

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
Honolulu, Hawai'i
March 20, 2018

FILE NO.: SSBN OA-19-04

Chairperson's Office
Department of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

REGARDING: Conservation District Use Application for Category II Small Scale Beach Nourishment (SSBN) OA-19-4 for the Kuhio Beach Stub Groin and Back Passing Small Scale Beach Nourishment Project, Located at Waikiki Beach, Honolulu, Oahu, TMKs: (1) 2-6-001:003 and 008

APPLICANT: DLNR Office of Conservation and Coastal Lands

LANDOWNER: State of Hawaii

LOCATION: Kuhio Beach, Waikiki, Oahu

TMK: Shoreline fronting TMK: (1) 2-6-001:003 and 008

AREA OF USE: 1.25 acres

SUBZONE: Resource Subzone

BACKGROUND

The Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL) is proposing a Category II Small Scale Beach Restoration (SSBN) project to restore the eastern end of Royal Hawaiian Beach in Waikiki, Oahu (**Exhibits 1 and 2**) through groin construction and placement of approximately 750 cubic yards of sand.

The project was developed in response to severe erosion that ensued following the 2012 Waikiki Beach Maintenance Project (DLNR Ref: CDUA OA-2011-3558). As part of that project, approximately 27,000 cy of sand was recovered from an offshore deposit and pumped ashore to nourish the beach. Additionally, two short, old, and deteriorated cement-filled stacked bag groins (**Exhibits 3 and 4**) were removed from the eastern end of Royal Hawaiian Beach near the beach concessions.

A beach monitoring study conducted as part of the 2012 Waikiki Beach Maintenance Project reported steady erosion and beach recession of the eastern and western ends of the Royal

Hawaiian Beach sector (**Exhibit 5**), with beach recession of about 4.5 feet per year at the eastern end fronting the beach concessions. The erosion exposed the old concrete foundation of the Waikiki Tavern (**Exhibit 6**), creating a hazardous condition for beach users and swimmers and resulting in damage and flanking of the terminal structure at the eastern end of Royal Hawaiian Beach (**Exhibit 7**). The exposed concrete foundation features displaced concrete rubble and rusting reinforcing steel, which has created an unsightly and hazardous shoreline condition. Although the area is currently filled with sand, seasonal shifts in sediment transport will revert the area to an erosional condition.

Installation of a sand bag groin and beach fill utilizing sand borrowed from Kuhio Beach Park is proposed, with the objective of stabilizing the east end of Royal Hawaiian Beach and maintaining sand cover over the concrete foundation. The sand intended for fill is compatible with the existing beach following OCCL *Guidelines for SSBN Cat II General Application*. The project is intended to enhance the beach for public use and improve access and safety for beachgoers by restoring the deflated beach volume and covering the exposed foundation located at the back of the beach.

DESCRIPTION OF AREA

The proposed project site is located on Waikiki Beach, along the shoreline of Malama Bay on the south shore of Oahu, fronting TMK: (1) 2-6-001:003 and 008. The project site is at the boundary of two discrete Waikiki beach sectors – Kuhio Beach Park and Royal Hawaiian Beach, and fronts an open area used by beach concessionaires and was the site of the old Waikiki Tavern (ca. 1930s). It is in the Resource Subzone of the State Land Use Conservation District.

Kuhio Beach sector extends 1,460 feet from the Kapahulu storm drain to the western edge of two enclosed basins composed of groin and breakwater systems known as the crib walls; the western basin is known as the Ewa crib wall basin, while the eastern basin is known as the Diamond Head crib wall basin. Construction of the crib walls began in 1938, when a 700-foot long shore parallel breakwater was constructed, with shore return structures at each end to help retain sand. In 1952 a 703-foot long extension was added to the southeast end of the crib wall breakwater. Between 1972 and 1975, improvements were made to the Ewa crib wall, including increasing the height. Approximately 20,000+ cy of sand was placed on the beach. In 2000, approximately 1,400 cy of sand was pumped from an offshore deposit onto the Ewa crib wall basin, and in 2006 an additional 8,200 cy was pumped from offshore into the two basins.

The crib walls provide beach areas that are protected from wave action. This lack of wave energy reaching the shore prevents typical beach slope formation. Therefore, over time the sand slumps and moves from the shore into the basins. Thus, the beach face slopes in the basins are relatively flat, typically 1V:12H (as opposed to 1V:7H on the adjacent unprotected Royal Hawaiian Beach).

The Royal Hawaiian Beach sector extends 1,730 feet to the southeast from the Royal Hawaiian groin to the western extent of the Ewa crib wall basin. The beach sector fronts the Moana Surfrider, Outrigger Waikiki, and Royal Hawaiian hotels. There are no stabilizing structures along this reach, and the concave beach is held in place by the Royal Hawaiian groin, initially constructed in 1927 and rebuilt and lengthened in 1930.

The Royal Hawaiian groin and the western extent of the Ewa crib wall basin effectively prevent longshore sediment transport into and out of this beach sector. There is, however, longshore transport within the sector itself. In the nearshore waters there are wave generated longshore currents that are the major drivers of sediment transport direction and magnitude.

Sand can also be transported offshore by rip currents generated by large swells. A rip current has been noted in the vicinity of a paleo-channel that was formed when the Apuakehau Stream had flowed into the sea in the Royal Hawaiian Beach sector. The paleo-channel constitutes a low-lying bathymetric feature that provides a conduit for offshore sand loss.

Beach surveys following the 2012 beach nourishment project showed that the beach width decreased an average of 2.9 feet over the year following completion of the 2012 Waikiki Beach Maintenance Project. The width change varied by location within the sector, ranging from +5.7 feet in the central segment to -9.4 feet at the west end near the Royal Hawaiian groin. Continued monitoring of the 2012 beach nourishment project shows that after six years roughly half of the original 2012 width has been lost. The greatest loss of beach width has occurred at the east and west ends, with beach recession of 3 to 5 feet per year recently being experienced at the proposed project site. The monitoring also confirmed predominant longshore transport to the west and onshore-offshore transport through the deeper paleo stream channel. Shoreline change adjacent to the Kuhio groin between 2012 and 2018 is shown in Exhibit 5.

DESCRIPTION OF PROPOSED ACTION

The objective of the proposed project is to re-stabilize the eastern end of Royal Hawaiian Beach and to maintain sand cover over the concrete foundation by sand placement and construction of a groin (**Exhibit 8**). The proposed groin would consist of a 95-foot ElcoRock geotextile structure installed 140 feet west of the Ewa crib wall basin along the eastern end of Royal Hawaiian Beach in Waikiki, Oahu. The proposed beach fill would entail transport of 750 cubic yards of sand from the beach face of the Diamond Head crib wall basin to the area between the Ewa crib wall basin and the proposed structure.

The 95-foot groin length is the minimum length necessary to ensure adequate beach width to keep the concrete rubble covered. The structure would have a crest elevation of +3.5 feet msl and would have a toe elevation of -2.8 feet. The groin would require 68 2.5m³ sand-filled geotextile containers to construct, and 225 cy of sand to fill the containers.

Approximately 750 cy of sand will be required to cover the concrete rubble and fill the cell between groins to its design shape. The sand would be removed from the beach face using an excavator, and temporarily stockpiled on the basin backshore until being trucked to the fill site. The excavator would not operate in the water. Fill sand would be pushed into place between the western extent of the Ewa crib wall basin and the new geotextile groin using a small bulldozer. Trucking activity would require the temporary closure of the makai lane of Kalakaua Ave.

To determine quality of the sand source, the sand bottom seaward of the beach toe was probed along three transects (North, Mid, South) in both the Ewa and Diamond Head basins (**Exhibit 9**). The transect profiles and the sand surface and hard refusal probe depth are shown in Exhibits 10 and 11. Water depths in the basins were typically 1 to 3 feet, and the jet probe refusal depth

(which often indicates hard bottom) was at elevations of -5 to -9 msl. Sand layer thickness ranged from about 5 to 8 feet (**Exhibit 9**). Note that at the northern end of the Ewa basin, seaward of which there is a gap in the crib wall and thus limited wave protection, there is virtually no sand overlaying the hard bottom and a steeper beach face of about 1V:8H. Hammer push core sand samples were taken in each basin at the locations shown in Exhibit 9, and illustrations of the core depths and in situ sand color are also shown. Significant variation in sand color was noted in the cores, ranging from light brown/tan to dark gray almost black. The sand color variation is shown in **Exhibit 12**.

The dark gray/black sample rapidly changed to light gray with exposure to air and sunlight. Grain size analysis of the core samples shows an average median grain size of 0.42, and percent fine material (<0.074mm) ranging from 1.2 to 3.2. The sand is moderately sorted.

Sand for the geotextile containers would be obtained from the Pacific Aggregate, Inc. inland sand quarry. Filling and placing the containers would involve a small excavator for placing sand in the hopper of the filling stand. A medium size excavator (40 ton) would be used to transport and place the containers. An estimated 3 containers can be filled and placed per hour. Construction would proceed from the shore seaward. The beach within the groin footprint would be excavated down to the -2.8-foot elevation for placement of the first layer of containers, with excavated sand being side cast to the east. The first and second course of containers would be placed all the way to the end and would provide a stable platform above the water line for the placement equipment (excavator) to traverse. Groin construction would then proceed from the seaward end and work landward placing the third layer to complete the groin. Turbidity containment devices (silt curtains) would be placed around the area of groin construction and sand placement.

The proposed project is anticipated to take an estimated 10 days from mobilization on-site. Construction would require the closure of a portion of the beach in the vicinity of the groin installation and a portion of the Diamond Head basin for approximately two weeks to ensure the safety of the public. While the project area portion of the beach is closed, the area would be cordoned off with informative signs posted to ensure that the public does not enter the work site. The makai lane of Kalakaua Avenue near the project site would also need to be closed for part of the project duration to allow for trucks to deliver groin materials and transport sand from the Kuhio Beach Diamond Head Basin to the fill area. Crossing guards would be placed at designated crossings along the shoreline to assist the public in transiting across the access route while trucks are operating. Construction activities would also disrupt the business activity of the beach concessionaire located in the vicinity of the construction activity. The State and City and County will work with the beach vendor to develop a temporary relocation or activity consolidation plan to minimize impacts. The work specifications would specify that the construction is to be completed in the most time effective manner as possible so as to minimize the inconvenience of beach closure.

The proposed project is not intended to be a permanent improvement, thus ElcoRock geotextile containers are proposed for the groin construction. The Department is currently preparing an environmental impact statement that will propose a permanent solution to stabilize beach in this sector. ElcoRock is a coastal construction system utilizing robust geotextile containers designed

to be filled with sand and then placed to form a stable and durable structure. Large 2.5m³ containers are proposed to be used, each weighing approximately 10,000 pounds, which will provide a stable structure for the project site wave conditions. The large bags are also efficient to install and remove. The non-woven geotextile fabric is UV and vandal resistant, has excellent abrasion resistance, and its soft finish is attractive and non-abrasive. The design beach position would maintain a two-foot (2') vertical buffer of sand over the makai edge of the foundation.

In accordance with Department of Health Clean Water Branch Section 401 Water Quality Certification requirements, water quality test methods promulgated in 40 CFR, Part 136 and the chemical methodology for sea water analyses in HAR, §11-54-10 would be employed. If enterococcus bacteria monitoring were to exceed the Statistical Threshold Value (STV) of 130 per one hundred milliliters, warning signs would be posted, and daily monitoring would be conducted until the receiving water enterococcus count reads below 130 /100 ml. The specific criteria for enterococcus shall be expressed in colony forming units (CFU) per one hundred milliliters or as a most probable number (MPN) per one hundred milliliters, as specified by the analytical method used.

SUMMARY OF COMMENTS

The application was referred to the following agencies for their review and comment:

- DLNR Historic Preservation
- Department of Health, Clean Water Branch
- DLNR Division of Boating and Ocean Recreation
- DLNR Division of Aquatic Resources
- Department of Health, Clean Water Branch
- US Army Corps of Engineers

Responses were received from the following agencies:

DLNR Aquatic Resources (DAR)

The Division is supportive of this project with no major objections as the construction plan submitted by the applicant clearly details efforts to minimize impacts on the aquatic environment. With the foundation of the old Waikiki Tavern being exposed there is a clear need for this project for the safety of the public. No long term impacts to the marine environment are anticipated.

The Division is in agreement with the Best Management Practices (BMPs) outlines in the Basis of Design and Project Assessment. The only suggestion we have in addition to the already outlined BMPs is to try to schedule site work during periods of low tides and minimal rainfall to the extent possible, in order to minimize and control material flowing in and out of the construction area.

Thank you for providing DAR the opportunity to review and comment on the proposed project. Should there be any changes to the project plans, DAR requests the opportunity to review and comment on those changes.

Applicant's Response

We greatly appreciate comments received from DAR regarding the Kuhio Beach Groin and Sand Nourishment Project. The main comment from DAR was the suggestion that site work to be scheduled during period of low tides and minimal rainfall to the extent possible, in order to minimize and control material flowing in and out of the construction area.

In response to this comment we have amended one of the existing terms and conditions as follows:

"Work shall be conducted at low tide during minimal rainfall and calm weather periods to the most practical extent possible and no work shall occur if there is high surf or ocean conditions that will create unsafe work or beach conditions;"

Should there be any changes to the project plans, DAR will be informed of the changes and invited to review and comment on those changes.

A response was received from the DLNR Division of Boating and Ocean Recreation which stated that the agency had no comments regarding the project.

The application was also made available for 30-day public review and comment in the Office of Environmental Quality and Control (OEQC) Environmental Bulletin on February 23, 2019¹. No comments have yet been received, however the comment period has passed.

All required permits are currently being processed, including Department of the Army (DA) Section 10 and Section 404 permits, the Department of Health (DOH) National Pollutant Discharge Elimination System (NPDES) permit, the State of Hawaii Coastal Zone Management (CZM) Federal Consistency Determination, the State of Hawaii Department of Health Section 401 Water Quality Certification (WQC), and the Conservation District Use Permit (CDUP).

We note that owing to the location of the project entirely seaward of the shoreline (**Exhibit 13**), the project is not located with the County Special Management Area (SMA). Therefore, A Special Management Area Use Permit is not Required.

State Historic Preservation Division (SHPD)

Finally, on March 8, 2019, OCCL wrote to The State Historic Preservation Division and determined as follows:

Identification and inventory of historic properties:

The foundation of the old Waikiki Tavern is adjacent to the project site. The foundation was covered for many decades following successive beach restoration projects in Waikiki starting in the 1930s. In 2012 the State conducted a beach maintenance project in which two sand bag groins were removed. This resulted in erosion occurring and uncovering the foundation of the Waikiki Tavern. The foundation is currently covered with sand.

¹ Office of Environmental Quality Control (February 23, 2019). The Environmental Notice. http://oeqc2.doh.hawaii.gov/The_Environmental_Notice/2019-02-23-TEN.pdf

Evaluation of significance:

Placement of the new sand bag groin would occur to the west of the foundation of the Waikiki Tavern foundation and would not affect the structure. Sand would be borrowed from the Diamond Head Basin of Kuhio Beach and placed over the area where the foundation exists.

Determining effects to significant historic properties:

The OCCL has determined “no historic properties affected.”

Mitigation:

As we have determined “no historic properties affected,” no mitigation is warranted.

ANALYSIS

After reviewing the application, the Department finds that:

1. The proposed activities are identified land uses within the Resource subzone of the Conservation District, according to Hawaii Administrative Rules (HAR) §13-5-22 (P-16) *Beach Restoration*;
2. The project is consistent with the purpose of the Conservation District and consistent with the goals and objectives of the Hawaii Coastal Erosion Management Plan (COEMAP) adopted by the Board of Land and Natural Resources in 1999. It is a major goal of COEMAP to promote appropriate erosion control and beach restoration efforts such as this.
3. The beach restoration approach taken has been to develop an effective design with the smallest environmental and community “footprint” possible and follows the SSBN and COEMAP guidelines and policies.
4. The project is consistent with the Environmental Assessment and Statewide Conservation District Use Permit (CDUP ST-3000) for Small-Scale Beach Nourishment projects in Hawaii. A Finding of No Significant Impact (FONSI) for the Final Environmental Assessment supporting the Statewide CDUP and State Program General Permit for Small Scale Beach Nourishment Projects in the Hawaiian Islands was issued by DLNR in May, 2000.

DISCUSSION:

The proposed project is intended to re-stabilize the eastern end of Royal Hawaiian Beach and to maintain sand cover over a hazardous concrete foundation through a combination of sand back-passing and installation of a temporary groin structure. The project will utilize approximately 750 cubic yards of calcium carbonate sand currently present within the Diamond Head crib wall basin for the back-passing component of the project. The existing beach at the project site is a combination of native and place carbonate sand from previous beach activities. Sand samples from the borrow location indicate an acceptable match to the existing beach at the project site. Suitable carbonate sand sourced from a local off-site quarry will be used to fill geotextile sandbags that will comprise the groin structure.

The proposed project was developed in response to localized erosion that occurred following the 2012 Waikiki Beach Maintenance Project (DLNR Ref: CDUA OA-2011-3558), which included removal of two dilapidated groins that had served to decelerate seasonal sediment transport. According to a post-project monitoring study², two main erosional hotspots were observed near the eastern and western terminal structures of Royal Hawaiian Beach (Ewa crib wall basin and Royal Hawaiian Groin, respectively). The highest rates of erosion were measured adjacent to the eastern terminal structure, which resulted in exposure of an antecedent hard structure that had been previously buried beneath the beach face. As reported by the monitoring study, localized erosion adjacent to the eastern terminal structure was found to result from a combination of flanking and groin removal, which allowed the area to experience more rapid changes in beach width as part of and seasonal reversals in the direction of sand transport.

The nourishment project is intended to re-stabilize the eastern end of Royal Hawaiian Beach in a similar fashion as the preexisting groins, although erosion is expected to continue as sand is transported alongshore and offshore as it had in the past prior to groin removal.

It is understood that extensive care has been taken in designing the project and choosing the location of the sand placement and quality in order to minimize user conflicts and environmental impacts, including impacts on water quality and local flora and fauna including coral reefs.

As such, Staff recommends the following:

RECOMMENDATION

Based on the preceding analysis, Staff recommends that the Chair of the Board of Land and Natural Resources **Approve** Category II Small Scale Beach Nourishment (SSBN) application OA-19-04 for the Kuhio Beach Stub Groin and Sand Back Passing Project, at Waikiki, Oahu, Hawaii; fronting TMK: (1) 2-6-001:003 and 008.

TERMS AND CONDITIONS

If approved, the project will be subject to the following Terms and Conditions:

1. The applicant shall comply with all applicable statutes, ordinances, rules, and regulations of the Federal, State, and County governments, and applicable parts of Chapter 13- 5, HAR;
2. The applicant shall comply with all applicable Department of Health administrative rules;
3. Any work or construction to be done on the land shall be initiated within one (1) year of the approval of such use, in accordance with construction plans that have been signed by the Chairperson, and, unless otherwise authorized, shall be completed within three (3) years of the approval of such use;

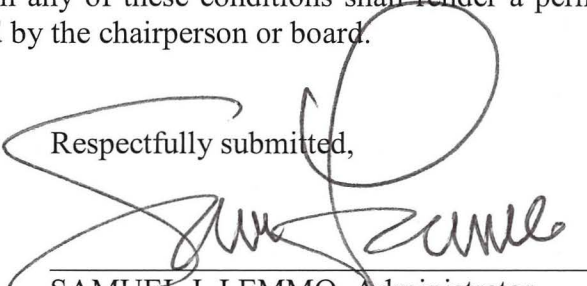
² Habel, S., Fletcher, C. H., Barbee, M., & Anderson, T. R. (2016). The influence of seasonal patterns on a beach nourishment project in a complex reef environment. *Coastal Engineering*, 116, 67-76.

4. The applicant understands and agrees that the permit does not convey any vested right(s) or exclusive privilege;
5. Work shall be conducted at low tide during minimal rainfall and calm weather periods to the most practical extent possible and no work shall occur if there is high surf or ocean conditions that will create unsafe work or beach conditions;
6. Authorization of the sand use and placement is contingent upon review and approval of the sand by the Department. 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;
7. Sand used for beach maintenance shall be screened of course material (rocks) and any non-beach compatible material;
8. To avoid encroachments upon the area, the applicant shall not use artificially accreted areas due to nourishment as indicators of the shoreline;
9. The applicant shall implement Best Management Practices (BMPs) to minimize dirt and silt from entering the ocean and the ability to contain and clean up fuel, fluid, or oil spills immediately for projects authorized under this authorization and immediately report any spill(s) or other contamination(s) that occurs at the project site to the Department of Health and other appropriate agencies;
8. The applicant shall ensure that excessive siltation and turbidity is contained or otherwise minimized to the satisfaction of the all appropriate agencies, through silt containment devices or barriers, high sand quality and selective sand placement;
9. Appropriate safety and notification procedures shall be carried out. This shall include high visibility safety fencing, tape or barriers to keep people away from the active construction site and a notification to the public informing them of the project;
10. All placed material shall be free of contaminants of any kind including: excessive silt, sludge, anoxic or decaying organic matter, turbidity, temperature or abnormal water chemistry, clay, dirt, organic material, oil, floating debris, grease or foam or any other pollutant that would produce an undesirable condition to the beach or water quality;

11. A survey of the project area shall be conducted prior to commencement of the proposed activities to ensure no protected marine species are in the project area. If protected species are detected activities shall be postponed until the animal(s) voluntarily leave the area. All on-site personnel shall be apprised of the status of any protected species;
12. At the conclusion of work, the applicant shall clean and restore the site to a condition acceptable to the Chairperson;
13. The permittee shall comply with all applicable statutes, ordinances, rules, and regulations of the federal, state, and county governments, and applicable parts of this chapter;
14. The permittee, 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 this permit or relating to or connected with the granting of this permit;
15. The permittee shall obtain appropriate authorization from the department for the occupancy of state lands, if applicable;
16. The permittee shall comply with all applicable department of health administrative rules;
17. In issuing the permit, the department and board have relied on the information and data that the permittee has provided in connection with the permit application. If, subsequent to the issuance of the permit such information and data prove to be false, incomplete, or inaccurate, this permit may be modified, suspended, or revoked, in whole or in part, and the department may, in addition, institute appropriate legal proceedings;
18. Where any interference, nuisance, or harm may be caused, or hazard established by the use, the permittee shall be required to take measures to minimize or eliminate the interference, nuisance, harm, or hazard;
19. Obstruction of public roads, trails, lateral shoreline access, and pathways shall be avoided or minimized. If obstruction is unavoidable, the permittee shall provide alternative roads, trails, lateral beach access, or pathways acceptable to the department;
20. For all landscaped areas, landscaping and irrigation shall be contained and maintained within the property, and shall under no circumstances extend seaward of the shoreline as defined in section 205A-1, HRS;

- 21. Artificial light from exterior lighting fixtures, including but not limited to floodlights, uplights, or spotlights used for decorative or aesthetic purposes, shall be prohibited if the light directly illuminates or is directed to project across property boundaries toward the shoreline and ocean waters, except as may be permitted pursuant to section 205A-71, HRS. All exterior lighting shall be shielded to protect the night sky;
- 22. The permittee acknowledges that the approved work shall not hamper, impede, or otherwise limit the exercise of traditional, customary, or religious practices of native Hawaiians in the immediate area, to the extent the practices are provided for by the Constitution of the State of Hawaii, and by Hawaii statutory and case law;
- 23. Should historic remains such as artifacts, burials or concentration of charcoal be encountered during construction activities, work shall cease immediately in the vicinity of the find, and the find shall be protected from further damage. The contractor shall immediately contact HPD (692-8015), which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary;
- 24. Other terms and conditions as prescribed by the chairperson;
- 25. Failure to comply with any of these conditions shall render a permit void under the chapter, as determined by the chairperson or board.

Respectfully submitted,



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

Under the authority of §13-5-22 (P-16), Hawai'i Administrative Rules, this request for a Departmental Permit for SSBN MA-15-2 is hereby:

- Approved
- Disapproved

Dated at Honolulu, Hawai'i 4/8/2019



SUZANNE D. CASE, Chairperson
Board of Land and Natural Resources



EXHIBIT 1: Project Location

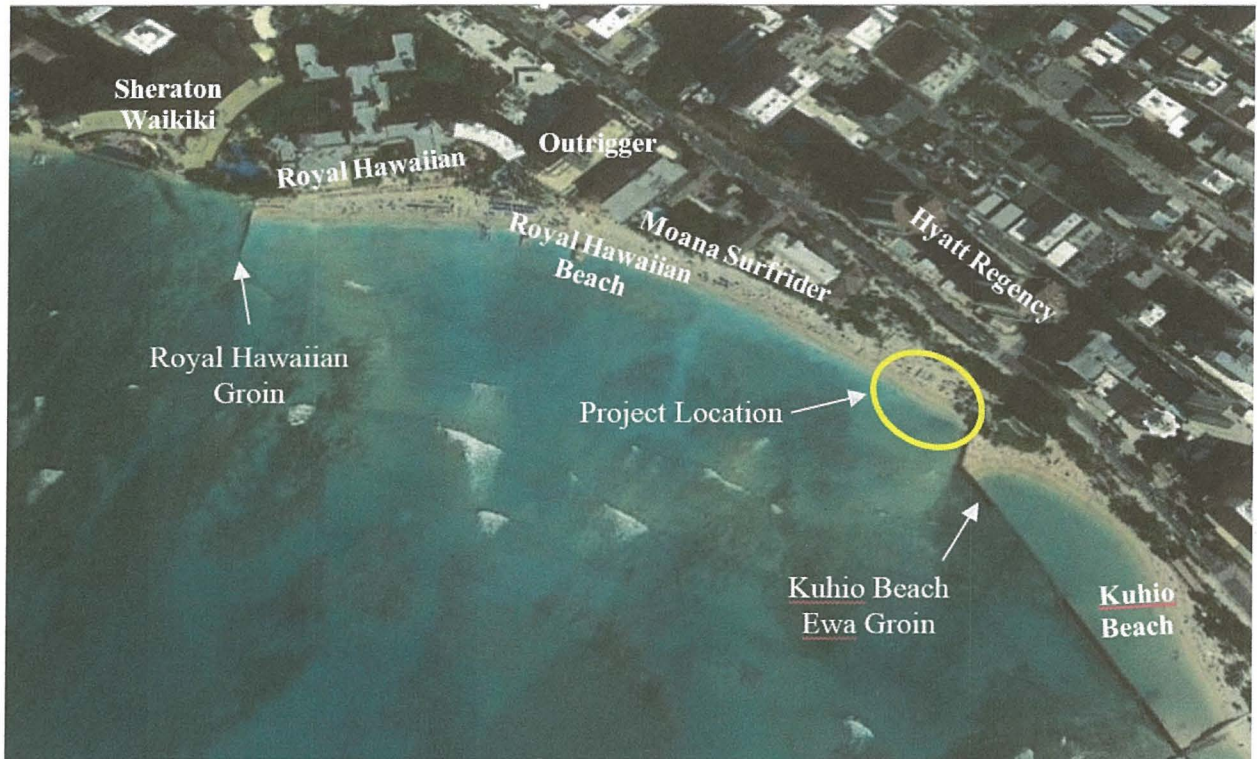


EXHIBIT 2: Overview of Project Site



EXHIBIT 3: 2008 aerial photo showing two groins that were removed in 2012



EXHIBIT 4: Groins that were removed in 2012 (2005 photo courtesy Dolan Eversole)

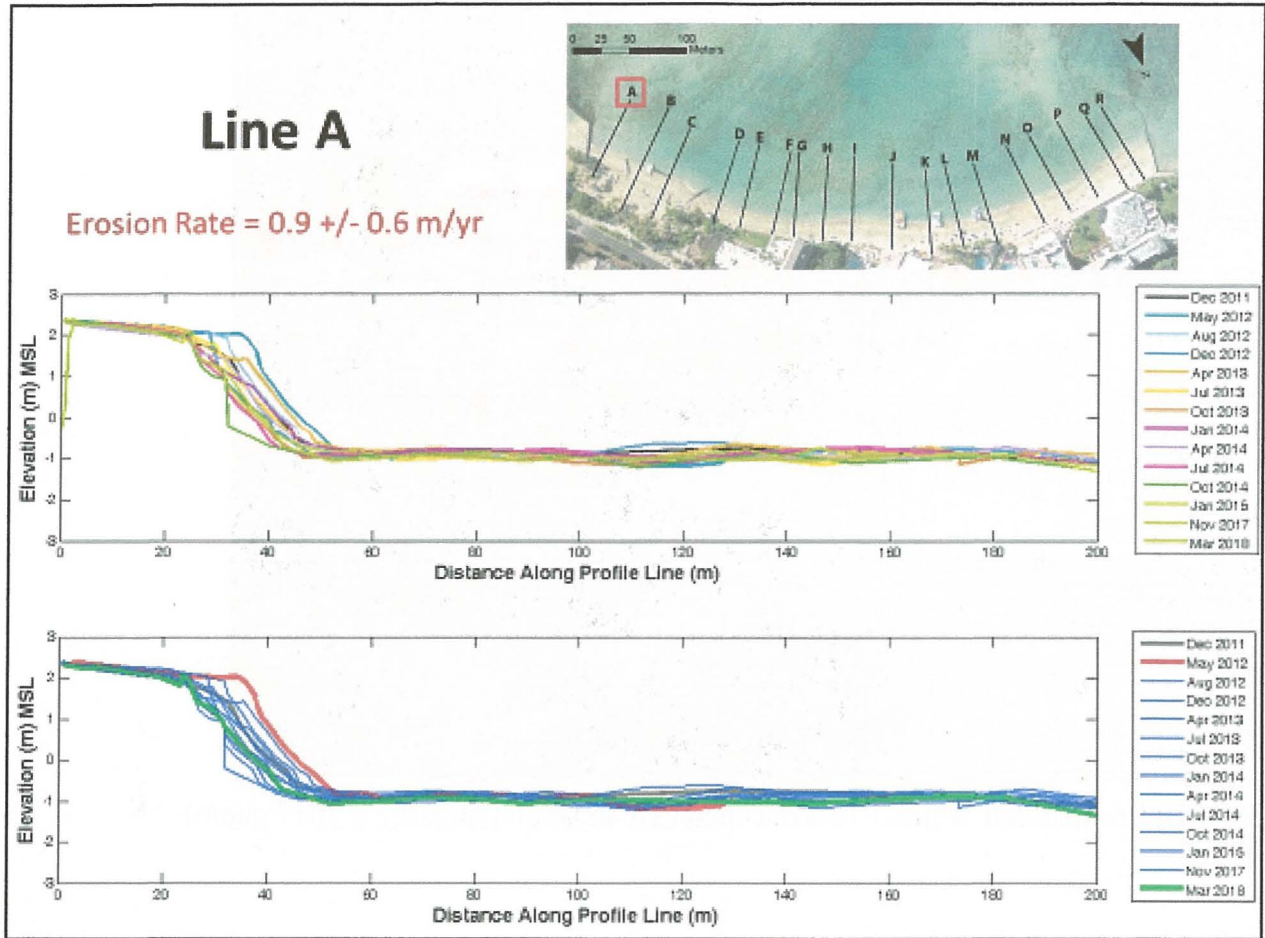


EXHIBIT 5: Shoreline change adjacent to the western extent of the Ewa crib wall basin between 2012 and 2018



EXHIBIT 6: Exposed Waikiki Tavern concrete foundation (August 21, 2017 photo)



EXHIBIT 7: Flanking of Kuhio Beach Ewa groin (May 2017 photo)

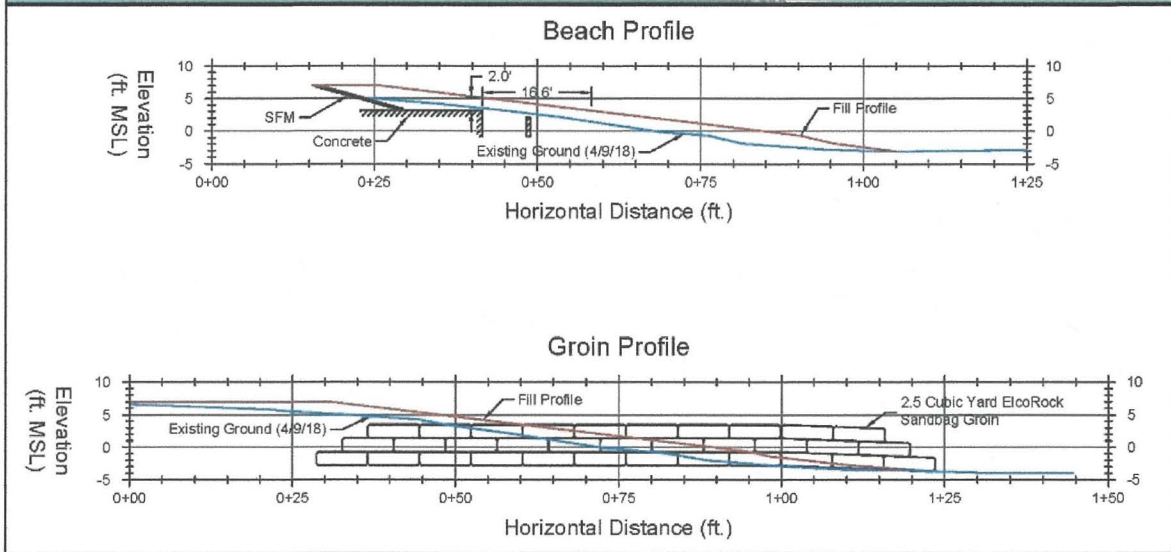
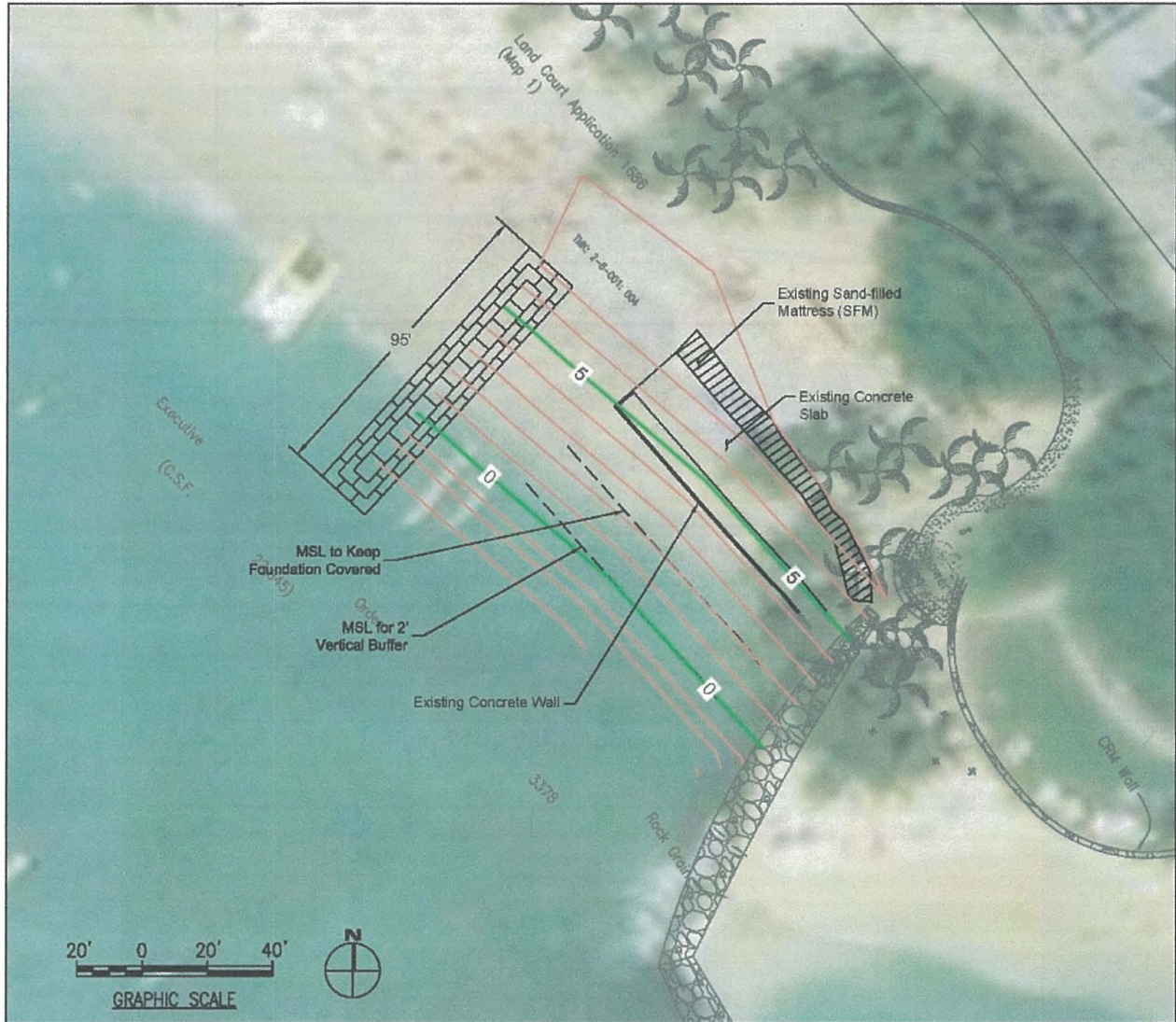


EXHIBIT 8: Project design including groin placement and fill profile

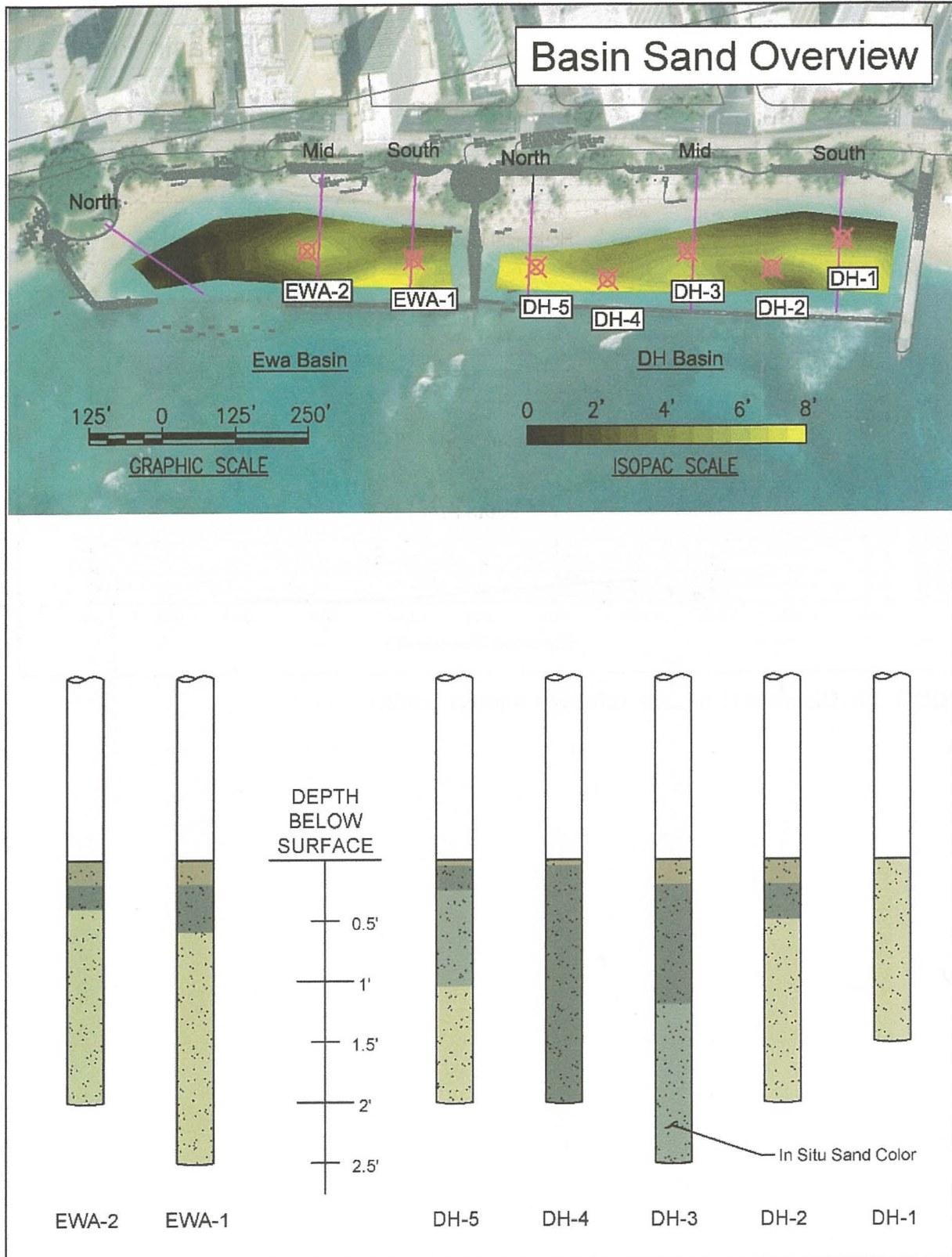


EXHIBIT 9: Transect line locations and sand thickness isopachs (top); sand core illustrations (bottom)

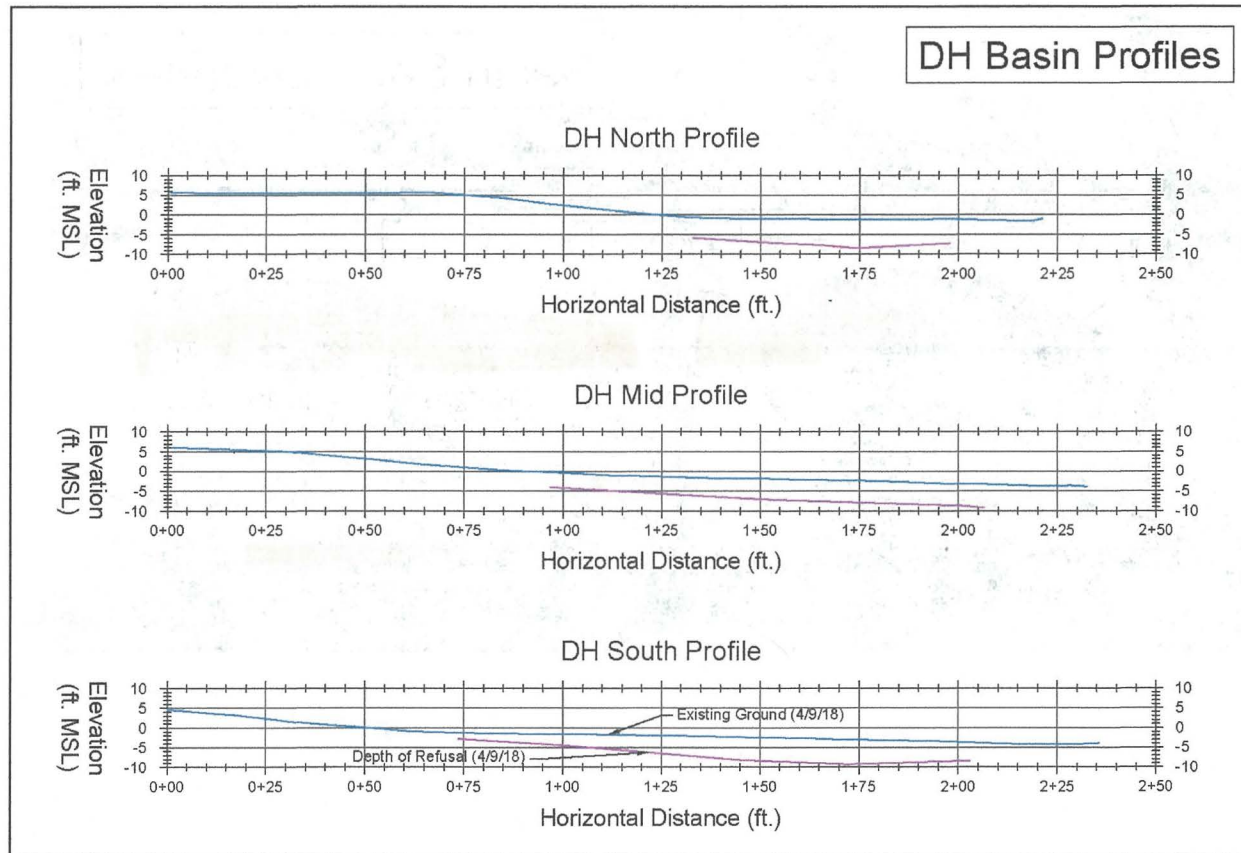


EXHIBIT 10: Diamond Head crib wall basin transect profiles

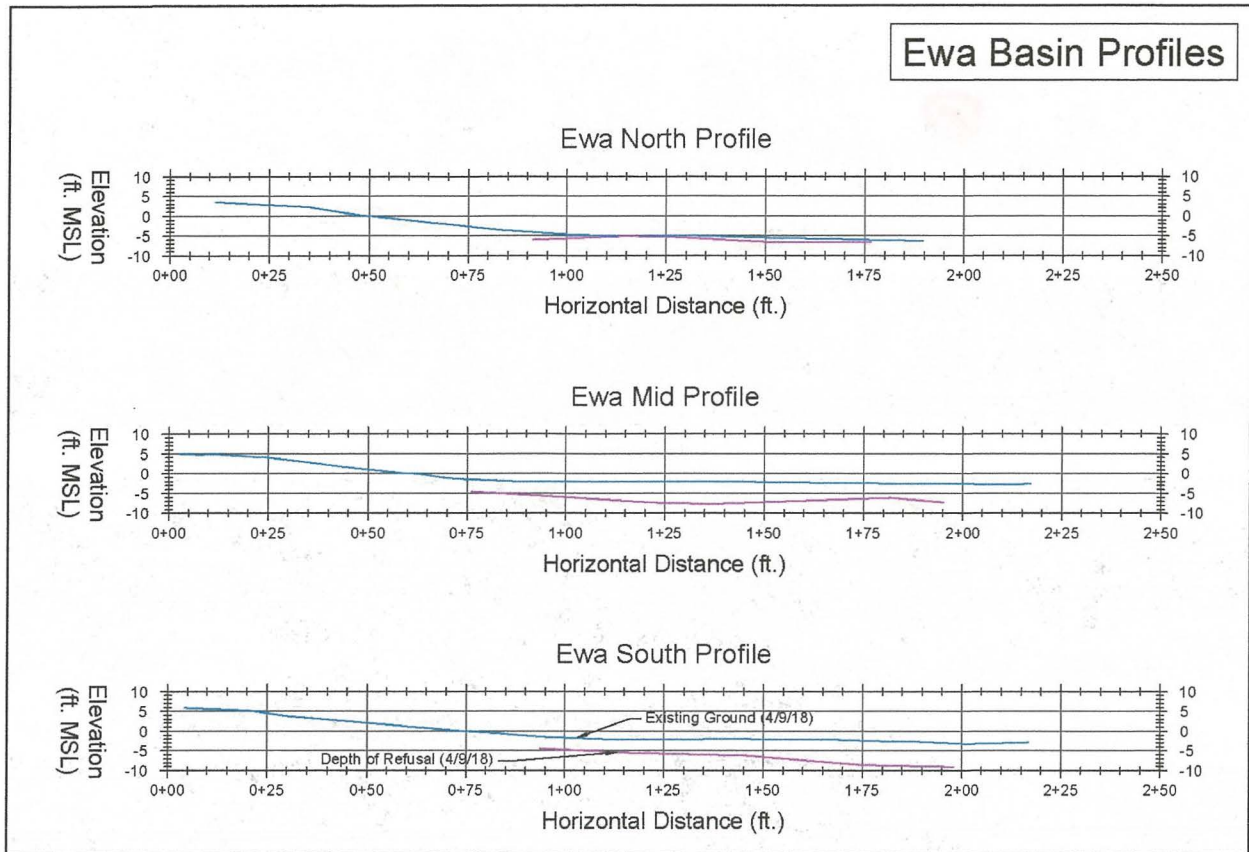


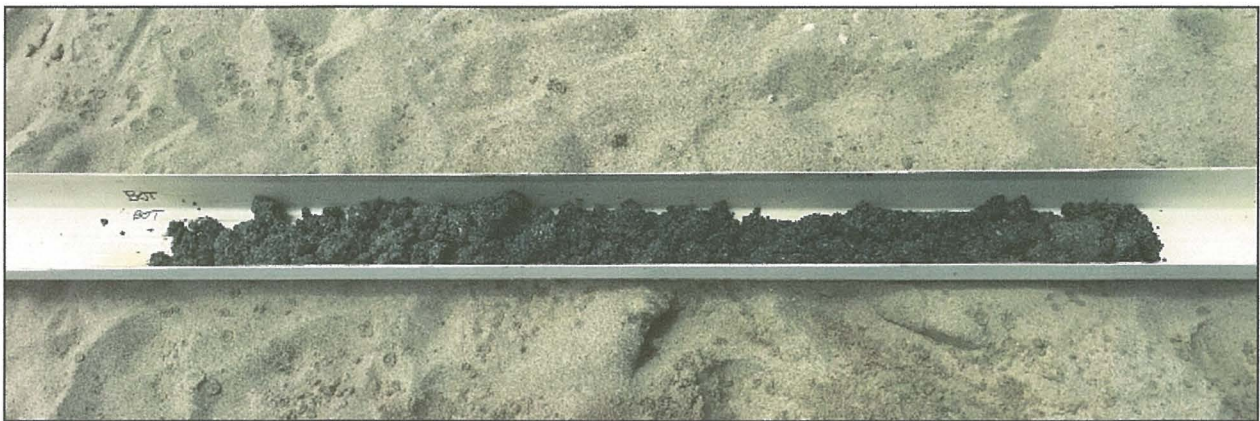
EXHIBIT 11: Ewa crib wall basin transect profiles



Ewa - 1



DH - 5



DH - 4

EXHIBIT 12: Sand core samples

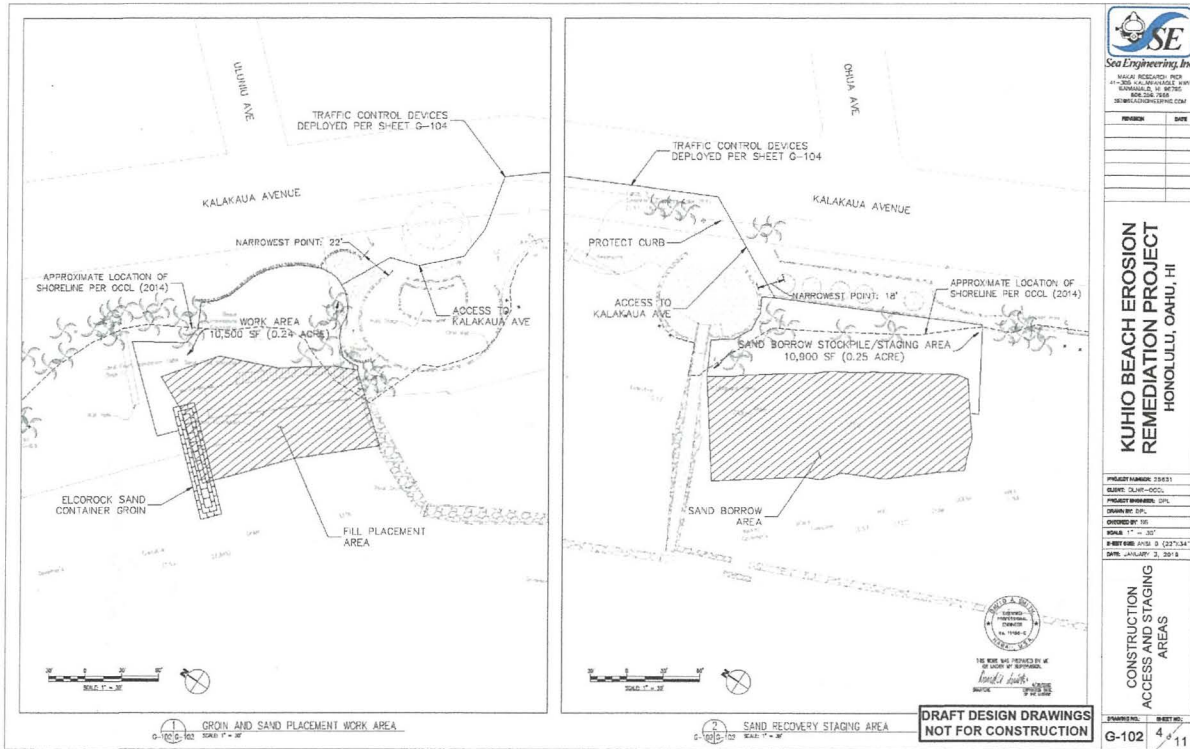


EXHIBIT 13: Location of the project entirely seaward of the shoreline