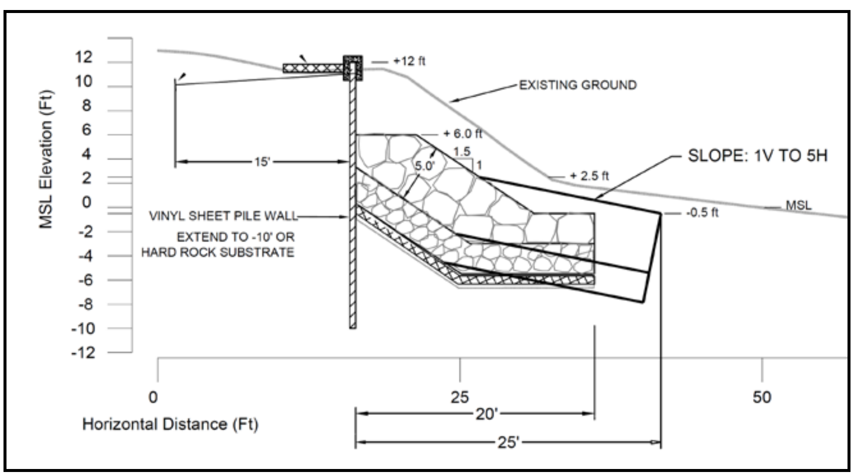


Figure 1. Hayashi-style wall

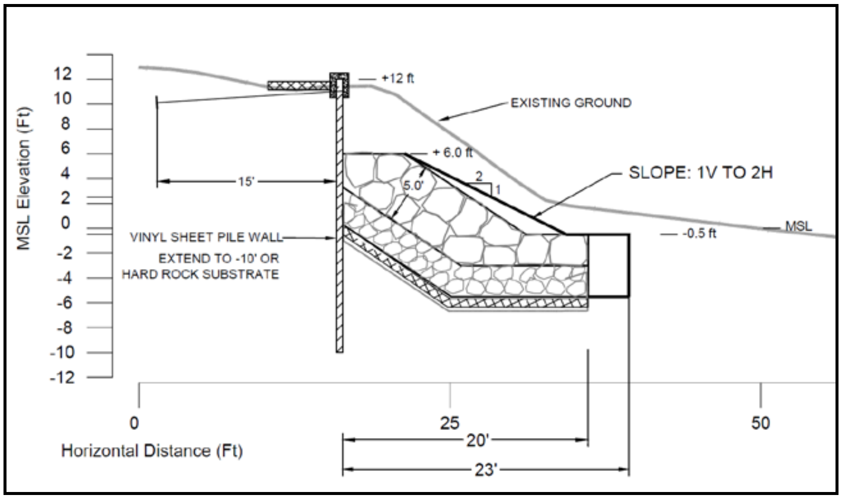

Figure 2. Preferred revetment alternative with a 1 vertical to 2 horizontal slope

Thank you for your review of the DEA, and consideration of this project. Please feel free to contact me should there be further questions.

James H. Barry, P.E.
Coastal Engineer
Sea Engineering, Inc.

Cc: DLNR-OCCL

13. Photograph Log of Kahana Beach, October 16, 2012

**PHOTOGRAPH LOG OF KAHANA BEACH**

October 16, 2012


**Notes:**

1. Photographs start at Pohaku Beach Park and end at Hololani Resort Condominiums
2. Photos taken on 10/16/2012 by Allana, Buick, & Bers, Inc.


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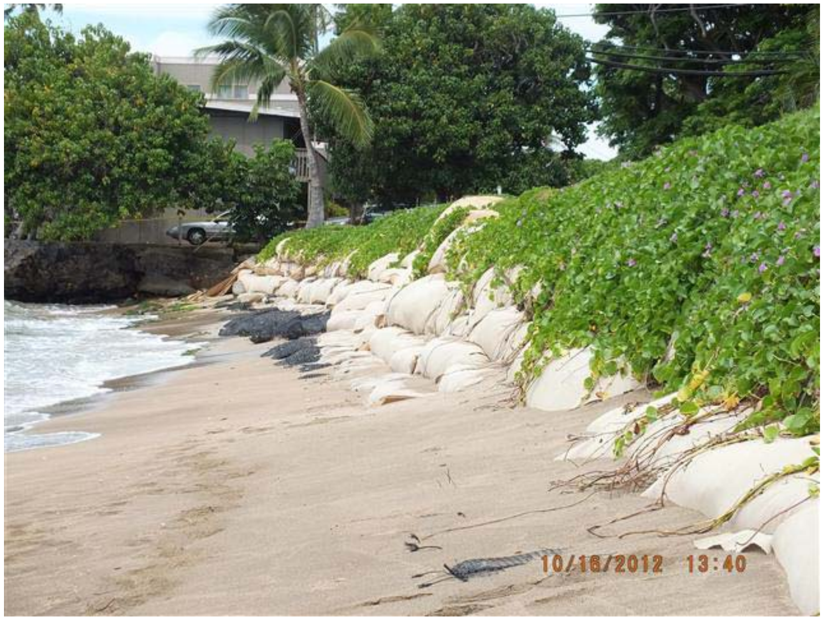
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14. DLNR-OCCL comments on the FEA (first submission, Januay, 2013)

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

ESTHER KIA'AINA
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

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

**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**

**Office of Conservation and Coastal Lands**
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DLNR:OCCL:SL

Mr. James H. Barry, P.E.
Sea Engineering, Inc.
41-305 Kalanianaole Hwy
Makai Research Pier
Waimanalo, HI 96795

Dear Mr. Barry,

Subject: Comments on The Final Environmental Assessment (EA) for Permanent Shore Protection of the Hololani Resort Condominiums at 4401 Lower Honoapiilani Road, Lahaina, Maui, Hawaii 96744, TMK (2) 4-3-010:009.

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) has reviewed the January 2013 Final EA for proposed Permanent Shore Protection of the Hololani Resort Condominiums at 4401 Lower Honoapiilani Road, Lahaina, Maui, TMK (2) 4-3-010:009. Sea Engineering, Inc. (the Applicant), on behalf of the Hololani AOAO, is proposing permanent shoreline armoring to protect the twin 8-story buildings from potential damage related to seasonal and chronic shoreline erosion. The Applicant's preferred alternative for erosion control at the subject property is a hybrid structure that combines a vertical seawall with a sloping rock rubble mound revetment.

The Draft EA was published in the June 23, 2012 issue of the OEQC Environmental Notice. The Applicant received comments on the Draft EA from a number of government agencies, including OCCL, UH Sea Grant, County of Maui Department of Planning, U.S. Army Corps of Engineers, Maui Planning Commission, and Maui Department of Public Works. Some revisions to the Draft EA were made and the agency comments letters and the Applicant's response letters were included as an appendix to the Final EA.

The OCCL has conducted a thorough review of the Final EA and finds the document complete, overall. However the OCCL has two comments on technical aspects of the Final EA, which we feel should be addressed before the document may be accepted and a determination on a FONSI can be made:

1. **OCCL recommends that the Applicant provide further consideration and discussion of potential impacts to the public beach resources that may result from installation of the preferred alternative erosion control structure.** OCCL staff

identify several potential long-term impacts to the State beach resources if the preferred alternative for permanent shoreline protection is installed fronting the subject property:

- The structure footprint will encroach on the State Conservation District beach, resulting in loss of that area of the public beach ("placement loss").
- Coastal armoring has been shown to contribute to beach loss in Hawaii and elsewhere through "passive erosion" (migration of a receding shoreline toward the foot of a structure) and may contribute to further loss of the public beach fronting the subject property.
- The structure may contribute to temporary (episodic) or long-term accelerated erosion on adjacent, unarmored portions of beach ("end effects" or "flanking erosion").

OCCL recommends that the Applicant identify and discuss these and any other potential impacts from the preferred alternative design in a revised version of the Final EA, including within Sections 1 *Introduction and Summary*, 1.5.2 *Environmental Assessment and Accepting Authority*, 6 *Environmental Consequences of the Proposed Action*, and 7 *Conclusions*. Additionally, OCCL recommends that the Applicant include a discussion of whether these and any other potential impacts meet criteria for "significant impacts."

2. **OCCL recommends considering an alternative to the proposed action, which would place a shoreline protection structure completely landward of the certified shoreline.** OCCL suggests including full consideration and analysis of this alternative to the proposed action within Section 3 *Alternatives Considered* and any other sections that may apply in the Final EA.

OCCL is requesting these additions and revisions to the Final EA with the goal of improved disclosure of potential impacts from the preferred alternative design, and to provide a more complete analysis of alternatives to the proposed action. The requested information will aid OCCL in its determination on a FONSI for the Final EA and will aid the Board of Land and Natural Resources and the County of Maui Planning Commission in their determination on the project authorization.

Please contact the Office of Conservation and Coastal Lands at (808) 587-0377, should you have any questions.

Sincerely,

SAMUEL J. LEMMO, Administrator
Office of Conservation and Coastal Lands

CC: Chairperson (DLNR)
William Spence (Maui Co Planning Dept)
Jim Buika (Maui Co Planning Dept)
Tara Owens (UH Sea Grant, c/o Maui Co Planning Dept)

15. FEA Submittal Letter (July, 2013) and response to DLNR-OCCL comments on the first submission.

Sea Engineering, Inc.

Makai Research Pier • Waimanalo, Hawaii 96795-1820 • E-mail: sei@seaengineering.com
Phone: (808) 259-7966 / FAX (808) 259-8143 • Website: www.seaengineering.com

July 18, 2013

Mr. Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands,
State of Hawaii, Department of Land and Natural Resources
Post Office Box 621
Honolulu, HI, 96809

Dear Mr. Lemmo,

Subject: Hololani Shore Protection: Second submittal of the Final Environmental Assessment

Thank you for your review of the Final Environmental Assessment for Permanent Shore Protection of the Hololani Resort Condominium (FEA), dated January, 2013. We received your comment letter of April 18, 2013 and have made significant revisions in the FEA in response. We trust that these will prove satisfactory to your office. Enclosed please find two bound copies of the complete document, as well as a CD containing an electronic version. A "track changes" version is also included on the CD for your convenience in assessing the changes made.

If you need additional copies, please notify our office manager at 259-7966 (ext. 20). If you have any questions concerning the project or this submittal, please contact me at 259-7966 ext. 24 or at 265-2870 (cell).

Thank you for your assistance with this project.

J. Barry

James H. Barry, P.E.
Coastal Engineer
Sea Engineering, Inc

## APPENDIX F. COMMUNITY OUTREACH, SEPTEMBER 10, 2012


The shoreline at the Hololani Condominiums has receded almost 40 feet since 1959. The shoreline is now within 15 feet of the north building and has been stabilized by temporary structures. A new permanent structure has been designed that will allow removal of the temporary stabilization.

***The Public is invited to the Hololani to learn more about the project and voice their concerns and their support.***

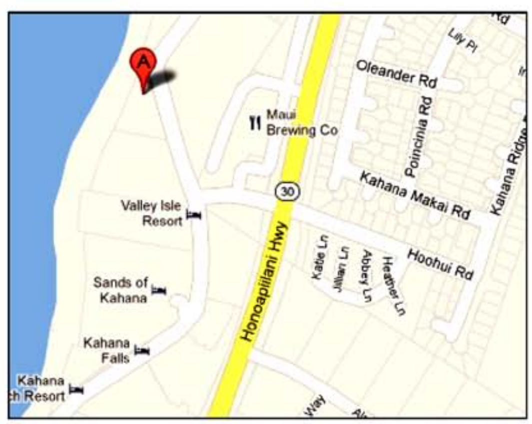
**WHEN:** September 10, 2012

**TIME:** 5:00 to 7:00 p.m.

**WHERE:** Hololani Resort Condominiums
4401 Lower Honoapiilani Rd.
Lahaina, HI 96761

**Presented By:** Mr. James Barry, P.E.
Sea Engineering, Inc.

Sea Engineering, Inc.



## INVITEES

*All of the following received invitations via email:*

***Government Officials:***

Mayor Alan M. Arakawa

Zeke Kalua

County Council Mike White

*Fire Chief* Jeffrey A. Murray

*Director of Public Works* David Goode

Senator Rosalyn H. Baker

Representative Angus L.K. McKelvey

***Council Members:***

Elle Cochran

Michael Victorino

Gladys Baisa

Joseph Pontanilla

Danny Mateo

Riki Hokama

Don Couch

Robert Carroll

***Condominiums (with contacts if available):***

*The following were contacted by phone, email or both:*

Kahana Village

Royal Kahana (Patrick Kelly, Jim Johnson )

Kahana Beach (Wayne Cober)

Sands of Kahana (Pat Sullivan, Jim Hence)

Kahana Reef (Tim Tover)

Kahana Manor (Marilynn Boland)

Kahana Gateway

Kahana Falls (Suzie Moore)

Kahana Villa (Jody Takeuchi)

***Management Companies:***

Hawaiiana

Hawaii First
Destination Maui
CRM Hawaii

***Notices were also posted by the Hololani Resident Manager on available bulletin boards at local stores.***

**Video:**
A video of the outreach proceedings is available at the following link:
http://www.youtube.com/user/seaengineering1

**Sign In:**
Following is transcribed from the on-site sign-in sheet.

# Hololani Shore Protection

COMMUNITY OUTREACH SIGN-IN SHEET

**Facilitator:** Sea Engineering, Inc. **Meeting Date:** 09/10/12

| Name/Email | Phone | Address |
|---|---|---|
| Name: Matt Rauch<br>Email: | 808-283-2550 | The Hololani<br>4401 Lower Honoapiilani Rd.<br>Lahaina, HI 96761 |
| Name: Donna & Don Hodgkinson<br>Email: | 808-665-1503 | B303 Hololani |
| Name: Paul ?<br>Email: | | |
| Name: Michelle Moore<br>Email: | 808-421-9898 | 15 Kiouohu #3 Lahaina, HI 96761 |
| Name: Chris Hart<br>Email: Chart@chpmaui.com | 808-242-1955 | 115 N. Market St. Wailuku, HI 96793 |
| Name: Paul Johnson<br>Email: paulj@hmcmgt.com | 808-264-0829 | 140 Hoohana St., Ste. 208<br>Kahului, HI 96732 |
| Name: Clay Scott<br>Email: | 808-357-1688 | PO Box 10103 Lahaina, HI 96761 |
| Name: Tara Owens<br>Email: taram@hawaii.edu | | |
| Name: Brett Davis<br>Email: bdavis@chpmaui.com | | |
| Name: Patrick Kelley<br>Email: patrickkelly09@gmail.com | | |