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October 29, 2025

Ms. Mary Alice Evans, Director
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Office of Planning and Sustainable Development
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Honolulu, HI 96813

Ms. Dawn N. S. Chang, Chairperson
Department of Land and Natural Resources
Kalanimoku Building
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Honolulu, HI 96813

SUBJECT Publication of the Draft Environmental Impact Statement for the Proposed Hoʻāla Honokōwai Project Located at Honokōwai, Lahaina, Maui, Tax Map Keys (TMKs) (2) 4-4-001:097, 098, and 100

Dear Ms. Evans and Ms. Chang:

On behalf of the West Maui Resort Partners, L.P., "the Applicant", Munekiyo Hiraga (MH) is submitting the Draft Environmental Impact Statement (EIS) for the Proposed Hoʻāla Honokōwai Project, located at Honokōwai, Lahaina, on the island of Maui at Tax Map Keys (TMKs): (2) 4-4-001:097, 098, and 100. In accordance with Hawaiʻi Administrative Rules (HAR) Section 11-200.1-5(e)(5)(C), the Draft EIS has been filed simultaneously with the Environmental Review Program (ERP) and the State of Hawaiʻi, Department of Land and Natural Resources as the Accepting Authority via the Office of Conservation and Coastal Lands.

We respectfully request the Draft EIS be published in the next edition of *The Environmental Notice* on November 8, 2025. An electronic copy of this transmittal letter and the supporting documents have been uploaded to the ERP online submittal form. As required by HAR Section 11-200.1-5(e)(5)(D) a hard copy of the Draft EIS has been submitted to the Hawaiʻi Documents Center and the Wailuku Library.

Should you have any questions, please contact me at (808) 244-2015 or via email at honokowai@munekiyohiraga.com.

Very truly yours,

Tessa Munekiyo Ng, AICP
Vice President

TMN:tn
Enclosure
cc: Michael Elliott, West Maui Resort Partners, L.P.
Tyler Middleton, Hilton Grand Vacations
Michael Cain, Administrator, Office of Conservation and Coastal Lands
K:\DATA\HGV\KBC Beach Restor\Apps\0Draft EIS\0ERP DRAFT EIS SUBMITTAL\Draft EIS trans.ltr.docx

From: dbedt.opsd.erp@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Wednesday, October 29, 2025 3:40:53 PM

Action Name

Proposed Hoʻāla Honokōwai Project

Type of Document/Determination

Draft environmental impact statement (DEIS)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds
- (2) Propose any use within any land classified as a conservation district
- (3) Propose any use within a shoreline area

Judicial district

Lahaina, Maui

Tax Map Key(s) (TMK(s))

(2) 4-4-001:097; (2) 4-4-001:098; (2) 4-4-001:100

Action type

Applicant

Other required permits and approvals

See Chapter IX, List of Permits and Approvals.

Discretionary consent required

Conservation District Use Permit, Easement (if applicable), Special Management Area Use Permit, and Shoreline Setback Variance (if applicable)

Agency jurisdiction

State of Hawai'i

Approving agency

Department of Land and Natural Resources

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Is there a consultant for this action?

Yes

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Map It

Action summary

Honokōwai Beach (Project Site) is located north of Kā‘anapali and south of Kahana Bay on the west coast of Maui.

The Project Site primarily fronts the Ka‘anapali Beach Club, Kaanapali Shores Condominium to the north, and Maui Kai Condominiums to the south. The Project Site at is located approximately a half mile south of Honokōwai Beach Park.

Honokōwai Beach is an important natural, cultural, recreational, and aesthetic resource that supports a variety of cultural, recreational, and economic uses. Honokōwai Beach offers perpendicular and lateral shoreline access and public parking and restrooms. The beach acts as a natural buffer that absorbs wave energy and protects the backshore and infrastructure from erosion, avulsion, and flooding.

In 2016 a combination of human-caused environmental conditions led to a significant beach erosion and backshore avulsion event which permanently changed the makeup of the beach and backshore. The Proposed Action is beach restoration at Honokōwai Beach which is a proactive, nature-based response to human-induced sea level rise. This EIS assesses three methods of beach restoration, beach nourishment, beach maintenance, and beach stabilization.

Attached documents (signed agency letter & EA/EIS)

- Hoala_Honokowai_Project-_Scoping-_Meeting_-Recording_2023_01_17.m4a
- Hoala_Honokowai_Project-_DEIS_Volume-II_Nov_2025.pdf
- Hoala_Honokowai_Project-_DEIS_Volume-I_Nov_2025.pdf
- Hoala_Honokowai_Project-_DEIS_Transmittal_Letter_10.29.25.pdf

ADA Compliance certification (HRS §368-1.5):

The authorized individual listed below acknowledges that they retain the responsibility for ADA compliance and are knowingly submitting documents that are unlocked, searchable, and may not be in an ADA compliant format for publication. Audio files do not include transcripts, captions, or alternative descriptions. The project files will be published without further ADA compliance changes from ERP, with the following statement included below the project summary in The Environmental Notice: "If you are experiencing any ADA compliance issues with the above project, please contact (authorized individual submitting the project at email)."

Shapefile

- The location map for this Draft EIS is the same as the location map for the associated EIS Preparation Notice.

Action location map

- Hoala_Honokowai_Project-_DEIS_Shapefile.zip

Authorized individual

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honokowai@munekiyohiraga.com

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(808) 244-2015

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

VOLUME I OF II
(INCLUDING APPENDICES A TO C)

Draft Environmental Impact Statement

PROPOSED HOʻĀLA HONOKŌWAI PROJECT, LAHAINA, MAUI, HAWAIʻI

(TMK Nos. (2) 4-4-001:097, 098, and 100)



Prepared for:

West Maui Resort Partners, L.P.

November 2025

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Docusign Envelope ID: 8FE41C17-271B-4E25-A52A-D8A36C464A7F

VOLUME I OF II

(INCLUDING APPENDICES A TO C)

Draft Environmental Impact Statement

PROPOSED HOʻĀLA HONOKŌWAI PROJECT, LAHAINA, MAUI, HAWAIʻI

(TMK Nos. (2) 4-4-001:097, 098, and 100)

Prepared for:

West Maui Resort Partners, L.P.

Accepting Authority:

Department of Land and Natural Resources

This Draft Environmental Impact Statement and all ancillary documents were prepared under my direction or supervision, and the information submitted to the best of my knowledge, fully addresses document content requirements set forth in Hawaiʻi Revised Statutes, Chapter 343 and Hawaiʻi Administrative Rules, §11-200.1, as applicable.

Signed by:
Michael Elliott
[illegible]

Signed by Michael Elliott, West Maui Resort Partners, L.P.

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November 2025

MUNEKIYO HIRAGA

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Project Summary

Project Name:	Hoʻāla Honokōwai
Type of Document:	Draft Environmental Impact Statement (Draft EIS)
Legal Authority:	Chapter 343, Hawaiʻi Revised Statutes Title 11, Chapter 200.1, Hawaiʻi Administrative Rules
Applicable Chapter 343, Hawaiʻi Revised Statutes (HRS) "Triggers":	The use of State lands, work within the State Land Use Conservation District, work within the shoreline area.
Location:	Lahaina, Maui, Hawaiʻi
Tax Map Keys (TMKs):	(2) 4-4-001:097 (Kaanapali Shores Condominium) (2) 4-4-001:098 (West Maui Resort Partners, L.P., Applicant) (2) 4-4-001:100 (Maui Kai Condominium) Lands seaward of above-mentioned TMKs
Landowners:	Kaanapali Shores Condominium ((2) 4-4-001:097) West Maui Resort Partners, L.P. ((2) 4-4-001:098) (Applicant) Maui Kai Condominium ((2) 4-4-001:100) State of Hawaiʻi (lands seaward of the shoreline)
Applicant:	West Maui Resort Partners, L.P. 5323 Millenia Lakes Boulevard Orlando, Florida 32839 Contact: Michael Elliott Phone: (407) 613-3348 Email: Michael.Elliott@hgv.com
Accepting Authority:	Department of Land and Natural Resources State of Hawaiʻi 1151 Punchbowl Street, Room 131 Honolulu, Hawaiʻi 96813 Contact: Michael Cain, Administrator, Office of Conservation and Coastal Lands Phone: (808) 587-0377 Email: michael.cain@hawaii.gov
Consultant:	Munekiyo Hiraga 305 High Street, Suite 104 Wailuku, Hawaiʻi 96793 Contact: Tessa Munekiyo Ng, AICP Phone: (808) 244-2015 Email: honokowai@munekiyohiraga.com

Project Summary
(continued)

1. Description of Proposed Action

Honokōwai Beach (Project Site) is located north of Kāʻanapali and south of Kahana Bay on the west coast of the island of Maui. The Project Site primarily fronts the Kaʻanapali Beach Club (KBC) (TMK (2) 4-4-001:098), as well as Kaanapali Shores Condominium (Kaanapali Shores) (TMK (2) 4-4-001:097) to the north and Maui Kai Condominiums (Maui Kai) (TMK (2) 4-4-001:100) to the south. The Project Site at Honokōwai Beach is located approximately a half mile south of Honokōwai Beach Park. Like many beaches in Hawaiʻi, the Project Site is subject to erosion, avulsion[1], and beach loss from human-induced sea level rise. It has been found that the average shoreline recession in the State is projected to be nearly twice the historical rates by 2050, and nearly 2.5 times the historical rates by 2100. See **Appendix "A"**, Section 7.3.4. Projected Sea level rise will impact Maui beaches, including the Project Site at Honokōwai Beach.

Honokōwai Beach is an important natural, cultural, recreational, and aesthetic resource that supports a wide variety of cultural, recreational, and economic uses. Honokōwai Beach offers perpendicular and lateral shoreline access, public parking, and public restrooms. The beach also acts as a natural buffer that absorbs wave energy and protects the backshore and infrastructure from the destructive forces of the ocean that can cause erosion, avulsion, and flooding.

In 2016, a combination of persistent North Pacific swell and elevated water levels produced high waves, strong currents, and abnormally high tides. This led to significant erosion, avulsion, and beach loss at Honokōwai Beach. The backshore area eroded, and a vertical escarpment (steep slope) formed along the shoreline creating a risk to public health, safety, and welfare, and impeded public access to and along the shoreline. The shoreline retreated 6 to 12 ft. in just a few months, and the beach was almost entirely eroded. Approximately 5,600 square feet (s.f.) of fast land (land located above the high water mark) was lost to avulsion, and over 1,000 cubic yards (cy) of alluvial sediment (i.e., clay, silt, boulders) was discharged into the ocean. The eroded sediment caused substantial turbidity plumes (i.e., brown water) to form in the nearshore waters, which negatively impacted water quality and prevented access to and use of the shoreline for cultural practices and recreational activities. The erosion and avulsion dramatically altered the configuration, appearance, and stability of Honokōwai Beach. The severity of these impacts is directly attritutable to sea level rise, a byproduct of human-induced climate change.

[1] Avulsion is a sudden and perceptible loss of land by the action of water.

The Project title “Ho‘āla Honokōwai” reflects the Project’s primary objective of restoring Honokōwai Beach for the West Maui community. The Project’s four (4) objectives are:

- Improve beach stability;
- Preserve and enhance cultural and shoreline access;
- Increase resilience to coastal hazards and human-induced sea level rise; and
- Enable planning for long-term adaptation to sea level rise.

The Proposed Action is beach restoration at Honokōwai Beach which is a proactive, nature-based response to human-induced sea level rise. Three (3) methods of beach restoration, described below, are assessed in this Environmental Impact Statement (EIS).

- **Beach Nourishment** – Beach Nourishment refers to an individual action (a single project) that involves the placement of additional sand to increase beach width and sand volume to offset the effects of erosion without modifying existing structures or installing any new structures. Approximately 27,000 cy of sand would be added, providing an initial beach width of 40 ft. Without stabilizing structures, the expected design life of benefits associated with a one-time Beach Nourishment action at Honokōwai Beach is approximately 10 years, although the design life could be shortened by episodic events.
- **Beach Maintenance** – Beach Maintenance refers to a series of actions (program) that consists of periodic beach nourishment actions combined with sand pushing and/or sand back passing, without modifying existing structures or installing any new structures. Beach Maintenance actions are typically intended to be conducted on a recurring, periodic basis over a specified period of time and are, therefore, considered to be programmatic in nature. At Honokōwai Beach, the initial nourishment effort would be identical to the Beach Nourishment alternative described above. Approximately 27,000 cy of sand would be placed at the south end of the Honokōwai littoral cell along approximately 1,000 ft. of shoreline, providing a beach width of approximately 40 ft. Because there would be no stabilizing structures, periodic beach maintenance would be performed after the initial nourishment and throughout the 50-year design life to maintain the desired beach width. This maintenance would require sand to be added at time intervals corresponding to beach erosion. To maintain a minimum beach width of 25 to 30 ft., it is anticipated that renourishment would be required approximately every 10 years. Each renourishment effort would require approximately 5,000 cy of sand, resulting in a total of 20,000 cy of additional sand to restore the beach. In total, 47,000 cy of sand would be required for the initial nourishment event and four (4) renourishment efforts.
- **Beach Stabilization** – Beach stabilization refers to an individual action that involves placing to nourish the beach and modifying existing structures, and/or installing new structures (e.g., groins) to stabilize the sand (i.e., keep the sand in

place and prevent it from being washed away). Beach stabilization projects are typically designed to be implemented as a single, discrete project with a specified design life. At Honokōwai Beach, the Beach Stabilization alternative would involve beach nourishment along with the construction of three (3) T-head groins and one (1) L-head groin. The groins would extend seaward between 220 ft. and 250 ft. from the existing backshore and would be spaced between 330 ft. and 340 ft. along the shoreline. The groins have been designed to accommodate up to 3.3 ft. of sea level rise, which corresponds to a design life of 50 years based on the National Oceanic and Atmospheric Administration (NOAA, 2022) Intermediate-High sea level rise scenario for the anticipated Project start date. An estimated 33,000 cy of sand would be required for this alternative.

After numerous studies were conducted to assess the proposed alternatives, Beach Stabilization arose as the preferred method for beach restoration.

All three (3) methods of beach restoration would involve sand recovery, sand transportation, and sand placement; and, in the case of Beach Stabilization, the action would also include construction of groins to stabilize the sand. Detailed sand investigations were conducted by Sea Engineering, Inc. (SE) and are discussed in the EIS. The proposed sand source for the Project is a large sand field located approximately 1,500 to 2,200 ft. offshore of Puʻu Kekaʻa in Kāʻanapali, at water depths of 120 to 170 ft. The sand recovery operation will require a crane barge that will use an environmental clamshell bucket to dredge sand from the sea floor. Due to ocean conditions at the Project Site and limited onshore space for dewatering and sand stockpiling, the sand cannot be directly pumped onshore after the sand recovery operations. As such, the sand would be barged to Kahului Harbor where it would be offloaded. From Kahului Harbor, the sand will be trucked to the Project Site.

In addition to the primary action of beach restoration, described above, there are related secondary actions (e.g., additional actions that may occur beyond the shoreline area) that may be implemented to further support the Project objectives. Potential secondary actions would be aimed at increasing resiliency and reducing exposure to or risk from climate change and coastal hazards. These secondary actions would be limited to common elements of the KBC property and may include modification or strategic relocation of existing common elements of the KBC property within the Project Site, such as walkways, landscape and hardscape features, and water features. Secondary actions may also include environmental restoration actions or public access improvements within the KBC property or shoreline areas. Secondary actions would not involve any intensification of uses within the KBC property that would present adverse environmental impacts.

2. Alternatives Considered

a. Adaptation Pathways

Due to the ongoing and anticipated future impacts of climate change and sea level rise, adaptation pathways were created to allow planners and decision-makers to map out a sequence of adaptation strategies, such as modifying structures or the environment, modifying human activities, or some combination thereof in response to rising sea levels. Adaptation pathways may involve short-term responses, mid-term solutions, and long-term adaptations, as described below.

- **Short-term responses** are intended to address existing conditions over a period of 0 to 10 years. Short-term responses are intended to address erosion, flooding, or other events that pose threats to land, infrastructure, or public health. Ideally, these responses should provide time for mid-term solutions to be planned and implemented.
- **Mid-term solutions** are intended to address existing conditions and prepare for anticipated future impacts and can last from 10 to 50 years. Mid-term solutions typically require more environmental and engineering analysis than short-term responses. Mid-term solutions are intended to provide continuing protection to land and infrastructure that may be vulnerable to hazards while providing time to plan and prepare long-term adaptations.
- **Long-term adaptations** normally take more time to plan and implement and are intended to last more than 50 years. Long-term adaptations typically require complex processes of technical analysis, public planning and environmental review processes, disaster risk analysis, and consideration of fiscal, economic, and land ownership impacts. Long-term adaptation strategies may include fundamentally altering the character and appearance of the existing environment and the range of beneficial uses currently supported. In addition, long-term adaptation strategies may require development of guidance, laws, and policies at a State and County level, along with private collaboration and participation to seek a balanced way to obtain community goals and objectives.

b. Preferred Alternative (Beach Stabilization Mid-Term Solution)

Beach Stabilization (the “Preferred Alternative”) has been selected as the Preferred Alternative due to the semi-confined nature of the beach. Beach Stabilization is anticipated to offer the most reliable and longest period of beneficial impacts from a beach restoration effort. With a design life of 50 years, the stabilizing groins will offer ongoing protection for the beach and flexibility for future adaptation. For example, design features such as concrete crest caps would allow

for the groins to be modified to accommodate additional sea level rise, should sea level rise be greater than projected. Additionally, these structures will ensure that the added sand will stay in place, mitigate the need for further sand recovery, and minimize beach and backshore erosion should an episodic beach loss and avulsion event occur such as what occurred in 2016.

c. Alternative Mid-Term Beach Restoration Methodologies

The alternative methods for this Project consist of Beach Nourishment and Beach Maintenance. These alternatives were considered and evaluated because they have merit and the potential to benefit the beach. However, based on the Project objectives, neither of these alternatives are anticipated to be as beneficial as Beach Stabilization. Beach Stabilization is the only alternative that meets all four (4) project objectives identified. Beach Nourishment and Beach Maintenance address some of these objectives to varying degrees, but do not address the first objective of improving beach stability.

Beach Nourishment has a significantly shorter design life than the other two (2) assessed alternatives. Furthermore, it is less stable and more vulnerable to sea level rise when compared to Beach Stabilization. Beach Nourishment does not increase beach stability and only delays the impacts of No Action by an estimated 10 years.

Beach Maintenance is less stable and more vulnerable to sea level rise when compared to Beach Stabilization. While this alternative would have a design life of approximately 50 years, it would require renourishment events approximately every 10 years and as a result, requires the most sand of the alternatives considered. Periodic renourishment will require reliance on sand availability at the Sand Recovery Site and construction related impacts would recur approximately every 10 years.

d. No Action

No Action is an alternative that evaluates the impacts of not doing beach restoration and allowing Honokōwai Beach to erode naturally. The No Action alternative would involve the removal of the existing temporary erosion skirt that was installed at Honokōwai Beach in 2018. The impacts associated with No Action were assessed over a 50-year time frame to put it in context with the other action alternatives. Without the implementation of beach restoration, the projected erosion that would occur with 3.2 ft of sea level rise would result in the loss of approximately 60,946 s.f. (1.4 acres) of land, and the discharge of approximately 19,542 cy of terrigenous sediment into the ocean.

e. Design and Construction Implementation Alternatives

In addition to the beach restoration and No Action alternatives, a number of other design and construction implementation alternatives were considered but dismissed. A three-groin alternative was considered as opposed to the four-groin alternative that was selected for Beach Stabilization. The three-groin alternative would block the channel that runs through the reef from the beach to deeper water and also require larger groins that would extend further into the ocean. The combination was determined to be less suitable and thus was not selected. A large-scale beach nourishment project was considered, which would involve sand placement along the beach from Honokōwai Stream to approximately 3,000 ft. south of Honokōwai Point. This option would be a total of 4,000 linear ft. of nourishment which would require significantly more sand and would involve a great number of properties, as well as a much longer period of construction impacts and resources. For these reasons, this option was not further assessed.

A detailed sand source analysis was conducted by Sea Engineering, Inc. that evaluated potential terrestrial, nearshore, and offshore sand sources. The terrestrial and nearshore sand sources were determined to be not viable options. The proposed Sand Recovery Site was the only site among seven (7) offshore sand sources analyzed that is compatible with the existing sand at the Project Site and meets the parameters of Department of Land and Natural Resources (DLNR) guidelines for beach nourishment projects. The EIS also discusses various alternative methodologies for sand recovery, sand transport, and sand placement. The proposed construction methodology outlined with the Preferred Alternative represents the most feasible and least impactful construction methodology.

f. Other Alternatives Considered

In addition to the previously discussed and dismissed alternatives, other alternatives were considered but were not fully evaluated for a variety of reasons. These options include dune construction, shore protection, offshore breakwaters, loko iʻa (fishponds), and artificial lagoons. Reasons for elimination include feasibility, effectiveness, potential impacts, existing and historical land uses, existing infrastructure, and existing laws and ordinances.

g. Deferred Action

The Deferred Action alternative, which involves deferring implementation of beach restoration, was dismissed for several reasons. The existing temporary erosion skirt at Honokōwai Beach is a short-term response and is intended to be removed when a mid-term solution can be approved and implemented. Deferral of the implementation of beach restoration would be inconsistent with the intended short-term design life of the temporary erosion skirt and would delay achievement of the

Project goals of improving beach stability, preserving and enhancing cultural and shoreline access, and increasing resilience to coastal hazards and sea level rise.

h. Long-Term Adaptation Planning

While the Proposed Action evaluated in this Draft EIS is a mid-term solution, with a design life of 50 years, the effects of climate change, sea level rise, and coastal hazards pose a significant long-term threat to beaches and existing coastal developments in the Project Site and other shoreline areas. Long-term adaptation could consist of a number of strategies that could be implemented individually or in combination. These strategies include but are not limited to resist, accommodate, avoid, retreat, and advance. The Draft EIS includes a discussion of these potential long-term adaptation strategies. The Proposed Action is a mid-term solution designed to allow time for planning and implementation of other long-term adaptation strategies at Honokōwai Beach in the future. The Proposed Action would not preclude or inhibit the implementation of any of the identified adaptation strategies in the future.

3. Compatibility with Land Use Plans and Policies and Federal Standards

The Proposed Action has been analyzed for its applicability to applicable Federal laws and authorities as well as State and County plans and policies. The Project has been analyzed for consistency with the following:

- Federal laws and authorities
- Hawai‘i State Plan
- State Functional Plans
- State Land Use District
- Hawai‘i Sustainability Plan 2050
- Maui Island Plan
- Maui Countywide Policy Plan
- West Maui Community Plan
- Maui County Zoning
- Hawai‘i Coastal Zone Management Program
- Hawai‘i Revised Statutes (HRS) § 205A-26 Special Management Area Guidelines
- Maui Planning Commission Special Management Area Rules
- Maui Planning Commission Shoreline Rules

A detailed discussion of Project applicability to the aforementioned plans and policies is included in Chapter IV of the EIS

4. List of Permits and Approvals

The following is a preliminary list of the permits and approvals that are anticipated to be required for the Project.

Federal:

1. Department of the Army Section 10, Rivers and Harbors Act for work in or over Navigable Waters of the U.S.
2. Clean Water Act Section 404 Individual Permit
3. Other Federal laws that potentially could be triggered by the Proposed Action include:

    - Archaeological and Historic Preservation Act (16 USC § 469a-1)
    - National Historic Preservation Act of 1966 (16 USC § 470(f))
    - Native American Graves Protection and Repatriation Act of 1990 (25 USC § 3001)
    - Clean Air Act (42 USC § 7506(C))
    - Coastal Zone Management Act (16 USC § 1451 et seq.)
    - Endangered Species Act (16 USC § 1531 et seq.)
    - Magnuson-Stevens Fishery Conservation and Management Act (16 USC § 1801 et seq.)
    - Marine Mammal Protection Act of 1972, as amended (16 USC §§ 1361-1421(H))
    - Migratory Bird Treaty Act of 1918, as amended (16 USC §§ 703-712)
    - Fish and Wildlife Coordination Act of 1934, as amended (16 USC § 661 et seq.)
    - Executive Order (EO) 13089, Coral Reef Protection (63 FR 32701)
    - EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (16 USC § 703-711 (66 FR 3853))

State of Hawaiʻi:

1. Shoreline Certification
2. HRS Chapter 6E Historic Preservation Review
3. Department of Health, Community Noise Permit
4. Conservation District Use Permit (CDUP)
5. Coastal Zone Management Consistency Review
6. Clean Water Act Section 401 Water Quality Certification (WQC)
7. National Pollutant Discharge Elimination System (NPDES) Permit
8. Right of Entry Permit
9. Revocable Permit, as applicable
10. Term, Non-exclusive Easement, as applicable

County of Maui:

1. Special Management Area (SMA) Permit
2. Shoreline Setback Approval
3. Shoreline Setback Variance (SSV) (for portions of stabilizing groins)
4. Grubbing and Grading Permit
5. Building Permit
6. Coastal High Hazard Area Certification
7. Special Flood Hazard Area Development Permit

5. Technical Studies, Relevant Environmental Assessments, and Environmental Impact Statements Reviewed

A variety of studies were conducted to analyze the potential impacts associated with each alternative as well as the potential impacts of No Action, when applicable. The list of studies includes:

- Coastal Engineering Assessment (including sand investigations, geotechnical investigations, Best Management Practices Plan, Applicable Monitoring and Assessment Program, and an Assessment of the Marine Environment)
- Structural Assessment
- Terrestrial Biological Survey
- Greenhouse Gas Assessment
- Visual Impact Analysis
- Archaeological Literature Review and Field Inspection
- Cultural Impact Assessment
- Public Trust Resources Analysis
- Economic and Fiscal Impact Report
- Coastal and Marine Uses Report
- Traffic Impact Analysis Report

In addition to the above-noted Project-specific studies, environmental review documents for other beach restoration projects in Hawai‘i were consulted during the preparation of this EIS.

- Kahana Bay Erosion Mitigation – Second Draft EIS – Published November 11, 2021;
- Kā‘anapali Beach Restoration Project – Final EIS – Published December 8, 2022;
- Waikiki Beach Improvement and Maintenance Program – Final EIS – Published October 23, 2024 and accepted January 8, 2025;
- Waikiki Beach Maintenance – Final EA – Published June 23, 2010;
- Royal Hawaiian Groin Replacement – Final EA Published May 23, 2016;
- Iroquois Point Beach Nourishment and Stabilization – Final EA – Published November 14, 2011.

6. Unresolved Issues

The following issues were identified as unresolved at the time of writing this Draft EIS:

- **Project Funding** - While the proposed Project will be fully funded by private parties, specific funding sources will be identified following completion of the HRS Chapter 343 environmental review process.
- **Construction Design, Means, and Methods** - The final construction design, means, and methods for the Proposed Action remain unresolved at this stage of the environmental review process. Final construction plans, including the selection

of materials, sources of materials, and specific construction techniques, will be determined following the completion of the HRS Chapter 343 review.

- **Secondary Related Actions** - The Project may incorporate secondary actions, aimed at increasing resiliency and reducing exposure to or risk from climate change and coastal hazards. These secondary actions would be limited to common elements of the Ka‘anapali Beach Club (KBC) property and could include environmental restoration actions or public access improvements.
- **Permits, Easements, and Rights-Of-Way** - The necessary permits, easements, and rights-of-way required for the Proposed Action are currently unresolved and will be addressed following the completion of the HRS Chapter 343 environmental review process. These legal and regulatory requirements will be resolved in accordance with the applicable laws and agencies.
- **Access and Use of Groins** - The four (4) groins presented for the Beach Stabilization alternative have been designed to meet engineering requirements to maintain a stable beach. Individuals may try to access the groins for fishing or other recreational activities. A non-exclusive easement is anticipated to be required from the DLNR for the groins. Limitations to access of the groins may be explored with the DLNR and other government agencies.
- **Long-Term Adaptation Strategies** - A number of strategies may be implemented individually or in combination for long-term adaptation to climate change. These strategies include resist, accommodate, avoid, retreat, and advance. Long-term adaptation planning is anticipated to occur beyond the timeline of the Proposed Action.

7. Summary of Beneficial and Negative Impacts and Proposed Mitigation

The Draft EIS assesses existing conditions, and potential impacts and mitigation measures for the physical environment, socioeconomic environment, public services, and infrastructure for the anticipated 50-year design life of the Proposed Action. A summary of the impacts and mitigation measures, where appropriate, is presented for the three (3) beach restoration alternatives and the No Action alternative. Where appropriate, construction-related impacts and ongoing impacts are separately identified. Construction-related impacts refer to those impacts that pertain to demolition and removal of the temporary erosion skirt, sand recovery, sand transport, sand placement, and groin construction (in the case of Beach Stabilization). Ongoing impacts refer to post-construction impacts for the anticipated 50-year design life.

Summary of Beneficial and Negative Impacts and Proposed Mitigation

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
Physical Environment				
Climate	No impact	No impact	No impact	No impact
Bathymetry and Benthic Conditions	**Construction-Related Impacts:** Alteration of bathymetric and benthic conditions at the Project Site within the footprint of the beach fill; sand Recovery Site would experience temporary change from sand recovery **Ongoing Impacts:** Groins would alter bathymetric and benthic conditions within the groin footprints and beach fill; increased biomass and additional habitat for certain species	**Construction-Related Impacts:** Temporary alteration of bathymetric and benthic conditions at the Project Site within the footprint of the beach fill; the Sand Recovery Site would experience temporary change from sand recovery **Ongoing Impacts:** With continued erosion, bathymetric and benthic conditions would be expected to return to a similar condition to what existed prior to Beach Nourishment; Beach Nourishment would temporarily delay the impacts of the No Action alternative	**Construction-Related Impacts:** Temporary alteration of bathymetric and benthic conditions at the Project Site within the footprint of the beach fill; the Sand Recovery Site would experience temporary change from sand recovery; impacts would be recurring with each maintenance action **Ongoing Impacts:** Alteration of bathymetric and benthic conditions on a recurring basis, approximately every 10 years	**Construction-Related Impacts:** No impact **Ongoing Impacts:** Bathymetry at the Project Site may change as sand and alluvium are discharged into the nearshore waters from natural erosion. Potential for ongoing impacts to benthic conditions due to erosion and sedimentation.
Sand Characteristics	**Construction-Related Impacts:** Discoloration and unpleasant odor associated with sand placement, which will fade from UV and air exposure **Ongoing Impacts:** No impact	**Construction-Related Impacts:** Discoloration and unpleasant odor associated with sand placement, which will fade from UV and air exposure **Ongoing Impacts:** No impact	**Construction-Related Impacts:** Discoloration and unpleasant odor associated with sand placement, which will fade from UV and air exposure **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action	**Construction-Related Impacts:** No impact **Ongoing Impacts:** Existing sand characteristics may be altered as beach narrows with erosion
Coastal Processes	Alteration of existing current and circulation patterns at the Project Site in the immediate vicinity of the groins, and reduction of sediment transport during the lifetime of Beach Stabilization; potential secondary impact of increasing beach width along the shoreline in the vicinity of the south terminal groin	Potential to temporarily facilitate sediment exchange between littoral cells; benefits dissipate as erosion causes beach narrowing	Potential to facilitate sediment exchange between littoral cells during Project lifespan; benefits dissipate as erosion causes beach narrowing	Negative impact on sediment availability and transport patterns at the Project Site
Waves	Calmer wave conditions and reduced currents within the groin cells and in the immediate vicinity of the groins; no impact to surf breaks outside of the groin cells	No impact	No impact	No impact
Sea Level Rise and Flooding	Most positive impact in terms of preserving the beach and reducing flood risks as the groins and beach cells would provide a wider and more stable beach that would mitigate compounding impacts of sea level rise	Positive impact with temporarily increasing beach width and volume; benefits decrease as time elapses from sand placement	Positive impact of enhancing the natural buffer between the terrestrial and marine environments to reduce flooding; benefits preserved over the approximate 50-year anticipated Project lifespan	Increased vulnerability and decreased resilience to sea level rise, erosion, and flooding; anticipated significant erosion, beach loss, and shoreline recession that could substantially alter the configuration of the shoreline
Tsunamis	A wider and more stable beach would provide a natural buffer between the terrestrial and marine environments, but Beach Stabilization is not designed to reduce impacts from tsunamis	Wider beach for an approximate 10-year Project lifespan would provide a natural buffer between terrestrial and marine environments, but Beach Nourishment is not designed to reduce impacts from tsunamis	Wider beach would provide a natural buffer between the terrestrial and marine environments, but Beach Maintenance is not designed to reduce impacts from tsunamis	Increased risk of impacts from tsunamis as the wave dissipating properties of the beach diminish over time

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
Topography and Soils	Increase in beach width and elevation and retention of backshore soil for the anticipated 50-year design life	Increase in beach width and elevation and retention of backshore soil for approximately 10 years	Increase in beach width and elevation and retention of backshore soil for the anticipated 50-year design life	Significant or total loss of beach width and elevation (approximately 60,946 s.f. of land loss); loss of backshore soil and alluvium occurring as a result of ongoing erosion
Terrestrial Environment	**Construction-Related Impacts:** Impacts from demolition and removal of the temporary erosion skirt, sand placement, and groin construction **Ongoing Impacts:** Positive benefit of a wider and more stable shoreline that would mitigate erosion, beach narrowing, and shoreline recession **Mitigation:** Construction-related BMPs including material management, waste management, and erosion control measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Impacts from demolition and removal of the temporary erosion skirt and placement of sand **Ongoing Impacts:** Likely erosion, beach narrowing, shoreline recession, and potential beach loss following the anticipated 10-year Project lifespan **Mitigation:** Construction-related BMPs including material management, waste management, and erosion control measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Impacts from demolition and removal of the temporary erosion skirt and placement of sand **Ongoing Impacts:** Positive benefit of a wider sandy beach that would limit erosion of the backshore **Mitigation:** Construction-related BMPs including material management, waste management, and erosion control measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Impacts from demolition and removal of the temporary erosion skirt **Ongoing Impacts:** Erosion, beach narrowing, shoreline recession, and potential beach loss **Mitigation:** Construction-related BMPs including material management, waste management, and erosion control measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**
Streams and Wetlands	**Construction-Related Impacts:** No work within stream **Ongoing Impacts:** Potential secondary benefit of groin design preventing stream mouth from accumulating sand, improving water quality and natural stream flow **Mitigation:** BMPs including erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** No work within stream **Ongoing Impacts:** No impact **Mitigation:** BMPs including erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** No work within stream **Ongoing Impacts:** No impact **Mitigation:** BMPs including erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** No work within stream **Ongoing Impacts:** No impact **Mitigation:** BMPs including erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**
Flora, Fauna, and Avifauna	**Construction-Related Impacts:** Impacts associated with demolition and removal of temporary erosion skirt, sand placement, and in-water construction of groins; potential for in-water disturbance to monk seals and sea turtles **Ongoing Impacts:** No adverse impacts; potential secondary benefit of improved surface connection and water quality in Honokōwai Stream; potential benefit of larger haul out area for monk seals and sea turtles **Mitigation:** Avoidance of vegetated areas, replanting with native species, biological monitoring before, during, and after construction; for a full list of BMPs for flora, fauna, and avifauna refer to **Appendix "C"**	**Construction-Related Impacts:** Impacts associated with demolition and removal of temporary erosion skirt and sand placement **Ongoing Impacts:** Potential loss of available haul out area for monk seals and sea turtles after the approximately 10-year lifespan of the alternative **Mitigation:** Avoidance of vegetated areas, replanting with native species, biological monitoring before, during, and after construction; for a full list of BMPs for flora, fauna, and avifauna refer to **Appendix "C"**	**Construction-Related Impacts:** Impacts associated with demolition and removal of temporary erosion skirt and sand placement **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action; potential adverse impact of fluctuating available haul out area for monk seals and sea turtles between each renourishment interval **Mitigation:** Avoidance of vegetated areas, replanting with native species, biological monitoring before, during, and after construction; for a full list of BMPs for flora, fauna, and avifauna refer to **Appendix "C"**	**Construction-Related Impacts:** Impacts associated with demolition and removal of temporary erosion skirt **Ongoing Impacts:** Loss of land and erosion may impact habitat availability and haul out area for monk seals and sea turtles **Mitigation:** Avoidance of vegetated areas, replanting with native species, biological monitoring before, during, and after construction; for a full list of BMPs for flora, fauna, and avifauna refer to **Appendix "C"**

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
Rare, Threatened, and Endangered Species	**Construction-Related Impacts:** Impacts associated with demolition and removal of the temporary erosion skirt, sand placement, and groin construction, including potential disturbance from noise and human activity, and an increase in nearshore turbidity from in-water work **Ongoing Impacts:** Positive impact of a stabilized beach, larger haul out area for sea turtles, and increased terrestrial critical habitat for monk seals **Mitigation:** BMPs include conducting visual surveys for ESA-listed species and postponing or halting work when ESA-listed species are within 50 yards of the proposed work area; refer to species-specific BMPs in the Best Management Practices Plan, contained within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Impacts associated with demolition and removal of the temporary erosion skirt and sand placement, including potential disturbance from noise and human activity **Ongoing Impacts:** Positive impact of a wider beach, larger haul out area for sea turtles, and increased terrestrial critical habitat for monk seals limited to the approximate 10-year anticipated Project lifespan **Mitigation:** BMPs include conducting visual surveys for ESA-listed species and postponing or halting work when ESA-listed species are within 50 yards of the proposed work area; refer to species-specific BMPs in the Best Management Practices Plan, contained within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Impacts associated with demolition and removal of the temporary erosion skirt and sand placement, including potential disturbance from noise and human activity **Ongoing Impacts:** Recurring construction impacts; potential adverse mid-term impacts to sea turtle and monk seal behavior since the amount of sand available for haul out would fluctuate over the anticipated 50-year lifespan **Mitigation:** BMPs include conducting visual surveys for ESA-listed species and postponing or halting work when ESA-listed species are within 50 yards of the proposed work area; refer to species-specific BMPs in the Best Management Practices Plan, contained within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Impacts associated with demolition and removal of the temporary erosion skirt **Ongoing Impacts:** Potential adverse mid-term impacts to sea turtle and monk seal habitat since the amount of sand available for haul out would decrease progressively over time. **Mitigation:** BMPs include conducting visual surveys for ESA-listed species and postponing or halting work when ESA-listed species are within 50 yards of the proposed work area; refer to species-specific BMPs in the Best Management Practices Plan, contained within the CEA, **Appendix "A"**
Marine and Nearshore Environment	**Construction-Related Impacts:** Elevated turbidity and disruption to marine species in the vicinity of active work areas **Ongoing Impacts:** Permanent displacement of fish populations within the footprint of groins and beach fill; new habitat creation with potential to increase fish biomass and biodiversity **Mitigation:** A containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement and groin construction; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** Elevated turbidity and disruption to marine species in the vicinity of active work areas **Ongoing Impacts:** Seaward extension of sand into intertidal and subtidal areas with limited impact to marine species **Mitigation:** A containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** Elevated turbidity and disruption to marine species in the vicinity of active work areas **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action; seaward extension of sand into intertidal and subtidal areas with limited impact to marine species **Mitigation:** A containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** Demolition and removal of temporary erosion skirt may temporarily increase turbidity **Ongoing Impacts:** Beach and backshore erosion may have negative impacts of deteriorating water quality, habitat loss, and elevated turbidity levels **Mitigation:** A containment system of silt curtains and fences will be used to limit the potential for turbidity during demolition and removal of the temporary erosion skirt; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**
Marine Water Quality	**Construction-Related Impacts:** Elevated turbidity in the vicinity of active work areas **Ongoing Impacts:** Positive impact of limiting water quality deterioration from unstable beach and backshore erosion; potential secondary benefit from preventing sand from accumulating at the Honokōwai Stream mouth. **Mitigation:** Measures for erosion and sediment control, oil and spill containment, and water quality monitoring; refer to the Best Management Practices Plan and Applicable Monitoring and	**Construction-Related Impacts:** Elevated turbidity in the vicinity of active work areas **Ongoing Impacts:** Negative impact of water quality deterioration from an unstable beach and backshore following the anticipated 10-year lifespan of the initial nourishment **Mitigation:** Measures for erosion and sediment control, oil and spill containment, and water quality monitoring; refer to the Best Management Practices Plan and Applicable Monitoring and Assessment Program contained within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Elevated turbidity in the vicinity of active work areas **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action (approximately once every 10 years) **Mitigation:** Measures for erosion and sediment control, oil and spill containment, and water quality monitoring; refer to the Best Management Practices Plan and Applicable Monitoring and Assessment Program contained within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Elevated turbidity in the vicinity of active work areas from demolition and removal of existing temporary erosion skirt **Ongoing Impacts:** Negative impact of water quality deterioration from an unstable beach and backshore erosion, resulting in the loss of approximately 60,946 s.f. (1.4 acres) of land, and the discharge of approximately 19,542 cy of terrigenous sediment into the ocean **Mitigation:** Measures for erosion and sediment control, oil and spill containment,

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
	Assessment Program contained within the CEA, **Appendix "A"**			and water quality monitoring; refer to the Best Management Practices Plan and Applicable monitoring and Assessment Program contained within the CEA, **Appendix "A"**
Fisheries	**Construction-Related Impacts:** Impacts to Sand Recovery Site during the sand recovery period, including habitat loss and displacement of marine life **Ongoing Impacts:** Alterations to existing habitat within the groin footprints which would offer improved habitat and increase fish biomass **Mitigation:** Use of an environmental clamshell bucket for sand recovery; to the extent feasible, sand recovery may be scheduled outside of the Kona Crab spawning season of May to August to limit impacts to propagation; refer to the Best Management Practices Plan within the CEA in **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** Impacts to Sand Recovery Site during the sand recovery period, including habitat loss and displacement of marine life **Ongoing Impacts:** No impact **Mitigation:** Use of an environmental clamshell bucket for sand recovery; to the extent feasible, sand recovery may be scheduled outside of the Kona Crab spawning season of May to August to limit impacts to propagation; refer to the Best Management Practices Plan within the CEA in **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** Impacts to Sand Recovery Site during the combined sand recovery period, including habitat loss and displacement of marine life **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action **Mitigation:** Use of an environmental clamshell bucket for sand recovery; to the extent feasible, sand recovery may be scheduled outside of the Kona Crab spawning season of May to August to limit impacts to propagation; refer to the Best Management Practices Plan within the CEA in **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** No impact **Ongoing Impacts:** Potential impacts to fisheries in vicinity of Project Site as beach and backshore erosion degrades water quality
Air Quality	**Construction-Related Impacts:** Fugitive dust and emissions from construction equipment **Ongoing Impacts:** No impact **Mitigation:** Dust control measures, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks; refer to the BMP Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Fugitive dust and emissions from construction equipment **Ongoing Impacts:** No impact **Mitigation:** Dust control measures, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks; refer to the BMP Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Fugitive dust and emissions from construction equipment **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action **Mitigation:** Dust control measures, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks; refer to the BMP Plan within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Fugitive dust as temporary erosion skirt is removed **Ongoing Impacts:** Potential for windblown dust as backshore erodes **Mitigation:** Dust control measures, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks; refer to the BMP Plan within the CEA, **Appendix "A"**
Greenhouse Gas Emissions	**Construction-Related Impacts:** Project construction would generate 2,459.8 MT CO_2e, which is equivalent to 49.2 MT CO_2e per year of the Project design life **Ongoing Impacts:** No impact	**Construction-Related Impacts:** Project construction would generate 866.3 MT CO_2e, which is equivalent to 86.6 MT CO_2e per year of the Project design life **Ongoing Impacts:** No impact	**Construction-Related Impacts:** Project construction would generate 1,667.7 MT CO_2e (cumulative for initial and recurring nourishment actions), which is equivalent to 33.4 MT CO_2e per year of the Project design life **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action	**Construction-Related Impacts:** GHG impacts associated with the demolition and removal of the temporary erosion skirt (not quantified) **Ongoing Impacts:** No impact

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
Noise	**Construction-Related Impacts:** Temporary construction-related noise **Ongoing Impacts:** No impact **Mitigation:** Compliance with Chapter 11-46; use of low-noise emission products and suitable mufflers; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Temporary construction-related noise **Ongoing Impacts:** No impact **Mitigation:** Compliance with Chapter 11-46; use of low-noise emission products and suitable mufflers; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Temporary construction-related noise **Ongoing Impacts:** Recurring construction related impacts with each nourishment action **Mitigation:** Compliance with Chapter 11-46; use of low-noise emission products and suitable mufflers; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**	**Construction-Related Impacts:** Temporary construction-related noise (for demolition and removal of the temporary erosion skirt) **Ongoing Impacts:** No impacts **Mitigation:** Compliance with Chapter 11-46; use of low-noise emission products and suitable mufflers; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**
Scenic and Open Space Resources	**Construction-Related Impacts:** Temporary impacts associated with construction equipment, impacting beach access and scenic resources **Ongoing Impacts:** Groins would change the landscape of the Project Site; impacts to the scenic resources would be balanced by the benefits associated with stabilizing the only sandy beach in the area **Mitigation:** Portions of the beach will remain open during construction to allow for beach access in areas not under construction; refer to the Best Management Practices Plan contained within the CEA in **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** Temporary impacts associated with construction equipment, impacting beach access and scenic resources **Ongoing Impacts:** After the approximate 10-year lifespan, the negative impacts associated with the No Action alternative may be realized **Mitigation:** Portions of the beach will remain open during construction to allow for beach access in areas not under construction; refer to the Best Management Practices Plan contained within the CEA in **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** Temporary impacts associated with construction equipment, impacting beach access and scenic resources **Ongoing Impacts:** A wider sandy beach supports the preservation of the open space and scenic resources of the area; recurring construction-related impacts with each nourishment action **Mitigation:** Portions of the beach will remain open during construction to allow for beach access in areas not under construction; refer to the Best Management Practices Plan contained within the CEA in **Appendix "A"** for a full list of BMPs	**Construction-Related Impacts:** Temporary impacts associated with construction equipment, impacting beach access and scenic resources **Ongoing Impacts:** Adverse impacts resulting from degraded scenic value and limited open space access **Mitigation:** Portions of the beach will remain open during construction to allow for beach access in areas not under construction; refer to the Best Management Practices Plan contained within the CEA in **Appendix "A"** for a full list of BMPs
Socio-Economic Environment				
Surrounding Land Uses	**Construction-Related Impacts:** Increased traffic and limited beach/shoreline access during construction **Ongoing Impacts:** Positive impacts of a wider and more stable beach	**Construction-Related Impacts:** Increased traffic and limited beach/shoreline access during construction **Ongoing Impacts:** Positive impact of increased beach width, limited to the anticipated 10-year lifespan of the action alternative	**Construction-Related Impacts:** Increased traffic and limited beach/shoreline access during construction **Ongoing Impacts:** Positive impact of increased beach width; recurring construction impacts approximately once every 10 years	**Construction-Related Impacts:** Construction-related impacts during temporary erosion skirt demolition and removal **Ongoing Impacts:** Negative impact of erosion, shoreline recession, beach narrowing, potential beach loss, and general degradation of the shoreline area; negative impacts to beach access, land use, and community character

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
Archaeological Resources	Given the sand loss and exposure of the alluvial substrate as a result of beach erosion, there is a low probability of encountering sites in the shoreline area, but may require archaeological testing in the backshore area **Mitigation:** No further archaeological investigation required in the shoreline area; further archaeological investigation in backshore area may be recommended upon preparation of final construction plans; archaeological monitoring is recommended during sand recovery and construction	Low probability of encountering sites **Mitigation:** No further archaeological investigation required in the shoreline area; archaeological monitoring recommended during sand recovery	Low probability of encountering sites **Mitigation:** No further archaeological investigation required in the shoreline area; archaeological monitoring recommended during sand recovery	Low probability of encountering sites **Mitigation:** No further archaeological investigation required
Cultural Resources	Temporary impacts at the Project Site and Sand Recovery Site related to fishing, ocean gathering, and the setting and feeling at Puʻu Kekaʻa; additional long-term effects to flora and fauna, fishing, ocean gathering, and intangible cultural resources associated with the stabilizing groins **Mitigation:** Implementation of recommended measures for historic sites per Chapter 6E, HRS review; implementation of construction BMPs; use of appropriate plants the Project Site; avoidance of areas used for fishing, gathering, and other ocean activities; development of community benefits program to mitigate adverse impacts	Temporary impacts at the Project Site and Sand Recovery Site related to fishing, ocean gathering, and the setting and feeling at Puʻu Kekaʻa; potential benefit to culturally significant fauna such as honu and monk seals who use the beach as habitat for basking **Mitigation:** Implementation of recommended measures for historic sites per HRS § 6E review; implementation of construction BMPs; use of appropriate plants in the Project Site; avoidance of areas used for fishing, gathering, and other ocean activities; development of community benefits program to mitigate adverse impacts	Temporary impacts at the Project Site and Sand Recovery Site related to fishing, ocean gathering, and the setting and feeling at Puʻu Kekaʻa; potential benefit to culturally significant fauna such as honu and monk seals who use the beach as habitat for basking **Mitigation:** Implementation of recommended measures for historic sites per HRS review; implementation of construction BMPs; use of appropriate plants in the Project Site; avoidance of areas used for fishing, gathering, and other ocean activities; development of community benefits program to mitigate adverse impacts	Potential effect on cultural practices and resources due to loss of beach environment from ongoing erosion.
Public Trust Resources	Protects public trust resources by providing a wider and more stable beach and retention of the backshore soil and landward areas for the anticipated 50-year design life	Protects public trust resources by providing a wider beach and retention of the backshore soil and landward areas for approximately 10 years	Protects public trust resources by providing a wider beach and retention of the backshore soil and landward areas for the 50-year duration of the Beach Maintenance program	Does not fulfill State's responsibility to protect public trust resource; progressive erosion, shoreline recession, beach narrowing, and potential beach loss would negatively impact public trust resources
Population	No impact	No impact	No impact	No impact
Economy and Labor Force	**Construction-Related Impacts:** Increase in jobs, labor income, economic output, and State and County Revenues **Ongoing Impacts:** No long-term job losses, positive fiscal impacts	**Construction-Related Impacts:** Increase in jobs, labor income, economic output, and State and County Revenues **Ongoing Impacts:** Negative impacts associated with No Action after the anticipated 10-year lifespan	**Construction-Related Impacts:** Increase in jobs, labor income, economic output, and State and County Revenues **Ongoing Impacts:** No long-term job losses, positive fiscal impacts	**Construction-Related Impacts:** Limited increase in jobs for demolition and removal of the temporary erosion skirt **Ongoing Impacts:** Reduced operations or forced closure of KBC which would result in job loss, negative economic output, and negative fiscal impacts
Beach Access	**Construction-Related Impacts:** Temporary disruption to beach access and public beach parking	**Construction-Related Impacts:** Temporary disruption to beach access and public beach parking	**Construction-Related Impacts:** Temporary disruption to beach access and public beach parking **Ongoing Impacts:** Preserved beach access for the anticipated 50-year Project lifespan;	**Construction-Related Impacts:** Temporary disruption to beach access and public beach parking (for demolition and removal of temporary erosion skirt)

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
	Ongoing Impacts: Positive benefit of a stabilized shoreline and preserved beach access **Mitigation:** Implementation of construction methods and BMPs to minimize and reduce duration for impacts to access; portion of beach to remain open during construction; designation of alternative public beach parking	**Ongoing Impacts:** Preserved beach access for the anticipated 10-year Project lifespan; negative impacts of No Action after 10-year lifespan **Mitigation:** Implementation of construction methods and BMPs to minimize and reduce duration for impacts to access; portion of beach to remain open during construction; designation of alternative public beach parking	recurring construction impacts with each renourishment action **Mitigation:** Implementation of construction methods and BMPs to minimize and reduce duration for impacts to access; portion of beach to remain open during construction; designation of alternative public beach parking	**Ongoing Impacts:** Erosion of the beach and backshore that would significantly impair beach access **Mitigation:** Implementation of construction methods and BMPs to minimize and reduce duration for impacts to access; portion of beach to remain open during construction; designation of alternative public beach parking
Recreational Resources	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit recreational access to the beach and ocean **Ongoing Impacts:** Stabilized shoreline and sandy beach would positively impact recreational resources; secondary benefit of groins improving safety by interrupting longshore currents and rip currents **Mitigation:** Portion of beach to remain open during construction; implementation of construction methods and BMPs to minimize and reduce duration for impacts to recreational access	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit recreational access to the beach and ocean **Ongoing Impacts:** Sandy beach would improve recreational access; impacts of No Action anticipated after 10-year Project lifespan **Mitigation:** Portion of beach to remain open during construction; implementation of construction methods and BMPs to minimize and reduce duration for impacts to recreational access; groins designed to avoid blocking channel used for launching canoes and other recreational uses	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit recreational access to the beach and ocean **Ongoing Impacts:** Sandy beach would improve recreational access for anticipated 50-year lifespan; recurring construction-related impacts with each nourishment action **Mitigation:** Portion of beach to remain open during construction; implementation of construction methods and BMPs to minimize and reduce duration for impacts to recreational access	**Construction-Related Impacts:** Temporary construction-related impacts from demolition and removal of the temporary erosion skirt, which would limit recreational access to the beach and ocean. **Ongoing Impacts:** Progressive erosion, shoreline recession, beach narrowing, and potential beach loss would negatively impact recreational resources **Mitigation:** Portion of beach to remain open during demolition and removal of temporary erosion skirt; implementation of construction methods and BMPs to minimize and reduce duration for impacts to recreational access
Ocean Safety	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit beach and ocean access **Ongoing Impacts:** Positive benefit of a stabilized shoreline for anticipated 50-year design life; a gentle beach slope improves safety of ocean entry and exit; groins reduce turbidity and interrupt dangerous longshore currents and rip currents **Mitigation:** Implementation of construction BMPs, signage, and barriers	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit beach and ocean access **Ongoing Impacts:** Positive benefit of a wider beach for anticipated 10-year lifespan of the alternative; gentle beach slope improves safety of ocean entry and exit; negative impacts of No Action after anticipated 10-year lifespan **Mitigation:** Implementation of construction BMPs, signage, and barriers	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit beach and ocean access **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action; positive benefit of a wider beach for anticipated 50-year lifespan of the alternative; gentle beach slope improves safety of ocean entry and exit **Mitigation:** Implementation of construction BMPs, signage, and barriers	**Construction-Related Impacts:** Temporary construction-related impacts from demolition and removal of temporary erosion skirt, which would limit beach and ocean access **Ongoing Impacts:** Erosion, shoreline recession, beach narrowing, and potential beach loss resulting in potentially dangerous nearshore conditions; elevated turbidity levels pose a hazard to ocean users; steep escarpment impacts ocean entry and exit **Mitigation:** Implementation of construction BMPs, signage, and barriers
Mountain Access	No impact	No impact	No impact	No impact
Public Services				
Police and Fire Protection	Wider and more stable sandy beach would provide better access for emergency responders to the shoreline area	After the anticipated 10-year lifespan, progressive erosion, shoreline recession, beach narrowing, and potential beach loss could potentially impair access to the shoreline for emergency responders	Wider sandy beach would provide better access for emergency responders to the shoreline area	Progressive erosion, shoreline recession, beach narrowing, and potential beach loss could potentially impair access to the shoreline for emergency responders

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
Medical Services	Wider and more stable sandy beach would provide better access for emergency medical responders to the shoreline area	After anticipated 10-year lifespan, progressive erosion, shoreline recession, beach narrowing, and beach loss could potentially impair access to the shoreline for emergency medical responders	Wider sandy beach would provide better access for emergency medical responders to the shoreline area	Progressive erosion, shoreline recession, beach narrowing, and beach loss could potentially impair access to the shoreline for emergency medical responders
Solid Waste	**Construction-Related Impacts:** One-time generation of solid waste as the temporary erosion skirt is demolished and removed **Ongoing Impacts:** No impact	**Construction-Related Impacts:** One-time generation of solid waste as the temporary erosion skirt is demolished and removed **Ongoing Impacts:** No impact	**Construction-Related Impacts:** One-time generation of solid waste as the temporary erosion skirt is demolished and removed **Ongoing Impacts:** No impact	**Construction-Related Impacts:** One-time generation of solid waste as the temporary erosion skirt is demolished and removed **Ongoing Impacts:** No impact
Education	No impact	No impact	No impact	No impact
Airports	No impact	No impact	No impact	No impact
Infrastructure				
Roadways	**Construction-Related Impacts:** 31 AM and PM peak hour trips generated during construction in 2028 **Ongoing Impacts:** No impact	**Construction-Related Impacts:** 15 AM and PM peak hour trips generated during construction in 2028 **Ongoing Impacts:** No impact	**Construction-Related Impacts:** 15 AM and PM peak hour trips generated during construction in 2028, 2038, 2048, 2058, and 2068 **Ongoing Impacts:** Recurring construction-related impacts for each renourishment event	**Construction-Related Impacts:** 10 AM and PM peak hour trips generated during demolition and removal of temporary erosion skirt in 2028 **Ongoing Impacts:** No impact
Marine Transportation Routes	**Construction-Related Impacts:** Temporary increase in vessel activity near west breakwater of Kahului Harbor; temporary impacts to channel used for canoe launching **Ongoing Impacts:** No impact **Mitigation Measures:** Groins designed to avoid blocking channel used for canoe launching	**Construction-Related Impacts:** Temporary increase in vessel activity near west breakwater of Kahului Harbor; temporary impacts to channel used for canoe launching **Ongoing Impacts:** No impact	**Construction-Related Impacts:** Temporary increase in vessel activity near west breakwater of Kahului Harbor; temporary impacts to channel used for canoe launching **Ongoing Impacts:** Recurring construction-related impacts for each renourishment event	No impact
Water System	No impact	No impact	No impact	No impact
Wastewater System	No impact	No impact	No impact	No impact
Drainage System	**Construction-Related Impacts:** Potential construction-related erosion and increased turbidity **Ongoing Impacts:** Potential secondary benefit of preventing sand from accumulating at the Honokōwai Stream mouth **Mitigation:** Construction BMPs such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected; NPDES permit; refer to Best Management Practices Plan in CEA, **Appendix "A"**	**Construction-Related Impacts:** Potential construction-related erosion and increased turbidity **Ongoing Impacts:** No impact **Mitigation:** Construction BMPs such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected; NPDES permit; refer to Best Management Practices Plan in CEA, **Appendix "A"**	**Construction-Related Impacts:** Potential construction-related erosion and increased turbidity **Ongoing Impacts:** Recurring construction-related impacts for each renourishment event **Mitigation:** Construction BMPs such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected; NPDES permit; refer to Best Management Practices Plan in CEA, **Appendix "A"**	**Construction-Related Impacts:** Potential construction-related erosion and increased turbidity (for removal of temporary erosion skirt) **Ongoing Impacts:** Beach and backshore erosion could impact drainage systems by exposing them to seawater and wave action **Mitigation:** Construction BMPs such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected; NPDES permit; refer to

	Beach Stabilization (Preferred Alternative)	Beach Nourishment	Beach Maintenance	No Action
				Best Management Practices Plan in CEA, **Appendix "A"**
Electrical, Telephone, and Cable Television Services	No impact	No impact	No impact	No impact

List of Document Preparers

Study	Preparer
Environmental Impact Statement	Munekiyo Hiraga
Coastal Engineering Assessment (CEA)	Sea Engineering, Inc.
Sand Source Investigation (contained in CEA)	Sea Engineering, Inc.
Assessment of the Marine Environment (contained in CEA)	Marine Research Consultants, Inc.
Applicable Monitoring and Assessment Program (contained in CEA)	Marine Research Consultants, Inc.
Best Management Practices Plan (contained in CEA)	Sea Engineering, Inc.
Structural Assessment	KAI Hawaii, Inc.
Structural Engineering Assessment (contained in CEA)	MKE Associates
Geotechnical Assessment (contained in CEA)	Shinsato Engineering
Terrestrial Biological Survey	AECOS, Inc.
Greenhouse Gas Assessment	Munekiyo Hiraga
Visual Impact Analysis	G70
Archaeological Literature Review and Field Inspection	ʻAina Archaeology
Cultural Impact Assessment	Honua Consulting
Ka Paʻakai Analysis	Honua Consulting; Starn, O'Toole, Marcus & Fisher
Public Trust Resource Analysis	Honua Consulting; Starn, Oʻ Toole, Marcus & Fisher
Economic Impact Report	Environment & Economics, LLC
Coastal and Marine Uses Report	Ian Masterson, Ocean Recreation and Safety Consultant
Traffic Impact Analysis Report	Austin, Tsutsumi & Associates, Inc.

List of Acronyms

ADA	Americans with Disabilities Act
AM	Ante Meridiem (morning)
ATA	Austin, Tsutsumi, and Associates, Inc.
AMAP	Applicable Monitoring and Assessment Program
BLNR	Hawai‘i Board of Land and Natural Resources
BMPs	Best Management Practices
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
cm	centimeters
cy	cubic yards
CAA	Clean Air Act
CalEEMod	California Emissions Estimator Model
CDUP	Conservation District Use Permit
CEA	Coastal Engineering Assessment
CFR	Code of Federal Regulations
CH_4	Methane
Chl a	Chlorophyll a
CIA	Cultural Impact Assessment
CML	Central Maui Landfill
CO_2	Carbon Dioxide
CO_2e	CO_2 equivalent
CWA	Clean Water Act
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DA	Department of the Army
DAR	Division of Aquatic Resources
dBA	decibels
DEDBT	Department of Economic Development, Business & Tourism
Draft EIS	Draft Environmental Impact Statement
Diss. O_2	Dissolved Oxygen
DLNR	Hawai‘i Department of Land and Natural Resources
DOE	State of Hawai‘i, Department of Education
DOH	Hawai‘i Department of Health
DOH-CWB	Hawai‘i Department of Health, Clean Water Branch
EF	emissions factor
EFH	Essential Fish Habitat
EIR	Economic Impact Report
EIS	Environmental Impact Statement
EISPN	Environmental Impact Statement Preparation Notice
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERP	Environmental Review Program
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FEP	Fishery Ecosystem Plan
FIRM	Flood Insurance Rate Map
FMP	Fisheries Management Plan
ft.	feet
FWCA	Fish and Wildlife Coordination Act

GHG	Greenhouse gases
GHGRP	Greenhouse Gas Reporting Programs
HAPC	Habitat Areas of Particular Concern
HAR	Hawai‘i Administrative Rules
HEMA	Hawai‘i Emergency Management Agency
HRS	Hawai‘i Revised Statutes
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
JHM	Kapalua Airport
KBC	Kā‘anapali Beach Club
KOA	Kā‘anapali Operations Association, Inc.
l.f.	linear feet
LOS	Level of Service
LRFI	Literature Review and Field Inspection
LWRF	Lahaina Wastewater Reclamation Facility
m	meters
MBTA	Migratory Bird Treaty Act
MCC	Maui County Code
MD	mid-day
mgd	million gallons per day
MHHW	mean higher high water
mi.	miles
mm	millimeters
MIP	Maui Island Plan
MMPA	Marine Mammal Protection Act
mph	miles per hour
MRC	Marine Research Consultants, Inc.
MSL	mean sea level
MT	metric tons
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NFIP	National Flood Insurance Program
NH_4+	ammonium nitrogen
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_3	nitrate and nitrite nitrogen
NO_{3-}	nitrate
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
OCCL	State of Hawai‘i, Department of Land and Natural Resources Office of Conservation and Coastal Lands
OPSD	State of Hawai‘i Office of Planning and Sustainable Development
ORMA	Ocean Recreation Management Area
PacIOOS	Pacific Islands Ocean Observing System
pH	acidity
PM	Post Meridiem (afternoon)
PO_4^{3-}	orthophosphate phosphorous
ROM	Rough Order of Magnitude
s.f.	square feet
SALT	salinity
SDOT	State of Hawai‘i, Department of Transportation

SE	Sea Engineering, Inc.
SHOALS	Scanning Hydrographic Operational Airborne Lidar Survey
SHPD	State Historic Preservation Division
SIHP	State Inventory of Historic Places
Si	Silica
SLR-XA	sea level rise exposure area
SLRVAR	Hawai‘i Sea Level Rise Vulnerability and Adaptation Report
SMA	Special Management Area
SSA	Shoreline Setback Approval
SSV	Shoreline Setback Variance
TDN	total dissolved nitrogen
TDP	total dissolved phosphorous
TEMP	Temperature
TIAR	Traffic Impact Analysis Report
TMK	Tax Map Key
TN	Total Nitrogen
TON	Total Organic Nitrogen
TOP	Total Organic Phosphorous
TP	Total Phosphorous
TURB	Turbidity
yr.	Year
UH-CGG	University of Hawai‘i Coastal Geology Group
UHERO	University of Hawai‘i Economic Research Organization
UHMC	University of Hawai‘i-Maui College
UNFCCC	United Nations Framework Convention on Climate Change
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WMRP	West Maui Resort Partners, L.P.
WPRFMC	Western Pacific Regional Fishery Management Council
WQC	Water Quality Certification

CONTENT CHECKLIST

Pursuant to § 11-200.1-24, Hawai'i Administrative Rules (HAR), the Draft EIS, at a minimum, shall contain the following information:

11-200.1-24 Section	Requirement	Location
(d)	The draft EIS shall contain a summary that concisely discusses the following: (1) Brief description of the action; (2) Significant beneficial and adverse impacts; (3) Proposed mitigation measures; (4) Alternatives considered; (5) Unresolved issues; (6) Compatibility with land use plans and policies, and a list of permits or approvals; and (7) A list of relevant EAs and EISs considered in the analysis of the preparation of the EIS.	Project Summary
(e)	The draft EIS shall contain table of contents	Contents
(f)	The draft EIS shall contain a separate and distinct section that includes the purpose and need for the proposed action.	Chapter I.B.
(g)	The draft EIS shall contain a description of the action that shall include the following information, but need not supply extensive detail beyond that needed for evaluation and review of the environmental impact: (1) A detailed map (such as a United States Geological Survey topographic map, Flood Insurance Rate Maps, Floodway Boundary Maps, or state sea level rise exposure area maps, as applicable) and a related regional map; (2) Objectives of the proposed action; (3) General description of the action's technical, economic, social, cultural, and environmental characteristics; (4) Use of state or county funds or lands for the action; (5) Phasing and timing of the action; (6) Summary technical data, diagrams, and other information necessary to enable an evaluation of potential environmental impact by commenting agencies and the public; and (7) Historic perspective.	 Figure 1 to Figure 35 Chapter I.C Chapter I.D and Chapter I.E Chapter I.G Chapter I.E Chapter III Chapter III.B
(h)	The draft EIS shall describe in a separate and distinct section discussion of the alternative of no action as well as reasonable alternatives that could attain the objectives of the action. The section shall include a rigorous exploration and objective evaluation of the environmental impacts of all such alternative actions. Particular attention shall be given to alternatives that might enhance environmental quality or avoid, reduce, or minimize some or all of the adverse environmental effects, costs, and risks of the action. Examples of alternatives include: (1) Alternatives requiring actions of a significantly different nature that would provide similar benefits with different environmental impacts; (2) Alternatives related to different designs or details of the proposed action that would present different environmental impacts; and (3) Alternative locations for the proposed action.	Chapter II

11-200.1-24 Section	Requirement	Location
	In each case, the analysis shall be sufficiently detailed to allow the comparative evaluation of the environmental benefits, costs, and risks of the proposed action and each reasonable alternative. For alternatives that were eliminated from detailed study, the section shall contain a brief discussion of the reasons for not studying those alternatives in detail. For any agency actions, the discussion of alternatives shall include, where relevant, those alternatives not within the existing authority of the agency.	
(i)	The draft EIS shall include a description of the environmental setting, including a description of the environment in the vicinity of the action, as it exists before commencement of the action, from both a local and regional perspective. Special emphasis shall be placed on environmental resources that are rare or unique to the region and the action site (including natural or human-made resources of historic, cultural, archaeological, or aesthetic significance); specific reference to related actions, public and private, existent or planned in the region shall also be included for purposes of examining the possible overall cumulative impacts of such actions. Proposing agencies and applicants shall also identify, where appropriate, population and growth characteristics of the affected area, any population and growth assumptions used to justify the proposed action, and any secondary population and growth impacts resulting from the proposed action and its alternatives. The draft EIS shall expressly note the sources of data used to identify, qualify, or evaluate any and all environmental consequences.	Chapter III
(j)	The draft EIS shall include a description of the relationship of the proposed action to land use and natural or cultural resource plans, policies, and controls for the affected area. Discussion of how the proposed action may conform or conflict with objectives and specific terms of approved or proposed land use and resource plans, policies, and controls, if any, for the affected area shall be included. Where a conflict or inconsistency exists, the draft EIS shall describe the extent to which the agency or applicant has reconciled its proposed action with the plan, policy, or control, and the reasons why the agency or applicant has decided to proceed, notwithstanding the absence of full reconciliation.	Chapter IV
(k)	The draft EIS shall also contain a list of necessary approvals required for the action from governmental agencies, boards, or commissions or other similar groups having jurisdiction. The status of each identified approval shall also be described.	Chapter IX
(l)	The draft EIS shall include an analysis of the probable impact of the proposed action on the environment, and impacts of the natural or human environment on the action. This analysis shall include consideration of all phases of the action and consideration of all consequences on the environment, including direct and indirect effects. The interrelationships and cumulative environmental impacts of the proposed action and other related actions shall be discussed in the draft EIS. The draft EIS should recognize that several actions, in particular those that involve the construction of public facilities or structures (e.g., highways,	Chapter III

11-200.1-24 Section	Requirement	Location
	airports, sewer systems, water resource actions, etc.) may well stimulate or induce secondary effects. These secondary effects may be equally important as, or more important than, primary effects, and shall be thoroughly discussed to fully describe the probable impact of the proposed action on the environment. The population and growth impacts of an action shall be estimated if expected to be significant, and an evaluation shall be made of the effects of any possible change in population patterns or growth upon the resource base, including but not limited to land use, water, and public services, of the area in question. Also, if the proposed action constitutes a direct or indirect source of pollution as determined by any governmental agency, necessary data regarding these impacts shall be incorporated into the EIS. The significance of the impacts shall be discussed in terms of subsections (m), (n), (o), and (p).	
(m)	The draft EIS shall include in a separate and distinct section a description of the relationship between local short-term uses of humanity's environment and the maintenance and enhancement of long-term productivity. The extent to which the proposed action involves trade-offs among short-term and long-term gains and losses shall be discussed. The discussion shall include the extent to which the proposed action forecloses future options, narrows the range of beneficial uses of the environment, or poses long-term risks to health or safety. In this context, short-term and long-term do not necessarily refer to any fixed time periods, but shall be viewed in terms of the environmentally significant consequences of the proposed action.	Chapter VII
(n)	The draft EIS shall include in a separate and distinct section a description of all irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented. Identification of unavoidable impacts and the extent to which the action makes use of non-renewable resources during the phases of the action, or irreversibly curtails the range of potential uses of the environment, shall also be included. The possibility of environmental accidents resulting from any phase of the action shall also be considered.	Chapter VI
(o)	The draft EIS shall address all probable adverse environmental effects that cannot be avoided. Any adverse effects such as water or air pollution, urban congestion, threats to public health, or other consequences adverse to environmental goals and guidelines established by environmental response laws, coastal zone management laws, pollution control and abatement laws, and environmental policy including those found in chapters 128D (Environmental Response Law), 205A (Coastal Zone Management), 342B (Air Pollution Control), 342C (Ozone Layer Protection), 342D (Water Pollution), 342E (Nonpoint Source Pollution Management and Control), 342F (Noise Pollution), 342G (Integrated Solid Waste Management), 342H (Solid Waste Recycling), 3421 (Special Wastes Recycling), 342J (Hazardous Waste, including Used Oil), 3421 (Underground Storage Tanks), 342P (Asbestos and Lead), and 344 (State Environmental Policy), HRS, and those effects discussed in this section that are adverse and unavoidable under the proposed action must be	Chapter V

11-200.1-24 Section	Requirement	Location
	addressed in the draft EIS. Also, the rationale for proceeding with a proposed action, notwithstanding unavoidable effects, shall be clearly set forth in this section. The draft EIS shall indicate what other interests and considerations of governmental policies are thought to offset the adverse environmental effects of the proposed action. The draft EIS shall also indicate the extent to which these stated countervailing benefits could be realized by following reasonable alternatives to the proposed action that would avoid some or all of the adverse environmental effects.	
(p)	The draft EIS shall consider mitigation measures proposed to avoid, minimize, rectify, or reduce impacts, including provision for compensation for losses of cultural, community, historical, archaeological, and fish and wildlife resources, including the acquisition of land, waters, and interests therein. Description of any mitigation measures included in the action plan to reduce significant, unavoidable, adverse impacts to insignificant levels, and the basis for considering these levels acceptable shall be included. Where a particular mitigation measure has been chosen from among several alternatives, the measures shall be discussed and reasons given for the choice made. The draft EIS shall include, where possible, specific reference to the timing of each step proposed to be taken in any mitigation process, what performance bonds, if any, may be posted, and what other provisions are proposed to ensure that the mitigation measures will in fact be taken in the event the action is implemented.	Chapter III
(q)	The draft EIS shall include a separate and distinct section that summarizes unresolved issues and contains either a discussion of how such issues will be resolved prior to commencement of the action, or what overriding reasons there are for proceeding without resolving the issues.	Chapter VIII
(r)	The draft EIS shall include a separate and distinct section that contains a list identifying all governmental agencies, other organizations and private individuals consulted in preparing the draft EIS, and shall disclose the identity of the persons, firms, or agency preparing the draft EIS, by contract or other authorization.	Chapter X, and List of Preparers
(s)	The draft EIS shall include a separate and distinct section that contains: (1) Reproductions of all written comments submitted during the consultation period required in section 11-200.1-23; (2) Responses to all substantive written comments made during the consultation period required in section 11-200.1-23. (3) For comments that are form letters or petitions, that contain identical or near-identical language, and that raise the same issues on the same topic: (A) The response may be grouped (B) A single response may be provided that addresses all substantive comments within the form letter or petition and that includes a distinct section listing the individual commenters who submitted the form letter or petition. At least one (1) representative sample of the form letter or petition shall be appended to the final document; and	Chapter X, Appendix M, Appendices N-1, and N-2

11-200.1-24 Section	Requirement	Location
	(4) A summary of any EIS public scoping meetings, including a written general summary of the oral comments made, and a representative sample of any handout provided by the proposing agency or applicant related to the action provided at any EIS public scoping meeting; (5) A list of those persons or agencies who were consulted and had no comment in a manner indicating that no comment was provided; and (6) A representative sample of the consultation request letter.	

PROJECT OVERVIEW

1

I. PROJECT OVERVIEW

A. PROJECT LOCATION

West Maui Resort Partners, L.P. (WMRP) is proposing beach restoration to restore and preserve Honokōwai Beach (Proposed Action) in Lahaina, Maui, Hawai‘i. Honokōwai Beach is located on the West Coast of Maui, north of Kā‘anapali, and south of Kahana Bay, in the Kā‘anapali District and Honokōwai Ahupua‘a. See **Figure 1** (Regional Location). The Project Site is referred to as Honokōwai Beach because it is located in the Honokōwai ahupua‘a and within the Honokōwai littoral cell between Honokōwai Point and Honokōwai Stream. The Project Site at Honokōwai Beach is located approximately a half mile south of Honokōwai Beach Park; no work is proposed at Honokōwai Beach Park.

The portion of beach proposed for restoration primarily fronts the Ka‘anapali Beach Club (KBC) (TMK (2) 4-4-001:098), as well as Kaanapali Shores Condominiums (Kaanapali Shores) (TMK (2) 4-4-001:097) to the north and Maui Kai Condominiums (Maui Kai) (TMK (2) 4-4-001:100) to the south. Lands located seaward of the certified shoreline are considered State submerged lands, while lands located landward of the shoreline are privately owned condominium and time share properties. See **Figure 2** (Project Location). Access to this portion of Honokōwai Beach is provided from a public access road and parking lot on the north side of the KBC property off of Kā‘anapali Shores Place. Lateral beach access is available through a coastal walkway that spans the neighboring resorts, KBC and Kaanapali Shores properties.

Honokōwai Beach is a predominantly engineered shoreline located at the southern end of the Honokōwai littoral cell. A littoral cell extends seaward from the shoreline and can be described as a geographic region where sand (sediment) is transported, stored, and sourced. Littoral cells are dynamic environments which contribute to seasonal sediment change and varying beach widths. Littoral cells can interact with neighboring cells, or they can remain isolated depending on nearshore hydrodynamics, geology, hydrology, and other factors. The Honokōwai littoral cell stretches from Honokōwai Point to Kahana Bay. See **Figure 3** (Littoral Cells).

The shoreline fronting the KBC property is unarmored, the shoreline areas surrounding the sandy beach at the Project Site are characterized by a number of engineered structures, including seawalls, revetments, hybrid seawall-revetments, and drainage headwalls. The presence of seawalls and other human-made structures surrounding the beach classifies the Project Site as a semi-confined beach system with unique characteristics that distinguish it from the surrounding shoreline areas. As a result, adaptation in response to human-induced sea level rise must be tailored to the unique environmental conditions.

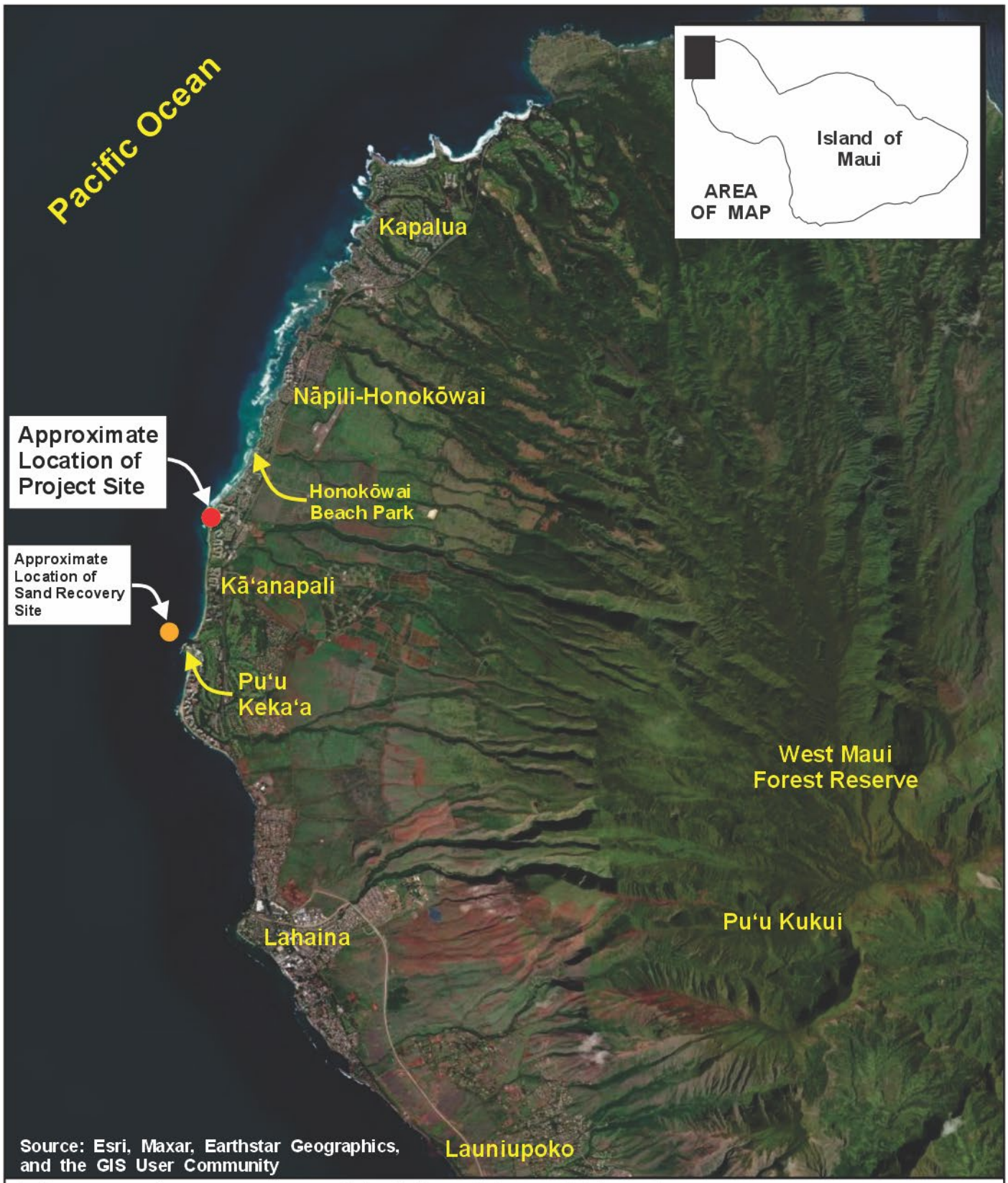


Figure 1

Ho‘āla Honokōwai
Regional Location

0 4,000 8,000
Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\RegLoc



Figure 2

Ho'āla Honokōwai

Project Location

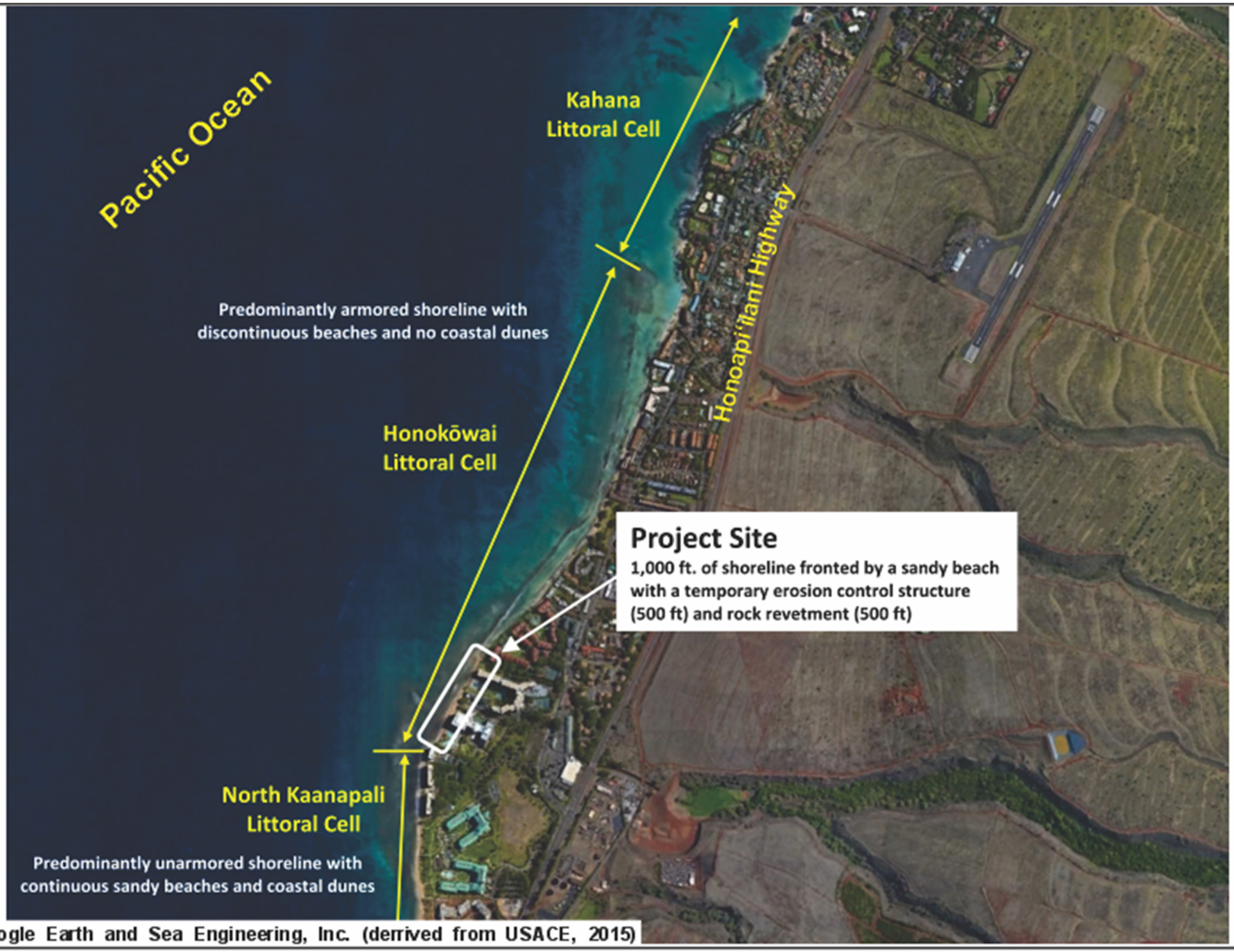
0 175 350

Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\ProjLoc



Source: Google Earth and Sea Engineering, Inc. (derrived from USACE, 2015)

Figure 3

Ho'āla Honokōwai
Littoral Cells

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Reston\Apps\Figures\LittoralCells

Honokōwai Beach is unique in that it is one (1) of the only places in West Maui that provides Americans with Disabilities Act (ADA) compliant perpendicular access to the shoreline and 1,000 linear feet (l.f.) of ADA compliant lateral access along the shoreline. Perpendicular access is provided via the public parking area and sidewalk via an easement on the KBC property. Lateral access is provided via a coastal walkway that abuts the shoreline through the KBC and Kaanapali Shores properties. In addition to the public right of way, there are public restrooms, showers, and changing stations adjacent to the parking lot and perpendicular beach access that are maintained by KBC.

The Project Site encompasses submerged lands extending approximately 220 ft. seaward from the certified shoreline. The bathymetry and habitat in and around the submerged portions of the Project Site are within the nearshore scour zone, which has depths of 0 to 1 meter (m) and consists of either sand and rocks or a bed of rocks and cobble with no corals present.

The Proposed Action is beach restoration, which involves the placement of sand along the shoreline. The proposed Sand Recovery Site for the Proposed Action is located about 1.5 miles (mi.) south from the Project Site, offshore of Kāʻanapali, herein referred to as "Sand Wave" or the "Sand Recovery Site". See **Figure 4** (Project Site and Sand Recovery Site). Sand investigations were conducted by Sea Engineering, Inc. (SE) (**Appendix "A"**, Section 5) which identified this sand source as the best match for the existing sand on Honokōwai Beach. As such, during the sand recovery stage of the Project, vessels will temporarily be staged offshore, at the Sand Recovery Site.

B. PROJECT NEED AND PURPOSE

Honokōwai Beach is an important natural, cultural, recreational, and aesthetic resource that supports a variety of uses for both residents and visitors. It is also a Federally designated critical habitat for Hawaiian monk seals and green sea turtles. The dynamic, sandy shoreline at Honokōwai Beach is exposed to chronic, seasonal, and episodic erosion and avulsion.

Nearshore hydrodynamics are very complex along the Honokōwai shoreline. Sediment is transported along the shoreline based on the direction of wave exposure, water depth, bathymetry, sediment availability, and nearshore currents. This is what gives Honokōwai Beach its dynamic shoreline which creates a constant change of the beach profile throughout the seasons. This sediment transport typically makes the southern portion of the beach wider during the winter months when the area is dominated by northerly swell, pushing sediment south. During the summer months, the southerly swell normally moves the sand to the north end of the beach. See **Figure 5** (Honokōwai Beach Seasonal Variability). Seasonal sediment transport is a common coastal process that affects beaches throughout Hawaiʻi.



Figure 4

Ho‘āla Honokōwai

Project Site and Sand Recovery Site

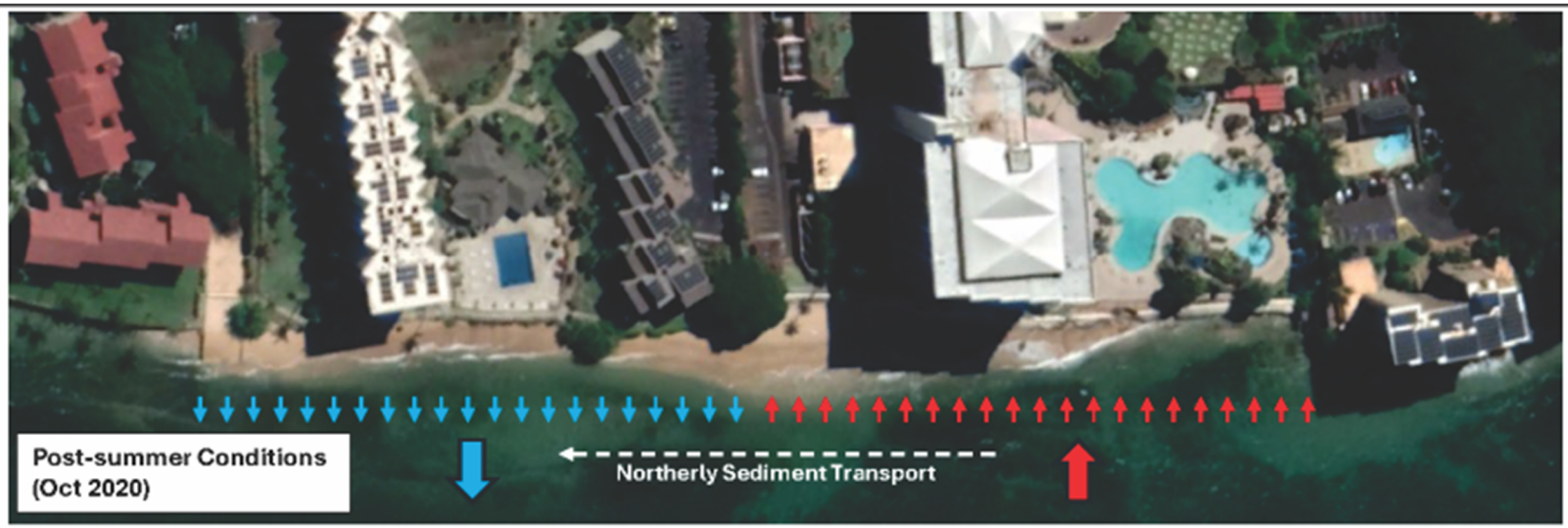
0 625 1,250

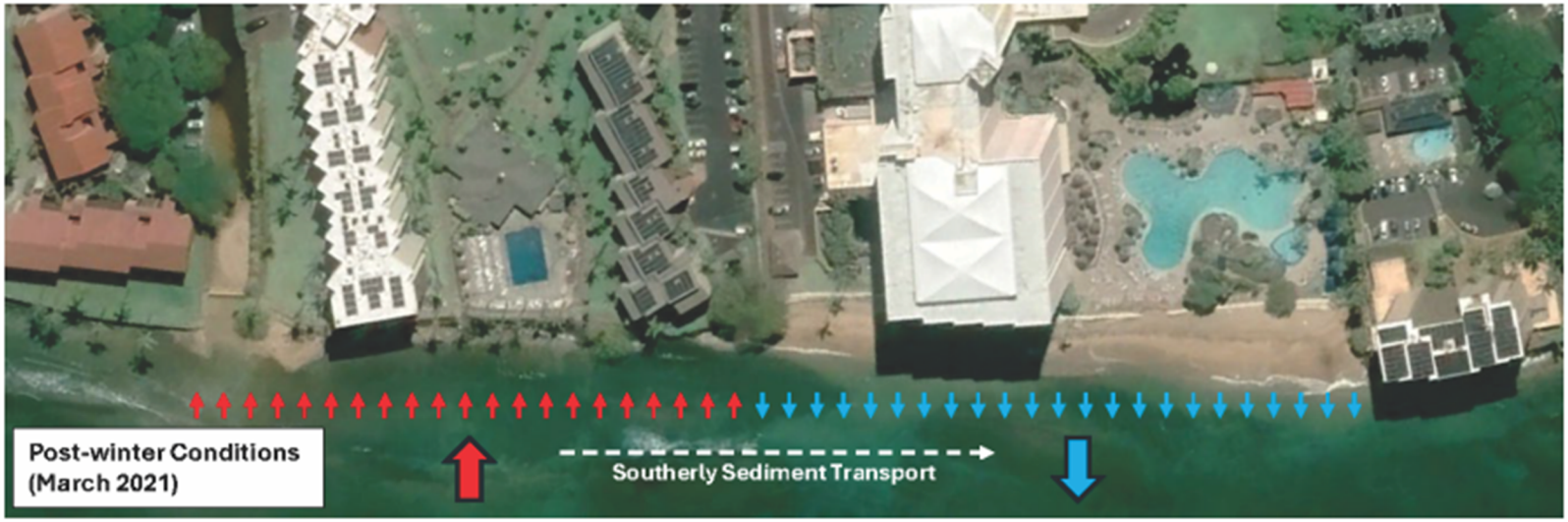
Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\ProjSite.SandRec





EROSION
(beach narrowing)

ACCRETION
(beach widening)

Source: Sea Engineering, Inc.

Figure 5

Hoʻāla Honokōwai

Honokōwai Beach Seasonal Variability

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGI/KBC Beach Restor/Apps/Figures/BeasVar

In the winter of 2016, a beach loss and avulsion event occurred which eroded almost the entire beach and portions of the backshore. A combination of persistent North Pacific swell and elevated water levels produced high waves, strong currents, and abnormally high tides. This anomalous combination of ocean conditions caused significant erosion, avulsion, and beach loss, and formation of a vertical escarpment[2] along the shoreline. The escarpment was about 5 to 8 ft. high on the southern portion of the shoreline and 3 to 5 ft. on the central and northern portions of the shoreline fronting KBC. The vertical escarpment was a drastic change from the gently sloping beach face present before the beach loss and avulsion event. See **Figure 6** (Shoreline Before and After Beach Loss and Avulsion Event). At the Kaanapali Shores to the north of KBC, an existing revetment prevented backshore erosion, but a larger portion of the revetment was exposed, and the shoreline was dangerous and inaccessible.

The eroded embankment caused public safety hazards; portions of the eroded embankment collapsed onto the shoreline, taking down trees, boulders, and large blocks of terrigenous sediments. Additionally, infrastructure including the coastal walkway, shower pads, irrigation lines, electrical wiring, and propane gas lines were damaged. The shoreline retreated 6 to 12 ft. in a matter of months, compared to the historical average annual erosion rate of -0.44 ft. per year.

Over the course of 2016, approximately 5,600 square feet (s.f.) of fast land[3] was permanently lost (i.e., was not restored by natural coastal processes) to the ocean at the Project Site. This loss is directly attributable to human-induced sea level rise. Unlike sand below the high-water mark, fast land cannot be restored by natural processes. In addition to the lost fast land, over 1,000 cubic yards (cy) of alluvial sediment (clay, silt, boulders, etc.) was discharged into the ocean as a result of the erosion and avulsion. The discharged sediment caused large turbidity plumes, commonly referred to as brown water, which extended approximately 1,500 ft. offshore. See **Figure 7** (Turbidity Plumes During 2016 Beach Loss and Avulsion Event). Increased turbidity negatively impacted cultural and recreational activities onshore and offshore. The negative water quality impacts persisted until the implementation of a temporary erosion skirt in 2018.[4]

In response to the beach loss and avulsion event, a temporary erosion skirt was installed in 2018 along the shoreline fronting KBC. The temporary erosion skirt was authorized by the State of Hawai‘i, Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL) and the County of Maui, Department of Planning through emergency permitting processes. The Applicant continues to maintain and monitor the

[2] An escarpment is a vertical or near vertical slope along the edge of a land feature such as a bluff, plateau, or a beach face.
[3] Fast land is land located above the high water mark.
[4] The water quality of Honokōwai Beach has been monitored and documented by an independent non-profit, Hui O Ka Wai Ola, to further their mission of understanding Maui’s coastal water quality. The efforts of Hui O Ka Wai Ola are unrelated to this project, but do document conditions at Honokōwai Beach over time.



Source: Sea Engineering, Inc.

Figure 6 Hoʻāla Honokōwai

Shoreline Before and After Beach Loss and Avulsion Event

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\Shoreline



Source: Sea Engineering, Inc.

Figure 7 Hoʻāla Honokōwai

Turbidity Plumes During 2016 Beach Loss and Avulsion Event

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\Turbidity

condition of the temporary erosion skirt. Photographic monitoring reports are submitted to the OCCL and County of Maui, Department of Planning on a monthly basis and multiple beach profile monitoring reports have been conducted. More information on the temporary erosion skirt is contained within the Coastal Engineering Assessment, **Appendix "A"**.

Before the beach loss and avulsion event in 2016, Honokōwai Beach was a wider and more stable shoreline with seasonal variation in sediment volume. The beach profile showed an active lower beach face, a wide and elevated upper beach face, and an upper beach berm with well-established vegetation. See **Figure 8** (Stable vs. Unstable Beach Conditions). Furthermore, prior to the 2016 beach loss and avulsion event, there was a narrow sandy beach located in front of the Maui Kai which allowed some degree of sediment exchange between the Honokōwai and North Kāʻanapali littoral cells.

As a result of the beach loss and avulsion event, a significant amount of sand left the Honokōwai littoral cell. Without the beach fronting the Maui Kai connecting the Honokōwai and North Kāʻanapali littoral cells, natural sediment transport between the littoral cells was disrupted. The loss of sand volume in the littoral cell and reduction in sediment transport conditions caused by the beach loss and avulsion event have left an unstable beach that is less able to naturally replenish the lost sand.

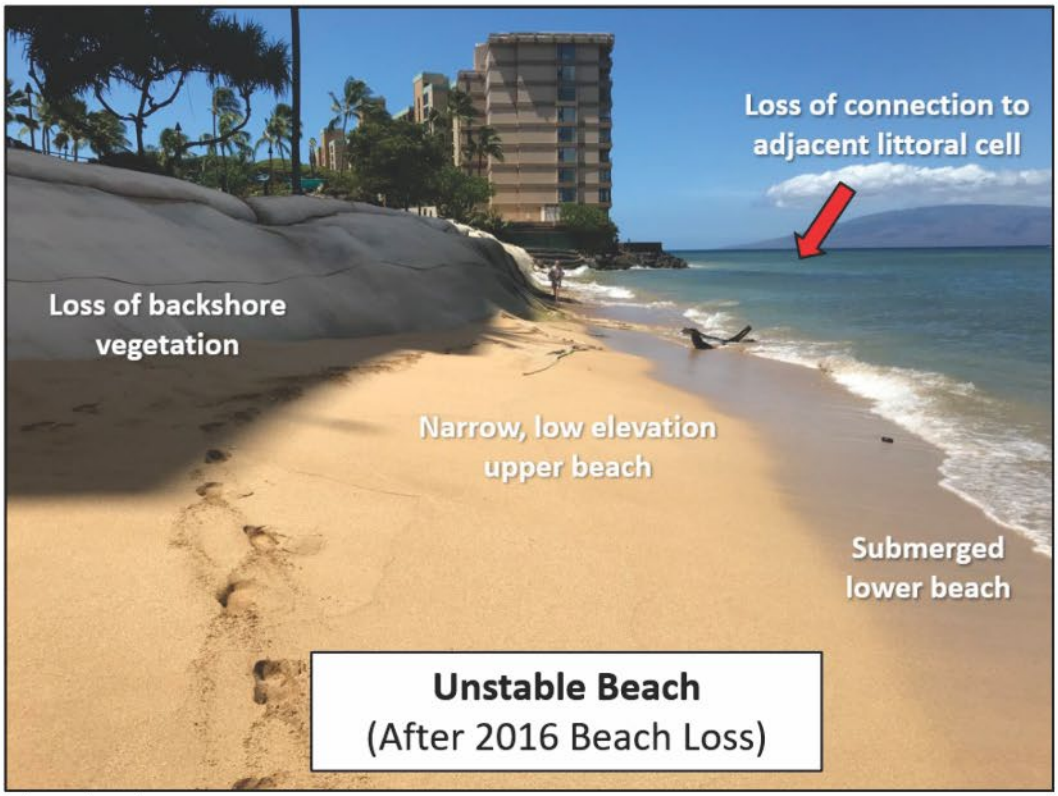
This Project is intended to help restore a wider and more stable beach to allow for continued shoreline access for cultural and recreational activities and function as a natural buffer for wave energy. This is anticipated to make the beach and surrounding shoreline less sensitive to erosion and more resilient to human-induced sea level rise. The temporary erosion skirt is a short-term response and has improved conditions in the nearshore environment by mitigating further erosion, while providing time for mid-term solutions and long-term adaptations to be developed and implemented. The Proposed Action intends to create a mid-term solution to replace the short-term response (temporary erosion skirt).

C. OBJECTIVES OF THE PROPOSED ACTION

Following the beach loss and avulsion event in 2016 and installation of the temporary erosion skirt, the Applicant outlined objectives to create a mid-term solution to protect and preserve Honokōwai Beach. The four (4) objectives below have been identified for the Proposed Action:

1. **Improve beach stability** – The Project seeks to implement a nature-based solution using a proven design methodology to create a wider and more stable beach that will protect both public and private resources.
2. **Preserve and enhance cultural and shoreline access** – Honokōwai Beach provides ADA compliant perpendicular and lateral shoreline access for cultural and recreational uses, including public parking, public restrooms, and showers. The Project seeks to preserve and enhance the shoreline access at Honokōwai Beach.





Source: Sea Engineering, Inc.

Figure 8 Ho'āla Honokōwai

Stable vs. Unstable Beach Conditions

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\StblvsUnstbl

3. **Increase resilience to coastal hazards and human-induced sea level rise** – The Project has been designed based on best available science and best practices to be consistent with State and County recommendations for sea level rise adaptation and create a wider and more stable beach to be resilient to sea level rise and future erosion. The beach will provide a wider and more stable natural buffer between the ocean and existing infrastructure.

4. **Enable planning for long-term adaptation to sea level rise** – As a mid-term solution for the next 50 years, the proposed Project will enable planning and analysis for long-term adaptation strategies.

It is anticipated that restoring the beach and preventing further erosion of the backshore will have a beneficial impact on the environment by preserving the beach and improving water quality. It is anticipated that beach restoration will help to preserve and enhance the fundamental character of Honokōwai Beach by maintaining shoreline access and supporting existing uses and resources along the shoreline.

D. PROPOSED ACTION

WMRP proposes beach restoration at Honokōwai Beach to achieve the objectives described above as a proactive response to human-induced climate change and based on the unique nature of the beach being semi-confined. Beach restoration is a mid-term solution to address beach loss and sea level rise, allowing time to plan and implement long-term adaptations. Beach restoration is widely recognized as a nature-based alternative for shoreline management that is promoted by various agencies. Three (3) methods of implementing beach restoration will be assessed in this EIS and are summarized below. The design parameters of these three (3) methodologies are further detailed in the Coastal Engineering Assessment (CEA) prepared by SE and presented in **Appendix "A"**.

1. Beach Nourishment

Beach Nourishment refers to an individual action (a single project) that involves the placement of additional sand to increase beach width and sand volume to offset the effects of erosion without modifying existing structures or installing any new structures.

At Honokōwai Beach, the Beach Nourishment alternative would involve placing sand at the south end of the Honokōwai littoral cell, along approximately 1,000 ft. of shoreline between Honokōwai Stream to the north and Honokōwai Point to the south. The beach would have a crest elevation of +8.5 ft. mean sea level (MSL) and a beach slope of 1V:8H (vertical to horizontal). The design elevation and slope are typical for beaches in Hawai'i. Approximately 27,000 cy of sand would be added, providing an initial beach width of approximately 40 ft. See **Figure 9** (Beach Nourishment and Beach Maintenance Project Alternatives). Without stabilizing structures, the expected design life of benefits associated with a one-time Beach



Source: Sea Engineering, Inc.

Figure 9 Ho'āla Honokōwai
Beach Nourishment and Beach Maintenance
Project Alternatives

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\Alternatives

Nourishment action at Honokōwai Beach is 10 years, although the design life could be shortened by episodic events. This design life can be increased by subsequent nourishment (i.e., Beach Maintenance) or with stabilizing structures such as groins (i.e., Beach Stabilization), discussed below.

2. Beach Maintenance

Beach Maintenance refers to a series of actions (program) that consists of periodic beach nourishment actions combined with sand pushing and/or sand back passing, without modifying existing structures or installing any new structures. Beach Maintenance actions are typically intended to be conducted on a recurring, periodic basis over a specified period of time and are, therefore, considered to be programmatic in nature.

At Honokōwai Beach, the initial nourishment effort would be identical to the Beach Nourishment alternative described above. Approximately 27,000 cy of sand would be placed at the south end of the Honokōwai littoral cell along approximately 1,000 ft. of shoreline, providing an initial beach width of approximately 40 ft. Because there would be no stabilizing groins, periodic beach maintenance would be performed after the initial nourishment and throughout the 50-year design life to maintain a wider beach. This maintenance would require sand added at time intervals corresponding to beach erosion. To maintain a minimum beach width of 25 to 30 ft., it is anticipated that renourishment would be required approximately every 10 years when the initial beach shape migrates landward 15 ft. This estimate is based on future shoreline change rate projections that anticipate approximately 10 to 15 ft. of shoreline recession projected over 10 years (an average rate of -1.27 ft./year). Over a 50-year period, four (4) renourishment efforts would be required to maintain the desired beach width. Each renourishment effort would require approximately 5,000 cy of sand, resulting in a total of 20,000 cy of additional sand to restore the beach and provide a minimum beach width of 40 ft. In total, approximately 47,000 cy of sand would be required for the initial nourishment event and four (4) renourishment efforts. Refer to **Figure 9** (Beach Nourishment and Beach Maintenance Project Alternatives).

3. Beach Stabilization

Beach Stabilization refers to an individual action that involves placing sand to nourish the beach and modifying existing structures, and/or installing new structures (e.g., groins) to stabilize the sand (i.e., keep the sand in place and prevent it from being washed away). Beach Stabilization projects are typically designed to be implemented as a single, discrete project with a specified design life.

At Honokōwai Beach, the Beach Stabilization alternative would involve beach nourishment along with the construction of three (3) T-head groins and one (1) L-head groin. The beach and groin layout are presented in **Figure 10** (Beach Stabilization Alternative) and are the result of detailed engineering analysis and design described further in **Appendix "A"**. The groins would extend seaward between 220 and 250 ft. from the existing backshore and would be spaced between 330 and 340 ft. along the shoreline.

The southwest groin near Honokōwai Point and the northwest groin near Honokōwai Stream are considered terminal groins, meaning that they are at the ends of the beach system. The other groins would have sand on either side. Sand fill would be placed between the groins to create a beach with a minimum 40-foot width, +8.5-foot MSL crest elevation, and a 1V:8H slope from the beach crest to the beach toe. An estimated 33,000 cy of sand would be required for this alternative. There is the potential for the southern terminal groin to allow sand accretion in front of Maui Kai, outside of the groin cell. The design and location of the northern terminal groin may prevent sand from accumulating at the mouth of Honokōwai Stream, allowing for uninterrupted stream flow into the ocean and lower concentrations of pollutants in the stream.

The groins have been designed to accommodate up to 3.3 ft. of sea level rise, which corresponds to a design life of 50 years based on the National Oceanic and Atmospheric Administration (NOAA, 2022) Intermediate-High sea level rise scenario for the anticipated Project start date. The design could be modified to include cast-in-place concrete crest caps[5] which would serve as a base for groin modification as sea levels continue to rise. If vertical extensions to the groins are needed due to rising sea levels, a crown wall can be constructed on top of the concrete core to raise the height of the groin. This adaptable design allows the initial design to have lower elevations to maintain a more open view plane rather than designing taller groins at the outset. The design for 3.3 ft. of sea level rise also accounts for a +0.5 ft. sea level anomaly (discussed in Chapter III.A.6) and an astronomical tide level of +1.1 ft. which puts the total still water design condition of the groins at +4.9 ft. MSL. Refer to **Appendix "A"**, Section 7.2.3.

The groins would not extend beyond the nearshore scour zone, a primarily barren area consisting of either sand and rocks or a bed of rocks and cobble. The nearshore scour zone is not a suitable habitat for corals or macroalgae and does not support robust fish populations.

[5] Concrete crest caps are concrete base pieces in the center of the surface of the groin.



Source: G70

Figure 10

Ho'āla Honokōwai
Beach Stabilization Alternative

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\BchStblAlt

It is important to note that groins are not considered “shoreline hardening”. Groins are a nature-based solution that utilizes a combination of natural processes and human engineering to create stable beaches. Shoreline hardening or shore protection structures are designed to mitigate erosion and loss of land by creating a hard barrier between the land and the ocean, thereby preventing erosion of fast land and loss of sediment (soil) in the cross-shore direction. While shore protection structures can be effective in stabilizing the shoreline and protecting land and infrastructure, they are not designed to stabilize beaches. In some cases, the presence of an armored shoreline can exacerbate beach erosion, particularly along chronically eroding shorelines. In contrast, groins are designed to stabilize sandy beaches by inhibiting the movement of sand along the shoreline or the loss of sand due to erosion.

E. CONSTRUCTION METHODOLOGY

All three (3) methods of beach restoration would involve sand recovery, sand transportation, and sand placement; in the case of Beach Stabilization, the action would also include construction of groins to stabilize the sand. This section of the EIS describes the identification of the sand source for beach restoration and the construction methodology related to sand recovery, sand transportation, sand placement, and groin construction. The construction methodology is further detailed in the CEA (**Appendix “A”**). A preliminary Best Management Practices Plan has also been prepared to ensure that adequate protective measures are in place during project implementation. See Best Management Practices Plan within the CEA, **Appendix “A”**. The Project specifications will require the contractor to adhere to the environmental protection measures included in the Best Management Practices Plan.

1. Sand Source

Beach restoration is considered a nature-based solution for shoreline management because it uses a combination of natural elements, such as sand, as well as human engineering for restoration. A key factor of beach restoration is determining an available sand source that matches the sand characteristics of the target beach. Detailed sand investigations were conducted by SE. The sand sources investigated are discussed in Chapter II, Alternatives and are further detailed in **Appendix “A”**, Section 5 and sand characteristics are described in **Appendix “A”**, Section 7.5.

The proposed Sand Recovery Site is located 1.5 mi. south of the Project Site and approximately 1,500 to 2,200 ft. offshore of Puʻu Kekaʻa at a depth of 120 to 170 ft. Offshore reconnaissance of the sand deposit included side-scan sonar imaging, sub-bottom profiling, towed video transects, and vibracoring. Laboratory analysis of the vibracore samples included dry color comparison, grain size distribution analysis, and turbidity analysis. Sand sample analysis confirmed that the sand in

the Sand Recovery Site is suitable for placement on Honokōwai Beach. Based on the sub-bottom and side scan sonar investigations, the Sand Recovery Site is estimated to encompass approximately 12.5 acres with sand thickness ranging from 13 to 59 ft. This area corresponds to a total estimated volume of 975,000 cy of sand within the boundaries of the survey area. More detail on the Sand Recovery Site is presented in **Appendix "A"**, Section 5.

2. Sand Recovery Methodology

Clamshell dredging is the process of mechanically scooping and lifting sediment from the sea floor. An environmental clamshell bucket is lowered from a crane in the open position.[6] Once the clamshell bucket reaches the sea floor, the crane operator closes the jaws to capture the sand and lifts the bucket out of the water. As the bucket is removed from the ocean, the water drains out and the sand material is placed on a waiting barge. Images of the operation and design of clamshell dredging can be found in **Appendix "A"**.

Clamshell buckets vary in size from 1 cy to 20 cy. A typical 15 cy rated bucket has a footprint of 13 ft. by 13 ft. when open and penetrates between 2 to 6 ft. below the surface of the sea floor. This method can recover approximately 12 cy of sediment per bucket, and the flexibility on depth ensures precise recovery and that the lower sediment layers remain undisturbed. More detailed information on the sand recovery methodology is presented in **Appendix "A"**, Section 8.2.

Clamshell dredging would be used for all three (3) project alternatives considered despite the difference in volume requirements for the methods. **Table 1** shows the volume of sand required for each method.

Table 1. Summary of Sand Volume Requirements

Alternative	Sand Volume (cy)
Beach Nourishment	27,000
Beach Maintenance	47,000
Beach Stabilization	33,000
Source: Sea Engineering, Inc.	

It is assumed that offshore sand cannot be stockpiled (e.g., for use in subsequent sand placement in the future) and as such, for the Beach Maintenance alternative, five (5) separate sand recovery efforts would be required over a period of 50 years for a cumulative total of 47,000 cy of sand.

[6] An environmental clamshell bucket is specifically designed to minimize sediment disturbance and contamination release during dredging operations, with features such as tight rubber seals, precise cutting edges, and a low center of gravity. A regular clamshell bucket is a standard design used for general material excavation, often with less focus on environmental considerations and potentially causing more sediment disruption when used in sensitive areas

3. Sand Transport

Due to bathymetric conditions fronting the Project Site and limited onshore space for dewatering and stockpiling of sand, the sand cannot be directly pumped onshore after the sand recovery operations. As such, the sand would be barged to Kahului Harbor where it would be offloaded. Sand is proposed to be offloaded and temporarily stockpiled at the west breakwater at Kahului Harbor. Approval from the State of Hawai'i, Department of Transportation (HDOT), Harbors Division is confirmed for offloading and stockpiling activities. The anticipated offload site will be along the interior side of the west breakwater. The contractor will determine the preferred method to offload the sand from the deck barge to the shore which could potentially be accomplished using long-reach excavators or a power conveyor system. From the harbor, the sand would be loaded into trucks able to transport 12 cy per truckload and taken directly to the Project Site. See **Figure 11** (Sand Transport Route). It is assumed that sand transport will require two (2) trucks per hour during an 8-hour work day, resulting in approximately 16 truckloads per day. See **Table 2**.

Table 2. Truckloads and Estimated Sand Volumes for Each Alternative

Alternative	Sand Volume (cy)	Total Truckloads	Truckloads per day
Beach Nourishment	27,000	2,250	16
Beach Maintenance	47,000	3,917	16
Beach Stabilization	33,000	2,750	16

4. Sand Placement

Once trucks loaded with sand arrive at the Project Site, the sand would be managed and placed at the discretion of the contractor. Beach Stabilization involves the construction of groins and as such, it is anticipated that sand would be trucked and placed as each groin cell is constructed. Construction for sand placement and groin construction would require mechanical equipment such as front end-bucket loaders, bulldozers, excavators, and trucks. Refer to **Appendix "A**".

As construction occurs, sand would be placed landward to seaward, so that the beach width would increase from onshore to offshore. In the case of Beach Stabilization, it is anticipated that sand would be placed one (1) groin cell at a time. As construction progresses, the design of beach profiles will be verified by an engineer during construction with surveys and survey stakes. Final beach height markings will be used for referencing. A containment system using silt curtains and fences will be used in the area of active sand placement to reduce potential impacts associated with turbidity.

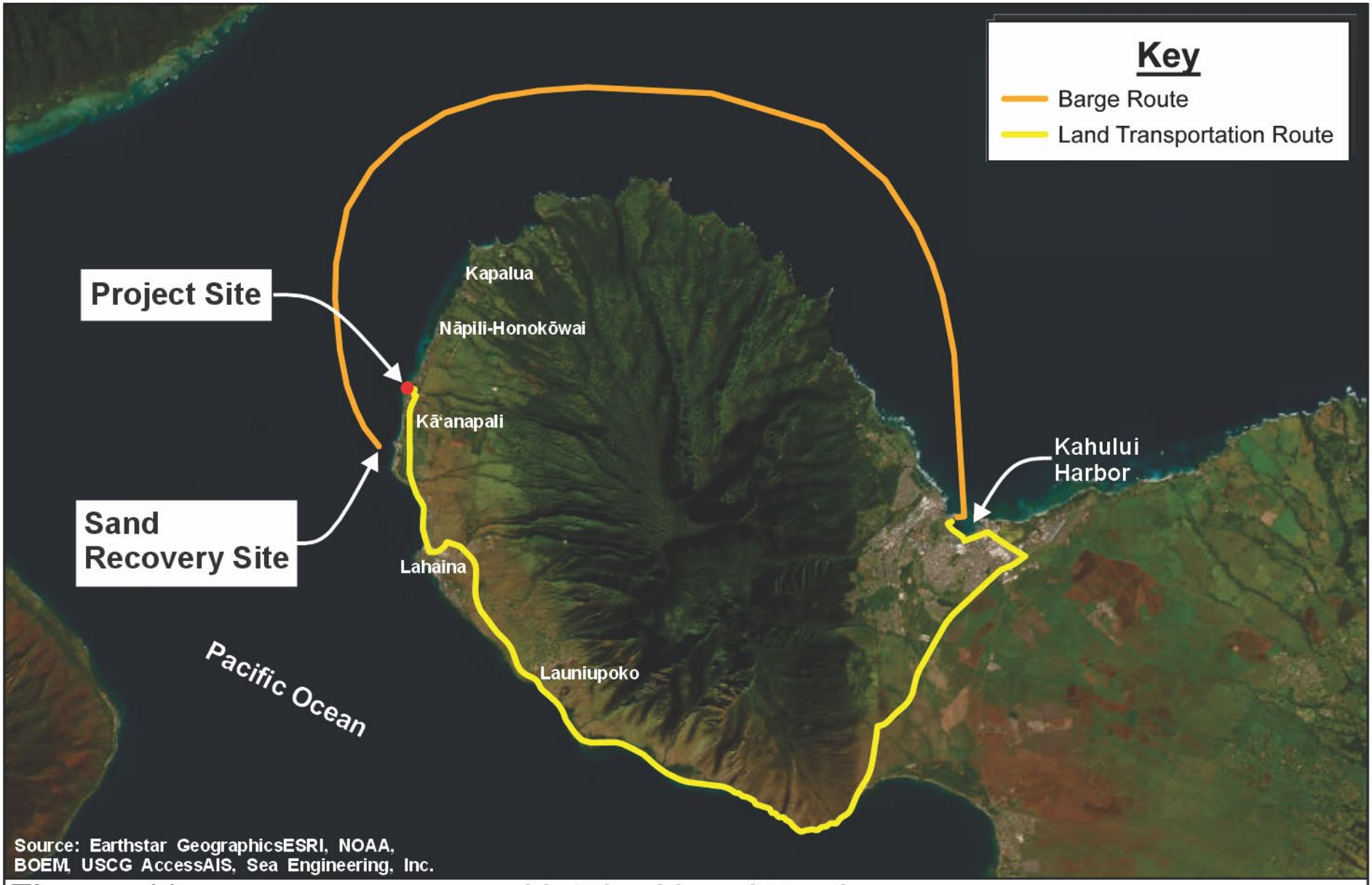


Figure 11

Ho'āla Honokōwai
Sand Transport Route

0 10,000 20,000
Feet

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

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Phasing of the sand placement is most important for the Beach Stabilization alternative as filling groin cells is a crucial step in building a stable beach. The contractor would determine the phasing of construction and could be end-to-end from either direction or could start in the center and work in either direction. For Beach Maintenance and Beach Nourishment, it is important that once nourishment starts, each area is completed before moving laterally down the beach. This method minimizes impacts to beach users as portions of the beach remain open during the workday.

5. Groin Construction (Beach Stabilization Only)

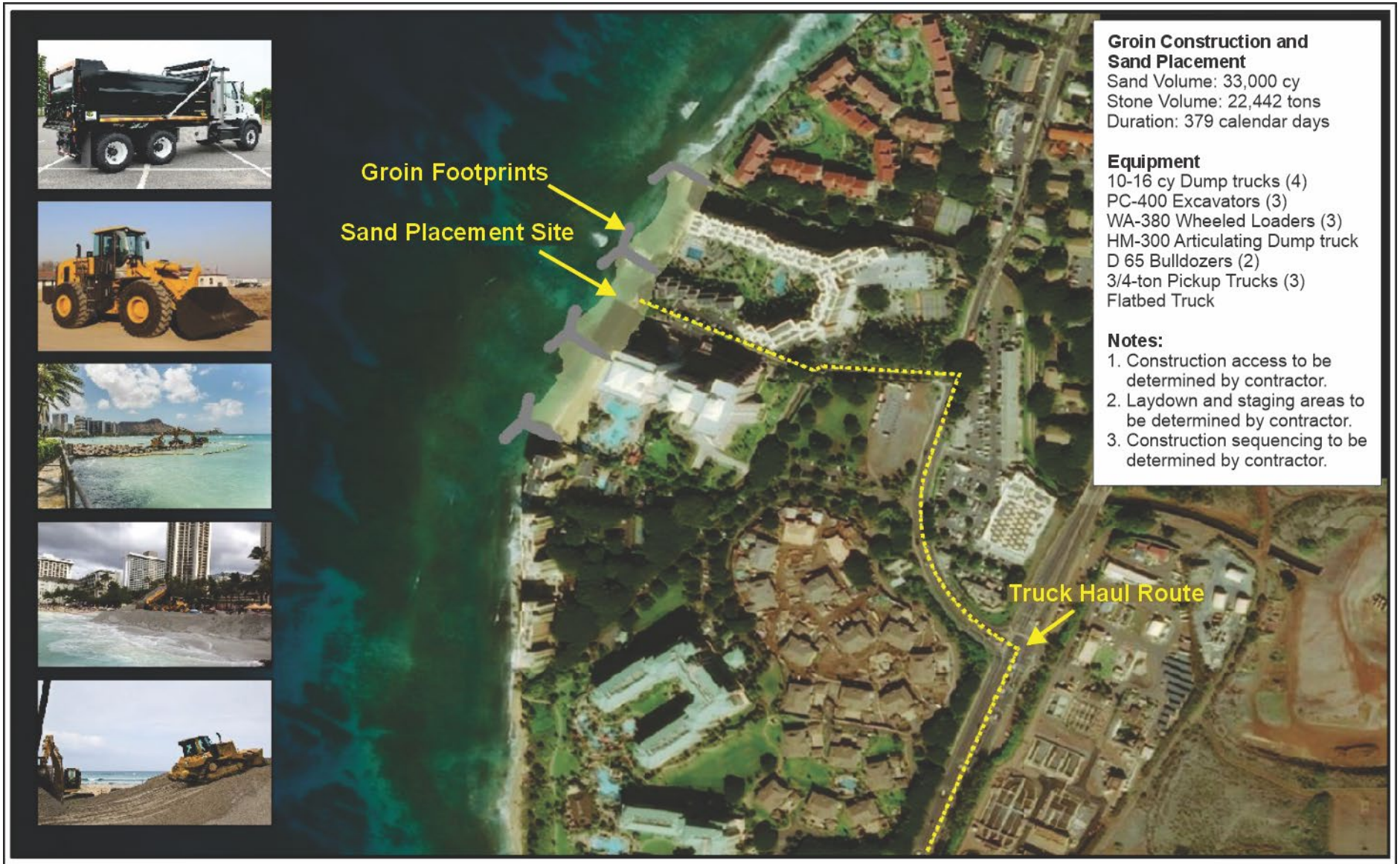
The Beach Stabilization alternative involves the construction of groins as stabilizing structures. It is anticipated that one (1) groin cell would be built at a time. A groin cell is a unit comprised of two (2) groins. Groins are constructed in cells to ensure the beach is nourished properly and forms correctly as beach dynamics, wave patterns, and currents are altered within each cell. 22,442 tons of stone would be brought to the Project Site for groin construction, requiring approximately 1,400 truckloads. Stone is anticipated to be sourced from the HC&D baseyard in Puʻunēnē. Similarly to sand transportation, two (2) trucks are anticipated to move stone per 8-hour workday from the baseyard to the Project Site.

Access to the Project Site is a constraint for the Project. Access from the sea is not available due to the shallow reef flat and wave action. Access from land is limited to the area between the buildings landward of the shoreline. Currently, the most available accessway is the public parking area and perpendicular access provided between KBC and Kaanapali Shores. See **Figure 12** (Groin Construction and Sand Placement Methodology).

The groin stem and head sections would be temporarily overbuilt by about 15 ft. in width to enable equipment and personnel access. Groin construction would start at the groin head and work landward. As work is completed and moves landward, the material built in excess to allow access would be collected and removed.

6. Construction Duration

Construction duration is reflected in weeks and varies for each project alternative. See **Table 3**. Construction is anticipated to begin follwing receipt of necessary permits and approvals, which is currently projected to be around the fourth quarter of 2027.



Groin Construction and Sand Placement
Sand Volume: 33,000 cy
Stone Volume: 22,442 tons
Duration: 379 calendar days

Equipment
10-16 cy Dump trucks (4)
PC-400 Excavators (3)
WA-380 Wheeled Loaders (3)
HM-300 Articulating Dump truck
D 65 Bulldozers (2)
3/4-ton Pickup Trucks (3)
Flatbed Truck

Notes:
1. Construction access to be determined by contractor.
2. Laydown and staging areas to be determined by contractor.
3. Construction sequencing to be determined by contractor.

Source: Sea Engineering, Inc.

Figure 12

Hoʻāla Honokōwai

Groin Construction and Sand Placement Methodology

NOT TO SCALE

MUNEKIYO HIRAGA

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Table 3. Anticipated Construction Duration and Design Life

Alternative	Weeks of Land Based Construction	Sand Recovery and Transport (Weeks)	Number of Actions	Anticipated Design Life
Beach Nourishment	19	11	1	10 years
Beach Maintenance[a]	47	20	5	50 years
Beach Stabilization	55	13	1	50 years

[a] One (1) initial nourishment and four (4) renourishments
Source: Sea Engineering, Inc.

7. Construction Cost

Rough Order of Magnitude (ROM) construction cost estimates were prepared for each alternative. See **Table 4**.

Table 4. Rough Order of Magnitude Cost Estimates

Alternative	Cost Estimate
Beach Nourishment	$10,300,000
Beach Maintenance	$25,777,735
Initial Nourishment (year 0)	*$10,300,000*
Renourishment 1 (year 10)	*$3,335,000*
Renourishment 2 (year 20)	*$3,668,500*
Renourishment 3 (year 30)	*$4,035,350*
Renourishment 4 (year 40)	*$4,438,885*
Beach Stabilization	$19,827,000

Source: Sea Engineering, Inc.

8. Design Life

An objective of the Project is to establish mid-term solutions to sea level rise and beach erosion. As such, the minimum Project design life considered was 10 years.

Beach Nourishment is anticipated to have a 10-year lifespan. This alternative could potentially have a design life of less than 10 years, should an erosion event of similar magnitude to the 2016 beach loss and avulsion event occur. While the nourished beach would make the coastline more resilient under typical conditions, anomalous events could reduce the Project lifespan significantly.

Beach Maintenance is designed to have a 50-year lifespan based on one (1) initial nourishment event and four (4) subsequent renourishment events approximately every 10 years after the initial nourishment. These renourishment events would be quasi-scheduled to help the beach avoid significant beach loss in the event of another erosion event. It is noted, however, that no amount of nourishment or maintenance would mitigate the potential for episodic beach loss. Ideally, maintenance efforts would occur every 10 years, but erosion events could have an impact on the beach that would shorten that period. The maintenance program

would ensure benefits lasted much longer than the Beach Nourishment alternative but would still be susceptible to anomalous or episodic events.

Beach Stabilization is designed to have a 50-year lifespan. The groins would be designed to be adaptable to scenarios of sea level rise beyond current projections for the 50-year design life. This would allow for additional stone to be added to improve effectiveness against higher water levels. Utilizing stabilizing groins would help to ensure the 50-year design life and create a wider and more stable beach that is more resilient and less susceptible to anomalous or episodic erosion.

9. Summary of Beach Restoration Alternatives

The information provided in this chapter of the EIS is summarized in **Table 5**. Further detail on the construction methodology for each alternative is provided in the Coastal Engineering Assessment in **Appendix "A"**.

Table 5. Summary of the Information Presented Above

Action	Design Life (years)	Number of Actions	Utilizes Groins	Cubic Yards of Sand	Approximate Total Cost (in millions)
Beach Nourishment	10	1	No	27,000	$10.3
Beach Maintenance	50	5	No	47,000	$25.7
Beach Stabilization	50	1	Yes	33,000	$19.8
Source: Sea Engineering, Inc.					

F. POTENTIAL RELATED SECONDARY ACTIONS

As described above, the Proposed Action is a beach restoration project, intended to achieve the Project goals associated with beach restoration, beach stability, preserving and enhancing shoreline access, improving overall resilience to sea level rise, and enabling planning for long-term adaptation to sea level rise. While the beach restoration action is the primary action proposed and assessed in this EIS, there are related secondary actions (e.g., additional actions that may occur beyond the shoreline area) that may be implemented to further support the Project objectives.

Potential secondary actions would be aimed at increasing resiliency and reducing exposure to or risk from climate change and coastal hazards. These secondary actions would be limited to common elements of the KBC property and may include modification or strategic relocation of existing common elements of the KBC property within the Project Site, such as walkways, landscape and hardscape features, and water features. Secondary actions may also include environmental restoration actions or public access improvements within the KBC property or shoreline areas. Secondary actions would not involve any intensification of uses within the KBC property that would present adverse environmental impacts.

G. CHAPTER 343, HAWAIʻI REVISED STATUTES COMPLIANCE

The use of State submerged lands (lands seaward of the certified shoreline), work within the State Land Use Conservation District, and work within the Shoreline Area trigger compliance with Chapter 343, Hawaiʻi Revised Statutes (HRS). Due to the potential for significant environmental impacts, including those that may arise from the potential use of State lands, the State of Hawaiʻi, Department of Land and Natural Resources (DLNR) has determined that an EIS is required. An Environmental Impact Statement Preparation Notice (EISPN) was prepared and published in the December 23, 2022, edition of the Environmental Review Program's (ERP) *The Environmental Notice*.

This Draft EIS has been prepared in accordance with Hawaiʻi Administrative Rules (HAR) Title 11, Chapter 200.1 of Department of Health Administrative Rules, EIS Rules. Pursuant to HAR § 11-200.1-7(a)(1), the DLNR has final authority to accept the EIS. The EIS will act as the primary technical supporting document for the various land use entitlement applications required for the Project.

ALTERNATIVES CONSIDERED

II

II. ALTERNATIVES CONSIDERED

A. ADAPTATION PATHWAYS

Climate change and sea level rise pose significant current and long-term threats to Hawai‘i’s shorelines, beaches, and our way of life. Adaptation pathways, a planning approach to address the uncertainties and risks associated with climate change, can include protection, accommodation, retreat, or advancement. Adaptation pathways allow planners and decision-makers to map out a sequence of adaptation strategies, such as modifying structures or the environment (e.g., implementation of accommodative and/or protective actions or structures), modifying human activities (e.g., avoidance of or retreat from coastal effects), or some combination thereof in response to rising seas. Adaptation pathways identify triggers to indicate when adaptation is expected to be needed, and thresholds, or “tipping points” when an adaptation strategy may no longer be effective. In addition, adaptation pathways can help a community plan for a range of uncertain futures while only investing in adaptation strategies when necessary, and may involve short-term, mid-term, or long-term actions. For the purposes of this Project, short-term responses are considered to be 0 to 10 years, mid-term solutions 10 to 50 years, and long-term adaptations more than 50 years. For more information on adaptation pathways, refer to the Coastal Engineering Assessment in **Appendix “A”**, Section 2.2.

1. Short-Term Responses (0 to 10 years)

Short-term responses typically have a design life of less than 10 years. Short-term responses are normally intended to address imminent or immediate problems such as erosion or flooding events. These short-term responses are implemented as non-permanent solutions to protect land, infrastructure, public health, safety, and welfare. These responses are intended to offer time for mid-term solutions and long-term adaptations to be planned and implemented. Examples of short-term responses include sandbag structures, sand-filled mattresses, and temporary erosion skirts. These structures can be placed along the shoreline to help mitigate erosion and protect against high surf damage. A temporary erosion skirt has been used at the Project Site since 2018 in response to the 2016 beach loss and avulsion event. This temporary erosion skirt is considered a short-term response and is common in Hawai‘i.

2. Mid-Term Solutions (10 to 50 years)

Mid-term solutions are intended to address existing conditions and prepare for anticipated future impacts. Mid-term solutions are typically designed to have lifespans ranging from 10 to 50 years and, therefore, require more detailed design, planning, and environmental and engineering analysis than short-term responses.

Mid-term solutions often require physical improvements to landscapes, infrastructure, and buildings on a moderate geographic scale. Mid-term solutions are typically intended to provide continuing protection to land and existing infrastructure that may be vulnerable to coastal hazards or by altering land and existing infrastructure to accommodate coastal hazards and sea level rise, while providing adequate time to plan and prepare long-term adaptation strategies.

3. Long-Term Adaptation (More than 50 years)

Long-term adaptations normally take more time to plan and implement and are intended to last more than 50 years. Long-term adaptation planning is challenging due to the increased uncertainty of long-range projections and the increased significance of potential trade-offs. Long-term adaptations typically involve a complex process of technical analysis, public planning and environmental review processes, disaster risk analysis, and consideration of fiscal, economic, and land ownership impacts. With additional time to plan and prepare for environmental and economic scenarios, environmental monitoring, models, and trajectories are able to be completed and studied to better understand and prepare for impacts of climate change. Long-term adaptation strategies include fundamentally altering the character and appearance of the existing environment and the range of beneficial uses currently supported. In addition, long-term adaptation strategies may require development of guidance, laws and policies at a State and County level, along with private collaboration and participation to seek a balanced way to obtain community goals and objectives.

Considering the long-term projections for sea level rise, and the implications associated with the projected increase in erosion and flooding, alternative strategies may be required in the long-term to protect and preserve Honokōwai Beach and the adjacent properties.

The Proposed Action presented in this Draft EIS is a mid-term solution that is intended to preserve Honokōwai Beach in the mid-term to enable time for planning for long-term adaptation to sea level rise.

B. PREFERRED ALTERNATIVE (BEACH STABILIZATION MID-TERM SOLUTION)

Within the context of mid-term solutions, three (3) alternatives have been identified and are assessed in this Draft EIS. They are Beach Nourishment, Beach Maintenance, and Beach Stabilization. After an analysis of the three (3) methods throughout the Draft EIS preparation process, which included extensive field work, technical studies and community engagement, Beach Stabilization emerged as the preferred alternative for the benefits and timeline it offers as well as analysis of impacts compared to other alternatives.

Beach Stabilization is also the only alternative that meets all four (4) objectives identified, including (1) improving beach stability, (2) preserving and enhancing cultural and shoreline access, (3) increasing resilience to coastal hazards and human-induced sea level rise, and (4) enabling planning for long-term adaptation to sea level rise. Beach Nourishment and Beach Maintenance address some of these objectives to varying degrees but do not address the first objective of improving beach stabilitiy.

1. Beach Stabilization

Beach Stabilization (the "Preferred Alternative") has been selected as the Preferred Alternative because it offers the most reliable and longest period of beneficial impacts from a beach restoration effort. Beach Stabilization is the only alternative that improves beach stability. As described in Chapter I, Beach Stabilization would use a combination of sand nourishment and rock groins to effectively restore and stabilize Honokōwai Beach, protecting and preserving the beach, shoreline access, and land and infrastructure landward of the beach. With a design life of 50 years, the restored and stabilized beach would offer ongoing protection and flexibility should sea level rise be greater than projected. Design features such as concrete crest caps would allow for the groins to be modified to accommodate additional sea level rise, if necessary.

Beach Stabilization represents a nature-based approach to adaptation that would offset the reduction in sand volume caused by human-induced sea level rise. Unlike Beach Nourishment or Beach Maintenance, Beach Stabilization would also stabilize the sand, which would make the beach more resilient to chronic, seasonal, and episodic erosion and avulsion events. As previously discussed, Honokōwai Beach is a semi-confined beach system that is bounded by man-made structures. Beach Stabilization is a nature-based response to both human-induced sea level rise and human engineering that has altered the configuration of the shoreline and how it responds to natural processes. Beach Stabilization would be designed to conform to the existing configuration of the coastline and protect the beach from human-induced sea level rise. As a result, Honokōwai Beach would be less vulnerable to chronic and seasonal erosion and episodic events, such as the 2016 beach loss and avulsion event. Beach Stabilization provides an optimal balance of effectiveness, design life, and adaptability with minimal maintenance.

C. ALTERNATIVE MID-TERM BEACH RESTORATION METHODOLOGIES

The alternative methods for this Project consist of Beach Nourishment and Beach Maintenance. These alternatives were considered and evaluated because they have merit and potential to benefit the beach. However, based on the analysis of potential impacts and benefits associated with these alternatives with respect to the Project goals, neither of these alternative mid-term beach restoration methodologies are anticipated to be as

beneficial as Beach Stabilization and do not address the objective of improving beach stability.

1. Beach Nourishment

Beach Nourishment would constitute a single action of sand recovery, sand transportation, and sand placement on the beach without stabilizing groins or future maintenance. This alternative is anticipated to last for approximately 10 years and would be more susceptible to an episodic erosion event. As time goes on, the beach width would naturally fluctuate and decrease since the beach is also exposed to seasonal and chronic erosion and some of the sand would likely be transported out of the littoral cell. This sediment transport would lead to the loss of the sand added to the beach over the course of approximately 10 years.

While Beach Nourishment is a better alternative when compared to No Action for addressing the project objectives, there are some disadvantages associated with Beach Nourishment. In particular, Beach Nourishment has the shortest design life (10 years) of the alternatives considered. In the absence of the groins proposed for Beach Stabilization, placed sand would be less stable and the beach would be vulnerable to erosion, which is projected to continue and accelerate as sea levels continue to rise.

Honokōwai Beach is a semi-confined beach system that is bounded by man-made structures. While increasing sand volume would temporarily increase beach width, the beach would continue to be vulnerable to chronic, seasonal, and episodic erosion and avulsion events. This alternative does not increase beach stability, but only delays the anticipated impacts of No Action by an estimated 10 years through one (1) action of placing additional sand. Based on current projections for sea level and coastal erosion, Honokōwai Beach would remain vulnerable to further beach loss and avulsion events, such as what occurred in 2016. For these reasons, Beach Nourishment was not identified as the Preferred Alternative.

2. Beach Maintenance

Beach Maintenance would constitute a program of multiple Beach Nourishment events. One (1) initial nourishment event would be followed by four (4) subsequent renourishment actions that would occur approximately every 10 years over a period of 50 years. These repetitive actions would add sand as it is lost due to natural seasonal and chronic erosion. Like Beach Nourishment, there would be no groins to stabilize the sand and curtail erosion and beach narrowing.

Similar to Beach Nourishment, Beach Maintenance does not increase beach stability. While this alternative would have a design life of approximately 50 years, it would require renourishment events approximately every 10 years and as a

result, requires the most sand of the alternatives considered. The renourishment would require reliance on sand availability at the Sand Recovery Site and construction related impacts would recur approximately every 10 years.

As previously discussed, Honokōwai Beach is a semi-confined beach system that is bounded by man-made structures. While increasing sand volume would temporarily increase beach width, the beach would continue to be vulnerable to chronic, seasonal, and episodic erosion and avulsion events. Based on current projections for sea level and coastal erosion, Honokōwai Beach would remain vulnerable to further beach loss and avulsion events, such as occurred in 2016. Periodic renourishment would be required to maintain sand volume and beach width; renourishment may be required more frequently than anticipated. Beach Maintenance has the most overall construction day requirements and is the most costly. For these reasons, Beach Maintenance was not identified as the Preferred Alternative.

D. NO ACTION

No Action is an alternative that constitutes not doing beach restoration and allowing Honokōwai Beach to naturally erode. The No Action alternative would involve the demolition and removal of the existing temporary erosion skirt that was installed at Honokōwai Beach in 2018. To evaluate and quantify the impacts of No Action, cumulative impacts that may occur over a 50-year period are considered, which is consistent with the anticipated lifespan of Beach Stabilization and Beach Maintenance.

As previously discussed, Honokōwai Beach is subject to chronic, seasonal, and episodic erosion. Chronic erosion describes a gradual process in which a beach narrows incrementally, over a period of time. Seasonal erosion describes changes to a beach profile including width, volume of sand, and elevation, which typically occurs in a yearly cycle based on ocean processes. Episodic erosion (or avulsion) describes individual events which occur rapidly and unexpectedly. Events such as tsunamis, storms, and large swells would constitute an episodic event. All three (3) types of erosion can individually or collectively result in beach narrowing, beach loss, and permanent shoreline recession.

Coastal erosion is anticipated to accelerate around mid-century as a result of human-induced sea level rise. Significant impacts are anticipated at Honokōwai Beach. Historical shoreline changes have been assessed at the Project Site and show an annual average recession of -0.44 ft./year (yr.). Future sea level rise modeling at the Project Site anticipates an average recession of -1.27 ft./yr. at 1.1 ft. of sea level rise, and -1.81 ft./yr. with 3.2 ft. of sea level rise, an increase of three (3) to four (4) times historical rates, respectively. Refer to the Coastal Engineering Assessment in **Appendix "A"**, Section 7.5.4.2.

With the No Action alternative, erosion and beach loss would drastically change the shoreline. Shoreline recession, or the permanent landward migration of the shoreline due to permanent loss of land, would leave a narrower shoreline that is unable to serve as an effective buffer between the ocean and the land. Shoreline recession is anticipated to occur at the same time as beach narrowing and beach loss and would have significant impacts on land use at and beyond the shoreline. Additional changes, not limited to negative impacts to water quality and benthic habitat, loss of ecosystem services and critical natural habitat, and progressive degradation of the shoreline area would be anticipated.

While the exact timing of coastal erosion is uncertain, it is possible that total beach loss associated with human-induced sea level rise could occur at Honokōwai Beach before the end of the century, or sooner, if no mitigation is done. Projections vary for land loss and sediment discharge estimates based on projected sea level rise scenarios but with 3.2 ft. of sea level rise, land loss is anticipated to be up to 60,496 square feet (s.f.) with up to 19,542 cy of sediment discharged. See **Table 6**.

Table 6. Estimated Land Loss and Sediment Discharge Based on Sea Level Rise Projections

Projected Sea Level Rise (ft.)	Estimated Timeframe (yr.)[1]	Estimated Land Loss (s.f.)[2]	Estimated Sediment Discharge (cy)[3]
0.5	2024	8,783	2,584
1.1	2044	19,967	7,042
2.0	2060	42,625	13,589
3.2	2073	60,946	19,542

[1]Estimated timeframes for sea level rise are based on Int-High Task Force projections (Sweet et. Al. 2022).
[2]Estimated land loss is measured from the vegetation line to the SLR-XA coastal erosion hazard lines. Estimated Values are cumulative over time.
[3]Estimated sediment discharge is limited to the Kā‘anapali Beach Club property. Estimated values are cumulative over time.

Sandy beaches are an important natural resource that provide valuable ecosystem services including but not limited to sediment storage and transport, wave dissipation and buffering against coastal hazards and sea level rise, breakdown of organic materials and pollutants, water filtration, maintenance of biodiversity, scenic viewplanes, and recreational opportunities. Under the No Action alternative, erosion, shoreline recession, beach narrowing, and potential beach loss would continue to degrade the natural environment at Honokōwai Beach, resulting in the inevitable loss of ecosystem services and critical natural habitat.

The No Action alternative does not meet the Project objectives of improving beach stability, preserving and enhancing cultural and shoreline access, increasing resiliency to coastal hazards and sea level rise, and enabling planning for long-term adaptation to sea level rise. No Action is anticipated to negatively impact Project objectives as beach stability

would decrease, access would become more limited, resiliency would be lowered, and long-term adaptation would be required sooner.

E. DESIGN AND CONSTRUCTION IMPLEMENTATION ALTERNATIVES

In addition to the beach restoration and No Action alternatives, a number of design and construction implementation alternatives were considered but dismissed. These alternatives are listed below and further described in the CEA in **Appendix "A"**.

1. Three-Groin Beach Stabilization Alternative

The preferred alternative is Beach Stabilization using four (4) groins, including three (3) T-head groins and one (1) L-head groin. An alternative design was considered involving beach stabilization using three (3) groins. The four-groin approach (preferred alternative) would involve four (4) groins spanning approximately 1,000 ft. of shoreline, with each groin extending between 220 and 250 ft. seaward from the backshore (vegetation line). The three-groin approach would involve three (3) larger groins, each extending between 285 and 300 ft. from the backshore (vegetation line) and also spanning approximately 1,000 ft. of shoreline. See **Figure 13** (Groin Design Alternatives).

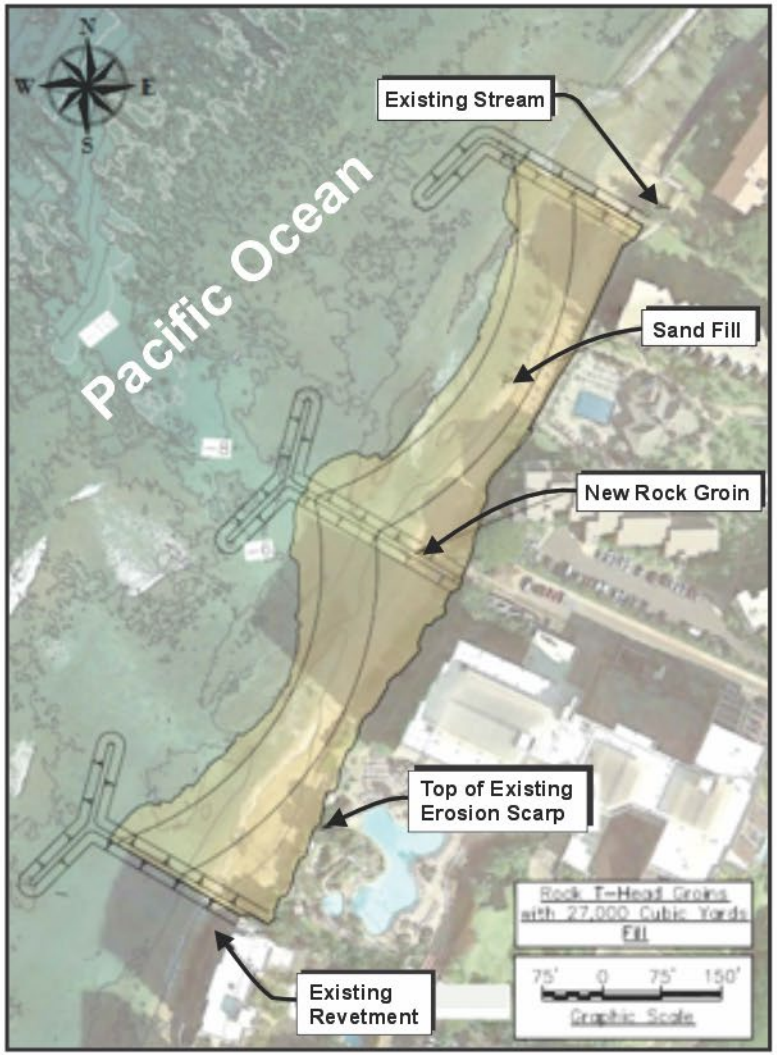
The three-groin approach would require placement of a larger quantity of sand and rock rubble mound compared to the four-groin approach. In addition, the three-groin approach would require placement of a groin in the location of the channel at the center of Honokōwai Beach, which would negatively impact the ability of surfers, paddlers, snorkelers, and divers to traverse the reef and access the outer reef and deeper waters further offshore. This three-groin design would also eliminate the only area within the Project Site with a sandy bottom that is conducive to swimming and snorkeling and would eliminate access through the shallow mid-reef platform to the outer reef and the deeper waters offshore. As the four-groin approach would leave the channel intact and has a smaller structural footprint, it is the preferred approach for Beach Stabilization.

2. Large Scale Beach Restoration

The proposed Project alternatives involve beach restoration by sand placement along approximately 1,000 ft. of shoreline in the vicinity of Honokōwai Beach, from Honokōwai Stream on the north to Honokōwai Point at the southern extent. A larger scale beach restoration project, covering a larger shoreline area, was also considered. Under the large-scale beach restoration scenarios, sand would be placed along approximately 4,000 ft. of shoreline from Honokōwai Stream on the north, extending approximately 3,000 ft. south of Honokōwai Point. The



Proposed 4-Groin Design



3-Groin Design (Alternative Dismissed)

Source: Sea Engineering, Inc.

Figure 13

Hoʻāla Honokōwai
Groin Design Alternatives

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methodologies of Beach Nourishment or Beach Maintenance could be implemented with this larger scale restoration alternative. See **Figure 14** (Beach Restoration Area Alternatives).

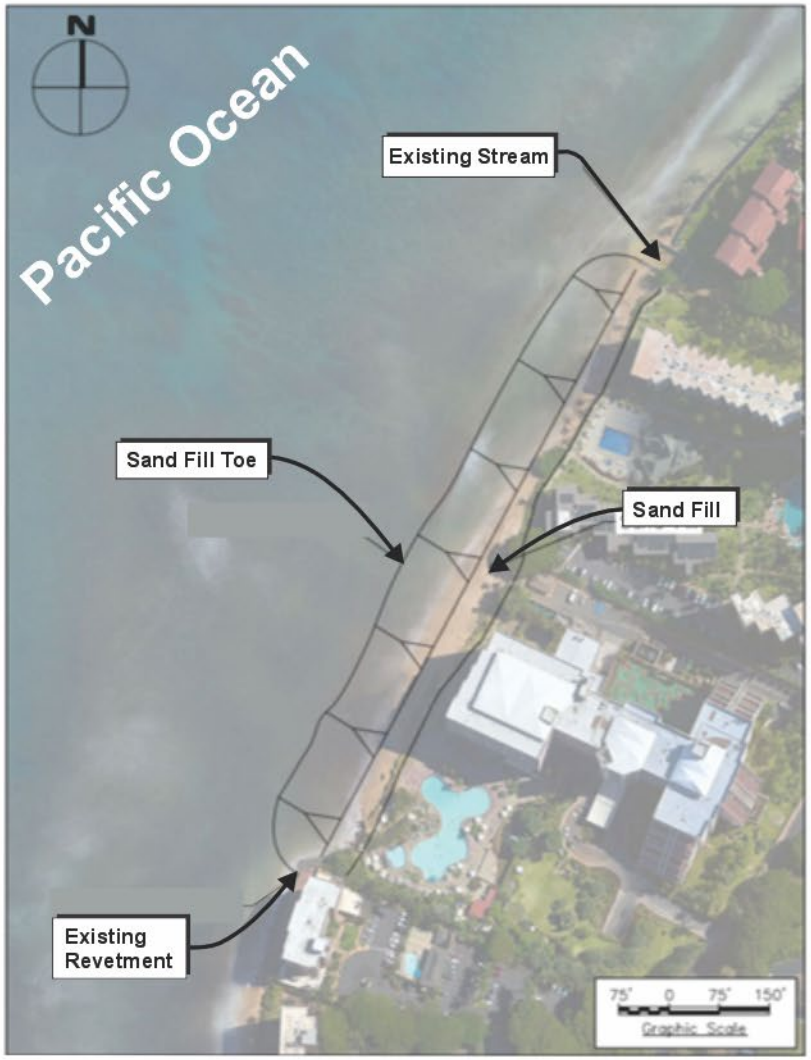
While a large-scale beach restoration action would create a larger beach and facilitate sand exchange between the Honokōwai and North Kāʻanapali littoral cells, it would also require at least three (3) times the volume of sand, approximately 92,000 (Large Scale Beach Nourishment) to 132,000 (Large Scale Beach Maintenance) cy, compared to the Proposed Action along just 1,000 ft. of shoreline, which would require 27,000 cy for Beach Nourishment or 47,000 cy for Beach Maintenance. In addition, the large-scale beach restoration would involve a greater number of properties along the shoreline. Furthermore, with the additional beach restoration, a significantly greater amount of beach would need to be restored. This would require a much longer period of construction impacts and a greater amount of resources such as sand and labor. The longer construction period would entail longer and more extensive beach closures during construction. For these reasons, the large-scale beach restoration alternative was dismissed.

3. Sand Source Alternatives

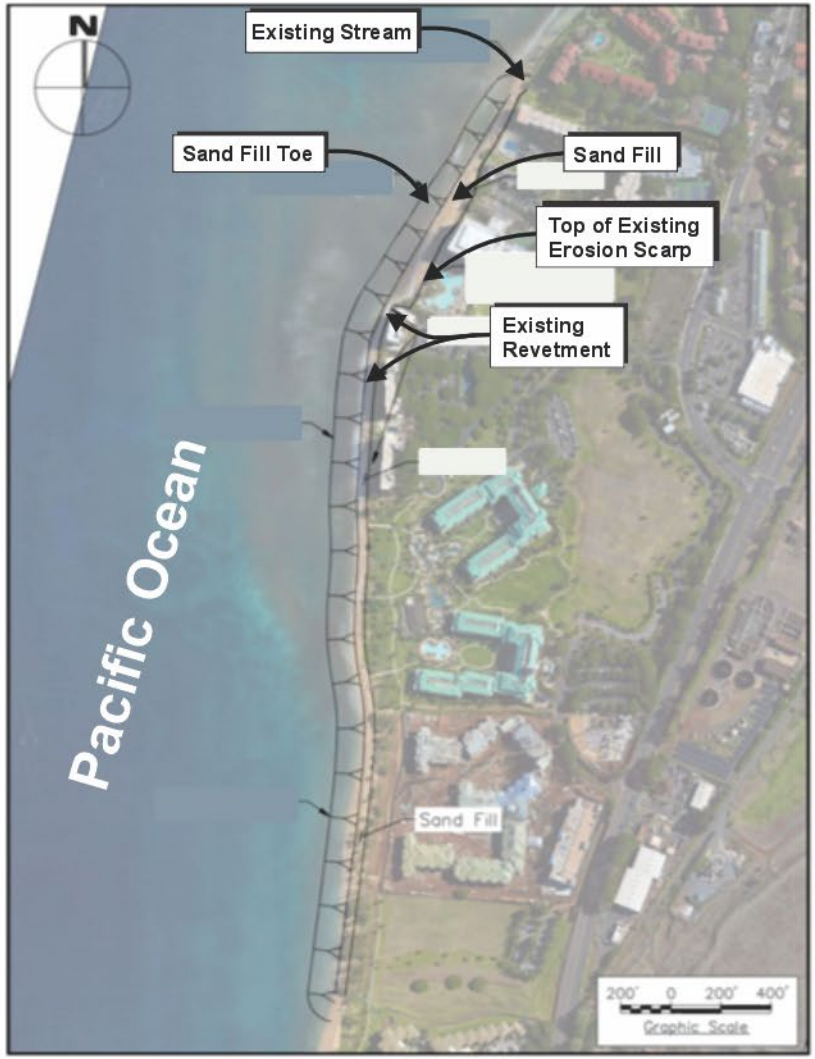
The Hawaiʻi Department of Land and Natural Resources (DLNR) guidelines specify standards for use of sand in beach nourishment projects under the Small Scale Beach Nourishment program. These guidelines are discussed in **Appendix "A"**, and are summarized below:

- Sand shall not contain more than 6 percent silt material (grain size smaller than 0.074 mm);
- Sand shall not contain more than 10 percent coarse material (grain size greater than 4.76 mm);
- Grain size distribution will fall within 20 percent of the existing beach grain size distribution;
- Overfill ratio of fill sand to existing sand shall not exceed 1.5;
- Sand will be primarily composed of naturally occurring carbonate beach or dune sand; and
- Sand shall be free of contaminants.

Generally, there are three (3) sources of beach-compatible sand: inland dune sand, nearshore sand (often found in channels and harbors), and offshore sand. SE investigated numerous sand sources on and around Maui and Oʻahu in preparation for the Project to assess a variety of factors associated with sand



Proposed Beach Restoration Area



Large Scale Beach Restoration Area
(Alternative Dismissed)

Source: Sea Engineering, Inc.

Figure 14

Hoʻāla Honokōwai
Beach Restoration Area Alternatives

MUNEKIYO HIRAGA

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composition. A summary of the sand source investigation is included in **Appendix "A"**.

Terrestrial sand sources from commercial supplies in Wailuku, Maui and Waiʻanae, Oʻahu were assessed by SE but were determined to be too fine for beach restoration purposes at Honokōwai Beach. Class A Maui Dune sand from HC&D on Maui was previously analyzed by SE and did fall within ±20 percent of the existing beach sand and complies with the DLNR guidelines for beach nourishment. However, the County of Maui placed a moratorium on sand mining of Central Maui Inland Sand in 2018 (Ordinance Number 4804, Bill Number 117). While the moratorium was a temporary measure, inland dune sand is no longer commercially available on Maui. Due to the lack of availability of high-quality inland sand sources, it is anticipated that sand used for future restorations will have to come from offshore resources. Refer to **Appendix "A",** Section 5.1.1.

The nearshore areas of Honokōwai Beach were assessed for sand deposits. It was determined that there is not an adequate amount of sand to support the Project.

Offshore deposits are an alternative sand source for beach restoration, particularly when considering the limited availability of beach-compatible sand from inland and nearshore sources. Generally speaking, offshore sand deposits occurring within the same littoral cell tend to have grain size characteristics and composition that are similar to the existing beach sand. In 2019, SE conducted offshore sand investigations from seven (7) offshore sand deposits within three (3) miles of the Project Site, ranging from Sand Wave in the south to Nāpili Bay in the north, and a site on Oʻahu known as Reef Runway. The average grain size distribution found at most of the offshore sand deposits was much finer than the existing beach sand at Honokōwai Beach, making them unsuitable for use in beach restoration. However, the Sand Wave offshore sand deposit was determined to be compatible with the existing beach sand at Honokōwai Beach based on the DLNR guidelines for beach nourishment. As such, the Sand Wave offshore sand deposit (herein referred to as the Sand Recovery Site) was selected as the proposed sand source for the Project. The locations of the seven (7) studied offshore sand deposits and detailed findings of the grain analysis are included in the Coastal Engineering Assessment, **Appendix "A"**, Section 5. A summary of the seven (7) offshore deposits is provided below.

- The Nāpili deposit included one (1) sample location. The sand has a smaller median grain size and is darker than the sand at Honokōwai Beach. Based on the average size of the sand, approximately 24 times the design fill volume would be required to produce a proper beach profile. This deposit is not compatible with DLNR guidelines.

- The North Kahana deposit included two (2) sample locations. The median grain size was much smaller than sand at Honokōwai Beach. Based on the median grain size, approximately 28 times the design fill volume would be required to produce a proper beach profile. This deposit is not compatible with DLNR guidelines.
- South Kahana was not surveyed by SE, but by Moffat & Nichol in 2016. Their findings showed a median grain size significantly smaller than the sand found at Honokōwai Beach. Regardless, the sand found at South Kahana would require approximately five (5) times the design fill volume to produce a proper beach profile. This deposit is not compatible with DLNR guidelines.
- The North Honokōwai deposit included seven (7) sample locations. The median grain size was smaller than the sand at Honokōwai Beach. Based on the median grain size, approximately 16 times the design fill volume would be required to produce a proper beach profile. This deposit is not compatible with DLNR guidelines.
- The South Honokōwai deposit included five (5) sample locations. The median grain size was smaller than the sand at Honokōwai Beach. Based on the median grain size, approximately 28 times the design fill volume would be required to produce a proper beach profile. This deposit is not compatible with DLNR guidelines.
- Reef Runway, located offshore of Daniel K. Inouye Airport on O‘ahu, contains two (2) deposits known as Reef Runway Outer and Reef Runway Inner. Reef Runway Inner has two (2) deposits, 1a and 1b. The Reef Runway Outer deposit was too fine for DLNR guidelines with a median grain size of 0.41 millimeters (mm) which would require an overfill ratio of 3.8. Reef Runway Inner had a grain size of 0.31 mm to 0.34 mm which would require an overfill ratio of 1.15 to 1.36. While Reef Runway Inner is potentially within design fill limits, the deposits are thin and transportation from O‘ahu would make the project more difficult and expensive. It is also noted that the HDOT Airports Division may not allow dredging in close proximity to the Reef Runway. Both deposits, 1a and 1b, were ultimately ruled out.
- Sand Wave was assessed two (2) times for previous investigations by SE, once in 2008 and once in 2016. The Sand Wave deposit has sand with a median grain size of 0.55 mm. This is a match for Honokōwai Beach and as such, does not require overfill for a proper beach profile. This sand source complies with DLNR guidelines for beach restoration.

It was determined that Sand Wave was the only site matching the parameters of DLNR guidelines per the grain size analysis. As such, an additional survey was

done in April 2021 by SE to further investigate the Sand Wave offshore sand deposit. This investigation included:

- Tow camera survey to evaluate sea floor conditions and the boundaries of the deposit.
- Vibracore sampling to collect composite sand samples at selected locations.
- Grain size analysis and photographic analysis of composite sand samples.
- Calculation of overfill ratios based on grain size distributions.

This additional investigation further clarified that the sand was the best match for the Project Site.

4. Sand Recovery Alternative

Two (2) methodologies have been considered for recovery of sand for the Project. As discussed in Chapter I of this EIS, clamshell dredging is proposed for each of the primary action alternatives for the Project. An alternative to clamshell dredging would involve the use of a submersible slurry pump.

A submersible slurry pump is deployed for sand recovery by suspension from a dredging barge located above a sand deposit. A slurry of sand and water is then pumped to the offload site. While submersible slurry pumps have been utilized effectively for other beach restoration projects including the 2007 Kūhiō Beach Nourishment Project and the 2012 and 2021 Waikīkī Beach Maintenance Projects, their use is dependent upon proximity to the sand placement site and favorable ocean conditions. As the Project Site experiences significant swells both in the summer and the winter due to its northerly and southerly exposure, operation of a slurry pump is likely to encounter significant delays and periods of inactivity due to unfavorable ocean conditions. In addition, sand recovered via a submersible slurry pump requires dewatering operations, which would require allocation of a significant area of onshore space which is not available at the Project Site. Additionally, the soil type has low permeability, which would increase the time needed to dewater the sand for placement. For these reasons, the submersible slurry pump methodology of sand recovery and transport was dismissed.

5. Sand Transport Alternatives

The sand will be transported from the Sand Recovery Site around West Maui to Kahului Harbor by barge. Two (2) areas within Kahului Harbor were assessed for offloading – the west breakwater and the east dock. Through preconsultation with the State of Hawai‘i, Department of Transportation, Harbors Division, the west breakwater was identified as the preferred offload location for the Project. Although

there are no existing or planned improvements at the west breakwater, it is anticipated that the Project contractor would be able to utilize the west breakwater for offloading with the use of temporary fender systems and anchoring systems. The west breakwater also has the advantage of available open space for temporary storage of offloaded sand before transportation to the Project Site. The east dock was not identified as the preferred offload location due to its existing use by regular users of Kahului Harbor and as a result, limited berth[7] availability. There are several users that have fixed schedules for use of the berths and many other users who compete for berth availability around the fixed schedules. In addition, there is no available temporary storage site at the east dock area. As such, an offsite temporary storage site would be required to store the sand prior to transport to the Project Site in West Maui. The offsite storage location would be an existing baseyard in Maui and would be subject to contractor discretion at the time of Project implementation. The baseyard would be chosen based on location and availability at the time of the Project.

F. OTHER ALTERNATIVES CONSIDERED

In addition to the previously discussed and eliminated alternatives, the CEA identified additional alternatives that were considered, but not fully evaluated. These include dune restoration, shore protection, offshore breakwaters, loko iʻa (fishponds), and artificial lagoons. Generally, reasons for elimination included existing land uses, infrastructure location, historical land use, and existing laws and ordinances. Further analysis on these alternatives can be found in **Appendix "A"**, Sections 4.2-4.6.

G. DEFERRED ACTION

The Deferred Action alternative, which involves deferring implementation of beach restoration, was dismissed for several reasons. The existing temporary erosion skirt was intended as a short-term response to the 2016 beach loss and avulsion event that damaged the beach and backshore and is intended to be removed when a mid-term solution can be approved and implemented. That short-term response has mitigated impacts to water quality and provided time for planning, technical studies, and community engagement, culminating in this EIS. Deferral of the implementation of beach restoration would be inconsistent with the intended short-term design life of the temporary erosion skirt and would delay achievement of the Project goals of improving beach stability, preserving and enhancing cultural and shoreline access, and increasing resilience to coastal hazards and sea level rise.

[7] A berth is a designated area in a harbor for docking and unloading.

H. LONG-TERM ADAPTATION PLANNING

While the Proposed Action evaluated in this Draft EIS is a mid-term solution, with an anticipated design life of 10 to 50 years, the effects of climate change pose a long-term threat to beaches and existing coastal developments in the Project Site and other shoreline areas. Long-term climate change adaptation solutions could consist of a number of strategies that could be implemented individually or in combination. These strategies include, but are not limited to, resist, accommodate, avoid, retreat, and/or advance.

Resist: One (1) climate change adaptation strategy is to resist the effects of climate change via construction of physical defenses to withstand the impacts of sea level rise, coastal erosion, and flooding. Examples include shore protection structures such as seawalls and revetments.

Accommodate: Other adaptation strategies involve adjustment of human behaviors and systems to accommodate the anticipated effects of climate change, such as updating building standards and practices to increase the resilience of shoreline developments to sea level rise. Examples include shoreline setbacks, and elevating and floodproofing structures. Nature-based solutions such as beach restoration and dune restoration may also be utilized to enhance shoreline resilience.

Avoid: Likewise, human behavior may be modified in an effort to avoid climate change, i.e., not building in hazardous areas. Avoidance is generally more feasible at locations without existing development.

Advance: Advancement involves land reclamation or building new land or structures that extend seaward.

Retreat: In some cases, it may be necessary to relocate or retreat from vulnerable shoreline areas. Retreat involves relocation of developments or infrastructure to less vulnerable locations, e.g., away from the shoreline. Retreat can happen all at once or can occur more gradually. Purposeful, systematic, and proactive retreat is often referred to as “managed retreat” while “unmanaged retreat” refers to retreat that happens haphazardly or on a reactive basis without shared intention. State and local governments should be involved in retreat efforts via community-wide planning and education efforts, land use regulation, and financial assistance programs to facilitate managed retreat (vs. unmanaged retreat).

Managed retreat in a heavily developed area, like the Project Site, would likely require a phased approach that may be implemented over the course of several decades. The Proposed Action is a mid-term solution to allow sufficient time for long-term sea level rise adaptation plans to be developed and implemented. These long-term plans may include strategic retreat of infrastructure away from the shoreline or a combination of strategies such as continued beach restoration combined with incremental movement of structures

and facilities away from the shoreline triggered by recurring erosion and flooding impacts and/or coinciding with permitting for planned improvements to individual properties.

Managed retreat could require substantial redevelopment or relocation of the resorts and condominiums that currently exist in the vicinity of the Project Site. Relocation at this scale would require extensive demolition and removal of existing infrastructure (e.g., buildings, parking facilities, utilities, hardscaping, landscaping, and potentially fill material) and extensive remediation to restore the area to an acceptable condition. Relocation at this scale would also require extensive new development at other locations on Maui. A project of this magnitude would fundamentally alter many aspects of the natural and built environments, and the appearance and character of the Honokōwai community as it exists today as well as the appearance and character of the receiving areas where new development would be located. Change of this magnitude should be addressed comprehensively and in collaboration with a broad range of stakeholders and clearly articulated in public plans and policies.

The report, *Assessing the Feasibility and Implications of Managed Retreat Strategies for Vulnerable Coastal Areas in Hawai'i* (OPSD, 2019) presented the next steps for the State of Hawai'i to develop a managed retreat plan. The report states that:

> *… to have a cogent and comprehensive retreat plan, it requires long-range planning, legal changes, funding, and some level of community agreement, understanding and support for retreat.*

The report also noted that retreat from chronic coastal hazards (e.g., erosion and sea level rise) can be incremental and may take decades to complete. Based on these findings, the report suggests the following next steps to develop a statewide managed retreat plan:

- *Determine the feasibility and implication of additional managed retreat tools.*
- *Establish criteria for areas to be retreated and priority list(s).*
- *Identify funding to retreat areas and review tax implications of retreat.*
- *Review State and County land uses to determine where it may be possible to retreat to.*
- *Review State and County plans to determine where they may be amended or updated or both to support retreat.*
- *Review laws and regulations that may have to be amended or adopted or both to facilitate retreat at the State or County or both levels.*
- *Engage in outreach to the communities to obtain their input and buy-in for retreat strategies to be adopted.*

A follow up report was published in 2025 to further explore the policy, legal, and funding opportunities and challenges for implementing managed retreat in Hawai‘i. The report, *An Analysis of Managed Retreat Strategies in Hawai‘i: Policy and Funding Opportunities and Challenges* (OPSD, 2025), highlighted challenges to implementing managed retreat, particularly around community acceptance, political will, planning frameworks, agency capacity, and funding. The greatest challenge lies in the need for systematic change and sustained commitment at many levels to transition from a piecemeal, reactive, and enforcement driven approach to coastal planning to a proactive, holistic, transparent, equitable, and consistent approach. The report proposes a Beach Resilience Program that would establish Beach Resilience Planning Areas to provide a transparent process to help property owners, the government, and the general public understand the future options for the areas and engage in planning and visioning for how to adapt their communities. Twenty recommendations for implementing the Beach Resilience Program were put forth in the report in the areas of policy, planning, funding, jurisdiction, regulatory, and land management.

Until policies, regulations, tools, and programs are in place to implement managed retreat in a heavily developed community like Honokōwai, other appropriate solutions should be considered, including implementation of a mid-term solution.

The Proposed Action is a mid-term solution and does not prevent the development and implementation of other sea level rise adaptation strategies at Honokōwai Beach in the future. Rather, the Proposed Action would protect Honokōwai Beach and help to maintain its environmental, cultural, social, recreational, and economic value while allowing sufficient time for the long-term process of developing and implementing adaptation pathways.

DESCRIPTION OF THE EXISTING ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

III

III. DESCRIPTION OF THE EXISTING ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

This chapter: (1) details the existing physical and socio-economic environments and infrastructure considerations of the Project Site and surrounding region; and (2) evaluates potential impacts for the anticipated 50-year design life for the Proposed Action and proposed management and design measures to mitigate negative impacts associated with the proposed beach restoration action alternatives, potential related secondary actions, and the No Action alternative. A summary table of anticipated impacts and applicable mitigation measures associated with each alternative is provided for each area of analysis. Where appropriate, construction-related impacts and ongoing impacts are separately identified in the summary tables. Construction-related impacts refer to those impacts that pertain to demolition and removal of the temporary erosion skirt, sand recovery, sand transport, sand placement, and groin construction (in the case of Beach Stabilization). Ongoing impacts refer to post-construction impacts for the anticipated 50-year design life.

A. PHYSICAL ENVIRONMENT

1. Climate

a. Existing Conditions

The Hawaiian Island chain is a remote land mass situated south of the eastern Pacific high-pressure cell. This area of high pressure produces consistent northeasterly trade winds for the region. The regulating effect of the Pacific Ocean causes the islands to experience small seasonal variations in temperature. During the winter months, cold fronts from the south bring rain and intermittently modify the trade wind regime.

Maui's climate is relatively consistent throughout the year but varies as a result of terrain. Characteristic of West Maui's climate, the Project Site experiences mild and uniform temperatures year-round, moderate humidity, and consistent northeasterly trade winds. Average temperatures at the Project Site (based on temperatures recorded at Kapalua Airport) range from the low 60s to high 80s (Fahrenheit). September is historically the warmest month, while January is historically the coolest.

Near the peaks of the West Maui Mountains and the windward slope of Haleakalā, rainfall averages nearly 250 inches per year. On the leeward side of the island, where the Project Site is located, rainfall is much lower. Annual precipitation in Lahaina, approximately 3.5 miles south of the

Project Site, was 9.65 inches in 2023 (State of Hawai‘i Department of Business, Economic Development & Tourism, 2023).

The Hawaiian Islands are anticipated to be further impacted by global climate change in the coming decades, including more frequent and intense storms, rising sea levels, ocean acidification, and variable rainfall patterns. Sea level rise is discussed later in this chapter, refer to Section III.A.6.

b. Potential Impacts and Mitigation Measures

The proposed beach restoration Project, including all alternatives, is not anticipated to have an impact on the local and regional climate. The objective of this proposed Project is to restore and stabilize Honokōwai Beach, ultimately bolstering resiliency to climate change for the residents, visitors, and economy of the area. The proposed Project would increase the resiliency of the shoreline to erosional forces and storm events, while preserving cultural and public access.

Beach Stabilization

The Beach Stabilization alternative would not impact the local and regional climate. Beach Stabilization would increase resiliency to sea level rise associated with climate change.

Beach Nourishment

The Beach Nourishment alternative would not impact the local and regional climate. Beach Nourishment would temporarily increase resiliency to sea level rise associated with climate change over the course of the approximate 10-year lifespan of the action.

Beach Maintenance

The Beach Maintenance alternative would not impact the local and regional climate. Beach Maintenance would increase resiliency to sea level rise associated with climate change.

No Action

The No Action alternative would not impact the local and regional climate and would decrease resiliency to sea level rise associated with climate change.

Potential Related Secondary Actions

As discussed in Chapter I of this Draft EIS, secondary actions would be limited to common elements of the KBC property and may include modification or strategic relocation of existing common elements of the KBC property within the Project Site, such as walkways, landscape and hardscape features, and water features. Secondary actions may also include environmental restoration actions or public access improvements within the KBC property or shoreline areas. The potential related secondary actions are not anticipated to impact the local and regional climate.

Summary

Action Alternative	Anticipated Impact to Climate
Beach Stabilization	No impact
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

2. Bathymetry and Benthic Conditions

a. Existing Conditions

Bathymetry refers to the measurement of the depth of water in the ocean. Bathymetry is heavily tied to benthic conditions, which refers to the physical and biological conditions of the sea floor. Local bathymetry and benthic conditions describe the area around the Project Site seaward of the shoreline. Local bathymetry and benthic conditions are consistent throughout and around the Project Site. The Coastal Engineering Assessment (CEA) describes bathymetry and benthic conditions in greater detail. Refer to **Appendix "A"**, Sections 7.1.1 and 7.1.2.

Bathymetric and benthic analyses in the CEA were conducted in the vicinity of the Project Site from the 50-meter resolution Hawai'i Bathymetry and Topography Synthesis obtained from the Hawai'i Mapping Research Group. Nearshore bathymetry was derived from the U.S. Army Corps of Engineers (USACE) Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS). Refer to **Appendix "A"**, Section 7.1.1. The maps provided in the Draft EIS display 1-m resolution LiDAR[8] from SHOALS as

[8] Lidar, or "LiDAR," stands for Light Detection and Ranging, and is a technique to measure distance and create a 3D model of Earth's surface. LiDAR measures the surface by emitting a cloud of light points that reflect off a surface such as the sea floor and return to emitter to create a 3D model of the surface. The resolution number is representative of how far apart the points are dispersed. A 1-meter resolution display has points emitted one meter apart and provides higher resolution than 50-meter data, but would be lower resolution than 10-centimeter data.

well. See **Figure 15** (Regional Bathymetry at Project Site and Sand Recovery Site).

Additional assessments of the physical composition of marine habitats at the Project Site were conducted by Marine Research Consultants, Inc. (MRC) via field assessments using SCUBA diving and snorkeling methods. Nearshore bathymetry at the Project Site consists of three (3) zones: a nearshore scour zone, mid-reef platform, and outer-reef coral zone. Depths range from approximately 0 to 4 ft. in the nearshore scour zone, 4 to 10 ft. in the mid-reef platform, and 10 to 30 ft. in the outer-reef coral zone. Water depths become progressively deeper outside the outer-reef coral zone approximately 1,000 ft. seaward of Honokōwai Beach. These zones are discussed in further detail in Section III.A.13.

Shown in **Figure 16** (Project Site Bathymetry) is the channel that runs perpendicular to the shoreline and is used for ocean recreation and access to the outer-reef. The channel is a deeper, and thus a calmer portion of the ocean that runs from the outer-reef to the shoreline through the Project Site.

The offshore Sand Recovery Site is approximately 1,500 to 2,200 ft. from the shoreline in water depths ranging from 120 to 170 ft. A sub-bottom survey referenced in **Appendix "A"**, Section 7.1.1 showed that the Sand Recovery Site has a series of terraces, or shelves, formed during ancient low sea level stands by wave-induced erosion of the reef limestone. The terraces have a stair-step appearance, with horizontal surfaces buried by thick wedge-like deposits of sand. This morphology is common in the Hawaiian Islands. Two (2) primary terraces were identified: one (1) starting at approximately 100 to 115 ft. water depth, and another at approximately 175 ft. water depth.

b. <u>Potential Impacts and Mitigation Measures</u>

The CEA notes that beach restoration is expected to have an impact on bathymetry and benthic conditions at the Project Site and the Sand Recovery Site. Impacts of dredging on bathymetry and benthic conditions at the Sand Recovery Site are expected to be minor and temporary in nature. Impacts to foreshore topography, the area between the high and low tide marks, along Honokōwai Beach would depend on the chosen action alternative. Following sand placement, there would be a period of beach equilibration, during which the beach profile and nearshore water depths can be expected to vary as the beach adjusts to the prevailing wave conditions and the beach assumes its stable configuration. These impacts



Figure 15

Ho‘āla Honokōwai
Regional Bathymetry at Project Site and Sand Recovery Site

0 625 1,250
Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

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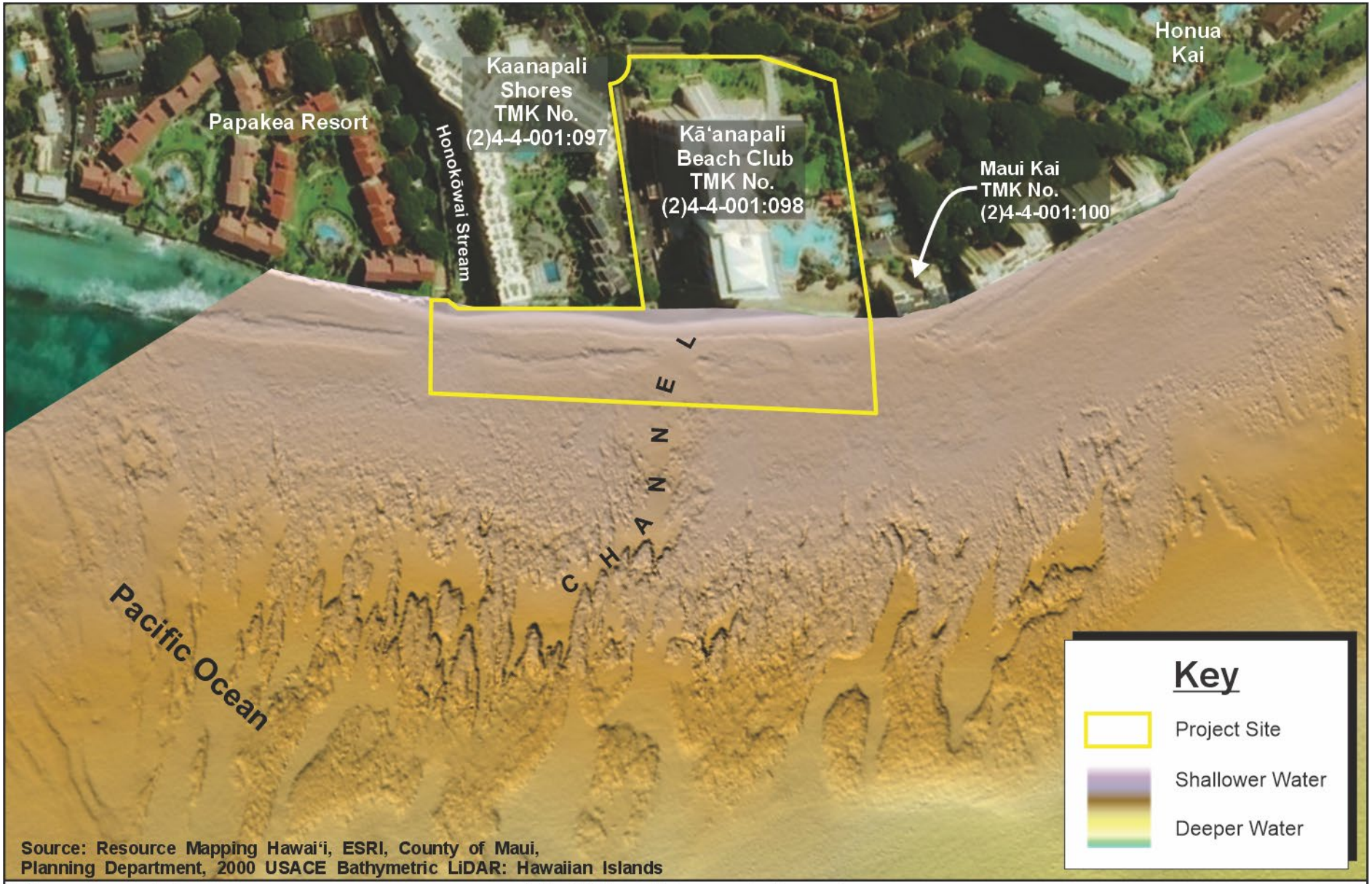


Figure 16

Ho'āla Honokōwai
Project Site Bathymetry

0 175 350
Feet

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

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are discussed in greater detail in the CEA. Refer to **Appendix "A"**, Sections 7.1.1 and 7.1.2.

Beach Stabilization

According to the CEA, Beach Stabilization would alter the foreshore topography along Honokōwai Beach by increasing dry beach width and elevation compared to the existing shoreline configuration. Impacts to foreshore bathymetry would be limited to the 46,145 square feet (s.f.) area within the footprint of the groins that extend seaward of the pre-erosion beach toe, and the 43,395 s.f. area of beach fill that would be placed along the toe of the beach. Benthic habitat in this area currently consists of a barren scour zone that is composed of pavement, rubble, and sand. No significant loss of benthic habitat is expected. The fill would result in an approximately 37 percent increase in beach width when compared to the pre-erosion shoreline conditions in 2007. Refer to **Appendix "A"**, Section 7.1.1.

Ongoing impacts to bathymetry and benthic conditions would be limited to the actual footprints of the groins and sand fill. Honokōwai Beach is bounded by Honokōwai Stream (to the north) and Honokōwai Point (to the south). These features limit sediment exchange between the adjacent shorelines. Constructing rock rubble mound groins would provide superior stability for the beach. The groin heads would help prevent the formation of cross-shore (rip) currents along the groin stems, minimizing the loss of sand due to cross-shore sediment transport. The groins would terminate well inshore of the offshore surf breaks and are not expected to alter the bathymetry or wave formation characteristics of the surrounding sea floor. The groins have been designed and located so as not to impact the function of the existing channel which is used to bypass the shallower parts of the reef by surfers, divers, paddlers, and other recreational uses.

Beach Stabilization would require recovery of 33,000 cy of sand, which is approximately 3.4 percent of the estimated total volume of sand within the Sand Recovery Site (975,000 cy). Dredging is anticipated to result in a 2- to 6-ft. depression on the sea floor following sand recovery. These impacts are anticipated to be temporary. The remaining sediment is anticipated to fill the depression as tidal currents, regional sediment transport, and wave action would smooth the area out over time. The time in which the ocean will smooth out will depend on the distribution of dredge extents, penetration depths, and ocean conditions after dredging is completed. Assuming typical tidal currents, SE would expect the infilling is anticipated to occur within weeks to months after dredging is completed. However, it is

noted that depressions occur naturally in the vicinity of the Sand Recovery Site and the sea floor is constantly changing. As such, a uniform sea floor would not be expected.

Beach Stabilization would result in an alteration of benthic conditions within the structural footprint of the groins during the lifespan of Beach Stabilization. The area currently consists of a barren nearshore scour zone that is composed of pavement, rubble, and sand.[9] The portions of the groins that would be below Mean Sea Level (MSL) would provide additional improved marine habitat by providing bare, stable surfaces for recruitment of corals, algae and other invertebrates. The interstitial spaces between the boulders would provide additional habitat for cryptic benthic (crabs, shrimps, worms, etc.) and sessile organisms (corals and macroalgae), which would provide additional foraging resources for fishes. This new and improved habitat would increase as sea levels continue to rise and the portions of the groins below MSL increase proportionally.

Benthic conditions at the Sand Recovery Site would be temporarily altered within the dredging extents. This area is predominantly composed of sand with 50 to <90 percent macroalgae cover. Macroalgae is robust and is expected to repopulate the area quickly after dredging operations are complete.

Beach Nourishment

Beach Nourishment would alter the foreshore topography along Honokōwai Beach by increasing beach width and elevation compared to the existing shoreline configuration. Impacts to bathymetry and benthic conditions would be limited to the 20,540 s.f. area of beach fill that would be placed seaward of the existing beach toe. However, unlike Beach Stabilization, there would be no ongoing changes associated with groin construction. Additionally, the positive benefits associated with habitat creation via groins would not occur. Impacts are anticipated to be limited to the sand placement area within the Project Site as the beach would be improved and a portion of this beach would sit below sea level.

Beach Nourishment would have similar impacts relating to the Sand Recovery Site as described for Beach Stabilization, however, a smaller volume of sand is required. The volume of sand required for Beach Nourishment (27,000 cy) is approximately 2.8 percent of the estimated total volume of sand within the Sand Recovery Site.

[9] See Chapter III.A.13 for more information on the nearshore scour zone.

Beach Nourishment would temporarily delay the impacts of the No Action alternative.

Beach Maintenance

Beach Maintenance would alter the foreshore topography along Honokōwai Beach in a similar manner to Beach Nourishment by increasing beach width and elevation compared to the existing shoreline configuration. Again, impacts to bathymetry and benthic conditions would be limited to the 20,540 s.f. area of beach fill that would be placed seaward of the existing beach toe. Sand would be placed on a recurring basis, approximately every 10 years.

Beach Maintenance would have similar impacts to the Sand Recovery Site as Beach Nourishment, but on a recurring basis. The cumulative volume of sand required (47,000 cy) is approximately 4.8 percent of the estimated total volume of sand within the Sand Recovery Site.

No Action

The No Action alternative would have no immediate impact on existing bathymetry, as it would not require sand recovery or sand placement. Bathymetry and benthic conditions at the Project Site would change over time as sand and alluvium is discharged into the nearshore waters due to ongoing erosion processes. No Action has the potential for ongoing impacts to benthic conditions due to erosion and sedimentation.

Potential Related Secondary Actions

There are no anticipated impacts to bathymetry or benthic conditions associated with any of the potential related secondary actions, as they would all occur landward of the shoreline.

Summary

The CEA concludes that all of the Proposed Action alternatives are expected to impact bathymetry and benthic conditions at the Project Site and the Sand Recovery Site. Impacts of dredging on bathymetry and benthic conditions are expected to be minor and temporary in nature. The impacts associated with Beach Nourishment are expected to be minor and temporary in nature. Beach Maintenance is anticipated to have an ongoing impact on bathymetry and benthic conditions due to the need for periodic sand recovery and sand placement. Beach Stabilization would permanently alter bathymetry within the footprint of the groins. Additionally, Beach Stabilization would permanently alter benthic conditions within the

footprint of the groins; however, this impact is anticipated to be positive in that the groins are expected to provide improved habitat that could potentially increase biomass and biodiversity in an area that is currently an uncolonized nearshore scour zone. Furthermore, the groins are expected to have a positive impact by stabilizing the beach and mitigating potential impacts to bathymetry and benthic conditions that could occur due to the discharge of sand and alluvium due to natural erosion, and the loss of sand due to cross-shore sediment transport.

Action Alternative	Anticipated Impact to Bathymetry and Benthic Conditions
Beach Stabilization	**Construction-Related Impacts:** Alteration of bathymetric and benthic conditions at the Project Site within the footprint of the beach fill; Sand Recovery Site would experience temporary change from sand recovery **Ongoing Impacts:** Groins would alter bathymetric and benthic conditions within the groin footprints and beach fill; increased biomass and biodiversity, and additional habitat for certain species
Beach Nourishment	**Construction-Related Impacts:** Temporary alteration of bathymetric and benthic conditions at the Project Site within the footprint of the beach fill; the Sand Recovery Site would experience temporary change from sand recovery **Ongoing Impacts:** With continued erosion, bathymetric and benthic conditions would be expected to return to a similar condition to what existed prior to Beach Nourishment; Beach Nourishment would temporarily delay the impacts of the No Action alternative
Beach Maintenance	**Construction-Related Impacts:** Temporary alteration of bathymetric and benthic conditions at the Project Site within the footprint of the beach fill; the Sand Recovery Site would experience temporary change from sand recovery; impacts would be recurring with each maintenance action **Ongoing Impacts:** Alteration of bathymetric and benthic conditions on a recurring basis, approximately every 10 years
No Action	**Construction-Related Impacts:** No impact **Ongoing Impacts:** Bathymetry at the Project Site may change as sand and alluvium are discharged into the nearshore waters from natural erosion. Potential for impacts to benthic conditions due to erosion and sedimentation.

3. Sand Characteristics

a. Existing Conditions

Honokōwai Beach, like most beaches in the Hawaiian Islands, is primarily comprised of carbonate sand with minimal fine material. Carbonate sand is the product of bioerosion and biological production on offshore reefs and marine waters. Carbonate sand can be composed of pieces of coral, algae, sea urchin spines, shells, or other marine organisms that have been tumbled in the surf or along the ocean floor. The composition of sand is determined by the relative abundance of each species in the region and, therefore, varies with location.

Carbonate sands range in color from pure white to yellow, brown, and dark grey. Beyond the aesthetic value, color also affects temperature, as darker sands achieve higher temperatures under the bright tropical sunlight than a lighter shade of sand. The existing beach sand at Honokōwai Beach is gold or tan in color. Refer to **Appendix "A"**, Section 7.5.1.

b. Potential Impacts and Mitigation Measures

Finding a suitable source for sand is a critical component of successful beach restoration. As discussed previously, detailed sand investigations were conducted and the sand from the Sand Recovery Site has been deemed to be suitable for placement at Honokōwai Beach.

Fill sand from offshore deposits is generally not anticipated to contain hazardous materials or contaminants. There have been no known significant environmental contamination events in close proximity to the Sand Recovery Site, and there are no known sources of pollution that could potentially contaminate the sand. Thus, there is no reason to anticipate that sand recovered from the offshore deposits would contain contaminants.

Based on previous beach restoration projects in Hawai‘i, the sand within the Sand Recovery Site could potentially be slightly finer in grain size, initially slightly grayish in color, and may initially have a slight odor. All of these conditions are anticipated to be minor and temporary in nature. As the finer grains are winnowed away by wave action, and the grayish color of the sand is diminished by UV exposure, the texture and appearance of the sand fill would become progressively more similar to the existing beach sand. Any potential odor associated with the sand would be diffused by air and UV exposure. After construction, no discernible difference in the physical composition or appearance of the sand is anticipated. Photographic monitoring of beach conditions would be conducted at

specified intervals to document environmental conditions at the Project Site.

Beach Stabilization

Beach Stabilization would involve the placement of 33,000 cy of sand along the shoreline and is expected to have a temporary impact on sand characteristics at the Project Site. Following sand placement, the appearance of the beach fill may be slightly darker than the existing beach sand. There would be a period of beach equilibration, during which the fill sand and existing beach sand mix and the color of the sand would be expected to lighten and achieve a more uniform appearance following sustained UV exposure. Beach Stabilization is expected to prevent the discharge of up to 19,542 cy of terrigenous sediment into the ocean and is, therefore, expected to have an ongoing positive impact on sand characteristics by preventing the introduction of fine material (alluvium) caused by erosion of the shoreline. Refer to **Appendix "A"**, Sections 3.1 and 7.1.7. No ongoing impacts to sand characteristics are expected.

Beach Nourishment

Beach Nourishment would involve the placement of 27,000 cy of sand along the shoreline as a single action, which is expected to have a lifespan of approximately 10 years. While the nourished beach would make the coastline more resilient, weather events could reduce the Project lifespan significantly.

The impacts of Beach Nourishment on existing sand characteristics would be similar to the Beach Stabilization alternative; however, the timeframe of the impacts would be shorter due to the limited design life of the project.

Beach Maintenance

Beach Maintenance would involve the initial placement of 27,000 cy of sand along the shoreline followed by a series of four (4) renourishment efforts with a total volume of 47,000 cy of sand placed over a period of 50 years. The impacts of Beach Maintenance on existing sand characteristics would be similar to the Beach Stabilization alternative. However, the period of beach equilibration would recur with each renourishment event, approximately every 10 years.

No Action

No Action would have no immediate impact on existing sand characteristics at the Project Site or the Sand Recovery Site as it would not require sand

recovery or sand placement. Sand characteristics at the Project Site may change over time as alluvium is discharged onto the beach and into the nearshore waters due to natural erosion.

Potential Related Secondary Actions

The potential related secondary actions would occur landward of the shoreline and the beach. There would be no impacts to sand characteristics for the potential related secondary actions.

Summary

All of the beach restoration alternatives are expected to have a temporary impact on sand characteristics at the Project Site. Following sand placement, the appearance of the beach fill may be slightly darker than the existing beach sand and unpleasant odor. There would be a period of beach equilibration, during which the fill sand and existing beach sand mix and the color of the sand would be expected to lighten and achieve a more uniform appearance following sustained UV exposure. Any odor from recovered sand is anticipated to diminish with exposure to sun and air.

Action Alternative	Anticipated Impacts to Sand Characteristics
Beach Stabilization	**Construction-Related Impacts:** Discoloration and unpleasant odor associated with sand placement, which will fade from UV and air exposure **Ongoing Impacts:** No impact
Beach Nourishment	**Construction-Related Impacts:** Discoloration and unpleasant odor associated with sand placement, which will fade from UV and air exposure **Ongoing Impacts:** No impact
Beach Maintenance	**Construction-Related Impacts:** Discoloration and unpleasant odor associated with sand placement, which will fade from UV and air exposure **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action
No Action	**Construction-Related Impacts:** No impact **Ongoing Impacts:** Existing sand characteristics may be altered as beach narrows with erosion

4. Coastal Processes

a. Existing Conditions

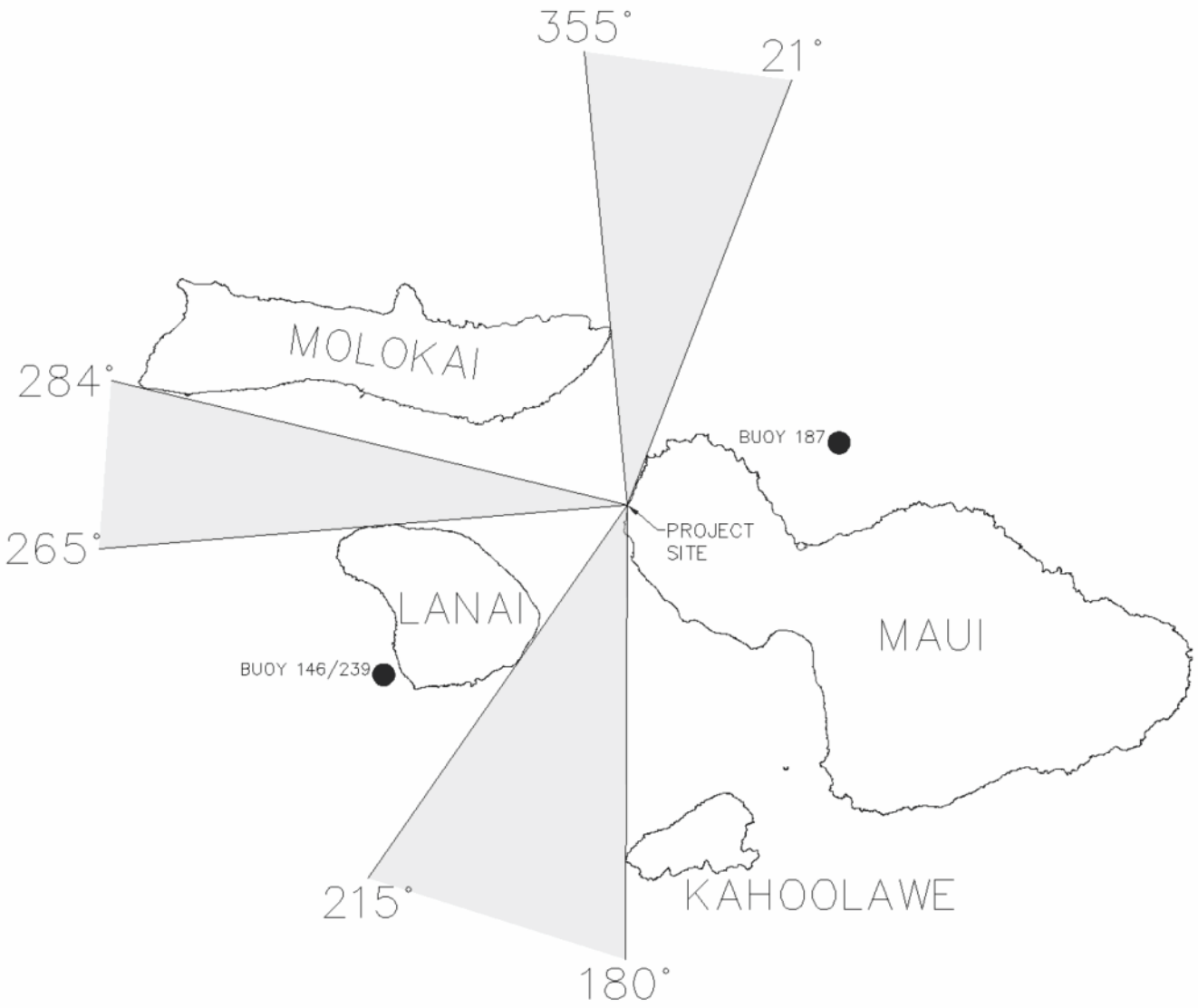
Coastal processes describe the natural processes that occur along the shoreline in the coastal zone, including erosion, accretion, currents, circulation, and sediment transport. Honokōwai Beach is located in the Honokōwai littoral cell, which extends from Honokōwai Point northwards to Kahana Bay and spans approximately 6,200 ft. (1.15 mi.) of shoreline. The North Kāʻanapali littoral cell (south of the Project Site) extends from Honokōwai Point southwards to Puʻu Kekaʻa.

Currents, circulation, and sediment transport in West Maui are driven by a combination of wave-induced currents and tide-induced currents. West Maui is exposed to both winter swell coming predominantly from the northwest and summer swell coming predominantly from the south. In addition to these two (2) dominant seasonal occurrences, West Maui is also exposed to Kona storm waves which approach from the south-southwest and winter westerly swells. Due to the Project Site's location within the Maui Nui complex, the islands of Molokaʻi, Lānaʻi, and Kahoʻolawe limit the directions of swell that can impact the Project Site. See **Figure 17** (Wave Exposure Windows).

Currents and circulation patterns in offshore waters are primarily driven by the cyclic rise and fall of tides, which generate predictable currents that affect the entire water column. These tide-driven currents diverge offshore near the Sand Recovery Site with offshore currents in the Honokōwai and North Kāʻanapali littoral cells (north of the Sand Recovery Site) being predominantly south to north, and offshore currents in the South Kāʻanapali littoral cell (south of the Sand Recovery Site) being predominantly north to south. Refer to **Appendix "A"**, Section 7.5.2.

Currents and circulation patterns in the nearshore waters are primarily driven by wave energy. As waves approach the shoreline and break over the shallow reef, they generate wave-driven currents that transport sediment (sand) alongshore (parallel to shore) and cross-shore (to/from shore). Wave-driven currents are less predictable and more variable due to changes in wave direction, wave energy, and water levels. Refer to **Appendix "A"**, Section 7.5.2.

Nearshore hydrodynamics (i.e., waves, currents, and water circulation) at the Project Site are primarily driven by wave-induced currents. Sediment transport is bi-directional and driven by a combination of wave exposure, bathymetry, benthic conditions, nearshore currents, and sediment



Source: Sea Engineering, Inc.

Figure 17

Hoʻāla Honokōwai
Wave Exposure Windows

NOT TO SCALE

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availability. While large Kona storm waves from the west or southwest can impact the coastal zone, the predominant seasonal wave patterns from the north northwest (North Pacific Swell) and the south southwest (Southern Swell) have the greatest influence on the coastal zone within the Project Site, as described above. Seasonal patterns influence wave action, height, and intensity, influence longshore and nearshore currents, and influence sediment transport and thus beach width, size, and shape. As northerly swell is experienced throughout the winter, sediment is transported from the north end of the beach to the south, where it widens the southern portion of the beach. During the summer southerly swell, the sand on the beach is pushed from south to north, widening the northern end of the beach. This makes Honokōwai Beach a seasonally dynamic beach.

As a seasonally dynamic beach, seasonal changes associated with erosion do occur. Prior to the 2016 storm which caused significant damage to the backshore, the historical average erosion rate at the Project Site was measured at -0.44 ft./yr. In addition to ongoing seasonal processes, however, episodic erosion events can significantly impact coastal processes. The 2016 beach loss and avulsionl event resulted in the shoreline retreating by 6 to 12 ft. within a period of a few months, resulting in a reduction of sediment transport between the Honokōwai littoral cell and the North Kāʻanapali littoral cell. The reduction in beach sand volume and disruption of natural sediment transport between the two (2) littoral cells has caused Honokōwai Beach to become unstable, making it more sensitive to seasonal erosion forces and less capable of natural recovery.

b. <u>Potential Impacts and Mitigation Measures</u>

The CEA concludes that beach restoration has the potential to impact currents, circulation, and sediment transport patterns at the Project Site, but is not expected to impact these processes at the Sand Recovery Site. The CEA includes an evaluation of potential impacts to nearshore current patterns using numerical wave modeling. Refer to **Appendix "A"**, Section 7.5.3.

<u>Beach Stabilization</u>

Beach Stabilization would permanently alter existing current and circulation patterns at the Project Site. The groins would inhibit the transport of sand both alongshore (parallel to shore) and cross-shore (perpendicular to shore). As a result, Honokōwai Beach would be wider, more stable, and less susceptible to seasonal and episodic variations in beach width and volume.

Beach Stabilization would inhibit longshore sediment transport in both the northerly and southerly directions but is not anticipated to have an adverse effect on the shorelines to the north or south. The shoreline north of the Project Site is predominantly armored by existing shore protection structures (i.e., seawalls and revetments) that extend approximately 1,700 ft. north from the Project Site to Honokōwai Beach Park. The backshore area along this reach of the shoreline is composed of alluvium and there are no coastal dunes in this area. The nearshore area (seaward of the shoreline) consists of a barren scour zone with thin, discontinuous sand deposits and is surrounded by armored shoreline. As such, Beach Stabilization is not expected to result in any downdrift erosion or reduction in sand volume along the shoreline.

Beach Stabilization would inhibit sediment transport to the south but is not anticipated to result in any downdrift erosion or reduction in sand volume along this reach of shoreline. Sand that currently exists along this reach of shoreline would remain subject to both longshore and cross-shore sediment transport and would continue to move freely along the shoreline. As a secondary impact, Beach Stabilization has the potential to increase beach width and stability along the shoreline immediately to the south in the vicinity of the terminal groin.

There are no anticipated adverse impacts to coastal processes as a result of sand recovery.

Beach Nourishment

Beach Nourishment is not expected to have any construction-related or ongoing impacts to currents or circulation patterns at the Project Site or the Sand Recovery Site. Beach Nourishment may help to temporarily facilitate sediment exchange between the Honokōwai littoral cell and the North Kā‘anapali littoral cell (south of the Project Site). The degree to which sediment exchange increases would depend on how the beach equilibrates after construction and the rate of erosion that occurs during the 10-year anticipated lifespan of the Project. Based on the projected erosion rates, the degree of sediment exchange would be expected to decrease as the beach gradually narrows due to chronic erosion. The beach would also remain vulnerable to episodic erosion, beach loss, and avulsion events, such as that which occurred in 2016.

Beach Maintenance

Similar to Beach Nourishment, Beach Maintenance is not expected to have any construction-related or ongoing impacts to currents or circulation

patterns at the Project Site or the Sand Recovery Site. Beach Maintenance may help to facilitate sediment exchange between the Honokōwai littoral cell and the North Kāʻanapali littoral cell, depending on how the beach equilibrates after construction and how the beach responds to sea level rise over the 50-year anticipated lifespan of the Project. Based on current sea level rise projections, the degree of sediment exchange would be expected to decrease as a result of erosion and shoreline recession associated with sea level rise. The beach would also remain vulnerable to episodic erosion, beach loss, and avulsion events, such as that which occurred in 2016.

No Action

The No Action alternative would have no construction-related impact to currents, circulation, and sediment transport patterns at the Project Site or the Sand Recovery Site, as it would not require sand recovery or sand placement. Currents, circulation, and sediment transport patterns at the Project Site may change over time as the beach profile and shoreline position adjust to rising sea levels. Current projections of future shoreline change in response to sea level rise for Hawaiʻi suggest that the beach would likely become narrower and more isolated as it is squeezed between the surrounding shore protection structures to the north and south, which would further inhibit sediment exchange between the Honokōwai littoral cell and the North Kāʻanapali littoral cell. The backshore area at the Project Site is also composed of alluvial sediment (clay, silt, sand, gravel, boulders), which is not conducive to beach formation. The No Action alternative is anticipated to have an ongoing negative impact on sediment availability and transport patterns at the Project Site.

Potential Related Secondary Actions

The potential related secondary actions would occur on the KBC property landward of the shoreline. As such, these actions are not anticipated to impact coastal processes.

Summary

Beach Stabilization would permanently alter existing currents, circulation, and sediment transport patterns at the Project Site in the immediate vicinity of the groins. The groins would inhibit the transport of sand both alongshore (parallel to shore) and cross-shore (perpendicular to shore). As a result, Honokōwai Beach would be wider, more stable, and less susceptible to seasonal and episodic variations in beach width and volume. The groins would provide superior stability for the beach, and the sand fill would

mitigate the reflection of wave energy from the existing seawalls. The Beach Nourishment, Beach Maintenance, and No Action alternatives are not anticipated to have any construction-related or ongoing impacts to currents or circulation patterns at the Project Site or the Sand Recovery Site. Beach Nourishment and Beach Maintenance may help to facilitate sediment exchange between the Honokōwai littoral cell and the North Kāʻanapali littoral cell. The No Action alternative is anticipated to have an ongoing negative impact on sediment availability and transport patterns at the Project Site.

Action Alternative	Anticipated Impact to Coastal Processes
Beach Stabilization	Alteration of existing current and circulation patterns at the Project Site in the immediate vicinity of the groins, and reduction of sediment transport during the lifetime of Beach Stabilization; potential secondary impact of increasing beach width along the shoreline in the vicinity of the south terminal groin
Beach Nourishment	Potential to temporarily facilitate sediment exchange between littoral cells; benefits dissipate as erosion causes beach narrowing
Beach Maintenance	Potential to facilitate sediment exchange between littoral cells during Project lifespan; benefits dissipate as erosion causes beach narrowing
No Action	Negative impact on sediment availability and transport patterns at the Project Site

5. Waves

a. Existing Conditions

The general wave climate in Hawaiʻi is dominated by long period swell generated by distant storm systems, short period waves generated by local winds, and occasional bursts of energy associated with intense local storms. There are five (5) general types of waves in Hawaiʻi: northeast trade wind waves, southeast trade wind waves, South Pacific swell, North Pacific swell, and Kona storm waves.

Trade wind waves occur throughout the year and are most persistent from April to September when they usually dominate the local wave climate. Due to its location, the Project Site is protected by the island of Maui from the typical direction of trade winds and associated waves.

South Pacific swells generated from storms in the southern hemisphere are most prevalent from April to September. South Pacific swell typically has deep water wave heights of 1 to 4 ft., with periods of 14 to 20 seconds. The Project Site is directly exposed to southerly swell.

North Pacific swell is generated from storms in the North Pacific during the winter months. These storms range in direction from the west-northwest to the northeast and arrive at the northern shores of the Hawaiian Islands with considerable wave energy. These swells often reach deep water wave heights of 15 ft. and can exceed 30 ft. Periods vary between 12 and 20 seconds. The Project Site is protected by northeasterly swell by the island of Maui itself and Molokaʻi protects the site from northwest swell. Even with the sheltering, the Project Site is still exposed to North Pacific swell.

Kona storm waves are infrequent but can approach the Project Site. Kona storm waves are typically short period with 6 to 10 second periods and heights of 5 to 10 ft. Honokōwai is directly exposed to Kona storm waves that approach from the west between Lānaʻi and Molokaʻi or from between Lānaʻi and Kahoʻolawe.

The Project Site is at the center of the Maui Nui Island complex and is partially sheltered from swells due to its location. However, exposure windows between the various islands allow for direct impact from swells from some directions. Refer to **Figure 17** (Wave Exposure Windows).

Around the Project Site there are two (2) main surf breaks known as “Rainbows” and “Hotels”. “Hotels” is an inconsistent left-breaking surf break located offshore of the Maui Kai. “Rainbows” is located south of Honokōwai Point and is an inconsistent right-breaking surf break.

b. <u>Potential Impacts and Mitigation Measures</u>

Wave modeling was conducted by SE and is further described in **Appendix “A”**, Section 7.4.7. The CEA has detailed modeling for a variety of wave conditions. The wave modeling assessed southerly and northerly swells to assess conditions at and around the Project Site. The wave modeling accounted for wave heights and nearshore wave-induced current patterns under typical and more extreme swell conditions.

Design of the beach restoration alternatives must accommodate all wave types with the potential to impact conditions at the Project Site. The nearby surf breaks as well as the channel have been considered in designing the alternatives. The degree to which wave patterns are altered would depend on the selected methodology for beach restoration.

Beach Stabilization

According to the CEA, Beach Stabilization is expected to alter existing nearshore wave patterns within the groin cells and in the immediate vicinity of the groins. Wave conditions within the groin cells are anticipated to generally be calmer for both northerly and southerly swells, when accounting for waves and currents. Directly outside of the groin heads, wave heights are anticipated to increase slightly as a result of reflection of the wave energy off of the groin heads. Wave-induced currents are also anticipated to be reduced within the groin cells. Minimal change directly outside of the groins is anticipated by the modeling. Beach Stabilization is anticipated to alter wave patterns in the vicinity of the groins but is not anticipated to have any significant impact on the surf breaks around the Project Site. The groins would terminate shoreward of the nearby surf breaks and impacts to the surf breaks are not anticipated to be greater than 0.5 ft.

Sand Recovery would occur 1,500 to 2,200 ft. offshore, at water depths of 120 to 170 ft. and is not anticipated to impact nearshore wave conditions.

Beach Nourishment

Beach Nourishment was not explicitly modeled in the same way Beach Stabilization was. This is because the alternative would be very similar to the existing conditions as modeled and involves no substantial modification to the existing shoreline configuration. As such, there would be a negligible impact on existing nearshore wave patterns.

Sand Recovery would occur 1,500 to 2,200 ft. offshore at water depths of 120 to 170 ft. and is not anticipated to impact nearshore wave conditions.

Beach Maintenance

Beach Maintenance was not explicitly modeled in the same way Beach Stabilization was. This is because the alternative would be very similar to the existing conditions as modeled and involves no substantial modification to the existing shoreline configuration. As such, there would be a negligible impact on existing nearshore wave patterns.

Sand Recovery would occur 1,500 to 2,200 ft. offshore at water depths of 120 to 170 ft. and is not anticipated to impact nearshore wave conditions.

No Action

The No Action alternative is not anticipated to impact nearshore wave conditions.

Potential Related Secondary Actions

The potential related secondary action would be done landward of the shoreline and are not anticipated to impact nearshore wave conditions.

Summary

Beach Stabilization is anticipated to alter nearshore wave conditions and currents as it is intended to stabilize the beach. The impact would be confined to wave patterns within the groin cells and in the immediate vicinity of the groins. The Beach Nourishment, Beach Maintenance, and No Action alternatives are not anticipated to have impacts on the nearshore wave climate.

Action Alternative	Anticipated Impact to Waves
Beach Stabilization	Calmer wave conditions and reduced currents within the groin cells and in the immediate vicinity of the groins; no impact to surf breaks outside of the groin cells
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

6. Sea Level Rise and Flooding

a. Existing Conditions

Global mean sea level, or simply sea level, refers to the average height of the entire ocean surface. Due to human-induced climate change, sea levels are rising, primarily as a result of melting land-based glaciers and ice sheets and thermal expansion of the ocean water column. Refer to **Appendix "A"**, Section 7.3.1.

The present rate of global mean sea level rise is +3.1 mm/yr., according to a 2022 study (Sweet et. al., 2022). Sea level data for Maui has been measured since 1947 at the Kahului Harbor and the data trends to year 2024 show a change of +2.21 ± 0.37 mm/yr., which is equivalent to a change of 0.73 ft. in 100 years.

Sea level rise has been accelerating in Hawai‘i over the years, but at a lower rate than that of the global average. Since 1993, 27 years of continuous satellite altimeter measurements tied to tide gauges and

averaged across the planet show that global mean sea level is rising at a rate of 3.56 mm/yr. (1.40 inches per decade) and has accelerated to 4.42 mm/yr. (1.74 inches per decade) averaged over the past decade (February 2013 to February 2023). According to a 2022 study by Nerem et al. (Nerem, 2022), global mean sea level rise is accelerating at a rate that will lead to 23 cm (9 inches) by 2050, relative to the year 2020; and as continued global warming is expected to increase this rate of acceleration, 9 inches of sea level rise by 2050 may be a conservative (low-end) sea level rise scenario.

Sea level rise projections prepared by NOAA have recently been updated based on current scientific research. The updated data projects the intermediate scenario for sea level rise to be 1 ft. by 2050 and 3.9 ft. by 2100, and the high scenario be 1.5 ft. by 2050 and more than 8.1 ft. by 2100 as compared to year 2000 sea levels (Sweet et al., 2022). These scenarios are outlined in the Hawai‘i Sea Level Rise Vulnerability and Adaptation Report (SLRVAR) 2022 Update, which has updated projections and builds off the original 2017 SLRVAR draft. Currently, the SLRVAR recommends the use of a 3.2 ft. State of Hawai‘i Sea Level Rise Viewer for planning purposes. See **Figure 18** (Sea Level Rise Coastal Erosion Projections and 3.2 Foot Sea Level Rise Exposure Area).

Impacts to shorelines associated with human-induced sea level rise include beach narrowing, beach loss, coastal erosion, and negative impacts to water quality and benthic habitat as well as existing development. As the rate of sea level rise increases, average shoreline recession is anticipated to be nearly twice the historical rates by 2050 and nearly 2.5 times historical rates by 2100. Refer to **Appendix “A”**, Section 7.3.4. This acceleration of sea level rise would increase the potential for events and impacts similar to the 2016 beach loss and avulsion event at Honokōwai Beach, especially if combined with anomalous sea levels.

Impacts associated with sea level rise include worsening coastal erosion, passive flooding, and high wave flooding. The sea level rise exposure area (SLR-XA) mapping tool was prepared by Pacific Islands Ocean Observing System (PacIOOS) based on modeling from the University of Hawai‘i Coastal Geology Group (UH-CGG) for the Hawai‘i Climate Change Mitigation and Adaptation Commission to model projected impacts associated with 0.5, 1.1, 2.0, and 3.2 ft. of sea level rise. SLR-XA combines models for the three (3) above mentioned factors, that were prepared independently to assess their combined impacts. When put together to assess the potential combined impacts for all three (3), the SLR-XA model is derived. The model is broad, covering all islands, and as such has some limitations. These limitations include the following:

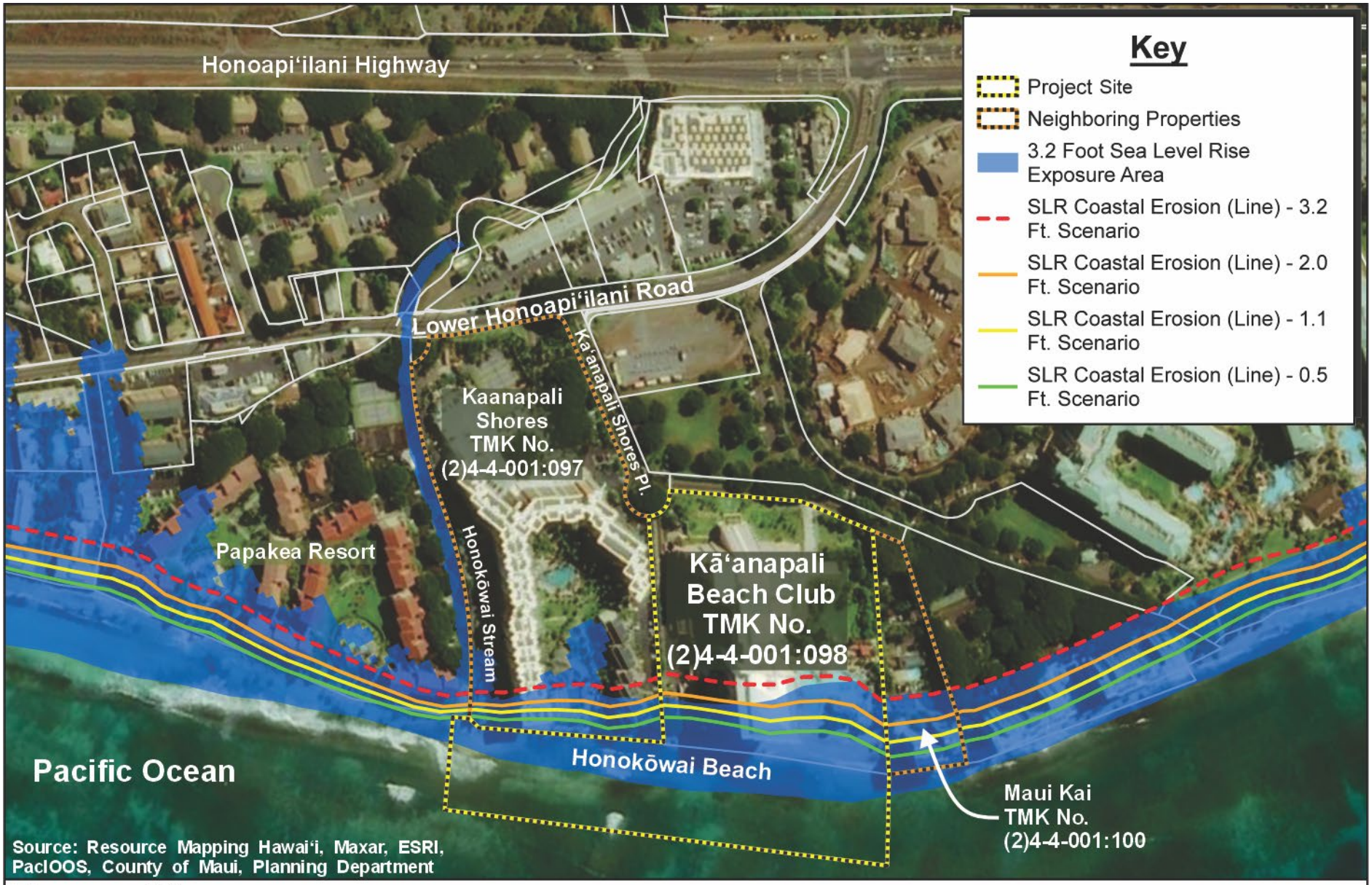


Figure 18

Ho‘āla Honokōwai

Sea Level Rise Coastal Erosion Projections and 3.2 Foot Sea Level Rise Exposure Area

0 175 350
Feet

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- The model does not account for the interactive nature of these three (3) hazards as would be expected by natural processes.
- The model does not account for future land use changes.
- The model does not include impacts from less frequent high wave events, storm surge, or tsunamis.
- Mapping errors may be present in some areas due to clipping of the original map layers.
- The model assumes all shorelines modeled have sandy beaches and backshores and does not account for existing shoreline conditions (e.g., rocky headlands, shore protection structures, etc.).
- The Viewer only includes one (1) of several SLR scenarios projected by the IPCC and none of the SLR scenarios projected by NOAA to model the SLR-XA.
- The model does not account for future (unknown) land use changes, including any adaptation measures.
- Possible modeling errors in the Annual High Wave Flooding model at reef and harbor channels.
- Over-predicted flooding along some transects with deep, shore-perpendicular indentations in the sea bottom such as nearshore reef channels.
- The modeling does not account for the presence of a nearby shallow reef which refracts and dissipates some of the wave energy traveling through the channel toward the shore.
- The modeling did not account for possible changes to sediment supply from future shoreline development and engineering, such as construction or removal of coastal armoring or other coastal engineering.

Despite these limitations, SLR-XA has been peer reviewed on a scientific basis but not for its application to planning, policy, or decision-making purposes. SLR-XA was recommended by SLRVAR as appropriate for land use planning. SLR-XA and Coastal Erosion projections are shown in **Figure 18** (Sea Level Rise Coastal Erosion Projections and 3.2 Foot Sea Level Rise Exposure Area).

Passive flooding, as modeled by the UH-CGG data, shows minimal passive flooding impacts within the Project Site. See **Appendix "A"**, Section 7.3.4.

Annual high wave flooding as shown by the UH-CGG models shows impacts to portions of the Project Site located landward of the shoreline. As this model is prepared to show impacts that are as low as 10 cm in depth, the flooding on this portion of the property could be considered nuisance flooding that is unlikely to be life-threatening or capable of causing structural damage. This is further confirmed by modeling done unrelated to the Project which modeled annual and maximum annual high wave flooding at 3.3 ft. of sea level rise. The impacts from annual high wave flooding and maximum annual high wave flooding could still be considered minimal (see **Appendix "A"**, Section 7.3.4). See **Figure 19** (High Wave Flooding Projections).

Coastal erosion poses a significant threat to the Project Site including the beach itself and the infrastructure and property landward of the shoreline under any sea level rise scenario. See **Appendix "A"**, Section 7.3.4.

In addition to the trend of rising sea levels, there are sea level anomalies that represent a discernable change in sea level. For this EIS, sea level anomalies can be understood as a difference between the measured sea level and the long-term trends in sea level at the Kahului Harbor NOAA tide station. Sea level anomalies can be caused by a variety of factors such as El Niño Southern Oscillation[10], climate change, geostrophic currents[11], and mesoscale eddies[12]. Refer to **Appendix "A"**, Section 7.3.4. The higher water levels associated with sea level anomalies can lead to coastal erosion and inundation and when combined with high tides and high surf events, the impacts can compound into what was observed in 2016 at Honokōwai Beach.

While king tides[13] were well documented by local news agencies around the time of the 2016 beach loss and avulsion event and did contribute to the damage, sea level anomalies ranging from +0.5 to +1 ft. above the astronomical tide and persistent North Pacific swell contributed significantly

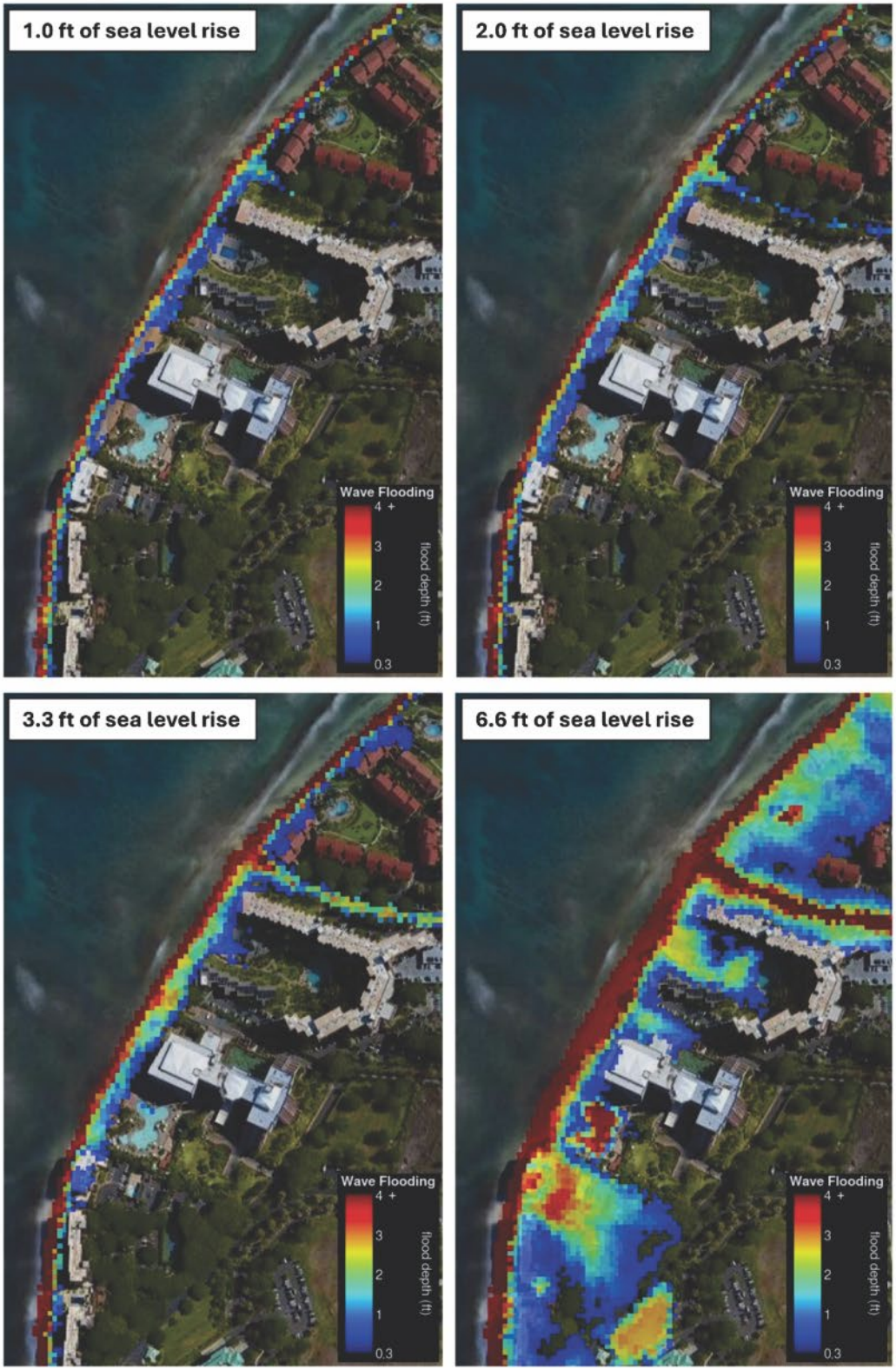
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[10] El Niño Southern Oscillation (ENSO) is a climate phenomenon which for Hawai'i includes above average ocean temperatures, altered rainfall patterns, near to slightly above normal sea levels, the weakening of trade winds, and an increased risk for tropical cyclones. ENSO is a natural phenomenon that occurs every 2-7 years on average. Similarly, La Niña can result in lower than anticipated sea levels and is the opposite portion of El Niño in the ENSO cycle.

[11] Geostrophic currents are formed by a balance between Coriolis acceleration and pressure gradients in the ocean. This balance results in water moving parallel to the pressure contours rather than moving from high to low pressure, which can cause sea level anomalies.

[12] Mesoscale Eddies are eddies of horizontal scales of less than 100 kilometers. Eddies can be thought of as the ocean's weather because they are currents with a defined area of similar temperature, salinity, sea level, and structure. Eddies rotate around a center and are observable only by satellite. Eddies are a natural phenomenon which provide nutrients and store a significant amount of the ocean's kinetic energy which is important for ocean circulation. As Eddies move and circulate their characteristics such as salinity, nutrient concentrations, and sea level move as well.

[13] King tides refer to periods of exceptionally high tide typically occurring during a full moon. King tides are a popular term although not scientific nor used in scientific context. King tides are predictable and are part of a normal tide cycle occurring yearly.



Source: Azouri et al. 2022 and Sea Engineering Inc., 2024

Figure 19 Hoʻāla Honokōwai

High Wave Flooding Projections

NOT TO SCALE

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HGV\KBC Beach Restor\Apps\Figures\HWFP

to the beach loss and avulsion event. The damage to Honokōwai Beach was not due to a singular impact of climate change but the combination of sea level anomalies, king tides, and persistent high surf. With the anticipated rates of sea level rise, a higher average sea level would mean anomalous sea levels would not be necessary to contribute to erosion events of a similar scale. However, when anomalous sea levels are present with anticipated future sea levels, impacts from high surf events could lead to beach loss and avulsion of a larger magnitude. Refer to **Appendix "A",** Section 7.3.4.

The Project Site is located in Flood Zone VE as designated by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM). These maps and Flood Zones are used to classify risks and hazards associated with a specific area. Flood Zone VE is defined as a coastal area with a one (1) percent or greater chance of flooding and an additional hazard associated with storm waves. Although FEMA does not provide a definition for storm waves, USACE, which is cited by FEMA in a focus group study on storm waves, defines them as storm surges, caused by a combination of low barometric pressure and high onshore winds which can raise sea level by several meters. This definition indicates that storm waves are not waves associated with yearly storms, but rather larger events such as tropical storms and hurricanes. As such, the impacts associated with this Flood Zone are not inclusive of the analysis on passive flooding and high wave flooding as previously described.

b. Potential Impacts and Mitigation Measures

As a result of human-induced sea level rise, the Project Site is becoming increasingly more vulnerable to passive flooding, high wave flooding, and coastal erosion. While impacts from passive flooding and high wave flooding can be observed within the boundary of the Project Site through sea level rise projection models, the impacts are not anticipated to be significant on their own. Coastal erosion, however, does have the potential to cause significant damage within and surrounding the Project Site within the lifespan of the Project Alternatives, and is the primary hazard at the Project Site.

Beach Stabilization

The CEA notes that Beach Stabilization is not expected to impact future sea levels. Beach Stabilization is expected to have an ongoing positive impact by restoring the beach and improving beach stability, which would provide a natural buffer to reduce vulnerability to coastal hazards and make the beach and the surrounding shoreline area more resilient.

Beach Stabilization is designed to have an approximate 50-year lifespan and would be designed to accommodate sea level rise through the year 2080. The sand would be placed on the beach and the groins would stabilize this sand to prevent sediment transport associated with typical or atypical beach conditions such as currents, wave action, and seasonal, chronic, or episodic erosion. The sand would be placed so that it fills up to the existing backshore grade and covers the escarpment created by the 2016 beach loss and avulsion event. The groins would be built into the backshore and designed to accommodate for 3.3 ft. of sea level rise. The groins would be designed to be adaptable should they need to be made taller if sea level rise were to outpace the current projections set for the year 2080.

The groins have been designed for sea level rise adaptation. The groin crests would have cast-in-place concrete crest caps, which would serve as a base for groin modification if sea level rise is greater than anticipated. If vertical extensions to the groins are needed with rising sea levels, a crown wall can be constructed on top of the concrete core to raise the height of the groin. This adaptable design allows the initial design to have lower elevations to keep a more open view plane rather than designing taller groins at the outset.

The implementation of Beach Stabilization would help to mitigate impacts associated with sea level rise such as increased wave run up, coastal inundation, chronic erosion, seasonal erosion, and episodic erosion as the sand would be unable to leave the groin cells. With the beach stabilized, compounding effects of sea level rise would be mitigated and predictions for beach narrowing, beach loss, habitat impacts, and water quality impacts would be mitigated at Honokōwai Beach as well.

The groins would begin interacting with waves approximately 220 ft. seaward of the backshore (vegetation line) and dissipate wave energy significantly by the time waves reach the shoreline. As a result of this wave energy dissipation, impacts from wave runup at the backshore which contributes to erosion would be minimized.

Beach Stabilization is expected to have the most positive impact in terms of preserving the beach and reducing flood risks as the groins and beach cells would provide a wider and more stable buffer between the terrestrial and marine environments. The groins would decrease and reorient the amount of wave energy reaching the backshore and potentially decrease the inland extent of any wave overtopping that may occur.

Construction is not anticipated to have any impacts on sea levels at the Project Site or at the Sand Recovery Site.

Beach Nourishment

Beach Nourishment is expected to have a positive impact by temporarily increasing beach width and volume. During the 10-year anticipated lifespan, the beach would continue to be exposed to erosion, so the protective characteristics of the beach would be expected to decrease over time. With continued erosion, beach width would be expected to return to pre-construction conditions within approximately 10 years and continue to become progressively narrower as sea levels continue to rise.

Beach Nourishment would establish a more functional beach profile that would help to protect the backshore and associated infrastructure. Benefits associated with Beach Nourishment are anticipated to last for approximately 10 years as future shoreline projections indicate an average shoreline change rate of -1.27 ft./yr. Beach Nourishment would temporarily restore the beach similarly to its pre-2016 conditions. As such, the beach would still be vulnerable to impacts associated with sea level rise such as increased wave run up, coastal inundation, chronic erosion, seasonal erosion, and episodic erosion.

As the beach is exposed to natural coastal processes, the benefits of Beach Nourishment would diminish as the beach narrows due to natural shoreline change without stabilization or sand replenishment. The armoring of the surrounding coastline to the north and south of the Project Site prevents necessary amounts of new sand from being supplied to replenish what is lost to natural sediment transport and coastal erosion. After the anticipated 10-year lifespan of Beach Nourishment, the loss of sand that is not replenished would result in an unstable beach that is more vulnerable and less resilient to the impacts of sea level rise.

Beach Nourishment is expected to have a positive impact in terms of temporarily enhancing the natural buffer between the terrestrial and marine environments. However, the wave energy dissipating properties of the beach would decrease over time as the beach continues to erode over the 10-year anticipated lifespan of the Project and beyond. The risk of wave-induced flooding in the backshore area would be expected to increase as the beach gradually narrows over time.

Construction is not anticipated to have any impacts on sea levels at the Project Site or at the Sand Recovery Site.

Beach Maintenance

Beach Maintenance would have similar impacts and benefits as Beach Nourishment but over a longer period of time. Future shoreline projections indicate an average shoreline change rate of -1.27 ft./yr. over the 50-year design life. As such, the maintenance activities would help mitigate the continued beach loss of approximately 10 to 15 ft. every 10 years. As mentioned for Beach Nourishment, Honokōwai Beach would still be susceptible to episodic events compounded with sea level rise. This could significantly reduce the anticipated 10-year lifespan of each maintenance effort and could shorten the overall lifespan of the Project by requiring beach maintenance events more frequently than anticipated based on the projected shoreline change rate.

Beach Maintenance is expected to have a similarly positive impact to Beach Nourishment in terms of enhancing the natural buffer between the terrestrial and marine environments to reduce flooding. With periodic renourishment, the wave energy dissipating properties of the beach would be preserved over the 50-year anticipated lifespan of the Project.

No Action

No Action would increase vulnerability and decrease resilience to sea level rise. Without implementation of beach restoration, erosion and beach loss would result in significant shoreline recession that could substantially alter the configuration of the shoreline at Honokōwai Beach. As with the beach restoration action alternatives, the No Action alternative would involve the demolition and removal of the temporary erosion skirt that is currently installed at the Project Site. With its removal, the exposed backshore would not be improved and would be vulnerable to high surf and sea level rise. Furthermore, the coastal walkway and infrastructure beneath it would be exposed to sea level rise impacts and beach access would be significantly limited, especially as sea levels continue to rise.

No Action would have no immediate impact on coastal flooding. However, over a period of 50 years, or following a significant erosion event, which could occur at any time, the beach would be expected to narrow due to increasing erosion pressure and rising water levels. The risk of wave-induced flooding is anticipated to increase as the wave dissipating capacity of the beach diminishes over time.

Potential Related Secondary Actions

As discussed in Chapter I of this Draft EIS, potential related secondary actions would be limited to common elements of the KBC property and may include modification or strategic relocation of existing common elements of the KBC property within the Project Site, such as walkways, landscape and hardscape features, and water features. Secondary actions may also include environmental restoration actions or public access improvements within the KBC property or shoreline areas. Potential secondary actions would be located landward of the shoreline on private property. Potential secondary actions would be aimed at improving resiliency from the impacts of sea level rise. Improvements would also be subject to flood development standards as it relates to development within the Flood Zone VE.

Summary

Beach restoration is expected to preserve the beach and associated recreational and cultural activities, reduce future erosion rates, and increase the resilience of the beach and the surrounding shoreline area to sea level rise. Beach Stabilization is the most effective approach to preserve Honokōwai Beach and mitigate the impacts of sea level rise. Beach Maintenance would have a similar impact on long-term shoreline change rates; however, the beach would remain vulnerable to chronic erosion, seasonal erosion, and episodic beach loss and avulsion events. Beach Nourishment could temporarily delay the impacts of sea level rise and erosion by approximately 10 years, but these benefits would be temporary in nature, and the beach would again be vulnerable to erosion and episodic events.

All of the beach restoration alternatives have the potential to reduce wave overtopping and wave-induced flooding, thereby increasing resilience to sea level rise. Beach Stabilization is the most stable and durable of the beach restoration methodologies considered and is anticipated to provide the most positive impact in terms of flood risk reduction.

Action Alternative	Anticipated Impact to Sea Level and Flooding
Beach Stabilization	Most positive impact in terms of preserving the beach and reducing flood risks as the groins and beach cells would provide a wider and more stable beach that would mitigate compounding impacts of sea level rise

Action Alternative	Anticipated Impact to Sea Level and Flooding
Beach Nourishment	Positive impact with temporarily increasing beach width and volume; benefits decrease as time elapses from sand placement
Beach Maintenance	Positive impact of enhancing the natural buffer between the terrestrial and marine environments to reduce flooding; benefits preserved over the approximate 50-year anticipated Project lifespan
No Action	Increased vulnerability and decreased resilience to sea level rise, erosion, and flooding; anticipated significant erosion, beach loss, and shoreline recession that could substantially alter the configuration of the shoreline

7. Tsunamis

a. Existing Conditions

Tsunamis are waves that result from large scale displacements of the sea floor. Tsunamis are most commonly associated with earthquakes, typically of magnitude 7.0 or greater. When an earthquake involves a large segment of land displacing a large volume of water, the water is forced outwards in a series of waves which extend from the sea floor to the sea surface.

In the open ocean, where the water is deep, these tsunami waves can have a small wave height, but will have a very long wavelength, up to hundreds of miles. These waves can move up to 500 miles per hour (mph) and can travel across the Pacific Ocean in less than one (1) day.

Most tsunamis in Hawai‘i originate from tectonically active areas around the Pacific Rim such as Alaska, Japan, and Chile. When tsunamis are generated from these areas, the Pacific Tsunami Warning System is able to provide Hawai‘i with several hours of advanced warning that a tsunami will hit the area. Less commonly, tsunamis can originate in Hawai‘i. There is little to no advanced warning for locally generated tsunamis.

As described by the Hawai‘i Emergency Management Agency (HEMA), the Project Site is located within the Tsunami Hazard Zone.

b. Potential Impacts and Mitigation Measures

The CEA notes that all potential beach restoration alternatives may decrease the impacts of tsunami flooding by increasing beach width and

volume and increasing the buffer between the marine and terrestrial environments. This buffer would improve the wave dissipating capacity of the beaches and potentially decrease the landward extent of wave runup. Damage from a tsunami depends on the height of the water level rise relative to the backshore elevation, neither of which would be altered by any of the methods discussed. Tsunamis are unpredictable events with no statistical characteristics or recurrence interval for design of coastal structures. Unlike typical ocean waves, tsunamis have very long wavelengths that can span hundreds of miles, so they can travel very long distances with minimal loss of energy. Even smaller tsunami waves can carry immense energy due to the large volume of water involved.

While beach restoration may decrease impacts of tsunami flooding, it is important to note that none of the beach restoration alternatives are designed to protect against tsunamis.

Beach Stabilization

Beach Stabilization is expected to have the most positive impact of all the alternatives in terms of potential tsunami risk reduction as the groins and beach cells would provide a wider and more stable buffer between the terrestrial and marine environments. However, as noted above, Beach Stabilization is not designed to protect against tsunamis. Refer to **Appendix "A"**, Section 7.6.3.

Beach Nourishment

Beach Nourishment is expected to have a positive impact in terms of enhancing the natural buffer between the terrestrial and marine environments. However, the wave energy dissipating properties of the beach would decrease over time as the beach continues to erode over the 10-year design life of the alternative. Beach Nourishment is not designed to protect against tsunamis. Refer to **Appendix "A"**, Section 7.6.3.

Beach Maintenance

Beach Maintenance is expected to have a similarly positive impact to Beach Nourishment in terms of enhancing the natural buffer between the terrestrial and marine environments. With periodic renourishment, the wave energy dissipating properties of the beach would be preserved over the anticipated 50-year lifespan of the Project, however, there would be some deterioration of benefits between renourishment efforts. As with Beach Stabilization and Beach Nourishment, Beach Maintenance is not

designed to protect against tsunamis. Refer to **Appendix "A"**, Section 7.6.3.

No Action

No Action would have no immediate impact on tsunamis. Over a period of 50 years, the beach would be expected to gradually narrow due to increasing erosion pressure and rising water levels. The risk of impacts from tsunami wave run-up and inundation would be expected to increase as the wave dissipating properties of the beach diminish over time. Refer to **Appendix "A"**, Section 7.6.3.

Potential Related Secondary Actions

Tsunami evacuation routes would not be impacted by any additional potential secondary actions. Any improvements would be implemented on KBC property.

Summary

All of the beach restoration alternatives have the potential to reduce wave overtopping and wave-induced flooding caused by tsunamis by increasing the buffer between the marine and terrestrial environment. Beach Stabilization would be the most stable and durable alternative and is therefore expected to provide the most positive impact in terms of tsunami risk reduction. However, none of the Project Alternatives are designed to reduce impacts from tsunamis. No Action would have the highest risk of impacts from a tsunami. Refer to **Appendix "A"**, Section 7.6.3.

Action Alternative	Anticipated Impact to Tsunamis
Beach Stabilization	Wider and more stable beach would provide a natural buffer between the terrestrial and marine environments, but Beach Stabilization is not designed to reduce impacts from tsunamis
Beach Nourishment	Wider beach for an approximate 10-year Project lifespan would provide a natural buffer between terrestrial and marine environments, but Beach Nourishment is not designed to reduce impacts from tsunamis
Beach Maintenance	Wider beach would provide a natural buffer between the terrestrial and marine environments, but Beach Maintenance is not designed to reduce impacts from tsunamis
No Action	Increased risk of impacts from tsunamis as the wave dissipating properties of the beach diminish over time

8. Topography and Soils

a. Existing Conditions

The Project Site is situated on the Kāʻanapali coastal plain, which is characterized by generally flat to gently sloping topography. The area features a combination of sandy beaches and rocky shorelines, interspersed with fringing reef complexes that contribute to the local ecosystem. The topography transitions from the coastal plain to the steep volcanic slopes of the West Maui Mountains, creating a unique geomorphological setting.

Terrestrial soils in the vicinity of the Project Site belong to the Pulehu-Ewa-Jaucas association (United States Department of Agriculture Natural Resources Conservation Service, n.d.). See **Figure 20** (Soil Association Map). The Pulehu-Ewa-Jaucas association encompasses a range of soils that are generally well-drained and formed from volcanic materials.

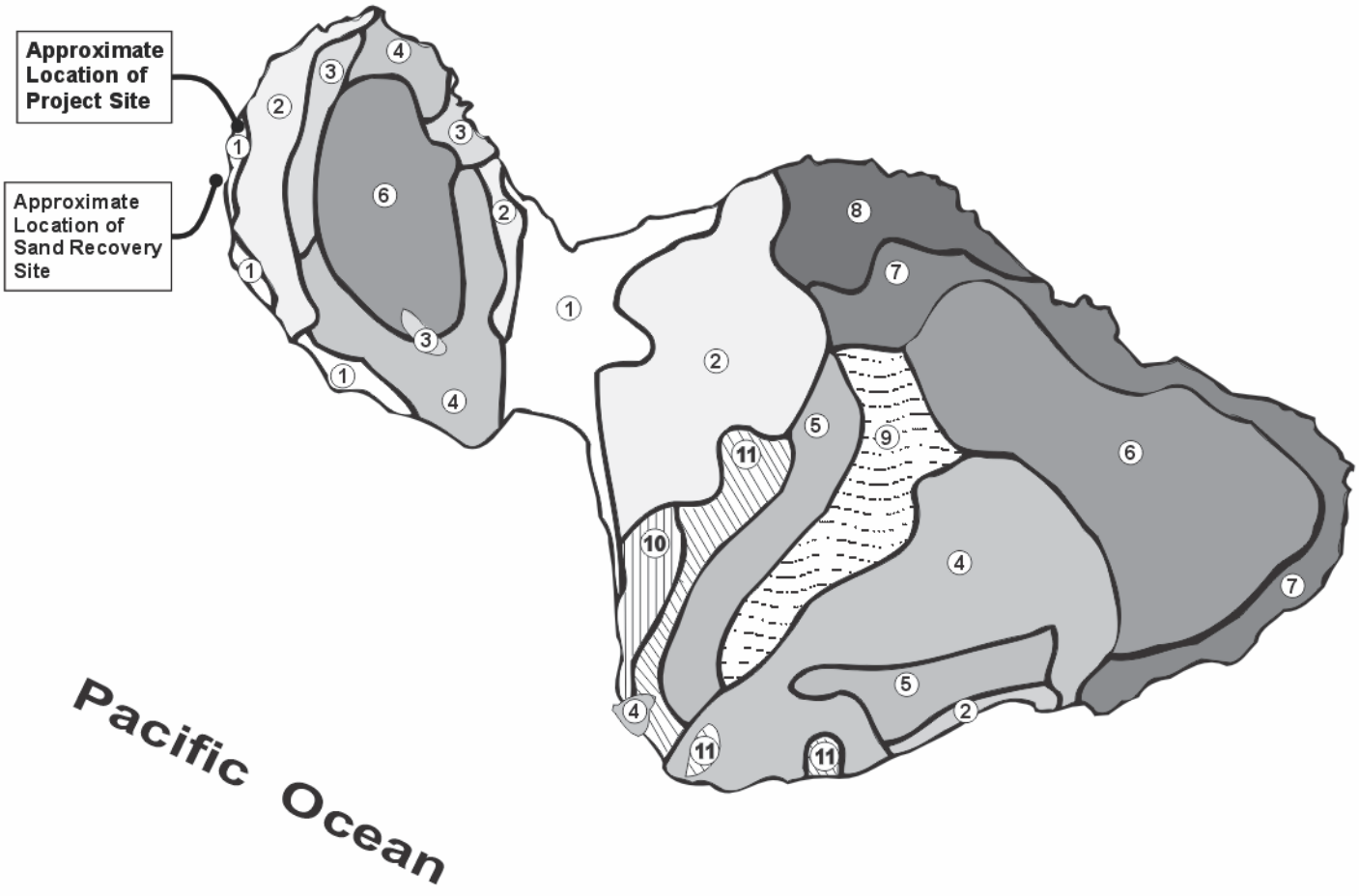
The specific soil classifications underlying the Project Site include Beaches (BS) in the area of Honokōwai Beach; and Pulehu silt loam, 0 to 3 percent slopes (PpA) in the areas underlying the Kāʻanapali Beach Club and neighboring properties. See **Figure 21** (Soil Classification). Beaches are typified by narrow, sloping areas of coastal sand and gravel, excessively drained with low runoff, and varying in color and composition according to the material in which they formed.

A detailed analysis of the beach sand characteristics at Honokōwai Beach is provided in the CEA. Refer to **Appendix "A"**, Section 5.1. Pulehu silt loam is associated with alluvial fans and terraces and is derived from deposits from streams such as Honokōwai Stream. Pulehu silt loam is well-drained, moderately permeable, and is well suited for cultivation of various vegetation types, including sugar cane.

The soils and topography at the Project Site are subject to impacts of erosion associated with cyclical and seasonal beach processes as well as the progressive effects of sea level rise. Following the erosional event of 2016, the backshore at Honokōwai Beach was exposed to erosion, causing the discharge of alluvium and associated turbidity, along with the formation of a steep vertical escarpment ranging from three (3) to eight (8) feet in height at the shoreline fronting the Project Site. The 2016 beach loss and avulsion event damaged trees, plants, and minor structures including a concrete coastal walkway and utility lines.

LEGEND

- 1 Pulehu-Ewa-Jaucas association
- 2 Waiakoa-Keahua-Molokai association
- 3 Honolua-Olelo association
- 4 Rock land-Rough mountainous land association
- 5 Puu Pa-Kula-Pane association
- 6 Hydrandepts-Tropaquods association
- 7 Hana-Makaalae-Kailua association
- 8 Pauwela-Haiku association
- 9 Laumaia-Kaipoipoi-Olinda association
- 10 Keawakapu-Makena association
- 11 Kamaole-Oanapuka association



Source: U.S. Department of Agriculture, Natural Resources Conservation Service, 2006

Figure 20

Ho‘āla Honokōwai
Soil Association Map

NOT TO SCALE

Prepared for: West Maui Resort Partners, L.P.

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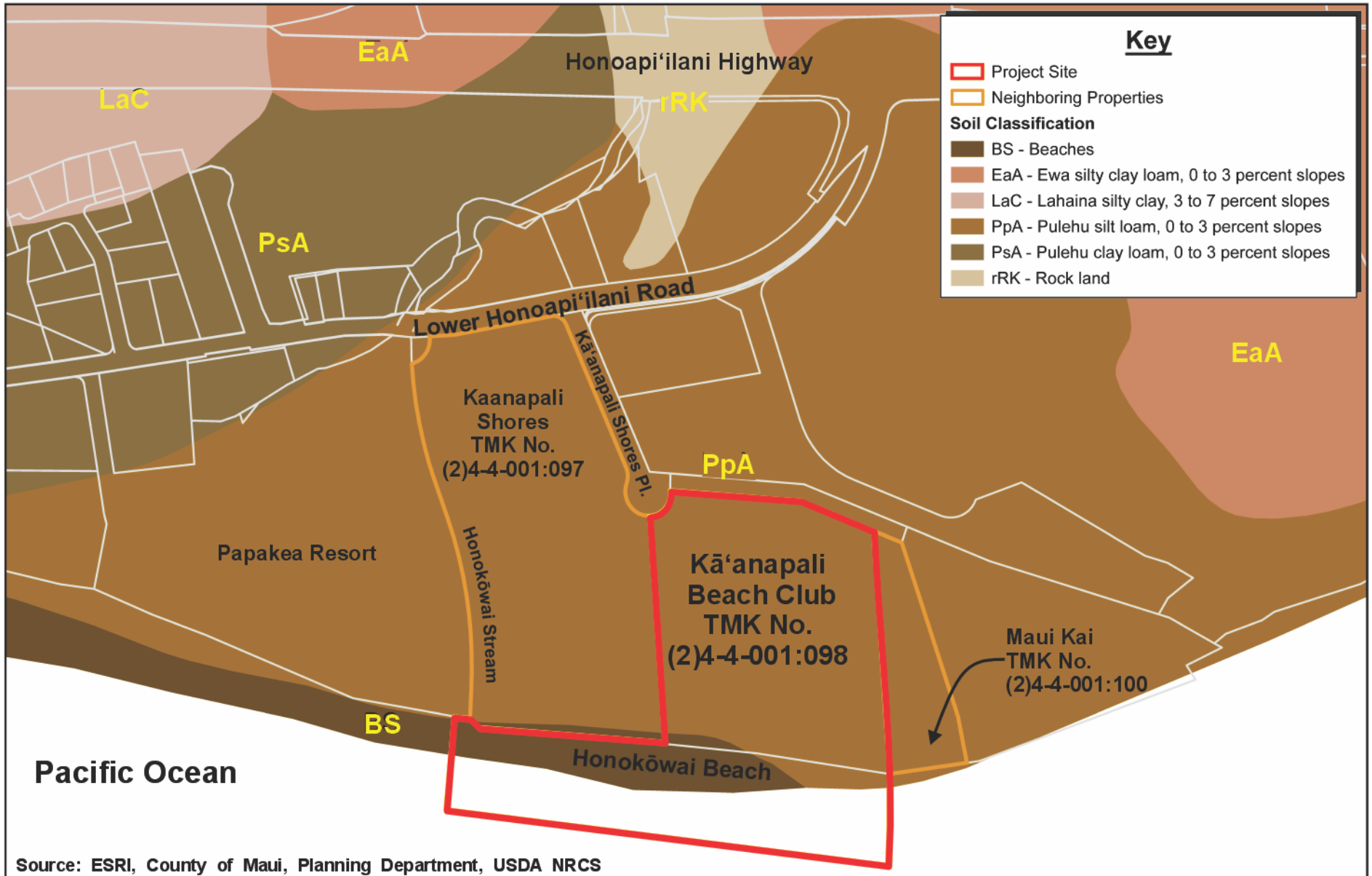


Figure 21

Ho‘āla Honokōwai
Soil Classification

0 175 350
Feet

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\SoilClass

A Structural Assessment for the makai building at the KBC structure was conducted by KAI Hawaii, Inc. in 2024. See **Appendix "B"**. The western building of the KBC property is supported on concrete piles that are driven deep into the substrate. The substrate consists of sandy gravel down to a depth of approximately 92 ft. below grade, at which point hard basalt is found. Each building column is supported on a cluster of four (4) piles. There are a total of six (6) building columns (comprised of 24 piles) along the western face of the building, and each column is set back three (3) feet from each other. More than 150 additional pilings are located to the east. Because no quantitative analysis of the existing building foundation was performed, it is assumed that the buildings and support piles were adequately designed in 1986.

b. Potential Impacts and Mitigation Measures

The Proposed Action intends to restore and preserve Honokōwai Beach and increase resilience to coastal hazards and sea level rise. All future Project scenarios are anticipated to be subject to the impacts of climate change.

According to the Structural Assessment prepared by KAI Hawaii, Inc. and its attached geotechnical report from Geolabs, Inc., a projected sea level rise of 3 ft. will result in a 2 to 3 ft. rise in ground water elevation as well. The rise in ground water elevation will likely have an insignificant impact on the ability of individual piles to support vertical loads. However, if future beach erosion manifests to the extent that the support piles begin to be undermined, then the ability of the piles to support lateral forces, such as hurricane and earthquake forces, could potentially be jeopardized. Therefore, supplemental erosion countermeasures are recommended along the makai face of the Kāʻanapali Beach Club structure to ensure that future erosion is held to a minimum. Erosion countermeasures such as those considered in the three (3) beach restoration alternatives would prevent the erosion of the soil substrate, and the soil that supports the existing piles would continue to provide adequate vertical and lateral support. As discussed below, each of the beach restoration alternatives involves placement of sand which will alter the topography of the shoreline area and provide protection against erosion associated with sea level rise as forecast to occur during the Project's lifespan. Refer to **Appendix "B"**.

Beach Stabilization

Implementation of Beach Stabilization involves both placement of sand to restore the existing beach, as well as construction of groins to stabilize the beach. Beach Stabilization would alter the foreshore topography along

Honokōwai Beach by increasing dry beach width and elevation compared to the existing shoreline configuration. The design calls for 43,395 s.f. of beach fill to be placed along the toe of the beach. This would result in an approximately 37 percent increase in beach width when compared to the pre-erosion shoreline conditions in 2007. The groins would have the effect of protecting the beach and the backshore land areas from future erosion and flooding and maintaining the underlying soil loads.

The ongoing result of the Beach Stabilization alternative is to reduce the impact of erosion processes to the soils and topography in the area of the Project Site over the 50-year anticipated lifespan of the Project. In this scenario, based upon the findings of the Structural Assessment report (refer to **Appendix "B"**) and the CEA (refer to **Appendix "A"**), the soil substrate underlying the Ka'anapali Beach Club foundation, in its existing condition, is anticipated to continue to adequately support the vertical and lateral loads of the structure.

Beach Nourishment

Beach Nourishment involves a one-time sand placement event with an anticipated 10-year lifespan. Beach Nourishment would alter the foreshore topography along Honokōwai Beach by increasing beach width and elevation compared to the existing shoreline configuration, with an estimated 20,540 s.f. of beach fill that would be placed seaward of the existing beach toe. Similar to the Beach Stabilization alternative, placement of sand would result in a wider and more elevated beach and would provide protection of soil in the backshore land areas from future erosion and flooding. However, beyond the 10-year anticipated lifespan of the one-time sand placement event, as the protective effects of the sand placement become diminished, the condition of the soils and topography in the area of the Project Site would be similar to that of the No Action alternative.

Beach Maintenance

Beach Maintenance would alter the foreshore topography along Honokōwai Beach in a similar manner to Beach Nourishment by increasing beach width and elevation compared to the existing shoreline configuration. Impacts would be limited to the 20,540 s.f. area of beach fill that would be placed seaward of the existing beach toe. Sand would be placed on a recurring basis, approximately every 10 years.

As Beach Maintenance involves a recurring program of sand placement over an anticipated Project lifespan of 50 years, its impacts would be similar to the Beach Stabilization alternative in that it would result in a wider and

more elevated sandy beach, with protection of backshore land areas continuing throughout the 50-year duration of the program.

No Action

With No Action, the sand at Honokōwai Beach, as well as the soil in the backshore land areas would continue to be affected by cyclical and progressive erosion effects. Over the course of time, this erosion would result in the narrowing, flattening, and potential complete loss of the sandy beach in the Project Site. Erosion of the beach, in turn, would result in loss of soil from the backshore with potential impacts to the soil substrate's capacity to support structures. Estimates for land loss vary by year and sea level rise scenario, but at 3.2 ft. of sea level rise, approximately 60,946 s.f. of land could be lost resulting in approximately 19,542 cy of sediment discharged into the ocean. This land loss would account for approximately 20 percent of TMK (2) 4-4-001:098. Refer to **Appendix "A"**, Section 3.1.

Potential Related Secondary Actions

No impacts to soils and topography in the vicinity of the Project Site are anticipated in connection with any potential related secondary actions.

Summary

The Proposed Action alternatives are anticipated to result in a wider and more elevated beach and to provide protection of the soils in the backshore areas from erosion. While the effects of Beach Stabilization and Beach Maintenance would continue through the 50-year design lives of these alternatives, the effects to the soils and topography at the Project Site associated with the Beach Nourishment alternative would be limited to approximately 10 years, after which the protective effects of the one-time sand placement would diminish. With No Action, the Project Site is anticipated to be subject to the continued impacts of erosion, over time, resulting in a receding shoreline with a significant or total loss of sand as well as loss of backshore soil to the ocean and potential loss of structures.

Action Alternative	Anticipated Impact to Topography and Soils
Beach Stabilization	Increase in beach width and elevation and retention of backshore soil for the anticipated 50-year design life
Beach Nourishment	Increase in beach width and elevation and retention of backshore soil for approximately 10 years
Beach Maintenance	Increase in beach width and elevation and retention of backshore soil for the anticipated 50-year design life

Action Alternative	Anticipated Impact to Topography and Soils
No Action	Significant or total loss of beach width and elevation (approximately 60,946 s.f. of land loss); loss of backshore soil and alluvium occurring as a result of ongoing erosion

9. Terrestrial Environment

a. Existing Conditions

The terrestrial environment at the Project Site includes the beach, landscaped vegetation, open grassy areas, parking spaces, a public restroom, and a paved walkway. The KBC property is professionally landscaped and consistent with other coastal resorts in West Maui. There is both perpendicular and lateral shoreline access available at the Project Site. Lateral shoreline access is available along the beach and via a paved coastal walkway along approximately 1,000 ft. of shoreline from the south end of the KBC property to the north side of Honokōwai Stream. The beach abuts the backshore which consists of soil, alluvial sediment, and infrastructure such as irrigation lines, electrical wiring, and propane gas lines.

In 2016 a combination of persistent swell and elevated water levels caused significant erosion and avulsion along the beach and backshore. The erosion and avulsion created a vertical escarpment along the shoreline fronting the Project Site. The escarpment was a steep slope 5 to 8 ft. high along the southern portion of the shoreline and 3 to 5 ft. high along the central and northern portions of the shoreline. Large sections of the embankment collapsed onto the beach including trees, root balls, boulders, and large blocks of terrigenous sediment. Approximately 5,600 s.f. of fast land was lost to erosion, and over 1,000 cy of alluvial sediment including clay, silt, and boulders was discharged into the ocean. Unlike beach sand, fast land is generally not capable of being restored by natural physical processes, so the loss can be considered permanent.

In 2018, a temporary erosion skirt was installed along the shoreline fronting KBC. The structure was authorized by the OCCL and the County of Maui, Department of Planning through the emergency permitting process. The temporary erosion skirt has allowed some sand to return to the beach, protected nearshore water quality, and limited further erosion of the backshore, but the beach width and height has not returned to its pre-2016 state.

b. Potential Impacts and Mitigation Measures

The Proposed Action of beach restoration is not anticipated to significantly impact the terrestrial environment and would provide a positive benefit of limiting further erosion of the backshore. There may be temporary construction-related impacts which would be mitigated by Best Management Practices (BMPs), including material management, waste management, and erosion control measures. For a full list of construction-related BMPs, refer to the Best Management Practices Plan within the CEA, **Appendix "A"**.

As previously discussed, land loss varies by timeframe and sea level rise scenario, but at 3.2 feet of sea level rise, approximately 60,946 s.f. of land would be lost resulting in approximately 19,542 cy of sediment discharged into the ocean. This land loss and sediment discharge would significantly change the configuration of the shoreline and backshore and would have impacts that extend to shoreline access, land ownership, and land use. Refer to **Appendix "A"**, Section 3.1.

Beach Stabilization

The Beach Stabilization alternative may result in construction-related impacts as the temporary erosion skirt is demolished and removed, sand is placed, and the groins are constructed, but these impacts would be mitigated by BMPs. Following construction, a wider and more stable beach would provide an ongoing benefit of preventing further erosion and loss of fast land.

Beach Nourishment

The Beach Nourishment alternative may result in construction-related impacts as the temporary erosion skirt is demolished and removed and sand is placed on the beach, but these impacts would be mitigated by BMPs. The estimated 10-year lifespan of this alternative is anticipated to defer the impacts of No Action initially, but the beach and backshore would continue to erode, causing the loss of more land from the terrestrial environment.

Beach Maintenance

As with Beach Nourishment, the Beach Maintenance alternative may have temporary construction-related impacts to the terrestrial environment as the temporary erosion skirt is removed, and sand is placed on the beach. With an anticipated 50-year lifespan, Beach Maintenance is anticipated to

provide a longer-term benefit of preventing future erosion and loss of fast land.

No Action

The No Action alternative may have construction-related impacts as the temporary erosion skirt is demolished and removed, but these impacts would be mitigated by BMPs. After construction, there is likely to be continued erosion and beach loss. As the backshore continues to erode, there would be a loss of more fast land from the terrestrial environment and discharge of sediment (alluvium) onto the beach and into the nearshore waters.

Potential Related Secondary Actions

No significant impacts to the terrestrial environment are anticipated in connection with potential related secondary actions.

Summary

The terrestrial environment is likely to be impacted during construction by the removal of the temporary erosion skirt. Beach Stabilization and Beach Maintenance would provide an ongoing positive impact by protecting the backshore from further erosion. No Action would lead to a loss of more fast land as the backshore erodes. Beach restoration would avoid the impacts of No Action for the 10-year anticipated lifespan, but there is anticipated to be an ongoing negative impact of fast land loss beyond the approximate 10-year timeframe.

Action Alternative	Anticipated Impact to the Terrestrial Environment
Beach Stabilization	**Construction-Related Impacts:** Impacts from demolition and removal of the temporary erosion skirt, sand placement, and groin construction **Ongoing Impacts:** Positive benefit of a wider and more stable beach that would mitigate erosion, beach narrowing, and shoreline recession **Mitigation:** Construction-related BMPs including material management, waste management, and erosion control measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**

Action Alternative	Anticipated Impact to the Terrestrial Environment
Beach Nourishment	**Construction-Related Impacts:** Impacts from demolition and removal of the temporary erosion skirt and placement of sand **Ongoing Impacts:** Likely erosion, beach narrowing, shoreline recession, and potential beach loss following the anticipated 10-year Project lifespan **Mitigation:** Construction-related BMPs including material management, waste management, and erosion control measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**
Beach Maintenance	**Construction-Related Impacts:** Impacts from demolition and removal of the temporary erosion skirt and placement of sand **Ongoing Impacts:** Positive benefit of a wider sandy beach that would limit erosion of the backshore **Mitigation:** Construction-related BMPs including material management, waste management, and erosion control measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**
No Action	**Construction-Related Impacts:** Impacts from demolition and removal of the temporary erosion skirt **Ongoing Impacts:** Erosion, beach narrowing, shoreline recession, permanent loss of land, and potential beach loss **Mitigation:** Construction-related BMPs including material management, waste management, and erosion control measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**

10. Streams and Wetlands

a. Existing Conditions

The Project Site lies within the Honokōwai watershed, which covers an area of 8.77 square miles on the western side of Puʻu Kukui Mountain. The Honokōwai Watershed consists of three (3) main drainages: Pōhakukāʻanapali Stream, Māhinahina Stream, and Honokōwai Stream.

Additionally, Honokōwai Stream is fed by the Amalu and Kapaloa Streams in the upper regions of the West Maui Mountains, in the State Conservation District. Each of the three (3) main streams terminate at the ocean and are ephemeral[14] in their lower sections. There is an existing agricultural ditch system that diverts water in the upper elevations, contributing to the dry conditions and lack of surface flow at lower elevations (State of Hawai‘i Department of Land and Natural Resources Commission on Water Resource Management, 2019).

The mouth of Honokōwai Stream is located at the northern end of the Project Site. Honokōwai Stream drains approximately 70 percent of the Honokōwai Watershed and is perennial[15] from its headwaters to an elevation of approximately 1,300 ft., where it becomes ephemeral. Honokōwai Stream is joined by smaller converging streams and flows to the Honokōwai Dam and desilting basin, located 750 ft. inland of Honoapi‘ilani Highway (NOAA Office of Ocean and Coastal Resource Management, 2012). From the dam to the stream mouth, Honokōwai Stream is a concrete box culvert with storm water outfalls. The box culvert has a length of approximately 3,000 ft. and terminates between the Papakea Resort and Kaanapali Shores on the northern end of the Project Site (State of Hawai‘i,Department of Land and Natural Resources, Commission on Water Resource Management, 2019).

The typical dry climate at the Project Site causes there to be no wetlands in the immediate vicinity, but at the mouth of the Honokōwai Stream culvert exists a perennial pond, or *muliwai.* Wave activity creates a sand berm that blocks the stream mouth, causing water to be impounded within the stream culvert. However, the pond shares a surface connection to the ocean depending on tidal, rainfall, storm, and runoff conditions. Without consistent stream flow, the enclosed water is subject to degraded water quality. When there is a large rainfall event or coastal flooding, the sand berm becomes dislodged, causing accumulated runoff, debris, and pollutants to flush into the nearshore waters (NOAA Office of Ocean and Coastal Resource Management, 2012).

b. <u>Potential Impacts and Mitigation Measures</u>

The Proposed Action is not anticipated to adversely impact streams and wetlands. There would be no work conducted within the Honokōwai Stream for any of the alternatives. Nevertheless, BMPs will be implemented to

[14] Ephemeral streams are those which only flow after rain (or snow) events. These streams do not flow throughout the year under typical conditions.

[15] Perennial streams are those which flow throughout the year with exception of severe drought conditions.

prevent adverse impacts to the stream from adjacent construction work. BMPs include erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures, among others. For a full list of construction-related BMPs, refer to the Best Management Practices Plan contained in the CEA, **Appendix "A"**.

Beach Stabilization

The Beach Stabilization alternative is not anticipated to significantly impact streams and wetlands.

A wider and more stable beach would provide an ongoing benefit of preventing future erosion and impacts to Honokōwai Stream. The groin design may provide a potential secondary benefit of preventing sand from accumulating in Honokōwai Stream mouth, which would facilitate a greater surface connection between the perennial pond and ocean. Refer to **Appendix "A"**, Section 7.1.6.

Beach Nourishment

The Beach Nourishment alternative is not anticipated to have significant adverse impacts to streams or wetlands. Without construction of stabilizing groins, there would be no potential secondary benefit of reducing sand accumulation at the Honokōwai Stream mouth.

Beach Maintenance

The Beach Maintenance alternative is not anticipated to have significant adverse impacts to streams or wetlands. Without construction of stabilizing groins, there would be no potential secondary benefit of reducing sand accumulation at the Honokōwai Stream mouth.

No Action

No Action, like Beach Nourishment and Beach Maintenance, would not have a secondary benefit of reducing sand accumulation at the Honokōwai Stream mouth.

Potential Related Secondary Actions

Any potential related secondary actions are not anticipated to adversely impact streams and wetlands.

Summary

There is no work proposed in the stream and no adverse impacts to streams or wetlands are anticipated. The Beach Stabilization alternative may provide a secondary benefit of reducing the accumulation of sand at the mouth of Honokōwai Stream. The No Action alternative is not anticipated to have an adverse impact on Honokōwai Stream.

Action Alternative	Anticipated Impact to Streams and Wetlands
Beach Stabilization	**Construction-Related Impacts:** No work within stream **Ongoing Impacts:** Potential secondary benefit of groin design preventing stream mouth from accumulating sand, improving water quality and natural stream flow **Mitigation:** BMPs including erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**
Beach Nourishment	**Construction-Related Impacts:** No work within stream **Ongoing Impacts:** No impact **Mitigation:** BMPs including erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**
Beach Maintenance	**Construction-Related Impacts:** No work within stream **Ongoing Impacts:** No impact **Mitigation:** BMPs including erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**

Action Alternative	Anticipated Impact to Streams and Wetlands
No Action	**Construction-Related Impacts:** No work within stream **Ongoing Impacts:** No impact **Mitigation:** BMPs including erosion and sediment control measures, water quality monitoring in the nearshore environment, and emergency spill response measures; refer to the Best Management Practices Plan within the CEA, **Appendix "A"**

11. Flora, Fauna, and Avifauna

a. Existing Conditions

A Terrestrial Biological Surveys report for the Project Site was prepared by AECOS, Inc. in February 2025. Biologists conducted a botanical survey, avian survey, and a terrestrial mammalian survey along the beach and backshore. An aquatic fauna survey was conducted from the right bank of Honokōwai Stream. An additional timed waterbird count was conducted at the mouth of Honokōwai Stream.

Flora

The botanical survey area consisted of the beach, coastal walkway, and landscaped beachfront. On the ocean side of the sidewalk, biologists observed naupaka (*Scaevola taccada*), pohuehue (*Ipomoea pes-caprae*), as well as some trees. The mauka side vegetation mostly consists of lawns of common grass including carpet grass (*Axonopus fissifolius*), St. Augustine (*Stenotaphrum secundatum*), and zoysia grass (*Zoysia matrella*), interspersed with ornamental plants. The survey area is maintained as a landscape, with no leaf litter or plant debris present.

In total, 70 species of vascular plants were recorded. There were 67 species of flowering plants (angiosperms) and three (3) species of ferns observed. Seven (7) species were native to the Hawaiian Islands with one (1) species considered endemic or only found in Hawai‘i. The endemic species recorded (‘ākia, *Wikstroemia uva-ursi*) and three (3) indigenous species, hala (*Pandanus tectorius*), hau (*Taliparitiliaceum*), and ‘ilima (*Sida fallax*), were planted as part of the landscaped vegetation. The other three (3) indigenous species reported, naupaka (*Scaevola taccada*), pohuehue (*Ipomea pes-caprae*), and milo (*Thespesia populnea*), appear to grow naturally on the beach side, but are more likely to be plantings as well. Early Polynesian introductions recorded included coconut palm or niu

(*Cocos nucifera*), ti (*Cordyline fruticosa*), and ʻihiʻai (*Oxalis corniculata*). These observations are all common plants across the Hawaiian Islands. Other plants observed were mainly ornamental and part of the landscaped vegetation. For a full analysis of observed flora, see **Appendix "C"**.

Fauna

During the survey of aquatic fauna at the mouth of Honokōwai Stream, there were five (5) fish species observed. Two (2) species observed were native to Hawaiʻi, the indigenous ʻamaʻama (Striped Mullet, *Mugil cephalus*), and the endemic aholehole (Hawaiian Flagtail, *Kuhlia xenura*). The presence of these species indicates an occasional surface connection between the stream mouth and ocean. The juveniles of these species typically are found in estuaries while adults can be found in nearshore waters.

One (1) female Hawaiian monk seal (*Neomonachus schauinslandi*) was observed on the beach. Two (2) green sea turtles (*Chelonia mydas*) were observed in the nearshore waters. For more discussion on these species please refer to Chapter III, Section A.11., Rare, Threatened, and Endangered Species, of this Draft EIS**.**

For a full analysis of fauna observed during biological surveys, refer to **Appendix "C"**.

Avifauna

During the avian surveys there were eight (8) species of birds observed. One (1) native species, the indigenous ʻaukuʻu (Black-Crowned Night Heron, *Nycticorax nycticorax hoactli*) was observed at the mouth of Honokōwai Stream. The remainder are common, alien species introduced to the Hawaiian Islands. For a full analysis of observed avifauna, refer to **Appendix "C"**.

b. Potential Impacts and Mitigation Measures

The Proposed Action would involve placement of sand (and construction of groins, in the case of Beach Stabilization) on Honokōwai Beach and demolition and removal of the temporary erosion skirt, which may have construction-related impacts to flora, fauna, and avifauna at the Project Site. These impacts are discussed in the Terrestrial Biological Surveys report (**Appendix "C"**) and listed below.

Impacts to Vegetation

The presence or use of machinery in the shoreline area has the potential to result in damage to existing vegetation. Transportation of construction equipment and construction activities could result in temporary direct physical disturbance to vegetation by trampling plant species. To minimize this potential impact, vegetated areas will be avoided as much as possible. In the event that damage to the indigenous flora occurs, there will be replanting with species that naturally grow in the coastal area (e.g., naupaka, pohuehue, milo).

Impacts to Aquatic Fauna

No impacts to aquatic fauna are anticipated as the stream area would be avoided during construction for all Project alternatives. Impacts and mitigation measures to aquatic fauna in the nearshore waters are discussed in Chapter III, Section A.13., Marine and Nearshore Environment. Impacts and mitigation measures for fisheries are discussed in Chapter III, Section A.15., Fisheries. For additional discussion on the Hawaiian monk seal (*Neomonachus schauinslandi*) and green sea turtle (*Chelonia mydas*), please refer to Chapter III, Section A.11., Rare, Threatened, and Endangered Species, of this EIS.

Mitigation in the form of biological monitoring is anticipated pre-construction, during construction, and post-construction. A detailed description of the anticipated monitoring can be found in **Appendix "A"**, Section 9.3. Pre-construction monitoring is typically conducted to establish a baseline for evaluating potential impacts. During construction, monitoring typically includes photomosaics[16] of biological conditions as well as visual observations of conditions. Post-construction analysis may include additional photomosaic analysis at various post construction intervals as well as marine biological monitoring on a scheduled basis.

Impacts to Waterbirds and Seabirds

There may be minor and temporary adverse effects to waterbirds and seabirds present at the Project Site during construction, including potential disturbance from noise and human activity, as well as risk of direct mortality from ground disturbance and vehicle/construction equipment strikes. Night work is not proposed, but if necessary, it may have an adverse effect on seabirds. Illumination at the Project Site may cause seabird behavior

[16] Photomosaics are larger images comprised of smaller, individual images. They are useful in analyzing a wide breadth of area in more detail than with one zoomed out photo.

modification, such as alteration of feeding, migration, and predator avoidance patterns. Visual inspections for nesting birds in the Project Site backshore will be conducted prior to construction. If found, appropriate buffers will be implemented.

Impacts to Terrestrial Mammals

While none were observed during biological surveys, it is possible that the native Hawaiian hoary bat (ʻōpeʻapeʻa, *Lasiurus cinereus semotus*) uses resources within the Project vicinity. Impacts of the Proposed Action on bats could occur only if trees are cleared. Potential adverse impacts to Hawaiian hoary bats would be avoided or minimized by not clearing woody vegetation taller than 4.6 m (15 ft.) between June 1 and September 15, the bat pupping season, and by avoiding the use of barbed wire for fencing (United States Fish & Wildlife Service Pacific Islands Fish and Wildlife Office, 2023).

The construction-related impacts described above will be mitigated through appropriate BMPs. It is also noted that the State Department of Land and Natural Resources, Division of Forestry and Wildlife provided recommended mitigation measures that were included in the Best Management Practices Plan. For a full discussion of BMPs for flora, fauna, and avifauna, refer to **Appendix "C"**.

Beach Stabilization

The Beach Stabilization alternative may cause construction-related impacts to flora, fauna, and avifauna through the demolition and removal of the temporary erosion skirt, placement of sand on the beach, and construction of the groins. The localized impacts from construction activity of the groins would cause in-water disturbance to monk seals and sea turtles, but these structures would stabilize and increase the beach area over the Project lifespan after construction. This increase in beach area could result in a beneficial long-term effect to monk seals and sea turtles since the amount of area available for haul-out would not fluctuate over the 50-year design life of the Project.

Beach Nourishment

The Beach Nourishment alternative would have similar impacts to Beach Stabilization, and may cause construction-related impacts to flora, fauna, and avifauna through the demolition and removal of the temporary erosion skirt and placement of sand on the beach. There would be no in-water work associated with this alternative in comparison to Beach Stabilization.

Following the approximately 10-year lifespan of Beach Nourishment, loss of land may negatively impact habitat availability and haul out area.

Beach Maintenance

The Beach Maintenance alternative would have similar impacts to Beach Nourishment, but impacts would be recurring as the beach is nourished approximately once every 10 years. The amount of beach area available for monk seals and sea turtles would fluctuate between each renourishment interval. According to the Terrestrial Biological Survey report (**Appendix "C"**), this recurring nourishment could result in adverse impacts to monk seal and sea turtle behavior since the amount of beach area available for haul-out would fluctuate repeatedly over the 50-year design life of the Project.

No Action

The No Action alternative involves the demolition and removal of the temporary erosion skirt, which may cause construction-related impacts to flora, fauna, and avifauna. The loss of land may negatively impact habitat availability and haul out area at Honokōwai Beach and the surrounding shoreline area.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to adversely impact flora, fauna, and avifauna.

Summary

The Proposed Action may cause temporary construction-related impacts to flora, fauna, and avifauna that can be mitigated by BMPs, as described in **Appendix "C"**. There may be impacts to existing vegetation from construction equipment and machinery on the beach. There are no impacts anticipated to aquatic fauna in Honokōwai Stream as the stream area will be avoided. There may be impacts to waterbirds and seabirds from noise and human activity, as well as risk of direct mortality from ground disturbance and vehicle/construction equipment strikes.

Action Alternative	Anticipated Impacts to Flora, Fauna, and Avifauna
Beach Stabilization	**Construction-Related Impacts:** Impacts associated with demolition and removal of temporary erosion skirt, sand placement, and in-water construction of groins; potential for in-water disturbance to monk seals and sea turtles **Ongoing Impacts:** No adverse impacts; potential secondary benefit of improved surface connection and water quality in Honokōwai Stream; potential benefit of larger haul out area for monk seals and sea turtles **Mitigation:** Avoidance of vegetated areas, replanting with native species, biological monitoring before, during, and after construction; for a full list of BMPs for flora, fauna, and avifauna refer to **Appendix "C"**
Beach Nourishment	**Construction-Related Impacts:** Impacts associated with demolition and removal of temporary erosion skirt and sand placement **Ongoing Impacts:** Potential loss of available haul out area for monk seals and sea turtles after the approximately 10-year lifespan of the alternative **Mitigation:** Avoidance of vegetated areas, replanting with native species, biological monitoring before, during, and after construction; for a full list of BMPs for flora, fauna, and avifauna refer to **Appendix "C"**
Beach Maintenance	**Construction-Related Impacts:** Impacts associated with demolition and removal of temporary erosion skirt and sand placement **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action; potential adverse impact of fluctuating available haul out area for monk seals and sea turtles between each renourishment interval **Mitigation:** Avoidance of vegetated areas, replanting with native species, biological monitoring before, during, and after construction; for a full list of BMPs for flora, fauna, and avifauna refer to **Appendix "C"**

Action Alternative	Anticipated Impacts to Flora, Fauna, and Avifauna
No Action	**Construction-Related Impacts:** Impacts associated with demolition and removal of temporary erosion skirt **Ongoing Impacts:** Loss of land and erosion may impact habitat availability and haul out area for monk seals and sea turtles **Mitigation:** Avoidance of vegetated areas, replanting with native species, biological monitoring before, during, and after construction; for a full list of BMPs for flora, fauna, and avifauna refer to **Appendix "C"**

12. Rare, Threatened, Endangered Species

a. Existing Conditions

Confirmed rare, threatened, and endangered species in the vicinity of the Project Site include the green sea turtle (*Chelonia mydas agassizi*), which feeds on the algae covered ocean bottom, and Hawaiian monk seals (*Neomonachus schauinslandi*) which occasionally haul out at Honokōwai Beach. During the biological surveys conducted by AECOS, Inc. in August 2024, two (2) green sea turtles were observed in nearshore waters, and a female Hawaiian monk seal (*Neomonachus schauinslandi*) was observed on the beach.

Critical habitat for Hawaiian monk seals has been designated and includes the sea floor and marine environment up to 10 m above the sea floor from the 200 m depth contour, extending through the shoreline onto the land 5 m inland from the shoreline between identified boundary points. These terrestrial boundary points define preferred pupping areas and significant haul out areas. Honokōwai Beach is designated as critical terrestrial habitat for Hawaiian monk seals, and the Sand Recovery Site and nearshore environment are designated as critical marine habitat.

The waters offshore of the Project Site are within the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS). Humpback whales (koholā, *Megaptera novaeangliae*) are frequently observed in deeper waters offshore of Honokōwai Beach, particularly during the months of January through March. No other listed species have been observed at the Project Site.

The lack of vegetation in Honokōwai Stream provides inadequate nesting or forage habitat for endangered waterbirds such as the Hawaiian Coot (*Fulica alai*) or Black-necked Stilt (*Himantopus mexicanus knudseni*). The Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) is a protected terrestrial mammal species. While not observed, it is possible that the bats use resources in the vicinity of the Project Site.

For a full discussion on rare, threatened, and endangered species, refer to the Terrestrial Biological Survey in **Appendix "C"** and CEA in **Appendix "A"**.

b. Potential Impacts and Mitigation Measures

The Proposed Action may cause temporary construction-related impacts from demolition and removal of the temporary erosion skirt, sand placement, and groin construction. Dredging activities at the Sand Recovery Site would produce an underwater sound that can be perceived by marine creatures. The ears of marine mammals and sea turtles are sensitive to changes in sound pressure, which is produced by the amplitude, wavelength, and frequency of a sound wave. While audiograms are not available for whales and sea turtles, it is generally accepted that 120 dB causes disturbance to these sea creatures. According to the CEA, (**Appendix "A"**) sand recovery activities are not anticipated to exceed this noise level.

Potential impacts to rare, threatened, and endangered species are discussed in the Terrestrial Biological Survey (**Appendix "C"**) and CEA (**Appendix "A"**). The Best Management Practices Plan contained within the CEA (**Appendix "A"**) outlines measures to be implemented to mitigate impacts to protected species, including appropriate measures identified in the Standard Local Operating Procedures for Endangered Species in the Central and Pacific Region. BMPs include conducting visual surveys for listed species and postponing or halting work when listed species are within 50 yards of the proposed work area. BMPs related to specific species are included in the BMP Plan within the CEA, **Appendix "A"**.

Hawaiian Monk Seals

There would be minor, localized and construction-related adverse impacts to Monk Seals and their associated critical habitat present at the Project Site. Potential impacts during construction include disturbance from noise and human activity, and an increase in nearshore turbidity. The BMP Plan outlines measures that will be implemented to mitigate impacts to Monk Seals, including monitoring of the area before and during work, halting

work, and establishing of a buffer for protection of the seal or seals. Refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**.

Green Sea Turtles

Adult green sea turtles forage in shallow nearshore areas and on coral reefs. Generally, contamination from effluent discharges and runoff can degrade these environments, and invasive species may reduce the native algae species preferred by green sea turtles. Potential impacts during construction include disturbance from noise and human activity, and an increase in nearshore turbidity. Night work is not proposed, but if necessary, it would illuminate the beach, potentially resulting in localized adverse impacts to listed sea turtles by modifying behavior, such as nesting. The BMP Plan identifies measures to mitigate impacts to sea turtles. Refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**.

Hawaiian Hoary Bats

While no Hawaiian Hoary Bats were observed at the Project Site, it is possible bats use resources in the Project vicinity. The principal potential impact of the Project on bats would occur when site vegetation is cleared and grubbed. Potential adverse impacts to Hawaiian hoary bats can be avoided or minimized by not clearing woody vegetation taller than 4.6 m (15 ft.) between June 1 and September 15, the bat pupping season, and by avoiding the use of barbed wire for fencing. Refer to **Appendix "A"**, Section 9.4.2, and **Appendix "C"**.

Humpback Whales

According to the CEA (**Appendix "A"**), the Proposed Action of beach restoration would not directly affect humpback whales, and sounds generated from sand recovery, sand placement, and groin construction activities are not expected to be substantial enough to cause an acoustic disturbance to protected species.

BMPs to mitigate impacts to humpback whales will be implemented, including surveying the work area for marine protected species before beginning any work in water, and at specified intervals while work is ongoing. Should a humpback whale or other marine protected species enter the work area, work will be halted until the animal has left the area. Vessel operators will alter their course to remain at least 100 yards from whales and will reduce vessel speed to 10 knots or less when piloting

vessels in the proximity of marine mammals. Refer to the Best Management Practices Plan within the CEA, **Appendix "A"**.

Onsite staff will receive education on the status and required protections for protected species. For a full discussion of mitigation measures for rare, threatened, and endangered species refer to the Terrestrial Biological Survey report in **Appendix "C"**, the Coastal Engineering Assessment in **Appendix "A"**, Section 9.4.2, and the Best Management Practices Plan in Best Management Practices Plan within the CEA, **Appendix "A"**.

Beach Stabilization

The Beach Stabilization alternative may cause temporary construction-related impacts to monk seals and sea turtles through demolition and removal of the temporary erosion skirt, placement of sand on the beach, and construction of the groins. Effects during the construction period include potential disturbance from noise and human activity, and an increase in nearshore turbidity from in-water work. The localized impacts from construction of the groins may cause in-water disturbance to monk seals and sea turtles. Adverse impacts will be mitigated through appropriate BMPs, as described in the Best Management Practices Plan within the CEA, **Appendix "A"**. With the installation of the groins, the amount of beach sand is anticipated to remain stable from year to year. This stabilization is expected to result in a beneficial ongoing impact to monk seals and sea turtles since the beach area available for haul out would not fluctuate over the 50-year anticipated lifespan of the alternative.

Beach Nourishment

The Beach Nourishment alternative would have similar impacts to Beach Stabilization and may cause temporary construction-related impacts to monk seals and sea turtles through demolition and removal of the temporary erosion skirt and placement of sand on the beach. Adverse impacts will be mitigated through appropriate BMPs, as described in the Best Management Practices Plan within the CEA, **Appendix "A"**. There would be no groin construction for this alternative, limiting potential impacts to monk seals and turtles from in-water work. Beach Nourishment would provide a larger beach area for monk seal and sea turtle haul out for the anticipated 10-year lifespan of the alternative.

Beach Maintenance

The Beach Maintenance alternative would have similar anticipated impacts to Beach Nourishment, but construction impacts would be recurring as the

beach is nourished approximately once every 10 years. Adverse impacts will be mitigated through appropriate BMPs, as described in the Best Management Practices Plan within the CEA, **Appendix "A"**. The amount of beach sand available for monk seals and sea turtles would fluctuate year to year. According to the Terrestrial Biological Survey report (**Appendix "C"**), this fluctuation could result in an adverse ongoing impact to monk seal and sea turtle behavior since the amount of sand available for haul out would fluctuate over the 50-year anticipated lifespan of the alternative.

No Action

The No Action alternative may cause temporary construction-related impacts to rare, threatened, and endangered species through demolition and removal of the temporary erosion skirt. In the absence of a beach restoration action, there would be no positive impact to monk seals and sea turtles from an increased haul out area. According to the CEA (**Appendix "A"**), as sea levels continue to rise, erosion, beach narrowing, and potential beach loss would be expected to result in less beach area available for haul out.

Potential Related Secondary Actions

The Potential Related and Secondary actions would be limited to developed portions of the KBC property, and are not anticipated to adversely impact rare, threatened, and endangered species.

Summary

The Proposed Action may cause temporary construction-related impacts to rare, threatened, and endangered species that can be mitigated by appropriate BMPs. Impacts during the construction period include potential disturbance from noise and human activity, and an increase in nearshore turbidity. A larger beach area would benefit monk seals and sea turtles by providing a larger haul out area, but a fluctuating beach area, as anticipated with Beach Maintenance, may have an adverse ongoing impact to monk seal and sea turtle behavior. The No Action alternative is expected to have an adverse ongoing impact to monk seal and sea turtle behavior since the amount of sand available for haul out would decrease progressively over time.

Action Alternative	Anticipated Impact to Rare, Threatened, or Endangered Species
Beach Stabilization	**Construction-Related Impacts:** Impacts associated with demolition and removal of the temporary erosion skirt, sand placement, and groin construction, including potential disturbance from noise and human activity, and an increase in nearshore turbidity from in-water work **Ongoing Impacts:** Positive impact of a stabilized beach, larger haul out area for sea turtles, and increased terrestrial critical habitat for monk seals **Mitigation:** BMPs include conducting visual surveys for ESA-listed species and postponing or halting work when ESA-listed species are within 50 yards of the proposed work area; refer to species-specific BMPs in the Best Management Practices Plan, contained within the CEA, **Appendix "A"**
Beach Nourishment	**Construction-Related Impacts:** Impacts associated with demolition and removal of the temporary erosion skirt and sand placement, including potential disturbance from noise and human activity **Ongoing Impacts:** Positive impact of a wider beach, larger haul out area for sea turtles, and increased terrestrial critical habitat for monk seals limited to the approximate 10-year anticipated Project lifespan **Mitigation:** BMPs include conducting visual surveys for ESA-listed species and postponing or halting work when ESA-listed species are within 50 yards of the proposed work area; refer to species-specific BMPs in the Best Management Practices Plan, contained within the CEA, **Appendix "A"**
Beach Maintenance	**Construction-Related Impacts:** Impacts associated with demolition and removal of the temporary erosion skirt and sand placement, including potential disturbance from noise and human activity **Ongoing Impacts:** Recurring construction impacts; potential adverse impacts to sea turtle and monk seal behavior since the amount of sand available for haul out would fluctuate

Action Alternative	Anticipated Impact to Rare, Threatened, or Endangered Species
	over the anticipated 50-year Project lifespan **Mitigation:** BMPs include conducting visual surveys for ESA-listed species and postponing or halting work when ESA-listed species are within 50 yards of the proposed work area; refer to species-specific BMPs in the Best Management Practices Plan, contained within the CEA, **Appendix "A"**
No Action	**Construction-Related Impacts:** Impacts associated with demolition and removal of the temporary erosion skirt **Ongoing Impacts:** Potential adverse impacts to sea turtle and monk seal habitat since the amount of sand available for haul out would decrease progressively over time **Mitigation:** BMPs include conducting visual surveys for ESA-listed species and postponing or halting work when ESA-listed species are within 50 yards of the proposed work area; refer to species-specific BMPs in the Best Management Practices Plan, contained within the CEA, **Appendix "A"**

13. Marine and Nearshore Environment

a. Existing Conditions

A Baseline Assessment of Marine Water Chemistry and Marine Biotic Communities at the Project Site was completed in September 2024 by Marine Research Consultants, Inc. See the Assessment of the Marine Environment contained within the CEA, **Appendix "A"**. Composition of the reef communities fronting the Project Site is influenced by several physical factors. The physical setting is on a protruding point (headland) that focuses on breaking waves, resulting in concussive forces that prevent settlement and growth of most reef organisms (primarily corals). In addition, resuspension of sand from wave action and wave-induced currents also prevent settlement and causes destructive abrasion of corals.

The overall physical and biotic composition of the survey area was evaluated by divers using snorkel and SCUBA working from a small boat. Dive surveys were conducted by swimming in a zigzag pattern along the three (3) transect lines used for water chemistry sampling that fronted Honokōwai Beach. For discussion purposes, the nearshore environment at

Honokōwai Beach can be divided into three (3) zones extending approximately 200 m (~650 ft.) seaward: a nearshore scour zone, a mid-reef platform zone, and an outer-reef coral zone. See **Figure 22** (Bathymetry Zones).

Nearshore Scour Zone

The nearshore scour zone extends approximately 100 m seaward of Honokōwai Beach with water depths generally at one (1) meter or less. This environment is characterized by sand, rocks, and cobble, with wave action and turbidity making it generally unsuitable for coral growth and other marine life. The rocks and cobbles present in the nearshore scour zone may be considered "live rock", which is defined as "*any natural hard substrate to which marine life is visibly attached or affixed*" (HAR § 13-95-1).

There were 22 species of macroalgae identified in the nearshore scour zone with 18 of these classified as rarely observed and four (4) classified as commonly observed in the survey area; however, while some of the rocks and cobbles are covered with a thin veneer of algal turf, filamentous and frondose macroalgae was rare when considering the whole of the survey area. The dearth of filamentous algae and corals in the nearshore scour zone are likely due to intense concussive forces from breaking waves, which limit colonization and growth of benthic organisms. An exception was a small area near the shoreline along Transect 1 during the 2024 survey which contained a community of macroalgae comprised primarily of *Dictyota sp.*, *Turbinaria ornata*, and *Halimeda sp*., refer to Assessment of the Marine Environment contained within the CEA, **Appendix "A"**. The occurrence of macroalgae in this area is likely the result of a localized area sheltered from direct wave impacts.

Fish were rarely observed in the nearshore scour zone, and only eight (8) species were observed across multiple surveys conducted in 2021 and 2024. Species present during both survey periods include the yellowstripe goatfish (*Mulloidichthys flavolineatus*), Picasso's triggerfish (*Rhinecanthus rectangulus*), and the Hawaiian sergeant (*Abudefduf abdominalis*). For a full list of observed species refer to the Assessment of the Marine Enviornment contained within the CEA, **Appendix "A"**.

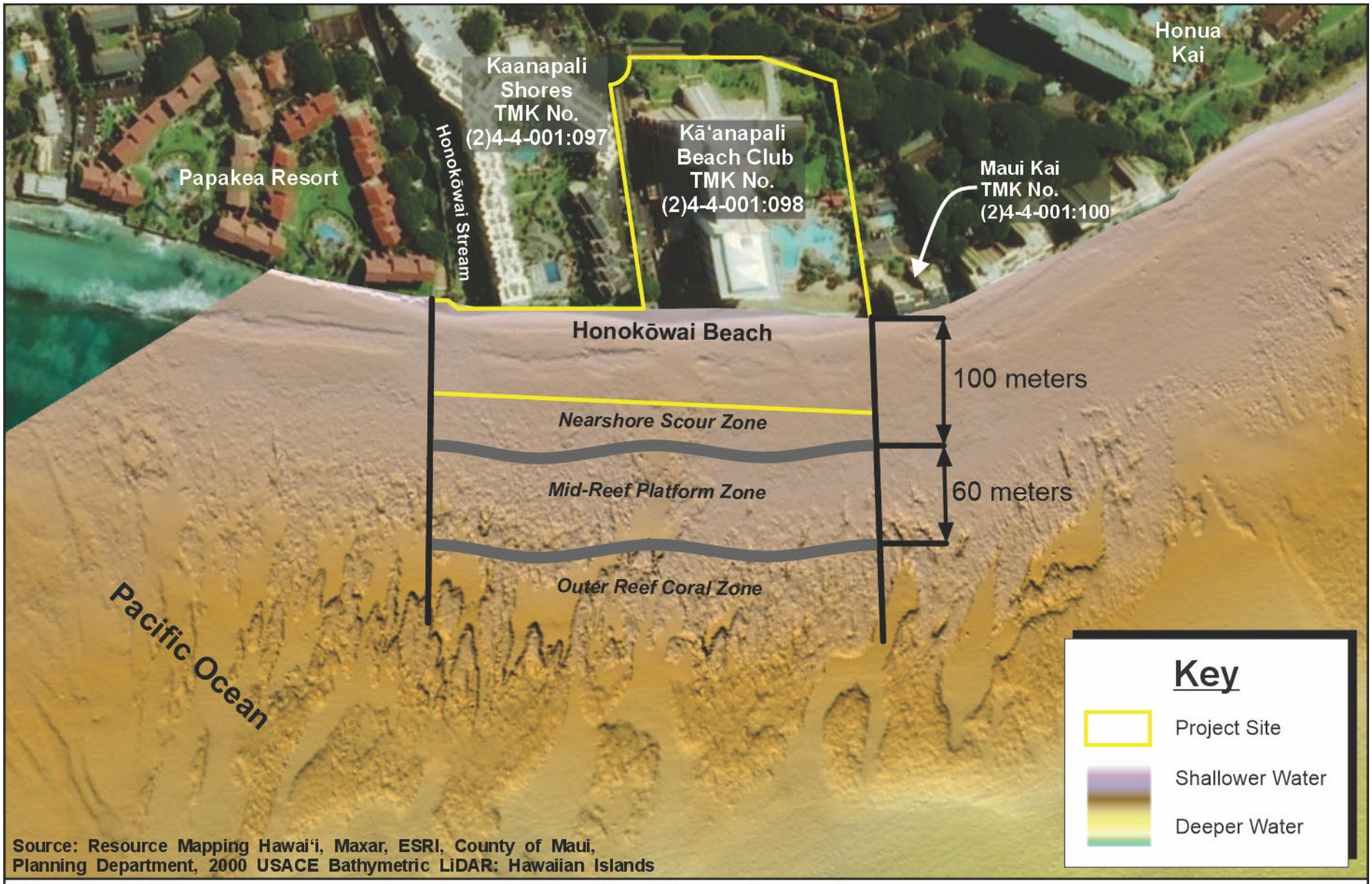


Figure 22

Ho'āla Honokōwai
Bathymetry Zones

0 175 350
Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\Bathy.Zones

Mid-Reef Platform Zone

The mid-reef platform zone begins approximately 100 m seaward of Honokōwai Beach and has a depth of approximately one (1) to two (2) meters. With increasing depth and distance from shore, the mid-reef platform zone consists of isolated coral colonies. The coral colonies observed were predominantly cauliflower coral (*Pocillopora meandrina),* lobe coral *(Porites lobate),* and ringed rice coral (*Montipora spp*.). The mid-reef platform is still exposed to consistent wave energy, which limits the growth and diversity of corals. Overall, 29 species of macroalgae were identified in the mid-reef platform zone with 14 of these classified as rarely observed, 12 classified as commonly observed, and three (3) classified as abundantly observed. The most conspicuous species of macroalgae was the green calcareous alga *Halimeda kanaloa*, which was present as small fields scattered across the mid-reef platform zone. *Dictyota acutiloba* and *Padina sanctae-crucis* were also classified as abundantly observed as they were commonly observed in tufts and patches scattered across the zone. Other than these three (3) species, no other macroalgae were observed in dense aggregations within the mid-reef platform. Coralline algae, turf algae, and the brown alga *Turbinaria ornata* were more abundantly observed on the mid-reef than the outer reef owing to their ability to successfully occupy higher energy areas. The ro10ck boring sea urchin (*Echinometra mathaei*) was observed in the mid-reef platform and can withstand wave action by burrowing into the limestone reef surface. Between the surveys conducted in 2021 and 2024, there were 36 species of fish observed. The most commonly observed fish included schools of the black triggerfish (*Melichthys niger*), roving schools of mixed surgeonfishes (*acanthurids*), and wrasses (*labrids*).

Outer-Reef Coral Zone

At approximately 140 m seaward of Honokōwai Beach, the mid-reef platform zone transitions into the outer-reef coral zone, characterized by water depths of two (2) to eight (8) meters with abundant coral colonies and numerous fish species. The change in water depth from the mid-reef platform zone allows for more abundant live corals, including massive colonies of lobe coral (*Porites lobata*), interconnected mats of finger coral (*Porites compressa*), and encrusting colonies of ringed rice coral (*Montipora patula* and *M. capitata*). Many of the coral colonies are up to one (1) meter in diameter, indicating that they are several decades old. Eight (8) species of macroalgae were identified in the outer reef coral zone with five (5) of these classified as rarely observed and three (3) classified

as commonly observed. All three (3) species classified as rarely observed were crustose coralline algae. No species of frondose macroalgae were classified as commonly or abundantly observed within the outer reef coral zone.

Fish are more common in the outer-reef coral zone in comparison to the nearshore scour zone and mid-reef platform. During the surveys in 2021 and 2024, 38 species were observed in the outer-reef coral zone. The most common fish were mixed schools of surgeonfish (*Acanthurids*) transiting the outer margin of the reef. Other commonly observed fish were seven (7) species of butterflyfishes (*Chaetodontidae*), wrasses (*Labridae*) and damselfishes (*Pomacentridae*). Macro-invertebrate species present in the outer-reef coral zone include several species of sea urchins (*Echinometra mathaei, Echinothrix diadema, Tripneustes gratilla,* and *Heterocentrotus mamillatus*) and the green sea turtle (*Chelonia mydas)*.

The outer-reef coral zone terminates at a depth of approximately seven (7) meters in a margin between a limestone platform and sand plain. Seaward of the outer-reef coral zone, the ocean bottom composition consists of a flat, gently sloping sand plain. For a more detailed description of the nearshore environment, refer to the Assessment of the Marine Environment contained within the CEA, **Appendix "A"**.

Sand Recovery Site

Offshore investigations by SE identified a suitable sand deposit approximately 1.5 miles south of the Project Site, approximately 1,500 to 2,200 ft. offshore of Puʻu Kekaʻa at a depth of 120 to 170 ft. The only prominent biotic colonizer observed in the Sand Recovery Site was a common macroalgae *Halimeda kaloana*; however, the area is within the suitable habitat range for Kona Crab (*Ranina ranina*) and nabeta (Laenihi, *Xyrichtys umbrillatus*). For a more detailed discussion of the Sand Recovery Site, refer to the CEA in **Appendix "A"**, Section 5.2.

b. Potential Impacts and Mitigation Measures

A Baseline Assessment of Marine Water Chemistry and Marine Biotic Communities prepared by Marine Research Consultants, Inc. assessed potential impacts to the nearshore environment associated with the three (3) beach restoration action alternatives and the No Action alternative. Refer to the Assessment of the Marine Environment contained within the CEA, **Appendix "A"**. As described below, work for the three (3) beach restoration alternatives would occur within the nearshore scour zone. All

the beach restoration alternatives involve dredging sand from the Sand Recovery Site and have the potential to cause construction-related impacts to the marine environment. There may be construction-related impacts during the sand recovery process including potential turbidity and displacement of marine organisms. These impacts are expected to be temporary and not have a broader regional impact, as the Sand Recovery Site is part of a much larger sand field. A more detailed analysis of potential impacts and mitigation measures for the Sand Recovery Site can be found in the CEA in **Appendix "A"**, Section 5.2. The impacts and mitigation measures at the Project Site for each alternative are described below.

Beach Stabilization

The Beach Stabilization alternative would be confined to the nearshore scour zone, which extends from the existing shoreline to approximately 100 m seaward. There may be temporary construction-related impacts from this action alternative, including elevated turbidity levels during and post-construction. These impacts would be confined to the nearshore scour zone, which periodically experiences elevated turbidity during periods of high surf and heavy rainfall events. The beach width would be increased from onshore to offshore, and a containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement in the water. There would also be a temporary disruption to marine species in the vicinity of active work areas, but this disruption would be confined to the nearshore scour zone which consists mostly of rocks and cobbles.

After construction, there would be a permanent displacement of fish populations within the footprint of the groins and sand fill. However, this displacement would again be limited to the nearshore scour zone where corals do not occur, and fish biomass and biodiversity are very low. The groins would create new marine habitat with the potential to increase fish biomass and biodiversity in the nearshore scour zone. The interstitial spaces between boulders would provide additional habitat for benthic and sessile organisms which would provide additional foraging resources for fish.

To forecast impacts of a potential increase in nearshore habitat complexity, the Beach Stabilization alternative can be compared to a completed groin project. A project at Iroquois Point on the Island of O'ahu stabilized the shoreline by constructing groins in 2013, and the project area was monitored over the following years for changes to the nearshore environment. Iroquois Point is located on the central south shore of O'ahu

between the Pearl Harbor entrance channel and ‘Ewa Beach. Construction consisted of nine (9) rock rubble mound T-head groins with added beach sand along an approximately 4,200 ft. section of shoreline. A marine monitoring program was developed to assess positive and negative impacts on the nearshore reef flat, with monitoring conducted both within the project area and at reference locations before and after construction (AECOS, 2012).

Prior to construction, the submerged project area at Iroquois Point was similar to the nearshore environment at Honokōwai Beach, consisting mostly of rubble and sand which offered limited topographical relief and structural complexity. This area supported few fishes with low species richness and a sparse coral assemblage. The project transformed portions of the nearshore reef flat into sandy beach and rock rubble mound groins, providing a more complex habitat for fish and other marine species. Three (3) years after completion of the project, the reef flat in the monitoring area had about the same amount of sand, approximately double the amount of rubble, and reduced macroalgal and turf cover. The basalt boulders of the new groins support an abundance of fishes, and fish species richness and diversity are much greater than before placement of the groins. The groins offer a substratum for sessile organisms, such as corals, which increased the habitat complexity for motile fauna like crustaceans (AECOS, 2012). Based on the history of monitoring at the Iroquois Point site, similar positive impacts to the nearshore environment at Honokōwai Beach are anticipated for Beach Stabilization.

Beach Nourishment

Beach Nourishment may result in seaward extension of sand into the intertidal[17] and subtidal[18] areas within the nearshore scour zone and would alter benthic conditions within the footprint of beach fill during the anticipated 10-year lifespan of the alternative. Seaward extension of sand into intertidal and subtidal areas is anticipated to be minor and would diminish as the beach erodes naturally. As corals do not occur in the nearshore scour zone, such a situation does not appear to present any potential for significant impact as the nearshore is already composed of pavement, cobbles, and sand. As such, there are no ongoing impacts to the marine and nearshore environment anticipated for Beach Nourishment.

[17] Intertidal - the area between high and low tide where the land and ocean meet.
[18] Subtidal - the area of the ocean that's below the low tide line and is always underwater, except during very low tides.

It is noted there may be construction-related impacts such as elevated turbidity levels, but these impacts would be confined to the nearshore scour zone which already experiences elevated turbidity during periods of high surf and heavy rainfall events. The beach width would be increased from onshore to offshore, and a containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement in the water.

Beach Maintenance

The Beach Maintenance alternative would have similar impacts to the Beach Nourishment alternative. These impacts, however, would be recurring as the beach is nourished approximately once every 10 years. Beach Maintenance would alter benthic conditions within the footprint of sand placement during the anticipated 50-year lifespan of the alternative. Repeatedly placing sand into the intertidal and subtidal areas is not anticipated to significantly impact the marine and nearshore environment, since this area is absent of corals and primarily composed of pavements, cobbles, and sand.

No Action

It is assumed that under the No Action alternative, the temporary erosion skirt would be demolished and removed, which could temporarily increase turbidity in nearshore waters. As the beach and backshore erode in the absence of any beach stabilization or maintenance actions, there may be ongoing negative impacts associated with deteriorating water quality, habitat loss, and elevated turbidity levels.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have any negative impacts on the marine and nearshore environment. Any construction-related impacts would be mitigated by BMPs.

Summary

The Beach Stabilization alternative would displace marine life within the footprint of the groins, but would increase fish habitat leading to an expected net gain in biomass and biodiversity. The Beach Nourishment and Beach Maintenance alternatives are not anticipated to have ongoing adverse impacts to the marine environment. There may be construction-related impacts during the sand recovery process including potential turbidity and displacement of marine organisms. These impacts are

expected to be temporary and not have a broader regional impact, as the Sand Recovery Site is part of a much larger sand field. The No Action alternative may result in ongoing negative impacts to the marine and nearshore environment from deteriorating water quality, habitat loss, and elevated turbidity levels. There may be construction-related impacts such as elevated turbidity levels, but these impacts would be confined to the nearshore scour zone which already experiences variable turbidity depending on ocean and wave conditions.

Action Alternative	Anticipated Impact to the Marine and Nearshore Environment
Beach Stabilization	**Construction-Related Impacts:** Elevated turbidity and disruption to marine species in the vicinity of active work areas **Ongoing Impacts:** Permanent displacement of fish populations within the footprint of groins and beach fill; new habitat creation with potential to increase fish biomass and biodiversity **Mitigation:** A containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement and groin construction; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"** for a full list of BMPs
Beach Nourishment	**Construction-Related Impacts:** Elevated turbidity and disruption to marine species in the vicinity of active work areas **Ongoing Impacts:** Seaward extension of sand into intertidal and subtidal areas with limited impact to marine species **Mitigation:** A containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"** for a full list of BMPs

Action Alternative	Anticipated Impact to the Marine and Nearshore Environment
Beach Maintenance	**Construction-Related Impacts:** Elevated turbidity and disruption to marine species in the vicinity of active work areas **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action; seaward extension of sand into intertidal and subtidal areas with limited impact to marine species **Mitigation:** A containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"** for a full list of BMPs
No Action	**Construction-Related Impacts:** Demolition and removal of temporary erosion skirt may temporarily increase turbidity **Ongoing Impacts:** Beach and backshore erosion may have negative impacts of deteriorating water quality, habitat loss, and elevated turbidity levels **Mitigation:** A containment system of silt curtains and fences will be used to limit the potential for turbidity during demolition and removal of the erosion skirt; refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**

14. Marine Water Quality

a. Existing Conditions

A Baseline Assessment of Marine Water Chemistry and Marine Biotic Communities was completed by Marine Research Consultants, Inc. in 2024, and is contained within the CEA, **Appendix "A"**. Water samples were taken along three (3) survey transects in 2021 and 2024, originating at the beach and extending 200 m offshore. During each sampling event, samples were collected at eight (8) locations along the three (3) transects at approximately 0.1, 1, 5, 10, 20, 50, 100, and 200 meters from the shoreline. This sampling technique was designed to span the greatest range of variability for water quality parameters with respect to material input at the shoreline. Sampling was concentrated close to shore because this area receives the most terrestrial input. Water quality parameters were evaluated with criteria designated for open coastal waters by the State of Hawai‘i, Department of Health (DOH) Water Quality Standards. These

criteria include total dissolved nitrogen (TDN), nitrate and nitrite nitrogen (NO_3), ammonium nitrogen (NH_4+), total dissolved phosphorous (TDP), Chlorophyll a (Chl a), turbidity, temperature, acidity (pH), and salinity. Silica (Si) and orthophosphate phosphorous (PO_4^{3-}) were also analyzed to inform the degree of biological activity and groundwater mixing.

There were no streams discharging into the ocean near the Project Site at the time of sampling. The results of the water quality survey indicate a small amount 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 nearshore scour zone, which is composed of rocks, sand, and cobble. Turbidity in the water column peaks at the shoreline and decreases steadily with distance from shore as a result of wave resuspension of naturally occurring bottom sediments. Generally, the dissolved nutrients Si, TN, NO_3- and NH_4+ were elevated in samples taken within 10 to 20 m of the shoreline. Salinity displayed the opposite trend, with lower concentrations close to shore. These trends indicate low-salinity groundwater, with high concentrations of Si and NO_3-, percolating into the ocean from the shoreline.

In many areas of the Hawaiian Islands, it is common for groundwater percolation to cause steep gradients of increasing salinity and decreasing nutrients with increasing distance from shore; however, these gradients off Honokōwai Beach are comparatively small, suggesting that there is only a low volume of groundwater discharge which is rapidly mixed by physical forces. Since the sampling area is exposed to wind and waves, the zone of groundwater mixing is much closer to shore than other areas of West Maui where semi-enclosed embayments occur or physical mixing processes are less vigorous. Turbidity also displayed peak values near the shoreline, with diminishing values moving seaward, likely due to decreasing wave energy as depth increases.

The values of NH_4+ were elevated near the shoreline of Transect 3 during the 2024 sampling when compared to the other transects, directly seaward of Honokōwai Stream (refer to the Baseline Assessment of Marine Water Chemistry and Marine Biotic Communities contained within the CEA, **Appendix "A"**). A sand plug typically obstructs the mouth of Honokōwai Stream, limiting the surface connection to nearshore waters. The elevated values of NH_4+ for Transect 3 at the time of sampling suggests there is subsurface discharge of stagnated stream water into the nearshore environment.

Compliance with DOH Water Quality Standards

During the survey conducted in 2021, the concentration of NH_4+ exceeded DOH limits five (5) times, but these occurrences were randomly distributed across the transects. The nearshore turbidity values also exceeded DOH limits but were likely a result of resuspension of naturally occurring sediment from wave action. Beyond 10 m from shore, all turbidity values were below DOH standards.

During the 2024 survey NH_4+ exceeded DOH standards three (3) times for samples taken near the shoreline. The elevated values of NH_4+ caused TN to also exceed DOH limits near the shoreline. Chl a was also elevated near the shoreline. Like the 2021 survey, it is likely that wave action caused these elevated turbidity and chlorophyll levels through the resuspension of plant matter and sediment.

A summary of the parameters evaluated, and results are presented in **Table 7**.

Table 7. Water Quality Survey Results, 2021 and 2024

Water Quality Parameter	Summary of Survey Results
Phosphate (PO_4^{3-})	Did not exceed DOH Water Quality Standards for “open coastal water”.
Nitrate (NO_3^-)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Ammonia (NH_4^+)	Elevated between 0-10 m from shore along transect 3 in 2024 survey.
Silica (Si)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Total Phosphorous (TP)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Total Nitrogen (TN)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Total Organic Phosphorous (TOP)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Total Organic Nitrogen (TON)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Turbidity (TURB)	Elevated between 0-10 m from shore in 2021 and 2024 surveys.
Salinity (SALT)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Acidity (pH)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Chlorophyll a (Chl a)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Temperature (TEMP)	Did not exceed DOH Water Quality Standards for “open coastal water”.
Dissolved Oxygen (Diss. O_2)	Did not exceed DOH Water Quality Standards for “open coastal water”.

For a full analysis and discussion of water quality parameters, refer to the Baseline Assessment of Marine Water Chemistry and Marine Biotic Communities contained within the CEA, **Appendix "A"**.

It is worth noting that the County of Maui Planning Department provided a comment letter during the EISPN comment period recommending the Applicant partner with local community groups to monitor water quality. Hui O Ka Wai Ola, a community group consisting of volunteers, scientists, supporters, and partner groups, has been conducting water quality monitoring at Honokōwai Beach since 2016. Their monitoring results have confirmed that high levels of turbidity and nitrates are prevalent along the leeward coast of Maui. Their most recent report (2022) found that turbidity and nitrate levels at Honokōwai Beach far exceed Hawai'i Department of Health (DOH) water quality standards, and that turbidity is expected to increase over time in northern West Maui, as coastal erosion worsens with sea level rise. The report notes that the existing temporary erosion protection structure at Kā'anapali Beach Club has helped to reduce turbidity levels at Honokōwai Beach.

b. <u>Potential Impacts and Mitigation Measures</u>

The Baseline Assessment of Marine Water Chemistry and Marine Biotic Communities prepared by Marine Research Consultants, Inc. assessed potential impacts to marine water quality for the three (3) beach restoration action alternatives and the No Action alternative. Refer to the Baseline Assessment of Marine Water Chemistry and Marine Biotic Communities contained within the CEA, **Appendix "A"**. As described below, work for the three (3) beach restoration alternatives would occur within the nearshore scour zone and is anticipated to cause construction-related impacts to water quality that exceed DOH standards. This increase would be anticipated to decrease exponentially and return to normal background levels in a relatively short period of time. These impacts are anticipated to be minor and temporary in nature.

The Best Management Practices Plan contained within the CEA (**Appendix "A"**) identifies BMPs to be implemented, including measures for erosion and sediment control, oil and spill containment, and water quality monitoring. A containment system will be required in the area of active sand placement to reduce the potential for turbidity impacts to coastal waters during sand placement. Silt curtains and fences will be required as well. An Emergency Spill Response Plan will be implemented

to detail procedures for managing the accidental release of petroleum products into the aquatic environment during construction.

An Applicable Monitoring and Assessment Program (AMAP) has been prepared for the Project. The AMAP is contained within the CEA (**Appendix "A"**). Six (6) water quality monitoring stations have been established, which will analyze pH, turbidity, salinity, temperature, and dissolved oxygen. Sampling will occur before, during and after construction. During construction, water samples will be collected twice a month from each of the six (6) monitoring stations. Following the completion of construction, three (3) increments of sampling will be conducted on a weekly basis commencing at least one (1) week after completion of in-water work. If water quality parameters fall outside of pre-construction baselines, additional BMPs or revisions to the construction plan will occur.

There may be ongoing positive impacts to water quality as beach and backshore erosion is avoided. The anticipated impact on water quality for each action alternative is discussed below.

Beach Stabilization

The Beach Stabilization action is not anticipated to have a significant ongoing impact to marine water quality. Results of the water quality survey indicate small amounts of groundwater entering the ocean near the shoreline which is rapidly mixed by wave action within the nearshore scour zone. There may be construction-related impacts such as elevated turbidity levels, but these impacts would be confined to the nearshore scour zone which already experiences variable turbidity depending on ocean and wave conditions. The beach width would be increased from onshore to offshore, and a containment system of silt curtains and fences will be used to limit the potential for turbidity during sand placement in the water.

By preventing beach and backshore erosion, Beach Stabilization would provide a benefit of limiting impacts to water quality from erosion and sedimentation. The design of the northern terminal groin may provide a potential secondary benefit of keeping the mouth of Honokōwai Stream from accumulating sand, preventing water from stagnating in the stream before flushing into the nearshore waters.

Beach Nourishment

Beach Nourishment is a one-time placement of sand on Honokōwai Beach with an anticipated lifespan of 10 years. There may be a construction-related impact of elevated turbidity during and immediately post-construction. Turbidity levels would be mitigated by BMPs and would normalize as the beach profile equilibrates. Beach Nourishment has a lifespan of approximately 10 years and would temporarily delay the effects of No Action, which include beach and backshore erosion that would ultimately degrade water quality. Water quality is likely to be negatively impacted as the beach and backshore erode in the absence of any groins.

Beach Maintenance

Beach Maintenance is not anticipated to adversely impact marine water quality. The negative impacts of No Action would be avoided for the anticipated 50-year lifespan of the alternative. There may be a construction-related impact of elevated turbidity during and post-construction. Turbidity level increases would be mitigated by BMPs and would normalize as the beach profile equilibrates. This impact would be recurring with each nourishment action, approximately once every ten years.

No Action

No Action assumes that the temporary erosion skirt would be removed, which may result in construction-related turbidity increases. As the beach and backshore erode over time in the absence of any stabilization, nourishment, or maintenance actions, there may be negative ongoing impacts associated with deteriorating water quality and elevated turbidity levels.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have significant negative impacts on marine water quality. Any construction-related impacts would be mitigated by BMPs.

Summary

Each of the proposed alternatives has the potential to cause construction-related impacts to water quality such as an increase of turbidity in nearshore waters. These impacts will be mitigated by BMPs including silt curtains and fences for active work areas. Refer to the Best Management

Practices Plan contained within the CEA, **Appendix "A"**. In addition, an AMAP has been prepared which specifies water quality sampling and testing to be conducted to confirm the BMP's effectiveness. Refer to the AMAP within the CEA, **Appendix "A"**.

Potential related secondary actions, if implemented, are not anticipated to have significant negative impacts on marine water quality. The No Action alternative may result in ongoing negative impacts to marine water quality through beach and backshore erosion. The Beach Nourishment alternative would delay these negative impacts, but water quality may be impaired after the anticipated 10-year lifespan. Beach Maintenance would avoid the negative impacts of No Action, but there would be recurring construction-related impacts. Beach Stabilization has the potential to improve ongoing marine water quality, as the negative impacts from No Action would be avoided, and there would be a potential secondary benefit to water quality from preventing sand from accumulating at the Honokōwai Stream mouth.

Action Alternative	Anticipated Impact to Marine Water Quality
Beach Stabilization	**Construction-Related Impacts:** Elevated turbidity in the vicinity of active work areas **Ongoing Impacts:** Positive impact of limiting water quality deterioration from unstable beach and backshore erosion; potential secondary benefit from preventing sand from accumulating at the Honokōwai Stream mouth. **Mitigation:** Measures for erosion and sediment control, oil and spill containment, and water quality monitoring; refer to the Best Management Practices Plan and Applicable Monitoring and Assessment Program contained within the CEA (**Appendix "A"**)

Action Alternative	Anticipated Impact to Marine Water Quality
Beach Nourishment	**Construction-Related Impacts:** Elevated turbidity in the vicinity of active work areas **Ongoing Impacts:** Negative impact of water quality deterioration from an unstable beach and backshore following the anticipated 10-year lifespan of the initial nourishment **Mitigation:** Measures for erosion and sediment control, oil and spill containment, and water quality monitoring; refer to the Best Management Practices Plan and Applicable Monitoring and Assessment Program contained within the CEA **(Appendix "A")**
Beach Maintenance	**Construction-Related Impacts:** Elevated turbidity in the vicinity of active work areas **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action (approximately once every 10 years) **Mitigation:** Measures for erosion and sediment control, oil and spill containment, and water quality monitoring; refer to the Best Management Practices Plan and Applicable Monitoring and Assessment Program contained within the CEA (**Appendix "A"**)
No Action	**Construction-Related Impacts:** Elevated turbidity in the vicinity of active work areas from demolition and removal of existing temporary erosion skirt **Ongoing Impacts:** Negative impact of water quality deterioration from an unstable beach and backshore erosion, resulting in the loss of approximately 60,946 s.f. (1.4 acres) of land, and the discharge of approximately 19,542 cy of terrigenous sediment into the ocean **Mitigation:** Measures for erosion and sediment control, oil and spill containment, and water quality monitoring; refer to the Best Management Practices Plan and Applicable monitoring and Assessment Program contained within the CEA (**Appendix "A"**)

15. Fisheries

a. Existing Conditions

The Western Pacific Regional Fishery Management Council (WPRFMC) oversees the Pacific Islands management area and develops fisheries management plans for the region. The WPRFMC restructured its management framework from species-based fisheries management plans to place-based fishery ecosystem plans. The Hawai‘i Archipelago Fishery Ecosystem Plan (FEP) establishes a framework for the WPRFMC to manage fishery resources and identifies management unit species and essential fish habitats (EFH). EFH is defined as "*those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity*". According to the NOAA EFH Mapper, the Project Site and Sand Recovery Site are within the EFH area for a number of species including Kona Crab (*Ranina ranina*), corals, Jacks, Snappers, and Jobfish. WPRFMC distinguishes areas within EFHs that are of particular importance, denoted as Habitat Areas of Particular Concern (HAPC). These areas are located within designated EFHs and meet one (1) or more of the following considerations: (a) the ecological function provided by the habitat is important; (b) the habitat is sensitive to human-induced environmental degradation; (c) development activities are, or will be, stressing the habitat type; and/or (d) the habitat type is rare. Neither the Project Site nor the Sand Recovery Site lies within a HAPC.

At a State level, the DLNR Division of Aquatic Resources (DAR) is responsible for managing marine resources in Hawai‘i. The Project Site and Sand Recovery Site are near two (2) DAR managed areas: the Lay Net Fishing Prohibited Area and Kahekili Herbivore Fisheries Management Area. It is unlawful to use lay nets within three (3) miles of the shoreline around the entire island of Maui. The Kahekili Herbivore Fisheries Management Area is located off North Kā‘anapali. This management area covers waters from Honokōwai Beach Park to Hanaka‘ō‘ō Beach, the seaward boundary extends approximately 4,000 ft. from the shoreline. Within this fishery management area, it is prohibited to take certain species of fish including rudderfish (nenue), parrotfish (uhu), or surgeonfish. These herbivorous fish are a natural control for marine algae and are intended to help the marine ecosystem in the area. It is permitted to take other fin fish and invertebrates provided they are not on the prohibited species list (HAR § 13-60.7). While Honokōwai Beach and the Project Site are within the Kahekili Herbivore Fisheries Management Area, the Sand Recovery Site is

outside the southern end of the management area. See **Figure 23** (Marine Managed Areas).

b. Potential Impacts and Mitigation Measures

Fisheries can be described and impacted from an economic, cultural, and recreational perspective. Further discussion on fisheries and fish as a cultural resource and potential impacts in this Draft EIS can be found in Section III.B.3 Cultural Resources. Potential impacts to fishing as a recreational activity are discussed in Section III.B.7 Recreational Resources.

Beach restoration has the potential to impact EFH, which may be temporarily disrupted during sand recovery and placement. There may be construction-related impacts to water quality, increased noise levels, and impacts to the available spawning area for marine species. EFH consultation would be required during the Department of the Army permit processing for in-water work. The Proposed Action involves the recovery of sand from the identified Sand Recovery Site offshore of Kāʻanapali. The Sand Recovery Site, located approximately 1,500 to 2,200 ft. offshore of Puʻu Kekaʻa with depths ranging from 120 to 170 ft., is within the range of habitat for culturally important fisheries including the Kona Crab (Ranina ranina) and nabeta (Laenihi, Xyrichtys umbrillatus). There is anticipated to be a potential take of Kona Crab that may be living within the Sand Recovery Site, but the regional impact is anticipated to be negligible as the Sand Recovery Site is part of a much larger sand field system. Any impact would be temporary, limited to the sand recovery period, and Kona Crab are anticipated to repopulate the area after sand recovery is complete. To the extent feasible, sand recovery may be scheduled outside of the Kona Crab spawning season of May to August to limit impacts to propagation.

There is also anticipated to be a temporary displacement impact to fish, including the nabeta, transiting within the Sand Recovery Site. It is noted that the nabeta are solitary and the number anticipated to be displaced from sand recovery would be limited and temporary.

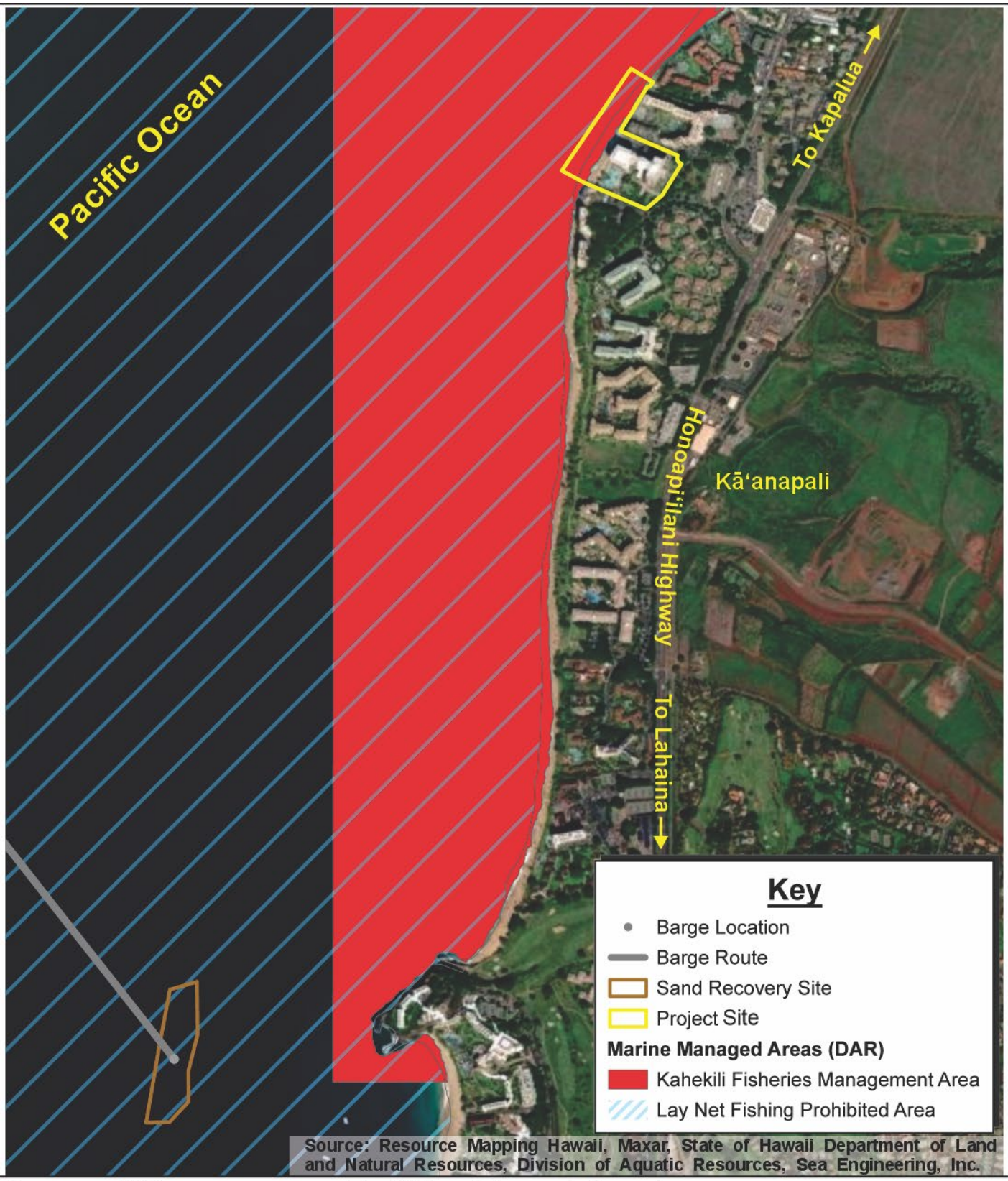


Figure 23

Ho'āla Honokōwai
Marine Managed Areas

0 625 1,250
Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\MarineMgd

Beach Stabilization

The Beach Stabilization alternative would involve sand recovery offshore of Kāʻanapali at the Sand Recovery Site. There may be construction-related impacts to fisheries during the sand recovery process, which is anticipated to last 13 weeks, including potential displacement of marine life and habitat loss. These impacts would be mitigated by BMPs, including the use of an environmental clamshell bucket. The environmental clamshell bucket can range in size from 1 to 20 cy. Assuming a 15-cy bucket is used, the environmental clamshell bucket has a small footprint of approximately 13 ft by 13 ft and penetrates two (2) to six (6) feet into the sea floor. As such, disturbance to fish and other marine organism habitat would be limited. Transient fish species would be able to avoid the dredge, and the amount of water that is accumulated from clamshell dredging is much less than other dredging methods, limiting impacts to fish or fish eggs suspended in the water column.

Beach Stabilization would alter EFH within the structural footprint of the groins. This area is currently a barren scour zone that is composed of sand, rocks, and cobble. The groins would provide new and improved EFH by providing bare, stable surfaces for recruitment of corals, algae, and other invertebrates. The interstitial spaces between the boulders would provide habitat for cryptic benthic and sessile organisms which offer foraging resources for fish. This new and improved EFH would increase as sea levels continue to rise and portions of the groins below MSL increase proportionately.

Beach Nourishment

The Beach Nourishment alternative would involve sand recovery offshore of Kāʻanapali at the Sand Recovery Site. There may be temporary impacts to fisheries, similar to Beach Stabilization, during the sand recovery process including marine life displacement and habitat loss. The sand recovery process is anticipated to last 11 weeks, and these impacts would be mitigated by BMPs including the use of an environmental clamshell bucket for dredging. Beach Nourishment would temporarily alter EFH at the Project Site within the footprint of sand placement. The impacted area would be limited to the 20,540 s.f. area of beach fill seaward of the existing beach toe, and the impacted area would decrease as the beach erodes.

Beach Maintenance

Anticipated impacts for Beach Maintenance are anticipated to be similar to Beach Nourishment. The frequency and duration of impacts are anticipated to be greater due to the recurring nourishment actions. The Beach Maintenance alternative would involve sand recovery offshore of Kāʻanapali at the Sand Recovery Site. There may be temporary impacts during the sand recovery process, which would be recurring due to the method of periodically nourishing the beach. There are anticipated to be a total of 20 weeks of sand recovery for the Beach Maintenance alternative. Impacts would be mitigated by BMPs, including the use of an environmental clamshell bucket for dredging.

No Action

The No Action alternative is not anticipated to adversely impact fisheries from sand recovery activities. Ongoing erosion of the beach and backshore may adversely impact the marine environment and EFH in the vicinity of the Project Site as water quality and marine habitats are degraded. Refer to CEA (**Appendix "A"**), Section 7.1.4.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to adversely impact fisheries.

Summary

The beach restoration alternatives are anticipated to have some impact on fisheries and EFH from the sand recovery process, which involves dredging with an environmental clamshell bucket. Neither the Sand Recovery Site nor the Project Site is located within any HAPCs as designated by NOAA. The Beach Nourishment alternative is anticipated to have minor and temporary impacts on EFH, while impacts from Beach Maintenance are expected to be greater due to recurring sand recovery and placement. Beach Stabilization would alter EFH within the footprint of the groins, but would positively impact EFH by creating improved habitat that may increase fish biomass and biodiversity. The No Action alternative is not anticipated to adversely impact fisheries as there is no sand recovery involved, but EFH in the vicinity of the Project Site may be impacted from ongoing erosion of the beach and backshore. The potential related secondary actions are not anticipated to adversely impact fisheries.

Action Alternative	Anticipated Impact to Fisheries
Beach Stabilization	**Construction-Related Impacts:** Impacts to Sand Recovery Site during the sand recovery period, including habitat loss and displacement of marine life **Ongoing Impacts:** Alterations to existing habitat within the groin footprints which would offer improved habitat and increase fish biomass and biodiversity **Mitigation:** Use of an environmental clamshell bucket for sand recovery; to the extent feasible, sand recovery may be scheduled outside of the Kona Crab spawning season of May to August to limit impacts to propagation; refer to the Best Management Practices Plan within the CEA in **Appendix "A"** for a full list of BMPs
Beach Nourishment	**Construction-Related Impacts:** Impacts to Sand Recovery Site during the sand recovery period, including habitat loss and displacement of marine life **Ongoing Impacts:** No impact **Mitigation:** Use of an environmental clamshell bucket for sand recovery; to the extent feasible, sand recovery may be scheduled outside of the Kona Crab spawning season of May to August to limit impacts to propagation; refer to the Best Management Practices Plan within the CEA in **Appendix "A"** for a full list of BMPs
Beach Maintenance	**Construction-Related Impacts:** Impacts to Sand Recovery Site during the combined sand recovery period, including habitat loss and displacement of marine life **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action **Mitigation:** Use of an environmental clamshell bucket for sand recovery; to the extent feasible, sand recovery may be scheduled outside of the Kona Crab spawning season of May to August to limit impacts to propagation; refer to the Best Management Practices Plan within the CEA in **Appendix "A"** for a full list of BMPs
No Action	**Construction-Related Impacts:** No impact **Ongoing Impacts:** Potential impacts to fisheries in vicinity of Project Site as beach and backshore erosion degrades water quality

16. Air Quality

a. Existing Conditions

Overall, the air quality in the region is considered good. There are no point sources of airborne emissions in the immediate vicinity of the Project Site. Although minimal, airborne pollutants are largely attributable to vehicular traffic on the surrounding roadways.

b. Potential Impacts and Mitigation Measures

The Proposed Action of beach restoration would involve construction activity at the Project Site, Sand Recovery Site, and Kahului Harbor which may cause temporary impacts of fugitive dust and emissions from construction vehicles. The Best Management Practices Plan within the CEA (**Appendix "A"**) outlines dust control measures to be implemented during construction.

Beach Stabilization

Beach Stabilization is not anticipated to have ongoing impacts on air quality. There may be some construction-related impacts on air quality in the form of fugitive dust emissions from construction activities or emissions from construction equipment. Fugitive dust emissions can be mitigated by BMPs, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks.

Beach Nourishment

Beach Nourishment is not anticipated to have any ongoing impacts on air quality. During construction, there may be temporary impacts to air quality in the form of fugitive dust or emissions from construction equipment. It is noted these construction-related impacts would be less significant than the Beach Stabilization alternative, as there would be no construction of groins at the Project Site.

Beach Maintenance

Beach Maintenance is anticipated to have similar construction-related impacts to air quality as the Beach Nourishment alternative. However, it is noted that these impacts would be recurring as the beach is maintained approximately once every ten years. The Beach Maintenance alternative is not anticipated to have ongoing impacts on air quality.

No Action

The No Action alternative is not anticipated to adversely impact air quality. As the beach becomes progressively narrower over time and the backshore becomes more exposed to wave-induced erosion, there may be a negative impact on air quality in the form of windblown dust.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have significant negative impacts on air quality. Any construction-related impacts would be mitigated by BMPs.

Summary

There are no anticipated significant impacts to air quality through the Proposed Action alternatives, potential related secondary actions, or the No Action alternative. Construction-related activities may temporarily impact air quality, but these impacts would be mitigated through BMPs.

Action Alternative	Anticipated Impact to Air Quality
Beach Stabilization	**Construction-Related Impacts:** Fugitive dust and emissions from construction equipment **Ongoing Impacts:** No impact **Mitigation:** Dust control measures, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks; refer to the BMP Plan within the CEA (**Appendix "A"**)
Beach Nourishment	**Construction-Related Impacts:** Fugitive dust and emissions from construction equipment **Ongoing Impacts:** No impact **Mitigation:** Dust control measures, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks; refer to the BMP Plan within the CEA (**Appendix "A"**)

Action Alternative	Anticipated Impact to Air Quality
Beach Maintenance	**Construction-Related Impacts:** Fugitive dust and emissions from construction equipment **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action **Mitigation:** Dust control measures, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks; refer to the BMP Plan within the CEA (**Appendix "A"**)
No Action	**Construction-Related Impacts:** Fugitive dust as temporary erosion skirt is demolished and removed **Ongoing Impacts:** Potential for windblown dust as backshore erodes **Mitigation:** Dust control measures, including watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering of open-bodied trucks; refer to the BMP Plan within the CEA (**Appendix "A"**)

17. Greenhouse Gas Emissions

a. Existing Conditions

The greenhouse effect is the natural ability of gases in the Earth's atmosphere to trap heat from the sun. Greenhouse gases (GHG) such as Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O) play a crucial role in trapping solar radiation from the sun to insulate the earth. Without the greenhouse effect, life as we know it would not exist on earth. Despite the importance of GHG, too much of these gases can have a negative effect as there is too much insulation, which creates a warmer average temperature on the earth. A temperature increase of just two (2) degrees Celsius from pre-industrial levels is considered a critical threshold for the earth being able to maintain natural functions as we know them. As such, it has been deemed important to monitor GHG emissions on a global scale.

To combat climate change, international cooperatives, countries, and states have implemented goals and legislation to reduce emissions. The most notable climate framework came from the Paris United Nations Framework Convention on Climate Change (UNFCCC) Conference in 2015. The Paris UNFCCC established the Paris Agreement which was a legally binding international treaty agreed to by 196 nations with the goal of limiting global climate change to two (2) degrees Celsius above pre-

industrial levels. Inspired by this agreement, the governors of 22 U.S. states, including Hawai‘i, and the territories of Guam and Puerto Rico created a bipartisan group to meet GHG targets to reduce emissions over time.

In 2018, Act 15 of the Legislature of the State of Hawai‘i, established a goal for a statewide energy portfolio of 100 percent renewable energy by 2045. This act is a legally binding benchmark in support of the 2015 Paris Climate Accord. Additionally, Act 238 of 2022 established a goal for the statewide GHG emissions limit to be 50 percent below 2005 levels by 2030. These acts are guiding the State towards a reduction in non-renewable energy usage. While these acts are guiding energy sourcing and usage, there is no legislation setting any maximum allowable amount of emissions, however, federal law still applies. As part of the federal regulations for GHG emissions, Greenhouse Gas Reporting Programs (GHGRP) were established and are monitored and enforced by the State. In Hawai‘i, the GHGRP requires reporting for emissions greater than 25,000 metric tons (MT) of CO_2 equivalent (CO_2e) per year.

The most recent data shows that in 2021, total GHG emissions for the State of Hawai‘i stood at 20.18 million MT CO_2e. Net emissions, which consider carbon sinks, were 17.79 million MT CO_2e. The energy sector was the largest emitter at 86.7 percent. Emissions have been trending down in Hawai‘i since the early 2000s. As a result of the COVID-19 pandemic, emissions were down in 2020, lower than 2021, but 2021 is still lower than the previous years of 2017-2019. Nevertheless, projections for future emissions are still estimated to be above the 2030 and 2045 targets by roughly 1.5 million MT and 10.5 million MT CO_2e, respectively. See **Appendix “D”**.

Currently, the only source of GHG emissions on or around the Project Site are from the resorts and condominiums along the shoreline and associated electricity use. There are no GHG emissions associated with the Project Site. Nothing within the Project Site is a part of the GHGRP.

b. Potential Impacts and Mitigation Measures

A Greenhouse Gas Assessment was conducted for this Project. Refer to **Appendix “D”**. The analysis assessed the potential GHG emissions associated with each proposed alternative except for No Action. The analysis used two (2) methods to quantify emissions. An emissions factor (EF) was used to assess GHG emissions from all barging-based activities including sand recovery and sand transport via barge. EFs have long been

used to set emission inventories and guide policy decisions. An EF can be understood as a standardized representational value used to assess CO_2e based on an activity. The EF selected for the Project uses the volume of sand for each Project alternative to quantify GHG emissions based on the total weight of the sand and the trip duration of eight (8) hours.

The California Emissions Estimator Model (CalEEMod) computer model was used to estimate GHG emissions associated with sand transport on land to the Project Site and all land-based construction, including groin construction and rock transport. CalEEMod uses the type and use case of construction equipment, duration of work, and other factors to estimate GHG emissions based on the amount of work being done. All values for the GHG analysis are expressed in MT CO_2e.

Beach Stabilization

Beach Stabilization is anticipated to require 33,000 cy of sand and construction is anticipated to last for 445 calendar days. The EF found that the GHG emissions associated with barging 33,000 cy of wet sand would result in 310.8 MT CO_2e. The CalEEMod estimated a total of 2,149 MT CO_2e for the land-based construction for Beach Stabilization. In total, this is 2,459.8 MT CO_2e for sand recovery, transport, and land-based work. When considering the total GHG as a per year value based on the lifespan of the Project, Beach Stabilization has a value of 49.2 MT CO_2e per year of expected benefits. See **Table 8**.

Table 8. Key factors for the GHG emissions calculation for Beach Stabilization

Factor	Amount and Unit
Sand	33,000 cubic yards
Total Construction Days	445 days
Sand Recovery Days	66 days
Land Based Calendar Days of Construction	379 days
Land Based Construction Workdays	271 days
Barging Emissions	310.8 MT CO_2e
Land Based Construction Emissions	2,149 MT CO_2e
Total Construction Emissions	**2,459.8 MT CO_2e**
Construction Emissions Per Year of Project Design Life	**49.2 MT CO_2e**
Source: Sea Engineering Inc. and Munekiyo Hiraga	

Beach Nourishment

Beach Nourishment is anticipated to require 27,000 cy of sand and construction is anticipated to last for 233 calendar days. The EF found that the GHG related to barging 27,000 cy of wet sand would result in 254.3 MT CO_2e. The CalEEMod estimated total of 612 MT CO_2e for land-based construction for Beach Nourishment. The combination of both models totals 866.3 MT CO_2e and would be the least GHG emitting scenario of the proposed alternatives. However, when considering the total GHG as a per year value based on the duration of anticipated benefits of the Project, Beach Nourishment has a value of 86.6 MT CO_2e per year of anticipated benefits. That is the highest value of the alternatives. See **Table 9**.

Table 9. Key factors for the GHG emissions calculation for Beach Nourishment

Factor	Amount and Unit
Sand	27,000 cubic yards
Total Construction Days	233 days
Sand Recovery Days	54 days
Land Based Calendar Days of Construction	179 days
Land Based Construction Workdays	128 days
Barging Emissions	254.3 MT CO_2e
Land Based Construction Emissions	612 MT CO_2e
Total Construction Emissions	**866.3 MT CO_2e**
Construction Emissions Per Year of Project Design Life	**86.6 MT CO_2e**
Source: Sea Engineering Inc. and Munekiyo Hiraga	

Beach Maintenance

Beach Maintenance is anticipated to require 47,000 cy of sand and construction is anticipated to last for 452 calendar days over the course of the initial nourishment action and subsequent recurring maintenance actions. The EF found that the GHG related to barging 47,000 cy of wet sand would result in 442.7 MT CO_2e. Utilizing the CalEEMod, the construction equipment and travel-based modeling yielded a total of 1,225 MT CO_2e. The combination of both models estimates 1,667.7 MT CO_2e. This translates to 33.4 MT CO_2e per year of anticipated benefits. See **Table 10**.

Table 10. Key factors for the GHG emissions calculation for Beach Maintenance

Factor	Amount and Unit
Sand	47,000 cubic yards
Total Construction Days	452 days
Initial Sand Recovery Days	54 days
Subsequent Maintenance Efforts (4 actions)	10 days per action
Total Sand Recovery Workdays	94 days
Initial Land Based Workdays	128 days
Subsequent Maintenance Efforts (4 actions)	45 days per action
Total Land Based Calendar Days of Construction	358 days
Total Land Based Construction Workdays	256 days
Barging Emissions	442.7 MT CO_2e
Land Based Construction Emissions	1,225 MT CO_2e
Total Construction Emissions	**1,667.7 MT CO_2e**
Construction Emissions Per Year of Project Design Life	**33.4 MT CO_2e**
Source: Sea Engineering Inc. and Munekiyo Hiraga	

It is noted that this assessment does not include an analysis for the initial transportation of the barge from O‘ahu where it is stationed to the Sand Recovery Site. For the previous actions, that would be a one-time action which would be equal for all alternatives. However, since this aspect will involve additional nourishment efforts, those impacts would be multiplied by four (4) for the additional nourishment efforts. This would impact the overall value of this alternative.

No Action

The GHG emissions associated with No Action were not assessed. While there would be GHG emissions associated with the demolition and removal of the temporary erosion skirt, emissions were not quantified as a part of this report. The location where sand used for the temporary erosion skirt would be redeposited is not known and as such any estimation of mileage used for the assessment would be speculative. The decision as to what to do with the sand and the geotextile fabrics will be left to the contractor at the time of demolition and removal.

Potential Related Secondary Actions

Potential impacts associated with potential related secondary actions would occur at the same time as Project implementation and would be negligible compared to the emissions associated with each Project alternative.

Summary

Beach Nourishment had the lowest estimated emissions associated with the action (866.3 MT CO_2e). However, when total emissions are considered on an annualized basis with respect to the alternative's design life, Beach Stabilization and Beach Maintenance were more efficient with 49.2 MT CO_2e/yr. and 33.4 MT CO_2e/yr. respectively. A comparison of all key values is shown in **Table 11**.

Table 11. Total GHG Emission Estimates for Each Project Alternative

	Beach Stabilization	**Beach Nourishment**	**Beach Maintenance**
Sand Recovery and Transport (Barge) (MT CO2e)	310.8	254.3	442.7
Sand Transport (Land), Placement and Groin Construction (MT CO2e)	2,149	612	1,225
Total (MT CO2e)	**2,459.8**	**866.3**	**1,667.7**
Project Design Life (Years)	50	10	50
Total Per Year of Project Lifespan (MT CO2e/year)	**49.2**	**86.6**	**33.4**
Source: Munekiyo Hiraga			

When comparing the Project alternatives to statewide emissions, the proposed Project has insignificant impacts. The State of Hawai‘i produced 20.18 million MT CO_2e in 2021, the most recently reported year. Emissions for Beach Stabilization, the highest emission scenario would account for 0.01 percent of statewide CO_2e emissions. The proposed Project is not anticipated to have impacts that would significantly impact statewide emission goals or would near the value for mandatory reporting by the GHGRP.

Action Alternative	Anticipated Impact to Greenhouse Gas Emissions
Beach Stabilization	**Construction-Related Impacts:** Project construction would generate 2,459.8 MT CO_2e, which is equivalent to 49.2 MT CO_2e per year of the Project design life **Ongoing Impacts:** No impact
Beach Nourishment	**Construction-Related Impacts:** Project construction would generate 866.3 MT CO_2e, which is equivalent to 86.6 MT CO_2e per year of the Project design life **Ongoing Impacts:** No impact
Beach Maintenance	**Construction-Related Impacts:** Project construction would generate 1,667.7 MT CO_2e (cumulative for initial and recurring nourishment actions), which is equivalent to 33.4 MT CO_2e per year of the Project design life **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action
No Action	**Construction-Related Impacts:** GHG impacts associated with the demolition and removal of the temporary erosion skirt (not quantified) **Ongoing Impacts:** No impact

18. Noise

a. Existing Conditions

Existing noise conditions at the Project Site are typical of developed beach areas in Maui County. Sources of noise include people on the beach and within the adjacent resort properties as well as noise from vehicular traffic on nearby roadways. Natural sounds that are associated with the Project Site come from waves crashing on the beach and wind blowing.

Community Noise Control, as described in Title 11, Chapter 46, HAR which outlines maximum permissible sound levels, provides rules and mitigation guidelines relevant to the construction that will be required for the Proposed Action. Title 11, Chapter 46, HAR provides standards for the protection of public health and welfare and to prevent degradation of the natural environment. The Project Site seaward of the shoreline is located within the Conservation District, but is not restricted by any noise-sensitive uses. As such, HAR § 11-46-3 Class B limits are applicable to lands zoned for

resort use. Per HAR § 11-46-4 Class B zoning has an allowable decibel (dBA) limit of 60 dBA from 7:00 a.m. to 10:00 p.m. The Director of the Department of Health is able to issue permits to operate a noise source which emits noise in excess of the maximum permissible levels if it is in the public interest per HAR § 11-46-7.

b. Potential Impacts and Mitigation Measures

There would be temporary construction-related noise at the Project Site with all action alternatives. The Best Management Practices Plan within the CEA (**Appendix "A"**) outlines noise control measures to be implemented, including conforming with requirements of Title 11, Chapter 46, HAR, Community Noise Control. The contractor shall make the maximum use of low-noise-emission products and utilize equipment with suitable mufflers to maintain noise levels within applicable regulations.

Based on the offshore location of the Sand Recovery Site, it is unlikely that any noise impacts created would be noticed by persons onshore. Following construction, there will be no ongoing noise impacts.

Beach Stabilization

Beach Stabilization would have temporary impacts to noise conditions that would occur during construction as it relates to sand recovery and onshore construction. Land based construction is anticipated to last 55 weeks and sand recovery is anticipated to last 13 weeks.

In addition to noise related to the sand placement and movement, there would be noise associated with the groin construction. Groin construction would include use of heavy machinery and movement and placement of heavy materials. While construction noise cannot be avoided, mitigation measures as outlined in the Best Management Practices Plan contained within the CEA (**Appendix "A"**) will be implemented to limit construction-related noise impacts.

The construction is anticipated to cause noise for the duration of the Project construction period at the Project Site. A Project hotline will be established to allow for noise feedback and other concerns from resort operators. This hotline can be used to help provide modifications to construction when feasible. Demolition and removal of the temporary erosion skirt would occur at the start of construction and thus, noise associated with that demolition and removal would occur at the same time as the Project initiation.

The sand recovery operation would also generate construction-related noise with the use of the dredging barge and support vessels. The sand recovery operation is located approximately 1,500 ft. offshore at its nearest point. As such, the construction noise associated with the sand recovery is not expected to be heard from the shoreline.

Once construction is completed, there are no anticipated ongoing impacts related to noise as a result of the Beach Stabilization action.

Beach Nourishment

Temporary impacts to noise conditions would occur during construction. Land based construction is anticipated to last 19 weeks and sand recovery is anticipated to last 11 weeks. The temporary construction related noise impacts related to sand recovery and land-based construction would be similar to that of Beach Stabilization, though with a shorter construction timeframe and without the noise associated with the groin construction. The mitigation measures noted for Beach Stabilization would be applicable for Beach Nourishment and impacts would end when construction ends.

Once construction is completed, there are no anticipated ongoing impacts related to noise as a result of the Beach Nourishment action.

Beach Maintenance

Beach Maintenance would have similar noise impacts to Beach Nourishment but would be repeated approximately every 10 years for each action of Beach Maintenance. Beach Maintenance would follow the same mitigation measures outlined for Beach Nourishment. In total, land based construction is anticipated to last 47 weeks, including initial nourishment and follow-up maintenance actions. Sand recovery is anticipated to last 20 weeks in total, inclusive of initial nourishment and maintenance efforts.

Once construction is completed, there are no anticipated ongoing impacts related to noise as a result of the Beach Nourishment action.

No Action

No Action would have similar noise impacts as already described associated with the demolition and removal of the temporary erosion skirt as described for the other three (3) Project alternatives due to the use of heavy machinery construction equipment. The duration of noise impacts would be much shorter than any Project action alternative and there would be no offshore noise impacts as sand recovery would not be conducted.

The construction required for No Action would generate noise which would experience the same mitigation measures associated with the Beach Nourishment alternative. Once the construction ended with the demolition and removal of the temporary erosion skirt, noise impacts would cease.

Potential Related Secondary Actions

Any potential related secondary actions would generate noise associated with construction. These secondary actions would be done concurrently with any Project alternative. As such, any additional noise generated from construction would be subject to the same mitigation measures as the rest of the construction efforts.

Summary

All Project alternatives would have temporary construction-related noise impacts. These impacts will follow all regulations outlined for the Conservation District as well as other applicable noise ordinances including Title 11, Chapter 46, HAR, Community Noise Control. Noise impacts associated with Project implementation and construction will end when construction does. There are existing noise sources at or around the Sand Recovery Site and Project Site and as such, project-related impacts are not anticipated to be significant.

Action Alternative	Anticipated Impact to Noise
Beach Stabilization	**Construction-Related Impacts:** Temporary construction-related noise **Ongoing Impacts:** No impact **Mitigation:** Compliance with Chapter 11-46; use of low-noise emission products and suitable mufflers; refer to the Best Management Practices Plan contained within the CEA (**Appendix "A"**)
Beach Nourishment	**Construction-Related Impacts:** Temporary construction-related noise **Ongoing Impacts:** No impact **Mitigation:** Compliance with Chapter 11-46; use of low-noise emission products and suitable mufflers; refer to the Best Management Practices Plan contained within the CEA (**Appendix "A"**)
Beach Maintenance	**Construction-Related Impacts:** Temporary construction-related noise

Action Alternative	Anticipated Impact to Noise
	Ongoing Impacts: Recurring construction related impacts with each nourishment action **Mitigation:** Compliance with Chapter 11-46; use of low-noise emission products and suitable mufflers; refer to the Best Management Practices Plan contained within the CEA (**Appendix "A"**)
No Action	**Construction-Related Impacts:** Temporary construction-related noise (for demolition and removal of the temporary erosion skirt) **Ongoing Impacts:** No impacts **Mitigation:** Compliance with Chapter 11-46; use of low-noise emission products and suitable mufflers; refer to the Best Management Practices Plan contained within the CEA (**Appendix "A"**)

19. Scenic and Open Space Resources

a. Existing Conditions

Honokōwai Beach is known for its scenic views, and the Project Site is one (1) of the only areas in which individuals who are looking for a sandy beach in the Honokōwai area are able to go and enjoy that type of open space. Much of the shoreline to the north and south of the Project Site is armored with no sandy beach. Views from the Honokōwai shoreline include a wide expanse of ocean, with typically calm waters and an unobstructed view of the island of Lānaʻi.

As explained in Chapter I, Honokōwai Beach experienced significant erosion and beach loss in 2016 that negatively impacted open space resources in the area. The shoreline retreated 6 to 12 ft. in a few months, compared to a historic average of -0.44 ft./yr., and approximately 5,600 s.f. of fast land was lost. As a result of the 2016 beach loss and avulsion event, the beach has been scarred by the damage left to the backshore. Along with this scar, a significant volume of sand has been taken from the beach which will not be naturally replenished. Without this sand, the beach will not be able to naturally retake its form prior to the erosion event. The narrower beach has negatively impacted the way the beach looks as well as the availability of usable open space. Currently, there is a temporary erosion skirt along the shoreline that has helped to stabilize the shoreline and backshore and has prevented negative impacts to water quality by

providing a buffer between the ocean and the alluvial backshore. During and after the episodic erosion event, the water quality was significantly and negatively impacted by runoff and sedimentation. Since the installation of the temporary erosion skirt, brown water and turbidity plume occurrences, which have aesthetic and open space impacts, have been decreased.

Puʻu Kekaʻa and Kāʻanapali Beach near the Sand Recovery Site also offer scenic views. In particular, Puʻu Kekaʻa is a well-recognized point at the north end of Kāʻanapali Beach that holds cultural significance. The area offshore of Puʻu Kekaʻa and Kāʻanapali Beach has frequent boat traffic associated with tour boats and catamarans taking visitors on trips around West Maui. Further out to sea, beyond the Sand Recovery Site, larger ships are often present in transportation around West Maui.

b. Potential Impacts and Mitigation Measures

There would be temporary impacts to scenic and open space resources during the construction periods for all three (3) beach restoration action alternatives. The groins constructed under the Beach Stabilization alternative would change the landscape of Honokōwai Beach. Conceptual renderings have been prepared for the three (3) beach restoration action alternatives and are presented in **Appendix "E"**.

Beach Stabilization

The onshore construction process would have temporary impacts to scenic and open space resources. Scenic impacts would occur from the construction equipment being present onsite and in use. Open space impacts would also result from construction. As mentioned, groin construction would be done in cells and would require access limitations while construction is ongoing. As much as is possible, portions of the beach would remain open during construction to allow for beach access in areas not under construction.

Placement of sand on the beach would result in temporary impacts associated with sand discoloration and odor. Newly placed sand recovered from the sea floor has a slightly different color and odor than dry beach sand. Once the sand sits on the beach and is exposed to sunlight and air, it will lighten to match the existing beach sand, and the odor will dissipate.

The sand recovery operation would also have temporary impacts to scenic resources from the Kāʻanapali shoreline. One (1) crane barge, two (2) deck barges, one (1) tugboat, and one (1) support vessel would be located

approximately 1,500 ft. offshore for approximately 13 weeks. The barges would be present at all times, and the support vessel would be present during operations. This area is frequented by tour boats such as catamarans, and several vessels can be seen in the area at once. The ocean around the Sand Recovery Site is also used by canoes. The mooring lines used to hold the sand recovery barge in place would be marked to ensure they are visible to other vessels and canoes. More specific measures for anchor line marking will be left up to the contractor at the time of operations. Typically, canoes pass shoreward of where the barge would be located and as such, impacts are not anticipated. Support vessels would be located around the barge to assist with operation and to direct ocean traffic around the barge. Impacts to scenic and open space resources from sand recovery will end once the 13-week sand recovery period is completed.

There would be temporary impacts associated with the barge present at the Sand Recovery Site. Based on the distance offshore, the barge is not anticipated to have more significant impacts to the viewshed than the other vessels already present in the area. The main difference is that the barge would be stationary and would remain in place 24 hours a day for the duration of sand recovery.

Beach Stabilization would change the landscape and have impacts on the scenic resources as a result of the construction of the four (4) groins. The groins would be visible from the beach, nearby resorts, and the ocean as shown in **Appendix "E"**. The groins are designed to use basaltic rocks which is typical on Maui as basaltic rock is naturally occurring on the island. To minimize impacts as well as to ensure structural integrity of the groins, the landward portions of the groins would be built into the ground. See **Figure 24** (Beach Stabilization Rendering). In addition, the groins incorporate an adaptable design that allows the initial design to have lower elevations to keep a more open view plane rather than designing taller groins at the outset. As described in Chapter I, the groins could be modified with vertical extensions if needed, allowing for lower initial groin elevations.

The groins would provide a positive impact in the form of availability for open space resources into the future as the potential for large scale erosion events such as what occurred in the 2016 beach loss and avulsion event is significantly reduced by the use of groins. The stability offered by the groins which would mitigate natural beach erosion and beach profile



Source: G70

Figure 24

Hoʻāla Honokōwai
Beach Stabilization Rendering

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\BSRendering

changes would not be a factor at the Project Site due to Beach Stabilization. This means that barring an event of a magnitude that exceeds design standards, there would be improvements to open space that are anticipated to last for the lifespan of the groins. There would be more open space availability than is currently present at the Project Site which would support various recreational and cultural activities. Furthermore, the surrounding landscape is that of a highly engineered coastline. Seawalls and revetments line the coast from the Project Site to Kahana Bay, with the exception of Honokōwai Beach Park, which is unarmored. While the groins would impact scenic resources of the existing beach, the visual impacts would be balanced by the benefits associated with stabilizing the only sandy beach in the area.

Beach Nourishment

Beach Nourishment would restore a functional beach profile, similar to what was present before the erosion event which triggered beach loss, avulsion, and shoreline recession. The restored beach would improve scenic and open space resources at the Project Site after construction by offering more space for recreation and protecting the backshore. Beach Nourishment would improve the scenic value of the beach for the anticipated 10-year lifespan.

Beach Nourishment would be subject to the same construction related impacts and visual impacts related to sand appearance and odor as Beach Stabilization. Impacts associated with the barge location at the Sand Recovery Site would last for approximately 11 weeks. Land-based construction would last for approximately 19 weeks, and temporary impacts will end when construction is completed.

With implementation of Beach Nourishment, a sandy beach would be present at the Project Site. See **Figure 25** (Beach Nourishment and Beach Maintenance Rendering). The beach would end at the mouth of Honokōwai Stream. The beach would offer additional room for open space resources in an area along the Honokōwai Coast which is otherwise characterized by the seawalls and revetments. Over time, however, beyond the anticipated 10-year lifespan of Beach Nourishment, the beach is anticipated to narrow and return to pre-Project conditions.

The benefits associated with the Beach Nourishment action (i.e., improved views and open space access) would be temporary as coastal processes are anticipated to reduce the quality of benefits within 10 years of Project implementation. As seasonal and chronic erosion naturally occurs, the beach will narrow, and the associated benefits will be diminished.



Note: The perspective presented here represents the beach after the initial nourishment action. The Beach Nourishment alternative is a one-time action with an estimated 10-year design life. Beach Maintenance involves subsequent re-nourishment events to maintain beach width over the project's 50-year design life.

Source: G70

Figure 25

Hoʻāla Honokōwai
Beach Nourishment and Beach Maintenance Rendering

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\BNMRendering

Beach Maintenance

Beach Maintenance would have similar impacts to Beach Nourishment, except there would be five (5) total actions. This will include the temporary visual and open space impacts of construction, and visual and odor impacts associated with newly placed sand for each occurrence of Beach Maintenance. As offshore sand is presumably unable to be stockpiled, there would be reoccurring scenic and open space impacts associated with the barge offshore at the Sand Recovery Site five (5) total times.

Total construction impacts are anticipated to last 47 weeks for land based constrcution, inclusive of the initial nourishment and maintenance efforts and 20 weeks for sand recovery, inclusive of the initial nourishment and follow up maintenance actions. These impacts will dissipate once an individual maintenance action is complete.

The maintenance actions would help to prevent the impacts of seasonal and chronic erosion that occur over time at the beach through natural processes. With the maintenance efforts, benefits to scenic and open space resources are anticipated to last 50 years.

Beach width will vary as seasonal and chronic erosion occurs. However, with each Beach Maintenance action, the beach would be restored. Refer to **Figure 25** (Beach Nourishment and Beach Maintenance Rendering). This would offer improved longevity and resilience of the beach and as such, scenic and open space resources would be improved.

No Action

No Action would have significant impacts to scenic and open space resources. With No Action, the temporary erosion skirt would be removed which would expose the escarpment on the backshore. With this escarpment, some infrastructure may be exposed to impacts from the ocean. The potential for future impacts to existing infrastructure would be great as there is no protection for the backshore without a functional beach face. In the case of No Action, impacts to visual and open space resources result in degraded scenic value and limited open space access. Furthermore, the aesthetics of the beach are negatively impacted by the exposed backshore.

As demonstrated by water quality monitoring done at the site, independent and unrelated to the Project, and images taken after the 2016 beach loss and avulsion event, water quality with the exposed escarpment is degraded

and turbidity can be significant. Turbidity, or brown water, is visually undesirable and deters people from recreating on the beach or in the water. Without the temporary erosion skirt and with no additional mitigation, scenic and open space resources would be significantly degraded at the Project Site. See **Figure 26** (Potential No Action Conditions).

Potential Related Secondary Actions

Any secondary actions carried out would not have any additional significant impacts to scenic or open space resources. Secondary actions would be carried out within common spaces on developed areas of the KBC property.

Summary

All three (3) beach restoration action alternatives, as well as the No Action alternative, would have temporary construction-related impacts to scenic and open space resources. The three (3) beach restoration alternatives would all have temporary impacts on land associated with construction equipment and temporary impacts to scenic resources at the Sand Recovery Site. Construction periods would vary based on the alternative.

The three (3) beach restoration alternatives are intended to provide positive impacts to open space resources by providing a wider sandy beach at the Project Site. The Beach Stabilization Alternative would also provide increased beach stability. The duration of benefits varies by alternative. While Beach Stabilization would change the landscape of the Project Site, the visual impacts will be balanced by the benefits associated with stabilizing the only sandy beach in the area.



Source: Sea Engineering, Inc.

Figure 26

Ho'āla Honokōwai
Potential No Action Conditions

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\PotentialNAC

Action Alternative	Anticipated Impact to Scenic and Open Space Resources
Beach Stabilization	**Construction-Related Impacts:** Temporary impacts associated with construction equipment, impacting beach access and scenic resources **Ongoing Impacts:** Groins would change the landscape of the Project Site; impacts to the scenic resources would be balanced by the benefits associated with stabilizing the only sandy beach in the area **Mitigation:** Portions of the beach will remain open during construction to allow for beach access in areas not under construction; refer to the Best Management Practices Plan contained within the CEA in **Appendix "A"** for a full list of BMPs
Beach Nourishment	**Construction-Related Impacts:** Temporary impacts associated with construction equipment, impacting beach access and scenic resources **Ongoing Impacts:** After the approximate 10-year lifespan, the negative impacts associated with the No Action alternative may be realized **Mitigation:** Portions of the beach will remain open during construction to allow for beach access in areas not under construction; refer to the Best Management Practices Plan contained within the CEA in **Appendix "A"** for a full list of BMPs
Beach Maintenance	**Construction-Related Impacts:** Temporary impacts associated with construction equipment, impacting beach access and scenic resources **Ongoing Impacts:** A wider sandy beach supports the preservation of the open space and scenic resources of the area; recurring construction-related impacts with each nourishment action **Mitigation:** Portions of the beach will remain open during construction to allow for beach access in areas not under construction; refer to the Best Management Practices Plan contained within the CEA in **Appendix "A"** for a full list of BMPs
No Action	**Construction-Related Impacts:** Temporary impacts associated with

Action Alternative	Anticipated Impact to Scenic and Open Space Resources
	construction equipment, impacting beach access and scenic resources **Ongoing Impacts:** Adverse impacts resulting from degraded scenic value and limited open space access **Mitigation:** Portions of the beach will remain open during construction to allow for beach access in areas not under construction; refer to the Best Management Practices Plan contained within the CEA in **Appendix "A"** for a full list of BMPs

B. SOCIO-ECONOMIC ENVIRONMENT

1. Surrounding Land Uses

a. Existing Conditions

The Honokōwai area is characterized by businesses, hotels, and resort-residential developments. The area immediately surrounding the Project Site features resorts, condominium complexes, commercial and retail businesses, dining establishments, as well as public access to the shoreline utilized by both residents and visitors. The portion of beach proposed for restoration is centered around Kāʻanapali Beach Club (KBC) (TMK (2) 4-4-001:098) and is bound by Kaanapali Shores (TMK (2) 4-4-001:097) to the north and Maui Kai Condominiums (Maui Kai) (TMK (2) 4-4-001:100) to the south. The KBC property was initially developed in 1988 as an Embassy Suites. The timeshare property was acquired by West Maui resort Partners, L.P. in 2021 and includes 413 units and related amenities.

Since the 2016 beach loss and avulsion event, there has been a loss of usable beach, which has negatively impacted shoreline access. A temporary erosion skirt was installed in 2018 as a short-term response, but the beach height and width have not returned to pre-2016 conditions.

Although not directly impacted by the devastating Lahaina wildfire in August 2023, which burned approximately 3.5 miles away from the Project Site, land use in the West Maui region has been permanently altered. Redevelopment of Lahaina will be a long-term effort, which currently remains in the early stages. While the specifics surrounding the redevelopment plans are still uncertain, they will impact the character of West Maui as a whole, including indirect impacts to other areas of West Maui, such as Honokōwai, Kāʻanapali, Nāpili, and Kapalua, which did not have any fire damage.

b. Potential Impacts and Mitigation Measures

The Proposed Action intends to restore and preserve Honokōwai Beach, providing a positive ongoing impact to the community character and surrounding land uses. As discussed below, there will be temporary construction-related impacts during the construction period(s). As described previously in this Draft EIS, it is anticipated that 3.2 ft. of sea level rise could result in up to 60,946 s.f. of land loss and the discharge of 19,542 cy of sediment into the ocean. This land loss would account for approximately 20 percent of the KBC property located at TMK (2) 4-4-001:098. If this were to occur, existing land use would be significantly altered which could impact the existing ADA compliant beach access, public facilities, and privately-owned land and structures.

Beach Stabilization

Implementation of Beach Stabilization involves the demolition and removal of the temporary erosion skirt, placement of sand to increase beach width and elevation, and construction of groins to stabilize the sand. This beach widening would require mechanical equipment, including a front-end loader, bulldozers, excavators, trucks, and more which would impact land use on and near the beach during construction. For groin construction, the shallow reef flat prohibits access from the ocean, but there is favorable access to the shoreline from land. Direct access to the shoreline will come from the KBC property. Additional access to the shoreline may be available through the Kaanapali Shores property to the north and the Maui Kai property to the south. Refer to **Figure 12** (Groin Construction and Sand Placement Methodology) in Chapter I. During construction, impacts to surrounding land uses would include increased traffic associated with sand transport (two (2) trucks, per hour, for eight (8) hours per construction day) and construction-related deliveries as well as temporary disruptions to beach access.

A construction traffic management plan will be implemented to minimize traffic disruptions. To ensure public safety during construction, access to active work areas along the shoreline and any staging areas within the KBC property will be limited. The beach width would increase from onshore to offshore, creating a dry substrate for machinery to operate on. Once sand placement begins in an area, nourishment would continue until that area is complete. This method would allow for a portion of the beach to stay open during a workday when feasible, and lateral access along the beach to be maintained during construction. These construction impacts would be temporary in nature.

Following completion of construction, the Beach Stabilization alternative would provide ongoing positive impacts on surrounding land use and community character by maintaining a wider and more stable sandy beach area for public use. Once the Project is complete, the stabilized shoreline would protect the backshore, preventing erosion, beach loss, shoreline recession, and associated turbidity conditions in nearshore waters. Sand would extend further seaward, but there are no adverse impacts anticipated to biotic communities. A stable beach with clear water would provide ongoing recreational opportunities and enjoyment to residents and visitors, as well as associated benefits to nearby businesses. The Beach Stabilization alternative has an anticipated Project lifespan of 50 years.

Beach Nourishment

Similar to the Beach Stabilization alternative, Beach Nourishment would create temporary impacts on the surrounding land uses during the construction phase of the Project, involving traffic, beach disturbance, and sand placement. The placement of sand on the beach would increase beach width from inland to seaward. This action would require mechanical equipment, including front-end loaders, bulldozers, and trucks which would impact land use on the beach during construction. However, as the Beach Nourishment alternative does not involve construction of stabilizing groins, it is anticipated that the duration of construction and associated construction-related impacts would be less than Beach Stabilization.

Beach Nourishment would provide positive impacts to surrounding land uses and community character following construction associated with a wider sandy beach. However, the benefits from this alternative would be limited to the approximate 10-year lifespan of this one-time Project, after which many of the benefits associated with the Beach Nourishment would be lost due to ongoing erosion.

Beach Maintenance

Construction impacts associated with the Beach Maintenance alternative would be similar to Beach Nourishment, as both involve demolition and removal of the temporary erosion skirt and placement of sand without the construction of stabilizing groins. However, unlike Beach Nourishment, the Beach Maintenance alternative is a program wherein sand would be replaced on a recurring basis approximately every 10 years. As such, construction-related impacts associated with traffic, staging, and sand placement would occur with each Beach Maintenance action.

The beach would be filled from inland to seaward and would require the same equipment as Beach Nourishment. As with Beach Nourishment, there would be impacts to land use on and around the beach during the construction phase. Once sand placement begins in an area, nourishment would continue until that area is complete. This method would allow for a portion of the beach to stay open during a workday, where feasible, and lateral access along the beach would be maintained during construction.

During the anticipated 50-year lifespan of the Beach Maintenance program, benefits would be realized similar to those provided by Beach Stabilization and Beach Nourishment. While the timed maintenance would improve conditions along Honokōwai Beach and help to restore the beach, the recurring construction impacts would affect the community character as every 10 years, the community would be subject to the same impacts related to construction and beach improvements.

No Action

Under a No Action alternative, there would be fewer construction-related impacts than those discussed above for Beach Stabilization, Beach Nourishment, and Beach Maintenance. There may be temporary impacts during the demolition and removal of the temporary erosion skirt. However, the No Action alternative would result in significant negative impacts to surrounding land uses and community character associated with ongoing progressive erosion, shoreline recession, beach narrowing, and potential beach loss, some of which have been observed during the 2016 beach loss and avulsion event. The No Action alternative would have negative impacts to beach access and infrastructure, including the public restrooms and public beach access parking located on the KBC property and the ADA compliant coastal walkway that provides lateral shoreline access. The beach and nearshore area would also become a hazard and potentially unusable to residents and visitors with continued erosion. As mentioned, coastal erosion models project up to 60,946 s.f. of land loss due to erosion with 3.2 ft. of sea level rise.

No Action would permanently change the land use and the community character at Honokōwai Beach. With No Action, KBC may need to reduce operations or be forced to close entirely due to the loss of Honokōwai Beach and the overall degradation of the shoreline area. This reduced operation or forced closure would have negative impacts on the community as a whole, including the landowner, individual unit owners at KBC, employees, and the surrounding local businesses.

Potential Related Secondary Actions

Any potential related secondary actions would be limited to improvements within the KBC property are not anticipated to adversely impact surrounding land use. These potential related secondary actions may include improvements to the beach access infrastructure such as the ADA compliant coastal walkway. As such, over the long-term these actions may increase public access to the shoreline area.

Summary

The beach restoration action alternatives have, to varying degrees, temporary impacts on surrounding land uses and community character during construction. From a long-term perspective, the Beach Stabilization and Beach Maintenance alternatives would provide positive impacts associated with a wider sandy beach. The positive impacts associated with Beach Nourishment would be limited to the anticipated 10-year lifespan of the action. The No Action alternative would have limited temporary construction impacts from the demolition and removal of the temporary erosion skirt and would negatively impact surrounding land use and community character over the long-term from erosion, shoreline recession, beach narrowing, and potential beach loss.

Action Alternative	Anticipated Impact to Surrounding Land Uses
Beach Stabilization	**Construction-Related Impacts:** Increased traffic and limited beach/shoreline access during construction **Ongoing Impacts:** Positive impacts of increased beach width and stable shoreline
Beach Nourishment	**Construction-Related Impacts:** Increased traffic and limited beach/shoreline access during construction **Ongoing Impacts:** Positive impact of increased beach width, limited to the anticipated 10-year lifespan of the action alternative
Beach Maintenance	**Construction-Related Impacts:** Increased traffic and limited beach/shoreline access during construction **Ongoing Impacts:** Positive impact of increased beach width; recurring construction impacts approximately once every 10 years

Action Alternative	Anticipated Impact to Surrounding Land Uses
No Action	**Construction-Related Impacts:** Construction-related impacts during temporary erosion skirt demolition and removal **Ongoing Impacts:** Negative impact of erosion, shoreline recession, beach narrowing, potential beach loss, and general degradation of the shoreline area; negative impacts to beach access, land use, and community character

2. Archaeological Resources

a. Existing Conditions

ʻĀina Archaeology completed a field inspection of the Project Site, along with a literature review of historical narratives of the overall area and previous archaeological studies within a one-mile radius of the proposed Project. The archaeological Literature Review and Field Inspection (LRFI) is provided in **Appendix "F"**.

Literature Review

The archaeological LRFI provided an in-depth review of the cultural and historical context of Honokōwai Ahupuaʻa and included pre-contact Hawaiian settlement patterns, the impact of Western arrival, and changes through the plantation and modern eras. The study notes that Honokōwai Ahupuaʻa was part of the broader Kāʻanapali Moku, divided under the rule of Kakaʻalaneo, and followed the typical ahupuaʻa configuration which extended from mountain to sea, providing access to diverse ecological resources. These regions allowed for agricultural activities, forest resources, and fishing, which were integral to the community's livelihood. The cultural significance of Honokōwai Ahupuaʻa included ceremonial sites, fishing shrines (koʻa), and residential settlements. Traditional burial practices have also been identified within sand and alluvial deposits.

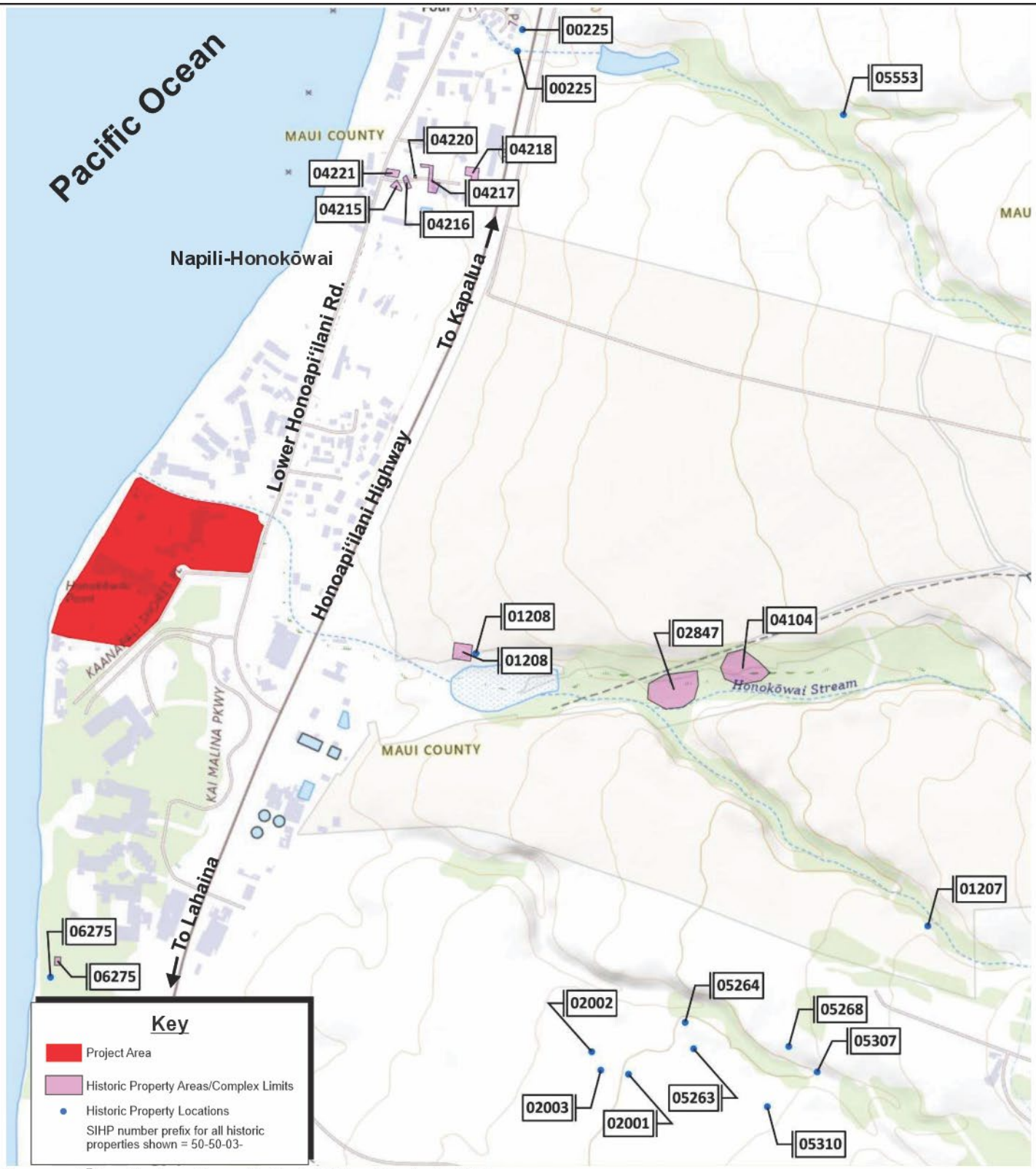
With the arrival of Westerners and the implementation of the Māhele in 1848, land division shifted from communal stewardship to private ownership. The growth of the sugar industry in West Maui transformed the landscape. Large agricultural systems were developed, focusing on sugarcane cultivation, which led to infrastructural developments such as reservoirs, ditches, and flumes.

By the early 20th century, Honokōwai had transitioned to a region focused on sugar production, with the Pioneer Mill Company playing a significant role. The mid-20th century saw a shift toward tourism, with the development of resorts and condominiums along the shoreline. This development further altered the land use patterns, with large-scale infrastructural changes to accommodate tourism growth.

Previous archaeological investigations within one (1) mile of the Project Site have identified a number pre-contact and historic-era features, including cultural deposits, petroglyphs, agricultural complexes, and boundary walls. These findings reflect both traditional Hawaiian land use practices and the subsequent impacts of sugar cultivation. The previously-identified historic properties, which have been assigned site numbers on the State Inventory of Historic Places (SIHP), are shown in **Figure 27** (Archaeological Resources). As shown, there are no previously identified historic properties within the Project Site or its immediate surroundings. The individual sites identified in **Figure 27** are further detailed in **Appendix "F"**.

From the pre-contact era, the historic sites identified in the archaeological LRFI include habitation, agriculture, and ceremonial sites. SIHP 50-50-03-00225, located approximately 0.7 miles to the north of the Project Site, includes evidence of habitation ranging from approximately 1000 to 1778 A.D. Inland approximately 0.5 to 1.0 miles from the Project Site are petroglyph sites (SIHP 50-50-03-01207 and 50-50-03-05037), evidence of habitation structures (SIHP 50-50-03-01208), and agricultural features and retaining walls (SIHP 50-50-03-02001, 50-50-03-04104 and 50-50-03-02003. A ceremonial fishing shrine with small, polished coral pebbles (SIHP-50-50-03-06275) was identified approximately 0.4 miles south of the Project Site, suggesting cultural practices which connect to the sea. Sites associated with the pre-contact to historic area include sites connected to agricultural and water management functions such as terraces, rock mounds, and flumes. The promontory of Puʻu Kekaʻa (SIHP 50-50-30 - 01206) has been identified as a leina a kaʻuhane (leaping off place of the spirits).

In addition, the archaeological LRFI report noted that the recovery of a probable kuʻula (ceremonial) stone within the channel approximately three (3) miles west of Hanakaʻōʻō Point by coral divers, combined with insights from divers familiar with the area, has raised concerns about the potential presence of significant traditional Hawaiian objects submerged within the channel. A review and assessment of footage from a side-scan sonar and



Source: 'Āina Archaeology, United States Geological Survey

Figure 27

Ho'āla Honokōwai
Archaeological Resources

NOT TO SCALE

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\ArchResrc

tow camera survey of the proposed Sand Recovery Site was conducted. In general, the tow camera survey footage showed sandy topography with undulating linear sand waves. According to the archaeological LRFI, the tow camera survey footage did not reveal the presence of any traditionally significant objects. However, the archaeological LRFI notes that potential remains for discovery of culturally significant materials below the sand surface or in un-surveyed portions of the Sand Recovery Site. Refer to **Appendix "F"**.

Field Inspection

A field inspection of the Project Site was conducted by ʻĀina Archaeology on February 18, 2023. The archaeological LRFI noted the built environment of the KBC property and the narrow, eroded condition of Honokōwai Beach. No pre-contact or historic era archaeological sites or structures were identified on the surface as a result of the field inspection.

With respect to the potential for additional discoveries of archaeological resources in the area of the Project Site, the archaeological LRFI notes that contemporary erosional patterns, such as those experienced during the beach loss and avulsion event of 2016, have significantly decreased the likelihood of encountering historically significant sites and features related to traditional settlement, ceremonial activities, and burial practices within the immediate shoreline area.

b. Potential Impacts and Mitigation Measures

The archaeological LRFI included an assessment of potential impacts to archaeological and historic resources for each alternative. For all alternatives, it is noted that the contemporary erosional history of the Project Site, including the significant erosion, avulsion, and beach loss event of 2016, has affected the potential for encountering historically significant sites and features within the shoreline area. Under circumstances that do not include such significant erosion and beach loss, the likelihood of encountering significant archaeological materials in the Project Site may have included sites and features related to traditional settlement, ceremonial activities, and burial practices. A description of anticipated impacts and appropriate mitigation measures for each alternative is provided below. Consultation with the State Historic Preservation Division (SHPD) will be undertaken pursuant to Chapter 6E, HRS. Recommended mitigation measures as identified by SHPD will be implemented.

Beach Stabilization

Beach Stabilization involves placement of additional sand along the affected shoreline to increase beach width and elevation, as well as construction of four (4) groins to stabilize the sand. Ground disturbing work includes the mechanical placement of sand, as well as mechanical grubbing and grading for site preparation and construction of structures. The archaeological LRFI states that depending on the final Project plans, archaeological testing within the construction footprint in the backshore area may be appropriate. However, the presence of underlying utilities poses challenges in identifying suitable areas for preconstruction testing, which may limit the effectiveness of an archaeological testing strategy. Therefore, archaeological monitoring during construction may serve as a more appropriate identification measure.

Beach Stabilization, like all alternatives, involves sand recovery. While tow camera survey footage of the Sand Recovery Site did not reveal the presence of traditionally significant objects along the documented transects, the archaeological LRFI determined that some potential exists for discovery of such objects during the sand recovery process. As such, archaeological monitoring of the dredging process at the sand recovery barge is recommended to address the potential for inadvertent discovery of significant cultural objects during sand recovery.

The archaeological LRFI also notes that sand recovery will require the temporary industrial presence of two (2) barges offshore of the leina at Puʻu Kekaʻa, which creates a potential temporary adverse effect to the setting and feeling of the leina. This impact is discussed further in Chapter III.B.2, Cultural Resources.

Beach Nourishment

The Beach Nourishment alternative involves a one-time placement of sand along the affected shoreline to increase beach width and elevation. Ground-disturbing activity would include mechanical placement of sand directly on the shoreline. According to the archaeological LRFI, based on the documented erosion history following the 2016 beach loss and avulsion event, the probability of encountering in situ historically significant or culturally sensitive sites is low. As such, further archaeological investigation may not be required for the shoreline areas. However, as with Beach Stabilization, archaeological monitoring is recommended during sand recovery.

Beach Maintenance

Similar to the Beach Nourishment alternative, Beach Maintenance involves mechanical placement of sand along the affected shoreline. The archaeological LRFI states that for Beach Maintenance, as with Beach Nourishment, the probability of encountering in situ historically significant or culturally sensitive sites is low, and as such, further archaeological investigation may not be required for the shoreline areas. However, the archaeological LRFI recommends archaeological monitoring during the sand recovery process.

No Action

The No Action alternative, like each of the beach restoration action alternatives, would include demolition and removal of the temporary erosion skirt. Temporary erosion skirt demolition and removal would involve ground disturbance, albeit in an area that has been extensively eroded and previously disturbed. The No Action alternative would not involve sand recovery or placement of sand or stabilizing groins at Honokōwai Beach. As such, the No Action alternative is assumed to present a lower probability of encountering in situ historically significant or culturally sensitive sites than the beach restoration action alternatives.

Potential Related Secondary Actions

Potential secondary actions would be limited to the developed areas of the KBC property and are not anticipated to adversely impact historical or archaeological resources.

Summary

Due to previous erosion patterns, the probability of impacting significant archaeological or historic resources in the shoreline area of the Project Site is low for all action alternatives. No further archaeological investigation is anticipated to be required for the Beach Nourishment and Beach Maintenance alternatives. For ground disturbing work in backshore areas, additional archaeological investigation may be required. The Beach Stabilization alternative may require further archaeological testing, depending upon final construction plans.

Action Alternative	Anticipated Impact to Archaeological Resources
Beach Stabilization	Given the sand loss and exposure of the alluvial substrate as a result of beach erosion, there is a low probability of encountering sites in the shoreline area, but may require archaeological testing in the backshore area **Mitigation:** No further archaeological investigation required in the shoreline area; further archaeological investigation in backshore area may be recommended upon preparation of final construction plans; archaeological monitoring is recommended during sand recovery and construction
Beach Nourishment	Low probability of encountering sites **Mitigation:** No further archaeological investigation required in the shoreline area; archaeological monitoring recommended during sand recovery
Beach Maintenance	Low probability of encountering sites **Mitigation:** No further archaeological investigation required in the shoreline area; archaeological monitoring recommended during sand recovery
No Action	Low probability of encountering sites **Mitigation:** No further archaeological investigation required

3. Cultural Resources

a. Existing Conditions

A Cultural Impact Assessment (CIA) was completed for the Project by Honua Consulting. See **Appendix "G-1"**. Research conducted for the CIA included extensive archival work, interviews with cultural practitioners and area descendants, and reviews of Hawaiian-language documents and oral histories. These efforts highlighted the profound cultural and historical significance of Honokōwai and its surrounding areas. The CIA looked at three (3) geographic areas: the Project Site, the Sand Recovery Site, and the larger geographic extent of Honokōwai (and to a lesser degree, Hanakaʻōʻō, as the Sand Recovery Site is offshore of Puʻu Kekaʻa, situated between Honokōwai and Hanakaʻōʻō).

The Honokōwai area, within the Kāʻanapali Moku and the Honokōwai Ahupuaʻa, is a culturally and historically significant area of West Maui which was home to some of the earliest human settlements on the island of Maui.

Prior to Western contact, the region had a significant population and was rich with agricultural resources, including dryland kula (open pastures) and kīhāpai (farming plots) where crops such as ʻuala (sweet potatoes), kō

(sugar cane), kalo (taro), maiʻa (bananas and plantains), and wauke (paper mulberry) were cultivated. These traditional agricultural settlements began to decline in the 19th century as access to land and resources was affected by Western modernization and land ownership practices. In the Māhele of 1848, the land including the Project Site was awarded through the Māhele to Lot Kapuiwa, later known as Kamehameha V. The region also is noted as a historically important area for fishing, with a number of accounts from traditional moʻolelo (oral history) and written history pointing to fishing activities in pre-contact as well as post-contact times.

While the Project Site is located at Honokōwai Beach in the area of the KBC property, sand for the Project would be recovered approximately 1,500 ft. to 2,200 ft. offshore of Kāʻanapali near Puʻu Kekaʻa. As such, cultural resources are also considered for Kekaʻa, located in the adjacent ahupuaʻa of Hanakaʻōʻō. Kekaʻa is known as leina (or leina a ka ʻuhane), an important cultural and spiritual landmark which serves as the leaping place for departed spirits into the ancestral realm, and features prominently in the moʻolelo of the region.

The ethnographic research documented traditional fishing, gathering, surfing, paddling, and ceremonial practices historically associated with the area. A summary of the cultural resources and practices in and around the Project Site identified by the CIA interviewees is provided in **Table 12**.

Table 12. Cultural Resources, Traditions and Customs

CIA Interviewee(s)	Cultural Resources	Traditions and Customs
Vernon Kalanikau	Mr. Kalanikau explained that the biggest cultural resources in the area are ocean resources, including fish. He considers sand to be a kinolau, as sand previously came from a living reef.	Mr. Kalanikau noted that the most likely traditional and customary practices that occur in the area likely revolve around fishing and gathering. He is not sure if people fish for subsistence in the area.
Rose and Walker Crichton	Mrs. Crichton explained that the northern part of Black Rock is where they commonly paddle. There are currents which front the point area, and the currents flow in such a way that they can regroup in front of the Kaʻanapali Beach Club. Mr. Crichton also explained that the area is also used by Native Hawaiian families for traditional fishing. He also shared that this area of the reef is known for tako (octopus) and other subsistence diving, and is also used for surfing under the right conditions.	Mr. Crichton made a special point to note that paddling a canoe is more than just going out in a canoe, it is a classroom. It is a way to show the keiki what used to be, and provide them a space to connect with a traditional practice. Mrs. Crichton explained that the area is used heavily by fishermen and is known as a traditional fishing and diving place.
Luana Kawaʻa	Mrs. Kawaʻa states the main cultural resources in the area are ocean resources such as fish, limu, and crustacean.	Among the many traditions within the Project Site, Mrs. Kawaʻa states fishing and ocean resource gathering as the main cultural tradition within the area.
Kekai Keahi	Mr. Keahi explained that the beaches have already been impacted by decades of development. He shared some of the cultural resources used for sustenance in the Project Site include fish and limu. Limu kohu is one (1) of the only present limu species in the area currently. Other limu including limu lipoa, pepeʻe, and manauea are all gone.	Mr. Keahi shared that paddling, surfing (usually on a south swell), fishing, and gathering take place in the general area.
Kahu Glenn Kamaka	Rev. Kamaka states that since the development of Kaʻanapali over the last few decades, the area has been highly over-developed and whatever resources were there at one (1) time have been built over or have been removed from the land. Rev. Kamaka claims that there used to be fresh water springs in the ocean left of the Kaanapali Shores. Those springs were noticable through bubbling up from the sand in the near shore waters. He makes note that many of the fresh water sources have been filled with concrete and diverted. Ocean resources include fish and limu, honu, sharks, and many other aquatic species which the local communities depended on for food. Rev. Kamaka claims that the sharks that are found outside the reef area are ʻaumākua, and many	Amongst the cultural and customary practices within and near the Project Site, Rev. Kamaka notes fishing, surfing, and gathering of limu.

CIA Interviewee(s)	Cultural Resources	Traditions and Customs
	of the locals will lay claim to those ʻaumākua. Rev. Kamaka also mentions that the surf break is really good in that reef area within the Project Site, and recalls that when he was growing up, the entire area was sandy.	
Jenny Lindsey	Octopus is a main source of resource in the area. Other ocean resources like Limu, manini, reef fish area plentiful along this reef area. This area is also known to have a popular surf break caused by the reef structure.	Surfing, diving for reef fish and octopus, and picking limu is a daily practice to provide subsistence for the families of Honokōwai. Paddlers utilize the shore of Honokōwai while navigating the northern path.
Jakob Opunui	Resources in the Project Site include reef fish, papio, small amounts of limu, and a bountiful number of octopus. Mr. Opunui states that the surf break is one (1) of the best in the area.	Amongst the cultural practices in the Project Site are fishing diving, surfing, and canoe paddling.
Daryl Fujiwara	Mr. Fujiwara states the main cultural resources in the area are ocean resources such as fish, limu, and crustacean.	Subsistence fishing and gathering of ocean resources.
Darryl Kaina	Mr. Kaina explains that the main cultural resources are ocean resources like ʻaʻama crab, oio, moi, omilu, papio, ulua, weke, oama, kumu, and popular edible reef fish. According to Mr. Kaina, Honokōwai is the best octopus grounds. Limu ogo and limu kohu at one (1) time were extremely plentiful in the area.	Fishing and diving are the main customary practices within the Project Site.
Cody Pueo Pata	Mr. Pata mentions that there are ancient waterways mauka of the property along with another stream south of the property which traditionally exits into the ocean near the Honua Kai property. Pueo also states the abundance of ocean resources from limu and native fish species which the community of Honokōwai depend upon.	Mr. Pata states that subsistence fishing and gathering of ocean resources are prominent in the area. Mr. Pata also mentions there are families near the Project Site in Kahana that are noted akule fishermen in the area. Pueo has also mentioned while growing up, they would gather various kinds of limu in the region. Turtles are known to be along the reefs feeding upon the limu. Mr. Pata states that there are canoe halau in Lahaina and Kahana which are adjacent ahupuaʻa. Mr. Pata also refers to mele and creation of mele as a traditional customary practice and the most enduring traditional practice in existence with mele still being composed for the area.

b. Potential Impacts and Mitigation Measures

The CIA indicates that based on the collected ethnographic data, the proposed beach restoration action may adversely impact cultural resources or traditional or customary practices**.** Refer to **Appendix "G-1"**.

Flora – According to the CIA, limu is gathered by cultural practitioners and supports subsistence practices and cultural practices in the Project Site. It is noted that the Assessment of the Marine Environment prepared by Marine Research Consultants, Inc. noted that there was limited macroalgae present at the time of the surveys. Refer to the Assessment of the Marine Environment contained within the CEA, **Appendix "A"**. However, the CIA states that interviewees identified limu resources in the Project Site and expressed concern about potential impacts from the project on limu. Based upon ethnographic data gathered from interviewees, the CIA anticipates a temporary effect to culturally significant flora such as limu from the Beach Nourishment and Beach Maintenance alternatives, and a long-term effect from the Beach Stabilization alternative.

Fauna – Interviewees expressed concern about the impact of beach restoration to fish populations in the area and their migration patterns. The Assessment of the Marine Environment noted that project-related displacement of fish populations is anticipated to be limited to the nearshore scour zone, where fish populations are very low; and in the case of Beach Stabilization, the groins would create additional marine habitat with the potential to increase fish biomass and biodiversity. Refer to the Assessment of the Marine Environment contained within the CEA, **Appendix "A"**. The CIA anticipates a temporary effect to culturally significant fauna, and potential benefit to species like honu and monk seals who use the beach as habitat for basking, from the Beach Nourishment and Beach Maintenance alternatives. The CIA anticipates a long-term effect to marine fauna from the Beach Stabilization alternative.

Historic Sites – Puʻu Kekaʻa is identified as a historic site that would be temporarily impacted by sand recovery efforts. Specifically, the project would create a temporary impact to the setting and feeling of the site, which are two (2) aspects of integrity utilized when evaluating a historic site. The CIA notes that vessels regularly moor off Puʻu Kekaʻa and the visual effect to setting and feeling resulting from sand recovery efforts for the Project would be similar to the impacts from these vessels.

Intangible Cultural Resources – Intangible cultural resources refer to those resources without physical form, such as hula or mele. The CIA indicates the Project would have a temporary effect on intangible cultural resources or practices at the Project Site and Sand Recovery Site. In the case of Beach Stabilization, the groins would adversely impact intangible resources or practices, especially those like mele which are still being written about the area to this day.

Cultural Practices – Interviewees expressed concern that the Beach Stabilization alternative would impact cultural practices associated with fishing, gathering, surfing, and paddling. Diving regularly occurs off Puʻu Kekaʻa, but the Project would not likely affect the ability of area residents to participate in these activities.

The CIA recommends various mitigation measures, summarized below:

- Implementation of mitigations recommended under Chapter 6E, HRS for impacts to historic sites.
- Construction BMPs to limit the potential effects on nearby water resources.
- Extensive use of reef safe and/or appropriate native, coastal plants throughout the Project Site to minimize erosion and create additional cultural resources for practitioners.
- Avoidance of impacts on paddling routes, fishing areas, gathering areas, surfing spots, and marine resources.
- Development of a robust community benefits program to mitigate adverse impacts.

Beach Stabilization

There would be temporary impacts to cultural resources and practices associated with construction and sand recovery activities, as described above. Sand recovery activities would impact the setting and feeling at Puʻu Kekaʻa and the CIA notes temporary impacts to fishing and ocean gathering activities. From a long-term perspective, the CIA states that interviewees expressed concern that the stabilizing groins would have a long-term effect on limu and other marine flora and fauna and have a potential effect on fishing and other ocean gathering activities. The CIA also

indicates that the groins would adversely impact intangible cultural resources such as mele and hula and cultural practices such as fishing, gathering, surfing, and paddling.

Beach Nourishment

There would be temporary impacts to cultural resources and practices associated with construction and sand recovery activities, similar to those which would occur with Beach Stabilization.

Beach Maintenance

Similar to Beach Nourishment, there would be temporary impacts to cultural resources and practices associated with construction and sand recovery activities. Rather than a one-time impact, these impacts would be recurring with each renourishment action, which is anticipated to occur approximately every 10 years.

No Action

The individuals interviewed for the CIA did not express concerns about potential impacts from the No Action alternative. However, the CIA notes that there may be a potential effect to cultural resources and practices that would result from beach loss under the No Action alternative.

Potential Related Secondary Actions

Potential secondary actions would be limited to the developed areas of the KBC property and are not anticipated to adversely impact cultural resources. The potential related secondary actions may include access related improvements that would improve shoreline access for cultural practices.

Summary

The CIA cites temporary impacts to cultural resources and practices for all three (3) action alternatives. No impacts or concerns were identified for the No Action alternative. Additional potential long-term impacts were identified for the Beach Stabilization alternative associated with the proposed stabilizing groins.

Action Alternative	Anticipated Impact to Cultural Resources
Beach Stabilization	Temporary impacts at the Project Site and Sand Recovery Site related to fishing, ocean gathering, and the setting and feeling at Puʻu Kekaʻa; additional long-term effects to flora and fauna, fishing, ocean gathering, and intangible cultural resources associated with the stabilizing groins **Mitigation:** Implementation of recommended measures for historic sites per Chapter 6E, HRS review; implementation of construction BMPs; use of appropriate plants in project site; avoidance of areas used for fishing, gathering, and other ocean activities; development of community benefits program to mitigate adverse impacts
Beach Nourishment	Temporary impacts at the Project Site and Sand Recovery Site related to fishing, ocean gathering, and the setting and feeling at Puʻu Kekaʻa; potential benefit to culturally significant fauna such as honu and monk seals who use the beach as habitat for basking **Mitigation:** Implementation of recommended measures for historic sites per Chapter 6E, HRS review; implementation of construction BMPs; use of appropriate plants in project site; avoidance of areas used for fishing, gathering, and other ocean activities; development of community benefits program to mitigate adverse impacts
Beach Maintenance	Temporary impacts at the Project Site and Sand Recovery Site related to fishing, ocean gathering, and the setting and feeling at Puʻu Kekaʻa; potential benefit to culturally significant fauna such as honu and monk seals who use the beach as habitat for basking **Mitigation:** Implementation of recommended measures for historic sites per Chapter 6E, HRS review; implementation of construction BMPs; use of appropriate plants in project site; avoidance of areas used for fishing, gathering, and other ocean activities; development of community benefits program to mitigate adverse impacts
No Action	Potential effect on cultural practices and resources due to loss of beach environment from ongoing erosion.

c. Ka Pa‘akai Framework Overview

The State of Hawai‘i has an obligation to protect the reasonable exercise of customarily and traditionally exercised rights of Hawaiians to the extent feasible, as recognized by the Hawai‘i Supreme Court (Court) in Public Access Shoreline Hawai‘i v. Hawai‘i County Planning Commission (“PASH”) in 1995.

In 2000, in the Ka Pa‘akai decision, the Court established an analytical framework for government agencies “to help ensure the enforcement of traditional and customary Native Hawaiian rights while reasonably accommodating competing private development interests.” Under this framework, an administrative agency must make specific findings of fact and conclusions of law as to three (3) items:

1) The identity and scope of ‘valued cultural, historical, or natural resources’ in the subject area, including the extent to which traditional and customary Native Hawaiian rights are exercised in the subject area;

2) The extent to which those resources—including traditional and customary Native Hawaiian rights—will be affected or impaired by the proposed action; and

3) The feasible action, if any, to be taken by the agency to reasonably protect Native Hawaiian rights if they are found to exist.

A Ka Pa‘akai Framework Overview to aid in the application of the Ka Pa‘akai framework to the Project was prepared and is provided in **Appendix “G-2”**. This overview considers applicable observations and findings from several of the Project’s technical reports that may be relevant to an agency’s analysis and application of the Ka Pa‘akai framework, including the CIA (**Appendix “G-1”**), the archaeological LRFI (**Appendix “F”**), the Assessment of the Marine Environment included within the CEA in **Appendix “A”**, the Coastal and Marine Uses Report (**Appendix “J”**), and the Terrestrial Biological Survey (**Appendix “C”**). The observations and findings from these studies as they relate to the three (3) Ka Pa‘akai framework items are discussed in **Appendix “G-2”** and are summarized as follows.

1. Identification and Scope of Resources in the Project Site

The technical reports show that potential resources may exist within the Project Site, although the scope and identity of resources vary among the technical reports. Overall, the ocean environment is a cultural resource in the Project Site, as it is used as a setting for

fishing, gathering, surfing, paddling, and other activities. Practitioners access the resource through a variety of locations and methods.

As discussed in this section of the Draft EIS and in **Appendix "G-1"**, the CIA interviews indicate extensive current cultural resources in the area that are used for traditional or customary practices. As discussed in the CIA, information gathered regarding beliefs from practitioners can differ from information gathered from other sources, and the CIA faithfully captured and documented beliefs from practitioners, even when these beliefs may be inconsistent with other data. Many cultural resources may be significant to members of the Native Hawaiian community but do not necessarily result in material evidence.

The archaeological LRFI (refer to **Appendix "F"**) identified approximately 25 previous archaeological investigations and previously identified historic properties in the region, but none were found within the Project Site or Sand Recovery Site. The probability of encountering in situ historically significant or culturally sensitive sites at the Project Site is low for the Beach Nourishment and Beach Maintenance alternatives. The Beach Stabilization alternative may warrant archaeological testing within the construction footprint given the potential need for excavation, which may identify additional resources. The recovery of a probable ku'ula stone near the Sand Recovery Site has raised concerns that significant traditional Hawaiian objects may be present in the Sand Recovery Site. While tow camera survey footage did not reveal the presence of traditionally significant objects along the documented transects, the potential remains for such an object to exist in un-surveyed portions of the Sand Recovery Site or beneath the surface of the deposited sand.

The Assessment of the Marine Environment (refer to **Appendix "A"**) identifies marine resources in and adjacent to the Project Site according to three (3) reef zones with limited biodiversity in the nearshore scour zone and increasing fish populations offshore. The most common and conspicuous fish were mixed schools (eight (8) species) of Acanthurids (surgeonfish) transiting the reef surface and mid-water near the outer margin of the reef. Other commonly observed fish were seven (7) species of Chaetodontidae (butterflyfishes), Labridae (wrasses) and Pomacentridae (damselfishes). Fish observed in the outer reef coral zone represent

typical assemblages found on Hawaiian reefs of similar physical and biotic structure.

The Coastal and Marine Uses Report (refer to **Appendix "J"**) identified recreational uses of the Project Site and the Sand Recovery Site through surveys and site visits. While no traditional gathering activities, such as gathering ʻopihi or limu, were observed during site visits, a few ʻopihi were observed on the breakwall fronting the Maui Kai south of the Project Site, and various types of limu were observed along the shoreline and in the shallow waters along Honokōwai Beach. As a result, the report notes that there is a high potential that gathering still occurs within and surrounding the Project Site. No gathering activities were identified at the Sand Recovery Site given its distance from the shoreline. Additionally, diving, spearfishing, surfing, fishing, cliff diving, and canoe paddling were identified.

The Terrestrial Biological Survey (refer to **Appendix "C"**) identified one (1) endemic (ʻākia or *Wikstroemia uva-ursi*) and six (6) indigenous species of flora. Of the indigenous flora, three (3) are planted as part of landscaped vegetation: hala (*Pandanus tectorius*), hau (*Talipariti tiliaceum*), and ʻilima (*Sida fallax*). The other three (3) species, naupaka, pohuehue, and milo (*Thespesia populnea*) appear to grow naturally, but are more likely to be plantings as well Aquatic fauna were identified in the Honokōwai Stream, which borders the Project Site. Fishes observed include mosquitofish (*Gambusia affinis*), mullet (*Mugil cephalus*), tilapia (*Oreochromis mossambicus* and *Sarotherodon melanotheron*), and Hawaiian flagtail or ʻaholehole (*Kuhlia xenura*). Only one (1) indigenous avian fauna was observed, the Black-crowned Night-Heron or ʻaukuʻu (*Nycticorax nycticorax*). The report further notes that protected Hawaiian waterbirds (e.g., the Hawaiian Duck, Hawaiian Coot, endemic subspecies of Common Gallinule, and endemic subspecies of Black-necked stilt) are unlikely to occur in the Project Site. Moreover, it is possible that night-flying Hawaiian seabirds are likely to overfly or otherwise use the Project Site and the Hawaiian hoary bat may use resources within the vicinity of the Project Site. Sightings of the Hawaiian monk seal (*Monachus schauinslandi*) at Honokōwai Beach have been reported 159 times between 2014 and 2023. Green sea turtles may also occur in the Project Site.

2. Extent to Which Resources May Be Affected or Impaired

The extent to which identified resources will be affected or impaired by the Proposed Action examines two (2) separate elements: the extent the resources itself is affected or impaired, and the extent that access to the resource is affected or impaired. There would be temporary impacts to access in all of the three (3) proposed alternatives except the No Action alternative. There would be a temporary impact on Puʻu Kekaʻa, specifically the setting and feeling of this significant historic site. Cultural practices in the area, like paddling or surfing, may also be temporarily impacted, as reflected in the Coastal and Marine Uses Report. Under the No Action alternative, shore-based activities would face long-term impacts with the loss of the beach in the Project Site. This would include fishing, surfing, and any other cultural practices that utilized beach access.

As discussed in the CIA (Refer to **Appendix "G-1"**), area practitioners expressed concern about a potential indirect effect resulting from construction activities fronting the KBC property. The extent of this impact is unknown, but practitioners expressed concern over a possible permanent impact on marine resources, namely fish and limu, which are actively gathered for subsistence purposes. Based on the interviews, the greatest potential effect would be from Beach Stabilization and the construction of groins, including potential impacts of sand on reef and marine environs, impacts on tako habitat, and the psychological and emotional impacts of development (e.g., groin construction) on the beach. Practitioners also expressed concern over the possible indirect impact of Beach Nourishment and/or Beach Maintenance, such as the impact of additional sand on reef and marine life. No concern was expressed among the people interviewed over the potential significant and adverse impacts arising from the No Action alternative. When weighed against the Assessment of the Marine Environment (refer to **Appendix "A"**) and the Coastal and Marine Uses Report (refer to **Appendix "J"**), the potential impact for cultural practices is lowered due to the fact that the marine resources within the nearshore scour zone are limited. The potential to affect cultural practices increases as the amount of resources increases in areas farther offshore.

The archaeological LRFI (refer to **Appendix "F"**) noted potential temporary adverse effects on Puʻu Kekaʻa. The report notes that at Puʻu Kekaʻa, depending on the season and the direction of the setting sun, the presence of barges (i.e., at the Sand Recovery Site) off the leaping point would present a temporary adverse effect on the setting and feeling of the leina, disrupting the perceived pathway of the soul's journey.

Impacts associated with each alternative were identified in the Assessment of the Marine Environment (refer to **Appendix "A"**). Under each alternative, potential temporary increases in turbidity in nearshore waters may occur during construction and, in the case of the Beach Restoration alternatives, during the post-construction equilibration period. With respect to the Beach Stabilization alternative, long-term impacts include the permanent coverage of existing marine habitat within the footprint of the proposed groins and sandfill, although these structures will also create new marine habitat and the loss of existing benthic habitat within the groin footprints is likely to be offset by new habitat created by the groins. Fish populations within the groin footprints and sand fill will be permanently displaced, although fish biomass and biodiversity there are very low due to its location in the nearshore scour zone. As a result, impacts to fish populations or migration patterns are expected to are expected to be negligible. The cumulative impacts of the No Action alternative are anticipated to be broad-ranging and substantial, including beach narrowing, negative impacts to water quality and benthic habitat, loss of ecosystem services and critical natural habitats, and progressive degradation of the shoreline area as a result of continued erosion following removal of the existing temporary erosion skirt.

The Coastal and Marine Uses Report (refer to **Appendix "J"**) anticipates impacts for each Beach Restoration alternative, as well as the No Action alternative. Anticipated impacts from sand recovery and placement (applicable for each Beach Restoration alternative) include minor turbidity at the Sand Recovery Site during sand recovery operations and at the Project Site during construction and equilibration. Turbidity may temporarily impact gathering activities, fishing, diving, surfing, canoe paddling, and potentially cliff diving. Construction will temporarily impact gathering activities, fishing, diving, surfing, and canoe paddling by limiting access to the Project Site while construction activities take place. Similarly, sand recovery operations will temporarily limit access to the Sand

Recovery Site which may impact fishing and canoe paddling. With respect to the Beach Nourishment and Beach Maintenance alternatives, in the event the effective life of the restoration is shorter than anticipated, beach narrowing or loss could occur without further action. The impacts of beach narrowing and/or loss are similar to those anticipated for the No Action alternative. Gathering activities, diving, surfing, fishing, and canoe paddling may be impacted by Beach Stabilization through the restoration of conditions similar to those before the 2016 beach loss and avulsion event at the Project Site. The Beach Stabilization alternative may also impact surfing due to the presence of groins, although the report notes that an assessment is difficult to make with certainty due to dependence on swell direction and size. For the No Action alternative, the report notes that if no action is taken, it is possible that eventually, the beach could disappear entirely and terrestrial sediment (alluvium) would be discharged, causing turbidity plumes that are potentially detrimental to corals and sea life. Beach narrowing and/or loss would negatively impact gathering activities (e.g., gathering of limu and shells) and would negatively impact fishing in the short-term and the long-term. Additionally, the No Action alternative would create a more hazardous environment for divers (e.g., due to increased turbidity), more hazardous surfing due to increased wave reflection and turbidity, and reduces safe access to and from the beach for canoe paddlers.

As discussed in the Terrestrial Biological Survey (refer to **Appendix "C"**), the presence or use of machinery on the beach and backshore area may impact existing fauna. Impacts to waterbird and seabird species, such as disturbance from noise and human activity and mortality from ground disturbance and vehicle strikes, may occur during construction for each of the Beach Restoration alternatives. Impacts to Hawaiian hoary bats could occur only if trees are cleared. Threatened or endangered species, such as monk seals and sea turtles, may be impacted by disturbance from noise and human activity and an increase in nearshore turbidity for all Beach Restoration alternatives. Additionally, for the Beach Stabilization alternative, construction activity related to the groins could cause in-water disturbance to monk seals and sea turtles. Increased beach area for monk seals and sea turtles to haul out is anticipated as a beneficial impact of each Beach Restoration alternative.

3. Potential Feasible Actions to Reasonably Protect Native Hawaiian Rights

The third part of the Ka Paʻakai framework aims to identify "the feasible action, if any, to be taken to reasonably protect Native Hawaiian rights if they are found to exist." Determining whether or not action has been suitably "feasible" is a matter for the State. These feasible actions could include continued access to the Project Site as needed to conduct cultural practices. Native planting may also be a potentially feasible action.

Some potential feasible actions identified in the technical reports include reasonably protecting the viewshed at Puʻu Kekaʻa to maintain spiritual sanctity and honor its cultural significance, protecting nabeta during sand recovery, restoring depleted ocean resources, such as limu and coral, developing a reef-safe landscaping plan in consultation with community groups, and working with the community to avoid or mitigate impacts on paddling routes, fishing areas, gathering areas, surfing spots, and marine resources (refer to **Appendix "G-1"**); conducting archaeological monitoring during sand recovery (for all alternatives) and construction (for the Beach Stabilization alternative) (refer to **Appendix "F"**); and implementing best management practices, such as biosocks and silt curtains (refer to **Appendix "A"**).

Further inquiry into the potential extent of the impact on marine resources is necessary to propose action that the State can take to protect Native Hawaiian rights in the area. These actions may include increased restoration efforts or establishing access for fishers and practitioners.

4. Public Trust Resources

a. Existing Conditions

Article XI, Section 1 of the Hawaiʻi Constitution declares that *"for the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawaiʻi's natural beauty and all natural resources, including land, water, air, minerals and energy sources".* Article XI, Section 7 further provides that the *"State has an obligation to protect, control and regulate the use of Hawaiʻi's water resources for the benefit of its people".* Article XII, Section 4 directs that all crown and government lands transferred to the State under the Admission Act,

commonly known as ‘ceded lands,’ *“shall be held by the State as a public trust for native Hawaiians and the general public”.*

The Proposed Action involves State-owned beaches and submerged lands, which are considered public trust resources and ceded lands pursuant to Articles XI and XII. A Public Trust Resource Analysis (see **Appendix “H”**) was compiled in order to identify public trust resources and project-related impacts to these resources. Public trust resources identified in the Project area are described as follows:

Beaches and Submerged Lands

Honokōwai Beach is located seaward of the certified shoreline, which under Hawai‘i law belongs to the State of Hawai‘i. In addition, the beach is located within the State Conservation District. As such, the beach and its related submerged lands are considered public trust resources.

Nearshore Waters and Marine Environment

The State’s obligation to *“protect, control and regulate the use of Hawai‘i’s water resources for the benefit of its people”* applies to the nearshore waters adjacent to Honokōwai Beach, which encompass critical wildlife habitats, essential fish habitats, coral reef ecosystems, and essential resources for subsistence and cultural practices.

Traditional and Customary Practices

The State’s Constitution protects *“the rights of Native Hawaiians to practice their traditional and customary rights”.* This includes fishing, gathering, and ceremonial practices exercised in the shoreline and nearshore areas of Honokōwai. The Cultural Impact Assessment (**Appendix “G-1”**) and Ka Pa‘akai framework (**Appendix “G-2”**) document the presence and exercise of such practices. Interviews with practitioners confirm that Honokōwai remains a significant site for subsistence fishing, seasonal gathering, and cultural ceremonies associated with the ocean and shoreline.

Public Access and Recreation

The Public Trust Resource Analysis identifies public access and recreation as trust purposes. Honokōwai Beach is a vital recreational area, supporting ocean sports, fishing, walking, and cultural events.

Environmental and Hazard Protection

The Public Trust Resource Analysis states that the State's duty to conserve natural resources includes ensuring public safety from environmental hazards. Beaches and dunes are not just recreational features; they serve as natural infrastructure, dissipating wave energy, reducing flooding, and protecting inland areas from coastal hazards. Honokōwai Beach is currently threatened by environmental hazards chronic erosion, storm surge, and sea level rise, posing a risk to public natural resources as well as inland properties, infrastructure, and cultural sites.

Economic and Social Values

The Public Trust Resource Analysis states that the public trust doctrine includes social, recreational, and community well-being alongside ecological and cultural values. Honokōwai Beach is both a key community gathering spot and an economic asset for West Maui's visitor industry. Recreational opportunities such as fishing, ocean sports, swimming, and gathering underpin community cohesion, while visitor enjoyment of beaches drives much of the regional economy.

b. Potential Impacts and Mitigation Measures

The Public Trust Resource Analysis summarizes legal cases that articulate public trust analyses and procedural requirements that the State must fulfill in executing its public trust. According to *Frankel v. Bd. of Land and Nat. Resources*, Hawai'i law requires the agency entrusted to protect that trust resources to (1) begin its analysis with the presumption in favor of public use when balancing between public and private purposes, (2) consider practicable alternatives, and (3) set forth its decision with clarity. The Public Trust Resource Analysis (**Appendix "H"**) provides an analysis for each step.

The Proposed Action aligns with public trust values by: 1) restoring a public beach resource; 2) preserving public access; 3) protecting cultural practices; 4) protecting water quality by reducing sediment discharge to nearshore waters; and 5) strengthening resilience against coastal hazards and sea level rise. Each of these objectives directly supports the State's constitutional trust duties to conserve resources for the benefit of present and future generations and to hold ceded lands in trust for both Native Hawaiians and the general public.

Beach Stabilization

Beach Stabilization, involving sand placement as well as stabilizing groins, provides a 50-year design life, reduces the frequency of interventions, and minimizes long-term environmental disruption. This alternative best achieves the Project's objectives while protecting public trust resources. It maintains lateral and perpendicular access, preserves cultural practice areas, reduces sediment discharge, and strengthens resilience to sea level rise.

By widening and stabilizing the shoreline, Beach Stabilization would reestablish and stabilize the beach as a functional public trust resource, ensuring continued access, cultural practice, and protective functions. In this way, the Project represents not a privatization or encroachment of trust lands, but their restoration and revitalization. Over the long term, the Project is expected to create a net benefit for nearshore waters by restoring sand stability, improving water quality, and preserving healthy reef ecosystems.

Beach Stabilization also improves the quality of recreational experiences, by reducing erosion and sediment discharge, restoring clear waters for swimming and safe sand corridors for walking and fishing. These outcomes fulfill the constitutional trust duty to preserve access and recreation as public uses. Additionally, Beach Stabilization would enhance hazard resilience and creates a platform for continued community use and economic activity.

Beach Nourishment

Beach Nourishment would involve a one-time placement of sand without stabilizing groins. Beach Nourishment would support public trust resources by offsetting the effects of erosion and increasing the beach width and sand volume. The outcomes and impacts of Beach Nourishment would be similar to the Beach Stabilization, but would be limited to an approximately 10-year lifespan, after which Honokōwai Beach and its associated public trust resources would be at risk from episodic erosion and beach loss events.

Beach Maintenance

Like Beach Nourishment, the outcomes and impacts of Beach Maintenance would be similar to Beach Stabilization and would support public trust resources. However, this alternative requires the most construction days overall, is the most costly over time, and is at risk for episodic erosion and beach loss events.

No Action

The No Action alternative is projected to result in the severe loss of beach width, loss of an estimated 1.4 acres of beach, discharge of 20,000 cubic yards of sediment into nearshore waters, and elimination of shoreline access over the next fifty years. This would compromise lateral shoreline access within the beach transit corridor, limit available shoreline area for fishing and recreation, and allow more frequent and severe erosion and inundation of inland areas. Without beach restoration, infrastructure improvements, such as parking areas, pedestrian pathways, and transit stops would be undermined by continued shoreline loss.

Nearshore waters and the marine environment would also be impacted by an additional 20,000 cubic yards of sedimentation as a result of chronic erosion under the No Action alternative over 50 years, resulting in adverse impacts to reef health, fish habitat, and water quality, directly undermining public trust obligations.

The ability of Native Hawaiians to exercise and practice their traditional and customary rights would be compromised by the erosion of Honokōwai Beach, as narrowed beaches would limit safe access to fishing grounds and gathering areas, and sediment discharges would reduce the abundance and health of fish populations.

Further, inland assets would face increasing risk, and the absence of a buffering beach would magnify hazard exposure and vulnerability and decrease resilience. Shoreline erosion would diminish economic and social values, making West Maui less attractive to residents and visitors alike.

Potential Related Secondary Actions

The Potential Related and Secondary actions would be limited to the KBC property, and are not anticipated to adversely impact public trust resources.

Summary

The Project's objectives of improving beach stability, preserving and enhancing cultural and shoreline access, increasing resilience to coastal hazards and human-induced sea level rise, and enabling planning for long-term adaptation to sea level rise are in alignment with the State's Constitutional obligations to protect public trust resources, in that the Proposed Action would restore eroded lands, protect cultural and ecological resources, and strengthen the resilience of Honokōwai Beach for future generations. From a public trust resource perspective, the No

Action alternative would represent a failure to protect these public trust resources and would not align with the State's Constitutional obligations.

Action Alternative	Anticipated Impact to Public Trust Resources
Beach Stabilization	Protects public trust resources by providing a wider and more stable beach and retention of the backshore soil and landward areas for the anticipated 50-year design life
Beach Nourishment	Protects public trust resources by providing a wider beach and retention of the backshore soil and landward areas for approximately 10 years
Beach Maintenance	Protects public trust resources by providing a wider beach and retention of the backshore soil and landward areas for the 50-year duration of the Beach Maintenance program
No Action	Does not fulfill State's responsibility to protect public trust resource; progressive erosion, shoreline recession, beach narrowing, and potential beach loss would negatively impact public trust resources

5. Population

a. Existing Conditions

According to the Department of Business, Economic Development & Tourism (DBEDT), as of 2023, the island of Maui had approximately 154,100 residents (DBEDT, 2024). The West Maui region is comprised of 29 ahupua'a and covers the majority of the traditional moku of Lahaina and Kā'anapali. As of 2017 and prior to the Lahaina fires of August 2023, West Maui had a resident population of 25,000 settled over approximately 96 square miles, with Lahaina being the major population center, and an estimated average daytime population of 63,706 people, consisting of about 10,287 residents, 19,868 workers, and 33,551 visitors (County of Maui, Department of Planning, 2022). Since the August 2023 Lahaina wildfires, there has been a decline in resident, visitor, and worker population; overall population trends are likely to persist over the long-term as recovery continues.

b. Potential Impacts and Mitigation Measures

The Proposed Action is not a population generator. As such, there are no significant impacts to the population of the Honokōwai region or island of Maui anticipated for the action alternatives or potential related secondary actions.

Beach Stabilization

The Beach Stabilization alternative is not anticipated to impact population. The creation of a wider and more stable beach is not a population generator and would not affect long-term population growth projections for the region.

Beach Nourishment

The Beach Nourishment alternative is anticipated to have a negligible impact on population characteristics. It is noted that the projected erosion and beach narrowing over approximately 10 years may result in a diminished transient visitor population in the immediate vicinity of Honokōwai Beach, as the negative effects associated with beach loss may lead to visitors choosing alternative areas of Maui. However, these potential localized impacts are not anticipated to significantly alter transient or permanent resident populations regionally or island wide.

Beach Maintenance

The Beach Maintenance alternative is not anticipated to impact population.

No Action

The loss of a sandy beach associated with the No Action alternative may result in a diminished transient visitor population in the immediate vicinity of Honokōwai Beach, as the negative effects associated with beach loss may lead to visitors choosing alternative areas of Maui. However, these potential localized impacts are not anticipated to significantly alter transient or permanent resident populations regionally or island wide.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to impact population.

Summary

As a beach restoration Project, no significant impacts to population parameters are anticipated for any of the Project alternatives.

Action Alternative	Anticipated Impact to Population
Beach Stabilization	No impact
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

6. Economy and Labor Force

a. Existing Conditions

Following the cessation of large-scale sugar cane and pineapple cultivation on Maui in the early 2000s, the visitor industry has contributed substantially to Maui's economy and supported the retail and service industries. The West Maui region is one (1) of the State's major resort destination areas with world-class resorts and beaches. Travel restrictions and resort closures brought about by the COVID-19 pandemic in 2020 had a devastating effect on the local economy, with many businesses being forced to shut down or drastically reduce operations. By mid-2022, however, visitor arrivals statewide and on Maui returned to approximately 90 percent of pre-pandemic levels from mid-2019, and visitor spending now exceeds mid-2019 levels (DBEDT, June 2022). As a result of the Lahaina wildfires in August 2023, there was a decline in both visitor population and spending on Maui. The University of Hawai'i Economic Research Organization (UHERO) forecasts that Maui hotels will see falling occupancy rates and the aftermath of the fires continues to disrupt the local labor market. Coupled with the ongoing affordable housing crisis, labor market disruptions and flat visitor spending are forcing some residents of Maui to leave West Maui or the island all together (UHERO, 2024). Labor statistics for the State of Hawai'i and Maui County are displayed in **Table 13**.

Table 13. State of Hawai'i and Maui County Labor Statistics

	2018	2019	2020	2021	2022	2023
State of Hawai'i						
Labor Force	692,457	686,066	665,964	670,193	672,727	676,355
Employment	675,849	668,769	588,159	630,151	650,151	656,336
Unemployment	16,608	17,297	77,805	40,042	22,055	20,019
Unemployment Rate	2.4%	2.5%	11.7%	6.0%	3.3%	3.0%
Maui County						
Labor Force	90,337	89,697	85,169	87,321	87,268	87,498
Employment	88,220	87,505	69,977	80,630	84,237	83,772
Unemployment	2,117	2,192	15,192	6,691	3,031	3,726
Unemployment Rate	2.3%	2.4%	17.8%	7.7%	3.5%	4.3%
Source: Economic Impact Report (**Appendix "I"**)						

Within the KBC property there are staff employed for housekeeping, guest services, management, maintenance, landscaping, security, culinary services, and vacation rental sales. Other local businesses are also

supported, including a massage parlor, spa, convenience store, lūʻau, and valet service. These services provide an important source of jobs for West Maui residents, and the property generates significant tax revenue for the county and state, much of which is from off island and out of state visitor spending. The KBC currently directly generates approximately 300 jobs. Honokōwai Beach also supports public use and numerous businesses not affiliated with KBC.

b. <u>Potential Impacts and Mitigation Measures</u>

During project implementation, the proposed beach restoration action alternatives would generate construction-related employment. Over the longer term, the Project would serve to restore and preserve the beach at Honokōwai. An Economic Impact Report (EIR) was prepared by Environment & Economics, LLC in October 2024. See **Appendix "I"**. The report evaluated economic and fiscal impacts associated with the three (3) proposed beach restoration action alternatives, as well as the No Action alternative. The economic impacts are evaluated in terms of jobs created or lost by the action, the associated labor income, and total anticipated economic output.

The EIR used a period of analysis of 50 years to correspond with the design life of the Beach Stabilization and Beach Maintenance alternatives. Since the job impacts are presented over multiple years, these jobs should be thought of as "job years", as the same impact is occurring over multiple years rather than new impacts being generated over time. Labor income represents income generated or sustained as a result of the action and related economic activity in the region. The total economic output equals the value of production of industries in the area of the Proposed Action. Fiscal results are considered in terms of tax revenues to the State and County that could be expected as a result of the action. These tax revenues could come from Transient Accommodation Tax, General Excise Tax, Corporate Profits Tax, Property Tax, and Personal Income Tax. For a complete analysis of economic impacts, see **Appendix "I"**.

The results of the EIR are provided below. These estimates are reported in 2024 dollars and include direct, indirect, and induced effects. Overall, the two (2) action alternatives with extended design lives (i.e., Beach Maintenance and Beach Stabilization) would, by far, be the most economically beneficial to Maui County. These alternatives would, in addition to generating moderate beneficial impacts associated with construction, avoid the substantial consequences associated with reduced or ceased operations of KBC. Conversely, the Beach Nourishment

alternative and No Action alternative scenarios would lead to substantial job loss and reduced economic vitality through the period of analysis for an indefinite period of time afterward.

Beach Stabilization

The Beach Stabilization alternative would allow for the continued operation of KBC during the 50-year analysis period, resulting in no long-term job losses. A wider and more stable beach and sustained KBC operations generate substantial economic and fiscal benefits in both Maui County and the State.

The anticipated economic and fiscal impacts of Beach Stabilization for the 50-year analysis period are presented in **Table 14** below.

Table 14. Economic and Fiscal Impacts, Beach Stabilization

Alternative	Jobs	Labor Income	Economic Output	State Revenue	County Revenue
Beach Stabilization	154	$10.7M	$31.1M	$1.4M	$0.51M

Beach Nourishment

Beach Nourishment would allow for the continued operation of KBC over a mid-term time frame. Because this would be a one-time action with a relatively brief lifespan, negative economic impacts associated with the No Action alternative, including beach and backshore erosion, are assumed to begin after 2053 for Beach Nourishment. The economic impact analysis assumes the effects of the moderate No Action scenario are considered from 2054 to 2078, which includes significant losses of 19,720 “job years”. Since the job impacts are presented over multiple years, these jobs should be thought of as “job years”, as the same impact is occurring over multiple years rather than new impacts being generated over time. Job losses occur as a result of KBC needing to cease operations when the impacts of No Action eventually occur following a one-time nourishment. Overall, Beach Nourishment is anticipated to have significant adverse impacts to the economy and labor force.

The anticipated economic and fiscal impacts of Beach Nourishment are presented in **Table 15** below.

Table 15. Economic and Fiscal Impacts, Beach Nourishment

Alternative	Jobs	Labor Income	Economic Output	State Revenue	County Revenue
Beach Nourishment	-19,720	-$1.09B	-$2.67B	-$168.4M	-$109.8M

Beach Maintenance

From a long-term perspective, the Beach Maintenance alternative, similar to Beach Stabilization, would allow for the continued operation of KBC, which generates substantial economic and fiscal benefits in Maui County and the State. Unlike Beach Nourishment, Beach Maintenance involves a recurring action of placing sand on the beach. Beach Maintenance would result in a net positive creation of jobs and economic output, since the recurring nourishment actions would avoid the impacts associated with No Action for the period of analysis.

The anticipated economic and fiscal impacts of Beach Maintenance for the 50-year analysis period are presented in **Table 16** below.

Table 16. Economic and Fiscal Impacts, Beach Maintenance

Alternative	Jobs	Labor Income	Economic Output	State Revenue	County Revenue
Beach Maintenance	140	$9.8M	$34.3M	$1.5M	$0.58M

No Action

The No Action alternative assumes that the KBC would need to reduce operations or be forced to close entirely due to the eventual loss of Honokōwai Beach and the overall degradation of the shoreline area. The Economic Impact Report prepared for the Project analyzed three (3) No Action scenarios of varying impact. The three (3) scenarios represent varying levels of reduced KBC operations, and associated reductions in county-wide economic activity that would be lost due to those reductions. No Action would result in the loss of jobs, revenue, and taxable moneys for the county of Maui and State under all three (3) scenarios. If the backshore of Honokōwai Beach was lost, there would be economic impacts related to job loss and closure of the buildings. This potential impact is highlighted in the low, moderate, and maximal scenarios. The purpose of these scenarios is to model a variety of outcomes that could occur based on modeling that shows the continued erosion of the shoreline over 25 years. Overall, No Action is anticipated to have significant adverse impacts to the economy and labor force.

The anticipated economic and fiscal impacts of the No Action scenarios are presented in **Table 17** below.

Table 17. Economic and Fiscal Impacts, No Action

Scenario	Jobs	Labor Income	Economic Output	State Revenue	County Revenue
Low Impact (KBC operations reduced by one third)	-16,492	-$914.3M	-$2.24B	-$140.0M	-$91.7M
Moderate Impact (KBC operations reduced by two thirds)	-32,983	-$1.3B	-$4.48B	-$281.8M	-$183.5M
High Impact (KBC full closure)	-49,475	-$2.74B	-$6.72B	-$422.7M	-$275.2M
Quantities shown in 2024 dollars					

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to adversely impact the economy and labor force in the Honokōwai area. Any impacts would be temporary, positive, and limited to construction spending.

Summary

A wider and more stable sandy beach provides long-term economic benefits to the Honokōwai region through sustained jobs and tax revenue. A No Action alternative may provide some short-term jobs for demolition and removal of the temporary erosion skirt, but would cause long-term losses of jobs and a reduction in visitor spending and associated tax revenues. The Beach Stabilization and Beach Maintenance alternatives would provide ongoing long-term positive impacts to the economy and labor force around Honokōwai Beach. These methods would create construction jobs as well as related State and County revenues, while avoiding negative impacts associated with erosion, shoreline recession, beach narrowing, and potential beach loss.These alternatives would allow for the continued operation of KBC for the period of analysis, which would allow for sustained jobs and tax revenues. Beach Nourishment would offer positive short-term impacts but around 2054, the No Action impacts would cause a loss in jobs and revenue associated with the reduced operations and eventual shutdown of KBC operations. Both Beach Nourishment and No Action are anticipated to have significant adverse impacts to the economy and labor force over the long-term. No Action was assessed in three (3) scenarios, low, moderate, and maximal. These three (3) scenarios show various ways in which the economy around Honokōwai Beach may be impacted by beach erosion, through a partial or full closure of KBC operations, if the erosion is allowed to continue unabated. See **Table 18**. The potential related secondary actions are not anticipated to adversely impact the economy or labor force in the region.

Table 18. Summary of Economic and Fiscal Impacts

Alternative	Jobs	Labor Income	Economic Output	State Revenue	County Revenue
Beach Stabilization	154	$10.7M	$31.1M	$1.4M	$0.51M
Beach Nourishment	-19,720	-$1.09B	-$2.67B	-$168.4M	-$109.8M
Beach Maintenance	140	$9.8M	$34.3M	$1.5M	$0.58M
No Action – Moderate	-32,983	-$1.83B	-$4.48B	-$281.8M	-$183.5M

Action Alternative	Anticipated Impact to the Economy and Labor Force
Beach Stabilization	**Construction-Related Impacts:** Increase in jobs, labor income, economic output, and State and County Revenues **Ongoing Impacts:** No long-term job losses, positive fiscal impacts
Beach Nourishment	**Construction-Related Impacts:** Increase in jobs, labor income, economic output, and State and County Revenues **Ongoing Impacts:** Negative impacts associated with No Action after the anticipated 10-year lifespan
Beach Maintenance	**Construction-Related Impacts:** Increase in jobs, labor income, economic output, and State and County Revenues **Ongoing Impacts:** No long-term job losses, positive fiscal impacts
No Action	**Construction-Related Impacts:** Limited increase in jobs for demolition and removal of the temporary erosion skirt **Ongoing Impacts:** Reduced operations or forced closure of KBC which would result in job loss, negative economic output, and negative fiscal impacts

7. Beach Access

a. Existing Conditions

Honokōwai Beach provides a unique combination of perpendicular and lateral shoreline access with public amenities that is rare along the West Maui coastline. Perpendicular access to the shoreline is available via a paved road between KBC and the Kaanapali Shores to the north. The public beach right-of-way includes a public parking lot and changing station with a restroom and shower facilities. Lateral shoreline access is available along the beach and via a coastal walkway that provides ADA compliant

access along approximately 1,000 l.f. of shoreline from the south end of the KBC property to the north side of Honokōwai Stream.

The beach loss and avulsion event of 2016 severely impaired the existing beach access as Honokōwai Beach was almost entirely lost. The erosion caused substantial beach loss, structural damage, and posed a safety hazard to beach and ocean users. Since installation of the temporary erosion skirt, beach width has gradually increased but has not returned to pre-2016 conditions. Beach users must currently traverse over the temporary erosion skirt to access the beach, but without the temporary erosion skirt in place they may not be able to access the beach at all as they would face a steep vertical escarpment.

b. Potential Impacts and Mitigation Measures

The Proposed Action is anticipated to help preserve and enhance the fundamental character of Honokōwai Beach by maintaining shoreline access and supporting existing beach uses. In addition to stabilizing the shoreline, an objective of the Project is to preserve and enhance both cultural and shoreline access. As part of this effort, public parking is anticipated to be increased by four (4) stalls.

During the sand recovery and placement process, there would be temporary limitations to beach access to ensure public health and safety. Access to the public parking area, restrooms, and ADA lateral coastal walkway may be impacted by construction activities relating to the transfer, stockpiling, and placement of sand. During sand placement, the beach width would increase from onshore to offshore, creating a dry substrate for machinery to operate on. Once sand placement begins in an area, nourishment would continue until that area is complete. This method would allow for a portion of the beach to stay open during a workday when feasible, and lateral access along the beach to be maintained during construction. For a full discussion of construction-related BMPs, refer to the Best Management Practices Plan contained within the CEA, **Appendix "A"**.

Beach Stabilization

Implementation of Beach Stabilization, like all alternatives, involves demolition and removal of the temporary erosion skirt, placement of sand to increase beach width, and construction of groins. There would be temporary disruptions to beach access and public beach parking during construction. However, as described above, construction methodology will be sequential to allow for a portion of the beach to stay open during a

workday where feasible, and lateral access along the beach to be maintained during construction. In addition, mitigation measures may include designation of alternative public beach parking onsite at KBC.

The Beach Stabilization alternative is anticipated to have a positive impact to beach access as the threat of erosion, shoreline recession, beach narrowing, and potential beach loss are avoided for the anticipated 50-year lifespan of the alternative. A wider and more stable beach with a naturalized slope provides a more sandy access and calmer waters for individuals entering and exiting the ocean with less risk of injury or damage to recreational equipment from exposed rocks or rocky sea floor substrate.

Beach Nourishment

The Beach Nourishment alternative would have similar short-term construction-related impacts to and mitigation measures for Beach Stabilization. Beach access would be preserved for the anticipated 10-year Project lifespan of the alternative, after which the impacts of No Action would be expected to occur.

Beach Maintenance

The Beach Maintenance alternative would have similar short-term construction-related impacts and mitigation measures as those described for Beach Stabilization, but these impacts would be recurring as the beach is nourished approximately every 10 years. Beach access would be preserved for the anticipated 50-year Project lifespan of the alternative.

No Action

The No Action alternative would include the demolition and removal of the temporary erosion skirt. As observed during the beach loss and avulsion event in 2016, a wave-cut vertical scarp would form along the backshore as the beach and backshore erode. Beach access would be severely impaired, and the existing lateral and perpendicular public access infrastructure would be at risk of damage. Closure of the coastal walkway would eliminate ADA compliant lateral access along the shoreline.

Potential Related Secondary Actions

Potential related secondary actions are not anticipated to adversely impact beach access. These potential secondary actions may include improvements to beach access facilities, such as the lateral and perpendicular shoreline access paths.

Summary

The beach restoration action alternatives have, to varying degrees, temporary construction-related impacts to beach access. Following construction, the beach restoration alternatives are not anticipated to adversely affect public beach access, and as part of the Project objective of enhancing access, public parking is anticipated to be increased by four (4) stalls. Beach Stabilization would provide the largest positive impact to beach access through a wider and more stable beach and gently sloping sandy beach, as well as calmer swimming conditions between groins compared to offshore waters. Beach Nourishment and Beach Maintenance would preserve beach access for their respective Project lifespans. No Action is anticipated to adversely impact beach access as the beach and backshore erode over time.

Action Alternative	Anticipated Impact to Beach Access
Beach Stabilization	**Construction-Related Impacts:** Temporary disruption to beach access and public beach parking **Ongoing Impacts:** Positive benefit of a stabilized shoreline and preserved beach access **Mitigation:** Implementation of construction methods and BMPs to minimize and reduce duration for impacts to access; portion of beach to remain open during construction; designation of alternative public beach parking
Beach Nourishment	**Construction-Related Impacts:** Temporary disruption to beach access and public beach parking **Ongoing Impacts:** Preserved beach access for the anticipated 10-year Project lifespan; negative impacts of No Action after 10-year lifespan **Mitigation:** Implementation of construction methods and BMPs to minimize and reduce duration for impacts to access; portion of beach to remain open during construction; designation of alternative public beach parking
Beach Maintenance	**Construction-Related Impacts:** Temporary disruption to beach access and public beach parking **Ongoing Impacts:** Preserved beach access for the anticipated 50-year Project lifespan; recurring construction impacts with each renourishment action

Action Alternative	Anticipated Impact to Beach Access
	Mitigation: Implementation of construction methods and BMPs to minimize and reduce duration for impacts to access; portion of beach to remain open during construction; designation of alternative public beach parking
No Action	**Construction-Related Impacts:** Temporary disruption to beach access and public beach parking (for demolition and removal of temporary erosion skirt) **Ongoing Impacts:** Erosion of the beach and backshore that would significantly impair beach access **Mitigation:** Implementation of construction methods and BMPs to minimize and reduce duration for impacts to access; portion of beach to remain open during construction; designation of alternative public beach parking

8. Recreational Resources

a. Existing Conditions

A Coastal and Marine Uses Report was completed for the Project Site and Sand Recovery Site in October 2024 which identified existing recreational uses of the Project Site and nearshore waters through a survey and site visits. See **Appendix "J"**. Honokōwai Beach, including the nearshore and offshore waters, and the Sand Recovery Site support a variety of shoreline and ocean-based recreational activities, listed and described below:

- **Sunbathing, Beach Walking, Ocean Wading, Beachcombing, and Gathering** – Sunbathing takes place along the entire length of Honokōwai Beach. Families enjoy walking, wading, and beachcombing on Honokōwai Beach. Many beachgoers walk along the 1,000 ft. of sandy shoreline within the Project Site. Seasonal sand migration and erosion impacts beach walking and wading when the rocky sea floor substrate is exposed. Longshore currents tend to run towards the remnant stream channel where they turn offshore, creating a strong rip current that is a safety hazard for unsuspecting patrons who wade into the deeper channel waters and risk getting swept off their feet and taken offshore. Several rescues of this type were noted by local patrons who responded to the recreation survey.

- **Swimming** – Swimming tends to be concentrated near the public access and in the remnant stream channel offshore of the Project Site. The shoreline is bordered by a shallow reef shelf, while the remnant stream channel has a mostly sandy sea floor. Although the Sand Recovery Site is over half a mile offshore, approximately 1,850 ft. from the beach adjacent to Puʻu Kekaʻa, there is potential for swimmers to swim offshore and into this area.

- **Bodyboarding and Bodysurfing** – The sandy bottom within the remnant stream channel and along the shoreline south of the channel provides an opportunity for bodysurfing and bodyboarding in the shore break, whereas the exposed reef shelf north of the channel inhibits such activities due to the potential for lacerations from the ocean floor. Bodyboarding also occurs in the breakers just offshore of the Project Site, though the shallow waters and reef shelf at the surf break are not favorable for bodysurfing. Because the Sand Recovery Site is approximately 1,850 ft. offshore of the beach adjacent to Puʻu Kekaʻa, the water is generally too deep to cause waves to break there, so no bodysurfing or bodyboarding occurs, only at the Project Site in Honokōwai Beach and along Kāʻanapali Beach.

- **Skimboarding** – The sandy shoreline fronting the remnant stream channel is utilized for skimboarding activities. Skimboarding was observed taking place in the Project Site, along the shoreline fronting KBC. Seasonal sand migration as well as continued erosion inhibits skimboarding activities when the rocky sea floor substrate is exposed. Because the Sand Recovery Site is approximately 1,850 ft. offshore of the beach adjacent to Puʻu Kekaʻa, no skimboarding occurs there since the activity requires a very thin sheet of water over a sandy beach to support the gliding board.

- **Snorkeling, Free Diving, and Scuba Diving** – With generally good visibility and depths to 15 ft. in the channel, there is a wide variety of sea life, including fish, turtles, sting rays, and crustaceans in and around the Project Site that attract snorkelers, free divers, and scuba divers. Live coral is present about 450 to 600 ft. offshore as well. Recreational snorkelers were observed in and around the Project Site. Freediving and spearfishing, including night diving, by individual free divers and scuba divers also occurs along the fringing reef within the Project Site and beyond. Divers access the area from the shoreline through the remnant stream channel at

Honokōwai Beach, or from Kāʻanapali Beach, or by boat when accessing offshore areas.

Although the Sand Recovery Site is approximately 1,850 ft. offshore of the beach adjacent to Puʻu Kekaʻa, there is potential for snorkelers or divers to access by boat or swim offshore and into this area. Snorkelers and divers who go offshore more than 200 ft. are required to have a dive buoy for visibility. Divers who make their way out that far or even come by boat are at risk for being caught up in wind or sea-borne currents, or be at risk of injury by boaters passing by, as well as the potential for an encounter with marine life that might pose a threat to an unsuspecting snorkeler or diver such as sharks. Other risks are present relating to fatigue and equipment failure.

- **Boating** – In general, commercial vessels charge a fee to take people diving or whale watching. Recreational vessels are usually smaller. Although there is no recreational launch site for boats within the Project Site, nor do commercial catamarans and monohull boats operate out of Honokōwai Beach, they tend to transit the waters just offshore of the fringing reef within the designated Ocean Recreation Management Area (ORMA), as observed during site visits. A recreational operator with a small vessel could potentially come near or into Project Site waters through the remnant stream channel at Honokōwai Beach, though it would be quite dangerous due to the shallow reef flat on either side of the channel. At least one (1) beach concession north of Puʻu Kekaʻa advertises catamaran rides. Many of these commercial vessels originate from the Kāʻanapali mooring areas south of Hanakaʻōʻō Point, and recreational boaters utilize nearby boat ramps and harbor entrances. In addition to the storefronts and beach concessions that offer ocean recreation equipment and lessons, a number of commercial catamarans and monohull boats operate from the Kāʻanapali mooring zone off Hanakaʻōʻō Point and offer snorkeling and scuba diving lessons, but not at Kāʻanapali Beach or outside of Puʻu Kekaʻa. Commercial boats use other destinations for their tours, such as Honolua Bay and Olowalu. However, they pick up their passengers from Kāʻanapali Beach, south of the Project Site but in the vicinity of the Sand Recovery Site. Catamarans land directly on Kāʻanapali Beach using ingress/egress lanes designated by DLNR, while the monohull vessels use smaller boats, such as motorized inflatable crafts, to pick up and return their passengers in the designated lanes. This

activity is addressed in HAR § 13-251-76 as follows: The maximum number of Kāʻanapali commercial permits that may be issued for monohull vessels to embark and disembark passengers at Kāʻanapali Beach shall not be greater than five (5), but small craft used to shuttle passengers to and from a monohull vessel in the Kāʻanapali ocean waters may be included under that vessel's commercial activity permit.

Commercial vessels have a fair probability of passing through the Sand Recovery Site, especially if they pick up passengers at Kāʻanapali Beach or run commercial parasailing or water sledding operations. Recreational boaters transiting or participating in offshore ocean recreation activities may also enter or pass through the Sand Recovery Site, in addition to the Project Site at Honokōwai Beach.

- **Prone Paddleboarding, Standup Paddle Boarding, and Kayaking** – Several beach concessions along the Honokōwai beachfront rent standup paddle boards and offer lessons. A few concessions also rent ocean kayaks and offer kayak tours along the beach and fringing reefs outside of the Project Site. Paddlers in both activities transit to the nearshore waters of the Project Site, accessing the area from both Honokōwai Beach as well as North Kāʻanapali Beach. Standup Paddleboarders were observed paddling around Honokōwai Point on both of the site visits. A kayaker was seen entering and then exiting the water at North Kāʻanapali Beach after paddling north of the point. Several kayaks were observed on the beach at the southern edge of Maui Kai, possibly owned by residents of that complex, or made available to visitors who stay there.

- **Surfing** – The most popular surf spots along Honokōwai Beach are located off of Honokōwai Point. "Rainbows" (also known as Osterizers) skirts the southern boundary of the Project Site, and "Hotels" is just to the north, rolling into the Project Site along the remnant stream channel. "Hotels" is the most consistent surf spot and offers the longest rides, which are preferable conditions for beginners and other surfers. Although surf may be somewhat inconsistent throughout the year, it breaks best during the winter months. That said, a surfer was observed at this break during a south swell that came up in June. Another potential surfing break was identified on the reef offshore to the north of the remnant stream channel, but is not the preferred surfing site due to its

uneven breakers. Still, at least one (1) survey respondent shared stories about surfing this site. This surfing site also rolls into the Project Site, but it remains unnamed and considered to be part of the “Hotels” break area.

Surfboard rentals and surfing lessons are offered at a number of locations at beach concession stands in the vicinity of Honokōwai Beach and Kā‘anapali Beach. In addition to the beach concessions, a number of commercial operators along Honoapi‘ilani Highway offer surfboard rentals and surfing lessons that transit through the public access to get to the surfing sites at Honokōwai Beach. Prior to the 2016 beach loss and avulsion event, surf lessons from these remote companies were given under a large tree fronting the public bathroom at Honokōwai Beach, within the present Project Site.

- **Fishing** – Shore casting, throw net fishing, and spear fishing, including night diving, by individual free divers occur along the fringing reef within the Project Site and beyond. Fisherman “throw net” to catch fish from the sandy beach within the Project Site. Divers access the area from the shoreline through the remnant stream channel at Honokōwai, or by boat. A fisherman was observed fishing all night long from the corner of the Maui Kai property, and another person fished from the sand for several hours during the day. Small reef fish such as pāpio (*Caranx ignobilis*), moi (*Polydactylus sexfilis*), kūmū (*Parupeneus porphyreus*), and octopus (*Octopus cyanea*) are typically sought after by these shore casters and spear fishers, but larger catches such as ‘ulua (*Caranx ignobilis*) are hoped for. Fisherman trolling, bottom fishing, or laying traps have the potential to transit through, anchor, or drift within the Sand Recovery Site.

- **Kitesurfing and Wing Foiling** – Recreational wing foiling was observed occurring along the remnant stream channel within the Project Site and out into nearshore waters. The sandy beach and deeper waters of the channel allow for access to shore for surfboards with a foil fin on the bottom. These boards require at least two (2) feet of clearance because of the long shaft or “mast” on the foil board. Although no kitesurfing was observed during the site visits, one (1) survey respondent indicated that they participate in kitesurfing at Honokōwai Beach. The strong tradewinds, coupled with the deeper waters of the channel and the sandy beach for an access point, have the potential to create favorable conditions for kitesurfing at Honokōwai Beach. The channel provides clear

passage through to the offshore waters where kite surfers and wing foilers have access to a more expansive area with deeper water and stronger winds. Although windsurfing was very popular in decades past, no windsurfers were observed, nor was windsurfing mentioned by any of the survey respondents, and no equipment rental for windsurfers was found among the shops renting ocean recreation equipment in Honokōwai or Kāʻanapali.

Nothing prevents a kitesurfer or wingfoiler from operating in the West Maui Designated ORMA, so although the Sand Recovery Site is approximately 1,850 ft. offshore of the beach adjacent to Puʻu Kekaʻa, there is potential for kitesurfers or wingfoilers to access or transit through this area, especially since winds blow stronger and more consistently further offshore along this coastline.

- **Cliff Diving/Jumping** – This activity takes place on the low seacliff on the south side of Puʻu Kekaʻa, or Black Rock, south of the Project Site. The dive/jump site is approximately 30 ft. above sea level. Most divers swim to the base of the cliff from Kāʻanapali Beach and then climb to the top of the dive/jump site. The Sheraton Maui Resort and Spa offers a nightly torch lighting ceremony on Puʻu Kekaʻa, which concludes with a cliff dive by a single diver. Cliff diving/jumping does not occur at the Project Site or within the Sand Recovery Site because there are no leaping points to enter the water from at either location.

- **One-person and Six-person Outrigger Canoe Paddling** – One-person and six-person outrigger canoe paddling was observed within and just offshore of the Project Site. During the first site visit, a one-person outrigger transited from offshore, into the remnant stream channel, and up onto the sandy beach, where the person then continued up through the access to the parking lot behind the public restrooms. The channel and sandy bottom make Honokōwai Beach a decent place to end a long-distance paddle or launch and land there, but seasonally when the sand migrates away from the area, the rocky substrate would not be ideal. A six-person canoe team was observed transiting the coastline from north to south, outside of the fringing reef, approximately 900 ft. offshore of the Project Site.

  The shallow reef, unpredictable waves, and seasonal sand migration do not make Honokōwai Beach suitable for regular launching, landing, or storage of these larger 6-person outrigger

canoes. Hanakaʻōʻō Beach Park is the most popular launch, recovery, and storage area for outrigger canoes, south of the Project Site and Sand Recovery Site. Other launch areas are situated north of the Project Site around Kahana. Although the Sand Recovery Site is approximately 1,850 ft. offshore of the beach adjacent to Puʻu Kekaʻa, there is potential for one-person and six-person outrigger canoe paddlers to access or transit through this area.

- **Parasailing** – Parasailing takes place in an assigned area about 1,000 ft. west of the Sand Recovery Site outside the Designated ORMA boundary line of 3,000 ft. This activity is not permitted during Humpback Whale season from December 15th to May 15th of the following year, the time of year when whales are wintering in Hawaiʻi. Commercial vessels have a fair probability of passing through the Sand Recovery Site, especially if they pick up passengers at Kāʻanapali Beach or run commercial parasailing operations. Recreational boaters transiting or participating in offshore ocean recreation activities such as parasailing may also enter or pass through the area. Parasailing does not take place in or near the Project Site since the northern extent of the assigned area ends at Puʻu Kekaʻa, and is just offshore of the Sand Recovery Site.

- **Thrill Craft** – The use of recreational thrill craft is not permitted in or near the Project Site. Thrill craft must remain in undesignated State Waters, operating at least 3,000 ft. offshore while transiting along the coastline to and from their launching point and an area designated for thrill craft use. There is no assigned area for recreational thrill craft in the West Maui Designated ORMA. Commercial thrill craft operations, which includes using personal watercraft such as jet skis, takes place in two (2) designated areas south of Hanakaʻōʻō Point, but is not permitted during the winter and spring from December 15th to May 15th of the following year, the season when whales are wintering in Hawaiʻi. Because the Kāʻanapali Commercial Thrill Craft areas and launching points are all situated south of the Sand Recovery Site, it is unlikely that thrill craft operations would occur there. Likewise, any recreational operators passing by should be transiting at least 1,000 ft. west of the Sand Recovery Site, outside the Designated ORMA boundary line.

- **Water Sledding** – This activity, which includes using a motorized vessel to tow one (1) or more persons on a water sled, such as an inflatable raft or tube, takes place within an assigned area in the Designated ORMA far south of the Project Site, but is not permitted during the winter and spring, the season when whales are present in Hawai‘i. Water sledding does not take place in or near the Project Site at Honokōwai, but the Sand Recovery Site lies within the designated Water Sledding Zone at its northeastern boundary off of Pu‘u Keka‘a. Commercial vessels have a fair probability of passing through the Sand Recovery Site, especially if they pick up passengers at Kā‘anapali Beach or run commercial water sledding operations. Recreational boaters transiting or participating in offshore ocean recreation activities such as water sledding may also enter or pass through the area. Water Sledding does not take place in or near the Project Site since the northern extent of the assigned area ends at Pu‘u Keka‘a.

For a full list and discussion of existing recreational uses and resources, refer to the Marine and Coastal Uses Report in **Appendix "J"**.

It is noted that Honokōwai Beach is located approximately half a mile south of Honokōwai Beach Park. The information presented above is specific to Honokōwai Beach in the Project Site.

b. <u>Potential Impacts and Mitigation Measures</u>

During the preparation of the Coastal and Marine Uses Report, an Ocean Recreation and Safety Impacts Survey was conducted to understand how the project alternatives may impact coastal and marine uses at Honokōwai Beach, and to receive public comments on the project. There were 12 respondents to the survey, and a total of 20 face-to-face contacts made during site visits to Honokōwai Beach. The results of the survey indicate the considerable recreational value that respondents place on Honokōwai Beach and the wide range of recreational activities that occur in the vicinity of the Project Site. The respondents discussed the impacts of recent weather and surf events, expressed concerns regarding beach loss and environmental degradation, and provided their thoughts about improving shoreline access as well as ocean safety. In addition, respondents provided input for potential impacts of beach restoration on beach and ocean recreation. Refer to **Appendix "J"** for a full documentation of survey results and observations from site visits.

Honokōwai Beach was identified as an important recreational resource, which is anticipated to be further impacted from beach and backshore erosion. The Proposed Action is anticipated to positively impact recreational resources by providing a wider (and, in the case of Beach Stabilization, more stable) sandy beach and preserving safe recreational access. The beach restoration action alternatives would have a range of impacts to the array of recreational activities pursued at Honokōwai Beach, as described in the Coastal and Marine Uses Report. Refer to **Appendix "J"**. To mitigate impacts as much as practicable during construction, a portion of the beach will remain open during Project construction, and construction methods and BMPs will be implemented in order to reduce the duration of project-related impacts to recreational access. A summary of the anticipated impacts to recreational resources for each action alternative is provided below.

Beach Stabilization

The Beach Stabilization alternative is anticipated to have short-term construction-related impacts on recreational resources from demolition and removal of the temporary erosion skirt, sand placement, and groin construction. During construction, recreational access to the beach and nearshore waters would be limited. Beach Stabilization has a greater short-term impact than other action alternatives due to the longer duration of the construction activities as well as the construction of the groins which would extend offshore.

Following construction, Beach Stabilization would create a wider and more stable beach with a naturalized slope, providing a more sandy access and calmer waters for individuals entering and exiting the ocean, and reducing risk of injury or damage to equipment from the rocky sea floor substrate.

Additionally, the groins are anticipated to provide a secondary benefit of disrupting dangerous longshore currents and rip currents, creating a safer nearshore area for swimming and snorkeling. Beach Stabilization would create a wider and more stable beach that would facilitate a higher level of recreational use. Based on observations in the Coastal and Marine Uses Report, the groins would extend into the shoreward edge of the offshore surf breaks, but only near the end of the surfing course where the waves dissipate or rear up and close-out across the beach. Beach Stabilization may cause surfers to end the riding of a wave in proximity to the groins, or navigate between the groins to get to and from shore; however, this assessment depends on swell size and direction. The anticipated construction-related impacts and ongoing impacts for specific recreation

activities are provided in the table below. For a full discussion of the impacts to specific recreational uses for Beach Stabilization, refer to **Appendix "J"**.

Recreational Activity	Anticipated Construction-Related Impacts from Beach Stabilization	Anticipated Ongoing Impact from Beach Stabilization
Sunbathing, Beach Walking, Gathering, and Beachcombing	Construction activities and sand placement would temporarily limit beach access. Individuals may have to alter their normal beach activities by avoiding the construction area.	A stabilized beach would allow beachgoers to continue sunbathing, beach walking, gathering, and beachcombing in the vicinity of the Project Site.
Swimming	Swimmers may need to alter their entry point into the water during construction.	A stabilized sandy beach would provide swimmers a safer access into nearshore waters with a gently sloping beach face; groins are anticipated to reduce hazardous rip current effects.
Surfing, Bodyboarding and Bodysurfing	Construction activities would temporarily limit access to surf breaks in the vicinity of the Project Site and Sand Recovery Site.	A stabilized sandy beach would allow surfers safe access to nearshore waters; groins are anticipated to reduce hazardous rip current effects. The placed sand would lower the risk of bodysurfers and bodyboarders coming into contact with the rocky substrate which could cause injury to riders or damage to bodyboards.
Skimboarding	Construction activities and sand placement activities would temporarily prevent skimboarders from using areas of the beach.	A stabilized sandy beach would facilitate skimboarding and protect riders from the rocky substrate below the beach. The distance between groins would allow for some wave energy to reach the beach and may create conditions suitable for skimboarding.
Kitesurfing & Wingfoiling	Access to the ocean may be restricted during construction. Kitesurfers and wingfoilers may need to alter their course during sand recovery to avoid the barge.	A stabilized sandy beach would allow kitesurfers and wingfoilers safer access to nearshore waters. There are no long-term impacts anticipated to kitesurfing and wingfoiling.
Snorkeling, Free Diving, and SCUBA Diving	Recovered sand may create turbidity plumes which could temporarily inhibit snorkeling, free diving, and SCUBA diving in nearshore waters. Access to the ocean would be limited during construction. Turbidity during sand recovery may temporarily impact visibility in the vicinity of Puʻu Kekaʻa.	A stabilized sandy beach would allow safer access for snorkelers, free divers, and SCUBA divers. Groins are anticipated to reduce hazardous rip current effects and provide a more complex nearshore habitat for fish and other marine organisms, which may improve the recreational experience of snorkelers, free divers, and SCUBA divers.
Boating	There is no recreational boat launch at the Project Site, but small boats may be prevented from transiting through the remnant stream channel during	There are no long-term impacts to boating anticipated.

Recreational Activity	Anticipated Construction-Related Impacts from Beach Stabilization	Anticipated Ongoing Impact from Beach Stabilization
	construction. Recovered sand may increase nearshore turbidity which could impact boaters in the vicinity of the Project Site. Commercial tour boats that operate in the vicinity of Puʻu Kekaʻa may be temporarily impacted by sand recovery operations. These boats may need to alter their course to avoid the sand recovery barge and may be affected by turbidity from sand recovery.	
Standup Paddleboarding and Kayaking	Construction activities would limit access to the ocean. Turbidity may impact paddleboarders and kayakers in the vicinity of the Project Site and Sand Recovery Site.	A stabilized sandy beach would allow safer access to the ocean and the ability to safely launch paddleboards and kayaks. Groins are anticipated to reduce hazardous rip current effects.
Fishing	Construction would limit access to nearshore waters for fishermen. Recovered sand may create nearshore turbidity which could impact fishing. Turbidity near the sand recovery site may impact fisherman who choose to fish the area via boat or kayak.	A stabilized sandy beach would allow fisherman safer access to the shore at the Project Site. The groins may provide fisherman access to cast farther out into nearshore waters, but also pose a potential safety risk if fisherman attempt to set and tend poles during large swell events. The groins may create a more complex nearshore habitat, which has the potential to attract more fish to the Project Site.
Cliff Jumping/Diving	No impacts	No impacts
One- and Six-Person Canoe Paddling	Access for launching canoes would be temporarily limited during construction activities. Canoes may have to alter their course to avoid the barge during sand recovery.	A stabilized sandy beach would allow safer access to the ocean for canoe paddlers. The groins are not anticipated to block the channel, and there would be adequate space for launching and landing canoes. As such, there are no long-term impacts to canoe paddling anticipated.
Parasailing, Thrill Craft, and Water Sledding	Parasailing vessels, thrill craft, and water sledding vessels may need to alter their course to avoid the barge during sand recovery.	There are no long-term impacts to parasailing, thrill craft, and water sledding anticipated.

Beach Nourishment

The Beach Nourishment alternative is anticipated to have temporary construction-related impacts on recreational resources from demolition and removal of the temporary erosion skirt and sand placement. During construction, recreational access to the beach would be limited. These

impacts would be lesser than the Beach Stabilization alternative as the duration of construction is shorter, and no groins would be built in the nearshore environment.

A nourished beach would maintain a gently sloping beach face, providing a positive impact on recreational beach access from the public access area and sidewalk pathways fronting the public restrooms and public parking. The presence of sand would have a positive impact for beachgoers who could continue to enjoy the aesthetics of the beach while engaging in ocean recreational activities at the Project Site. Since there would be no stabilizing groins constructed, there are no anticipated secondary benefits of interrupted longshore and rip currents, reduction of hazardous rip currents, and safer swimming conditions. After the 10-year lifespan of the action alternative, the impacts of No Action are anticipated to occur, including erosion, shoreline recession, beach narrowing, and potential beach loss, which may negatively impact recreational resources by creating a steeper beach face and exposing the rocky sea floor substrate.

For a full discussion of construction-related impacts and ongoing impacts to specific recreational uses for Beach Nourishment, refer to **Appendix "J"**.

Beach Maintenance

The Beach Maintenance alternative is anticipated to have similar impacts to Beach Nourishment. These impacts would be temporary and confined to the construction period; however, construction-related impacts would be recurring as the beach is nourished approximately once every 10 years. A nourished beach would maintain a gently sloping beach face, providing a positive impact on recreational beach access. This sandy beach would be provided for the lifespan of the project alternative but would fluctuate between renourishment events. Similar to Beach Nourishment, there would be no groin construction which would not provide a secondary benefit of interrupting dangerous longshore currents and rip currents. For a full discussion of construction-related impacts and ongoing impacts to specific recreational uses for Beach Maintenance, refer to **Appendix "J"**.

No Action

Under the No Action alternative there would be temporary construction impacts from the demolition and removal of the temporary erosion skirt, as well as ongoing impacts to recreational resources due to progressive erosion of the beach and backshore. Negative impacts are anticipated for nearly all of the existing beach and ocean recreational uses. Ongoing

erosion would create a steeper beach face, and loss of sand would cause submerged rocky substrate to be exposed. The rocky sea floor substrate would have the potential to injure beach users, impede access to the ocean and water's edge for recreational users, and damage recreational equipment like canoes, paddleboards, and kayaks. Erosion of the beach and backshore would cause terrestrial sediment to enter nearshore waters, creating turbidity plumes similar to those observed during the beach loss and avulsion event of 2016. Turbidity plumes would hamper visibility for swimmers, snorkelers, and divers, as well as potentially discourage beach users from pursuing their existing recreational activities. Turbidity may also negatively impact fishing by causing less fish to inhabit the nearshore waters at the Project Site. Within the Project Site, continued erosion may cause the longshore currents that tend to run towards the remnant stream channel to increase due to the absence of sand that absorbs current and wave energy. Benefits to recreational resources associated with a wider and more stable sandy beach would eventually be lost under the No Action alternative. For a full discussion of impacts to specific recreational uses for No Action, refer to **Appendix "J"**.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to adversely impact recreational resources. Improvements would be confined to KBC property inland of the beach. Improved access to the beach may improve recreational resources over the long-term.

Summary

Honokōwai Beach hosts a diverse array of recreational activities and resources, as detailed in the Coastal and Marine Uses Report. Refer to **Appendix "J"**. The proposed beach restoration action alternatives are anticipated to result in temporary construction related impacts that may temporarily affect recreational access from demolition and removal of the temporary erosion skirt, sand placement, and groin construction. Beyond the temporary effects of construction, however, Beach Stabilization would provide a stabilized sandy beach for recreation over the mid-term, and improve safety by interrupting dangerous longshore currents and rip currents. Beach Nourishment and Beach Maintenance would provide a benefit of a sandy beach in the short- to mid-term, but would not have a secondary benefit of interrupting longshore currents and rip currents. Since no groins would be constructed, the beach would be at risk of erosion under Beach Nourishment and Beach Maintenance. No Action may have both construction-related impacts to recreational resources from initial demolition and removal of the temporary erosion skirt, and ongoing impacts

related to progressive erosion, shoreline recession, beach narrowing, and potential beach loss, which would adversely impact recreation at the Project Site.

As previously mentioned, Honokōwai Beach is located approximately half a mile south of Honokōwai Beach Park. No work is proposed at Honokōwai Beach Park and as such, no impacts to Honokōwai Beach Park are anticipated.

Action Alternative	Anticipated Impact to Recreational Resources
Beach Stabilization	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit recreational access to the beach and ocean **Ongoing Impacts:** Stabilized shoreline and sandy beach would positively impact recreational resources; secondary benefit of groins improving safety by interrupting longshore currents and rip currents **Mitigation:** Portion of beach to remain open during construction; implementation of construction methods and BMPs to minimize and reduce duration for impacts to recreational access
Beach Nourishment	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit recreational access to the beach and ocean **Ongoing Impacts:** Sandy beach would improve recreational access; impacts of No Action anticipated after 10-year Project lifespan **Mitigation:** Portion of beach to remain open during construction; implementation of construction methods and BMPs to minimize and reduce duration for impacts to recreational access; groins designed to avoid blocking channel used for launching canoes and other recreational uses
Beach Maintenance	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit recreational access to the beach and ocean **Ongoing Impacts:** Sandy beach would improve recreational access for anticipated 50-year lifespan; recurring construction-related impacts with each nourishment action

Action Alternative	Anticipated Impact to Recreational Resources
	Mitigation: Portion of beach to remain open during construction; implementation of construction methods and BMPs to minimize and reduce duration for impacts to recreational access
No Action	**Construction-Related Impacts:** Temporary construction-related impacts from demolition and removal of the temporary erosion skirt, which would limit recreational access to the beach and ocean **Ongoing Impacts:** Progressive erosion, shoreline recession, beach narrowing, and potential beach loss would negatively impact recreational resources **Mitigation:** Portion of beach to remain open during demolition and removal of temporary erosion skirt; implementation of construction methods and BMPs to minimize and reduce duration for impacts to recreational access

9. Ocean Safety

a. Existing Conditions

There are no lifeguard towers at the Project Site. The County of Maui, Department of Fire & Public Safety operates lifeguard towers at Hanakaōʻō Beach Park (over 2 miles south of the Project Site) and DT Fleming Beach Park (over 4 miles north of the Project Site) in West Maui. Ocean safety officers, or lifeguards, are on duty every day from 8:00 a.m. to 4:45 p.m. (County of Maui, Department of Fire & Public Safety, 2024).

Ocean safety incidents that have occurred in the general vicinity of the Project Site include drownings, spinal cord injuries, and shark attacks. Specific data for Honokōwai Beach is limited, but the Hawaiʻi Department of Health (DOH) reports that a total of 62 fatal ocean drownings occurred in Maui County between 2007 and 2011. About three-quarters of the ocean drowning victims in Maui County were non-residents. There were 16 drownings (including 15 non-residents) from Kāʻanapali Beach to Hanakaʻōʻō Beach Park. Between 2005 and 2014 there were 34 drownings in Kāʻanapali, with 15 of them occurring in the vicinity of Puʻu Kekaʻa. More recent data from DOH shows that between 2009 and 2018, there were 193 drownings in Maui County, as well as 96 spinal cord injuries. Of those drownings, at least 24 happened in the vicinity of Puʻu Kekaʻa. Snorkeling and swimming had the highest activity rates resulting in fatal drownings,

but other activities that resulted in a fatal drowning included surfing, bodyboarding, free diving, falling or being swept into the water, scuba diving, boating and kayaking, picking ‘opihi, and fishing from shore. See **Appendix “J”**.

Several respondents to the recreational survey noted dangerous longshore currents and rip currents that are present in the area and pose a risk to swimmers. Longshore currents tend to run towards the remnant stream channel at the Project Site where they turn offshore, creating a strong rip current that is a safety hazard for unsuspecting ocean users. Several rescues of this type were noted by local patrons who responded to the recreational survey.

Spinal cord injuries can result from being struck by waves while bodyboarding, bodysurfing, surfing, or diving. Twenty spinal cord injuries occurred along Kā‘anapali Beach between 2009 and 2018.

There have been at least 65 shark attacks on Maui since 1995, with 11 of them occurring in the general vicinity of the Project Site between Kahana and Kā‘anapali. For a full discussion of ocean safety and incidents in the vicinity of the Project Site, as well as perceptions of ocean safety from the recreational survey, refer to **Appendix “J”**.

b. <u>Potential Impacts and Mitigation Measures</u>

The Proposed Action is anticipated to have an ongoing positive impact on ocean safety. There may be temporary construction-related impacts to ocean safety that can be mitigated by appropriate BMPs. During construction, signage and barriers would be used to mitigate potential safety hazards of construction equipment and in-water work. For a full list of construction-related BMPs, refer to the Best Management Practices Plan contained within the CEA, **Appendix “A”**.

<u>Beach Stabilization</u>

The Beach Stabilization alternative involves demolition and removal of the temporary erosion skirt, placement of sand on the beach, and construction of stabilization structure. Beach Stabilization is anticipated to have a positive long-term impact on ocean safety. The additional sand would provide a gentle sloping beach which covers the rocky substrate below, providing safer ocean entry and exit. The groins would reduce turbidity and interrupt the dangerous longshore currents, creating a safer environment for swimmers and snorkelers. Refer to **Appendix “J”**.

Beach Nourishment

The Beach Nourishment alternative involves demolition and removal of the temporary erosion skirt and placement of sand on the beach. Beach Nourishment is anticipated to have a positive impact on ocean safety for the projected 10-year lifespan of the alternative, after which the impacts associated with No Action would be realized. Without the presence of stabilizing groins, there would be no interruption of dangerous longshore currents and rip currents.

Beach Maintenance

The Beach Maintenance alternative is anticipated to have similar impacts to Beach Nourishment. Short-term construction-related impacts would be recurring as the beach is nourished approximately once every 10 years.

No Action

The No Action alternative involves demolition and removal of the temporary erosion skirt. In the absence of stabilizing groins or beach nourishment actions, the beach and backshore are anticipated to further erode, increasing the potential for ocean safety incidents to occur. Elevated nearshore turbidity is anticipated which would pose more dangerous swimming and snorkeling conditions. A steep escarpment with an exposed rocky substrate is likely to form which would make ocean entry and exit more hazardous. Refer to **Appendix "J"**.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to adversely impact ocean safety.

Summary

The beach restoration action alternatives are anticipated to have varying impacts on ocean safety. Beach Stabilization would provide the greatest benefit, as the stabilizing groins would improve nearshore turbidity and interrupt dangerous longshore currents and rip currents. Beach Nourishment and Beach Maintenance would provide a positive benefit of safer ocean entry and exit for their respective Project lifespans. No Action would result in more dangerous ocean conditions, including nearshore turbidity that would pose a hazard to swimmers and snorkelers, and steeper ocean entry and exit with exposed rocky substrate.

Action Alternative	Anticipated Impact to Ocean Safety
Beach Stabilization	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit beach and ocean access **Ongoing Impacts:** Positive benefit of a stabilized sandy shoreline for anticipated 50-year design life; a gentle beach slope improves safety of ocean entry and exit; groins reduce turbidity and interrupt dangerous longshore currents and rip currents **Mitigation:** Implementation of construction BMPs, signage, and barriers
Beach Nourishment	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit beach and ocean access **Ongoing Impacts:** Positive benefit of a wider beach for anticipated 10-year lifespan of the alternative; gentle beach slope improves safety of ocean entry and exit; negative impacts of No Action after anticipated 10-year lifespan **Mitigation:** Implementation of construction BMPs, signage, and barriers
Beach Maintenance	**Construction-Related Impacts:** Temporary construction-related impacts, which would limit beach and ocean access **Ongoing Impacts:** Recurring construction-related impacts with each nourishment action; positive benefit of a wider beach for anticipated 50-year lifespan of the alternative; gentle beach slope improves safety of ocean entry and exit **Mitigation:** Implementation of construction BMPs, signage, and barriers
No Action	**Construction-Related Impacts:** Temporary construction-related impacts from demolition and removal of temporary erosion skirt, which would limit beach and ocean access **Ongoing Impacts:** Erosion, shoreline recession, beach narrowing, and potential beach loss resulting in potentially dangerous nearshore conditions; elevated turbidity levels pose a hazard to ocean users; steep escarpment impacts ocean entry and exit **Mitigation:** Implementation of construction BMPs, signage, and barriers

10. Mountain Access

a. Existing Conditions

Connected access routes between mountain and coastal areas are important assets in Hawai‘i for cultural, recreational, and emergency uses. The Project Site lies along the shoreline at Honokōwai Beach, and perpendicular access is provided via the public parking area easement on KBC property. The State highway provides the primary access through the area and runs parallel to the shoreline while secondary roads provide access to residential, commercial, and industrial areas. Former agricultural roads provide limited access to the upland areas of Honokōwai (DLNR, 2019). The upper areas of the region are part of the West Maui Forest Reserve and are generally restricted to the public. Additional information on mountain access is presented in the Cultural Impact Assessment (**Appendix "G-1"**).

b. Potential Impacts and Mitigation Measures

The Proposed Action is not anticipated to adversely affect mountain access.

Beach Stabilization

The Beach Stabilization alternative is not anticipated to have any adverse impacts to mountain access.

Beach Nourishment

The Beach Nourishment alternative is not anticipated to have any adverse impacts to mountain access.

Beach Maintenance

The Beach Maintenance alternative is not anticipated to have any adverse impacts to mountain access.

No Action

The No Action alternative is not anticipated to have any adverse impacts to mountain access.

Potential Related Secondary Actions

Any potential related secondary actions are not anticipated to negatively impact mountain access. These actions may improve perpendicular and

lateral access to the beach, which could better facilitate mountain-to-ocean access.

Summary

Mountain access is not anticipated to be adversely affected by any of the proposed beach restoration action alternatives or potential related secondary actions.

Action Alternative	Anticipated Impact to Mountain Access
Beach Stabilization	No impact
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

C. PUBLIC SERVICES

1. Police and Fire Protection

a. Existing Conditions

Law enforcement in West Maui is provided by the Maui Police Department, Lahaina District. The Lahaina Police Station is located at the Lahaina Civic Center. Fire protection in West Maui is provided by the Maui County Department of Fire and Public Safety. Two (2) fire stations are located in West Maui: the Lahaina Fire Station, located at the Lahaina Civic Center, and the Nāpili Fire Station, located on Honoapi‘ilani Highway in Nāpili.

b. Potential Impacts and Mitigation Measures

The Proposed Action is not a population generator and is not anticipated to adversely impact police and fire protection. Over the long-term there may be impacts related to access for emergency responders as the beach and backshore erode.

Beach Stabilization

Beach Stabilization is not a population generator and is not anticipated to have adverse impacts on police or fire services. The Project Site is within an existing service area for emergency services. The provision of a wider and more stable sandy beach would provide better access for emergency responders to the shoreline area.

Beach Nourishment

As with Beach Stabilization, no adverse impacts to police or fire services are anticipated with Beach Nourishment. The provision of a wider sandy beach would provide better access for emergency responders to the shoreline area. However, it is noted that under the one-time Beach Nourishment alternative, the benefits associated with the wider sandy beach are anticipated to exist for approximately 10 years before returning to the existing condition.

Beach Maintenance

As with Beach Stabilization, no adverse impacts to police or fire services are anticipated with Beach Maintenance. The provision of a wider sandy beach would provide better beach access for emergency responders to the shoreline area.

No Action

No direct adverse impacts to police or fire services are anticipated under a No Action alternative. However, it is noted that the loss of the existing sandy beach may impede access to shoreline areas for emergency responders.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have any negative impacts on police or fire service and may increase the accessibility of the shoreline area to emergency responders.

Summary

There would be no direct negative impacts to emergency services associated with the Proposed Action, No Action alternative, or Potential related secondary actions. It is noted that with No Action and one-time Beach Nourishment, the loss of a sandy beach may impede access to shoreline areas for emergency responders. Stabilizing and maintaining a sandy beach along with access-related secondary actions may increase access to the shoreline for emergency responders.

Action Alternative	Anticipated Impact to Police and Fire Protection
Beach Stabilization	Wider and more stable sandy beach would provide better access for emergency responders to the shoreline area
Beach Nourishment	After the anticipated 10-year lifespan, progressive erosion, shoreline recession, beach narrowing, and potential beach loss could potentially impair access to the shoreline for emergency responders
Beach Maintenance	Wider sandy beach would provide better access for emergency responders to the shoreline area
No Action	Progressive erosion, shoreline recession, beach narrowing, and potential beach loss could potentially impair access to the shoreline for emergency responders

2. Medical Services

a. Existing Conditions

The only major hospital on the island of Maui is the Maui Memorial Medical Center in Kahului. The 214-bed facility provides general, acute, and emergency care services. Ambulance service is operated under a state contract with American Medical Response. Two (2) units operate in West Maui, out of the Nāpili Fire Station and the Lahaina Comprehensive Health Center. Other health services in West Maui include the Maui Medical Group which has temporarily relocated to the Nāpili Plaza until repairs are made to the Lahaina clinic, which sustained damages in the 2023 wildfire, Lahaina Physicians, West Maui Healthcare Center, and other small private practices.

b. Potential Impacts and Mitigation Measures

The Proposed Action is not a population generator and is not anticipated to adversely impact medical services. Over the long-term there may be impacts related to access for emergency responders as the beach and backshore erode.

Beach Stabilization

Beach Stabilization is not a population generator and is not anticipated to have any adverse impacts on medical services. The Project Site is within an existing service area for medical services. The provision of a wider and more stable sandy beach would provide for better beach access for emergency medical responders to the shoreline area.

Beach Nourishment

As with Beach Stabilization, no adverse impacts to medical services are anticipated with Beach Nourishment. The provision of a wider sandy beach would provide for better beach access for emergency medical responders to the shoreline area. However, it is noted that under the one-time Beach Nourishment alternative, the benefits associated with the wider sandy beach are anticipated to exist for approximately 10 years before returning to the existing condition.

Beach Maintenance

As with Beach Stabilization, no adverse impacts to medical services are anticipated with Beach Maintenance. The provision of a wider sandy beach would provide for better access for emergency medical responders to the shoreline area.

No Action

No direct adverse impacts to medical services are anticipated under a No Action alternative. However, it is noted that the loss of the existing sandy beach may impede access to shoreline areas for emergency medical responders and potentially more hazardous nearshore conditions which would warrant emergency response.

Potential Related Secondary Actions

Any potential related secondary actions are not anticipated to have any negative impacts on medical service and may increase the accessibility of the shoreline area to emergency medical responders.

Summary

There would be no direct negative impacts to medical services associated with the proposed alternatives, No Action alternative, or potential related secondary actions. It is noted that with No Action and one-time Beach Nourishment, the loss of a sandy beach may impede access to shoreline areas for emergency medical responders. Stabilizing and maintaining a sandy beach along with access-related secondary actions may increase access to the shoreline for emergency medical responders.

Action Alternative	Anticipated Impact to Medical Services
Beach Stabilization	Wider and more stable sandy beach would provide better access for emergency medical responders to the shoreline area
Beach Nourishment	After anticipated 10-year lifespan, progressive erosion, shoreline recession, beach narrowing, and beach loss could potentially impair access to the shoreline for emergency medical responders
Beach Maintenance	Wider sandy beach would provide better access for emergency medical responders to the shoreline area
No Action	Progressive erosion, shoreline recession, beach narrowing, and beach loss could potentially impair access to the shoreline for emergency medical responders

3. Solid Waste

a. Existing Conditions

The County of Maui provides solid waste collection service to West Maui. Construction waste is accepted at the Pohakulepo Concrete Recycling Facility and the Maui Demolition and Construction Landfill located in Central Maui. Smaller waste associated with residential use is collected twice a week by the County of Maui. This solid waste is disposed of at the County's 55-acre Central Maui Landfill (CML), located four (4) miles southeast of the Kahului Airport. The CML also collects waste from private collection companies. A recycling and refuse convenience center located in Olowalu, approximately 11 miles south of the Project Site, serves West Maui residents and accommodates household refuse and green waste, as well as used oil and recyclable materials. No commercial waste is accepted at this facility.

The Pohakulepo Recycling Facility and Maui Demolition and Construction Landfill, both located in central Maui, accept construction waste including concrete and any building materials left over from construction processes.

b. Potential Impacts and Mitigation Measures

The Proposed Action is not anticipated to impact solid waste over the long-term. There may be temporary impacts related to construction, and there would be a one-time generation of solid waste as the temporary erosion skirt is demolished and removed, which would be consistent across all alternatives.

Beach Stabilization

Beach Stabilization would involve a one-time generation of solid waste as the temporary erosion skirt is demolished and removed. Beach Stabilization is not anticipated to have an ongoing impact on solid waste collection services or the construction concrete recycling facility, as the Proposed Action is not anticipated to generate large amounts of excess waste.

Beach Nourishment

Beach Nourishment would involve a one-time generation of solid waste as the temporary erosion skirt is demolished and removed. Beach Nourishment is not anticipated to have an ongoing impact on solid waste collection services or on the construction concrete recycling facility, as the Proposed Action is not anticipated to generate large amounts of excess waste. Impacts are anticipated to be less than with Beach Stabilization as there are no groins to be constructed with this alternative.

Beach Maintenance

Beach Maintenance would involve a one-time generation of solid waste as the temporary erosion skirt is demolished and removed. Beach Maintenance would have similar negligible impacts to solid waste as Beach Nourishment.

No Action

The No Action alternative would not have any anticipated impacts to solid waste generation, aside from the one-time generation of waste associated with the demolition and removal of the temporary erosion skirt.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have significant negative impacts on solid waste generation or collection services.

Summary

There would be a one-time generation of solid waste from the demolition and removal of the temporary erosion skirt for each of the action alternatives. Beyond initial demolition activities, there are no anticipated significant impacts to solid waste demand associated with the proposed alternatives, potential related secondary actions, or the No Action alternative.

Action Alternative	Anticipated Impact to Solid Waste
Beach Stabilization	**Construction-Related Impacts:** One-time generation of solid waste as the temporary erosion skirt is demolished and removed **Ongoing Impacts:** No impact
Beach Nourishment	**Construction-Related Impacts:** One-time generation of solid waste as the temporary erosion skirt is demolished and removed **Ongoing Impacts:** No impact
Beach Maintenance	**Construction-Related Impacts:** One-time generation of solid waste as the temporary erosion skirt is demolished and removed **Ongoing Impacts:** No impact
No Action	**Construction-Related Impacts:** One-time generation of solid waste as the temporary erosion skirt is demolished and removed **Ongoing Impacts:** No impact

4. Education

a. Existing Conditions

West Maui is served by four (4) public schools operated by the State of Hawai‘i, Department of Education (DOE): Lahainaluna High School, Lahaina Intermediate School, Princess Nāhi‘ena‘ena Elementary School, and King Kamehameha III Elementary School. King Kamehameha III Elementary School was, unfortunately, destroyed by the August 2023 wildfires. The region is also served by privately operated pre-elementary and elementary schools, such as Sacred Hearts Elementary School and Maui Preparatory Academy, the latter of which also serves through high school.

University of Hawai‘i-Maui College (UHMC), located in Kahului, is part of the University of Hawai‘i Community College system. UHMC is the primary higher education institution serving the island of Maui.

b. Potential Impacts and Mitigation Measures

The Proposed Action is not a population generator and therefore, is not anticipated to have significant impacts to education for the region or island of Maui.

Beach Stabilization

Beach Stabilization is not a population generator and as such, is not anticipated to have significant adverse impacts on local schools.

Beach Nourishment

Beach Nourishment is not a population generator and as such, is not anticipated to have significant adverse impacts on local schools.

Beach Maintenance

Beach Maintenance is not a population generator and as such, is not anticipated to have significant adverse impacts on local schools.

No Action

No Action would not have significant adverse impacts on local schools.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have any negative impacts on local schools.

Summary

The Project is not a population generator. As such, the proposed beach restoration action alternatives, No Action alternative, or potential related secondary actions are not anticipated to have a significant adverse impact on education.

Action Alternative	Anticipated Impact to Education
Beach Stabilization	No impact
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

5. Airports

a. Existing Conditions

The Kapalua Airport (JHM) is one (1) of three (3) airports on Maui owned and operated by the SDOT and is located 3.19 miles from the Project Site. The airport was formerly a private facility until it was acquired by the SDOT in 1993. JHM is a regional airport consisting of a single runway, terminal facilities, and support facilities. JHM offers inter-island flights served by commercial propeller air carriers and commuter aircrafts only and does not offer domestic or international flights.

b. Potential Impacts and Mitigation Measures

The Project Site is located approximately 6,020 ft. from the end of Runway 2 of JHM. The State Department of Transportation, Airports Division discourages uses that may attract hazardous wildlife within five (5) miles of airport boundaries to minimize impacts related to wildlife-aircraft strikes. The proposed beach restoration project does not represent an action that would be a substantial attraction for hazardous wildlife. The proposed beach restoration also does not involve potential glint and glare impacts or potential aerial obstructions. Based on the foregoing, no impacts are anticipated to JHM.

Beach Stabilization

Beach Stabilization is not anticipated to impact JHM operations.

Beach Nourishment

Beach Nourishment is not anticipated to impact JHM operations.

Beach Maintenance

Beach Maintenance is not anticipated to impact JHM operations.

No Action

No Action is not anticipated to impact JHM operations.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have any negative impacts on JHM operations.

Summary

The proposed beach restoration action alternatives, No Action alternative, or Potential Related Secondary Actions are not anticipated to impact JHM operations.

Action Alternative	Anticipated Impact to Airports
Beach Stabilization	No impact
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

D. INFRASTRUCTURE

1. Roadways

a. Existing Conditions

The Project Site is located fronting the KBC in the Honokōwai area of West Maui. The KBC property is located on and accessed via Kāʻanapali Shores Place, which connects to Lower Honoapiʻilani Road. A Traffic Impact Analysis Report (TIAR) prepared by Austin, Tsutsumi, and Associates, Inc. (ATA) provided an analysis of current traffic conditions in the vicinity of the Project Site. See **Appendix "K"**. The roadways in the vicinity of the Project Site are described as follows.

Honoapiʻilani Highway

Honoapiʻilani Highway is a state highway that provides regional connectivity for West Maui. Honoapiʻilani Highway begins in Wailuku, where it transitions from South High Street near Keanu Street and continues southward toward Māʻalaea. The highway parallels the coastline as it curves back around West Maui and northward again toward Kapalua, where it transitions into Kahekili Highway near Honokohau Bay. In the vicinity of the Project Site, Honoapiʻilani Highway is generally a two-way, four-lane undivided road with a speed limit of 35 miles per hour (mph).

Lower Honoapiʻilani Road

Lower Honoapiʻilani Road is a two-way, two-lane roadway that begins to the north of the Project Site at its intersection with Office Road and extends south to its intersection with Honoapiʻilani Highway. It is generally parallel to the Honoapiʻilani Highway and provides access to beach-front properties. In the vicinity of the Project, Lower Honoapiʻilani Road has a posted speed limit of 20 mph.

Kāʻanapali Shores Place

Kāʻanapali Shores Place is a two-way, two-lane roadway that begins at its intersection with Lower Honoapiʻilani Road and heads west towards various hotels and beach facilities. It has a posted speed limit of 5 mph.

Keawe Street

Keawe Street is a two-way, four-lane divided roadway connecting Honoapiʻilani Highway and Lahaina Bypass Road and currently serves as

the northernmost terminus of Lahaina Bypass Road pending the construction of the future northward extension of Lahaina Bypass Road. Keawe Street also serves Lahaina Gateway and Lahaina Business Park. It has a posted speed limit of 25 mph within the study area of the TIAR.

Lahaina Bypass Road

Lahaina Bypass Road is generally a two-way, two-lane highway that begins to the north at its intersection with Keawe Street and extends southward until it transitions into Honoapiʻilani Highway near Olowalu. Lahaina Bypass Road generally travels parallel to Honoapiʻilani Highway and provides access to Lahaina and Launiupoko. It has a posted speed limit of 45 mph within the study area.

Kai Hele Ku Street

Kai Hele Ku Street is a two-way, two-lane roadway that begins to the west at its intersection with Honoapiʻilani Highway and terminates to the east after its intersection with Kumu Niu Place. Kai Hele Ku Street facilitates traffic through Launiupoko and provides connectivity between Honoapiʻilani Highway and Lahaina Bypass Road. It has a posted speed limit of 25 mph within the study area.

The TIAR measured traffic volumes at seven (7) intersections in the vicinity of the Project Site and surrounding region of West Maui. Traffic count data was collected on Thursday, May 9, 2024, and Saturday, May 11, 2024, at peak traffic hours in the morning (AM), afternoon (PM), and mid-day (MD). Traffic movements at these intersections were observed, quantified, and assigned a Level of Service (LOS) rating, which is a standard qualitative measure used to describe the conditions of traffic flow at intersections, with values ranging from free-flow conditions at a LOS of A, to congested conditions at a LOS of F.

The TIAR noted that due to the ongoing impacts of the Lahaina wildfires in August 2023, traffic volumes were significantly lower than previously observed volumes. During all peak hours, all movements at all study intersections operate at LOS of D or better across all peak hours, with the exception of the southbound left-turn at Honoapiʻilani Highway and Lower Honoapiʻilani Road. A more detailed description of the traffic volumes is presented in **Appendix "K"**.

It is noted that beginning in June 2025, the County of Maui began transferring nonhazardous debris from the 2023 Lahaina fires from the Temporary Debris Storage Site in Olowalu to the Permanent Disposal Site

in Central Maui. During this time, motorists are advised that they may experience slower than usual traffic. The debris transfer process is expected to be completed in November 2025, prior to the implamentation of the proposed Project.

b. Potential Impacts and Mitigation Measures

The TIAR included base year and future year calculations for vehicle trips associated with the three (3) beach restoration alternatives as well as the No Action alternative. Project-related vehicle trips are generated in connection with specific tasks for each alternative, involving on-site staff vehicle trips, as well as material transport truck trips.

All three (3) beach restoration action alternatives involve dredging, transport, and placement of sand to restore and, in the case of Beach Stabilization, to stabilize the beach. Following dredging at the Sand Recovery Site, sand would be transported by barge to Kahului Harbor. Sand would then be transported via 16-cy capacity trucks to the Project Site, or to an offsite holding area prior to later transport to the Project Site for Beach Stabilization, additional materials are required for construction of stabilization structures. Vehicle trips are generated by demolition and removal of the temporary erosion skirt removal for all alternatives, as the temporary erosion skirt is assumed to be removed regardless of the alternative selected.

Materials transport for the beach restoration alternatives, including trucks delivering sand (and stone for Beach Stabilization) or removing waste from the Project Site, is anticipated to require trucks to arrive and depart the Project Site at a rate of two (2) trucks per hour during working hours for the duration of construction or sand placement activities.

Tasks such as sand placement, groin construction, and demolition and removal of the temporary erosion skirt each generate a specific number of vehicle trips associated with on-site staff going to and from the Project Site. These vehicle trips are assumed to occur during the AM and PM peak hours, contributing to the total estimated peak-hour trips.

Beach Stabilization

Beach Stabilization involves transportation and placement of sand to restore the beach, as well as transportation of materials for construction of groins to stabilize the sand. As such, this alternative is anticipated to generate more vehicle trips than the Beach Nourishment alternative, due

to the additional material and additional workers required on site for construction of the groins.

This alternative is anticipated to generate a maximum of 31 vehicle trips per hour at the AM and PM peak hours during the duration of construction, which is assumed to occur in the year 2028 over approximately 55 weeks and is inclusive of both sand and stone transportation and construction. Although delays are anticipated to increase slightly overall with Project implementation, the operational LOS for each movement is not anticipated to change as a result of this alternative. As such, Beach Stabilization is not anticipated to significantly impact the traffic environment in the area.

Beach Nourishment

Beach Nourishment involves a one-time action to transport and place sand on Honokōwai Beach, which is assumed to occur in the year 2028 over approximately 19 weeks. This alternative is anticipated to generate a maximum of 15 vehicle trips per hour at the AM and PM peak hours during the duration of construction, which is greater than the No Action alternative, but still relatively low. This alternative is not anticipated to significantly impact the traffic environment in the area.

Beach Maintenance

The Beach Maintenance alternative involves periodic transportation and placement of sand, occurring a total of five (5) times in approximately 10-year intervals. As with the Beach Nourishment alternative, this alternative is anticipated to generate a maximum of 15 vehicle trips per hour at the AM and PM peak hours during the duration of construction in the year 2028. Vehicle trips generated during subsequent sand placement actions, assumed to occur in the years 2038, 2048, 2058, and 2068, would be somewhat less as these future actions require a smaller volume of sand to be transported and would not include demolition and removal of the temporary erosion skirt which is included as part of the initial sand placement action in 2028. In total, land based construction would take approximately 47 weeks over initial nourishment and four (4) subsequent renourishment events. This alternative is not anticipated to significantly impact the traffic environment in the area.

No Action

The No Action alternative is anticipated to generate only vehicle trips associated with removal of the existing erosion skirt, which is assumed to occur in the year 2028. Peak vehicle trip generation associated with this

alternative is calculated to be 10 vehicles per hour at the peak AM and PM hours during the duration of demolition and removal. Because this trip generation is relatively low, the No Action alternative is not anticipated to significantly impact the traffic environment within the study area. Intersection operations are expected to remain similar to base year conditions.

Potential Related Secondary Actions

The potential related secondary actions, if implemented, may result in some increase to Project-related vehicle trips. Compared to the vehicle trips generated by the beach restoration action alternatives, however, these additional impacts are not anticipated to be significant. Any increases in vehicle trips generated by related secondary actions would be temporary construction-related increases and would not add to long-term impacts to roadways.

Summary

The TIAR concludes that for all alternative scenarios, the number of trips generated by the Project is negligible, and the Project is not anticipated to have a significant impact on traffic operations at study intersections. Therefore, no mitigative measures are recommended as a result of the Project.

Action Alternative	Anticipated Impact to Roadways
Beach Stabilization	**Construction-Related Impacts:** 31 AM and PM peak hour trips generated during construction in 2028 **Ongoing Impacts:** No impact
Beach Nourishment	**Construction-Related Impacts:** 15 AM and PM peak hour trips generated during construction in 2028 **Ongoing Impacts:** No impact
Beach Maintenance	**Construction-Related Impacts:** 15 AM and PM peak hour trips generated during construction in 2028, 2038, 2048, 2058, and 2068 **Ongoing Impacts:** Recurring construction-related impacts for each renourishment event
No Action	**Construction-Related Impacts:** 10 AM and PM peak hour trips generated during demolition and removal of temporary erosion skirt in 2028 **Ongoing Impacts:** No impact

2. Marine Transportation Routes

a. Existing Conditions

The Project Site is located landward of shallow reef flats. As such, there is no marine transportation at or within the Project Site proposed for beach restoration. Canoes are occasionally launched from the beach through the channel that is within the Project Site. Refer to **Figure 16** (Project Site Bathymetry). These canoes leave the beach through the channel and once into deeper portions of the ocean, typically move parallel to shore either north or south beyond the Project Site.

Marine vessel traffic does occur in the vicinity of the Sand Recovery Site. See **Figure 28** (Localized Large Vessel Marine Transportation Lanes). Catamarans and other tour boats can often be seen offshore in the area of Kāʻanapali Beach. Marine activity has been partially observed by AccessAIS, a vessel tracking program run by NOAA, the United States Coast Guard (USCG) and the Bureau of Ocean Energy Management (BOEM). AccessAIS is an automatic identification system which collects data through an onboard navigation system that monitors and transmits the location and characteristics of large vessels to the USCG. This data comes from large vessels and is not reported for all vessels such as smaller tour boats or private vessels. Data for the year 2023 indicates transit of some large vessels near the Sand Recovery Site. While there is data showing a pattern in usage, it is hard to quantify how often vessels are present near the Sand Recovery Site, as AccessAIS may exclude some tour boats and catamarans that are visually observed. Together, the data from AccessAIS and visual observations of the area suggest that the ocean around the Sand Recovery Site is consistently used by marine vessels, but typically shoreward of where the barge would be stationed. Sand is anticipated to be barged around the West Maui land mass to Kahului Harbor. See **Figure 29** (Large Vessel Marine Transportation Lanes). Kahului Harbor is heavily trafficked, with most commercial activity concentrated on the east dock. The east dock has regular schedules for cruise ships and handles services such as cement delivery and general inbound and outbound shipping operations, as well as other irregularly scheduled operations. The area adjacent to the west breakwater is currently undeveloped and during initial Project coordination, SDOT-Harbors Division indicated that there are no current plans to develop this area.

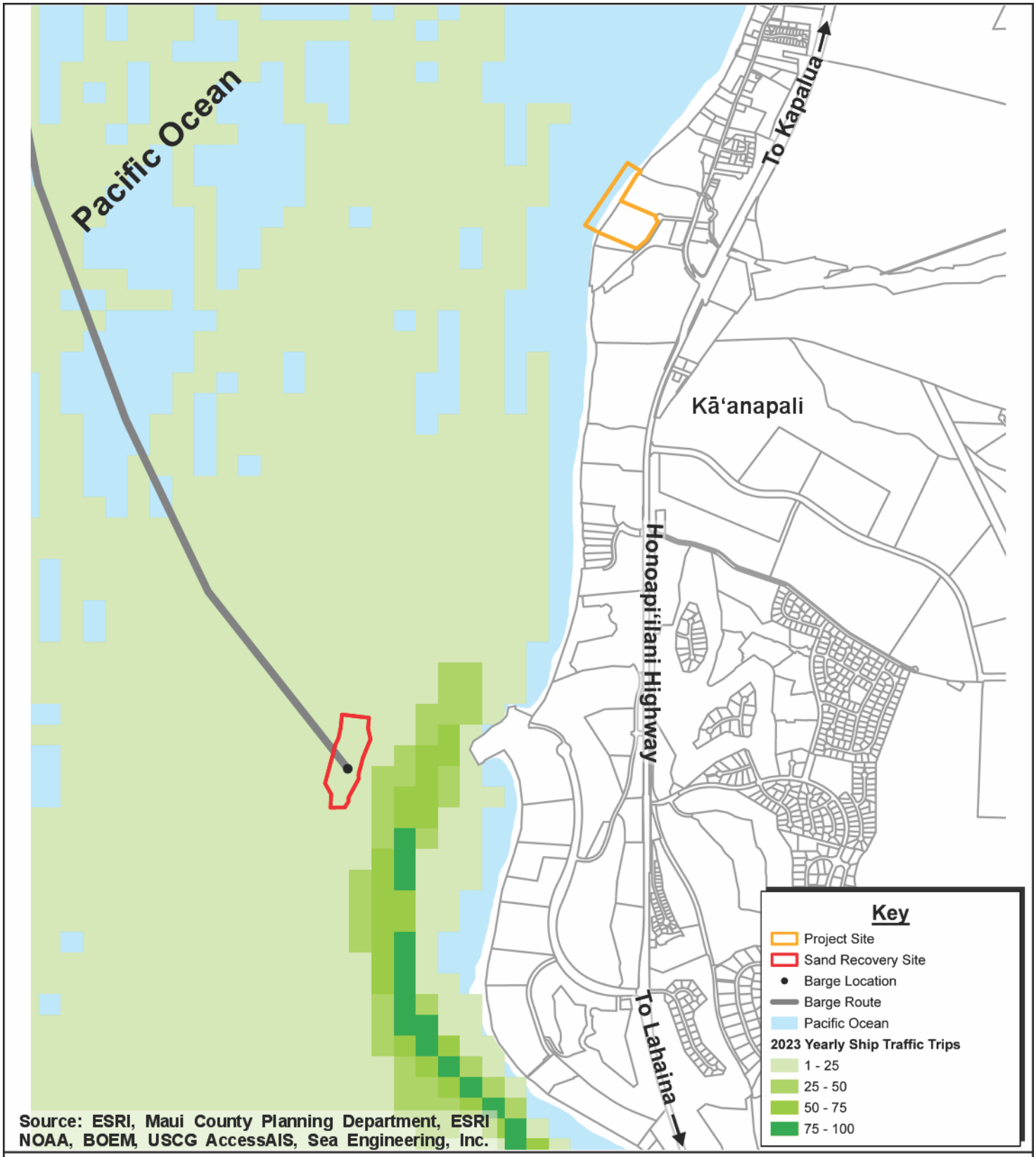


Figure 28

Ho‘āla Honokōwai
Localized Large Vessel Marine Transportation Lanes

0 1,000 2,000
Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\LocLgVesMTL

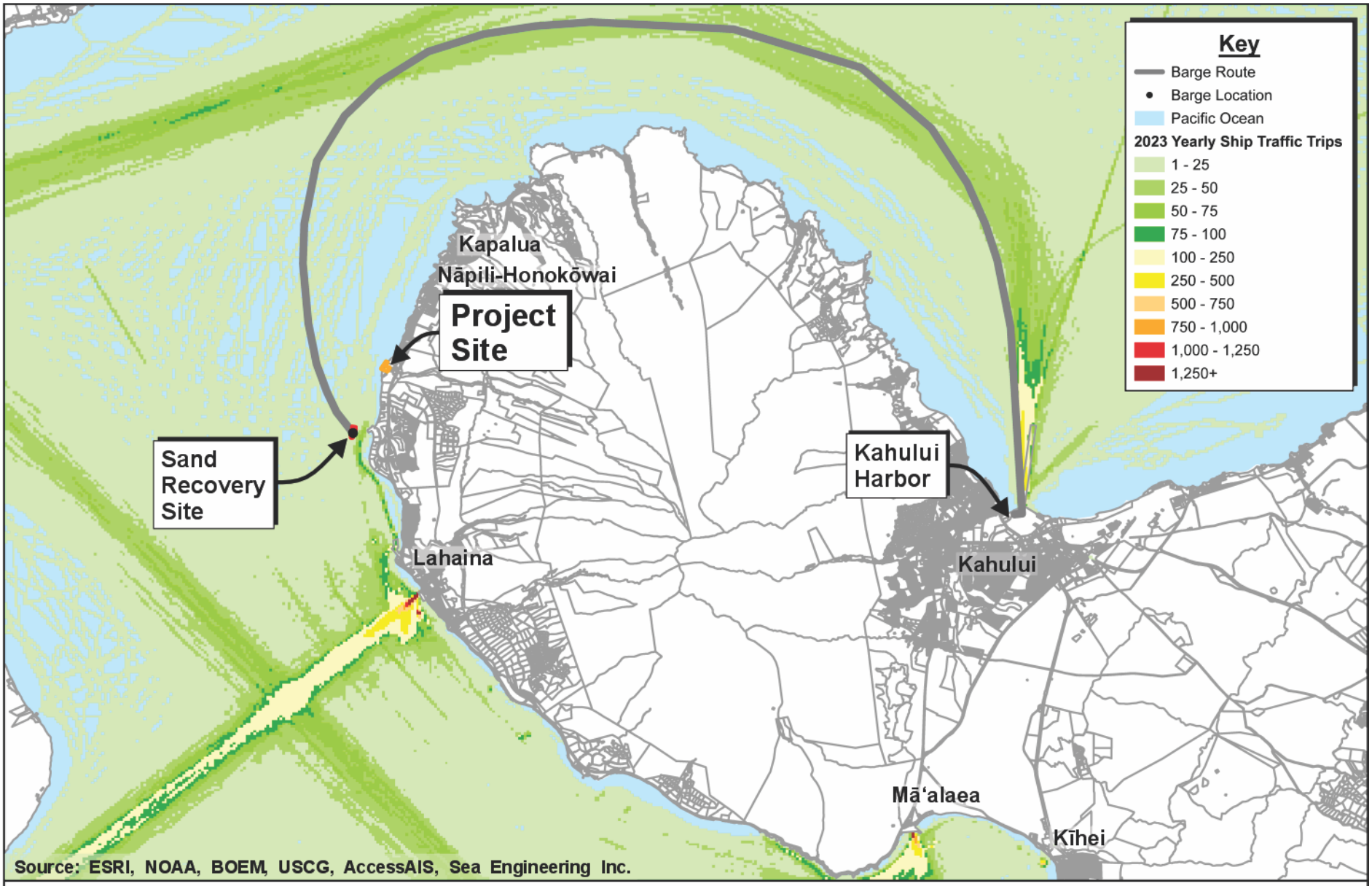


Figure 29

Ho'āla Honokōwai

Large Vessel Marine Transportation Lanes

0 8,750 17,500

Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\LgVesMTL

b. Potential Impacts and Mitigation Measures

The sand recovery and sand transport processes are not anticipated to have significant impacts to marine transportation patterns and infrastructure, as discussed below.

Beach Stabilization

The sand recovery and transport operation, which includes the barge station at the Sand Recovery Site, barge route to Kahului Harbor, and the barge entry to Kahului Harbor, would interact with existing marine transportation routes. At the Sand Recovery Site, vessels which transit the area would have to avoid mooring lines which would extend out from the barge as well as the barge itself. Support vessels would be present during sand recovery operations to monitor the area and ensure that other vessels in the area are able to effectively avoid the barge and all mooring lines. These lines would also be marked to increase visibility. A single four-point anchor spread is anticipated for mooring the barge to provide access to the Sand Recovery Site while minimizing impacts to marine traffic. The proposed barge location would be approximately 1,500 to 2,200 ft. offshore; further offshore than these vessels typically travel as they generally move parallel with the shoreline. Furthermore, the barge location is not in any heavily trafficked shipping lanes per data from AccessAIS. The barge is anticipated to be stationed at the Sand Recovery Site for 13 weeks for Beach Stabilization and any impacts associated with the operation would end when sand recovery is complete, and the barge is removed from the Sand Recovery Site. The barge route from the Sand Recovery Site to Kahului Harbor would interact with two (2) of Maui's shipping lanes as shown by AccessAIS data. One (1) lane is around the northern tip of West Maui coming from Molokaʻi and the other is the entrance to Kahului Harbor. Refer to **Figure 29**. Vessel traffic offshore of northwest Maui is greater and more concentrated than other regions of offshore Hawaiʻi as a clear path is visible based on the data from AccessAIS. The barge would travel through a portion of this area which, according to AccessAIS, saw between 25 and 50 trips in 2023, in its most concentrated area. The Proposed Action would not add more than one (1) to two (2) barge trips per day of sand recovery. With the low volume of additional trips and the amount of available space in the ocean, there are no significant impacts anticipated with the barging through the existing transportation route.

The entrance to the Kahului Harbor does see a significant amount of vessel traffic as it is the start or end point for much of the shipping done in Maui. Yearly data from AccessAIS indicates the entrance to the harbor saw over

1,250 large vessel trips through the harbor in 2023. Refer to **Figure 29**. This site is accustomed to having heavy traffic from large and small boats and has tugboats able to assist when and if necessary. A majority of the existing vessel traffic uses the east dock at the harbor for offloading. The Proposed Action plans to use the west breakwater for offloading, which is infrequently used. Impacts to the shipping lanes would end when sand recovery operations are completed.

As mentioned in Chapter II, sand cannot be transported directly to the Project Site from the ocean side due to the shallow inner reef, lack of space for dewatering, and low permeability of soil which would hinder dewatering if space were available. As such, shipping the sand to Kahului Harbor was identified as the most feasible method to transport sand to the Project Site.

The proposed groins are anticipated to extend between 220 ft. and 250 ft. seaward of the backshore (vegetation line). The groins would be located in the nearshore scour zone on the inner reef flat where water depths are too shallow for commercial vessels to operate. The groins are designed to not interfere with access to the existing channel which can be used for canoe launching, and other recreational uses that require access to the deeper waters offshore. Temporary impacts to channel access would occur for the duration of the Project construction, a period of 55 weeks, and would end once construction is finished. There are no anticipated ongoing impacts to marine transportation routes associated with the groins.

Beach Nourishment

Similar impacts associated with sand recovery, transportation, and offloading can be anticipated for Beach Nourishment as described for Beach Stabilization. Impacts are only anticipated to last for 11 weeks for Beach Nourishment compared to the 13 weeks for Beach Stabilization. At the Project Site, canoe launching may be impacted during the construction phase, but would not be impacted after implementation as the channel at Honokōwai Beach would remain open.

Beach Maintenance

The discussion of impacts to marine transportation presented for Beach Nourishment would apply for Beach Maintenance on a recurring basis. The impacts associated with sand transportation from the offshore barge to the Kahului Harbor would be reoccurring approximately every 10 years, for a total of 20 weeks. Impacts to the channel used for canoe launching at the Project Site would also be reoccurring.

No Action

No Action would not involve sand recovery or transportation and would, therefore, have no impact to marine transportation routes.

Potential Related Secondary Actions

Potential related secondary actions would be located on land and within the KBC property. As such, these actions would not impact marine transportation routes.

Summary

Beach Stabilization, Beach Nourishment, and Beach Maintenance would all have temporary impacts to marine transportation associated with sand recovery and marine sand transportation. These impacts are associated with up to two (2) barge trips per day transporting sand to Kahului Harbor and returning to the Sand Recovery Site, the barge stationed at the Sand Recovery Site, and Project Site construction impacts to canoe launches. Based on the vessel movement data provided by AccessAIS, the additional barge trips are not anticipated to impact open ocean shipping. The barge entering and then heading to the west breakwater for offload is not anticipated to impact existing shipping and harbor operations as the harbor is conditioned for heavy usage. Once sand recovery is completed, all impacts to marine transportation would end. Once Project Site construction is completed, all impacts to canoe launches would end.

Action Alternative	Anticipated Impact to Marine Transportation
Beach Stabilization	**Construction-Related Impacts:** Temporary increase in vessel activity near west breakwater of Kahului Harbor; temporary impacts to channel used for canoe launching **Ongoing Impacts:** No impact **Mitigation Measures:** Groins designed to avoid blocking channel used for canoe launching
Beach Nourishment	**Construction-Related Impacts:** Temporary increase in vessel activity near west breakwater of Kahului Harbor; temporary impacts to channel used for canoe launching **Ongoing Impacts:** No impact

Action Alternative	Anticipated Impact to Marine Transportation
Beach Maintenance	**Construction-Related Impacts:** Temporary increase in vessel activity near west breakwater of Kahului Harbor; temporary impacts to channel used for canoe launching **Ongoing Impacts:** Recurring construction-related impacts for each renourishment event
No Action	No impact

3. Water System

a. Existing Conditions

The County of Maui, Department of Water Supply, provides potable water to West Maui. Water in West Maui is sourced from the Kanaha Stream. Water treatment and storage take place at the Lahaina Water Treatment Facility above Lahainaluna High School, which has an average daily production of 1.6 million gallons per day (mgd). Each of the private properties has water meters and purchase potable water from the County of Maui. There is a public restroom adjacent to KBC property that is also connected to the County water system.

b. Potential Impacts and Mitigation Measures

The Proposed Action will not generate new water demands. As such, no significant impacts to water systems are anticipated.

Beach Stabilization

Beach Stabilization would not generate new water demands and as such, water infrastructure would not be adversely affected.

Beach Nourishment

Beach Nourishment would not generate new water demands and as such, water infrastructure would not be adversely affected.

Beach Maintenance

Beach Maintenance would not generate new water demands and as such, water infrastructure would not be adversely affected.

No Action

The No Action alternative does not have any anticipated impacts on water systems.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have any adverse impacts on water systems.

Summary

There are no anticipated impacts to water systems through any proposed action, including No Action and potential related secondary actions.

Action Alternative	Anticipated Impact to the Water System
Beach Stabilization	No impact
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

4. Wastewater System

a. Existing Conditions

Wastewater in Honokōwai is treated at the Lahaina Wastewater Reclamation Facility (LWRF), located approximately 0.5 miles southeast of the Project Site. The facility receives approximately 4 million gallons per day (mgd) of sewage from a collection system serving approximately 40,000 people including the major resorts along the coast. The LWRF is currently working on new permit requirements as required by a U.S. Supreme Court Decision in 2020 which found the County was in violation to the Clean Water Act. The Lahaina facility utilizes microfiltration to treat surface wastewater and chlorine to disinfect it after treatment. Injection wells pump wastewater into the ground where it eventually percolates into the ocean. A National Pollutant Discharge Elimination System (NPDES) Permit is now required. The County of Maui published a draft permit for public review, but this has been delayed as a result of the Lahaina fires in August 2023.

b. Potential Impacts and Mitigation Measures

The Proposed Action is not anticipated to generate new wastewater demands. As such there are no significant impacts to wastewater systems anticipated for the beach restoration action alternatives.

Beach Stabilization

Beach Stabilization would not generate new wastewater demands and as such, wastewater infrastructure and treatment capacities would not be adversely affected.

Beach Nourishment

Beach Nourishment would not generate new wastewater demands and as such, wastewater infrastructure and treatment capacities would not be adversely affected.

Beach Maintenance

Beach Maintenance would not generate new wastewater demands and as such, wastewater infrastructure and treatment capacities would not be adversely affected.

No Action

The No Action alternative does not have any anticipated impacts on wastewater treatment demands.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have any adverse impacts on wastewater systems.

Summary

There are no anticipated impacts to wastewater demands through any Proposed Action, including No Action.

Action Alternative	Anticipated Impact to Wastewater Systems
Beach Stabilization	No impact
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

5. Drainage System

a. Existing Conditions

Notable drainage features in the vicinity of the Project Site include the Honokōwai Stream channel and engineered drainage structures such as culverts and diffuser pipes. Honokōwai Stream is a perennial stream from

its headwaters to an elevation of approximately 1,300 ft. where it becomes ephemeral (NOAA, 2012). The stream functions as the primary drainage for the Honokōwai watershed, originating in the West Maui Mountains. The County-owned Honokōwai Dam and Desilting Station are located 750 ft. to the east of Honoapiʻilani Highway. From the stream headwaters to the dam, the stream is in a natural state. Downstream of the dam the stream is channelized, fitted with a box culvert that passes under Honoapiʻilani Highway and Lower Honoapiʻilani Road. Outfalls discharge stormwater runoff into the concrete section of the stream in several locations west of the highway. The mouth of the stream channel is typically obstructed by a sand plug created by wave action, creating a perennial pond that is typically stagnated. During periods of heavy rainfall, a high volume of water pushes through the sand plug. Any debris, concentrations of nutrients, pollutants, and sediment then enters the nearshore waters which contributes to the turbidity plumes often observed during heavy rainfall.

b. Potential Impacts and Mitigation Measures

The proposed beach restoration is anticipated to have no significant ongoing impacts to drainage. There may be various temporary impacts associated with construction activities such as erosion and increased turbidity. Appropriate BMPs will be implemented such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected during project operations.

Beach Stabilization

The Beach Stabilization alternative is not anticipated to have adverse impacts to the drainage system. As a secondary benefit, the design of the northern terminal groin may prevent sand from accumulation at the Honokōwai Stream mouth, restoring a more natural and persistent stream flow into the ocean and minimizing the accumulation of sediment, pollutants, and debris in the stream channel.

There may be temporary impacts to drainage associated with construction. Construction-related impacts will be mitigated with BMPs, such as covering any debris to reduce runoff and preventing hazardous substances from entering drainage ways. An NPDES permit will be obtained for Project implementation because the project size is greater than 1 acre.

Beach Nourishment

The Beach Nourishment alternative is not anticipated to have adverse impacts to the drainage system. The design of this alternative would not

prevent sand from accumulating at the Honokōwai Stream mouth. Beach Nourishment would increase the volume of sand along the shoreline, which would increase the likelihood of the sand plug remaining intact at the stream mouth. Similar construction-related impacts to Beach Stabilization may occur, but they would be diminished as the construction period is a lesser duration, and no groins would be constructed. Construction-related impacts will be mitigated with BMPs, such as covering any debris to reduce runoff and preventing hazardous substances from entering drainage paths. An NPDES permit will be obtained for Project implementation.

Beach Maintenance

The Beach Maintenance alternative is anticipated to have similar negligible impacts to drainage as Beach Nourishment. However, construction-related impacts would be recurring as the beach is nourished approximately once every 10 years. An NPDES permit will be obtained for Project implementation.

No Action

The No Action alternative is not anticipated to adversely affect drainage systems. Construction-related impacts during the demolition and removal of the temporary erosion skirt will be mitigated with BMPs, such as covering any debris to reduce runoff and preventing hazardous substances from entering drainage paths. Over the long- term, erosion of the beach and backshore could have a significant negative impact to drainage systems in the area as they are exposed to seawater and wave action.

Potential Related Secondary Actions

There are no adverse impacts to drainage anticipated for the potential related secondary actions. Any potential construction-related impacts will be mitigated with BMPs.

Summary

There are no adverse impacts to drainage associated with any of the proposed beach restoration action alternatives, potential related secondary actions, or No Action alternative. The No Action alternative may result in negative impacts as the beach and backshore erode, exposing drainage systems to seawater and wave action. A potential secondary benefit of Beach Stabilization is preventing sand from accumulating at the mouth of Honokōwai Stream, restoring a more natural stream flow into the ocean.

Action Alternative	Anticipated Impact to the Drainage System
Beach Stabilization	**Construction-Related Impacts:** Potential construction-related erosion and increased turbidity **Ongoing Impacts:** Potential secondary benefit of preventing sand from accumulating at the Honokōwai Stream mouth **Mitigation:** Construction BMPs such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected; NPDES permit; refer to Best Management Practices Plan in CEA (**Appendix "A"**)
Beach Nourishment	**Construction-Related Impacts:** Potential construction-related erosion and increased turbidity **Ongoing Impacts:** No impact **Mitigation:** Construction BMPs such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected; NPDES permit; refer to Best Management Practices Plan in CEA (**Appendix "A"**)
Beach Maintenance	**Construction-Related Impacts:** Potential construction-related erosion and increased turbidity **Ongoing Impacts:** Recurring construction-related impacts for each renourishment event **Mitigation:** Construction BMPs such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected; NPDES permit; refer to Best Management Practices Plan in CEA (**Appendix "A"**)
No Action	**Construction-Related Impacts:** Potential construction-related erosion and increased turbidity (for removal of temporary erosion skirt) **Ongoing Impacts:** Beach and backshore erosion could impact drainage systems by exposing them to seawater and wave action **Mitigation:** Construction BMPs such as silt curtains, biosocks, booms, and/or silt fences that will be individually anchored and regularly inspected; refer to Best Management Practices Plan in CEA (**Appendix "A"**)

6. Electrical, Telephone, and Cable Television Services

a. Existing Conditions

Electrical service to West Maui is provided by Maui Electric Company, Ltd. Hawaiian Telcom provides telephone service and Spectrum provides cable television service. No electrical, telephone, or cable television infrastructure is located within the shoreline area of the Project Site.

b. Potential Impacts and Mitigation Measures

There is existing electrical, telephone, and cable television infrastructure at the Project Site which is not anticipated to be adversely impacted from the Proposed Action.

Beach Stabilization

Beach Stabilization is not anticipated to have impacts on electrical, telecommunications, or television services.

Beach Nourishment

Beach Nourishment is not anticipated to have impacts on electrical, telecommunications, or television services.

Beach Maintenance

Beach Maintenance is not anticipated to have impacts on electrical, telecommunications, or television services.

No Action

The No Action alternative is not anticipated to have impacts on electrical, telecommunications, or television services.

Potential Related Secondary Actions

The potential related secondary actions are not anticipated to have an impact on electrical, cable, or television services.

Summary

The three (3) beach restoration alternatives are not anticipated to have significant adverse impacts on electrical, telecommunications, or television services. The No Action alternative is likewise not anticipated to have significant adverse impacts on electrical, telecommunications, or television services.

Action Alternative	Anticipated Impact on Electrical, Telecommunications, or Television Services
Beach Stabilization	No impact
Beach Nourishment	No impact
Beach Maintenance	No impact
No Action	No impact

E. CUMULATIVE AND SECONDARY IMPACTS

1. Secondary Impacts

"Secondary impacts" or "indirect effects" are defined by HAR § 11-200.1:

> *[M]eans an effect that is caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. An indirect effect may include growth inducing effect and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water, and other natural systems, including ecosystems.*

Secondary impacts are those which have the potential to occur later in time or farther removed in distance, but are still reasonably foreseeable. They can be viewed as actions of others that are taken because of the presence of the Project. Secondary impacts from highway projects, for example, can occur because they can induce development by removing one (1) of the impediments to growth.

Table 19 summarizes potential secondary impacts for the Beach Stabilization, Beach Nourishment, Beach Maintenance, and No Action Alternatives. The presentation of potential secondary impacts is organized around the impact categories presented earlier in this chapter: Physical Environment, Socio-Economic Environment, Public Services, and Infrastructure. As indicated in **Table 19** below, the secondary impacts for Beach Stabilization, Beach Nourishment, and Beach Maintenance are similar in many instances, but there are some additional secondary impact considerations for Beach Stabilization as it relates to the proposed groins. The No Action Alternative is anticipated to result in a variety of adverse secondary impacts associated with erosion, shoreline recession, beach narrowing, and potential beach loss.

Table 19. Secondary Impacts

	Beach Stabilization	Beach Nourishment	Beach Maintenance	No Action
Physical Environment: Land Use	Beach Stabilization, Beach Nourishment, and Beach Maintenance are not anticipated to result in new land use development inland of the shoreline. Restoring and stabilizing the beach will not increase private property boundaries, development rights, or land uses along the shoreline. The County of Maui's Shoreline Rules, which establishes the Shoreline Setback Area to be the erosion hazard line under a 3.2-foot sea level rise scenario, governs development along the shoreline and the proposed Beach Stabilization action will not change the shoreline setback area for the Project Site. As discussed in this EIS, potential related secondary actions within the Project Site beyond the shoreline may include improvements to common elements within the KBC property aimed at increasing resiliency and reducing exposure to or risk from climate change. These actions, however, would be limited to improvements to existing developed areas of the KBC property and would not represent new land use development.			Under the No Action Alternative, KBC may need to reduce operations or be forced to close entirely due to the eventual loss of Honokōwai Beach and the overall degradation of the shoreline area.
Physical Environment: Adjacent Shoreline Properties	Beach Stabilization would reduce the exposure of the existing shore protection structure fronting Kaanapali Shores to wave action, which could potentially decrease the likelihood of structural damage, decrease the need for future repair and maintenance, and extend the effective life of the structure. The northern terminal groin would be expected to prevent sand from accumulating at the mouth of Honokōwai Stream, allowing for uninterrupted stream flow into the ocean. This would be considered a secondary benefit of the project, but cannot be ensured. A more frequent and persistent connection would facilitate a more natural stream flow and prevent the accumulation of sediment that could cause flood waters to overtop the stream channel walls potentially resulting in flooding of the adjacent properties. The southern terminal groin would mitigate erosion along the north side of the Maui Kai building, which is currently threatened by erosion. The southern terminal groin would inhibit sediment transport to the south but is not anticipated to result in any downdrift erosion or reduction in sand volume along this reach of the shoreline. Sand that currently exists along this reach of shoreline would remain subject to both longshore and cross-shore sediment transport and would continue to move freely along the shoreline. During the summer months, when sand is transported from south to north by southerly swell, sand is expected to accumulate on the updrift (south) side of the southern terminal groin. During the winter months, when northerly swell is dominant, the heads of this terminal groin would create a lee to the south that would inhibit this sand from being mobilized and transported alongshore to the south. As a result, Beach Stabilization has the potential to	Beach Nourishment is expected to provide a temporary secondary benefit by delaying erosion, shoreline recession, beach narrowing, and potentially beach loss that could threaten or damage adjacent structures along the shoreline, including the north side of the Maui Kai building, which is currently threatened by erosion. Beach Nourishment would temporarily reduce the exposure of the existing shore protection structure fronting Kaanapali Shores to wave action, which could potentially decrease the likelihood of structural damage, decrease the need for future repair and maintenance, and extend the effective life of the structure. Reducing impacts to adjacent properties and structures would be considered a secondary benefit of the project, but cannot be ensured.	Beach Maintenance is expected to provide a temporary secondary benefit by delaying erosion, shoreline recession, beach narrowing, and potential beach loss that could potentially threaten or damage adjacent structures along the shoreline, including the north side of the Maui Kai building, which is currently threatened by erosion. Beach Maintenance would reduce the exposure of the existing shore protection structure fronting Kaanapali Shores to wave action, which could potentially decrease the likelihood of structural damage, decrease the need for future repair and maintenance, and extend the effective life of the structure. Reducing impacts to adjacent properties and structures would be considered a secondary benefit of the project, but cannot be ensured.	Under the No Action Alternative, progressive erosion, shoreline recession, beach narrowing, and potential beach loss has the potential to increase flank erosion at the ends of the existing shore protection structures fronting Kaanapali Shores and the Maui Kai, which could potentially result in structural damage or loss of structural integrity. If the adjacent shore protection structures were to be damaged or compromised by erosion, the adjacent properties may need to reduce operations or be forced to close entirely.

	Beach Stabilization	Beach Nourishment	Beach Maintenance	No Action
	increase beach width along the shoreline immediately to the south in the vicinity of the southern terminal groin. This would reduce the exposure of the existing shore protection structure fronting the Maui Kai to wave action, which could potentially decrease the likelihood of structural damage, decrease the need for future repair and maintenance, and extend the effective life of the structure. These would be considered secondary benefits of the project, but cannot be ensured.			
Physical Environment: Streams and Wetlands	The northern terminal groin is expected to likely prevent sand from accumulating at the mouth of Honokōwai Stream, allowing for uninterrupted stream flow into the ocean. This would be considered a secondary benefit of the Project, but cannot be ensured.	No impact	No impact	No impact
Physical Environment: Marine and Nearshore Environment	The groins would provide new and improved marine habitat by providing bare, stable surfaces for recruitment of corals, algae and other invertebrates. The interstitial spaces between the boulders would provide additional habitat for cryptic benthic (crabs, shrimps, worms, etc.) and sessile organisms (corals and macroalgae), which would provide additional foraging resources for fishes.	No impact	No impact	As the beach and backshore erode in the absence of any beach stabilization or maintenance actions, there may be negative impacts associated with deteriorating water quality, habitat loss, and elevated turbidity levels.
Socio-Economic Environment: Economy and Labor Force	The construction of the Beach Stabilization action would generate secondary economic and fiscal impacts in the form of jobs, labor income, economic output, and tax revenues. These secondary impacts may include other businesses in the region.	The construction of the Beach Nourishment action would generate secondary economic and fiscal impacts in the form of jobs, labor income, economic output, and tax revenues. Inasmuch as the Beach Nourishment alternative has a design life of approximately 10 years, adverse secondary economic and fiscal impacts associated with reduced operations or forced closure of KBC would be expected, similar to the No Action Alternative, but delayed by 10 years.	The construction of the Beach Maintenance program would generate secondary economic and fiscal impacts in the form of jobs, labor income, economic output, and tax revenues.	Adverse secondary impacts to the economy would result from reduced operations or forced closure of KBC that is presumed to occur under a No Action Alternative due to the eventual loss of Honokōwai Beach and the overall degradation of the shoreline area. State and County tax revenues would also be adversely impacted. If adjacent shore protection structures were to be damaged or compromised by erosion, the adjacent properties may need to reduce operations or be forced to close entirely.
Public Services	Beach Stabilization, Beach Nourishment, and Beach Maintenance are not anticipated to result in new land use development that would generate additional demands on public services. Potential secondary actions may involve improvements to access to the shoreline for emergency responders.			Progressive erosion, shoreline recession, beach narrowing, and the potential for beach loss associated with the No Action Alternative have the potential to create dangerous conditions along the shoreline, similar to those that developed during the 2016 episodic erosion and beach loss event. A potential related secondary impact of the dangerous shoreline conditions is increased calls for public safety and medical services to the area.

	Beach Stabilization	Beach Nourishment	Beach Maintenance	No Action
Infrastructure	Beach Stabilization, Beach Nourishment, and Beach Maintenance are not anticipated to result in new land use development that would generate additional infrastructure demands.			Progressive erosion, shoreline recession beach narrowing, and the potential for beach loss associated with the No Action Alternative has the potential to impact existing infrastructure improvements and systems within the KBC property including, but not limited to water, sewer, drainage improvements. Failure of these infrastructure systems has the potential to adversely impact the nearshore marine environment.

2. Cumulative Impacts

Cumulative impacts are defined by HAR, Chapter 11-200.1, Environmental Impact Statement Rules as:

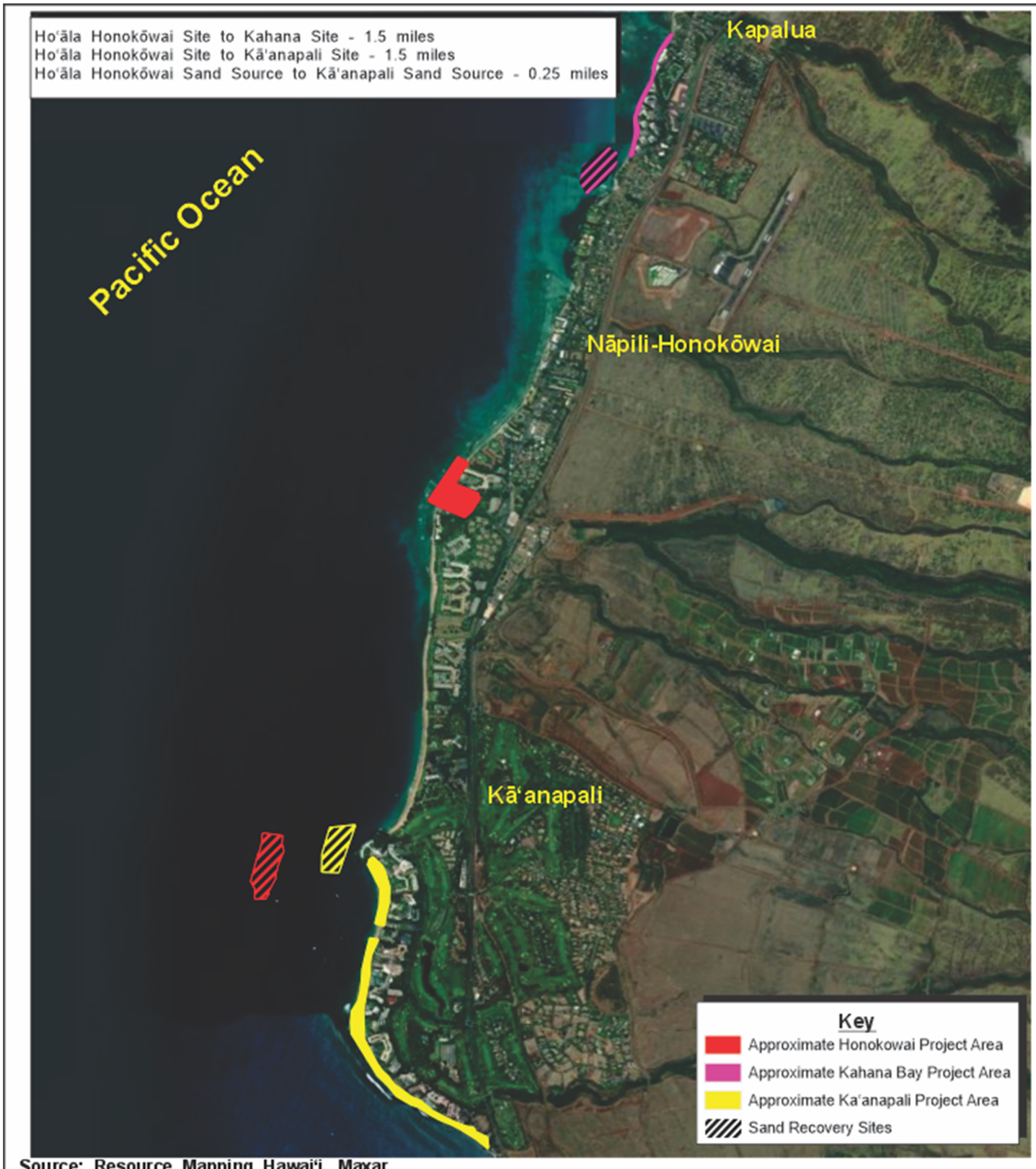
> *[T]he impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

The context for analyzing cumulative impacts is defined by multiple project impacts within "the reasonably foreseeable future" and vicinity of the proposed Project. There are two (2) other beach restoration projects proposed for West Maui that establish context for analyzing the cumulative impacts for the Hoʻāla Honokōwai Project. These projects are summarized below and presented in **Figure 30** (Proposed West Maui Beach Restoration Projects).

Kāʻanapali Beach Restoration and Berm Enhancement Project: The Kāʻanapali Operations Association, Inc. (KOA) has proposed a beach restoration and berm enhancement project along the shoreline of Kāʻanapali Beach. Beach restoration is proposed for the section of beach between Hanakaʻōʻō Beach Park and Hanakaʻōʻō Point ("Hanakaʻōʻō Littoral Cell"), and beach berm enhancement is proposed for the section of beach between Hanakaʻōʻō Point and Puʻu Kekaʻa ("Kāʻanapali Littoral Cell"). Approximately 75,000 cy of sand from a regional sand field fronting Kāʻanapali is proposed for the project. The 2nd Final EIS for the project was published on July 23, 2022, and the acceptance of the EIS was published in the December 8, 2022, edition of *The Environmental Notice.*

Kahana Bay Erosion Mitigation Project: The Kahana Bay Erosion Mitigation Project proposes to restore approximately 3,700 ft. of shoreline located between Kahana Stream and Pōhaku Park in Kahana, Maui, approximately 1.5 miles north of the Project Site. The project proposes to restore the beach to the width that existed in 1975 by placing between 50,000 cy and 100,000 cy of sand from three (3) potential offshore sand sources located in the Kahana area. In addition, seven (7) rock T-head groins and one (1) reinforced rock headland structure are proposed to stabilize the beach. The Second Draft EIS for this project was published in the November 8, 2021, edition of *The Environmental Notice*.

Potential cumulative impacts associated with the Hoʻāla Honokōwai and the Kāʻanapali Beach Restoration and Berm Enhancement Project and Kahana Bay Erosion Mitigation Project are summarized below:



Source: Resource Mapping Hawai'i, Maxar

Figure 30

Ho'āla Honokōwai
Proposed West Maui Beach Restoration Projects

0 1,500 3,000
Feet

MUNEKIYO HIRAGA

Prepared for: West Maui Resort Partners, L.P.

HGV\KBC Beach Restor\Apps\Figures\PWMBRP

Construction Timeline: The three (3) beach restoration projects are each independent projects with independent timelines. While the specific construction timelines for each project are dependent on completion of the lengthy regulatory approval processes, it is not anticipated that the projects would be under construction at the same time because each project is at a different stage in the environmental review and entitlement process. The Kāʻanapali Beach Restoration and Berm Enhancement Project has an accepted Final EIS and the Kahana Bay Erosion Mitigation Project published its Second Draft EIS in November 2021. For this reason, cumulative construction impacts are not anticipated across the three (3) beach restoration projects.

Sand Recovery: As indicated in **Figure 30**, the three (3) proposed beach restoration projects have identified different sand recovery sites. It is noted that the Kāʻanapali Beach Restoration and Berm Enhancement Project Sand Recovery Site and the Hoʻāla Honokōwai Sand Recovery Site are located within close proximity of each other, both offshore of Puʻu Kekaʻa. If both projects were conducting sand recovery operations at the same time, there may be cumulative visual impacts associated with having an increased number of barges and support vessels offshore of Puʻu Kekaʻa at the same time. However, as discussed above, the projects are on different timelines and sand recovery operations are not anticipated to occur at the same time.

Groins in West Maui: The Hoʻāla Honokōwai Project proposes the development of four (4) groins, while the Kahana Bay Erosion Mitigation Project proposes seven (7) groins. If both projects are developed, there would be a total of 11 groins. These projects are located 1.5 miles apart and are not within the same viewshed or littoral cell. As such, there would not be cumulative view impacts across the two (2) projects. There are no other projects proposed to include beach stabilizing structures, such as groins. It is noted that groins are appropriate under specific shoreline conditions and are not generally applicable across all shorelines. For this reason, multiple beach stabilization projects with groins are not anticipated to be proposed across the West Maui region.

In addition to other West Maui beach restoration projects, there are other actions proposed within West Maui that inform the cumulative impact analysis. These additional projects include various master plan developments such as Pulelehua and the Department of Hawaiian Home Lands' Honokōwai Master Plan as well as other proposed commercial and residential developments. In addition to these projects, recovery and rebuilding following the August 2023 Lahaina wildfire is anticipated to be an ongoing effort for many years.

Potential cumulative impacts associated with the Hoʻāla Honokōwai project and other West Maui developments are anticipated to be primarily limited to the

construction period. Inasmuch as the Hoʻāla Honokōwai Project is a beach restoration project that does not involve the development of new land uses, there are no long-term cumulative impacts anticipated. From a construction standpoint, cumulative impacts associated with truck traffic could present a potential cumulative impact. The TIAR analyzes traffic impacts in the context of traffic generated by known planned and proposed development projects as well as traffic growth attributed to the rebuilding in Lahaina. The TIAR concluded that the number of trips generated by the beach restoration actions is negligible and the proposed Project is not anticipated to have a significant impact. Beyond potential cumulative traffic impacts which have been assessed as part of the TIAR, the proposed Project is not anticipated to result in other adverse construction-related cumulative impacts.

IV

RELATIONSHIP TO GOVERNMENTAL PLANS, POLICIES, AND CONTROLS

IV. RELATIONSHIP TO GOVERNMENTAL PLANS, POLICIES, AND CONTROLS

A. FEDERAL STANDARDS

The Project Site involves Navigable Waters of the United States, defined by Title 33, Code of Federal Regulations (CFR) § 329 as:

> *Those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.*

Within the Project Site, the submerged areas lying seaward of both the shoreline and the mean higher high water (MHHW) line are within the Navigable Waters of the United States, and as such, are subject to federal jurisdiction. The Project has been reviewed with respect to the following federal standards and regulations.

1. Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 requires a Department of the Army (DA) permit for any activity that obstructs or alters Navigable Waters of the United States, or the course, location, condition, or capacity of any port, harbor, refuge, or enclosure within the limits of any breakwater, or of the channel of any navigable water. DA permits are issued by the U.S. Army Corps of Engineers (USACE). As the Proposed Action would involve removing and placing materials including sand in the Navigable Waters of the United States, a DA permit will be required pursuant to Section 10.

2. Clean Water Act

The Clean Water Act (CWA) of 1972, as amended, is the key legislation governing surface water quality protection in the United States. The CWA offers regulatory mechanisms designed to control point source pollution and set water quality standards to protect aquatic life and human health. Sections 401, 402, and 404 of the CWA require permits for actions that involve wastewater discharges or discharge of dredged or fill material into Waters of the United States.

a. Section 401

A Section 401 Water Quality Certification (WQC) is required for projects that also require a Section 404 permit (discussed below). In Hawai‘i, the Hawai‘i Department of Health, Clean Water Branch (DOH-CWB) has been designated by the U.S. Environmental Protection Agency (EPA) as

responsible for implementing Section 401 of the CWA. A Section 401 WQC will be applied for in conjunction with the Section 404 permit. The WQC application will require submission of an Applicable Monitoring and Assessment Program (AMAP) to the DOH-CWB. The AMAP specifies the water quality sampling and testing that will be conducted before, during, and after construction to quantitatively confirm the effectiveness of the BMPs that will be implemented to isolate and minimize potential contamination of coastal waters. Six (6) water quality monitoring stations have been established, which will analyze pH, turbidity, salinity, temperature, and dissolved oxygen. During construction, water samples will be collected twice a month from each of the six (6) monitoring stations. Following the completion of construction, three (3) increments of sampling will be conducted on a weekly basis commencing at least one (1) week after completion of in-water work. If water quality parameters fall outside of pre-construction baselines, additional BMPs or revisions to the construction plan will occur. The AMAP is included within the CEA (**Appendix "A"**).

b. Section 402

Section 402 of the CWA regulates point source pollution, which refers to pollution that discharges from a specific point, such as a sewer pipe or construction site. Discharges of point sources of pollutants into surface waters of the U.S. are controlled under the NPDES program, pursuant to Section 402 of the CWA. The CWA allows states to administer permit programs in order to identify and minimize point source discharge. The NPDES program is administered by the DOH-CWB, under Title 11, Chapter 55, HAR. A NPDES permit will be obtained as applicable for compliance with CWA Section 402.

c. Section 404

CWA Section 404 defines requirements for discharges in Navigable Waters of the U.S. and sets limits on the discharge of dredged or fill material into navigable waters. Permit approval is through the USACE. Dredging activities and placement of fill for the completion of the Proposed Action triggers the need for a Section 404 permit.

3. Clean Air Act

The Clean Air Act (CAA) and amendments regulate air emissions from area, stationery, and mobile sources. The CAA authorizes the U.S. EPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. Pursuant to the CAA and HAR § 11-60.1, the Department of Health

(DOH) implements an operating permit program to regulate air pollutants within the State of Hawai'i. The Project will comply with permitting requirements pursuant to HAR § 11-60.1, as may be applicable to the Project.

4. National Historic Preservation Act (Section 106)

The National Historic Preservation Act (NHPA) of 1966 established a national preservation program and a system of procedural protections for the identification and preservation of historic places. The NHPA requires federal agencies having direct or indirect jurisdiction to consider effects on any district, site, building, structure, or object that is included or is eligible for inclusion in the National Register of Historic Places (NRHP) prior to the approval of expenditure of any funds or issuance of any license or permit. Because federal permits are required, Section 106 review will be triggered. A NHPA Section 106 review will be conducted in connection with the DA permit review process. Consultation with the State Historic Preservation Division (SHPD) will be conducted to ensure that the Proposed Action complies with the provisions of the NHPA.

5. National Flood Insurance Program

The National Flood Insurance Program (NFIP) is managed by FEMA. The NFIP is intended to provide insurance to reduce the socio-economic impact of floods on property owners, renters, and businesses. FEMA maintains maps that are used to assess the flood risk of different areas. Under NFIP requirements, permits are necessary for proposed construction in flood-prone areas (National Flood Insurance Program 60.3(a)(1)). These permits ensure that proposed development meets NFIP and community floodplain management requirements. Within Maui County, compliance with NFIP requirements is administered under Maui County Code, Chapter 16.29. As the Project Site includes areas identified as Special Flood Hazard Areas, it is anticipated that processing of a Coastal High Hazard Area Certification and Special Flood Hazard Area Development Permit will be necessary for the proposed beach restoration Project to ensure NFIP compliance.

6. Coastal Zone Management Act

The federal Coastal Zone Management Act (CZMA) of 1972 (16 USC §§ 1451-1464) was established to preserve, protect, develop, and where possible, restore or enhance, coastal zone resources. The CZMA encourages coastal states to develop and implement coastal zone management plans. The State of Hawai'i developed Chapter 205A, HRS (the Hawai'i Coastal Zone Management Program) in 1977, which was later approved as a Coastal Zone Management Plan in 1978. The State of Hawai'i Office of Planning and Sustainable Development (OPSD) is the regulatory body for the CZMA. As such, a Coastal Zone Management (CZM)

Consistency Determination will be coordinated by the State of Hawai‘i, Office of Planning and Sustainable Development, CZM Program.

7. Endangered Species Act

The Endangered Species Act (ESA) of 1973 establishes a process for identifying and listing threatened and endangered species. It requires federal agencies to ensure the conservation of federally listed endangered and threatened plants and wildlife. Additionally, it mandates the designation of critical habitats for such species and prohibits actions by federal agencies that would likely jeopardize the continued existence of those species or result in the destruction or adverse modification of designated critical habitat. Two (2) main sections from the ESA impact the Project. Section 7 of the ESA requires consultation with federal wildlife management agencies on actions that may affect listed species or designated critical habitat. Section 7 consultation is conducted during the DA permit processing for work in Navigable Waters. Section 9 of the ESA prohibits the “taking”, or the harm or harassment of endangered species without an agency-issued permit. There is no anticipated taking, harm, or harassment of endangered species for the Proposed Action. Appropriate BMPs will be adhered to in order to limit temporary construction-related impacts to monk seals and sea turtles.

Critical habitat for Hawaiian monk seals has been designated and includes the sea floor and marine environment to 10 m above the sea floor from the 200 m depth contour, through the shoreline and extending onto the land 5 m inland from the shoreline between identified boundary points. These terrestrial boundary points define preferred pupping areas and significant haul-out areas. Honokōwai Beach is designated as critical habitat for Hawaiian monk seals, and the Sand Recovery Site and nearshore environment is designated as critical marine habitat. Because beaches in Hawai‘i are federally designated critical habitat for Hawaiian monk seals and green sea turtles, beach restoration can be considered as habitat restoration under the ESA.

The waters offshore of the Project Site are within the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS). The Proposed Action would not directly affect humpback whales, and sounds generated from sand placement and groin construction activities are not expected to be substantial enough to cause an acoustic disturbance to the protected species.

While endangered species do have the potential to occur at the Sand Recovery Site and the Project Site and have been observed in the Project vicinity, the Proposed Action is not anticipated to have significant adverse impacts to existing marine biotic communities or listed species. Refer to the Assessment of the Marine Environment contained within the CEA, **Appendix “A”**.

8. Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act as amended, is the primary law that governs marine fisheries management in federal waters of the United States. This act includes waters extending to 200 nautical miles around the Hawaiian Islands which are under the jurisdiction of the Western Pacific Regional Fishery Management Council (WPRFMC). The WPRFMC has approved Fisheries Management Plans (FMP) for Hawai‘i that designate the ocean waters surrounding Maui, from the shore to depths of over 100 ft., including the area that would be affected by the Proposed Action as “Essential Fish Habitat” (EFH) (including water column and all bottom areas) for coral reef ecosystem, bottomfish, pelagic, and crustacean Management Unit Species).

The WPRFMC has also defined “Habitat Areas of Particular Concern” (HAPC) a subset of EFH that are “rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area.” The Proposed Action does not involve any HAPC.

Consultation with the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) will be conducted during DA permit processing. Mitigation measures will be put in place as necessary to meet EFH protection guidelines pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. While endangered species such as Hawaiian monk seals and green sea turtles do have the potential to occur at the site and have been observed in the Project vicinity, the Proposed Action is not likely to have a significant adverse impact to existing marine biotic communities. Temporary construction-related impacts will be mitigated through appropriate BMPs. Refer to the Assessment of the Marine Environment contained within the CEA, **Appendix “A”**.

9. Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972, as amended, restricts the taking (i.e., harassment, hunting, capture or killing, or attempting to harass, hunt, capture, or kill) of marine mammals in waters of the United States. Biological surveys were conducted to identify marine species in the vicinity of the Proposed Action and potential impacts and recommended mitigation measures. The waters offshore of the Project Site are within the HIHWNMS. The humpback whale or koholā (*Megaptera novaeangliae*) are frequently observed in deeper waters offshore of Honokōwai Beach, particularly during the months of January through March. Beach restoration would not directly affect humpback whales, and sounds generated from sand placement and groin construction activities are not expected to be substantial enough to cause an acoustic disturbance to protected species.

BMPs to mitigate impacts to humpback whales will be implemented, including surveying the work area for marine protected species before beginning any in-water work, and at specified intervals while work is ongoing. Should a humpback whale or other marine protected species enter the work area, work will be halted until the animal has left the area. Refer to **Appendix "A"**, Section 9.4.2.

While endangered species such as Hawaiian monk seals and green sea turtles do have the potential to occur at the site and have been observed in the Project vicinity, the Proposed Action is not likely to have a significant adverse impact on existing marine biotic communities. Refer to the Assessment of the Marine Environment, contained within the CEA in **Appendix "A"**. The Project will apply with all applicable mitigation recommendations and permit requirements.

10. Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918, as amended, establishes protections for migratory birds and restricts the taking of migratory bird species. A Terrestrial Biological Survey was conducted for the Project Site by AECOS Inc. The Black-Crowned Night Heron is an indigenous water-obligate species with healthy populations on most Hawaiian Islands and is protected under the federal MBTA. Black-Crowned Night Heron were observed during the biological surveys of the Project Site. In addition, the U.S. Fish and Wildlife Service (USFWS) provided a list of species that may occur based on observation, or have potential for occurrence based on location or habitat to best understand and plan for any potential scenario. In the event a listed migratory bird enters the construction zone, the contractor must stop work in the immediate area so as not to disturb the bird. Additionally, reduced speed limits will be enforced, and Project personnel and contractors will be informed about the presence of any listed species onsite or nearby. Creating surface water features after grading will be avoided.

11. Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) of 1934, as amended, mandates that wildlife, including fish, receive equal consideration and coordination with other aspects of water resource development. Consultation with the NMFS, the USFWS, and appropriate state agencies is required when any body of water is proposed to be modified in any way and requires a federal permit or license.

The NMFS, the USFWS, and appropriate state agencies will be consulted to determine the possible harm to fish and wildlife resources, the measures needed to prevent damage and loss, and measures needed to develop and improve these resources, in connection with water resource development. Consultation with these agencies will be undertaken during DA permit processing to identify potential impacts and recommended mitigation measures pursuant to the FWCA. While

endangered species do have the potential to occur at the Project Site and have been observed in the Project vicinity, the Proposed Action is not likely to have any impact to existing biotic communities. Refer to the Assessment of the Marine Environment, contained within the CEA in **Appendix "A"**.

12. Other

Other federal laws that may be applicable, include the Archaeological and Historic Preservation Act, the Native American Graves Protection and Repatriation Act of 1990, Executive Order (EO) 13089 for Coral Reef Protection, EO 13186 related to Responsibilities of Federal Agencies to Protect Migratory Birds, and EO 12898 related to Environmental Justice. The Project will comply with all federal requirements as may be applicable to the Proposed Action.

B. HAWAIʻI STATE PLAN

Chapter 226, HRS, also known as the Hawaiʻi State Plan, is a long-range comprehensive plan that serves as a guide for the future long-term development of the State by identifying goals, objectives, policies, and priorities, as well as implementation mechanisms. The Hawaiʻi State Plan was enacted in 1978 after a multi-year cross-sector effort and the last comprehensive review of the Plan was completed in 1985. The plan consists of three (3) parts. Part I includes the Overall Theme, Goals, Objectives, and Policies; Part II includes Planning, Coordination, and Implementation; and Part III establishes Priority Guidelines. Part II of the State Plan covers its administrative structure and implementation process. An analysis of the Project's applicability to Part I and Part III of the Hawaiʻi State Plan is provided in **Appendix "L-1"**.

The overall theme of the Hawaiʻi State Plan is governed by the following general principles:

1. Individual and family self-sufficiency;
2. Social and economic mobility; and
3. Community or social well-being.

In consonance with the foregoing principles, the Hawaiʻi State Plan identifies three (3) clarifying goals:

1. A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaiʻi's present and future generations.
2. A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.

3. Physical, social, and economic well-being, for individuals and families in Hawai‘i, that nourishes a sense of community responsibility, of caring, and of participation in community life.

This section of the Draft EIS examines the applicability of the Proposed Action as it relates to the objectives, policies, and priority guidelines of the Hawai‘i State Plan, as set forth in HRS §§ 226-5 through 226-27.

A summary of the Project's relationship to the Hawai‘i State Plan, as detailed in **Appendix "L-1"** is provided below. The methodology for the analysis involves examining the Project's applicability to the Hawai‘i State Plan's goals, objectives, and policies. "Applicability" refers to a Project's need, purpose and effects, and how these aspects advance or promote a particular set of goals, objectives and priority guidelines. In assessing the relationship between a Proposed Action and the Hawai‘i State Plan, an action may be categorized in one (1) of the following groups:

1. **Directly applicable:** the action and its potential effects directly advances or promotes the objective, policy or priority guideline.

2. **Indirectly applicable:** the action and its potential effects indirectly advances or promotes the objective, policy or priority guideline.

3. **Not applicable:** the action and its potential effects neither directly nor indirectly advance or promote the objective, policy, or priority guideline.

In general, a Proposed Action's applicability to the objectives, policies and priority guidelines of the Hawai‘i State Plan is judged on the basis of the action's direct or indirect relationship to the respective objectives, policies and priority directions. It is recognized that the categorization of "applicability" is subject to interpretation and should be appropriately considered in the context of local and regional conditions.

The assessment presented in **Table 20** and summarized below focuses on key elements of the Proposed Actions' relationship to the Hawai‘i State Plan. Detailed discussion of the applicability of the Proposed Action to each goal and related objectives, policies, and implementing actions of the Hawai‘i State Plan is provided in **Appendix "L-1"**.

Table 20. Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives, and Policies (HRS § 226-1 to 226-27)

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies **Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable**	**DA**	**IA**	**NA**
HRS § 226-1: Findings and Purpose			
HRS § 226-2: Definitions			
HRS § 226-3: Overall Theme			
HRS § 226-4: State Goals. In order to ensure, for the present and future generations, those elements of choice and mobility that ensure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve: (1) A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaii's present and future generations. (2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people. (3) Physical, social, and economic well-being, for individuals and families in Hawaii, that nourishes a sense of community responsibility, of caring, and of participation in community life.			
HRS § 226-5 Objective and Policies for Population			
Objective:			
(a) It shall be the objective in planning for the State's population to guide population growth to be consistent with the achievement of physical, economic and social objectives contained in this chapter.			✓
HRS § 226-6 Objectives and policies for the economy – – in general			
Objectives:			
(a) Planning for the State's economy in general shall be directed toward achievement of the following objectives:			
(1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawaii's people, while at the same time stimulating the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.		✓	
(2) A steadily growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.			✓
HRS § 226-7 Objectives and policies for the economy – – agriculture.			
Objectives:			
(a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:			
(1) Viability of Hawaii's sugar and pineapple industries.			✓

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(2) Growth and development of diversified agriculture throughout the State.			✓
(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.			✓
HRS § 226-8 Objective and policies for the economy – – visitor industry.			
Objective:			
(a) Planning for the State's economy with regard to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawaii's economy.		✓	
HRS § 226-9 Objective and policies for the economy – – federal expenditures.			
Objective:			
(a) Planning for the State's economy with regard to federal expenditures shall be directed towards achievement of the objective of a stable federal investment base as an integral component of Hawaii's economy.			✓
HRS § 226-10 Objective and policies for the economy – – potential growth and innovative activities.			
Objective:			
(a) Planning for the State's economy with regard to potential growth and innovative activities shall be directed towards achievement of the objective of development and expansion of potential growth and innovative activities that serve to increase and diversify Hawaii's economic base.			✓
HRS § 226-10.5 Objectives and policies for the economy – – information industry.			
Objective:			
(a) Planning for the State's economy with regard to telecommunications and information technology shall be directed toward recognizing that broadband and wireless communication capability and infrastructure are foundations for an innovative economy and positioning Hawaii as a leader in broadband and wireless communications and applications in the Pacific Region.			✓
HRS § 226-11 Objectives and policies for the physical environment – – land based, shoreline, and marine resources.			
Objectives:			
(a) Planning for the State's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of the following objectives:			

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(1) Prudent use of Hawaii's land-based, shoreline, and marine resources.	✓		
(2) Effective protection of Hawaii's unique and fragile environmental resources.	✓		
HRS § 226-12 Objective and policies for the physical environment – – scenic, natural beauty, and historic resources.			
Objective: (a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historical resources.	✓		
HRS § 226-13 Objectives and policies for the physical environment – – land, air, and water quality.			
Objectives:			
(a) Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives.			
(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.	✓		
(2) Greater public awareness and appreciation of Hawaii's environmental resources.	✓		
HRS § 226-14 Objective and policies for facility systems – – in general.			
Objective:			
(a) Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, sustainable development, climate change adaptation, sea level rise adaptation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.			✓
HRS § 226-15 Objectives and policies for facility systems – – solid and liquid waste.			
Objectives:			
(a) Planning for the State's facility systems with regard to solid and liquid wastes shall be directed towards the achievement of the following objectives:			
(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes.			✓
(2) Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility, and other areas.			✓
HRS § 226-16 Objective and policies for facility systems – – water.			
Objective:			
(a) Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.			✓

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
HRS § 226-17 Objectives and policies for facility systems – – transportation.			
Objectives:			
(a) Planning for the State's facility systems with regard to transportation shall be directed towards the achievement of the following objectives:			✓
(1) An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.			✓
(2) A statewide transportation system that is consistent with and will accommodate planned growth objectives throughout the State.			✓
HRS § 226-18 Objectives and policies for facility systems – – energy.			
Objectives:			
(a) Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:			
(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;			✓
(2) Increased energy security and self-sufficiency through the reduction and ultimate elimination of Hawaii's dependence on imported fuels for electrical generation and ground transportation.			✓
(3) Greater diversification of energy generation in the face of threats to Hawaii's energy supplies and systems;			✓
(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use; and			✓
(5) Utility models that make the social and financial interests of Hawaii's utility customers a priority.			✓
HRS § 226-18.5 Objectives and policies for facility systems – – telecommunications.			
Objective:			
(a) Planning for the State's telecommunications facility systems shall be directed towards the achievement of dependable, efficient, and economical statewide telecommunications systems capable of supporting the needs of the people.			✓
HRS § 226-19 Objectives and policies for socio-cultural advancement – – housing.			
Objectives:			
(a) Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:			✓

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
(1) Greater opportunities for Hawaii's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals, through collaboration and cooperation between government and nonprofit and for-profit developers to ensure that more affordable housing is made available to very low-, low- and moderate-income segments of Hawaii's population.			✓
(2) The orderly development of residential areas sensitive to community needs and other land uses.			✓
(3) The development and provision of affordable rental housing by the State to meet the housing needs of Hawaii's people.			✓
HRS § 226-20 Objectives and policies for socio-cultural advancement – – health.			
Objectives:			
(a) Planning for the State's socio-cultural advancement with regard to health shall be directed towards achievement of the following objectives:			
(1) Fulfillment of basic individual health needs of the general public.			✓
(2) Maintenance of sanitary and environmentally healthful conditions in Hawaii's communities.			✓
(3) Elimination of health disparities by identifying and addressing social determinants of health.			✓
HRS § 226-21 Objectives and policies for Socio-cultural advancement – – education.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to education shall be directed towards achievement of the objective of the provision of a variety of educational opportunities to enable individuals to fulfill their needs, responsibilities, and aspirations.			✓
HRS § 226-22 Objective and policies for socio-cultural advancement – – social services.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to social services shall be directed towards the achievement of the objective of improved public and private social services and activities that enable individuals, families, and groups to become more self-reliant and confident to improve their well-being.			✓
HRS § 226-23 Objective and policies for socio-cultural advancement – – leisure.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.	✓		

Hawai'i State Plan, Chapter 226, HRS Part I. Overall Themes, Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
HRS § 226-24 Objective and policies for socio-cultural advancement – – individual rights and personal well-being.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to individual rights and personal well-being shall be directed towards achievement of the objective of increased opportunities and protection of individual rights to enable individuals to fulfill their socio-economic needs and aspirations.			✓
HRS § 226-25 Objective and policies for socio-cultural advancement – – culture.			
Objective:			
(a) Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawaii's people.	✓		
HRS § 226-26 Objectives and policies for socio-cultural advancement – – public safety.			
Objectives:			
(a) Planning for the State's socio-cultural advancement with regard to public safety shall be directed towards the achievement of the following objectives:			
(1) Assurance of public safety and adequate protection of life and property for all people.			✓
(2) Optimum organizational readiness and capability in all phases of emergency management to maintain the strength, resources, and social and economic well-being of the community in the event of civil disruptions, wars, natural disasters, and other major disturbances.			✓
(3) Promotion of a sense of community responsibility for the welfare and safety of Hawaii's people.			✓
HRS § 226-27 Objectives and policies for socio-cultural advancement – – government.			
Objectives:			
(a) Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of the following objectives:			
(1) Efficient, effective, and responsive government services at all levels in the State.			✓
(2) Fiscal integrity, responsibility, and efficiency in the state government and county governments.			✓

The Proposed Action is directly applicable to objectives and policies for the physical environment regarding land-based, shoreline, and marine resources; scenic, natural beauty, and historic resources; and land, air and water quality. The Project is proposed to restore and preserve the beach by resupplying the sediment budget with a natural, native

marine sand resource, and is anticipated to result in beneficial impacts including a greater sandy beach environment, a more resilient coastline, and reduced turbidity in the nearshore marine environment. The Project will be conducted with implementation of BMPs that are aimed at conserving natural resources and minimizing adverse impacts to the physical environment. The Proposed Action would increase the beach width and ensure that it is more resilient so that future coastal hazards and sea level rise do not have the same impact as that which occurred in 2016. Ensuring that large escarpments do not degrade heavily used areas of beach will ensure that beach users are able to safely access and enjoy Honokōwai Beach. Beach restoration is also anticipated to reduce the vulnerability of the backshore to coastal flooding, reduce turbidity in the water, and promote nearshore water quality.

The Proposed Action is directly applicable to objectives and policies for socio-cultural advancement regarding recreation and leisure. The Proposed Action would promote recreational, cultural, and educational potential of Honokōwai Beach by increasing sand volume and beach width. On a wider beach, public users would have more space for recreational and educational activities, ensuring opportunities for everyone to use and enjoy the resource. In addition to supporting policies and objectives for leisure, beach restoration would indirectly support objectives and policies for the economy related to the visitor industry. The provision of a wider and in the case of Beach Stabilization, more stable beach, would indirectly support the visitor industry in the area.

Priority Guidelines

"Priority guidelines" means those guidelines which shall take precedence when addressing areas of statewide concern. This section addresses applicability criteria to the priority guidelines set forth in HRS § 226-103.

Priority guidelines of the Hawai'i State Plan cover the economy, population growth and land resources, crime and criminal justice, affordable housing, quality education, sustainability, and climate change adaptation.

Table 21 below summarizes the relationship between the Proposed Action and the priority guidelines of the Hawai'i State Plan. A more detailed discussion is presented in **Appendix "L-1"**.

Table 21. Hawai'i State Plan, Chapter 226, HRS Part III. Overall Themes, Goals, Objectives, and Policies (HRS § 226-101 to 226-109)

Hawai'i State Plan, Chapter 226, HRS Part III. Priority Guidelines **Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable**	**DA**	**IA**	**N/A**
HRS § 226-101: Purpose. The purpose of this part is to establish overall priority guidelines to address areas of statewide concern.			

Hawai'i State Plan, Chapter 226, HRS Part III. Priority Guidelines Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	N/A
HRS § 226-102: Overall direction. The State shall strive to improve the quality of life for Hawaii's present and future population through the pursuit of desirable courses of action in seven major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, quality education, principles of sustainability, and climate change adaptation.			
HRS § 226-103: Economic priority guidelines.			
(a) Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawaii's people and achieve a stable and diversified economy	✓		
(b) Priority guidelines to promote the economic health and quality of the visitor industry		✓	
(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries			✓
(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture			✓
(e) Priority guidelines for water use and development			✓
(f) Priority guidelines for energy use and development			✓
(g) Priority guidelines to promote the development of the information industry			✓
HRS § 226-104: Population growth and land resources priority guidelines.			
(a) Priority guidelines to effect desired statewide growth and distribution			✓
(b) Priority guidelines for regional growth distribution and land resource utilization			✓
HRS § 226-105: Crime and criminal justice.			
Priority guidelines in the area of crime and criminal justice			✓
HRS § 226-106: Affordable housing.			
Priority guidelines for the provision of affordable housing			✓
HRS § 226-107: Quality education.			
Priority guidelines to promote quality education			✓
HRS § 226-108: Sustainability			
Priority guidelines and principles to promote sustainability	✓		
HRS § 226-109: Climate change adaptation priority guidelines			
Priority guidelines to prepare the State to address the impacts of climate change, including impacts to the areas of agriculture; conservation lands; coastal and nearshore marine areas; natural and cultural resources; education; energy; higher education; health; historic preservation; water resources; the built environment, such as housing, recreation, transportation; and the economy	✓		

The Proposed Action is directly applicable to the State priority guidelines related to sustainability. Honokōwai Beach provides valuable natural resources along with important cultural, recreational, aesthetic, and economic value. While privately funded, the proposed Project would provide a public benefit of sustainably restoring and preserving public resources at Honokōwai Beach for present and future generations.

The Proposed Action indirectly supports the State economic priority guidelines. The Proposed Action represents a large investment to restore environmental quality, nearshore water quality, and natural features that indirectly supports the tourism economy. The Proposed Action promotes a clean tourism industry that has minimal impact on Hawaii's environment. Restoration of Honokōwai Beach is a capital improvement project that enhances both the natural environment and the experiences of residents and visitors.

The Proposed Action responds to the impacts of climate change at Honokōwai Beach. Chronic, seasonal, and episodic erosion are anticipated to continue to affect Honokōwai Beach and the surrounding areas, including impacts to conservation lands, coastal and nearshore marine areas, natural and cultural resources, water resources, the built environment, and the economy. As such, the Proposed Action directly supports the State's priority guidelines for climate change adaptation.

C. STATE FUNCTIONAL PLANS

A key element of the Statewide Planning System is Functional Plans which set forth the policies, statewide guidelines, and priorities within a specific field of activity. There are 13 Functional Plans which have been developed by the State agency primarily responsible for a given functional area. Together with the County General Plans, the State Functional Plans establish more specific strategies for implementation. In particular, State Functional Plans provide for the following:

- Identify major statewide priority concerns;
- Define current strategies for each functional area;
- Identify major relationships among functional areas;
- Provide direction and strategies for departmental policies, programs, and priorities;
- Provide a guide for the allocation of resources; and
- Coordinate State and County roles and responsibilities in the implementation of the Hawai'i State Plan.

Table 22 provides an assessment of the relationship between the Proposed Action and each of the 13 Functional Plans prepared by State agencies.

Table 22. Relationship Between the Proposed Hoʻāla Honokōwai Project and the State Functional Plans

	State Functional Plan	State Coordinating Agency	Purpose	Analysis
1	Agriculture Functional Plan (1991)	Department of Agriculture	Continued viability of agriculture throughout the State.	Not Applicable.
2	Conservation Lands State Functional Plan (1991)	Department of Land and Natural Resources	Addresses issues of population and economic growth and its strain on current natural resources; broadening public use of natural resources while protecting lands and shorelines from overuse; additionally, promotes the aquaculture industry.	By restoring and preserving Honokōwai Beach, the Proposed Action supports the objectives of the Conservation Lands State Function Plan relating to establishment of plans for natural resource management, enhancement of natural resources, and appropriate development of natural resources. The Proposed Action will require approval of a Conservation District Use Permit from the Hawai'i Board of Land and Natural Resources.
3	Education State Functional Plan (1989)	Department of Education	Improvements to Hawaii's educational curriculum, quality of educational staff, and access to adequate facilities.	Not Applicable.
4	Employment State Functional Plan (1990)	Department of Labor and Industrial Relations	Improve the qualifications, productivity, and effectiveness of the State's workforce through better education and training of workers as well as efficient planning of economic development, employment opportunities, and training activities.	The Proposed Action will provide construction employment opportunities in the short term, indirectly supporting the objectives of the Employment State Functional Plan. Beyond construction, beach restoration will allow the KBC property to continue to support local jobs.
5	Energy State Functional Plan (1991)	Department of Business, Economic Development and Tourism	Lessen the reliance on petroleum and other fossil fuels in favor of alternative sources of energy so as to keep up with the State's increasing energy demands while also becoming a more sustainable island state; achieving dependable,	Not Applicable.

	State Functional Plan	State Coordinating Agency	Purpose	Analysis
			efficient, and economical statewide energy systems.	
6	Health State Functional Plan (1989)	Department of Health	Improve health care system by providing for those who don't have access to private health care providers; increasing preventative health measures; addressing 'quality of care' elements in private and public sectors to cut increasing costs.	Not Applicable.
7	Higher Education Functional Plan (1984)	University of Hawai'i	Prepare Hawai'i's citizens for the demands of an increasingly complex world through providing technical and intellectual tools.	Not Applicable.
8	Historic Preservation State Functional Plan (1991)	Department of Land and Natural Resources	Preservation of historic properties, records, artifacts and oral histories; provide public with information/education on the ethnic and cultural heritages and history of Hawai'i.	Coordination with SHPD will be carried out for the Proposed Action and appropriate mitigation measures identified by the SHPD will be implemented. As such, the Proposed Action is in consonance with the Historic Preservation State Functional Plan.
9	Housing State Functional Plan (2017)	Hawai'i Housing Finance and Development Corporation	Based largely on joint public/private efforts to finance, build, and maintain an adequate supply of affordable housing. It will be a working tool to guide the State, the counties, as well as the private sector in meeting the overall goal that every Hawai'i resident will have the opportunity to live in a safe, decent and affordable home.	Not Applicable.
10	Human Services State Functional Plan (1989)	Department of Human Services	Refining support systems for families and individuals by improving elderly care, increasing preventative measures to combat child/spousal	Not Applicable.

	State Functional Plan	State Coordinating Agency	Purpose	Analysis
			abuse and neglect; providing means for 'self-sufficiency'.	
11	Recreation State Functional Plan (1991)	Department of Land and Natural Resources	Manage the use of recreational resources via addressing issues: (1) ocean and shoreline recreation, (2) mauka, urban, and other recreation opportunities, (3) public access to shoreline and upland recreation areas, (4) resource conservation and management, (5) management of recreation programs/facilities/areas, and (6) wetlands protection and management.	The Proposed Action supports the objectives of the Recreation State Functional Plan by preserving Honokōwai Beach for recreational use and preserving the coastal walkway to maintain ADA compliant shoreline access.
12	Tourism State Functional Plan (1991)	Department of Business, Economic Development and Tourism	Balance tourism/economic growth with environmental and community concerns; development that is cognizant of the limited land and water resources of the islands; maintaining friendly relations between tourists and community members; development of a productive workforce and enhancement of career and employment opportunities in the visitor industry.	The Proposed Action indirectly supports the objectives and policies of the Tourism State Functional Plan. Maintaining a wider and in the case of Beach Stabilization, more stable sandy beach would enhance both resident and visitor experiences at Honokōwai Beach.
13	Transportation State Functional Plan (1991)	Department of Transportation	Development of a safer, more efficient transportation system that also is consistent with planned physical and economic growth of the state; construction of facility and infrastructure improvements; develop a transportation system balanced with new alternatives; pursue land use initiatives which help reduce travel demand.	Not Applicable.

D. STATE LAND USE DISTRICTS

Pursuant to Chapter 205A, Hawai'i Revised Statutes (HRS), all lands in the State have been designated into one (1) of four (4) land use districts by the State Land Use Commission. These land use designations are "Urban", "Rural", "Agricultural", and "Conservation". Conservation District lands are further broken down into four (4) primary subzones that dictate what types of activities can and cannot take place. These subzones, from most restrictive to least restrictive, are (1) Protective, (2) Limited, (3) Resource, and (4) General. The Conservation District also has a Special subzone which is unique for each location it is applied to. With the exception of the lands seaward of the shoreline, the Project Site is designated "Urban" by the State Land Use Commission. See **Figure 31** (State Land Use Classification).

Coastal Lands, which include beaches, dunes, and rocky shorelines that are seaward of County jurisdictions, are part of the Conservation District. The coastal lands in the Project Site are located in the Conservation District, Resource Subzone. Pursuant to Hawai'i Administrative Rules (HAR) § 13-5-13, lands and State marine waters seaward of the shoreline to the extent of the State's jurisdiction fall within the State Conservation District, Resource Subzone.

The OCCL is responsible for the management of coastal resources. The Hawai'i Board of Land and Natural Resources (BLNR) regulates use of State Conservation District lands by issuing Conservation District Use Permits (CDUP) for approved activities. Statutes governing the Conservation District are written in Chapter 183C, HRS (Conservation District) and further clarified in, Title 13, Chapter 5, HAR (Conservation District).

The Conservation District Rules identify allowed uses in the various Conservation District subzones and the types of permits required (HAR § 13-5-22). The Proposed Action would be consistent with the following identified use, which would require a CDUP from the BLNR[19].

> *P-16 Beach Restoration*
>
> *(D-1) Sand placement in excess of 10,000 cy including structures necessary to retain sand, extraction of sand from submerged lands, and transportation or transmission of sand from an offshore extraction site to the replenishment site.*

[19] The Proposed Action may also be consistent with P-15, Shoreline Erosion Control, which also requires a CDUP from the BLNR. While the Proposed Action is primarily a beach restoration action, the Beach Stabilization methodology would include the construction of stabilizing groins, as allowed under beach restoration.

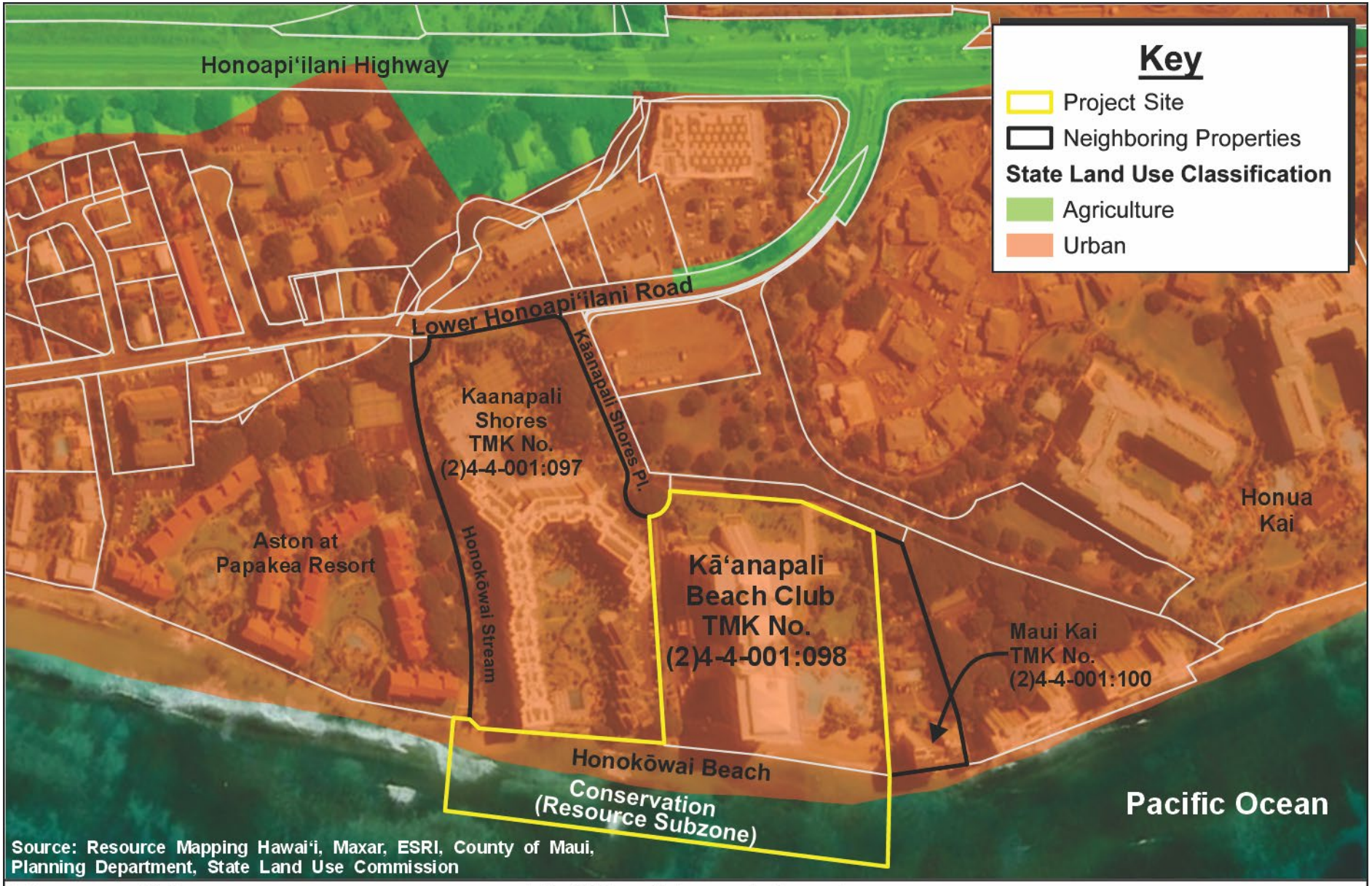


Figure 31

Ho‘āla Honokōwai
State Land Use Classification

0 175 350
Feet

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\SLUC

The OCCL evaluation criteria for actions within the Conservation District are outlined in HAR § 13-5-30. Each criterion is listed below, followed by a discussion of the Proposed Action compliance.

1. Conservation District Purpose

(1) The proposed land use is consistent with the purpose of the Conservation District.

Discussion:

The purpose of the Conservation District is "*…to regulate land-use in the conservation district for the purpose of conserving, protecting, and preserving the important natural and cultural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety, and welfare*". (HAR § 13-5-1). The Proposed Action is anticipated to restore, enhance, and preserve Honokōwai Beach, which is an important and valuable public trust resource. The Proposed Action is a mid-term solution to prepare for the long-term sustainability of Honokōwai Beach, while also not materially impacting public health, safety, and welfare. Beach restoration is anticipated to create a safer beach and nearshore environment by stabilizing the shoreline and improving nearshore water quality. The Proposed Action is anticipated to restore the public beach, improve recreational resources, improve lateral shoreline access, and increase resilience to coastal hazards and sea level rise. These objectives are consistent with the purpose of the State of Hawai'i Conservation District.

2. Subzone Objectives

(2) The Proposed Actions are consistent with the objectives of the subzone of the land on which the use will occur.

Discussion:

As discussed above, the Proposed Action is an identified land use within the Resource subzone of the Conservation District. The objective of the Resource (R) subzone is *"…to ensure, with proper management, the sustainable use of the natural resources of those areas."* (HAR § 13-5-13). The Proposed Action will provide for long-term adaptation planning and sustainability of natural resources at Honokōwai Beach.

The Proposed Action is anticipated to restore the public beach, improve recreational resources, improve lateral shoreline access, and increase resilience to coastal hazards and sea level rise. This is consistent with the purpose of the Resource (R) subzone.

3. Coastal Zone Management

(3) The proposed actions comply with provisions and guidelines contained in Chapter 205A, HRS, entitled "Coastal Zone Management," where applicable;

Discussion:

Detailed discussion of the Proposed Action and their relationship to the Hawai'i Coastal Zone Management Program is presented in Section IV.I. of this Draft EIS.

4. Natural Resources

(4) The proposed actions will not cause substantial adverse impact to existing natural resources within the surrounding area, community, or region;

Discussion:

Preserving and restoring the sandy Honokōwai Beach will contribute to the preservation and continuation of an important and valuable public trust resource. This Draft EIS has presented an analysis of the Proposed Action's impacts to natural resources and appropriate mitigation measures have been developed for implementation with the Project. While there are anticipated to be temporary construction-related impacts to the marine, nearshore, and terrestrial environments, over the long-term there are benefits to natural resource communities that would be realized when compared to a No Action alternative.

5. Coastal Zone Management

(5) The proposed actions, 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 Action will restore an existing public beach and is intended to preserve an important and valuable public trust resource along the coastline. The proposed beach restoration will use offshore sand that is compatible with the existing physical conditions of Honokōwai Beach. For the Beach Stabilization alternative, the proposed groins would be designed in a way to complement the existing aesthetic of Honokōwai Beach and the surrounding area, which consists of armored shoreline to the north and south of the KBC property. In addition, the stabilized beach and groins will help protect the land inland of the shoreline which fronts public infrastructure and developed urban uses. While surrounding land uses may experience construction-related impacts, these impacts will be

temporary and BMPs will be implemented to mitigate impacts in accordance with the BMP Plan.

6. Physical and Environmental Aspects

(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:

Construction equipment, material staging areas, and construction activities will be present within the Project Site during construction. Additionally, the dredging equipment at the Sand Recovery Site will be visible from the shoreline. These impacts are temporary and will not be present once construction is completed.

The Proposed Action is intended to increase the recreational dry beach area and improve lateral and perpendicular shoreline access. The color of sand from the offshore sand deposits may be slightly grayer than the existing beach sand; however, after a season of mixing and fading in the sun, the color difference is anticipated to be negligible. Specific to Beach Stabilization, the proposed groins would make the beach less vulnerable to chronic, seasonal, and episodic erosion, and more resilient to storms, high surf events, and sea level rise. While Beach Stabilization would change the landscape of the Project Site, the visual impacts will be balanced by the benefits associated with stabilizing the only sandy beach in the area. The proposed beach restoration supports the stability and sustainability of Honokōwai Beach as a public trust resource along this section of the coast.

7. Land Subdivision

(7) Subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District;

Discussion:

The Proposed Action does not include the subdivision of land.

8. Public Health, Safety, and Welfare

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

Discussion:

Beaches and shorelines are inherently dangerous, especially in Hawai‘i. Strong waves and currents occur throughout the year and can cause injuries or death. There are no lifeguard towers at the Project Site. The County of Maui, Department of Fire & Public Safety operates lifeguard towers at Hanakaō‘ō Beach Park and DT Fleming Beach Park in West Maui. The Proposed Action is not expected to have significant negative impacts on beach safety or ocean safety. In the case of Beach Stabilization, groin cells are anticipated to reduce the ocean current and create safer environmental conditions within each cell. The existing conditions at Honokōwai Beach consist of dangerous longshore currents and rip currents that can impact recreational ocean users. The groins proposed under the Beach Stabilization alternative would interrupt these currents and improve nearshore water quality, creating a safer nearshore environment.

Heavy equipment including barges, dump trucks, excavators, and boats could pose a hazard to the public during construction. With the implementation of proper BMPs and other reasonable precautions, notices, markings, and community outreach, no changes to public health hazards in marine waters or along the shoreline are anticipated as a result of the Proposed Action. This equipment would be removed once construction is complete.

The Proposed Action would have some temporary impacts on air, noise, and water quality during construction; however, these impacts would be mitigated to the maximum extent practicable using BMPs and monitoring protocols. All necessary permits would be obtained, and regulations complied with. The Proposed Action is not anticipated to result in any post-construction or adverse long-term impacts on public health, safety, or welfare.

E. HAWAI‘I SUSTAINABILITY PLAN 2050

The Hawai‘i 2050 Sustainability Plan is intended to serve as the State’s climate and sustainability strategic action plan pursuant to HRS § 226-65. The Hawai‘i 2050 Sustainability Plan was developed using public engagement consistent with a community-driven approach in addition to collaboration with state and county stakeholder agencies.

The analysis to follow focuses on what the Plan describes as the Decade of Action. The Decade of Action is defined as 2020-2030, a timeframe in which the United Nations declared to accelerate sustainable solutions for the biggest climate challenges. This analysis looks at eight (8) Recommended Actions which contain 38 strategies intended to guide Hawai‘i to a more sustainable future. **Table 23** outlines the ways in which the Project meets the Recommended Actions outlined by the Plan.

Table 23. Hawai'i 2050 Sustainability Plan (HRS § 226-65)

Hawai'i 2050 Sustainability Plan (HRS § 226-65) DA = Directly Applicable, IA = Indirectly Applicable, N/A = Not Applicable	DA	IA	N/A
1. Promote a Sustainable Economic Recovery			
Strategy 1: Support farmer livelihoods			✓
Strategy 2: Support local markets for locally grown food			✓
Strategy 3: Promote sustainable & resilient farmland, practices, and infrastructure			✓
Strategy 4: Invest in green workforce development beginning with youth.			✓
Strategy 5: Foster the development of jobs that can sustain families financially.			✓
Strategy 6: Support diversification of the economy.			✓
Strategy 7: Reduce the environmental footprint of the tourism industry.			✓
Strategy 8: Support native Hawaiian culture and reduce impacts of the tourism industry to local communities.			✓
Analysis: Not Applicable.			
2. Reduce Greenhouse Gas Emissions			
Strategy 9: Measure, manage, and plan for GHG emission reduction.			✓
Strategy 10: Incorporate climate change planning into decision-making processes.	✓		
Strategy 11: Promote energy conservation and efficiency through outreach, communication, and community and public engagement.			✓
Strategy 12: Continue to invest in the deployment of clean energy technologies to reduce reliance on fossil fuels.			✓
Strategy 13: Expand the adoption of zero emission vehicles.			✓
Strategy 14: Promote alternative modes of transportation.			✓
Strategy 15: Reduce the generation of waste, including plastic waste.			✓
Strategy 16: Increase diversion of waste through recycling, reuse, and composting.			✓
***Analysis*:** The proposed Project is a response to human-induced climate change and is intended to provide greater resiliency at Honokōwai Beach.			
3. Improve Climate Resilience			
Strategy 17: Integrate climate change adaptation and resilience considerations into planning and implementation.	✓		
Strategy 18: Assess and communicate the impacts of climate change to residents, businesses, and communities most likely to be impacted.	✓		
Strategy 19: Implement actions that improve the state's resilience to climate change.	✓		
Strategy 20: Increase the resilience of vulnerable populations to the impacts of climate change and other shocks and stressors.	✓		

Hawai‘i 2050 Sustainability Plan (HRS § 226-65) DA = Directly Applicable, IA = Indirectly Applicable, N/A = Not Applicable	DA	IA	N/A
Analysis: The objective of this proposed Project is to restore and stabilize Honokōwai Beach, ultimately bolstering resiliency to climate change. A wider and in the case of Beach Stabilization, more stable beach would increase the resiliency of the shoreline to erosional forces and storm events, while preserving cultural and public access. The EIS and entitlement process for the Project communicates the potential impacts of sea level rise related to climate change to community.			
4. Advance Sustainable Communities			
Strategy 21: Advance smart growth initiatives and multimodal transportation systems.			✓
Strategy 22: Advance sustainability in school and university operations			✓
Strategy 23: Integrate sustainable design principles into new and existing buildings.			✓
Analysis: Not Applicable.			
5. Advance Equity			
Strategy 24: Strengthen broadband access to support digital learning and online solutions in rural areas.			✓
Strategy 25: Continue to improve economic and social sustainability of individuals through access to affordable housing.			✓
Strategy 26: Continue to implement strategies that reduce homelessness in Hawai‘i to enhance livelihoods.			✓
Strategy 27: Continue to advance opportunities for all, regardless of gender.			✓
Analysis: Not Applicable.			
6. Institutionalize Sustainability Throughout Government			
Strategy 28: Invest in staff and other resources to coordinate and advance sustainability goals across state agencies and local governments.			✓
Strategy 29: Update state policies to reflect sustainability and climate change priorities.			✓
Strategy 30: Incorporate sustainability into government operations.			✓
Analysis: Not Applicable.			
7. Preserve the Natural Environment			
Strategy 31: Improve water quality through reduced pollution and dumping.	✓		
Strategy 32: Support water reuse strategies to conserve water.			✓
Strategy 33: Establish policies to protect Hawai‘i’s unique marine ecosystems.			✓
Strategy 34: Manage climate change impacts to marine resources.	✓		
Strategy 35: Protect and manage watersheds.			✓
Strategy 36: Continue to adopt strategies that protect land-based natural resources.	✓		
Strategy 37: Conserve working forest landscapes, protect forests from harm, and enhance public benefits from trees and forests.			✓

Hawai'i 2050 Sustainability Plan (HRS § 226-65) DA = Directly Applicable, IA = Indirectly Applicable, N/A = Not Applicable	DA	IA	N/A
Discussion: Beach restoration will prevent beach and backshore erosion that may have negative impacts of deteriorating water quality, habitat loss, and elevated turbidity levels. The Project would protect land based resources such as the beach and backshore from sea level rise and coastal erosion.			
8. Perpetuate Traditional Ecological Knowledge and Values			
Strategy 38: Ground climate and sustainability strategies in our cultural foundation.			✓
Analysis: Not Applicable.			

F. GENERAL PLAN OF THE COUNTY OF MAUI

As indicated by Section 8-8.5 of the Maui County Charter, the purpose of the general plan shall be to:

> *... indicate desired population and physical development patterns for each island and region within the county; shall address the unique problems and needs of each island and region; shall explain opportunities and the social, economic, and environmental consequences related to potential developments; and shall set forth the desired sequence, patterns and characteristics of future developments. The general plan shall identify objectives to be achieved, and priorities, policies, and implementing actions to be pursued with respect to population density, land use maps, land use regulations, transportation systems, public and community facility locations, water and sewage systems, visitor destinations, urban design, and other matters related to development.*

Chapter 2.80B, Maui County Code (MCC), relating to the General Plan and Community Plans, implements the foregoing Charter provision through enabling legislation which calls for a Countywide Policy Plan and a Maui Island Plan (MIP).

1. Countywide Policy Plan

The Countywide Policy Plan was adopted in March 2010 and is a comprehensive policy document for the islands of Maui County through the year 2030. The plan provides the policy framework for the development of the MIP as well as for the nine (9) detailed Community Plans. The Countywide Policy Plan provides broad goals, objectives, policies, and implementing actions that portray the desired direction of the County's future. Goals are intended to describe a desirable condition of the County by the year 2030 and are intentionally general. Objectives tend to be more specific and may be regarded as milestones for achieving the larger goals. Policies are not intended as regulations, but instead provide general guidelines for County decision makers, departments, and collaborating

organizations toward the attainment of goals and objectives. Implementing actions are specific tasks, procedures, programs, or techniques that carry out policy.

Table 24 below summarizes the relationship between the Proposed Action and the 11 goals of the Countywide Policy Plan. The relationship between the action and the goals are categorized as directly applicable, indirectly applicable, or not applicable.

In general, a Proposed Action's applicability to the goals, objectives, policies and implementing actions of the Countywide Policy Plan is judged on the basis of the action's direct or indirect relationship to the respective objectives, policies, and priority directions. It is recognized that the categorization of "applicability" is subject to interpretation and should be appropriately considered in the context of local and regional conditions. The analysis presented in **Table 24** and summarized below focuses on key elements of the Proposed Action's relationship to the Countywide Policy Plan. Detailed discussion on the applicability of the Proposed Action to each goal and related objectives, policies, and implementing actions of the Countywide Policy Plan is provided in **Appendix "L-2"**.

Table 24. Countywide Policy Plan

COUNTYWIDE POLICY PLAN (Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable)	DA	IA	NA
A. PROTECT THE NATURAL ENVIRONMENT			
Goal: Maui County's natural environment and distinctive open spaces will be preserved, managed, and cared for in perpetuity.	✓		
B. PRESERVE LOCAL CULTURES AND TRADITIONS			
Goal: Maui County will foster a spirit of pono and protect, perpetuate, and reinvigorate its residents" multi-cultural values and traditions to ensure that current and future generations will enjoy the benefits of their rich island heritage.	✓		
C. IMPROVE EDUCATION			
Goal: Residents will have access to lifelong formal and informal educational options enabling them to realize their ambitions.			✓
D. STRENGTHEN SOCIAL AND HEALTHCARE SERVICES			
Goal: Health and social services in Maui County will fully and comprehensively serve all segments of the population.			✓
E. EXPAND HOUSING OPPORTUNITIES FOR RESIDENTS			
Goal: Quality, island-appropriate housing will be available to all residents.			✓
F. STRENGTHEN THE LOCAL ECONOMY			
Goal: Maui County's economy will be diverse, sustainable, and supportive of community values.		✓	

COUNTYWIDE POLICY PLAN (Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable)		DA	IA	NA
G. IMPROVE PARKS AND PUBLIC FACILITIES				
Goal:	A full range of island-appropriate public facilities and recreational opportunities will be provided to improve the quality of life for residents and visitors.	✓		
H. DIVERSIFY TRANSPORTATION OPTIONS				
Goal:	Maui County will have an efficient, economical, and environmentally sensitive means of moving people and goods.			✓
I. IMPROVE PHYSICAL INFRASTRUCTURE				
Goal:	Maui County's physical infrastructure will be maintained in optimum condition and will provide for and effectively serve the needs of the County through clean and sustainable technologies.			✓
J. PROMOTE SUSTAINABLE LAND USE AND GROWTH MANAGEMENT				
Goal:	Community character, lifestyles, economies, and natural assets will be preserved by managing growth and using land in a sustainable manner.	✓		
K. STRIVE FOR GOOD GOVERNANCE				
Goal:	Government services will be transparent, effective, efficient, and responsive to the needs of residents.			✓
L. MITIGATE CLIMATE CHANGE AND WORK TOWARD RESILIENCE				
Goal:	Minimize the causes and negative effects of climate change.	✓		

The Proposed Action is directly applicable to the objectives and policies that aim to protect the natural environment, promote sustainable land use and growth management, and minimize the negative effects of climate change. The Proposed Action will protect and restore Honokōwai Beach as a significant natural, scenic, cultural, recreational, and economic resource. The Proposed Action will increase resilience to coastal hazards and sea level rise and enable planning for long-term adaptation to sea level rise. In addition, the Proposed Action is directly applicable to the goal, objectives, and policies that aim to improve parks and public facilities. Restoration and protection of Honokōwai Beach will continue to provide public shoreline lateral and perpendicular access to an important cultural and recreational resource. Access to shoreline resources will expand options for recreational outdoor activities that promote physical fitness.

The Proposed Action is directly applicable to the objectives and policies that aim to preserve local cultures and traditions. Restoration and protection of Honokōwai Beach will maintain lateral and perpendicular shoreline access for cultural, commercial and recreational purposes. An archaeological LRFI and CIA were prepared for the Proposed Action to assess potential impacts to traditional Hawaiian cultural practices and resources. Recommendations identified by those studies and by the SHPD through the Chapter 6E, HRS historic review process will

be implemented. The restoration of the beach will maintain perpendicular shoreline access which promotes the use of ahupua‘a management practices connecting the upland resources with shoreline access and resource use.

The Proposed Action indirectly supports the goal, objectives, and policies that aim to strengthen the local economy. Restoration and preservation of Honokōwai Beach will indirectly support many upland commercial activities and businesses that rely on visitor attraction to the West Maui area and mitigate the economic impacts of No Action.

2. <u>Maui Island Plan</u>

The MIP is applicable to the island of Maui only, providing more specific policy-based strategies for population, land use, transportation, public and community facilities, water and wastewater systems, visitor destinations, urban design, and other matters related to future growth.

As provided by Chapter 2.80B, MCC, the MIP shall include the following components:

1. *An island-wide land use strategy, including a managed and directed growth plan;*
2. *A water element assessing supply, demand and quality parameters;*
3. *A nearshore ecosystem element assessing nearshore waters and requirements for preservation and restoration;*
4. *An implementation program which addresses the County's 20-year capital improvement requirements, financial program for implementation, and action implementation schedule; and*
5. *Milestone indicators designed to measure implementation progress of the MIP.*

The MIP addresses a number of planning categories with detailed policy analysis and recommendations framed in terms of goals, objectives, policies, and implementing actions. These planning categories address the following areas:

1. *Population;*
2. *Heritage Resources;*
3. *Natural Hazards;*
4. *Economic Development;*

5. *Housing;*

6. *Infrastructure and Public Facilities; and*

7. *Land Use.*

Additionally, an essential element of the MIP is its directed growth plan which provides a management framework for future growth in a manner that is fiscally, environmentally, and culturally prudent. Among the directed growth management tools developed through the MIP process are maps delineating urban growth boundaries, small town boundaries, and rural growth boundaries. The growth boundaries identify areas appropriate for future growth and their corresponding intent with respect to development character. The Project Site is located within the MIP's Urban Growth Boundary and is consistent with the character of the surrounding urban environment. See **Figure 32** (Maui Island Plan).

Table 25 below summarizes the relationship between the Proposed Action and the goals of the MIP. The relationship between the action and the goals are categorized as directly applicable, indirectly applicable, or not applicable.

In general, a Proposed Action's applicability to the MIP is judged on the basis of the action's direct or indirect relationship to the respective objectives, policies and priority directions. It is recognized that the categorization of "applicability" is subject to interpretation and should be appropriately considered in the context of local and regional conditions. The analysis presented in and summarized below focuses on key elements of the Proposed Action's relationship to the MIP. Detailed discussion on the applicability of the Proposed Action to each goal and related objectives, policies, and implementing actions of the MIP is provided in **Appendix "L-3"**.



Figure 32

Ho‘āla Honokōwai
Maui Island Plan

0 175 350
Feet

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\MIP

Table 25. Maui Island Plan Goals, Objectives, and Policies

Maui Island Plan Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
CHAPTER 1 – POPULATION			
1.1 Maui's people, values, and lifestyles thrive through strong, healthy, and vibrant island communities.			✓
CHAPTER 2 – HERITAGE RESOURCES			
CULTURAL, HISTORICAL, AND ARCHAEOLOGICAL RESOURCES ISSUES			
2.1 Our community respects and protects archaeological and cultural resources while perpetuating diverse cultural identities and traditions.	✓		
SHORELINE, REEFS, AND NEARSHORE WATERS			
2.2 An intact, ecologically functional system of reef, shoreline, and nearshore waters that are protected in perpetuity.	✓		
WATERSHEDS, STREAMS, AND WETLANDS ISSUES			
2.3 Healthy watersheds, streams, and riparian environments.	✓		
WILDLIFE AND NATURAL AREAS			
2.4 Maui's natural areas and indigenous flora and fauna will be protected.	✓		
SCENIC RESOURCES			
2.5 Maui will continue to be a beautiful island steeped in coastal, mountain, open space, and historically significant views that are preserved to enrich the residents' quality of life, attract visitors, provide a connection to the past, and promote a sense of place.	✓		
CHAPTER 3 – NATURAL HAZARDS			
3.1 Maui will be disaster resilient.	✓		
CHAPTER 4 – ECONOMIC DEVELOPMENT			
ECONOMIC DIVERSIFICATION			
4.1 Maui will have a balanced economy composed of a variety of industries that offer employment opportunities and well-paying jobs and a business environment that is sensitive to resident needs and the island's unique natural and cultural resources.			✓
TOURISM			
4.2 A healthy visitor industry that provides economic well-being with stable and diverse employment opportunities.		✓	
AGRICULTURE			
4.3 Maui will have a diversified agricultural industry contributing to greater economic, food, and energy security and prosperity.			✓

Maui Island Plan Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
EMERGING SECTORS			
4.4 A diverse array of emerging economic sectors.			✓
SMALL BUSINESS DEVELOPMENT			
4.5 Small businesses will play a key role in Maui's economy.		✓	
HEALTH CARE SECTOR			
4.6 Maui will have a health care industry and options that broaden career opportunities that are reliable, efficient, and provide social well-being.			✓
EDUCATION AND WORKFORCE DEVELOPMENT			
4.7 Maui will have effective education and workforce development programs and initiatives that are aligned with economic development goals.			✓
CHAPTER 5 – HOUSING			
5.1 Maui will have safe, decent, appropriate, and affordable housing for all residents developed in a way that contributes to strong neighborhoods and a thriving island community.			✓
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES			
SOLID WASTE			
6.1 Maui will have implemented the ISWMP thereby diverting waste from its landfills, extending their capacities.			✓
WASTEWATER			
6.2 Maui will have wastewater systems that comply with or exceed State and Federal regulations; meet levels-of-service needs; provide adequate capacity to accommodate projected demand; ensure efficient, effective, and environmentally sensitive operation; and maximize wastewater reuse where feasible.			✓
WATER			
6.3 Maui will have an environmentally sustainable, reliable, safe, and efficient water system.			✓
TRANSPORTATION			
6.4 An interconnected, efficient, and well-maintained, multimodal transportation system.			✓
TRANSIT			
6.5 An island-wide transit system that addresses the needs of residents and visitors and contributes to healthy and livable communities.			✓

Maui Island Plan Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
PARKS			
6.6 Maui will have a diverse range of active and passive recreational parks, wilderness areas, and other natural-resource areas linked, where feasible, by a network of greenways, bikeways, pathways, and roads that are accessible to all.	✓		
PUBLIC FACILITIES			
6.7 Maui will have adequate public facilities that meet the diverse needs of residents.			✓
SCHOOLS AND LIBRARIES			
6.8 Maui will have school and library facilities that meet residents' needs and goals.			✓
HEALTH CARE			
6.9 All of Maui residents will have the best possible health care to include healthy living, disease prevention, as well as acute and long-term care.			✓
ENERGY			
6.10 Maui will meet its energy needs through local sources of clean, renewable energy, and through conservation.			✓
HARBORS AND AIRPORT			
6.11 Maui will have harbors and airports that will efficiently, dependably, and safely facilitate the movement of passengers and cargo.			✓
CHAPTER 7 – LAND USE			
AGRICULTURAL LANDS			
7.1 Maui will have a prosperous agricultural industry and will protect agricultural lands.			✓
RURAL AREAS			
7.2 Maui will have a rural landscape and lifestyle where natural systems, cultural resources and farm lands are protected and development enhances and compliments the viability and character of rural communities.			✓
URBAN AREAS			
7.3 Maui will have livable human-scale urban communities, an efficient and sustainable land use pattern, and sufficient housing and services for Maui residents.	✓		

Maui Island Plan Goals, Objectives and Policies Key: DA = Directly Applicable, IA = Indirectly Applicable, NA = Not Applicable	DA	IA	NA
CHAPTER 8 – DIRECTED GROWTH PLAN			
URBAN AND SMALL TOWN GROWTH AREA			
8.1 Maui will have well-serviced, complete, and vibrant urban communities and traditional small towns through sound planning and clearly defined development expectations.	✓		
RURAL GROWTH AREA			
8.2 Maui will maintain opportunities for agriculture and rural communities through sound planning and clearly defined development expectations.			✓

The Proposed Action is directly applicable to the MIP goals, objectives, and policies related to Heritage Resources, Natural Hazards, Land Use, and Directed Growth. The Project aims to restore and preserve Honokōwai Beach for present and future generations, increase resilience to coastal hazards and sea level rise, protect the shoreline from erosion, and help protect and preserve nearshore water quality. The Proposed Action is compatible with the character of the surrounding area and land uses. The Proposed Action will comply with Chapter 6E, HRS historic preservation requirements, and will preserve cultural access to the shoreline and coastal resources.

The Proposed Action is indirectly applicable to the MIP goals, objectives, and policies related to Economic Development, inasmuch as the restoration and preservation of Honokōwai Beach will support commercial activities and businesses that rely on local tourism.

G. WEST MAUI COMMUNITY PLAN

The Project Site is located within the West Maui Community Plan area which extends from the east edge of the Ukumehame Ahupua‘a to just past the Nākālele blow hole on the edge of the east border of the Honokōnau Ahupua‘a. The West Maui Community Plan, updated in 2022, is one (1) of nine (9) community plans for the County of Maui. The community plans detail desired land use patterns and goals, objectives, policies, and implementing actions for various functional areas. The land underlying the KBC Property is designated RH (Resort/Hotel) by the West Maui Community Plan. The remaining portion of the Project Site seaward of the shoreline is not within the West Maui Community Plan area. See **Figure 33** (West Maui Community Plan).

The updated West Maui Community Plan sets forth a goal for responsible stewardship of resources, culture, and character, with specific policy language regarding the prohibition of the construction of vertical seawalls and revetments, except as may be permitted by

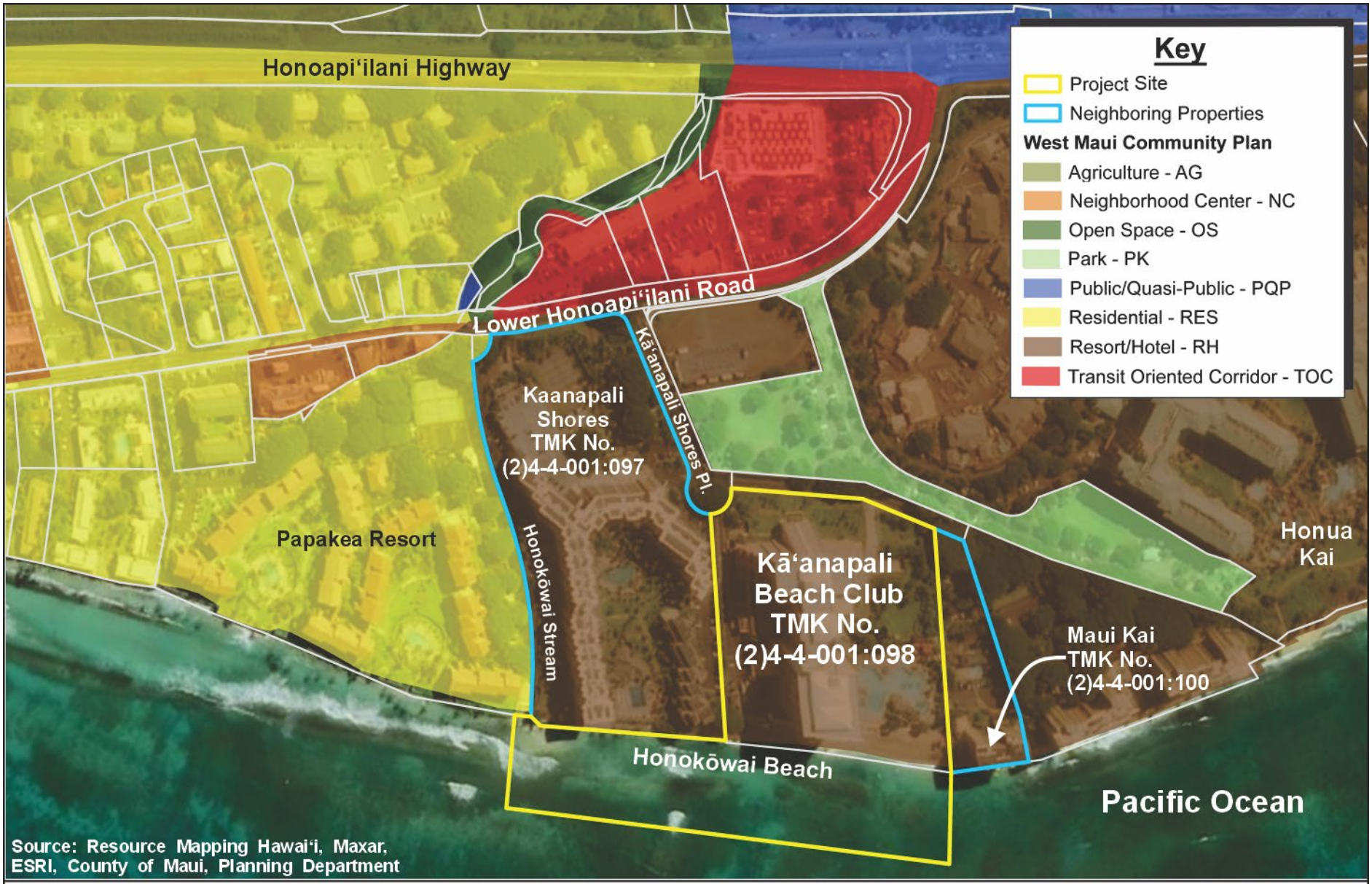


Figure 33

Ho‘āla Honokōwai
West Maui Community Plan

0 175 350
Feet

Prepared for: West Maui Resort Partners, L.P.

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rules adopted by the Maui Planning Commission regarding the SMA and Shoreline areas. Although the Proposed Action is primarily outside of the area encompassed by the West Maui Community Plan, it supports the goals of the West Maui Community Plan by addressing an erosion problem with beach restoration using natural marine sand and construction of groins (in the case of the Beach Stabilization alternative) instead of vertical seawalls and revetments. Further, the Proposed Action is consistent with the following goals and policies of the West Maui Community Plan.

Goal: Ready and Resilient Systems

Policies: Climate Change and Sea Level Rise

Policy 2.1.2: In order to minimize impacts from future coastal erosion, new permanent structures shall be located landward of the Erosion Hazard Line for 3.2 feet of sea level rise except a minimum buildable area shall be provided to allow for reasonable development. This restriction does not apply to structures needed as part of an approved beach restoration project or cultural project, such as loko i'a, and which must be evaluated on a case-by-case basis.

Policy 2.1.3: For redevelopment and new developments within the State-recognized Sea Level Rise Exposure Area, developers shall proactively a) coordinate with the Maui County Planning Department and adjacent or near-by property owners to understand possible collective relocation of at-risk structures, and b) incorporate results of coordination into development plans by siting any new planned structures out of harm's way. c. Make efforts to not hold the County of Maui and State of Hawai'i liable for any and all future costs associated with maintaining or protecting the property developed within the SLR-XA, including costs associated with retreat, hazard mitigation, and cleanup costs to maintain the health of the nearshore marine environment from material debris originating from the ocean or from the structures' own erosion; and d. Make efforts to waive the ability to ever request shoreline hardening for their property or project from the County of Maui or the State of Hawai'i.

Policy 2.1.4: Prioritize projects that provide multiple benefits from resilience actions.

Policy 2.1.5: Protect the shoreline and beaches by preserving waterfront land within the Sea Level Rise Exposure Area as open space wherever possible.

Actions:

Action 1.04: Work with affected property owners to create and implement beach management plans for beach cells in West Maui and conduct any necessary environmental assessments.

Action 1.09: Evaluate shoreline access locations to be impacted by sea level rise, identify solutions to preserve shoreline access.

Discussion:

Collectively, these policies and action items intend to create a more resilient shoreline that protects land and coastal resources. The policies outline the need for beaches to be resilient, keeping people and structures out of harm's way. The Proposed Action will support several policies as outlined in the West Maui Community Plan. As noted in the West Maui Community Plan Policy 2.1.2, "*This restriction does not apply to structures needed as part of an approved beach restoration project*." This acknowledgement shows that there may be a need for stabilizing structures (e.g., groins) and when appropriate, is an allowable action. Beach Stabilization will stabilize the shoreline by offering natural wave energy dissipation through the restoration of a coastal resource with the assistance of groins, ensuring that the beach is resilient and stable, and existing structures and infrastructure are maintained. The Proposed Action is anticipated to protect the reef from sedimentation while also protecting land inland of the Project Site from coastal erosion.

The Proposed Action will help to improve an area of development and an important natural resource from coastal hazards. The Proposed Action will maintain ADA compliant lateral beach access and perpendicular beach access for residents and visitors of West Maui, as well as providing beach users with a large sandy area in which to recreate and preserving access to the nearshore and offshore waters.

Responsible Stewardship of Resources, Culture and Character

Policies:

> *Policy 2.3.3: Protect ocean and stream water quality by requiring that wetlands, as defined by Section 404 of the Clean Water Act, be preserved with vegetated buffer areas that are adequate to protect them from pollutants.*
>
> *Policy 2.3.4: All development must implement recommendations of the Maui County Planting Plan for street and parking area trees, encouraging the use of native and endemic plants. Plants that are on the Hawai'i Pacific Weed Risk Assessment list must not be used.*
>
> *Policy 2.3.13: The marine and near-shore environment and open space areas are important assets of the region and should be protected and preserved. Habitat connectivity for threatened and endangered species, watersheds, undeveloped shoreline areas and other environmentally sensitive lands shall be preserved.*
>
> *Policy 2.3.15: Prohibit the construction of seawalls and revetments except as may be permitted by rules adopted by the Maui Planning Commission governing the Special Management Area and Shoreline Area and encourage beach nourishment through dune restoration.*

Policy 2.3.16: All development projects shall engage in consultation with the ʻAha Moku ʻo Maui representative associated with the project area – either Moku ʻo Lahaina or Moku ʻo Kāʻanapali – and provide evidence of this engagement to the Department.

Discussion:

This Project proposes to restore Honokōwai Beach and improve beach width and in the case of Beach Stabilization, beach stability through the Preferred Alternative of Beach Stabilization. The Proposed Action aligns with the goals of the West Maui Community Plan by addressing the erosion problem with beach restoration using natural marine sand and stabilizing groins, instead of building vertical seawalls and revetments. The Project further promotes responsible stewardship of natural resources by providing an opportunity to restore and protect the shoreline throughout the Project Site. These topographic features are essential to beach preservation and a significant element of the natural environment that should be protected.

Shorelines are a vital natural resource for the protection of land and sea. They serve as a natural buffer filtering runoff moving to the ocean and protect land and structures inland of the shoreline. A well-established shoreline will protect the coral reef from sedimentation, turbidity, and runoff. Honokōwai Beach has been designated as critical habitat for monk seals. The proposed beach restoration may offer the Hawaiian green sea turtle and Hawaiian monk seal additional haul out area, creating a habitat connection in an area of shoreline where sandy beaches are frequently changing and chronically eroding. This Proposed Action will establish a wider and in the case of Beach Stabilization, more stable beach without the need for seawalls or revetments.

The Proposed Action will utilize the recommendations of the Maui County Planting Plan to use native and endemic plants where possible and will not use any plant listed on the Hawaiʻi Pacific Weed Risk Assessment list.

Consultation with the Moku ʻo Kāʻanapali will be undertaken as part of the environmental review process.

Goal 2.5: Safe, Healthy, Livable Communities for All

Policy 2.5.21: Support public and private efforts to inventory, evaluate and expand public shoreline access. Require shoreline access to currently privatized shoreline areas by gates and walls.

Policy 2.5.23: Require public shoreline access to be provided through establishment of both vertical and lateral access through public rights-of-way and public transit corridors as a condition of any SMA Major permit for properties that lie within the Special Management Area and abut the shoreline to the extent permitted by law.

Discussion:

The Proposed Action represents private investment that will have public benefit in the form of improving and preserving shoreline access. As previously mentioned, Honokōwai Beach is unique in that it is one (1) of the only places in West Maui that provides ADA compliant perpendicular access to the shoreline and 1,000 l.f. of ADA compliant lateral access along the shoreline. Perpendicular access is provided via the public parking area and sidewalk via an easement on the KBC property. Lateral access is provided through the KBC and Kaanapali Shores properties. In addition to the public right of way, there are public restrooms, showers, and changing stations adjacent to the parking lot and perpendicular beach access that are maintained by KBC.

H. MAUI COUNTY ZONING

The KBC parcel is located primarily within the Maui County Zoning Code "Hotel" district. See **Figure 34** (Maui County Zoning). The existing resort uses and developments are located within and are consistent with Chapter 19.14, MCC for "Hotel" zoned lots. The proposed beach restoration action involves shoreline areas not regulated by Maui County zoning. However, the Proposed Action is compatible with the adjacent Hotel zoning use as well as the public use of the beach. Potential related secondary actions would also be consistent with the existing zoning district as these secondary actions may include improvements or adjustment to existing common elements of the KBC property without changing the underlying use of property.

I. HAWAIʻI COASTAL ZONE MANAGEMENT PROGRAM

The Coastal Zone Management Area, as defined in Chapter 205A, HRS, includes all the lands of the State. As such, the proposed activities lie within the Coastal Zone Management Area.

The relevant objectives and policies of the Hawaiʻi Coastal Zone Management (CZM) Program, along with a detailed discussion of how the Proposed Action does not conflict with these objectives and policies, is discussed below.

Land uses are required to comply with the objectives and policies contained in Chapter 205A, HRS, entitled "Coastal Zone Management", as described below. In implementing the objectives of the CZM Program, full consideration shall be given to ecological, cultural, historic, aesthetic, recreational, scenic, and open space values, and coastal hazards, as well as to needs for economic development.

1. Recreational Resources

Objective:

Provide coastal recreational opportunities accessible to the public.

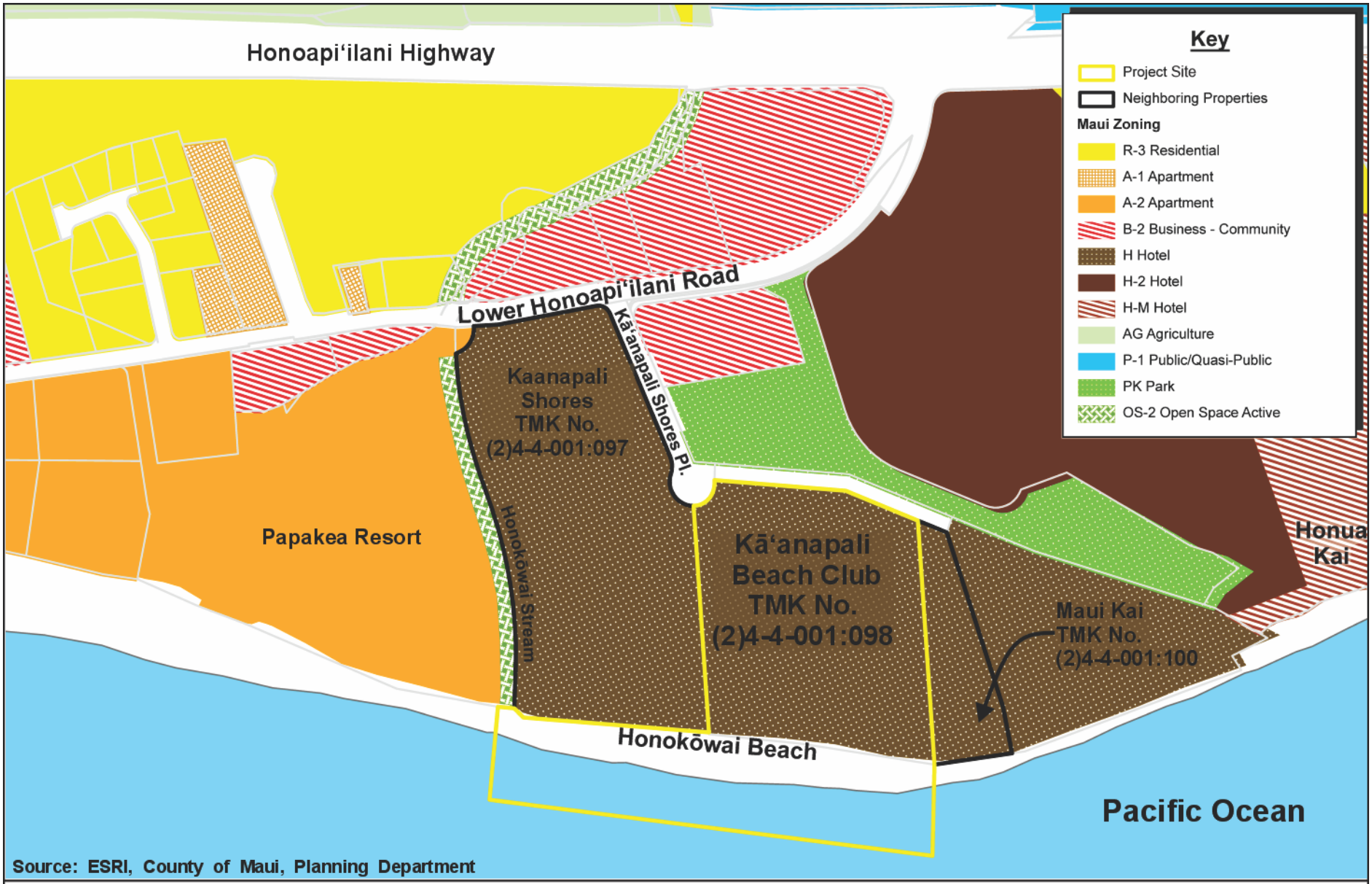


Figure 34

Ho‘āla Honokōwai
Maui County Zoning

0 175 350
Feet

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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 restoration of coastal resources that have significant recreational and ecosystem value, including but not limited to coral reefs, surfing sites, fishponds, sand beaches, and coastal dunes when these resources will be unavoidably damaged by development; or requiring monetary compensation to the State for recreation when restoration 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; and crediting that dedication against the requirements of Section 46-6.

Response: The Proposed Action is to restore and protect Honokōwai Beach as a coastal resource with significant recreational value. The eroding sediment is a source of pollution to the nearshore environment, which would be mitigated by the Proposed Action. The Proposed

Action would serve to maintain the connection between the beach, public perpendicular and lateral shoreline and beach access, public parking, and public restroom facility.

The proposed beach restoration would stabilize the recreational beach resource allowing for continued recreational access and use of the shoreline. Many recreational activities along the Honokōwai Beach shoreline, such as fishing, sunbathing, and snorkeling depend on the existence of the sandy beach. During and after the Proposed Action, all public access would be managed to promote the health, safety, and welfare of the public, as well as to maintain ample public access consistent with the conservation of the natural resource. In addition, this section of Honokōwai Beach has ADA compliant lateral and perpendicular shoreline access. This beach restoration Project is important for protecting a valuable natural resource for its intrinsic value as well as the social equity it provides through ADA access.

To meet State of Hawai'i water quality standards for the Project Site, appropriate BMPs will be used to prevent the release of pollutants into the marine environment. The Proposed Action will be an improvement of the existing beach recreational opportunities as the restored beaches are entirely for public use. Some impacts would be imposed on vessel and recreational ocean transit during sand recovery, transportation, and placement operations. Efforts will be made to notify potentially affected members of the local and visiting community.

2. Historic/Cultural 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.

Response: The proposed Project is intended to preserve and enhance perpendicular and lateral shoreline access for cultural and recreational uses. An archaeological LRFI and CIA were prepared for the Project and recommendations identified by those studies and by SHPD through the Chapter 6E, HRS historic review process will be implemented.

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 those 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.

Response: Project-related impacts to scenic and open space resources would largely be related to the sand recovery, transportation, and placement phases of the Proposed Action. Construction equipment including barges, tugboats, cranes, dump trucks, off-road capable vehicles, loaders, etc., would be present for offshore and beach uses during construction. The barges would be visible from the shoreline through the duration of sand recovery operations. Visible turbidity in the ocean water during operations may impact the deep-blue colors of the ocean. Other impacts relating to ocean usage for recreation such as surfing, snorkeling, and swimming would also only be confined to the construction phases and immediately after the end of the Project as the sand settles. Implementation of the Project would lead to an improvement in water quality as runoff plumes associated with storm events would be reduced as a result of the wider and in the case of Beach Stabilization, a more stable beach.

The Proposed Action is anticipated to be compatible with the visual environment and will improve the scenic and aesthetic resources of Honokōwai Beach. The color of sand from the offshore sand deposits may initially be slightly grayer than the existing beach sand, however, after a season of mixing and fading in the sun, no visible difference in sand color is anticipated. While Beach Stabilization would change the configuration of the shoreline at the Project Site, the visual impacts will be balanced by the benefits associated with stabilizing one (1) of the few sandy beaches in the area.

4. Coastal Ecosystems

Objective:

Protect valuable coastal ecosystems, including reefs, beaches, and coastal dunes, 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 of significant biological or economic importance, including reefs, beaches, and dunes;

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.

Response: The Proposed Action is designed to minimize potential impacts to the marine and nearshore environment. Turbidity containment barriers would surround the active work areas during sand recovery, transportation, and placement operations. Appropriate BMPs would be used to ensure impacts on water quality are minimized, temporary, and localized to the immediate vicinity of the work activities. No significant, adverse long-term impacts to water

quality are anticipated. With the restoration efforts, turbidity plumes associated with storms and high rainfall are anticipated to be less severe with a wider beach profile. Additionally, a wider and in the case of Beach Stabilization, more stable beach would protect the backshore which when impacted by high surf events has had significant impacts on water turbidity, as demonstrated by the beach loss and avulsion event that occurred in 2016. The preferred alternative of Beach Stabilization would provide a secondary benefit of reducing the accumulation of sand in the mouth of Honokōwai Stream, promoting more natural streamflow and reducing the concentration of debris and contaminants that accumulates between these events.

The beach resource and its consequent ecological value has been severely degraded by erosion. The erosion of fast land on the backshore poses a hazard to the coastal ecosystem. The Proposed Action would stabilize and restore the beach resource, supporting all manner of organisms that rely on the coastal sandy substrate, including endangered species such as green sea turtles and Hawaiian monk seals. Honokōwai Beach has been designated as critical habitat for monk seals, and restoration will provide a benefit of stabilizing this resource over the long-term. Appropriate BMPs, as recommended by the NOAA National Marine Fisheries Service, will be adhered to during construction to avoid adverse impacts to marine biota, protected species, and EFH.

5. Economic Use

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 and coastal related development are located, designed, and constructed to minimize exposure to coastal hazards and adverse social, visual, and environmental impacts in the coastal zone management area; and

c. Direct the location and expansion of coastal development to areas designated and used for that development and permit reasonable long-term growth at those areas, and permit coastal development outside of designated areas when:

i. Use of designated locations is not feasible;

ii. Adverse environmental effects and risks from coastal hazards are minimized; and

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

Response: The Proposed Action represents private investment that would have public benefit in the form of improving and preserving natural resources and shoreline access. The Economic Impact Report prepared for the Project concluded that beach restoration actions would present a positive economic and fiscal impact to the County and State while the No Action alternative would result in adverse economic impacts associated with presumed reduction or cessation of operations at the KBC. See **Appendix "I"**.

The Proposed Action is intended to minimize or reverse the impacts associated with beach loss at Honokōwai Beach. The Proposed Action would preserve public beach access and does not involve the expansion or intensification of coastal land uses inland of the beach. In addition to providing public benefits associated with preserving and maintaining the beach resources and shoreline access, the proposed beach restoration would support the visitor industry, which serves as a major economic resource in the area.

6. Coastal Hazards

Objective:

Reduce hazard to life and property from coastal hazards.

Policies:

a. Develop and communicate adequate information about the risks of coastal hazards;

b. Control development, including planning and zoning control, in areas subject to coastal hazards;

c. Ensure that developments comply with requirements of the National Flood Insurance Program; and

d. Prevent coastal flooding from inland projects.

Response: The Proposed Action is intended to reduce the impacts from coastal flooding by adding beach sand, adding new stabilizing structures, and reducing the potential for wave overtopping and flooding by increasing dry beach width and volume. The Project would provide

a protective buffer between the ocean and the existing backshore infrastructure, reducing the vulnerability of the backshore to marine related flooding, such as from high surf and storm surge. The Proposed Action is anticipated to have a negligible impact on hurricane and tsunami hazards for the Honokōwai Beach area. Damage from hurricanes and tsunamis depends on the height of the water level rise and backshore elevation. The Proposed Action would not affect this elevation, and it is generally not possible to protect against this type of issue in line with the scope of beach restoration.

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.

Response: The Proposed Action will be reviewed by Federal, State, and County agencies as well as the public through the EIS and permitting processes. Additionally, other consultation opportunities will be provided during the EIS review and final design process. All review accounts for short-term and long-term impacts and will be included in all permit applications. All required permits and approvals will be obtained prior to Project implementation.

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.

Response: Consultation with the community, the County of Maui, Department of Planning, OCCL, Hawai'i Department of Transportation and other stakeholders was undertaken to establish priorities and design criteria for the Proposed Action. The proposed beach restoration Project will create a viable, sustainable, and resilient sandy beach that will allow for cultural practices and recreation while also being able to support the tourism industry that relies on this stretch of beach.

The public was formally engaged through the publication of the Environmental Impact Statement Preparation Notice (EISPN), which was published in the Environmental Review Program's the Environmental Notice, on December 12, 2022. A public scoping meeting was held on January 17, 2023, at the Lahaina Civic Center. For additional information about the consultation process, please see Chapter X and **Appendix "M"**.

9. Beach and Coastal Dune Protection

Objectives:

a. Protect beaches and coastal dunes for:

i. Public use and recreation;

ii. The benefit of coastal ecosystems; and

iii. Use as natural buffers against coastal hazards; and

b. Coordinate and fund beach management and protection.

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 shoreline hardening structures, including seawalls and revetments, at sites having sand beaches and at sites where shoreline hardening structures interfere with existing recreational and waterline activities;

c. Minimize the construction of public shoreline hardening structures, including seawalls and revetments, at sites having sand beaches and at sites where shoreline hardening structures interfere with existing recreational and waterline activities;

d. Minimize grading of and damage to coastal dunes;

e. Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor; and

f. Prohibit private property owners from creating a public nuisance by allowing the private property owner's unmaintained vegetation to interfere or encroach upon a beach transit corridor.

Response: The improved beach would enhance recreational opportunities, improve public access to and use of the shoreline, and provide a natural buffer against coastal hazards and sea level rise. The Proposed Action is designed to restore and maintain the beach and mitigate chronic and seasonal erosion. The Proposed Action is consistent with the objective of Chapter 205A, HRS to protect beaches and coastal dunes and coordinate and fund beach management and protection. It is noted that groins constructed under Beach Stabilization is not considered shoreline hardening. Groins are a nature-based solution that utilizes a combination of natural processes and human engineering to create stable beaches. The benefits of this Project will extend to all residents of Maui, through the maintained perpendicular and lateral public beach access.

10. Marine and Coastal 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 and coastal processes, impacts of climate change and sea level rise, marine life, and other ocean resources to acquire and inventory information necessary to understand how coastal development activities relate to and impact ocean and coastal resources; and

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

Response: The Proposed Action is not anticipated to have significant ongoing negative impacts on marine resources. Temporary construction impacts associated with sand recovery, sand placement, and groin construction are anticipated to stay confined to the areas surrounding sand recovery and placement work. The use of the stabilizing groins (for the Beach Stabilization alternative) represents a nature-based solution that incorporates coastal resilience, as opposed to further shoreline hardening through seawalls and revetments. Appropriate BMPs would be implemented to protect marine and coastal resources, including but not limited to water quality, benthic flora and fauna, corals, fishes, and protected species. When compared to a No Action alternative, beach restoration is anticipated to stabilize the shoreline and provide an ongoing positive impact to coastal and marine resources. Formal consultations will be conducted with marine resource agencies, including the NOAA National Marine Fisheries Service, USFWS, USACE, and the DLNR Division of Aquatic Resources to ensure that all potential environmental impacts are mitigated as much as possible. The Proposed Action is anticipated to have an ongoing positive impact on the sandy beach and would benefit local ecology, providing an environmental and economic benefit to West Maui.

In addition to the foregoing objectives and policies and pursuant to Act 224 (2005), no SMA Use Permit or SMA Minor permit shall be granted for structures that allow

artificial light from floodlights, uplights, or spotlights used for decorative or aesthetic purposes when the light:

(1) Directly illuminates the shoreline and ocean waters, or

(2) Is directed to travel across property boundaries toward the shoreline and ocean waters.

Further, this prohibition shall not apply to authorized users for government operations, security, public safety, or navigational needs, provided that a government agency or its authorized users shall make reasonable efforts to properly position or shield lights to minimize adverse impacts.

Response: Construction associated with the beach restoration action is anticipated to be conducted during day-time hours only such that night lighting will not be required. No permanent new lighting is proposed with the beach restoration action. Existing lighting along the ADA compliant coastal walkway would be replaced and would utilize light fixtures that are shielded and downward facing to comply with the County lighting ordinance requirements and are not directed across property boundaries.

J. HRS § 205A-26 SPECIAL MANAGEMENT AREA GUIDELINES

The Proposed Action is consistent with the State's SMA guidelines, as set forth in HRS § 205A-26:

(1) All development in the special management area shall be subject to reasonable terms and conditions set by the authority in order to ensure:

(A) Adequate public access, by dedication or other means, to and along publicly owned or used beaches, recreation areas, and natural reserves is provided to the extent consistent with sound conservation principles;

Discussion:

The Proposed Action would preserve and enhance access to Honokōwai Beach by providing a larger sandy beach, as well as improving and maintaining perpendicular and lateral shoreline access routes.

(B) Adequate and properly located public recreation areas and wildlife preserves are reserved;

Discussion:

Honokōwai Beach's value as a public recreation area would be enhanced by the Proposed Action, while preserving natural and wildlife resources in the beach and nearshore environment.

(C) Provisions are made for solid and liquid waste treatment, disposition, and management that will minimize adverse effects upon special management area resources; and

Discussion:

The Proposed Action would not result in the ongoing generation of solid or liquid waste. Construction-related waste would be disposed of in accordance with State, County and Federal requirements.

(D) Alterations to existing land forms and vegetation, except crops, and construction of structures shall cause minimum adverse effect to water resources, beaches and coastal dunes, and scenic and recreational amenities and minimize risks from coastal hazards or failure in the event of earthquake.

Discussion:

The Proposed Action involves placement of sand on Honokōwai Beach, and in the case of Beach Stabilization, construction of stabilizing groins. These actions support the Project's goals to restore the beach and improve beach stability (for Beach Stabilization only); preserve and enhance cultural and shoreline access; increase resilience to coastal hazards and sea level rise; and enable planning for long-term adaptation to sea level rise. Compared to the No Action alternative, beach restoration is anticipated to improve nearshore water quality while not significantly impacting existing marine biotic communities. There may be temporary construction-related impacts to existing vegetation that can be mitigated by appropriate BMPs.

(2) No development shall be approved unless the authority has first found:

(A) That the development will not have any significant adverse environmental or ecological effect, except as any adverse effect is minimized to the extent practicable and clearly outweighed by public health, safety, or compelling public interests. The adverse effects shall include but not be limited to the potential cumulative impact of individual developments, each one of which taken in itself might not

have a significant adverse effect, and the elimination of planning options;

Discussion:

The Proposed Action provides a public benefit of preserving and maintaining a sandy beach at Honokōwai Beach. Honokōwai Beach is a public resource that provides economic, recreational, cultural, and aesthetic value. The alternatives presented in this EIS have been identified to minimize and mitigate potential adverse effects while fulfilling the Project's goals. Applicable BMPs have been developed for each action alternative to ensure that realized public benefits outweigh potential environmental and ecological impacts.

(B) That the development is consistent with the objectives, policies, and special management area guidelines of this chapter and any guidelines enacted by the legislature; and

Discussion:

The Proposed Action will comply with the objectives, policies, and special management guidelines of HRS § 205A-26. A SMA permit will be obtained prior to Project implementation.

(C) That the development is consistent with the county general plan, community plan, and zoning. Such a finding of consistency does not preclude concurrent processing where a general plan, community plan, or zoning amendment may also be required.

Discussion:

As discussed in this chapter, the Project is consistent with the Countywide Policy Plan, West Maui Community Plan, and Maui County zoning.

(3) The authority shall seek to minimize, where reasonable:

(A) Dredging, filling or otherwise altering any bay, estuary, salt marsh, river mouth, slough or lagoon;

Discussion:

The Project does not involve dredging sand from Honokōwai Stream. However, the Beach Stabilization alternative may prevent sand from accumulating at the mouth of Honokōwai Stream, a channelized stream characterized by a box culvert, resulting in a more natural stream flow.

(B) Any development that would reduce the size of any beach or other area usable for public recreation;

Discussion:

The Proposed Action would increase the size of Honokōwai Beach and its usable area for public recreation.

(C) Any development that would reduce or impose restrictions upon public access to tidal and submerged lands, beaches, portions of rivers and streams within the special management areas and the mean high tide line where there is no beach;

Discussion:

The Proposed Action would not reduce or impose long-term restrictions upon access to the beach or any public areas. During Project implementation, construction-related partial beach closures will be necessary to ensure public safety. However, this short-term impact is outweighed by the ongoing benefit of improving and maintaining perpendicular and lateral shoreline access at the Project Site.

(D) Any development that would substantially interfere with or detract from the line of sight toward the sea from the state highway nearest the coast; and

Discussion:

The Proposed Action would not be visible from state highways and would not impact any lines of sight between state highways and the sea.

(E) Any development that would adversely affect water quality, existing areas of open water free of visible structures, existing and potential fisheries and fishing grounds, wildlife habitats, or potential or existing agricultural uses of land.

Discussion:

The Proposed Action has the potential to cause temporary construction-related impacts to water quality and fisheries. The Best Management Practices Plan contained within the CEA, **Appendix "A"** identifies BMPs to be implemented, including measures for erosion and sediment control, oil and spill containment, and water quality monitoring. Compared to the No Action alternative, beach restoration is anticipated to positively impact water quality as beach and backshore erosion is avoided. Honokōwai Beach and the nearshore waters are designated critical

habitat for Hawaiian monk seals. Beach restoration is anticipated to positively impact the provision of critical habitat and consistency of available haul out area for monk seals and sea turtles. In the case of the Beach Stabilization alternative, the groins would provide new and improved habitat that has the potential to increase fish biomass and biodiversity.

K. MAUI PLANNING COMMISSION SPECIAL MANAGEMENT AREA RULES AND REGULATIONS

The Project Site involves the County of Maui's SMA. See **Figure 35** (Special Management Area). Specifically, the work occurring landward of the certified shoreline is located within the County SMA; work seaward of the shoreline is within State jurisdiction and is outside of the SMA. The Rules and Regulations of the Maui Planning Commission, Chapter 12-202 were established in order to implement HRS § 205A-26 relating to Coastal Zone Management and Special Management Areas. In addition to establishing procedures for processing of SMA applications and procurement of related permits, the rules assist the Commission in giving consideration to State policy regarding coastal zones.

This section addresses the Project's relationship to applicable CZM considerations as set forth in the Maui Planning Commission Rules and Regulations, Chapter 202, "Special Management Area Permit Procedures," which are provided for considering the significance of potential environmental and ecological effects of a Proposed Action. The criteria have been reviewed and analyzed with respect to the Proposed Action.

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

The development of the Project may result in certain unavoidable construction-related impacts as outlined in **Chapter III** and **Chapter V**. Potential effects include construction related noise, air quality, and water quality impacts occurring during the site preparation, sand recovery, sand placement, and groin construction (in the case of the Beach Stabilization Alternative) phases of the project. These impacts would arise as a direct result of construction activities, such as the generation of noise from construction equipment, the generation of dust and other airborne pollutants, nearshore turbidity during sand recovery and in-water work, and erosion from wind and stormwater runoff during grading and other construction activity.

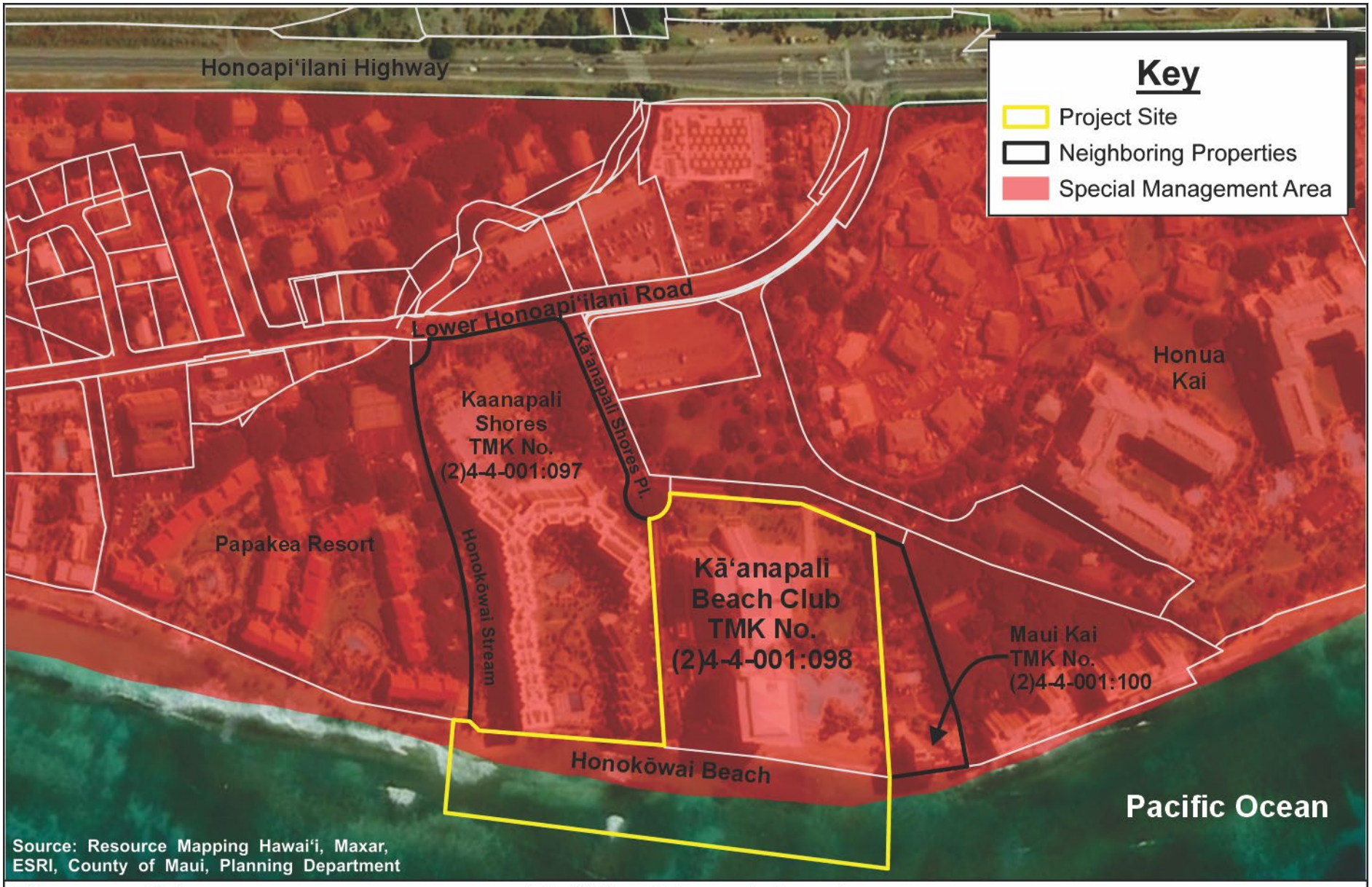


Figure 35

Ho‘āla Honokōwai
Special Management Area

0 175 350
Feet

Prepared for: West Maui Resort Partners, L.P.

MUNEKIYO HIRAGA

HGV\KBC Beach Restor\Apps\Figures\SMA

For the Beach Stabilization alternative, the construction of stabilizing groins would result in a permanent visual impact at the Project Site. The presence of groins would alter the physical and visual landscape of the nearshore; however, impacts to the scenic resources will be balanced by the benefits associated with stabilizing the only sandy beach in the area. The CIA anticipates additional impacts for the stabilizing groins, including possible impacts to flora, fauna, intangible cultural resources, and cultural practices.

The Project will include work along the shoreline and in-water work in the nearshore environment. Implementation of the Preferred Alternative would entail the irretrievable commitment of submerged lands within the groin footprint and areas of sand placement. Bathymetry within the groin footprint and between groins would be permanently altered by groin construction and sand placement. The Project would require the use of non-renewable resources including recovered sand and stone. The Preferred Alternative would require 33,000 cy of sand to be recovered from the Sand Recovery Site. Up to 47,000 cy would be required for the Beach Maintenance alternative and 27,000 cy of sand would be required for the Beach Nourishment alternative, recovered offshore of Kāʻanapali at the Sand Recovery Site. Stones of varying sizes will be mined or blasted from existing quarries to construct the groins for the Beach Stabilization alternative. Approximately 22,442 tons of stone are needed to construct the groins.

2. Significantly curtails the range of beneficial uses of the environment.

The Proposed Action is intended to preserve and potentially enhance the range of beneficial uses of the environment in the Project Site. The implementation of the Proposed Action, together with applicable mitigative measures, is not anticipated to significantly curtail the range of beneficial uses of the environment. Applicable dust control, noise control, and BMPs will be implemented during construction to minimize any construction-related impacts. Temporary impacts to the beach and its range of beneficial uses are anticipated but would cease shortly after construction. After this construction period, benefits to the resource are anticipated to improve.

3. Conflicts with the County's or the State's long-term environmental policies or goals.

The Proposed Action does not conflict with the State Environmental Policy and Guidelines set forth in Chapter 344, HRS. The Proposed Action is also in consistent with environmental goals, objectives and policies of the Countywide Policy Plan, the Maui Island Plan, and the West Maui Community Plan. See Section IV.F and Section IV.G of this EIS for an analysis of the Countywide Policy Plan, Maui Island Plan, and West Maui Community Plan in relation to this Project.

4. Substantially affects the economic or social welfare and activities of the community, County, or State.

The Proposed Action represents private investment that would have public benefits in the form of improving and preserving cultural and shoreline access. The Economic Impact Report prepared for the Project concluded that beach restoration would present a positive economic and fiscal impact to the County and State while the No Action alternative would result in adverse economic impacts associated with presumed reduction in or potential cessation of operations at the KBC. The preservation of the beach is anticipated to provide an ongoing public benefit by preserving beach access while also supporting the visitor industry in the region. The proposed beach restoration action is anticipated to have positive impacts on the economic and social welfare of the community, County, and State.

5. Involves substantial secondary impacts, such as population changes and increased effects on public facilities, streets, drainage, sewage, and water systems, and pedestrian walkways.

The secondary impacts for Beach Stabilization, Beach Nourishment, and Beach Maintenance would be similar in many instances, but there are some additional secondary impact considerations for Beach Stabilization as it relates to the groins. Potential secondary impacts related to the beach restoration alternatives include varying degrees of indirect and induced economic impacts; there are no anticipated secondary impacts to land use or public services. The No Action Alternative is anticipated to result in a variety of adverse secondary impacts associated with erosion and beach loss.

6. In itself has no significant adverse effects but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.

There are two (2) other beach restoration projects proposed for West Maui – the Kāʻanapali Beach Restoration and Berm Enhancement Project, and the Kahana Bay Erosion Mitigation Project – that establish context for analyzing the cumulative impacts for the Hoʻāla Honokōwai Project. The three (3) beach restoration projects are each independent projects with independent timelines. While the specific construction timelines for each project are dependent on completion of the lengthy regulatory approval processes, it is not anticipated that the projects would be under construction at the same time because each project is at a different stage in the environmental review and entitlement process. Two (2) of the three (3) projects – the Hoʻāla Honokōwai Project and the Kahana Bay Erosion Mitigation Project – propose stabilizing groins. If both projects are developed, there would be a total of 11 groins in West Maui. However, the projects are 1.5 miles apart and are not within the same viewshed or littoral cell. Because groins are only appropriate under specific shoreline conditions and are not generally applicable across all shorelines,

multiple beach stabilization projects with groins are not anticipated to be proposed across West Maui.

From a construction standpoint, cumulative impacts associated with truck traffic could present a potential cumulative impact. The TIAR analyzes traffic impacts in the context of traffic generated by known planned and proposed development projects as well as traffic growth attributed to the rebuilding in Lahaina. The TIAR concluded that the number of trips generated by the beach restoration actions is negligible and the proposed Project is not anticipated to have a significant impact.

7. Substantially affects a rare, threatened, or endangered species of animal or plant, or its habitat.

A Marine Resources Assessment and Terrestrial Biological Survey were prepared to identify potential effects to plants or animals at the Project Site. While endangered species do have the potential to occur at the site and have been observed in the Project vicinity, the Proposed Action is not anticipated to have a substantial negative impact to existing marine biotic communities. Hawaiian monk seals and green sea turtles have been observed in the vicinity of the Project Site. Critical habitat for Hawaiian monk seals includes the sea floor and marine environment to 10 m above the sea floor from the 200 m depth contour, through the shoreline and extending onto the land 5 m inland from the shoreline between identified boundary points. Honokōwai Beach is designated as critical habitat for Hawaiian monk seals, and the Sand Recovery Site and nearshore environment are designated as critical marine habitat. See the Assessment of the Marine Environment contained within the CEA, **Appendix "A"**.

8. Is contrary to the State plan, County's general plan, appropriate community plans, zoning and subdivision ordinances.

The Proposed Action does not contravene policy plans of the State of Hawai'i and the County of Maui. Additionally, the Proposed Action is in conformance with Maui County zoning and the West Maui Community Plan. The Proposed Action does not propose a subdivision action that would require compliance with the subdivision ordinance.

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

Construction related impacts on air quality and noise impacts would be expected but could be mitigated by the implementation of BMPs. Construction of the Proposed Action would be carried out in compliance with Department of Health Community Noise Control Standards. Adverse impacts to air quality and ambient noise levels are not anticipated following Project implementation.

10. Affects an environmentally sensitive area, such as flood plains, shoreline, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh waters, or coastal waters.

The Proposed Action involves work in the shoreline area and is anticipated to result in temporary impacts within the shoreline and nearshore environments. All of the beach restoration alternatives involve dredging sand from the Sand Recovery Site and have the potential to cause both construction related and ongoing impacts to the marine environment. There may be temporary impacts during the sand recovery process including potential turbidity and displacement of marine organisms. These impacts are expected to be temporary and not have a broader regional impact, as the Sand Recovery Site is part of a much larger sand field.

The Beach Stabilization alternative would create a permanent displacement of fish populations within the footprint of the groins and sand fill. However, this displacement would be limited to the nearshore scour zone where fish biomass and biodiversity are very low. The groins would create new marine habitat with the potential to increase fish biomass and biodiversity in the nearshore scour zone. The Beach Nourishment and Beach Maintenance alternatives are not anticipated to have significant impacts to the marine and nearshore environment.

11. Substantially alters natural land forms and existing public views to and along the shoreline.

The Proposed Action involves placement of sand along the shoreline in order to restore and preserve Hōnokowai Beach. In addition, the Preferred Alternative involves placement of stabilizing groins. These actions would result in an alteration to land forms and public views along the shoreline, which are considered to be reasonable in the context of the long-term value of preserving Honokōwai Beach.

12. Is contrary to the objectives and policies of Chapter 205A, HRS.

A review of the objectives and policies of Chapter 205A, HRS is provided in its entirety in the preceding part of this chapter. The review addresses the Project's relationship to the CZM considerations. Based on the analysis presented, the Project will appropriately and adequately mitigate impacts to SMA-relevant areas of interest.

L. MAUI PLANNING COMMISSION SHORELINE SETBACK RULES

1. Shoreline Setback Area

The Proposed Action is located within the shoreline setback area and is subject to the Maui Planning Commission's Shoreline Rules §12-203, Maui Planning

Commission Rules. The Shoreline Rules establish the shoreline setback for the Project Site as the erosion hazard line that is mapped for 3.2 feet of sea level rise.

2. Analysis of Shoreline Setback Criteria

Pursuant to Section 12-203-12 of the Shoreline Rules, the following structures and activities are permitted within the shoreline setback area:

> *(11) Beach nourishment, dune-restoration, sand-pushing, wetland restoration, fish pond restoration, and coastal revegetation projects approved by all applicable governmental agencies.*

Construction activities for the placement of sand seaward of the existing beach toe associated with Beach Nourishment, Beach Maintenance or Beach Stabilization is anticipated to be considered a permitted action within the shoreline setback area as a beach nourishment action. A Shoreline Setback Assessment application will also be submitted to the Department of Planning.

3. Shoreline Setback Variance Approval Criteria (for Beach Stabilization Only)

In the case of Beach Stabilization, groins would be constructed in the nearshore environment. A small portion of the groin stems, which anchor them to the backshore, would be developed within the shoreline setback area, triggering the need for a Shoreline Setback Variance. Beach Nourishment and Beach Maintenance would not involve action within the shoreline setback area that would be anticipated to require a Shoreline Setback Variance, since sand would be placed seaward of the existing beach toe.

Criteria for approval of a variance can be found in MPC Shoreline Rules § 12-203-15. A shoreline variance may be granted for a structure or activity otherwise prohibited by this chapter, if the Commission finds, based on the record presented, that the proposed structure or activity is necessary for or ancillary to private facilities or improvements which will not adversely affect beach processes or artificially fix the shoreline; provided that the applicant can show hardship.

The Beach Stabilization alternative has been assessed with respect to “Criteria for Approval of a Variance”, MPC Shoreline Rules § 12-203-15.

> *(a) A shoreline area variance may be granted for a structure or activity otherwise prohibited by this chapter, if the commission finds in writing, based on the record presented, that the proposed structure or activity is necessary for or ancillary to:*
>
> *(1) Cultivation of crops;*
>
> *(2) Aquaculture;*

(3) Landscaping; provided that, the commission finds that the proposed structure or activity will not adversely affect beach processes and will not artificially fix the shoreline;

(4) Drainage;

(5) Boating, maritime, or water sports recreational facilities;

(6) Facilities or improvements by public agencies or public utilities regulated under Chapter 269, HRS;

(7) Private facilities or improvements that are clearly in the public interest;

(8) Private facilities or improvements which will neither adversely affect beach processes nor artificially fix the shoreline; provided that, the commission also finds that hardship will result to the applicant if the facilities or improvements are not allowed within the shoreline area;

(9) Private facilities or improvements that may artificially fix the shoreline; provided that, the commission 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 provided further that, the commission imposes conditions to prohibit any structure seaward of the existing shoreline unless it is clearly in the public interest; or

(10) Moving of sand from one location seaward of the shoreline to another location seaward of the shoreline; provided that, the commission also finds that the moving of sand will not adversely affect beach processes, will not diminish the size of the public beach, and will be necessary to stabilize an eroding shoreline.

Response: The Beach Stabilization Action would restore and preserve the public beach, which would otherwise be eroded and diminished or lost over time. As such, it serves the public interest and is consistent with criterion No. (7). Beach Stabilization involves the moving of sand, and is consistent with the provisions of criterion No. (10), as it would not adversely affect beach processes, would enlarge and not diminish the size of the public beach, and is necessary to stabilize the eroding shoreline.

(b) A structure or activity may be granted a variance upon grounds of hardship if:

(1) The applicant would be deprived of reasonable use of the land if required to fully comply with the shoreline rules;

Response: Without the proposed Project, erosion, shoreline recession, beach narrowing, and potential beach loss would drastically change the shoreline at Honokōwai Beach. Shoreline recession, or the

permanent landward migration of the shoreline, will leave a narrower shoreline that is unable to serve as an effective buffer between the ocean and the land. Shoreline recession would have significant impacts on land use at and beyond the shoreline. While the exact timing of coastal erosion is uncertain, it is possible that total beach loss at Honokōwai Beach could occur before the end of the century if no mitigation is done. Beach access would be severely impaired, and the existing lateral and perpendicular public access infrastructure would be at risk of damage and may eventually need to be removed, which would eliminate the ADA-compliant coastal walkway which provides lateral access along 1,000 ft. of shoreline. Under this scenario, the public would be deprived of reasonable use of the beach. Furthermore, KBC may need to reduce operations or be forced to close entirely due to the loss of Honokōwai Beach and the overall degradation of the shoreline area, depriving the Applicant of reasonable use of the land.

(2) The applicant's proposal is due to unique circumstances and does not draw into question the reasonableness of the shoreline setback rules; and

Response: The shoreline in the region of the Project Site is characterized by a series of armored structures such as seawalls and revetments. Honokōwai Beach provides a sandy, public beach with a unique combination of perpendicular and lateral shoreline access and public amenities that is rare along the West Maui coastline. Beach Stabilization proposes to improve beach stability in order to restore and preserve Honokōwai Beach and maintain and enhance its use for cultural and recreational purposes.

T-head groins are typically used along shorelines that are subject to significant wave-induced currents where sediment (i.e., sand) is predominantly transported alongshore (i.e., laterally along the shoreline) and away from the shoreline by wave action and/or tidal forces.

Groins are not an appropriate engineering solution along all shorelines. In some cases, particularly along linear, unarmored sandy coastlines, groins have the potential to cause downdrift erosion that can exacerbate erosion, beach narrowing, and shoreline recession by inhibiting the longshore transport of sand to these areas. The extent of downdrift erosion can vary depending on several factors but is typically isolated to areas immediately

adjacent to the terminal groins. As a result, groins are best suited for areas where downdrift erosion is less likely to occur.

The project site is a semi-confined beach, uniquely situated between a series of armored structures, making it a suitable location for groins. At the Project Site, the terminal groins will be located adjacent to Honokōwai Stream and Honokōwai Point, where shoreline structures currently exist. The adjacent shorelines to the north and south of the Project Site are armored by shore protection structures (i.e., seawalls and revetments). The shoreline north of the Project Site is predominantly armored, the volume of sand in the littoral system is limited, and a sandy beach is typically not present. Wave-induced currents along the shoreline are less energetic in this area and the beach is bisected by two (2) drainage headwalls that extend seaward from both sides of the Honokōwai Stream mouth. These drainage headwalls act similarly to groins in that they interrupt longshore sediment transport and cause sand to accumulate in the stream mouth, preventing the sand from being transported further to the north. As a result, downdrift erosion is not expected to occur north of the Project Site.

The shoreline extending 800 feet south of the Project Site is also armored. However, due to a combination of increased sand volume in the littoral system and longshore sediment transport patterns, a narrow sandy beach is typically present in this area. The south terminal groin is designed to create a protective lee that is expected to reduce wave-induced currents that could cause downdrift erosion and beach narrowing in this area by transporting sediment alongshore in the southerly direction. The south terminal groin is also expected to facilitate accretion in this area by inhibiting sediment transport in the northerly direction. As a result, the beach in the immediate vicinity of the south terminal groin is expected to become wider and more stable as the volume of sand is expected to increase due to the presence of the groin.

(3) The proposal is the practicable alternative which best conforms to the purpose of the shoreline setback rules.

Response: Beach Stabilization, Beach Maintenance, and Beach Nourishment have been identified as feasible methods of implementing beach restoration and have been assessed in this EIS. Based on the analysis conducted for this EIS, Beach Stabilization was determined to be the preferred and most practicable alternative as it offers the most reliable and longest period of beneficial impacts

from a beach restoration effort. Unlike Beach Maintenance and Beach Nourishment, the stabilizing groins installed with the Beach Stabilization alternative will ensure that the placed sand will stay in place, not require further sand recovery, and minimize beach and backshore erosion should an episodic event occur. As a privately funded effort providing a public benefit within the shoreline area, these actions are considered to be reasonable within the context and purpose of the shoreline setback rules.

(c) Before granting a hardship variance, the commission must determine that the applicant's proposal is a reasonable use of the land. Because of the dynamic nature of the shoreline environment, inappropriate development may easily pose a risk to individuals or to the public health and safety. For this reason, the determination of the reasonableness of the use of land should properly consider factors such as shoreline conditions, erosion, surf and flood conditions and the geography of the lot.

Response: The Proposed Action represents a reasonable use of the land, in that it allows the uses of Honokōwai Beach that existed prior to the 2016 beach loss and avulsion event to continue, by preserving and stabilizing the sandy beach area for future use.

Erosion limits the effectiveness of beach nourishment projects, particularly along shorelines that are subject to chronic, seasonal, and/or episodic erosion, such as the Project Site. Thus, without additional mitigative measures, rates of pre-project beach erosion should be expected to continue following a beach nourishment project and potentially accelerate with sea level rise. In some cases, engineered beach stabilizing structures that mimic natural landscape features, such as T-head groins (engineered headlands), can be constructed to maintain a stable beach. T-head groins decrease and reorient wave energy approaching the shoreline and create artificial littoral cells to stabilize the sand.

There are numerous examples around the world of arc-shaped shorelines adjacent to headlands, both natural and manmade. The knowledge gained from studying natural headland-bay beaches provides a design tool for coastal engineers to produce stable sandy shorelines. Hsu and Evans (1989), Silvester and Hsu (1993), and Klein et. al (2003) present methods for determining the stable beach planform adjacent to rocky headlands, thus facilitating the use of engineered artificial headlands as beach stabilizing structures. Bodge (1998, 2003) furthered these studies by presenting a method for estimating the stable shoreline position for

a beach between two (2) T-head groins. This approach has been implemented successfully in numerous locations in Florida and the Caribbean (Bodge, 1998), and more recently at Iroquois Point on O'ahu (2013).

To be stable and effective, groins need to be securely anchored to the backshore (land). Burying the stems of the groins anchors the structures and protects against scouring that can be caused by the forces of waves, tides, and currents. When properly buried and anchored, groins are less vulnerable to the erosive forces of water, which can cause erosion downdrift or along the sides of the groins, potentially reducing the effectiveness and longevity of the structures.

The proposed groins will have a total structural footprint of 53,900 s.f. However, only a small portion of the groin stems will extend into the shoreline setback area. The structural footprint of the groin stems within the setback will be approximately 700 s.f., which represents 1.3 percent of the total structural footprint of the groins, and less than 0.1 percent of the lot size of the adjacent parcels. The portions of the groin stems within the shoreline setback will be buried below the existing grade and will therefore have no impact on existing view planes, shoreline access, or public health, safety, and welfare.

Burying portions of the groin stems in the shoreline setback is necessary to ensure that the proposed groins are stable and effective and to achieve the project objectives to improve beach stability, preserve and enhance cultural and shoreline access, increase resilience to coastal hazards and sea level rise, and enable long-term adaptation to sea level rise. The buried portions of the groin stems will occupy a very small portion of the existing parcels and will have no visual or social impacts. Burying portions of the groins stems in the shoreline setback represents the use of private land to restore and stabilize a natural public resource and is therefore considered a reasonable use of the land.

(d) *For purposes of this section, hardship shall not include: economic hardship to the applicant; county zoning changes, planned development permits, cluster permits, or subdivision approvals after June 16, 1989; any other permit or approval which may have been issued by the commission. If the hardship is a result of actions by the applicant, such result shall not be considered a hardship for purposes of this section.*

Response: If a variance is not granted to allow Beach Stabilization, the public is anticipated to experience hardship connected to the loss of use of and access to Honokōwai Beach due to degradation of the shoreline area and beach loss to erosion. In addition, ongoing shoreline erosion may result in loss of structures or infrastructure on the KBC property. This hardship is not the result of actions by the Applicant. The KBC property was lawfully developed in accordance with applicable SMA and Shoreline Rules at the time. The original site plan for the Embassy Suites (1987) shows a 60-foot shoreline setback from the certified shoreline, which was located "*along the top bank and edge of vegetation*". The setback at the time of development was 3 times the required setback of 20 feet. Based on the photographs taken during the 1987 shoreline survey, the beach was experiencing erosion at that time. The hardship is the result of a combination of chronic, seasonal, and episodic erosion at Honokōwai Beach. No consideration of economic hardship, hardship related to discretionary permits, or hardship related to applicant actions is proposed.

(e) No variance shall be granted unless appropriate conditions are imposed:

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

Response: Preserving and enhancing public access to the shoreline is one (1) of the stated objectives of the Proposed Action. Safe lateral and perpendicular access to and along the shoreline will be maintained. If a variance is not granted, safe lateral and perpendicular access to the shoreline will be impacted. The ADA-compliant coastal walkway that provides lateral shoreline access would be at risk of damage.

(2) To minimize risk of adverse impacts on beach processes;

Response: The proposed Project would reduce the adverse effects of erosion to the shoreline and adjacent lands and preserve a sandy beach at the Project Site. The backshore area at the Project Site is composed of alluvial sediment (clay, silt, sand, gravel, boulders), which is not conducive to beach formation. If no action is taken to stabilize the beach, it is anticipated that the beach will diminish over time. In addition, erosion of the beach and backshore areas is anticipated to result in negative impacts of deteriorating water quality, habitat loss, and elevated turbidity levels.

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

Response: The groins would stabilize the beach and prevent erosion and shoreline recession, reducing the vulnerability of inland features and preventing the backshore from eroding into the ocean.

(4) To minimize adverse impacts on public views to, from, and along the shoreline. For purposes of this section only, "adversely impacts public views" means the adverse impact on public views and open space resources caused by new building structures exceeding a one-story or 30-foot height limitation; and

Response: The stabilizing groins proposed by the Beach Stabilization action are below the existing grade and do not exceed a one-story or thirty-foot height limitation. While groins would change the landscape of the Project Site, impacts to the scenic resources would be balanced by the benefits associated with stabilizing the only sandy beach in the area. Without approval of the variance, the aesthetics of the beach will be adversely impacted by the exposed backshore. Turbidity, or brown water, is visually undesirable and deters people from recreating on the beach or in the water.

(5) To comply with chapters 19.62 and 20.08, Maui County Code, relating to flood hazard districts and erosion and sedimentation control respectively.

Response: The Project will comply with Maui County Code, Chapter 16.29 relating to flood hazard areas, and Chapter 20.08, relating to sedimentation control, as applicable.

(f) Notwithstanding any provision of this section to the contrary, 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.

Response: The shoreline at Honokōwai Beach has experienced significant beach loss following a beach loss and avulsion event in 2016 and is subject to chronic, seasonal, and episodic erosion. The Project continues to be proposed as a mid-term solution to restore Honokōwai Beach and improve beach stability, preserve and enhance cultural and shoreline access, increase resilience to coastal hazards and sea level rise; and enable planning for long-

term adaptation to sea level rise. The proposed use of stabilizing groins in the Beach Stabilization alternative represents an effective nature-based solution which incorporates coastal resilience, as opposed to further shoreline hardening through seawalls and revetments. If no action is taken to stabilize the beach, human-induced sea level rise will result in a loss of soil from the backshore area, with potential impacts upon the soil substrate's capacity to support structures at the KBC property. The Project is anticipated to protect the existing habitable structures on the property and represents the best shoreline management option assessed in this EIS.

V

SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

V. SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

The development of the Project may result in certain unavoidable construction-related impacts as outlined in **Chapter III**.

Potential effects include construction related noise, air quality, and water quality impacts occurring during the site preparation, sand recovery, sand transport, sand placement, and groin construction (in the case of the Beach Stabilization Alternative) phases of the Project. These impacts would arise as a direct result of construction activities, such as the generation of noise from construction equipment, the generation of dust and other airborne particulates, nearshore turbidity during sand recovery and in-water work, and erosion from wind and stormwater runoff during grading and other construction activity. Appropriate BMPs (e.g., the use of sound attenuating construction equipment), would be used, where practicable, to mitigate noise impacts caused by construction. Silt curtains would be used to mitigate potential impacts of nearshore turbidity during sand placement and groin construction (in the case of the Beach Stabilization alternative). Water quality monitoring would occur daily at the Sand Recovery Site and Project Site to ensure that construction activities do not result in significant adverse environmental impacts.

During construction, there would be temporary visual impacts at the Sand Recovery Site and Project Site. The sand recovery barges will present a visual impact from shore for the duration of sand recovery operations. At the Project Site, construction equipment and restricted access would create a visual impact for the duration of construction activities.

Construction activities taking place in the nearshore waters are expected to directly impact marine ecology, ocean recreation, and shoreline access in the area. For the Beach Stabilization alternative, an estimated 33,000 cy of sand would be removed from the Sand Recovery Site and placed on Honokōwai Beach. The Beach Nourishment alternative would require approximately 27,000 cy of sand, and the Beach Maintenance alternative would require a total of approximately 47,000 cy of sand over 50 years. During sand recovery operations, minor turbidity would be expected as sand is brought from the seafloor to the barge with an environmental clamshell bucket. This removal of sand would temporarily alter bathymetry and disrupt ecology within the extent of the dredge footprint. Anchor lines for the sand recovery barge would be in place for the duration of sand recovery operations. The recovered sand, though highly compatible with the dry beach sand, would still have some fine content that would be winnowed from the beach system and moved offshore during the initial equilibration process and consequent beach erosion events.

The CIA cites temporary impacts to cultural resources and practices for all three (3) action alternatives. There are anticipated to be temporary impacts at the Project Site and Sand Recovery Site related to fishing, ocean gathering, and the setting and feeling at Puʻu Kekaʻa. The CIA also

cites potential effects from the No Action alternative on cultural practices and resources due to loss of beach environment from ongoing erosion.

The foregoing unavoidable effects are temporary in nature and associated with project construction. Mitigation measures may include, among others, the BMPs cited above, which are anticipated to provide the necessary environmental protections, and should appropriately address public safety and welfare considerations to ensure Project implementation with the least amount of inconvenience, nuisance, and detriment.

For the Beach Stabilization alternative, the construction of stabilizing groins would result in a permanent visual impact at the Project Site. The presence of groins would alter the physical and visual landscape of the shoreline and nearshore areas; however, impacts to the scenic resources will be balanced by the benefits associated with stabilizing the only sandy beach in the area. Based upon ethnographic data gathered from interviewees, the CIA anticipates additional impacts for the stabilizing groins, including possible long-term impacts to flora, fauna, intangible cultural resources, and cultural practices.

As noted previously, the proposed Hoʻāla Honokōwai Project would, in the mid-term, provide a wider and more stable sandy shoreline at the Project Site if Beach Stabilization, the preferred alternative, is pursued. For Beach Stabilization, the construction of stabilizing groins would pose an unavoidable permanent impact to the nearshore environment within the 46,145 s.f. footprint of the groins, which extends seaward of the existing beach toe. Groin construction and sand placement in the Honokōwai Littoral Cell would bury areas of rocky substrate in the nearshore environment. Much of the substrate in the Project Site has been exposed through beach erosion in recent years and is barren, but there are portions which are colonized by algae or other marine species and may be affected by the Proposed Action. Ultimately, however, the groins are anticipated to create a more complex habitat in the nearshore environment which may increase overall fish biomass and biodiversity.

While the Beach Nourishment and Beach Maintenance alternatives would not involve construction of stabilizing groins, they would involve placement of sand which may bury areas of rocky substrate that were previously covered by sand and have been exposed through beach erosion. As such, the Beach Nourishment and Beach Maintenance alternatives also result in an unavoidable impacts to the nearshore environment.

VI

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

VI. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible or irretrievable commitment of resources refers to impacts on or losses to resources that cannot be recovered or reversed. Examples can include permanent conversion of wetlands and the loss of cultural resources, soils, wildlife, or agricultural production. Implementation of the proposed project would be expected to result in the irreversible and irretreivable committment of submerged lands and other non-renewable resources, including energy, labor and material resources. However, this commitment of resources is considered appropriate in the context of the project's mid-term objectives of creating a wider and in the case of Beach Stabilization, a more stable sandy shoreline at Honokōwai Beach, improving shoreline resilience to sea level rise and future erosion, and providing continued cultural and recreational shoreline access.

The proposed project would include work along the shoreline and in-water work in the nearshore environment. Implementation of the Preferred Alternative would entail the irretrievable commitment of submerged lands within the groin footprint and areas of sand placement. Bathymetry within the groin footprint and between groins would be permanently altered by groin construction and sand placement. The proposed Project would require the use of non-renewable resources including recovered sand and stone. The Preferred Alternative would require 33,000 cy of sand to be recovered from the Sand Recovery Site. Up to 47,000 cy would be required for the Beach Maintenance alternative and 27,000 cy of sand would be required for the Beach Nourishment alternative, recovered offshore of Kā‘anapali at the Sand Recovery Site. Stones of varying sizes would be sourced from existing quarries to construct the groins for the Beach Stabilization alternative. Approximately 22,442 tons of stone are needed to construct the groins.

While the sand and stone would be moved from their current locations, both would continue to serve as environmental resources. The sand would expand beach resources and form the foundation of a gently sloping sandy beach, while the stone will stabilize the beach and shoreline and provide a more complex nearshore habitat for marine flora and fauna. The commitment of resources described herein are considered appropriate in the context that the shoreline would be stabilized at Honokōwai Beach in the mid-term while long-term adaptation strategies for coastal erosion and sea level rise can be developed.

VII

RELATIONSHIP BETWEEN THE SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

VII. RELATIONSHIP BETWEEN THE SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

This chapter discusses the relationship between the short-term uses of environmental resources and the long-term productivity of these resources. The Proposed Action is intended to restore and preserve Honokōwai Beach via implementation of Beach Nourishment, Beach Maintenance, or Beach Stabilization. Each of these action alternatives would involve temporary construction-related impacts to the Project Site and Sand Recovery Site associated with sand and materials recovery, transport, and placement. Beach Stabilization, the Preferred Alternative, would also involve stone transport and construction of stabilizing groins. All alternatives, including the No Action alternative, would involve short-term impacts related to removal of the temporary erosion skirt at the Project Site. In the case of Beach Maintenance, construction-related impacts would recur with each sand placement action approximately every 10 years. Environmental parameters and resources that may be temporarily affected during Project construction include land use, air and noise quality, the marine and terrestrial environment, drainage, traffic, and greenhouse gas emissions. These environmental resources and parameters have been assessed with respect to the maintenance and enhancement of long-term environmental productivity. The assessment of these resources is summarized in **Table 26**.

Table 26. Assessment of the Relationship Between the Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Environmental Resource Parameter	Relationship Assessment
Land Use	The Proposed Action is intended to preserve and potentially enhance the range of beneficial uses at Honokōwai Beach, an important public trust resource. Use of the beach would be temporarily limited during Project construction, however, the Project would result in a long-term benefit of preserving a wider (and in the case of Beach Stabilization, more stable) sandy beach for future use at the Project Site. The Proposed Action would not foreclose future options for land use, and would provide additional time for long-term adaptation planning which may include consideration of alternative adaptation pathways, such as retreat from the shoreline. In addition, the Proposed Action would preserve safe access to the beach and along the shoreline, and would prevent potentially hazardous beach conditions associated with chronic, seasonal and episodic erosion, such as development of an escarpment (steep drop-off) with exposed rocky substrate, which would make ocean entry and exit more hazardous.

Environmental Resource Parameter	Relationship Assessment
Marine and Terrestrial Environment	The Beach Nourishment, Beach Maintenance, and Beach Stabilization alternatives would each involve recovery of sand offshore, and transport and placement of sand at the Project Site. These actions would result in temporary impacts within the marine environment, including alteration of the seafloor at the Sand Recovery Site, elevated turbidity, and disruption to marine species in the vicinity of active work areas. Likewise, temporary disruption of the terrestrial environment would be anticipated during sand placement and groin construction (for Beach Stabilization), as well as during removal of the temporary erosion skirt. However, the Proposed Action would be anticipated to result in an ongoing beneficial impact to the marine and terrestrial environment by preserving a wider (and in the case of Beach Stabilization, more stable) sandy beach, and preventing backshore erosion and its resulting impacts of deteriorating water quality and elevated turbidity levels.
Cultural, Scenic, Public Trust, and Recreational Resources	Construction activities would result in a temporary impact to cultural, scenic, and recreational resources at the Project Site, as well as a long-term change to scenic views in the case of Beach Stabilization due to the presence of the groins. In addition, the presence of barges at the Sand Recovery Site would temporarily alter the scenic environment and cultural sense of place at Puʻu Kekaʻa during sand recovery operations. However, the Project would result in long-term benefits to these resources at Honokōwai Beach through preservation of the beach. The Proposed Action restores eroded lands, protects cultural and ecological resources, and strengthens resilience for future generations.
Air and Noise Quality	Construction of the Proposed Action would result in temporary construction–related impacts to air quality and noise conditions. BMPs would be used to ensure that impacts associated with construction are mitigated to the maximum extent practicable. In addition, as warranted, the contractor(s) will obtain a noise permit in accordance with the Department of Health's Administrative Rules, Title 11, Chapter 46, Community Noise Control. In the long term, the proposed improvements are not anticipated to be sources of adverse air and noise pollution.
Greenhouse Gases	The Proposed Action would lead to a temporary increase in greenhouse gas (GHG) emissions due to sand recovery and transport activities, as well as the operation of construction equipment for sand placement and construction of the groins (for Beach Stabilization). The emissions which would be generated from construction activities are not considered significant. Inasmuch as the Proposed Action does not involve new land uses, the Project would not generate new long-term GHG emissions.

Environmental Resource Parameter	Relationship Assessment
Drainage	Construction may create temporary drainage impacts from stormwater runoff, such as increased sediment draining into nearshore waters. Erosion control BMPs would be implemented to minimize the temporary construction-related drainage impacts. The Proposed Action is anticipated to have an ongoing beneficial effect of preventing beach and backshore erosion, which could otherwise impact drainage systems by exposing them to seawater, wave action, and increased sedimentation.
Traffic	Each of the Proposed Action alternatives would involve generation of vehicle trips associated with sand and materials transport and construction activity. It is noted that the No Action alternative would also result in generation of vehicle trips related to removal of the temporary erosion skirt from the site. According to the Traffic Impact Analysis Report, traffic impacts are not anticipated to be significant, and would not extend beyond the construction period for each alternative.

The tradeoff for the short-term construction-related impacts discussed above is the implementation of a mid-term solution for Honokōwai Beach which achieves the Project's four (4) objectives of 1) improving beach stability (in the case of the Beach Stabilization alternative), 2) preserving and enhancing cultural and shoreline access, 3) increasing resilience to coastal hazards and sea level rise, and 4) enabling planning for long-term adaptation to sea level rise.

UNRESOLVED ISSUES | VIII

VIII. UNRESOLVED ISSUES

The following section summarizes the issues that remain unresolved at the time of writing the Draft Environmental Impact Statement (EIS).

A. PROJECT FUNDING

While the proposed Project would be fully funded by private parties, specific funding sources would be identified following completion of the Chapter 343, Hawai‘i Revised Statutes (HRS) environmental review process. It is noted that the funding sources for the Proposed Action do not affect the project scope nor the assessment of potential environmental impacts associated with the Proposed Action.

B. CONSTRUCTION DESIGN, MEANS AND METHODS

The construction design, means, and methods for the Proposed Action remain unresolved at this stage of the environmental review process. The preferred alternative of Beach Stabilization utilizes armor stone, which is not typically stockpiled for extended periods of time and is therefore difficult to secure well in advance of construction. Final construction plans, including the selection of materials, sources of materials, and specific construction techniques, will be determined following the completion of the HRS Chapter 343 review. Additionally, decisions regarding the location of staging or laydown areas, access routes, and any temporary infrastructure needed during construction have not yet been finalized. These details will be developed in consultation with relevant stakeholders and regulatory agencies to ensure compliance with environmental standards and minimize potential impacts.

C. SECONDARY RELATED ACTIONS

The Project may incorporate secondary actions, aimed at further increasing resiliency and reducing exposure to or risk from climate change and coastal hazards. These secondary actions would be limited to common elements of the KBC property and may include modification or strategic relocation of existing common elements of the KBC property within the Project Site, such as walkways, landscape and hardscape features, and water features. Secondary actions may also include environmental restoration actions or public access improvements within the KBC property or shoreline areas. Secondary actions would not involve any intensification of uses within the KBC property that would present adverse environmental impacts. It is anticipated that identification of secondary related actions would occur during agency and community consultation during the Chapter 343, HRS environmental review process, but may also continue beyond the completion of this process.

D. PERMITS, EASEMENTS, AND RIGHTS-OF-WAY

The necessary permits, easements, and rights-of-way required for the Proposed Action are currently unresolved and will be addressed following the completion of the Chapter 343, HRS environmental review process. The list of anticipated permits and approvals that may be required for the Proposed Action is presented in Chapter IX. At this stage, the specific permits needed from local, state, and federal agencies, such as permits for construction and access for shoreline activities have not yet been secured. The placement of sand and structures seaward of the shoreline involves land managed by the State of Hawai‘i. As such, a land disposition will need to be obtained from the Department of Land and Natural Resources (DLNR), Land Division, the terms of which are yet unresolved. For the Beach Stabilization alternative, a non-exclusive easement would likely need to be obtained, while the Beach Nourishment and Beach Maintenance alternatives would likely require a right-of-entry permit. Similarly, the identification and acquisition of any other required easements or rights-of-way (e.g., over neighboring parcels) for construction access or long-term maintenance are still to be finalized. These legal and regulatory requirements will be resolved in accordance with applicable laws and in coordination with the appropriate agencies or parties following completion of the environmental review process.

E. ACCESS AND USE OF STABILIZING GROINS

The four (4) groins presented for the Beach Stabilization alternative have been designed to meet engineering requirements to maintain a stable beach. While the purpose of stabilizing groins is to preserve and stabilize the beach against chronic and episodic erosion, individuals may seek access to the groins for fishing or other recreational activities. The terms of a non-exclusive easement from the DLNR, which is anticipated to be required for placement of the groins, may include specifications regarding public access to the easement. Public access and use of the groins may be explored with the DLNR and other government agencies.

F. LONG-TERM ADAPTATION

A number of strategies, in addition to the alternatives assessed in this EIS, may be implemented individually or in combination for long-term adaptation to climate change. These strategies include resist, accommodate, avoid, retreat, and advance. Long-term adaptation planning is anticipated to occur beyond the timeline of the Proposed Action. The Proposed Action is a mid-term solution which is intended to protect Honokōwai Beach and help to maintain this public trust resource and its environmental, cultural, social, recreational, and economic value while allowing sufficient time for the long-term process of developing and implementing adaptation strategies.

LIST OF PERMITS AND APPROVALS

IX

IX. LIST OF PERMITS AND APPROVALS

The following is a preliminary list of Federal, State, and County permits and approvals that may be required for Project implementation.

Federal:

1. Department of the Army Section 10, Rivers and Harbors Act for work in or over Navigable Waters of the U.S.
2. Clean Water Act Section 404 Individual Permit
3. Other Federal laws that potentially could be triggered by the Proposed Action include:
    - Archaeological and Historic Preservation Act (16 USC § 469a-1)
    - National Historic Preservation Act of 1966 (16 USC § 470(f))
    - Native American Graves Protection and Repatriation Act of 1990 (25 USC § 3001)
    - Clean Air Act (42 USC § 7506(C))
    - Coastal Zone Management Act (16 USC § 1451 et seq.)
    - Endangered Species Act (16 USC § 1531 et seq.)
    - Magnuson-Stevens Fishery Conservation and Management Act (16 USC § 1801 et seq.)
    - Marine Mammal Protection Act of 1972, as amended (16 USC §§ 1361-1421(H) et seq.)
    - Migratory Bird Treaty Act of 1918, as amended (16 USC §§ 703-712)
    - Fish and Wildlife Coordination Act of 1934, as amended (16 USC § 661 et seq.)
    - Executive Order (EO) 13089, Coral Reef Protection (63 FR 32701)
    - EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (16 USC § 703-711 (66 FR 3853))
    - EO 12898, Environmental Justice

State of Hawai‘i:

1. Shoreline Certification
2. Chapter 6E, HRS Historic Preservation Review
3. Department of Health, Community Noise Permit
4. Conservation District Use Permit (CDUP)
5. Coastal Zone Management Consistency Review
6. Clean Water Act Section 401 Water Quality Certification (WQC)
7. National Pollutant Discharge Elimination System (NPDES) Permit
8. Right of Entry Permit
9. Revocable Permit, as applicable
10. Term, Non-Exclusive Easement, as applicable

County of Maui:

1. Special Management Area (SMA) Permit
2. Shoreline Setback Approval (SSA) (for sand placement)
3. Shoreline Setback Variance (SSV) (for stabilizing groins)
4. Grubbing and Grading Permit
5. Building Permit
6. Coastal High Hazard Area Certification
7. Special Flood Hazard Area Development Permit

CONSULTATION AND OUTREACH IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

X

X. CONSULTATION AND OUTREACH IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

Consultation between the Applicant, West Maui Resort Partners, L.P., Sea Engineering, Inc. (SE) and the Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL) and County of Maui, Department of Planning regarding beach restoration at Honokōwai Beach has been ongoing for several years, beginning in 2016 with the design and subsequent implementation of a temporary erosion skirt in the Project Site. The purpose of this consultation and work has been to restore and preserve Honokōwai Beach.

Ongoing Consultation with State of Hawai‘i and County of Maui

As part of the ongoing consultation between the Applicant, the OCCL, and the County Department of Planning, monthly monitoring reports and quarterly progress reports have been provided to these agencies on a regular basis.

Monthly Monitoring Reports

As previously noted, a temporary erosion skirt was installed at the Project Site in 2018. Monthly monitoring of the temporary erosion skirt has been ongoing pursuant to Condition No. 14 of Shoreline Setback Approval (SSA) 2020/0062, which states that "*The Kā‘anapali Beach Club monitor shoreline conditions of its property and submit a report, consisting of dated photographs, documenting such conditions to the Department on the first day of each month, starting upon commencement of the work and continuing each month thereafter. Included shall be a site map showing where and in what direction such pictures are taken. Of particular interest is the integrity of the temporary erosion control measure and sand levels in front of it".* In compliance with this condition, SE, on behalf of the Applicant, submits monthly monitoring reports with photographs of the shoreline to the County of Maui Department of Planning and OCCL on or around the first of each month.

Quarterly Progress Reports

In addition to the monthly monitoring reports, quarterly progress reports have been voluntarily submitted to the OCCL and County Department of Planning, which outline overall progress on various items related to beach restoration at Honokōwai Beach. This includes updates on the temporary erosion skirt as well as updates on progress on the EIS process for the beach restoration Project. The intent of these voluntary quarterly reports is to provide transparency into the Applicant's commitment and ongoing efforts to pursue a mid-term solution, which would allow for the removal of the temporary erosion skirt and provide a wider and in the case of Beach Stabilization, a more stable beach at Honokōwai Beach.

Early Consultations Prior to Publication of the EIS Preparation Notice

Early consultations were conducted with the following agencies, landowners, individuals, and citizen groups prior to the publication of the EIS Preparation Notice (EISPN):

Agencies Consulted

Department of the Army, Honolulu Regulatory Branch
County of Maui Planning Department
Department of Land and Natural Resources Office of Conservation Coastal Lands
Department of Land and Natural Resources Division of Aquatic Resources

Landowners, Individuals, and Citizen Groups Consulted

Maui Kai Condominium
Kaanapali Shores Condominium
Don McLeish (local photographer and surfer)
Tova Callender (West Maui Ridge to Reef Initiative)
The Surfrider Foundation, Maui Chapter
Councilmember Tamara Paltin, Maui County Council (West Maui)
West Maui Preservation Association

EIS Public Scoping Meeting

Pursuant to HAR § 11-200.1-4(b)(4), a public scoping meeting was held on January 17, 2023, at the Lahaina Civic Center during the EISPN 30-day public comment period. The purpose of the public scoping meeting was to provide agencies, citizen groups, and the public with an opportunity to assist the proposing agency in determining the range of actions, alternatives, impacts, and proposed mitigation measures to be considered in the Draft EIS and the significant issues to be analyzed in depth in the Draft EIS. A copy of the presentation, posters, and sign in sheets from the meeting are provided in **Appendix "N-1"**.

The public scoping meeting included a separate portion reserved for oral comments; that portion of the public scoping meeting was audio recorded. The audio recording will be submitted together with this Draft EIS. Thirteen individuals provided oral comments on the Project. Oral comments were provided on topics including, but not limited to the following:

- Request to provide an overview of the EIS process and implementation timeline, Project lifespan, and key project stakeholders and funders.
- Request for an assessment of potential environmental impacts to the reef, ocean processes, ocean ecology, sea level rise, and island subsidence.
- Comments regarding impacts to recreational use of the beach and nearshore waters, such as swimming, boating, and surfing
- Comments regarding impacts to traditional and cultural uses of the beach.

- Request for an analysis of cultural resources, local history, and place knowledge from local residents.
- Comments comparing the proposed Project to the Iroquois Point project on Oʻahu and the proposed Kahana Beach groin project.
- Comments regarding impacts of T-groins on neighboring properties, nearby surfing waves, boat traffic, diving, and fishing.
- Comments that the proposed Project benefits tourism and lacks benefits for other public beaches such as Honokōwai Beach Park.
- Comments regarding impacts of shoreline hardening structures such as seawalls and oceanfront structures and the damage that can occur as a result of such structures as well as vegetation such as naupaka.
- Request for managed retreat and nearby geology to be analyzed in the Draft EIS. Comments regarding managed retreat included consideration of removal of pools, walkways, patios, and buildings along the shoreline.
- Request for information regarding project cost and funding sources.

In addition to oral comments, three (3) written comments were provided at the scoping meeting as well. Copies of these comments and written responses are attached in **Appendix "N-2"**.

Distribution of EISPN

The following agencies, organizations, and individuals were directly notified of publication of the EISPN for the Hoʻāla Honokōwai Project. It is noted that the individuals named in the list below represent the agency directors at the time of the EISPN publication and may not reflect the current agency leadership.

A total of 21 written comment letters were received on the EISPN. The agencies and organizations which provided no comment are noted below. Comments on EISPN and responses to those comments can be found in **Appendix "M"**.

	Agency	Date of Comment Letter			Agency	Date of Comment Letter
FEDERAL AGENCIES						
1	John P. Hoffmann, Center Director Pacific Islands Water Science Center U.S. Geological Survey 1845 Wasp Boulevard, B176 Honolulu, Hawaiʻi 96818	No Comment		2	Chelsie Javar-Salas, Acting Island Team Leader Pacific Islands Fish and Wildlife Office U.S. Fish and Wildlife Service 300 Ala Moana Boulevard., Room 3-122 Honolulu, Hawaiʻi 96850	No Comment

	Agency	Date of Comment Letter
3	Pacific Islands Regional Office National Marine Fisheries Service U.S. Department of Commerce 1845 Wasp Blvd., Building 176 Honolulu, Hawai‘i 96818	No Comment
4	Frank Lands, Regional Director National Park Service U.S. Department of the Interior 333 Bush Street, Suite 500 San Francisco, CA 94104	No Comment
5	Gerald Gregory, District Conservationist Natural Resources Conservation Service U.S. Department of Agriculture 77 Hoʻokele Street, Suite 202 Kahului, Hawai‘i 96732	No Comment
6	Linda Speerstra, Chief U.S. Army Corps of Engineers, Honolulu District U.S. Department of the Army Regulatory Branch, Bldg. 230 Fort Shafter, Hawai‘i 96858 Via email: CEPOH-RO@usace.army.mil	No Comment
7	Commander, 14th Coast Guard District U.S. Department of Homeland Security Coast Guard 300 Ala Moana Boulevard, Room 9-204 Honolulu, Hawai‘i 96850	No Comment
8	Pacific Islands Office U.S. Environmental Protection Agency, Region 4 P.O. Box 50003 Honolulu, Hawai‘i 96850	No Comment
STATE OF HAWAI‘I AGENCIES		
9	Phyllis Shimabukuro-Geiser, Chair State of Hawai‘i Department of Agriculture 1428 South King Street Honolulu, Hawai‘i 96814	No Comment
10	Keith Regan, Comptroller State of Hawai‘i Department of Accounting and General Services 1151 Punchbowl Street, #426 Honolulu, Hawai‘i 96813	01/12/23
11	Chris Sadayasu, Director State of Hawai‘i Department of Business, Economic Development & Tourism P.O. Box 2359 Honolulu, Hawai‘i 96804	No Comment
12	Major General Kenneth Hara, Adjutant General State of Hawai‘i Department of Defense 3949 Diamond Head Road Honolulu, Hawai‘i 96816	No Comment
13	William Aila, Jr., Chairman State of Hawai‘i Department of Hawaiian Home Lands P.O. Box 1879 Honolulu, Hawai‘i 96805	No Comment
14	Patti Kitkowski, District Environmental Health Program Chief Department of Health, Maui Sanitation Branch State of Hawai‘i 54 South High Street, Room 300 Wailuku, Hawai‘i 96793	12/30/22
15	State of Hawai‘i Department of Health Environmental Health Administration P.O. Box 3378 Honolulu Hawai‘i 96801	No Comment
16	Alec Wong, P.E., Chief State of Hawai‘i Department of Health Clean Water Branch Hale Ola, Room 225 2827 Waimano Home Road Pearl City, Hawai‘i 96782	No Comment

	Agency	Date of Comment Letter
17	Lene Ichinotsubo State of Hawai'i Department of Health, Solid and Hazardous Waste Branch 2827 Waimano Road, Suite 100 Pearl City, Hawai'i 96782	No Comment
18	Suzanne Case, Chairperson State of Hawai'i Department of Land and Natural Resources P. O. Box 621 Honolulu, Hawai'i 96809 Via email: dlnr@hawaii.gov and dlnr.land@hawaii.gov	01/23/23 and 02/01/23
19	Dan Orodenker, Executive Officer State of Hawai'i State Land Use Commission P.O. Box 2359 Honolulu, Hawai'i 96804	No Comment
20	Edwin Sniffen, Director State of Hawai'i Department of Transportation 869 Punchbowl Street Honolulu, Hawai'i 96813	01/18/23
21	Scott Glenn, Director State of Hawai'i Office of Planning and Sustainable Development P. O. Box 2359 Honolulu, Hawai'i 96804	01/24/23
22	Sylvia Hussey, Chief Executive Officer State of Hawai'i Office of Hawaiian Affairs 560 N. Nimitz Highway, Suite 200 Honolulu, Hawai'i 96817	No Comment
23	Sea Grant Program University of Hawai'i 2525 Correa Road Hawai'i Institute of Geophysics, Room 238 Honolulu, Hawai'i 96822	No Comment

	Agency	Date of Comment Letter
COUNTY OF MAUI AGENCIES		
24	Eric Nakagawa, Director County of Maui Department of Environmental Management 200 South High Street Wailuku, Hawai'i 96793	No Comment
25	Brad Ventura, Chief County of Maui Department of Fire and Public Safety 200 Dairy Road Kahului, Hawai'i 96732	No Comment
26	Karla Peters, Director County of Maui Department of Parks and Recreation 700 Halia Nakoa Street, Unit 2F Wailuku, Hawai'i 96793	01/13/23
27	Michele Chouteau McLean, Director County of Maui Department of Planning 2200 Main Street, Suite 315 Wailuku, Hawai'i 96793	01/23/23
28	Jordan Molina, Director County of Maui Department of Public Works 200 South High Street Wailuku, Hawai'i 96793	No Comment
29	Herman Andaya, Emergency Management Officer County of Maui Emergency Management Agency 200 South High Street Wailuku, Hawai'i 96793	No Comment
30	JoAnn Inamasu, Director County of Maui Office of Economic Development 2200 Main Street, Suite 305 Wailuku, Hawai'i 96793	No Comment

	Agency	Date of Comment Letter
31	John Pelletier, Chief County of Maui Police Department 55 Mahalani Street Wailuku, Hawai‘i 96793	02/01/23
ELECTED OFFICIALS		
32	Mazie K. Hirono, U.S. Senator 300 Ala Moana Blvd., Rm. 3-106 Honolulu, Hawai‘i 96850	No Comment
33	Brian E. Schatz, U.S. Senator 300 Ala Moana Blvd., Rm. 7-212 Honolulu, Hawai‘i 96850	No Comment
34	Ed Case, U.S. Representative 1003 Bishop St., Suite 1110 Honolulu, Hawai‘i 96813	No Comment
35	Kaiali‘i Kahele, U.S. Representative 99 Aupuni St., Suite 118 Hilo, Hawai‘i 96720	No Comment
36	Angus L.K. McKelvey, State Senator Hawai‘i State Capitol, Room 223 415 S. Beretania Street Honolulu, Hawai‘i 96813	No Comment
37	Elle Cochran, State Representative 415 S. Beretania Street Honolulu, Hawai‘i 96813	No Comment
38	Michael Victorino, Mayor County of Maui 200 South High Street Wailuku, Hawai‘i 96793	No Comment
39	Yuki Lei Sugimura, Council Vice-Chair Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	No Comment
40	Keani Rawlins-Fernandez, Council Vice Chair Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	No Comment
41	Alice Lee, Council Chair Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	No Comment
42	Gabe Johnson Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	No Comment
43	Tasha Kama Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	No Comment
44	Kelly King Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	No Comment
45	Mike Molina Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	No Comment
46	Tamara Paltin Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	01/23/23
47	Shane Sinenci Maui County Council 200 South High Street Wailuku, Hawai‘i 96793	No Comment
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49	Maui Kai 106 Kā‘anapali Shores Place Lahaina, Hawai‘i 96761	No Comment
50	Hawai‘i Tourism Authority 1801 Kalākaua Avenue, 1st Floor Honolulu, Hawai‘i 96815	No Comment

	Agency	Date of Comment Letter
51	West Maui Preservation Association P. O. Box 11150 Lahaina, Hawai'i 96761	No Comment
52	Tova Callender, Watershed Coordinator West Maui Ridge to Reef Initiative Via email: tova@westmauir2r.com	No Comment
53	Hawai'i Shore and Beach Preservation Association Via email: hisbpa@gmail.com	No Comment
54	Sierra Club Maui P.O. Box 791180 Paia, Hawai'i 96779	No Comment
55	Surfrider Foundation Maui Chapter P.O. Box 790549 Paia, Hawai'i 96779	No Comment
56	Ke'eaumoku Kapu, CEO 'Aha Moku O Maui Via email: kapukapuakea@gmail.com	No Comment
57	Kaipo Kekona, Kā'anapali Moku 'Aha Moku O Maui Via email: kekona83@gmail.com	No Comment
58	U'ilani Kapu, Lahaina Moku 'Aha Moku O Maui Via email: uilani.kapu@gmail.com	No Comment
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60	Harmony Colella Via email: hcolella@gmail.com	01/16/23 and 01/23/23
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62	Mark Deakos Via email: deakos@hawaii.edu	01/22/23
63	Kelly and Ken Fish Via email: kfish2@ptera.net	12/27/22
64	Paul Jenkins Via email: pjenkins@horizonelectricinc.com	12/28/22
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67	A.M. Quinlan Via email: amquinlan9@hotmail.com	12/26/22
68	Dave Williams Via email: davewil@mc.net	12/27/22

[20] The following individuals submitted comments on the EISPN during the public comment period.

A copy of the letter requesting comments on the EISPN is provided below.

Sea Engineering, Inc.

Makai Research Pier • 41-305 Kalaniana'ole Hwy • Waimānalo, Hawai'i 96795-1820
Phone: (808) 259-7966 • Website: www.seaengineering.com

December 23, 2022

NAME, TITLE
AGENCY
ADDRESS
CITY, STATE ZIP CODE

SUBJECT: Environmental Impact Statement Preparation Notice for the Ho'āla Honokōwai Project, Tax Map Keys (2) 4-4-001:097, 098, and 100, Lāhainā, Maui, Hawai'i

Dear SALUTATION:

On behalf of the State of Hawai'i Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL) and in accordance with Chapter 11-200.1, Environmental Impact Statement Rules, Hawai'i Administrative Rules (HAR), we are transmitting the Environmental Impact Statement Preparation Notice (EISPN) for the subject project for your review and comment. The EISPN is scheduled to be published in the Office of Planning and Sustainable Development, Environmental Review Program's "The Environmental Notice" on December 23, 2022, and may be downloaded from the following link:

https://files.hawaii.gov/dbedt/erp/Doc_Library/2022-12-23-MA-EISPN-Hoala-Honokowai.pdf

Please note that the link will not be active prior to December 23, 2022. Should you have any problems accessing the EISPN, please do not hesitate to contact me.

A public scoping meeting for the project, as required by §11-200.1-23, HAR, will be held on January 17, 2023 from 5:00 p.m. to 7:00 p.m. at the Lāhainā Civic Center Social Hall located at 1840 Honoapi'ilani Highway, Lāhainā, Maui.

We would appreciate any comments you may have on the EISPN no later than January 23, 2023. Please send your comments to the following:

OCCL: Michael Cain, Administrator
Office of Conservation and Coastal Lands
Department of Land and Natural Resources
State of Hawai'i
1151 Punchbowl Street, Room 131
Honolulu, HI 96813
Email: michael.cain@hawaii.gov

Consultant: Andy Bohlander
Sea Engineering, Inc.
41-305 Kalaniana'ole Hwy
Waimānalo, HI 96795
Email: honokowai@seaengineering.com

If additional clarification is required, please contact me at (808) 460-3442 ext. 208 or via email at honokowai@seaengineering.com.

Very truly yours,

Andy Bohlander
Coastal Scientist & Project Manager

Enclosure
cc: Tyler Middleton, Hilton Grand Vacations Inc.
Michael Cain, Office of Conservation and Coastal Lands

REFERENCES XI

XI. REFERENCES

AECOS. 2012. *Iroquois Point Beach Nourishment and Stabilization Project: Preconstruction Marine Ecosystem Monitoring Report*.

Anderson, T.R., Fletcher, C.H., Barbee, M.M., Frazer, L.N., and Romine, B.M. 2015. *Doubling of coastal erosion under rising sea level by mid-century in Hawaii.* Natural Hazards. DOI 10.1007/s11069-015-1698-6.

AVISO+. n.d. *Satellite Altimetry Data*. www.aviso.altimetry.fr/en/data/products/ocean-indicators-products/mean-sea-level, (Accessed December 2024).

Bodge, K. 1998. *Beach Fill Stabilization with Tuned Structures: Experience in the Southeastern U.S.A. and Caribbean. Proc. Coastlines, Structures, and Breakwaters '98*, Thomas Telford Publishing, London, p. 82-93.

Bodge, K.R. 2003. *Design Aspects of Groins and Jetties. Advances in Coastal Structure Design.*ASCE, p. 181-199.

County of Maui, Department of Fire and Public Safety. n.d. *Ocean Safety*. https://www.mauicounty.gov/463/Ocean-Safety, Accessed December 11, 2024.

County of Maui, Department of Planning. 2022 *West Maui Community Plan*. https://www.mauicounty.gov/DocumentCenter/View/131915/West-Maui-Community-Plan-January-2022

Hawai'i Climate Change Mitigation and Adaptation Commission. 2021. *State of Hawai'i Sea Level Rise Viewer. Version 1.15*. Prepared by the Pacific Islands Ocean Observing System (PacIOOS) for the University of Hawai'i Sea Grant College Program and the State of Hawai'i Department of Land and Natural Resources, Office of Conservation and Coastal Lands, with funding from National Oceanic and Atmospheric Administration Office for Coastal Management Award No. NA16NOS4730016 and under the State of Hawai'i Department of Land and Natural Resources Contract No. 64064. http://hawaiisealevelriseviewer.org.

Hsu, J.R.C, and C. Evans. 1989. *Parabolic Bay Shapes and Applications. Proc. Institution of Civil Engineers*, Vol. 87, No. 4, pp557-570.

Klein, A.F., Vargas, A., Raabe, A.A., and Hsu, J.C. 2003. *Visual assessment of bayed beach stability with computer software.* Computers and Geosciences, vol. 29, p. 1249-1257.

Nerem R.S., Frederikse T., Hamlington B.D. 2012. *Extrapolating Empirical Models of Satellite-Observed Global Mean Sea Level to Estimate Future Sea Level Change*. https://doi.org/10.1029/2021EF002290.

NOAA Office of Ocean and Coastal Resource Management. 2012. *Wahikuli-Honokōwai Watershed Management Plan Volume 1: Watershed Characterization.* https://health.hawaii.gov/cwb/files/2013/05/WHWMP_Vol1_WatershedCharacterization_Dec2012small.pdf.

Sherrod, D. R., Sinton, J.M., Watkins, S.E., and Brunt, K.M. 2007. *U.S. Geological Service. Geologic Map of the State of Hawai'i, Sheet 7 – Island of Maui*. https://pubs.usgs.gov/of/2007/1089/Maui_2007.pdf.

Silvester, R., and J.R.C. Hsu. 1993. *Coastal Stabilization, Innovative Concepts*. Prentice Hall, New Jersey. 578 pp.

State of Hawai'i Department of Business, Economic Development & Tourism. 2022. *June 2022 Visitor Count Second Highest Since January 2020*. https://dbedt.hawaii.gov/blog/22-35/.

State of Hawai'i, Department of Business, Economic Development & Tourism. 2023. *The State of Hawai'i Data Book 2023. Temperatures and Precipitation for Selected Places: 2023*. https://files.hawaii.gov/dbedt/economic/databook/2023-individual/05/054623.pdf

State of Hawai'i, Department of Business, Economic Development & Tourism. 2024. *Vintage 2023 County Population Estimates for the State of Hawai'i: July 1, 2020 through July 1, 2023*. https://files.hawaii.gov/dbedt/census/popestimate/2023/county-pop/2023_county-pop-est_highlights.pdf

State of Hawai'i, Department of Business, Economic Development & Tourism, Research Economic Analysis Division. 2018. *Population and Economic Projections for the State of Hawai'i to 2045*. https://labor.hawaii.gov/wdc/files/2019/11/Handout-2-DBEDT-2045-long-range-forecast-p1-16.pdf

State of Hawai'i, Department of Land and Natural Resources Commission on Water Resource Management. 2019. *Instream Flow Standard Assessment Report: Island of Maui Hydrologic Unit 6010 Honokowai.* https://files.hawaii.gov/dlnr/cwrm/ifsar/PR201901-6010-HonokowaiDraft.pdf

State of Hawai'i, Office of Planning and Sustainable Development. 2025. *An Analysis of Managed Retreat Strategies in Hawai'i: Policy and Funding Opportunities and Challenges.* https://files.hawaii.gov/dbedt/op/czm/ormp/ormp_implementation/Managed20Retreat/25050720OPSD20MR20Final20Report_full20appendices20v2.pdf

State of Hawai'i, Office of Planning and Sustainable Development. 2019. *Assessing The Feasibility and Implications of Managed Retreat Strategies for Vulnerable Coastal Areas in Hawai'i.* https://files.hawaii.gov/dbedt/op/czm/ormp/assessing_the_feasibility_and_implications_of_managed_retreat_strategies_for_vulnerable_coastal_areas_in_hawaii.pdf

Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak. 2022. *Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines*. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service.

United States Department of Agriculture Natural Resources Conservation Service. n.d. *Web Soild Survey*. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

APPENDIX

A

COASTAL ENGINEERING ASSESSMENT

Coastal Engineering Assessment

Hoʻāla Honokōwai

Lahaina, Maui, Hawai'i
Tax Map Key Nos. (2) 4-4-001:097, 098, and 100

September 2025



Prepared for:
West Maui Resort Partners, L.P.
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1. INTRODUCTION

This report examines the critical beach loss event that occurred at Honokōwai Beach, Maui in 2016 and presents a strategic response to ongoing coastal challenges. Located on West Maui's coastline between Kāʻanapali and Kahana Bay, Honokōwai Beach serves as a vital cultural, recreational, and economic resource, providing rare public access amenities and supporting diverse community uses including fishing, diving, surfing, and cultural practices.

The 2016 episodic erosion event, triggered by persistent North Pacific swell and elevated water levels directly attributable to human-induced sea level rise, resulted in catastrophic beach loss and coastal damage. Within months, the shoreline retreated 6-12 feet—dramatically exceeding the historical average erosion rate—while approximately 5,600 square feet of land was permanently lost to avulsion. This event discharged over 1,000 cubic yards of sediment into nearshore waters, creating extensive turbidity plumes that compromised water quality and restricted community access to traditional shoreline and ocean-based activities.

Responding to this predominantly human-caused beach loss event is imperative for multiple interconnected reasons. The erosion and avulsion exposed critical infrastructure, created public safety hazards through vertical escarpments, and disrupted the natural sediment transport processes that maintain beach stability. Compounding these impacts, the surrounding shoreline's extensive artificial armoring—including seawalls, revetments, and other engineered structures—has created a semi-confined beach system that limits natural recovery processes. Without intervention, continued beach loss and shoreline recession threatens not only the immediate area's environmental integrity and public access, but also the broader coastal management goals essential for long-term adaptation to accelerating human-induced sea level rise.

1.1 Purpose and Need

Honokōwai Beach is an important natural, cultural, and aesthetic resource that supports a wide variety of cultural, recreational, and economic uses. The beach also acts as a natural buffer that absorbs wave energy and reduces exposure of the backshore land and infrastructure to erosion and flooding. Honokōwai Beach also provides a rare combination of perpendicular shoreline access, public parking, public restrooms, and ADA-compliant lateral shoreline access. The channel that bisects the fringing reef at Honokōwai Beach is also unique in that it provides direct access to the offshore waters. In addition to the direct and indirect benefits of the beach itself, the adjacent properties support the local economy.

Nearshore hydrodynamics (i.e. waves, currents, and water circulation) along the Honokōwai shoreline are complex. At Honokōwai Beach, sediment (e.g., sand) is transported in multiple directions due to a complex combination of wave exposure, bathymetry, water depths, nearshore currents, and sediment availability. As a result, beach width and sand volume at Honokōwai Beach are constantly changing due to seasonal and episodic variations. The beach is particularly sensitive to water levels and wave-induced currents that move sand along the shoreline. Elevated water

levels associated with human-induced sea level rise, as discussed in Chapter 2, have resulted in significant erosion, beach loss, avulsion[1], and shoreline recession.

In 2016, a combination of persistent North Pacific swell and elevated water levels produced high waves, strong currents, and abnormally high tides that caused significant erosion, avulsion, and beach loss at Honokōwai Beach (Figure 1-1). The beach was almost entirely lost to erosion and the backshore area was exposed to wave action, which resulted in a significant avulsion event. A vertical escarpment (steep slope) formed along the shoreline fronting the Project Site. The escarpment was 3 to 8 feet (ft) high along the shoreline Kāʻanapali Beach Club. The eroded embankment created a risk to public health, safety, and welfare, and impeded public access to and along the shoreline. Large sections of the embankment collapsed onto the shoreline, including trees, root balls, boulders, and large blocks of terrigenous sediment. The erosion exposed and damaged infrastructure including a concrete walkway, shower pads, irrigation lines, electrical wiring and propane gas lines. The erosion also threatened the northern flank of the Maui Kai Condominiums. The erosion, avulsion, and beach loss caused the shoreline to retreat 6 to 12 ft in just a few months, compared to the historical average erosion rate of -0.44 feet/year (ft/yr).

Approximately 5,600 square feet (sf) of fast land[2] was lost to avulsion, and over 1,000 cubic yards (cy) of alluvial sediment (i.e., clay, silt, boulders) was discharged into the ocean. Unlike beach sand, fast land is generally not capable of being restored by natural physical processes (e.g., accretion), so the loss of fast land can be considered permanent. The eroded and avulsed sediment caused turbidity plumes (i.e., brown water) to form in the nearshore waters extending up to 1,500 ft offshore (Figure 1-2), which negatively impacted water quality and prevented access to and use of the shoreline for cultural and recreational activities. The erosion dramatically altered the configuration and appearance of Honokōwai Beach. The conditions that caused the 2016 beach loss and avulsion event at Honokōwai Beach, and the severity of the impacts that occurred, are directly attributable to sea level rise which is a byproduct human-induced climate change. Photographs comparing the shoreline conditions before and after the 2016 beach loss and avulsion event are shown in Figure 1-3.

In 2018, an emergency erosion protection skirt (EEPS) was installed along the shoreline fronting Kāʻanapali Beach Club. The EEPS was a human response to erosion, beach loss, and avulsion that resulted from human-induced sea level rise. The EEPS was designed and constructed by Scott Brothers Pacific and consists of an erosion protection skirt constructed from geotextile fabric overlaid on sand-filled geotextile mattresses. The structure is approximately 500 feet long, 5 to 8 feet tall (depending on scarp height), and 8 to 12 feet wide at the base, with a total footprint of approximately 9,800 square feet. Photographs showing the condition of the shoreline before and after installation of the EEPS are shown in Figure 1-4.

[1] "**Avulsion"** is a sudden and perceptible loss of land caused by the action of water, such as from a storm or flood. Unlike accretion or erosion, which are gradual, *National Oceanic and Atmospheric Administration (NOAA), Coastal Zone Management Glossary*

[2] "Fast Land" refers to land located above the high-water mark.

The EEPS was authorized by the Hawaiʻi Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL) and the County of Maui, Department of Planning. WMRP and its predecessor, Diamond Resorts International, Inc., obtained the following permits and approvals from the State of Hawaiʻi and County of Maui:

- Emergency Conservation District Use Permit (MA-17-30; MA-21-06)
- Revocable Permit (RP S-7943)
- Emergency Special Management Area Use Permit (SM3 2020-0014)
- Shoreline Setback Approval (SSA 2020-0062)
- Environmental Assessment Exemption (EAE 2021-0003)
- Flood Development Permit (FDP 2021-0038)
- Building Permit (B 2021-1283)
- Grading Permit (G 2021-0194)

Monitoring has been performed before, during, and after construction of the EEPS to monitor the condition of the structure and identify any potential impacts of the EEPS on beach processes, water quality, benthic habitat, and shoreline access. The monitoring program has included collection of ground and aerial photographs, beach profile surveys, beach sand sampling and analysis, and marine environmental monitoring. Independent water quality monitoring has also been performed by Hui O Ka Wai Ola. The EEPS is intended to mitigate the erosion until a long-term plan can be implemented.

In October 2024, WMRP requested a time extension to extend the authorization period for E-CDUP MA-21-06. Maintaining the EEPS will allow time to complete the environmental review process and obtain the necessary permits and approvals to implement the beach restoration project.



Figure 1-1. Erosion and structural damage caused by 2016 beach loss and avulsion event.



Figure 1-2. Turbidity plumes caused by 2016 beach loss and avulsion event.



Figure 1-3. Conditions at Honokōwai Beach before (top) and after (bottom) 2016 beach loss and avulsion event

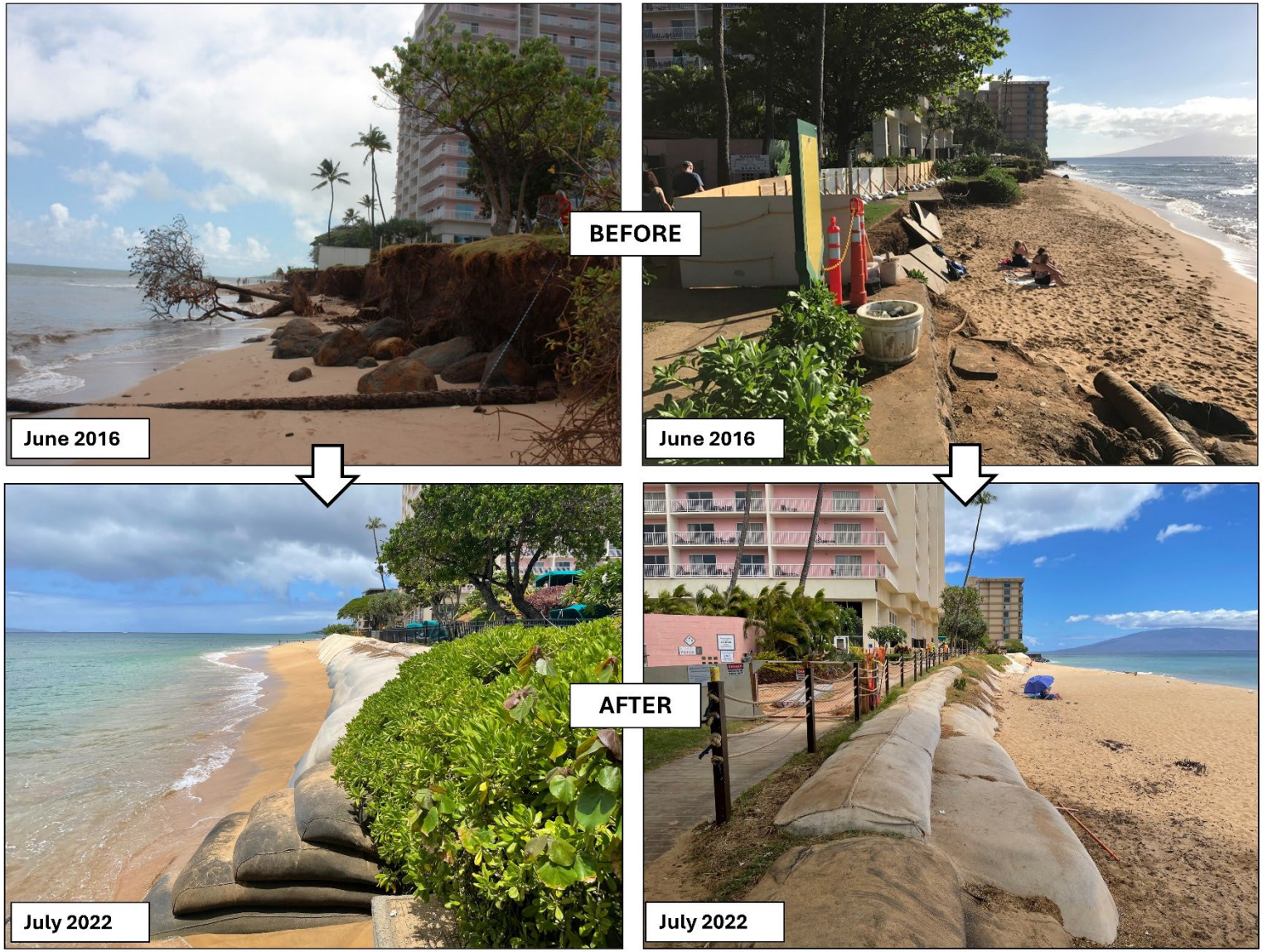


Figure 1-4. Conditions before (top) and after (bottom) installation of temporary erosion protection structure

1.2 Project Site Description

The Project Site, Honokōwai Beach, is located north of Kāʻanapali and south of Kahana Bay on the west coast of the island of Maui (Figure 1-5 and Figure 1-6). The beach supports a wide range of cultural and recreational uses and is a popular destination for beach goers, shoreline fisherman, spear fishers, divers, snorkelers, swimmers, surfers, and paddlers.

Honokōwai Beach is located at the southern end of the Honokōwai littoral cell[3], which extends from Honokōwai Point north to Kahana Bay and spans approximately 6,200 linear feet (lf) (1.15 miles (mi) of shoreline (Figure 1-7). The Project Site is located where the shoreline transitions from predominantly sandy beaches, dunes, and unarmored shoreline (south of Honokōwai Point) to predominantly rocky or armored shoreline (north of Honokōwai Point) (Figure 1-8) and consists of 1,000 lf of shoreline that is fronted by a sandy beach, locally referred to as Honokōwai Beach.

Honokōwai Beach provides a unique combination of perpendicular and lateral shoreline access and public amenities that is rare along the West Maui coastline (Figure 1-9). Perpendicular access to the shoreline is available via a paved road between Kāʻanapali Beach Club and Kāʻanapali Shores Condominium (adjacent property to the north). The public beach right of way features dedicated public parking stalls and a public changing station with restroom and shower facilities. Lateral shoreline access is available along the beach and via a coastal walkway that provides Americans with Disabilities Act (ADA)-compliant access along approximately 1,000 lf of shoreline from the south end of the Kāʻanapali Beach Club property to the north side of Honokōwai Stream.

The Project Site is located in the Kāʻanapali District and the Honokōwai Ahupuaʻa. The area between Honoapiʻilani Highway and the shoreline is located in the Special Management Area (SMA) and State Land Use Urban District. The area makai (seaward) of the shoreline consists of submerged lands that are located in the Resource Subzone of the Conservation District. The area mauka (landward) of the shoreline is densely developed with resort infrastructure. There are three (3) privately-owned parcels near the Project Site, all of which are zoned (H) Hotel by the County of Maui.

Honokōwai is a predominantly engineered coastline where the physical landscape has been modified by human-made structures and uses. The backshore is densely developed with resorts and condominiums, the foreshore is armored by shore protection structures, and Honokōwai Stream is channelized (Figure 1-10). Shoreline armoring begins approximately 800 feet (ft) south of the Project Site and extends north to Kahana Bay. There are only two unarmored properties in the Honokōwai littoral cell: Kāʻanapali Beach Club (within the Project Site) and Honokōwai Beach Park (0.5 mi north of the Project Site). Honokōwai Beach (Project Site) is bounded by man-made structures and relatively isolated from the adjacent shorelines to the north and south. As a result, Honokōwai Beach is a semi-confined beach system with unique characteristics that distinguish it from the surrounding shoreline areas.

[3] "Littoral Cell" is a coastal compartment that contains a complete cycle of sedimentation including sediment sources, transport paths, and sinks.

Honokōwai Beach is the northern terminus of a beach system that spans approximately 1.5 mi of shoreline between Puʻu Kekaʻa (Black Point) and Honokōwai Stream. The beach is widest to the south and gradually tapers as it approaches Honokowai Point and eventually terminates at Honokowai Stream. Honokōwai Beach is semi-confined between two dominant landscape features (Honokowai Point and Honokowai Stream). Sediment transport is primarily driven by wave-induced currents that are seasonal and bi-directional. As a result, Honokōwai Beach is seasonally dynamic and subject to seasonal variations in beach width and volume. During the summer months (May to October), southerly swell transports sand alongshore to the north (toward Honokōwai Beach). In contrast, during the winter months (November to April), this trend reverses and northerly swell transports sand alongshore to the south (away from Honokōwai Beach). Northerly swells are more energetic than southerly swells, which creates an imbalance in seasonal sediment transport dynamics that makes Honokōwai Beach more susceptible to erosion and beach loss.



Figure 1-5. Aerial photographs of the Project Site (Google Earth)





Figure 1-6. Oblique aerial photographs of the Project Site (06/07/2024)

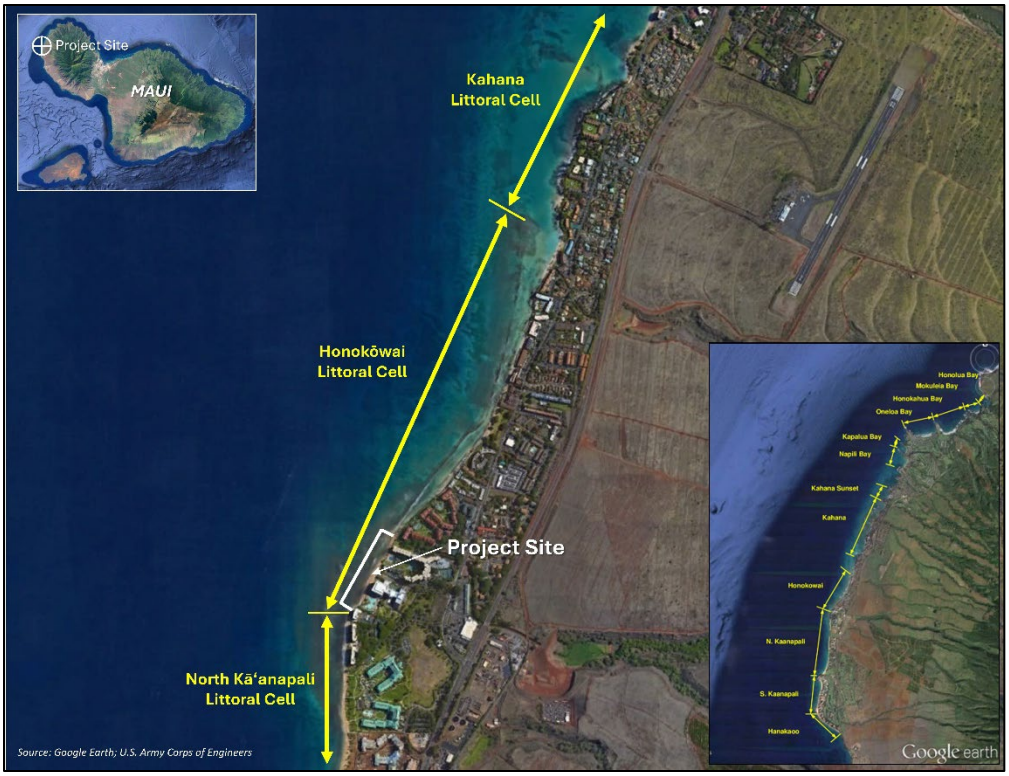


Figure 1-7. West Maui littoral cells (adapted from USACE, 2015)

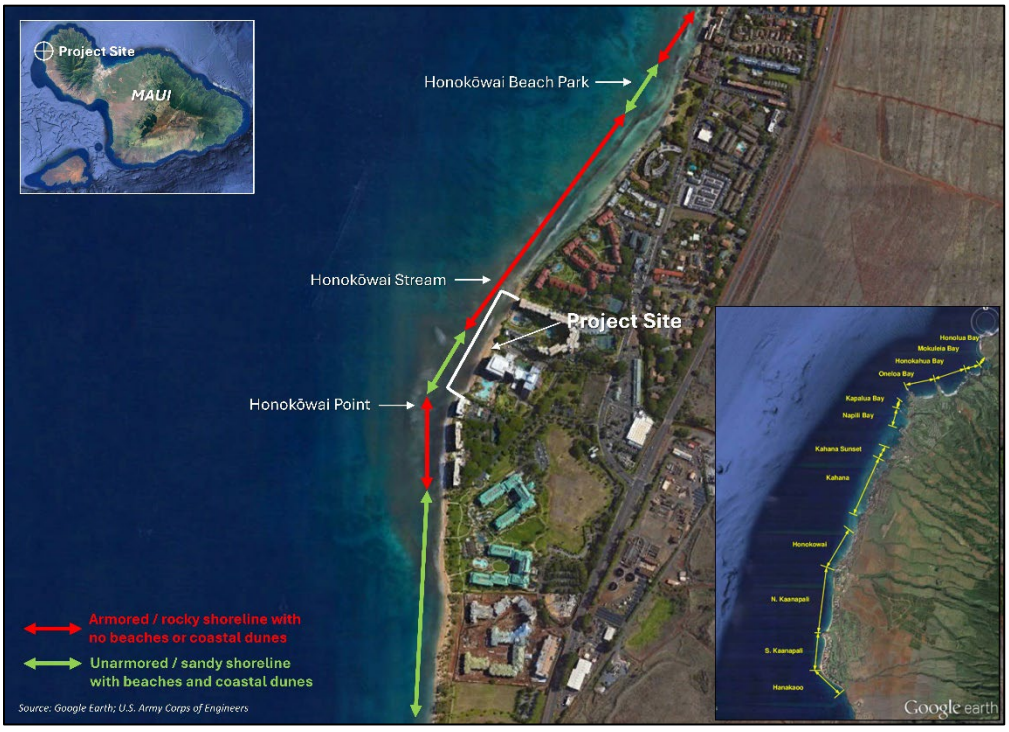


Figure 1-8. Character of coastline in the vicinity of the Project Site



Figure 1-9. Public access and amenities at Honokōwai Beach



Figure 1-10. Man-made shoreline structures in the vicinity of the Project Site

1.3 Project Objectives

Prior to the 2016 beach loss and avulsion event, Honokōwai Beach was a stable shoreline that experienced seasonal variations in beach width. The beach profile was characterized by features that are indicative of beach stability including an active lower beach face, a wide and elevated upper beach face, and an upper beach berm with stable vegetation (Figure 1-11). Prior to the 2016 beach loss and avulsion event, a sandy beach fronted the Maui Kai Condominiums, which enabled sediment exchange between the Honokōwai and North Kāʻanapali littoral cells. Stable beaches are typically less sensitive to erosional forces and more capable of recovery through natural processes.

In 2016, due to an unusual combination of persistent northerly swell, sustained elevated water levels, strong currents, and abnormally high tides, Honokōwai Beach was almost entirely lost to erosion. The erosion caused the shoreline to recede landward, which reduced the exchange of sediment (sand) between the Honokōwai and North Kāʻanapali littoral cells. The 2016 beach loss and avulsion event significantly reduced the volume of sand in the Honokōwai littoral cell, which has inhibited beach recovery. The reduction in sand volume and disruption of natural sediment transport have caused Honokōwai Beach to remain unstable (Figure 1-12), making it more sensitive to erosional forces and less capable of natural recovery.

The 2016 beach loss and avulsion event caused extensive environmental damage and negatively impacted the range of beneficial uses of Honokōwai Beach. The event caused substantial beach loss, structural damage, and created risks to public health, safety, and welfare, and impeded access to and along the shoreline and the avulsion that occurred due to the progressive erosion and beach loss resulted in the discharge of alluvial sediment (i.e., clay, dirt, and boulders) from the backshore, which caused the formation of large turbidity plumes that negatively impacted water quality. As previously discussed, the conditions that caused the 2016 beach loss and avulsion event at Honokōwai Beach, and the severity of the impacts that occurred, are directly attributable to sea level rise which is a byproduct human-induced climate change. West Maui Resort Partners, LP (WMRP) is proposing to restore and preserve Honokōwai Beach. The objectives of the Hoʻāla Honokōwai project are to:

- Restore beach width and improve beach stability.
- Preserve and enhance cultural and shoreline access.
- Increase resilience to coastal hazards and sea level rise; and
- Enable planning for long-term adaptation to sea level rise.

As previously discussed, Honokōwai Beach is a semi-confined beach system that is bounded by man-made structures. As a result, adaptation in response to human-induced sea level rise must be tailored to the unique environmental conditions that distinguish Honokōwai Beach's unique characteristics from the surrounding shoreline areas. It is anticipated that restoring Honokōwai Beach and preventing further erosion, shoreline recession, beach narrowing, and potential beach loss would have a positive net beneficial impact on the environment, including preserving the beach and improving water quality. It is also anticipated that beach restoration would help to preserve and enhance the fundamental character of Honokōwai Beach by maintaining shoreline access and supporting existing uses along the shoreline. Beach restoration is also anticipated to make the beach and the surrounding shoreline less sensitive to erosion and more resilient to human-induced sea level rise.



Figure 1-11. Stable beach before 2016 beach loss and avulsion event (1/15/2009)

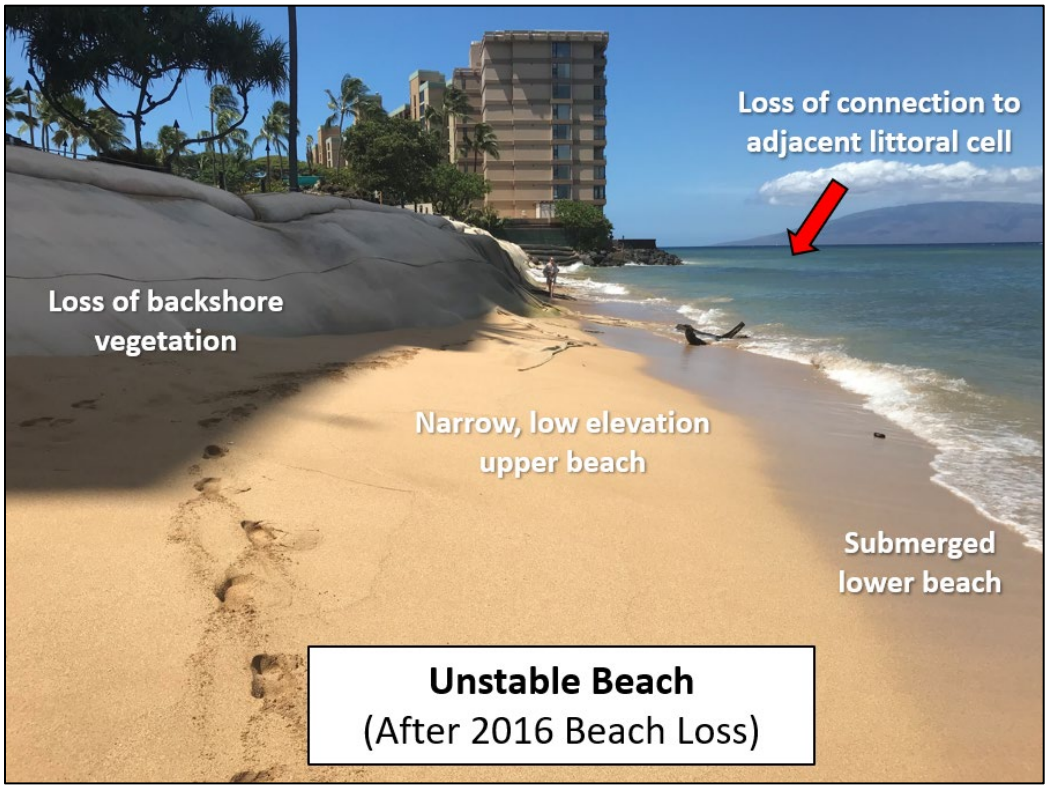


Figure 1-12. Unstable beach after 2016 beach loss and avulsion event (7/29/2022)

2. ADAPTATION GUIDANCE

This chapter details existing guidance for sea level rise adaptation including international, national, state, and county recommendations. This chapter also provides a detailed discussion of nature-based adaptation and timeframes for adapting to human-induced sea level rise.

Global mean sea level is the average height of the entire ocean surface. The present rate of global mean sea level change is +3.1 mm/yr (Sweet et al., 2022, Figure 2-1), where a positive number represents a rising sea level. Global mean sea level rise has accelerated over preceding decades compared to the mean of the 20th century. Regional effects cause sea levels to increase in some parts of the planet while decreasing or remaining relatively stable in other areas. In the contiguous United States (U.S.), sea level has risen on average by 6.5 inches (in) since 1950 (Sweet et al., 2018). Factors contributing to the observed rise in sea level include melting of land-based glaciers and ice sheets and thermal expansion of the ocean water column.

The Intergovernmental Panel on Climate Change (IPCC) states with high confidence that human influence has been the primary driver of the global mean sea level rise since 1971 (IPCC, 2021). The emission of greenhouse gases (GHG), primarily resulting from the burning of fossil fuels, has caused global temperatures to rise, which has resulted in thermal expansion of seawater and melting of glaciers and ice sheets, which are the primary drivers of global sea level rise. As a result, adaptation represents a human response to human-induced sea level rise.

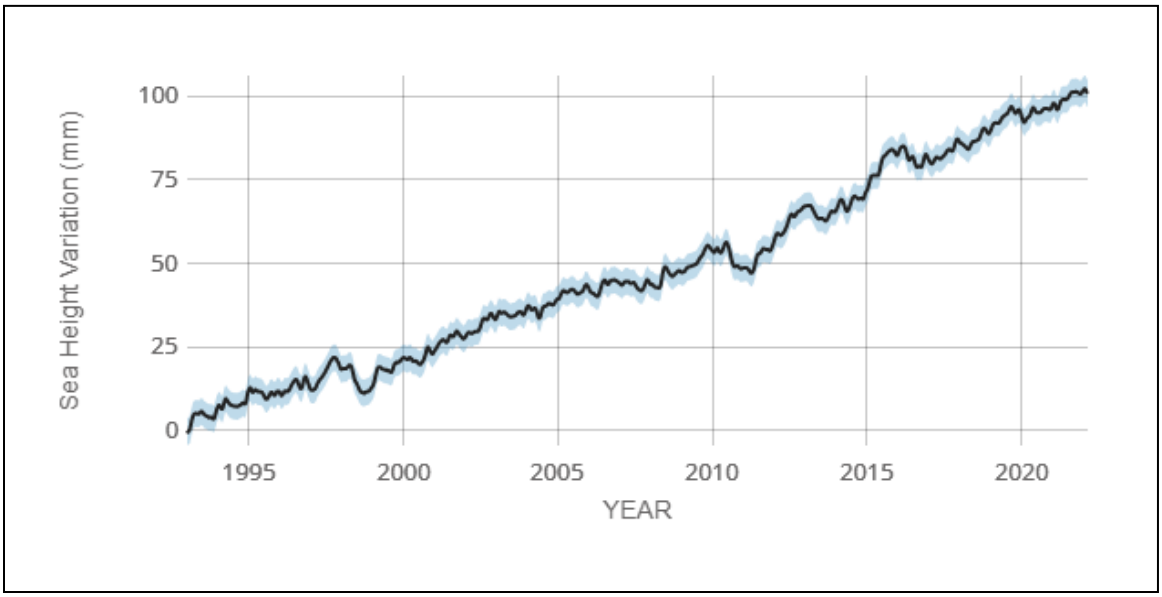


Figure 2-1. Global satellite sea level rise variability from 1993 to 2022 (Sweet et al., 2022)

Government agencies and communities have recognized the potential impacts of human-induced climate change and sea level rise and established guidance and objectives for sea level rise planning and adaptation with an emphasis on reducing vulnerability and increasing resilience. Guidance continues to evolve at the global, Federal, State, and County levels as the science and understanding of climate change and sea level rise improve.

2.1 International Guidance

This section details guidance and recommendations from the Intergovernmental Panel on Climate Change (IPCC) related to sea level rise.

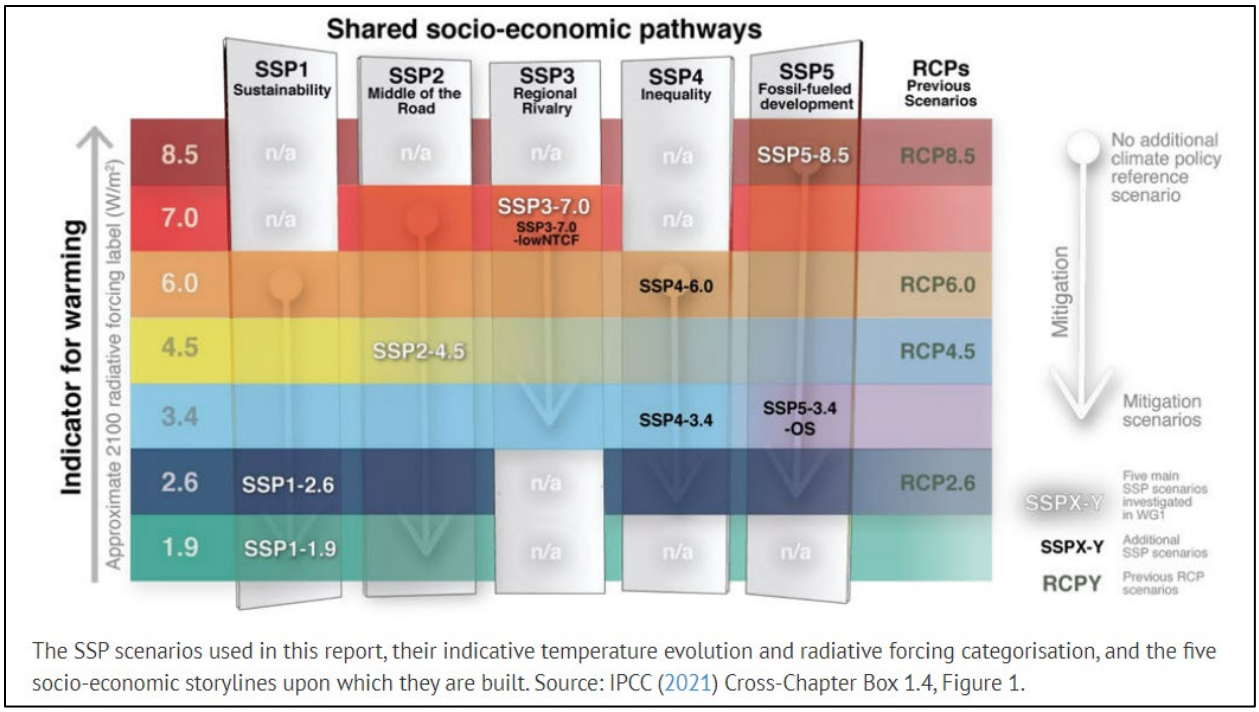
IPCC 6th Assessment Report (AR6)

The IPCC is the United Nations (U.N.) body for assessing the science related to climate change. The IPCC was created to provide policymakers with periodic scientific assessments on climate change, its implications, and potential future risks. As part of this effort, the IPCC surveys and distills the existing body of scientific research and provides consensus projections on future sea levels across the globe under a range of possible future scenarios. The most recent iteration of the IPCC's work, the 6th Assessment Report (AR6)[4], was published on August 9, 2021. Five Shared Socioeconomic Pathways (SSPs) representing future scenarios are described with sea level rise projections for each (Table 2-1 and Figure 2-2).

Table 2-1. IPCC Shared Socioeconomic Pathways (SSPs)

Scenario	Description
SSP1-1.9	Holds warming in 2100 to approximately 1.5°C relative to the years 1850 to 1900 after a slight overshoot (median) and implies net zero CO2 emissions around the middle of the century.
SSP1-2.6	Stays below 2.0°C warming relative to the years 1850 to 1900 (median) with implied net zero emissions in the second half of the century.
SSP2-4.5	Approximately in line with the upper end of aggregate Nationally Determined Contribution (NDC) emission levels by 2030. SR1.5 assessed temperature projections for NDCs to be between 2.7 and 3.4°C by 2100, corresponding to the upper half of projected warming under SSP2-4.5. New or updated NDCs by the end of 2020 did not significantly change the emissions projections up to 2030, although more countries adopted 2050 net zero targets in line with SSP1-1.9 or SSP1-2.6. The SSP2-4.5 scenario deviates mildly from a "no-additional-climate-policy" reference scenario, resulting in best-estimate warming of around 2.7°C by the end of the 21st century relative to the years 1850 to 1900.
SSP3-7.0	A medium to high reference scenario resulting from no additional climate policy under the SSP3 socio-economic development narrative. SSP3-7.0 has particularly high non-CO2 emissions, including high aerosol emissions.
SSP5-8.5	A high reference scenario with no additional climate policy. Emission levels as high as SSP5-8.5 are not obtained by Integrated Assessment Models under any of the SSPs other than the fossil-fueled SSP5 socio-economic development pathway.

[4] https://www.ipcc.ch/assessment-report/ar6/



The SSP scenarios used in this report, their indicative temperature evolution and radiative forcing categorisation, and the five socio-economic storylines upon which they are built. Source: IPCC (2021) Cross-Chapter Box 1.4, Figure 1.

Figure 2-2. IPCC AR6 shared socio-economic pathways (IPCC, 2021)

NASA Sea Level Rise Projection Tool

To visualize the AR6 sea level rise projections globally, the U.S. National Aeronautics and Space Administration (NASA) created the IPCC AR6 Sea Level Projection Tool[5], which is a web-based services that allows users to view both global and regional sea level projections from 2020 to 2150, along with how these projections differ depending on future scenarios. Users can click on a point anywhere in the ocean to obtain the IPCC projection of sea level for that specific location. The contributions of different physical processes to future sea level rise are also provided, indicating which processes will be the dominant drivers of future sea levels for a given location. A more detailed discussion of the IPCC AR6 sea level rise projections is provided in Section 7.3.

[5] https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool?psmsl_id=155&data_layer=scenario

2.2 National Guidance

This section details guidance and recommendations from the United States related to sea level rise.

National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) is engaged in a wide range of activities related to sea level rise including but not limited to monitoring relative sea level trends, modeling future sea level rise scenarios, providing scientific and technical data, tools, and services to support sea level analysis and adaptation planning, and providing funding for coastal adaptation and resilience projects. As part of these efforts, NOAA provides projections for future sea levels for all the U.S. states and territories.

NOAA Sea Level Rise Technical Report

In 2017, NOAA published a report entitled "Global and Regional Sea Level Rise Scenarios for the United States" [6] (Sweet, et al., 2022), which described global and regional sea level rise scenarios for all the U.S. states and territories. (Sweet et al. 2017). The report provided detailed projections and estimated uncertainties for a range of sea level rise scenarios ranging from Low to Extreme.

The report emphasized that coastal planners making critical decisions should weigh several factors when selecting which sea level rise scenario to use, such as the type of decision to be made, expected future performance, planning horizon, and overall risk tolerance, including the criticality of the asset and/or the size and vulnerability of the exposed population (Hall et al., 2016). For example, when designing a patio for a home or a bike path, a lower sea level rise scenario might be used for the design as it does not support any critical functions and may have a higher risk tolerance. In contrast, when designing critical infrastructure, such as a highway, hospital or power plant, with a lower risk tolerance and a higher criticality of the asset, a higher sea level rise scenario might be selected as a precautionary approach.

In 2018, SE participated in the regional climate assessment team for the Hawaiian Islands and Affiliated Pacific Islands, which contributed to the 4th National Climate Assessment (USGCRP, 2018). The consensus from the regional team, which included representatives from NOAA, the USGS, and the University of Hawai'i (UH), was that the NOAA Intermediate-High scenario projections are recommended for planning purposes in Hawai'i. According to the most recent IPCC AR6 report, the most aggressive, plausible sea level rise scenario is SSP5-8.5.

NOAA Updated Sea Level Rise Technical Report

The Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Interagency Task Force (Task Force) recently revised their sea level change projections through 2150, considering up-to-date scientific research and measurements. The Task Force consists of representatives from NASA, NOAA, U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), U.S. Army Corps of Engineers (USACE), and additional partners within academia.

[6] https://tidesandcurrents.noaa.gov/publications/techrpt83_Global_and_Regional_SLR_Scenarios_for_the_US_final.pdf

In 2022, NOAA published an updated report entitled "Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines"[7] (Sweet, et al., 2022), which provides the most up to date sea level rise projections for all the U.S. states and territories. To visualize the Task Force sea level rise projections globally, NASA created the Interagency Sea Level Rise Scenario Tool[8], which allows users to view both global and regional sea level projections from 2020 to 2150, along with how these projections differ depending on future scenarios. Users can select a point anywhere in the ocean to obtain the Task Force sea level rise projections for that specific location. The contributions of different physical processes to future sea level rise are also provided, indicating which processes will be the dominant drivers of future sea levels for a given location.

The Task Force scenarios and the IPCC AR6 scenarios are different but are based on the same underlying science and sea level rise projection framework. The primary difference is that the Task Force created scenarios for targeted sea level rise elevations at specific times in the future, whereas the IPCC created scenarios for specific emissions pathways. The Task Force's targeted sea level rise elevations represent outcomes that are considered unlikely but plausible, whereas the IPCC AR6 scenarios are considered likely. The goal of the Task Force projections is to examine the full range of plausible amounts of future sea level to help bound certain risk-based planning exercises. The Task Force scenarios are based on target elevations for sea level rise in 2100 of 1.0 ft (Low), 1.6 ft (Intermediate Low), 3.3 ft (Intermediate), 4.9 ft (Intermediate High), and 6.6 ft (High). A detailed discussion of the Task Force sea level rise projections is provided in Section 7.3.

Application Guide for the NOAA Updated Sea Level Rise Technical Report

In 2022, NOAA published a report entitled "Application Guide for the 2022 Sea Level Rise Technical Report"[9] (Collini et al. 2022) to assist decision makers and coastal professionals with applying and integrating the Task Force sea level rise projections into sea level rise planning and adaptation decisions. The report provides more detailed explanations of the technical assumptions, limitations, and uncertainties of the sea level rise projections, and provides guidance on how to apply the projections at various spatial scales.

The report also presents various approaches to utilize sea level projections for planning and decision-making purposes. Adaptation pathways is an approach that allows planners and decision makers to map out a sequence of adaptation strategies based on specific goals and identify thresholds, or "tipping points" when an adaptation strategy will no longer be effective. The adaptation pathways approach allows for a sequence of actions to be implemented over a longer period of time and is useful in highly dynamic environments, such as beaches (Collini et al. 2022).

[7] https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report-sections.html

[8] https://sealevel.nasa.gov/task-force-scenario-tool/

[9] https://oceanservice.noaa.gov/news/jun22/sealevelrise-report-guide.html

NOAA Sea Level Rise Calculator

The NOAA Sea Level Rise Calculator[10] is a web-based service that provides data, maps, and visualizations and produces location-specific reports for observed sea level trends, future sea levels, changes in flood frequency, extreme water levels, and seasonal variability. The service presents the U.S. Task Force sea level rise projections and allows users to compare the extrapolated, observed data to the modeled scenarios to determine which scenario best reflects real world conditions at a specific location. The service includes uncertainty percentages and contributing factors for each scenario including sterodynamic sea level change, glaciers, ice sheets, land water storage, and vertical land motion.

NOAA Sea Level Rise Viewer

The NOAA Sea Level Rise Viewer[11] is a web-based service that allows users to visualize the impacts of sea level rise up to 10 ft above Mean Higher High Water (MHHW). The service only accounts for passive flooding based on a Digital Elevation Model (DEM) and identifies flooded areas as either hydraulically connected to the ocean or unconnected. Hydraulically connected areas are expected to experience flooding propagating over land from the ocean, while unconnected areas are expected to experience groundwater flooding and/or water migration through gravity fed underground utilities connected to the ocean. The service also allows users to visualize the projected impacts of marsh migration, which represents the potential distribution of wetlands, how frequently they may be inundated under each scenario, and how they may eventually migrate into surrounding low-lying areas.

United States Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) is the primary Federal agency with authority over "Waters of the United States", which typically begins at the mean higher high water (MHHW) line and extends out to the 200 nautical mile limit of the U.S. exclusive economic zone (EEZ). Since the 1960's, the USACE has undertaken various initiatives to address the potential threats of sea level change to missions and operations.

In 1989, the USACE project plans were required to address the observed local relative rate of change (historic rate) and consider the consequences to the project of the full range of NRC scenarios. In 2000, a report entitled "Responding to Changes in Sea Level: Engineering Implications" (DA, 1987) provided technical guidance for future sea level change and recommended that coastal projects should consider the high probability of accelerated sea level rise. Engineer Regulation No. 1105-2-1 required that the USACE initiate planning for a scenario equivalent to 1.5 m (5 ft) of sea level rise by 2100.

[10] https://coast.noaa.gov/digitalcoast/tools/sea-level-calculator.html

[11] https://coast.noaa.gov/digitalcoast/tools/slr.html

Incorporating Sea Level Change in Civil Works Programs

In 2019, the Department of the Army (DA) issued Engineer Regulation No. 1100-2-8162[12], which requires that sea level rise be accounted for in all USACE Civil Works activities. The Regulation provides guidance for incorporating the direct and indirect physical effects of projected future sea level change across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects (DA, 2019). The Regulation references the sea level rise scenarios produced by the National Research Council (NRC), which result in global sea level rise values of 0.5 m (1.6 ft) 1.0 m (3.3 ft), and 1.5 m (4.9 ft) by the year 2100.

Sea Level Analysis Tool

The Sea Level Analysis Tool (SLAT)[13] is a web-based service that allows users to visualize observed sea level data, compare observations to projected sea level change, and estimate when tidal and extreme water levels will intersect multiple elevation thresholds. The SLAT facilitates the application of Engineer Regulation 1100-2-8162. The SLAT allows users to select 143 NOAA tide gauges and 1,461 gridded points from the Sweet et al. (2017; 2022) sea level rise projections for multiple water levels (datums) and extreme water levels. The SLAT also offers equation-based projections from multiple other sources (NOAA et al. 2012; CARSWG, 2016; USACE, 2019). The SLAT results for Kahului Harbor are shown in Figure 2-3.

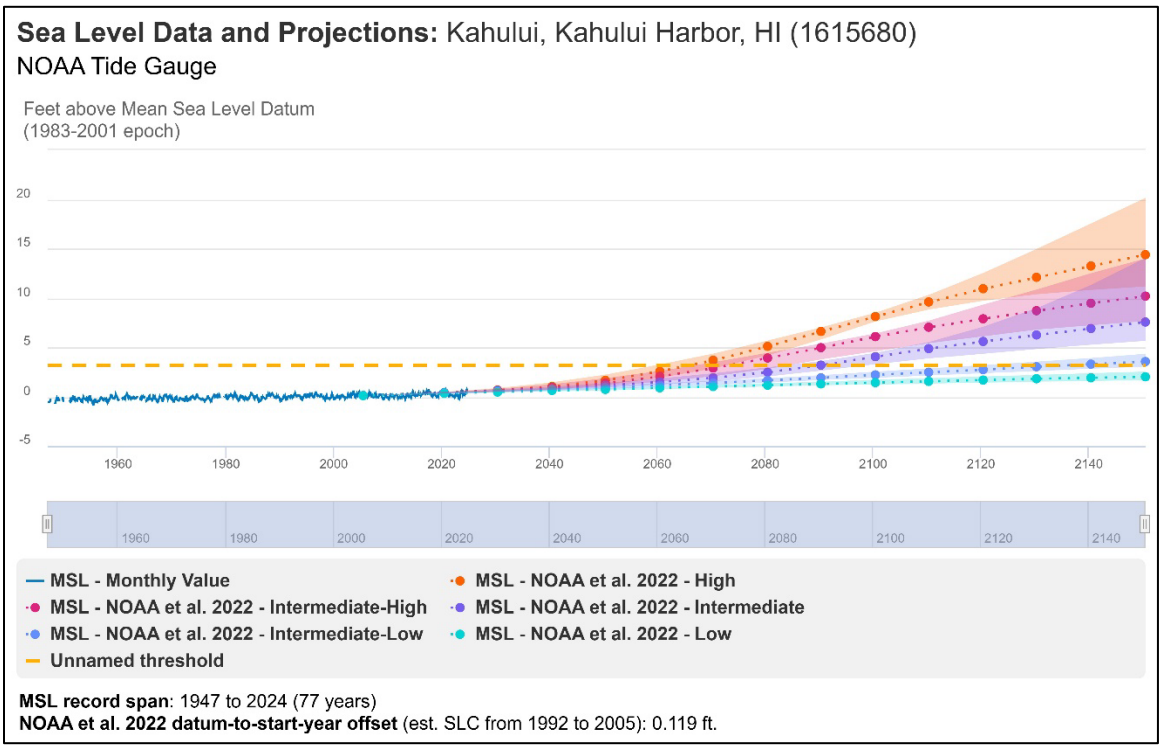


Figure 2-3. SLAT sea level rise data and projections for Kahului Harbor, HI (USACE, 20214)

[12] https:/www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1100-2-8162.pdf?ver=2014-02-12-131510-113

[13] https://climate.sec.usace.army.mil/slat/

National Shoreline Management Study

The USACE coordinates the National Shoreline Management Study (NSMS) program, which documents the physical, economic, environmental, and social impacts of shoreline change in coastal regions of the U.S. In 2021, the USACE published the "Hawaiian Islands National Shoreline Management Study", which assesses the regional causes and effects of erosion and accretion, social, cultural, economic, and environmental importance of our shorelines, and current and future risks. The report summarizes key findings, management actions being taken, and those recommended to restore and maintain resilient shorelines.

The report acknowledges that beach nourishment has been a key element in Hawaii's efforts to restore beaches and combat erosion and identifies beach nourishment with stabilizing structures (e.g., groins) as a nature-based approach for restoring and protecting existing beaches. The report states that groins can be designed to mimic natural features, such as Honokōwai Stream at the south end of the Project Site, to direct and dissipate wave energy to create a curved beach between the groins. The report also states that groins can be an effective strategy for sediment management along river or creek mouths where littoral transport clogs the entrance to the ocean waters, such as Honokōwai Stream at the north end of the Project Site.

Regional Sediment Management Program

The USACE coordinates the Regional Sediment Management (RSM) program, which identifies sediment as a valuable resource and seeks to reduce costs while increasing environmental and social benefits through adaptive management of sediments at the regional and project scales. The USACE has completed investigations and provided recommendations for sediment management for selected areas on the islands of Kauaʻi, Oʻahu, and Maui. The RSM program for the West Maui Region[14] has included shoreline change analysis, numerical modeling, mapping of littoral cells, analysis of regionals sediment budgets, and identification of potential RSM projects. The report provides the following recommendations that are relevant to this project:

- Optimize beneficial use of dredged material.
- Quantify the volume of suitable offshore sand available and the cost associated with dredging and placing it on various beaches within the region.
- Determine the nominal interval for beach renourishment in the region.
- Identify the impacts of beach nourishment in the region (both economic and environmental).
- Investigate the need for terminal structures for beach nourishment/fill on an open coast.
- Quantify the engineering benefits of combining different shore protection alternatives. An example would be construction of a revetment and nourishment of the beach.
- Investigate the seasonality of shoreline accretion/erosion in a site-specific manner through quantification of regional coastal processes.
- Develop beach nourishment project designs that maximize sand retention time through use of "headland" control features.
- Determine the consequences of introducing sediment into the littoral environment.

[14] https://rsm.usace.army.mil/hawaii/west_maui.htm

- Close the knowledge gap concerning the impacts of beach fill projects on reef systems. Anecdotal indications that sand negatively impacts reef systems need to be substantiated by rigorous scientific investigation. Until that time, resource agencies along with beach nourishment proponents should not rely on broad unsubstantiated claims to promote their points of view.
- Investigate the physical and chemical characteristics of calcium carbonate versus terrestrial sediment.
- Study the impacts of fine grain sand with particular focus on the dynamics of sediment that can be resuspended into the water column by waves and currents.
- Ensure that beach fill material is compatible with the native beach sand.
- Investigate the potential impacts of utilizing offshore sand resources for beach nourishment.
- Conduct detailed offshore sand investigations in support of beach nourishment.

2.3 State of Hawai‘i Guidance

This section details guidance and recommendations from the State of Hawai‘i related to sea level rise planning and adaptation.

Effects on Hawai‘i of a Worldwide Rise in Sea Level Induced By the “Greenhouse Effect”

In 1985, the Hawai‘i Coastal Zone Management submitted a report to the Hawai‘i State Legislature entitled “Effects on Hawai‘i of a Worldwide Rise in Sea Level Induced By the “Greenhouse Effect” [15] (DBEDT, 1985). The report acknowledged the potential threat of sea level rise in Hawai‘i and referenced four conceivable scenarios for future sea level rise including 56 cm (1.9 ft), 155 cm (4.8 ft), 217 cm (7.1 ft), and 345 cm (11.3 ft). The report recommended monitoring the evolution of sea level rise science and the associated projections and eventually developing a long-range plan to mitigate the impacts of sea level rise in Hawai‘i.

Coastal Zone Management Program

The Federal Coastal Zone Management Act of 1972 (16 USC §§1451-1464) was established as a United States National policy to preserve, protect, develop, and where possible, restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations. The Act encourages coastal states to develop and implement coastal zone management plans (CZMPs). Enacted as Chapter 205A, HRS, the Hawai‘i Coastal Zone Management (CZM) Program was promulgated in 1977 in response to the Federal Coastal Zone Management Act of 1972. The CZM area encompasses all lands throughout the entire state and all marine waters extending seaward from the shoreline to the extent of the state’s police power and management authority, including the United States territorial sea. The U.S. territorial sea extends 12 mi from the shoreline. Chapter 205A, HRS established the following objectives that are relevant to this project:

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

[15] https://planning.hawaii.gov/wp-content/uploads/2013/04/Sea-Level-Rise-Effects-on-Hawaii-1985.pdf

- Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value.
- Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation.
- Ensuring public recreational use 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.
- Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing.
- Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources.
- Improve the technical basis for natural resource management.
- Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance.

Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report

In 2017, the Hawaiʻi Climate Commission published the Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report[16] providing the first state-wide assessment of Hawaii's vulnerability to sea level rise and recommendations to reduce exposure and sensitivity to sea level rise and increase adaptive capacity. A key recommendation was that 3.2 ft of sea level rise should be adopted as a statewide vulnerability zone for planning purposes. The report provides the following recommendations that are relevant to this project:

- Support sustainable and resilient land use and community development.
- Provide new opportunities to use land more sustainably by identifying and prioritizing areas for smart redevelopment within existing urban land boundaries and to minimize pressure on agriculture and conservation lands.
- Incentivize improved flood risk management through support to a state-wide Community Rating System program, encouraging property owners outside currently regulated flood zones to purchase flood insurance, and incorporate sea level rise in hazard mitigation plan updates and disaster recovery frameworks.
- An inventory, protocols, and processes are needed to preserve Native Hawaiian culture and communities with sea level rise.
- A comprehensive review of environmental regulations that allow for the siting of environmental hazards, such as hazardous materials/waste storage facilities and onsite wastewater storage systems is needed to protect nearshore water quality with rising seas.
- Develop funding sources and incentives for adaptation.
- Support research, assessment, and monitoring of changing conditions fundamental to a learning approach to adaptation which involves conducting research, assessments, and monitoring needed to update the Report and other "living" outputs.
- Promote collaboration and accountability for adaptation.

[16] https:/climateadaptation.hawaii.gov/wp-content/uploads/2017/12/SLR-Report_Dec2017.pdf

Hawaiʻi Sea Level Rise Exposure Area

The Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report (State of Hawaiʻi, 2017) discusses the projected impacts of projected future sea level rise on coastal hazards, and the potential physical, economic, social, environmental, and cultural impacts of sea level rise in Hawaiʻi. The report concluded that 3.2 ft of sea level rise is projected to have substantial impacts on the State of Hawaiʻi. A key component of the report was a numerical modeling effort by the University of Hawaiʻi Coastal Geology Group (UH-CGG) to estimate the potential impacts that 0.5, 1.1, 2.0, and 3.2 ft of sea level rise would have on passive flooding, annual high wave flooding, and coastal erosion. The footprints of these three hazards were combined to map the projected impacts of sea level rise, referred to as the Sea Level Rise Exposure Area (SLR-XA). The modeling results are available through the State of Hawaiʻi Sea Level Rise Viewer[17]. A detailed discussion of the Hawaiʻi Sea Level Rise Exposure Area and the projected hazard extents at the Project Site is provided in Section 7.3.4.

Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report: 2022 Update

In 2022, the Hawaiʻi Climate Commission published an updated version of the 2017 Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report. The report includes guidance for understanding and interpreting the SLR-XA models and utilizing the SLR-XA model results for planning, zoning, and permitting purposes. The report recommends that the combined SLR-XA be used as a screening tool and that agencies should integrate sea level rise adaptation into neighborhood-scale or regional flood management or adaptation plans. The report references the provides the following specific guidance for sea level rise planning in Hawaiʻi:

- Sea level will rise around Hawaiʻi between 0.7 and 1.5 ft by 2050.
- The Intermediate (mid-range) estimate is for a rise of 1.0 ft by 2050.
- Sea level will rise around Hawaiʻi between 1.3 and 8.0 ft by 2100.
- The Intermediate (mid-range) estimate is for a rise of 3.9 ft by 2100.

This project assumes a sea level rise of 3.3 ft, which corresponds to the *Intermediate-High* scenario by the year 2075 (Sweet et al. 2022). This value was linearly interpolated from the values listed in Table 7-12 (see Section 7.3.2.2) to the year 2075 which represents the end of the 50-year design life of any beach stabilizing structures assuming construction is completed by the year 2025. A local sea level anomaly of +0.5 ft MSL is also included as part of the design water level. This is a typical value commonly used for planning and design purposes in Hawaiʻi. The total still water level used for design conditions is +4.9 ft MSL, which represents a probable worst-case scenario during an extreme wave event.

[17] https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/

Scoping Study for a Regional Shoreline Management Strategy for the State of Hawaiʻi (2022)

In 2022, the Hawaiʻi Office of Planning and Sustainable Development (OPSD) published a report entitled "Scoping Study for a Regional Shoreline Management Strategy for the State of Hawaiʻi[18] (Tetra Tech, Inc., 2022). The report acknowledges the need for shoreline management at geographic scales that exceed individual parcel boundaries and seeks to facilitate the implementation of a regional shoreline management program for Hawaiʻi.

The report recommends compartmentalizing Hawaii's shoreline into regions and subregions as the preferred geographic scale for shoreline management. Shoreline regions are delineated to characterize the regional coastal setting and establish the geographic and physical boundaries for shoreline management that extend along the coastline and landward and seaward of it. Shoreline subregions are specific reaches of shoreline within a region that are characterized by unique physical and environmental features and/or processes that differentiate it from the remainder of the region. The delineation of subregions allows for more detailed understanding of localized coastal processes and the physical, ecological, cultural, and social complexity of the backshore, foreshore, and nearshore environments.

The methodology was applied to selected shorelines on the islands of Kauaʻi, Oʻahu, and Maui. Preliminary mapping of shoreline regions and subregions was completed for the West Maui coastline. The boundaries of the Project Site referenced in this report are consistent with the shoreline region and subregions boundaries identified in the regional shoreline management scoping study. These boundaries also align with the littoral cell boundaries identified by the U.S. Army Corps of Engineers as part of the RSM program for the West Maui region (USACE, 2015).

2.4 County of Maui Guidance

This section details guidance and recommendations from the County of Maui related to sea level rise adaptation and planning.

Mayor Arakawa Proclamation

On February 22, 2018, Mayor Alan M. Arakawa issued a proclamation[19] acknowledging the potential impacts of sea level rise to the County of Maui. The proclamation formally accepted the 2017 Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report and Hawaiʻi Sea Level Rise Viewer as the best available science and established that the SLR-XA projections for 3.2 ft of sea level rise be used for planning purposes on Maui. The proclamation directed all County departments to incorporate sea level rise in their plans, programs, and capital improvement decisions and mitigate impacts to infrastructure and critical facilities. The proclamation also directed the County of Maui Planning Department to propose revisions to incorporate sea level rise into the shoreline rules for the Maui, Molokaʻi, and Lāna'i Planning Commissions.

[18] https://files.hawaii.gov/dbedt/op/czm/ormp/ormp_implementation/Regional%20Shoreline%20Mgmt%20Scoping%20Study/RSM%20SS%20Report_Main%20Body_FINAL.pdf

[19] https:/www.mauicounty.gov/DocumentCenter/View/111851/032718_Item-E_-DLNR-OCCL-Sea-Level-Rise-Rpt_SLR-Proclamation

County of Maui Shoreline Setback Rules

On August 25, 2024, the shoreline rules for the Maui Planning Commission were updated in accordance with Chapter 205A, HRS. The updated rules amended the process for establishing shoreline setbacks, established new categorical exceptions for certain types of projects, and clarified the structures and activities that are allowable in the shoreline setback area. Shoreline setbacks are now based on future projected erosion with 3.2 ft of sea level rise, referred to as the Erosion Hazard Line (EHL). The EHL was modeled and mapped by the University of Hawai'i Climate Resilience Collaborative with minor adjustments by the County of Maui to account for shorelines that are determined to be geologically stable or are accreting. For areas with a mapped EHL, the shoreline setback is the EHL. For areas that do not have a mapped EHL, the shoreline setback is determined to be 200 feet, or an optional lot-depth-based setback.

2.5 Nature-Based Adaptation

This section details the concept of nature-based adaptation as it relates to the Project.

As previously discussed, Honokōwai Beach is a semi-confined beach system that is bounded by man-made structures. As a result, adaptation in response to human-induced sea level rise must be tailored to the unique environmental conditions that distinguish Honokōwai Beach's unique characteristics from the surrounding shoreline areas. Nature-based approaches are increasingly preferred for sea level rise adaptation because they provide multiple co-benefits beyond just coastal protection, including but not limited to reduced environmental impacts, enhanced biodiversity, improved water quality, and preservation of human uses. Nature-based adaptation at Honokōwai Beach should be designed to work with the processes that occur naturally at this location, while minimizing the negative impacts that those natural processes have on the natural and human environments.

Beach restoration is widely recognized as a nature-based approach to environmental resource restoration (also referred to as "ecosystem-based adaptation") and sea level rise adaptation strategy that is promoted by various agencies. In some cases, structures are needed to restore and protect natural resources (e.g., beaches, dunes, coral reefs, streams, estuaries, wetlands, etc.). In the context of beach restoration, stabilizing structures (e.g., groins, breakwaters, sand retaining walls) are often needed to stabilize restored beaches. Groins are engineered structures that are designed to mimic natural landscape features (headlands) to produce stable beaches.

The application of natural and nature-based solutions has become increasingly more common in recent decades. A variety of guidance documents have been published by various organizations to inform program-level and project-level actions for specific types of natural and nature-based solutions.

International Guidelines on Natural and Nature-Based Features for Flood Risk Management

In 2021, the USACE published a report entitled "International Guidelines on Natural and Nature-Based Features for Flood Risk Management" [20] (Bridges et al. 2021). The purpose of the NBBF report was to distill the existing body of knowledge regarding natural and nature-based solutions and provide guidance and recommendations to improve flood risk management planning and decision-making. Natural and nature-based features (NNBF) refer to the use of landscape features to produce flood risk management benefits and notes that solutions may be natural (produced purely by natural processes) or nature-based (produced by a combination of natural processes and human engineering) (Bridges et al. 2021).

The report identifies beach nourishment as a nature-based solution and notes that, in some cases, control structures (e.g., groins) can be effective at locations experiencing long-term erosion, and where nourishment is not a viable or sufficiently effective option (e.g., Simm et al. 2020). When engineered interventions are needed to stabilize beaches, it is advisable to mimic natural processes and dynamics as much as possible. The report identifies several benefits associated with groins including coastal protection, tourism and recreation, and habitat. The report also notes that groins are most effective at locations where sediment transport processes are dominated by longshore drift, such as Honokōwai Beach. The report provided several examples of nature-based beach nourishment projects, including an example from Galveston Beach, Texas that involved placement of 490,000 cubic meters (641,000 cy) of sand and construction of 15 stone groins.

USACE Engineering With Nature

In 2010, the USACE established the Engineering With Nature[21] (EWN) initiative to facilitate projects that use natural processes to reduce demands on limited resources, minimize environmental footprints, and enhance the quality of benefits. The EWN program promotes science-based collaboration to organize stakeholders and produce more broadly acceptable projects. The EWN program promotes natural and nature-based solutions to reduce flood risk, increase property values, improve recreation, provide sustainable habitat, maintain or enhance biodiversity, and promote human health and community resilience.

EWN projects typically solutions that utilize natural processes, materials, and ecosystems to address engineering challenges while promoting environmental sustainability. Examples of EWN projects include green infrastructure (e.g., rain gardens, bioswales), wetland restoration, living shorelines, vegetated buffer zones, and sustainable drainage systems. Beach nourishment is a form of EWN in that it involves a combination of engineering and natural processes. Bridges et al. (2021) provide several examples of beach nourishment projects that utilize engineered structures (e.g., groins, engineered headlands, submerged sills, and breakwaters) to stabilize beaches and protect habitat.

[20] https://ewn.erdc.dren.mil/international-guidelines-on-natural-and-nature-based-features-for-flood-risk-management/

[21] https://ewn.erdc.dren.mil/

FHWA Nature-Based Solutions for Coastal Highway Resilience

In 2019, the U.S. Department of Transportation, Federal Highway Administration published a report entitled "Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide"[22] (Webb et al. 2019). The report refers to nature-based solutions as features that use natural materials and are created by human design, engineering, and construction to mitigate the impacts of flooding, erosion, shoreline retreat, and sea level rise to coastal infrastructure. The report notes that nature-based solutions may consist entirely of natural elements or a combination of natural and constructed elements (e.g., groins, sills, breakwaters, revetments).

A nature-based solution that combines natural and constructed elements is called a hybrid approach (Webb et al. 2019). The report identifies beach nourishment as a natural approach, whereas beach stabilization with groins and/or breakwaters is considered a hybrid approach because it involves the use of engineered structures to stabilize the beach fill. The report notes that the appropriate use of coastal structures, such as groins, breakwaters, or combinations thereof, can substantially extend the life and performance of beach fill projects

[22] https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/green_infrastructure/implementation_guide/fhwahep19042.pdf

2.6 Adaptation Timeframes

This section details the adaptation timeframes that informed selection of the Project.

Climate change and sea level rise are negatively impacting beaches and shorelines throughout the Hawaiian Islands. Impacts include beach narrowing and beach loss, loss of land due to erosion, negative impacts to water quality and benthic habitat, infrastructure damage due to erosion and flooding, and loss of cultural and recreational access. Anderson et al. (2015) found that, due to sea level rise, average shoreline recession in Hawaiʻi by 2050 is projected to be nearly twice the historical rates, and nearly 2.5 times the historical rates by 2100. Erosion can be chronic, seasonal, or episodic in nature. The nature of erosion affecting a particular shoreline is a key factor in evaluating potential adaptation strategies. In addition to increased erosion, anomalous sea level events (e.g., El Niño, king tides, mesoscale eddies, storm surge) are also likely to occur more frequently. Erosion and beach loss often need to be addressed over multiple timeframes with a combination of short-term responses, mid-term solutions, and long-term adaptation strategies.

Short-Term Responses

Short-term responses (0 to 10 years) are immediate interventions and are often required to address imminent, site-specific conditions or hazards, such as in the immediate aftermath of severe erosion or flooding events. These responses are typically non-permanent solutions that are intended to provide interim protection for threatened natural resources, land, and infrastructure, while mitigating risks to public health, safety, and welfare. Short-term responses typically consist of non-engineered measures that can be rapidly deployed during emergency situations. Examples of short-term responses include but are not limited to sand pushing erosion protection skirts, sand-filled mattresses, and sandbag revetments. Short-term responses are typically intended to function for a period of several years to provide adequate time for more durable and robust mid-term solutions to be developed and implemented. In some cases, structures are required to remain in place for longer periods to accommodate the time required to design and implement longer-term solutions. As discussed in Section 1.2, the existing temporary erosion protection skirt at the Project Site is a short-term response that is intended to mitigate erosion and prevent negative impacts to water quality until a mid-term solution can be approved and implemented.

The structure was installed in May 2018 and is currently authorized by an Emergency Conservation District Use Permit (Emergency CDUP MA-21-06) approved by the Hawaiʻi Department of Land and Natural Resources, Office of Conservation and Coastal Lands, and an Emergency Special Management Area Permit (SM3 2020/0014, SSA 2020/0062, EAE 2021/0003) approved by the County of Maui Planning Department. WMRP also leases the State submerged lands within the footprint of the structure through an existing Revocable Permit (S-7943), which was approved by the Hawaii Board of Land and Natural Resources (BLNR) and approved by the Hawaiʻi Department of Land and Natural Resources, Maui District Land Office. The RP requires that the applicant pay monthly rent, carry adequate liability insurance, and maintain the structure in good condition.

Monthly monitoring is performed to routinely evaluate the condition of the structure and the beach. Repairs are performed on an as-needed basis to maintain the structure in good condition in compliance with the permit conditions. WMRP plans to remove the existing temporary erosion protection structure when a mid-term solution can be approved and implemented.

Mid-Term Solutions

Mid-term solutions (10 to 50 years) are intended to address existing conditions and projected future changes to coastal environments in the next several decades. Mid-term solutions require more sophisticated engineering analyses, and a more robust and comprehensive process for planning, environmental review and permitting, which typically requires several years to complete. Mid-term solutions may include physical improvements to landscapes, infrastructure, and buildings. The geographic scale of mid-term solutions is typically moderate. Mid-term solutions create adequate time to conduct planning and feasibility studies to enable long-term adaptation. Examples of mid-term solutions include beach nourishment, beach maintenance and beach stabilization.

Beach nourishment projects involve adding sand to existing beaches to countervail the impacts of coastal erosion by temporarily increasing beach width and volume. Beach nourishment projects that are implemented as a single project with no recurring maintenance or stabilizing structures typically have a design life of 5 to 10 years and are therefore considered a short-term response.

Beach maintenance programs consist of multiple actions that are implemented over a specific period of time. Beach maintenance programs typically consist of an initial beach nourishment followed by a series of periodic maintenance (renourishment) projects. Beach maintenance programs are considered mid-term solutions because the lifespan of the program can be extended beyond 10 years through a series of periodic maintenance efforts.

Beach stabilization refers to individual actions (projects) that typically consist of an initial beach nourishment accompanied by modifications to existing structures and/or installation of new structures (e.g., groins) to stabilize the sand. Beach stabilization projects are typically designed to be implemented as a single, discrete project and can also be designed to accommodate or be adapted to future sea level rise. Beach stabilization projects typically have a design life of 25 to 50 years and are therefore considered mid-term solutions.

Additional information about beach nourishment, beach maintenance, and beach stabilization is provided in Chapter 3 and Chapter 4.

Long-term Adaptation

Long-term adaptation (more than 50 years) is a complex process that requires thoughtful planning, analysis and consideration of a wide variety of factors including, but not limited to, disaster risk reduction, social cohesion, environmental preservation, and economic security. These factors, combined with high levels of uncertainty regarding projected sea level rise and erosion, potential approaches, responsibilities, legal issues, funding, and logistics, presents a challenging planning dilemma.

Long-term adaptation planning is based on projected, but uncertain, environmental conditions that are substantially different than present conditions. Due to the uncertainties associated with the approaches in modeling sea level rise, it is important to continue monitoring and to update the trajectories of models (Sweet et al. 2022). Some long-term adaptation strategies may involve fundamentally altering the character and appearance of the existing environment and the range of beneficial uses it currently supports. Long-term adaptation planning should be a collaborative and participatory process that seeks to balance the needs, goals, and objectives of communities at broader scales.

Climate change and sea level rise pose both current and long-term threats to Hawaii's shorelines, economy, sustainability, and security. Considering the long-term projections for sea level rise, and the implications associated with the projected increase in erosion and flooding, alternative strategies may be required in the future to protect and preserve Honokōwai Beach and the adjacent properties. Long-term adaptation could potentially consist of one or more strategies that could be implemented individually or in combination (Figure 2-4).

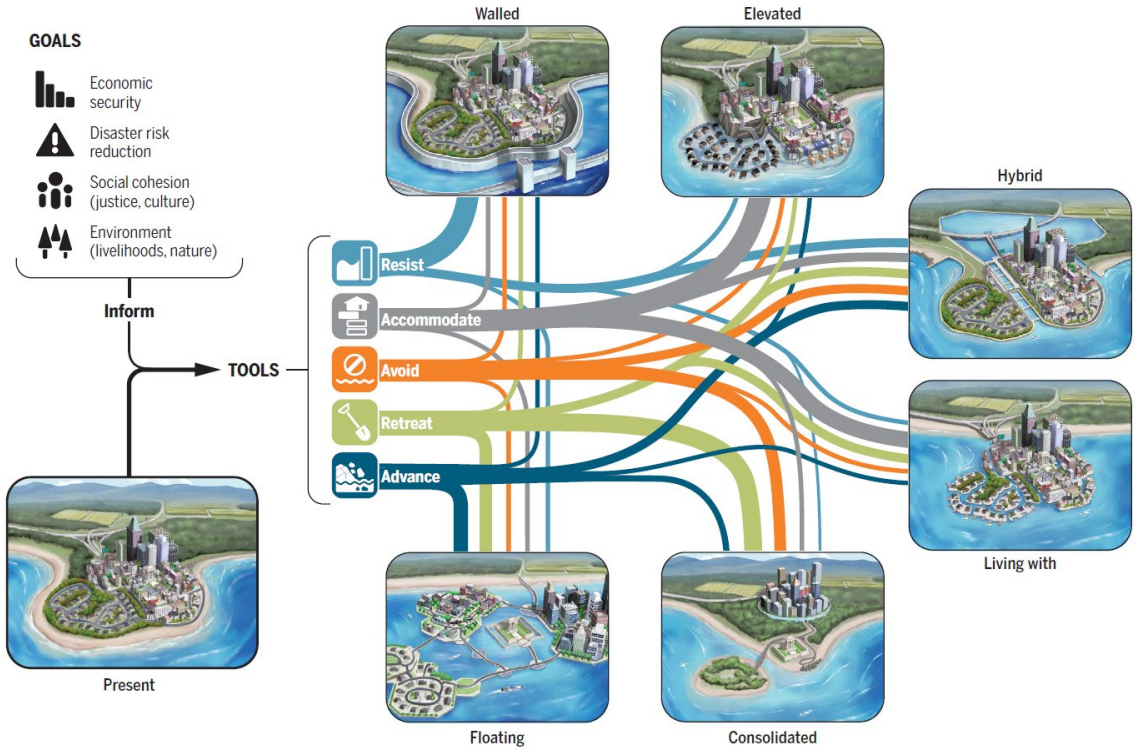


Figure 2-4. Holistic pathways of climate transformation (Mach et al. 2021)

3. ALTERNATIVES FULLY EVALUATED

This section details the No Action alternative and alternative methodologies for beach restoration that were fully evaluated.

3.1 Beach Nourishment

The beach nourishment alternative would consist of placing sand at the south end of the Honokōwai littoral cell without any structures to stabilize the sand. The sand would be placed along approximately 1,000 ft of shoreline between Honokōwai Stream and Honokōwai Point. The beach would have a crest elevation of +8.5 ft MSL and a beach slope of 1V:8H. This concept would require 27,000 cy of sand and would provide a minimum beach width of 40 ft. The concept plan for this alternative is shown in Figure 3-1.

Some of the advantages and disadvantages of Beach Nourishment are as follows:

Advantages

- Does not require groin construction.
- Requires the smallest volume of sand of the alternatives considered.
- Requires recovery of less than 5% of the sand available at the Sand Recovery Site.
- Requires the least construction days of the alternatives considered.
- Least expensive option of the alternatives considered.

Disadvantages

- Has the shortest design life (10 yrs) of the alternatives considered.
- Sand would be less stable and more vulnerable to erosion without stabilizing structures.
- Does not increase beach stability.
- Does not maintain a stable beach for a period of 50 years.
- Does not facilitate sand exchange with the North Kāʻanapali littoral cell.
- Does not improve shoreline access lateral shoreline access around Honokōwai Point.
- Least cost-effective of the options considered (average annual cost = $1,030,000).

Beach nourishment represents a nature-based approach to adaptation that would offset the reduction in sand volume caused by human-induced sea level rise. However, beach nourishment alone does not increase beach stability or reduce sensitivity to erosional forces. As previously discussed, Honokōwai Beach is a semi-confined beach system that is bounded by man-made structures. While increasing sand volume would temporarily increase beach width, the beach would continue to be vulnerable to chronic, seasonal, and episodic erosion events. Based on current projections for sea level and coastal erosion, Honokōwai Beach would remain vulnerable to further beach loss and avulsion events, such as occurred in 2016.



Figure 3-1. Concept plan view of the Beach Nourishment alternative

3.2 Beach Maintenance

The beach maintenance alternative would consist of an initial beach nourishment project with periodic renourishment at specified intervals. The initial nourishment effort would be identical to the beach nourishment alternative described in Section 3.2. Approximately 27,000 cy of sand would be placed at the south end of the Honokōwai littoral cell without any structures to stabilize the sand. The sand would be placed along approximately 1,000 ft of shoreline between Honokōwai Stream and Honokōwai Point. The beach would have a crest elevation of +8.5 ft MSL and a beach slope of 1V:8H. This concept would provide a minimum beach width of 40 ft. The concept plan for this alternative is the same as the plan for Beach Nourishment (Figure 3-1).

For beach nourishment without stabilizing structures, it is recommended that periodic beach maintenance be performed after the initial nourishment and throughout the 50-year design life to maintain the desired beach width. This would require additional sand added at time intervals corresponding to when the beach erodes landward a certain distance.

To maintain a minimum beach berm width of 25 to 30 ft, renourishment would be required when the initial beach shape (40-ft beach berm width) migrates landward approximately 10 to 15 ft. Based on the future shoreline change rates outlined in Section 7.5.3.2, Honokōwai Beach is projected to erode at an average rate of -1.27 ft/yr, which corresponds to 12.7 ft of shoreline recession over approximately 10 years. Over a period of 50 years, approximately four (4) renourishment efforts would be required to maintain the desired beach width of 40 ft. Each renourishment would require approximately 5,000 cy of sand, resulting in a total volume of 47,000 cy of sand to restore the beach and maintain a beach berm width of 40 ft. The renourishment interval is based on the projected average annual shoreline change rates. Depending on the actual rate of sea level rise, and how the shoreline responds, renourishment could potentially be required more or less frequently.

Some of the advantages and disadvantages of Beach Maintenance are as follows:

<u>Advantages</u>

- Does not require groin construction.
- Achieves the objective to maintain a beach for a period of 50 years.

<u>Disadvantages</u>

- Requires the most sand (47,000 cy) of the alternatives considered.
- Requires the most construction days of the alternatives considered.
- Renourishment would be required approximately every 10 years.
- Dependent on future sand availability at the Sand Recovery Site.
- Does not increase beach stability.
- Does not facilitate sand exchange with the North Kāʻanapali littoral cell.
- Does not improve shoreline access lateral shoreline access around Honokōwai Point.
- Most expensive of the alternatives considered.

Beach maintenance represents a nature-based approach to adaptation that would offset the reduction in sand volume caused by human-induced sea level rise. As previously discussed, Honokōwai Beach is a semi-confined beach system that is bounded by man-made structures. While increasing sand volume would temporarily increase beach width, the beach would continue to be vulnerable to chronic, seasonal, and episodic erosion events. Based on current projections for sea level and coastal erosion, Honokōwai Beach would remain vulnerable to further beach loss and avulsion events, such as occurred in 2016. Periodic renourishment would be required to maintain sand volume and beach width. Renourishment may be required on a more frequent basis than anticipated due to the beach remaining vulnerable to unpredictable episodic events.

3.3 Beach Stabilization

Ongoing erosion can limit the effectiveness of beach nourishment projects. Without additional mitigative measures, rates of pre-project beach erosion should be expected to continue following a beach nourishment project. Natural features such as headlands, embayments, or reefs that disrupt sediment transport can naturally stabilize beaches. In some cases, these natural features can be mimicked by engineered beach stabilizing structures, such as T-head groins, to maintain a stable beach. T-head groins decrease and reorient the amount of wave energy reaching the beach and create artificial littoral cells to stabilize the sand.

The knowledge gained from studying natural crenulate-shaped bays provides a design tool for coastal engineers to produce stable sandy shorelines. Silvester and Hsu (1993) present methods for determining the stable beach planform adjacent to rocky headlands, thus facilitating the engineering use of artificial headlands as beach stabilizing structures. Whereas natural beaches obtain a stable shape in response to the wave climate and headland orientation, beaches can also be stabilized by engineering artificial headlands with positions and orientations that produce the desired beach shape.

Klein et al (2003) proposed methods for using locations of upcoast and downcoast control points, along with incident wave angle, to approximate the stable shoreline position for an embayed beach. Bodge (2003) proposed the use of T-head groins as artificial headlands to produce stable beaches, an approach that has been implemented successfully on numerous beaches in Florida and the Caribbean (Bodge, 1998), and more recently at Iroquois Point on Oʻahu (Figure 3-2).

A schematic of the components of a tuned T-head groin system is presented in Figure 3-3. The heads of the T-groins can be aligned (tuned) according to the prevailing wave crest orientation to produce the desired beach configuration. Rubble mound T-head groins are recommended to reduce rip currents, wave reflection, and the loss of sand via cross-shore transport. The beach should be nourished with sand to achieve the predicted shoreline shape. According to Bodge (1998), tuned structures work well when the erosion is so severe that renourishment would be too frequent to be economical or practical, or when the shoreline is no longer conducive to having beaches, such as along hardened shorelines.

Key design parameters for T-head groin design include groin length, head length and orientation, armor stone sizing, and desired beach shape and width. In general, the beach shape responds more to the gap width (opening) between the groin heads than it does to the structure heads themselves. Thus, the stable beach is a function of the length and orientation of the gaps. Orientation of the gaps is primarily dictated by the shape of the shoreline and the prevailing direction of wave approach.

The groin layout and head angles should be oriented such that the gap opening is approximately parallel with the average prevailing wave crest. This “tuning” of the heads helps to ensure the predictability of the beach shape and yields greater shoreline stability within the beach cell. In many cases, it is not possible to achieve a perfect match between gap orientation and incident wave crest, because of the directional variability of waves approaching the shoreline. In practice, this difference should be no more than 25 degrees, and differences of up to 15 degrees have been consistently shown to produce a stable beach (Bodge, 2012).



Figure 3-2. Beach nourishment with T-head groins at Iroquois Point, O'ahu

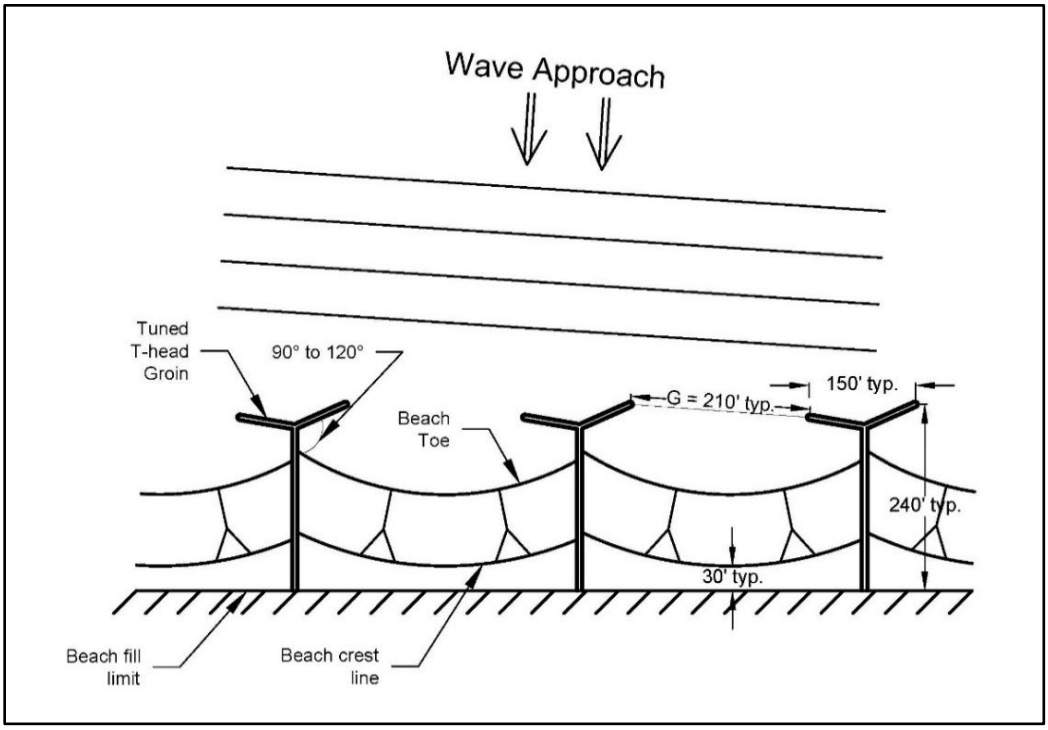


Figure 3-3. Schematic of a typical tuned T-head groin system

The beach design process includes establishing the desired physical characteristics of the beach and then applying coastal engineering analysis to orient structures to achieve the desired beach planform. Deviation of the gaps from parallel with the wave crests will result in a less uniform beach in the planform view, and wave modeling may be necessary to approximate the stable beach configuration. Physical beach characteristics include crest height, dry beach width, beach slope, and sand grain size. Standard methodology typically involves trying to match adjacent beach characteristics because this indicates what is naturally stable for local conditions and it is aesthetically more pleasing to match the adjacent beach.

The empirical relationships show that the mean low water (low tide) shoreline will be located between one-third and two-thirds of the gap length (G) behind the groin head (i.e., 0.35G to 0.65G). Larger values in this range are appropriate for 1) energetic open coasts that are directly exposed to wave action, 2) larger gap widths, 3) larger angles between the wave approach and the gap orientation, 4) reduced beach fill sand compatibility, and 5) a higher degree of conservatism. The groin head lengths should be long enough so that the mean low water shoreline approaches the groin head, while maintaining a minimum ratio of gap width to head width of about 60:40 for aesthetic reasons so that the groins do not dominate the viewplanes.

The groin stems should extend landward of the design beach crest to mitigate flanking and loss of sand from the cell around the back of the groin. The groin crest elevation should be above the high tide elevation and high enough to prevent significant overtopping during prevailing (non-storm) water levels and wave conditions. Experience at Iroquois Point, Oʻahu (Figure 3-2) suggests that a stable beach crest elevation would be approximately +8 to +9 ft MLLW, and the beach foreshore slope would be approximately 1V:8H (vertical to horizontal).

The Beach Stabilization alternative would consist of beach nourishment and construction of three T-head groins and one L-head groin. The project spans approximately 1,000 ft of shoreline. A sea level rise of 3.3 ft is used for design purposes, which corresponds to the *Intermediate-High* scenario by the year 2075. The beach and groin layout is shown in Figure 4-1. The groins would be spaced between 330 and 340 ft apart from southwest to northeast. The groins would extend between 220 and 250 ft from the existing backshore (vegetation line). The heads would extend between 72 and 84 ft to either side of the stem, at angles ranging from 90º to 120º in order to best orient the gaps between heads parallel to the typical wave approach.

The groin crests and elevations are designed with the capability of adapting to sea level rise. The groin heads are designed with a crest elevation of +6 ft MSL. That elevation would allow some overtopping during high wave events without sacrificing beach stability. The groins are designed to be modified as sea level rises. The groin crests would have cast-in-place concrete crest caps as shown on Figure 4-2. This concrete core would serve as a base for groin modification as sea level rises. When sea level has risen and vertical extension is needed, a crown wall can be constructed on top of the concrete core to effectively raise the height of the groin, likely by about 1.5 ft. Design of the groin heads in this manner keeps the heights lower and the view plane more open initially, as opposed to designing the elevations for 3.3 ft of sea level rise now and having groin heads with elevation likely exceeding +9 ft MSL now.

The heads would have crest widths of 11.4 ft and side slopes of 1V:1.5H. The crest elevation is +6 ft MSL and the groin stem elevations would increase from +6 ft MSL at the heads to +7.5 ft MSL at the inshore ends on the inner groins (Figure 4-3) and +8.5 ft MSL on the terminal groins (Figure 4-4). The stems would not require modification for sea level rise, so they are constructed with a three-stone crest width of 11.4 ft. Approximately 22,442 tons of stone would be required to construct the groins.

The southwest and northeast groins are considered terminal groins, meaning that they are at the ends of the beach system. All the other groins would have sand on either side, so they can be lower to allow for a continuous sandy beach. As terminal groins, the stem elevations would have to be higher than the other stems to prevent sand from washing over them. The terminal groin stem elevations are set to +8.5 ft MSL as shown in Figure 4-4.

Sand fill would be placed between the groins to create a beach with a minimum 40-ft width, +8.5-ft MSL elevation, and a 1V:8H slope from the crest to the sea bottom. The inner groin stems are lower than the beach crest elevation, thus approximately half of the groin stem would be covered by sand, with the groins gradually emerging from the beach slope. An estimated 33,000 cy of sand would be required for the alternative.

Some of the advantages and disadvantages of Beach Stabilization are as follows:

Advantages

- Meets the project objective to maintain a stable beach for a period of 50 years.
- Increases beach stability and mitigates erosion, shoreline recession, and beach narrowing.
- Mitigates the need for periodic renourishment.
- Requires recovery of less than 5% of the sand available at the Sand Recovery Site.
- Requires 14,000 cy less sand than Beach Maintenance.
- Less expensive than Beach Maintenance.

Disadvantages

- Requires groin construction.
- Does not facilitate sand exchange with the North Kāʻanapali littoral cell.
- Does not improve shoreline access lateral shoreline access around Honokōwai Point.
- Requires 6,000 cy more sand than Beach Nourishment.
- More expensive than Beach Nourishment.

Beach stabilization represents a nature-based approach to adaptation that would offset the reduction in sand volume caused by human-induced sea level rise. Unlike beach nourishment or beach maintenance, beach stabilization would also stabilize the sand, which would make the beach less sensitive and more resilient to chronic, seasonal, and episodic erosion and avulsion events. As previously discussed, Honokōwai Beach is a semi-confined beach system that is bounded by man-made structures. Beach stabilization is a nature-based response to both human-induced sea level rise and human engineering that has altered the configuration of the shoreline and how it responds to natural processes.

Beach stabilization would be designed to conform to the existing configuration of the coastline and protect the beach from human-induced sea level rise. As a result, Honokōwai Beach would be less vulnerable to chronic and seasonal erosion and episodic events, such as the 2016 beach loss and avulsion event. Beach stabilization provides an optimal balance of effectiveness, design life, and adaptability with minimal maintenance.

Groin Design and Accessibility

The groins presented in this report are primarily designed to stabilize the beach. The groins would be constructed seaward of the certified shoreline on State submerged land, which are a Public Trust resource. While the groins are not specifically designed to accommodate pedestrian traffic, given their location on a public beach, it is assumed that beach goers could access the groins by foot. The groins could potentially be modified to make them more accessible by incorporating additional design elements, such as mats, walkways, steps, ramps, and railings, or additional amenities, such as benches, shade structures, pole holders, and ocean safety floats.

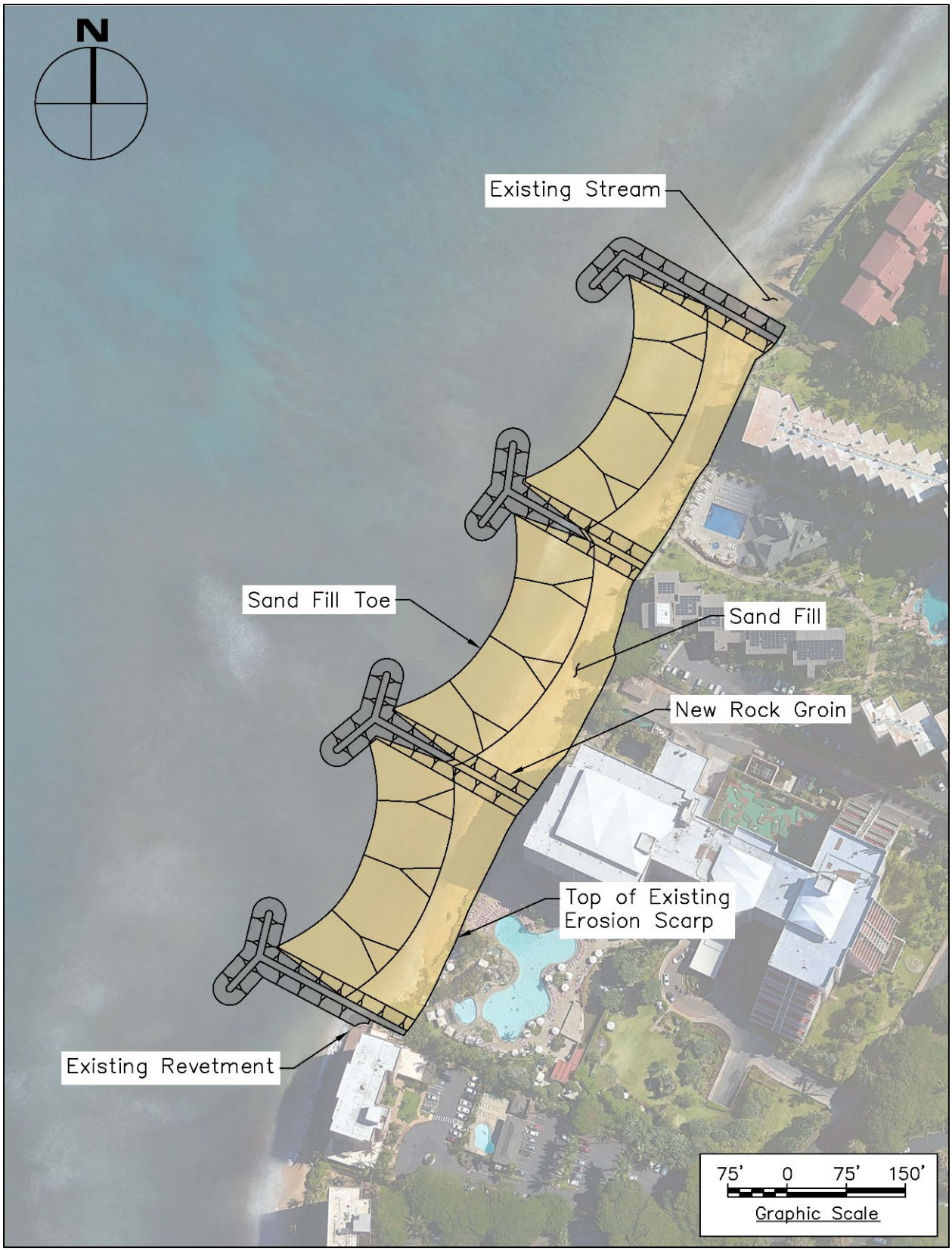


Figure 3-4. Concept plan view for Beach Stabilization

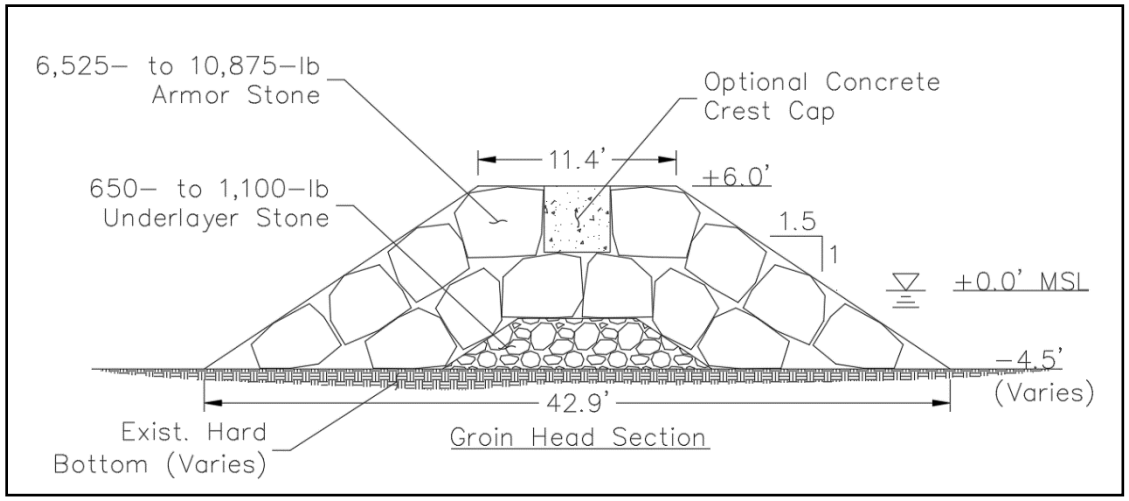


Figure 3-5. Typical groin head cross section for the Beach Stabilization alternative

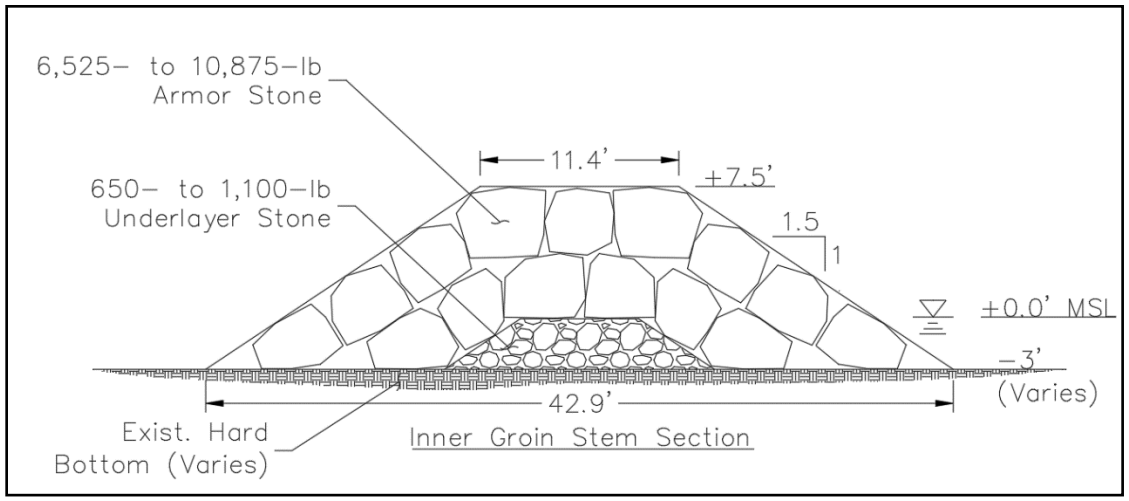


Figure 3-6. Typical inner groin stem cross section for the Beach Stabilization alternative

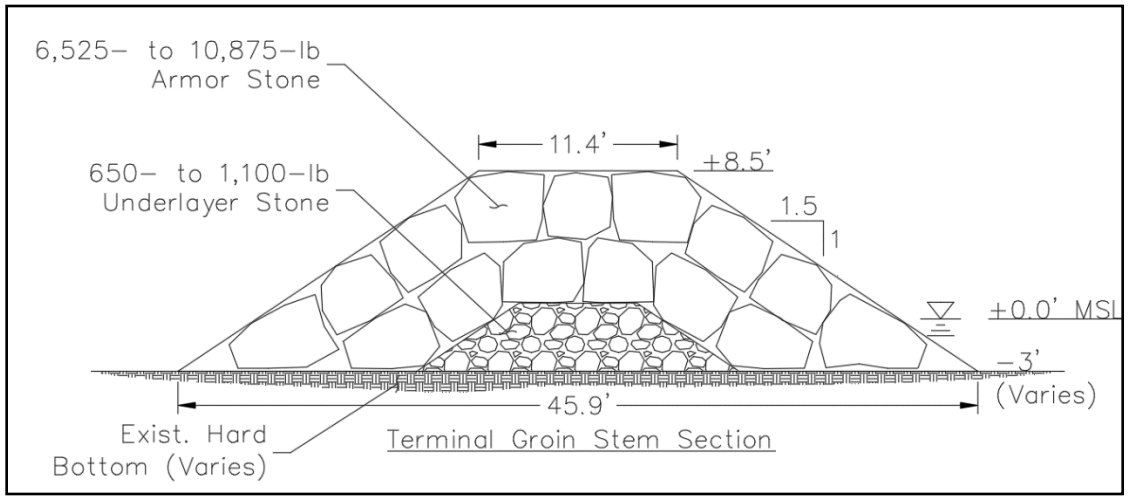


Figure 3-7. Typical terminal groin cross section for Beach Stabilization

3.4 Estimated Construction Costs

This section provides a detailed comparison of the estimated construction costs for the beach restoration alternatives considered.

Rough Order of Magnitude (ROM) construction cost estimates for the beach restoration alternatives evaluated in this report were prepared based on the construction methodologies described in Chapter 3 and Chapter 8. The expected accuracy range for ROM cost estimates is -20% to -50% and +30% to +100%.

Table 3-1. Estimated construction costs for beach restoration alternatives.

Alternative	Estimated Cost ($)	Design Life (yrs)	Amortized Cost ($/yr)
Beach Stabilization	$19,827,000	50	$396,540
Beach Nourishment	$10,300,000	10	$1,030,000
Beach Maintenance	$25,777,735	50	$515,555

3.5 Comparison of Beach Restoration Methodologies

This section provides a comparison of the potential alternative methodologies for beach restoration that were fully evaluated.

Table 3-2. Comparison of Beach Restoration Methodologies

	BEACH STABILIZATION	BEACH NOURISHMENT	BEACH MAINTENANCE
Groins	3 T, 1 L	-	-
Groin Area (ft^2)	53,900	-	-
Total Beach Area (ft^2)	159,400	139,140	139,140
Initial Sand Fill Required (yd^3)	33,000	27,000	27,000
Total Sand Fill Required (yd^3)	33,000	27,000	47,000
Design Life (yrs)	50	10	50
Maintenance Interval (yrs)	-	-	10
Maintenance Events [1]	-	-	4
Construction Days [2]	445	233	452
Truckloads [3, 4]	2,750	2,250	3,917
Mileage (mi)	159,500	130,500	227,186
Cost Estimate [5]	$19,827,000	$10,300,000	$25,777,735

[1] Offshore dredging would be required for each maintenance event.
[2] Construction days represent total project duration presented as calendar days. Actual workdays are approximately 70% of total calendar days.
[3] Assumes truck capacity of 12 cy for transport of sand from Kahului Harbor to Project Site.
[4] Assumes truck capacity of 25 cy to transport and place sand along the shoreline.
[5] Cost estimates for maintenance options include 10% inflation per maintenance interval.

3.6 No Action

The No Action alternative would consist of not implementing any of the beach restoration alternatives and allowing Honokōwai Beach to continue to erode naturally. No Action could occur if the applicant is unable to obtain the necessary permits and approvals to implement the preferred beach restoration alternative. For the purposes of the EIS analysis, it is assumed that the No Action alternative would involve removal of the existing temporary erosion protection structure. In order to evaluate and compare the potential impacts of No Action, it is necessary to consider the cumulative impacts that may occur over a period of 50 years, which corresponds with the design life of the Beach Stabilization and Beach Maintenance alternatives.

The cumulative impacts of No Action would be broad-ranging and substantial. Honokōwai Beach is subject to chronic, seasonal, and episodic erosion. Chronic erosion refers to the gradual process of beach narrowing that occurs incrementally over time. Seasonal erosion refers to changes in beach configuration (e.g., volume, width, elevation) that typically occur in cycles based on seasonal ocean conditions. Episodic erosion refers to individual events that occur rapidly and unexpectedly, such as large swells, storms, or tsunamis. Beach loss and shoreline recession may occur as a result of chronic, seasonal, or episodic erosion, or a combination thereof.

Coastal erosion, which is expected to accelerate by mid-century, would result in significant beach narrowing and beach loss at Honokōwai Beach. Table 3-3

Table 3-3 presents estimates for future average annual erosion rates based on projected sea level rise scenarios. Transects 1195 to 1188 correspond with the Kāʻanapali Shores property (TMK (2) 4-4-001:097) and transects 1188 to 1179 correspond with the Kāʻanapali Beach Club property (TMK (2) 4-4-001:098). These estimates are based on a combination of historical observations and numerical modeling. The model assumes that future erosion will occur as a linear progression at an average annual rate. The historical shoreline change trend (1912 to 2018) at Honokōwai Beach has been erosion at an average annual rate of -0.44 ft/yr. The model projects that the average annual erosion rate at Honokōwai Beach is projected to be -1.27 ft/yr with 1.1 ft of sea level rise, which is 3 times the historical rates, and -1.81 ft/yr with 3.2 ft of sea level rise, which is 4 times the historical rates.

Without implementation of beach restoration, erosion, beach narrowing, and potential beach loss would result in significant shoreline recession that could substantially alter the configuration of the shoreline at Honokōwai Beach. Shoreline recession refers to the landward movement of the shoreline that occurs when land is permanently lost to erosion. Without implementation of beach restoration, erosion would cause the beach profile to migrate landward. As the beach profile narrows, and the backshore becomes more exposed to wave action, the beach profile will begin to flatten. As the beach profile flattens and becomes progressively lower in elevation relative to sea level, the beach will be squeezed against the backshore and eventually become entirely submerged. While the precise timing of coastal erosion and sea level rise are not certain, current projections indicate that, if no action is taken to mitigate the erosion and restore Honokōwai Beach, total beach loss can be expected before the end of the century.

Table 3-3. Projected coastal erosion rates (ft/yr) at Honokōwai Beach

Transect	0.5 ft SLR (2025 to 2040)	1.1 ft SLR (2050 to 2065)	2.0 ft SLR (2075 to 2100)	3.2 ft SLR (2095 to 2125)
1179	-1.41	-1.67	-2.04	-2.44
1180	-1.40	-1.67	-2.03	-2.44
1181	-1.37	-1.65	-2.01	-2.42
1182	-1.35	-1.62	-1.99	-2.40
1183	-1.32	-1.60	-1.98	-2.39
1184	-1.21	-1.45	-1.77	-2.12
1185	-1.07	-1.26	-1.51	-1.78
1186	-1.01	-1.18	-1.41	-1.64
1187	-1.03	-1.20	-1.41	-1.65
1188	-1.15	-1.32	-1.53	-1.76
1189	-1.09	-1.26	-1.47	-1.70
1190	-1.01	-1.18	-1.40	-1.63
1191	-0.94	-1.10	-1.31	-1.54
1192	-0.87	-1.02	-1.21	-1.43
1193	-0.78	-0.92	-1.10	-1.31
1194	-0.67	-0.80	-0.97	-1.16
1195	-0.59	-0.71	-0.87	-1.05
Average:	**-1.07**	**-1.27**	**-1.53**	**-1.81**

Episodic erosion events can occur rapidly and unexpectedly and can dramatically alter the configuration of the shoreline over relatively short periods of time. During the 2016 episodic erosion and beach loss event at Honokōwai Beach, the foreshore (beach) eroded 70 to 125 ft, and the backshore (land) receded 6 to 12 ft in just a few months. The shoreline change that occurred during this period equates to an average annual erosion rate of -5.86 ft/yr, which is over 13 times the historical rate.

The 2016 episodic erosion and beach loss event substantially reduced the volume of sand present at Honokōwai Beach. The estimated volume of sand currently present at Honokōwai Beach is approximately half of what existed prior to the 2016 episodic erosion and beach loss event. The reduction in sand volume and alteration of natural sediment transport patterns have caused Honokōwai Beach to become unstable, making it more sensitive to erosion and less capable of natural recovery. The ability of Honokōwai Beach to recover naturally is further diminished by the lack of sand in the backshore area, which is primarily composed of terrigenous sediment (i.e., alluvium and fill material) (see Appendix A). As the backshore erodes, a vertical escarpment forms, and the fine sediment is distributed in the water column and washed offshore. These conditions would be present

if the temporary erosion protection structure were to be removed and would be expected to persist under the No Action alternative as the erosion scarp would remain exposed to wave action.

No Action would result in a range of potential environmental impacts including but not limited to beach narrowing, negative impacts to water quality and benthic habitat, loss of ecosystem services and critical natural habitat, and progressive degradation of the shoreline area.

Sandy beaches are an important natural resource that provides valuable ecosystem services including but not limited to sediment storage and transport, wave dissipation and buffering against coastal hazards and sea level rise, breakdown of organic materials and pollutants, water filtration, maintenance of biodiversity, scenic viewplanes, and recreational opportunities (Defeo et al., 2009). In Hawaiʻi, beaches are designated as critical habitat for protected and endangered species including green sea turtles and Hawaiian monk seals. Under the No Action alternative, erosion, shoreline recession, beach narrowing, and potential beach loss would continue to degrade the natural environment at Honokōwai Beach, resulting in the inevitable loss of ecosystem services and critical natural habitat.

In addition to providing a natural buffer against coastal hazards and sea level rise, sandy beaches prevent the erosion and discharge of materials and pollutants from land that can negatively impact water quality and benthic habitat. During the 2016 episodic erosion and beach loss event, approximately 5,600 sf of fast land was lost to erosion, and over 1,000 cy of alluvial sediment (i.e., clay, silt, boulders) was discharged into the ocean. The eroded sediment caused turbidity plumes (i.e., brown water) to form in the nearshore waters, which negatively impacted water quality.

Hui O Ka Wai Ola, a community group consisting of volunteers, scientists, supporters, and partner groups, has been conducting water quality monitoring at Honokōwai Beach since 2016. Their monitoring results have confirmed that high levels of turbidity and nitrates are prevalent along the leeward coast of Maui. Their most recent report (2022) found that turbidity and nitrate levels at Honokōwai Beach far exceed Hawaiʻi Department of Health (DOH) water quality standards, and that turbidity is expected to increase over time in northern West Maui, as coastal erosion worsens with sea level rise. The report notes that the existing temporary erosion protection structure at Kāʻanapali Beach Club has helped to reduce turbidity levels at Honokōwai Beach (Hui O Ka Wai Ola, 2024[23]).

Under the No Action alternative, continued erosion of the backshore area (landward of the shoreline) would result in the discharge of substantial volumes of terrigenous sediment (i.e., clay, silt, fill material) into the ocean, which would negatively impact water quality and benthic habitat.

[23] https://www.huiokawaiola.com/uploads/8/6/5/2/86526856/hokwo_water_quality_report_2016-2023.pdf

Table 3-4 presents estimates for the potential volume of terrigenous sediment that could be discharged into the ocean based on current erosion and sea level rise projections. Without the implementation of beach restoration, the projected erosion that would occur with 3.2 ft of sea level rise would result in the loss of approximately 60,946 sf (1.4 acres) of land, and the discharge of approximately 19,542 cy of terrigenous sediment into the ocean.

Table 3-4. Potential sediment discharge under the No Action alternative.

Projected Sea Level Rise (ft)	Estimated Timeframe (yr) [1]	Estimated Land Loss (sf) [2]		Estimated Sediment Discharge (cy) [3]	
0.5	2024	8,783	*8,783*	2,854	*2,584*
1.1	2044	11,184	*19,967*	4,188	*7,042*
2.0	2060	22,658	*42,625*	6,547	*13,589*
3.2	2073	18,320	*60,946*	5,953	*19,542*

[1] Estimated timeframes for sea level rise are based on Int-High Task Force projections (Sweet et.al. 2022).
[2] Estimated land loss is measured from the vegetation line to the SLR-XA coastal erosion hazard lines.
[3] Estimated sediment discharge is limited to the Kāʻanapali Beach Club property.

No Action would result in a range of potential cultural, recreational, and social impacts including but not limited to loss of public amenities, reduced perpendicular and lateral shoreline access, decreased opportunities for traditional and cultural practices, decreased opportunities for ocean access and ocean-based recreation, and increased risks to public health, safety, and welfare.

In Hawaiʻi, beaches are public natural resources that are held in trust by the state for the benefit of the people. Honokōwai Beach and the surrounding shoreline area are public natural resources that have tremendous cultural, recreational, and social value. Honokōwai Beach provides a rare combination of perpendicular and lateral shoreline access, including a coastal walkway that provides continuous ADA-compliant lateral access along 1,000 lf of shoreline. Honokōwai Beach also offers dedicated public beach parking and public restrooms with shower facilities.

Under the No Action alternative, continued erosion, shoreline recession, beach narrowing, and potential beach loss would reduce public access to and along the shoreline and negatively impact water quality and benthic habitat. Reduced lateral and perpendicular shoreline access would also decrease opportunities for beach and ocean-related recreation (e.g., walking, sunbathing, swimming, snorkeling, diving, surfing, and paddling). It is expected that erosion would eventually compromise the safety of the existing ADA-compliant coastal walkway. Removal of the walkway would eliminate lateral shoreline access for mobility disadvantaged individuals, and the steep erosion scarp that would exist along the shoreline would further inhibit perpendicular access to/from the shoreline and create a potential risk to public health, safety, and welfare.

No Action would result in a range of potential impacts to existing infrastructure and land ownership. No Action would increase hazard exposure and vulnerability and decrease hazard resilience, particularly in the context of rising sea levels. The backshore area (landward of the beach) along the Honokōwai coastline is completely developed with resorts and condominiums, most of which are currently protected by existing shore protection structures (e.g., seawalls and revetments). Kāʻanapali Beach Club is one of only two properties within the Honokōwai littoral cell that lacks shore protection.

As sea levels continue to rise and Honokōwai Beach continues to erode, Kāʻanapali Beach Club will be more exposed to coastal hazards and less resilient to sea level rise than the surrounding properties. Under the No Action alternative, the eventual loss of Honokōwai Beach would disproportionately impact Kāʻanapali Beach Club. Table 3-5 presents the estimated loss of land and the estimated decrease in parcel size based on projected erosion and sea level rise. Without implementation of beach restoration, the projected erosion that would occur with 3.2 ft of sea level rise would reduce the total lot size by 20%.

Table 3-5. Projected loss of land with sea level rise.

Sea Level Rise Scenario (ft)	Estimated Loss of Land (sf / acres) [1]	Estimated Decrease in Parcel Size (%) [2]
0.5	8,783 (0.20)	3
1.1	19,967 (0.46)	7
2.0	42,625 (0.75)	11
3.2 [1]	60,946 (1.40)	20

[1] Estimated land loss is measured from the vegetation line to the SLR-XA coastal erosion hazard lines.
[2] Estimated land loss and decrease in parcel size are limited to the Kāʻanapali Beach Club property.

4. ALTERNATIVES IDENTIFIED BUT NOT FULLY EVALUATED

This section details other potential alternatives that were identified but not fully evaluated.

4.1 Alternative Beach Restoration Methodologies

4.1.1 Beach Stabilization with 3 Groins

The Beach Stabilization with 3 Groins alternative would consist of beach nourishment and construction of three T-head groins and one L-head groin. The project would span approximately 1,000 ft of shoreline. The concept plan for Beach Stabilization with 3 Groins is shown in Figure 4-1. The groins would be spaced between 330 and 340 ft apart from southwest to northeast. The groins would extend between 220 and 250 ft from the existing backshore. The heads would extend between 72 and 84 ft to either side of the stem, at angles ranging from 90º to 120º in order to best orient the gaps between heads parallel to the typical wave approach.

The groin crests and elevations are designed with the capability of adapting to sea level rise. The groin heads are designed with a crest elevation of +6 ft MSL. That elevation would allow some overtopping during high wave events without sacrificing beach stability. The groins are designed to be modified as sea level rises. The groin crests would have cast-in-place concrete crest caps as shown on Figure 4-2. This concrete core would serve as a base for groin modification as sea level rises. When sea level has risen and vertical extension is needed, a crown wall can be constructed on top of the concrete core to effectively raise the height of the groin, likely by about 1.5 ft. Design of the groin heads in this manner keeps the heights lower and the view plane more open initially, as opposed to designing the elevations for 3.3 ft of sea level rise now and having groin heads with elevation likely exceeding +9 ft MSL now.

The heads would have crest widths of 11.4 ft and side slopes of 1V:1.5H. The crest elevation is +6 ft MSL and the groin stem elevations would increase from +6 ft MSL at the heads to +7.5 ft MSL at the inshore ends on the inner groins (Figure 4-3) and +8.5 ft MSL on the terminal groins (Figure 4-4). The stems would not require modification for sea level rise, so they are constructed with a three-stone crest width of 11.4 ft. Approximately 22,442 tons of stone would be required to construct the groins.

The southwest and northeast groins are considered terminal groins, meaning that they are at the ends of the beach system. All the other groins would have sand on either side, so they can be lower to allow for a continuous sandy beach. As terminal groins, the stem elevations would have to be higher than the other stems to prevent sand from washing over them. The terminal groin stem elevations are set to +8.5 ft MSL as shown in Figure 4-4.

Sand fill would be placed between the groins to create a beach with a minimum 40-ft width, +8.5-ft MSL elevation, and a 1V:8H slope from the crest to the sea bottom. The inner groin stems are lower than the beach crest elevation, thus approximately half of the groin stem would be covered by sand, with the groins gradually emerging from the beach slope. An estimated 33,000 cy of sand would be required for the alternative.

Some of the advantages and disadvantages of Beach Stabilization with 3 Groins are as follows:

Advantages

- Meets the project objective to maintain a stable beach for a period of 50 years.
- Increases beach stability and mitigates erosion, shoreline recession, and beach narrowing.
- Mitigates the need for periodic renourishment.
- Requires 54,000 cy less sand than Beach Maintenance.
- Less expensive than Beach Maintenance.

Disadvantages

- Requires beach stabilizing structures (groins).
- Groins would be larger and extend further offshore than Beach Stabilization with 4 Groins.
- Would negatively impact ocean access and recreational uses in the existing channel.
- Does not facilitate sand exchange with the North Kāʻanapali littoral cell.
- Does not improve shoreline access lateral shoreline access around Honokōwai Point.
- Requires 5,000 cy more sand than Beach Stabilization with 4 Groins.
- Requires 11,000 cy more sand than Beach Nourishment.
- More expensive than Beach Nourishment and Beach Stabilization with 4 Groins.

The Beach Stabilization with 3 Groins alternative was removed from further consideration due to concerns about impacts to ocean access and recreational uses in the existing channel.

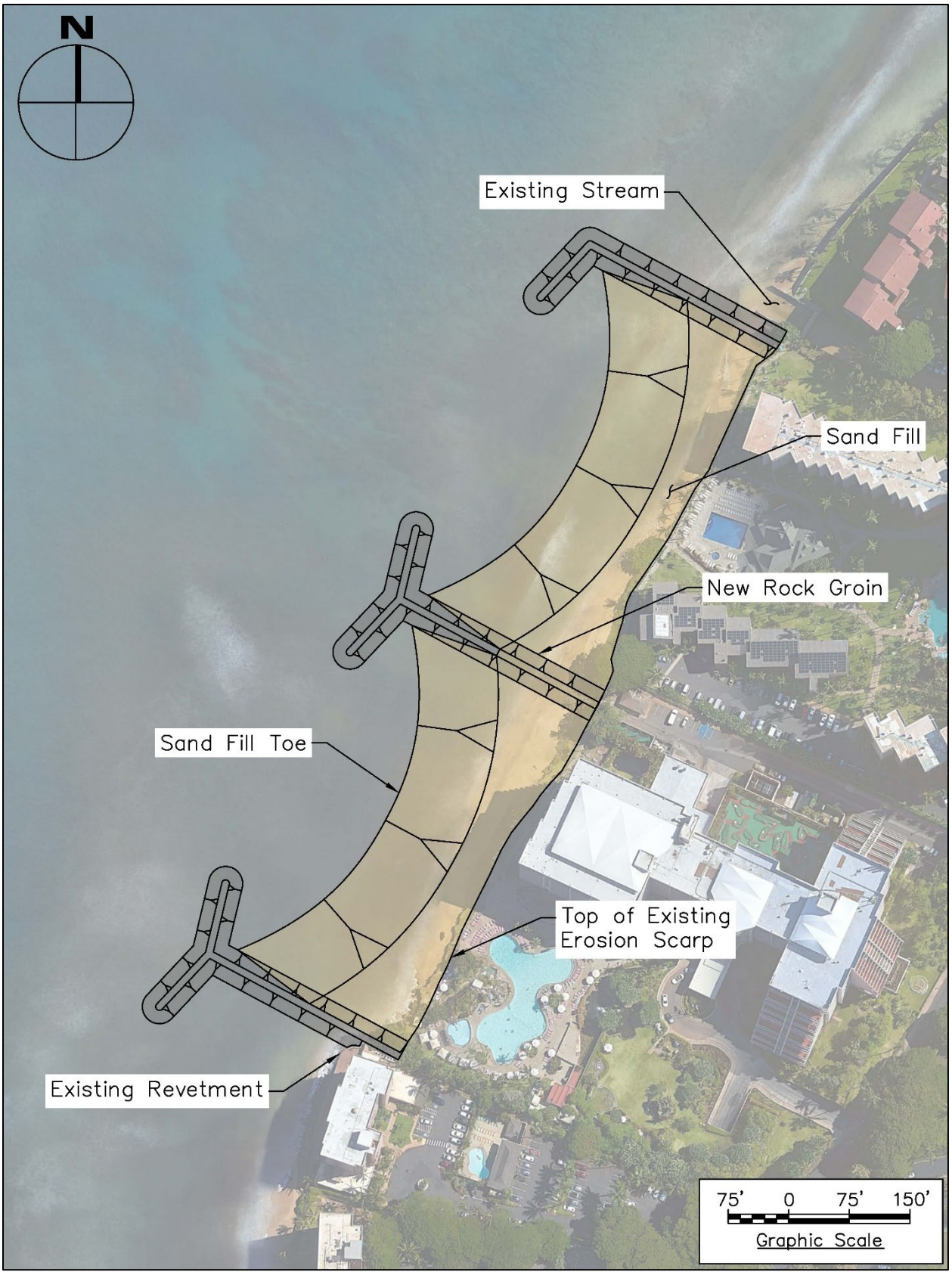


Figure 4-1. Concept plan view for Beach Stabilization with 3 Groins

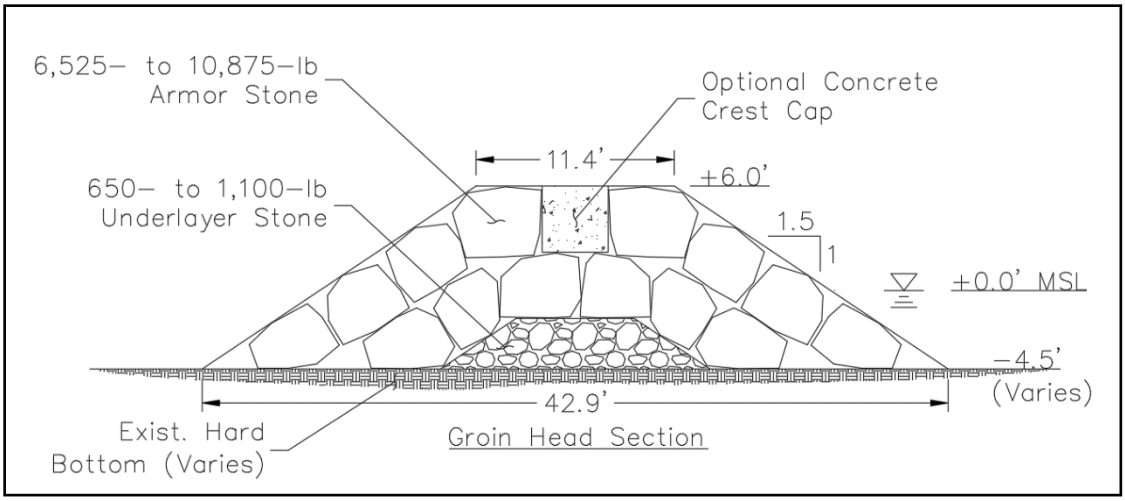


Figure 4-2. Typical groin head cross section for the Beach Stabilization alternative

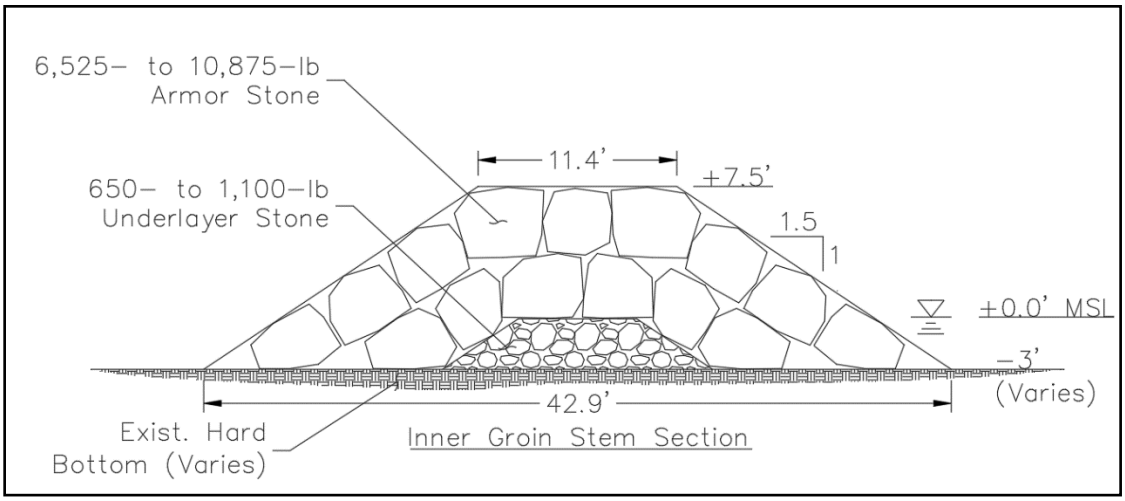


Figure 4-3. Typical inner groin stem cross section for the Beach Stabilization alternative

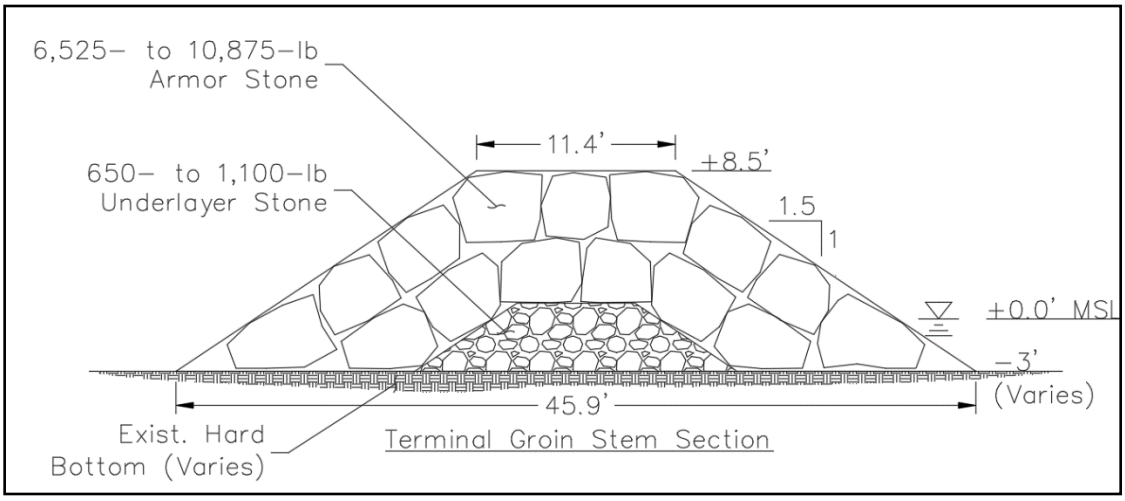


Figure 4-4. Typical terminal groin cross section for Beach Stabilization

4.1.2 Large Scale Beach Nourishment

A potential alternative method for transporting sand from the offshore Sand Recovery Site to the Project Site is by using an offloading site along the shoreline closer to the Project Site. The closest potential offload site is located approximately 3,000 ft south of Honokōwai Beach at Kekaʻa Open Space Park. Offloading at this site would be technically challenging and would require an anchoring system for the barges, a temporary bridge structure or floating platform, and machinery for transporting the sand from the barge to shore. The deck barges would be moored in approximately 15 ft of water depth, where they would hold position adjacent to the bridge structure. Bridge structures may be temporary floating bridges, trestles, or similar structures that allow for the transfer of sand from the barge to the shoreline. The sand would be transferred to shore along the bridge/trestle system. Land-based equipment would then transfer the sand from the offloading location to the placement area.

The truck haul route would be along the shoreline. Due to the relatively narrow beach width in this area, the existing beach would need to be widened to accommodate the necessary equipment to transport the sand along the shoreline to the Project Site. Widening of the beach would require an additional 65,000 cy of sand. For this alternative, it is assumed that articulating dump trucks with a capacity of 25 cy per truckload would be used to transport the sand from the offload site along the shoreline to the Project Site. This alternative would significantly increase the beach area that would need to be nourished to accommodate sand transport and is therefore referred to as Large Scale Beach Nourishment.

Large Scale Beach Nourishment would consist of placing sand at the south end of the Honokōwai littoral cell and the north end of the North Kāʻanapali littoral cell without any structures to stabilize the sand. This alternative would restore a sandy beach around Honokōwai Point to improve lateral shoreline access and facilitate sand exchange between the two littoral cells. The concept plan for the Large Scale Beach Nourishment alternative is shown in Figure 4-5. 92,000 cy of sand would be recovered from the offshore Sand Recovery Site and placed along approximately 4,000 ft of shoreline from Honokōwai Stream extending approximately 3,000 ft south of Honokōwai Point. The beach would have a crest elevation of +8.5 ft MSL and a beach slope of 1V:8H.

Some of the advantages and disadvantages of Large Scale Beach Nourishment are as follows:

<u>Advantages</u>

- Does not require beach stabilizing structures (groins).
- Temporarily facilitates sand exchange with the North Kāʻanapali littoral cell.
- Temporarily improves lateral shoreline access around Honokōwai Point.
- Requires the least construction days of the alternatives considered but not fully evaluated.
- Least expensive option of the alternatives considered but not fully evaluated.

Disadvantages

- Has the shortest design life (10 yrs) of the alternatives considered.
- Requires 2.4 times more sand than Beach Nourishment.
- Requires recovery of approximately 10% of the sand available at the Sand Recovery Site.
- Sand placement area is significantly larger than the alternatives considered.
- Trucking along the shoreline has the potential to increase impacts on adjacent landowners.
- Trucking along the shoreline may require more extensive beach closures.
- Sand would be less stable and more vulnerable to erosion without stabilizing structures.
- Does not maintain a stable beach for a period of 50 years.
- Does not increase beach stability.
- Least cost-effective of the options considered (average annual cost = $2,165,800).

The Large Scale Beach Nourishment alternative was removed from further consideration due to the technical challenges associated with offloading the sand directly onto shore, the potential for impacts to affect a larger geographic area, and the larger volume of sand fill required.

4.1.3 Large Scale Beach Maintenance

The Large Scale Beach Maintenance alternative would consist of an initial beach nourishment project with periodic renourishment at specified intervals. The initial nourishment effort would be identical to the Large Scale Beach Maintenance alternative described in Section 4.1.3. For beach nourishment without stabilizing structures, it is recommended that periodic beach maintenance be performed after the initial nourishment and throughout the 50-year design life to maintain the desired beach width. This would require additional sand added at time intervals corresponding to when the beach erodes landward a certain distance.

To maintain a minimum beach berm width of 25 to 30 ft, renourishment would be required when the initial beach shape (40-ft beach berm width) migrates landward approximately 10 to 15 ft. Based on the future shoreline change rates outlined in Section 7.5.3.2, Honokōwai Beach is projected to erode at an average rate of -1.27 ft/yr, which corresponds to 12.7 ft of shoreline recession over approximately 10 years. Over a period of 50 years, approximately four (4) renourishment efforts would be required to maintain the desired beach width of 40 ft. E The initial nourishment would require 92,000 cy of sand and each subsequent renourishment would require approximately 10,000 cy of sand, resulting in a total volume of 132,000 cy of sand to restore the beach and maintain a minimum beach width of 40 ft. The renourishment interval is based on the projected average annual shoreline change rates. Depending on the actual rate of sea level rise, and how the shoreline responds, renourishment could potentially be required more or less frequently.

Some of the advantages and disadvantages of Large Scale Beach Maintenance are as follows:

Advantages

- Does not require beach stabilizing structures (groins).
- Does not require barging and trucking to/from Kahului Harbor.
- Restores and maintains the largest beach area of the alternatives considered.
- Achieves the objective to maintain a beach for a period of 50 years.
- Facilitates sand exchange with the North Kāʻanapali littoral cell.

- Improves lateral shoreline access around Honokōwai Point.

Disadvantages

- Does not increase beach stability.
- Renourishment would be required approximately every 10 years.
- Requires the most sand (132,000 cy) of the alternatives considered.
- Requires recovery of approximately 13.5 % of the sand available at the Sand Recovery Site.
- Dependent on future sand availability at the Sand Recovery Site.
- Trucking along the shoreline has the potential to increase impacts on adjacent landowners.
- Trucking along the shoreline may require more extensive beach closures.
- Most expensive of the alternatives considered.

The Large Scale Beach Maintenance alternative was removed from further consideration due to the technical challenges associated with offloading the sand directly onto shore, the potential for impacts to affect a larger geographic area, the larger volume of sand fill required, and the potential for cumulative impacts associated with periodic renourishment.



Figure 4-5. Concept plan view for Large Scale Beach Nourishment and Beach Maintenance

4.2 Dune Construction

Dune restoration, like beach restoration, is widely accepted as a nature-based approach to natural resource restoration. Similar to beaches, coastal dunes are an important natural resource that provides a natural buffer that protects development from coastal hazards and provides habitat for coastal flora and fauna. Dune restoration can be implemented as a standalone project or as a component of a beach restoration project to provide additional sand volume and wave runup protection (Hawaiʻi Sea Grant, 2022). In addition to sand placement, dune restoration projects may include additional structural and non-structural components to protect and stabilize the dune, including but not limited to vegetation, signage, sand fencing, and dune walkovers. The County of Maui has partnered with local community groups on multiple dune restoration projects on Maui including projects at Kalepolepo Beach Park (Figure 4-6) and Kanahā Beach Park (Figure 4-7), with additional dune restoration and management projects planned at Kamaʻole Beach Park I and Kapukaulua Beach Park.

Coastal dunes can be preserved through either dune restoration or dune construction. Dune restoration is intended to return an existing coastal dune to a previous condition or improve its condition after it has been degraded or damaged. In contrast, dune construction involves constructing new coastal dunes at locations where dunes did not previously exist. There are no coastal dunes at the Project Site where the backshore geology is characterized as alluvium (clay, silt, gravel, and sand) (see Appendix A).

Beach restoration at the Project Site could potentially be modified to include a dune construction component that would simulate the appearance and ecological services of a coastal dune. Dune construction would involve placement of additional sand along the landward edge of the beach profile to provide additional protection from wave-induced flooding and improve the aesthetics of the shoreline area. Dune construction could also potentially reduce erosion due to foot traffic by directing beachgoers to designated beach access pathways and provide dedicated space for planting of native coastal vegetation.

The disadvantages of dune construction at the Project Site are that it would require recovery and placement of additional sand and human access may need to be restricted to protect and stabilize the newly constructed dune. Restricting access to the area of dune construction may inhibit lateral shoreline access and limit the range of human uses that this area can support. Due to space limitations within the Project Site, dune construction may preclude the option of maintaining an ADA-compliant coastal walkway, which would reduce lateral shoreline access for individuals with disabilities.

Dune construction at the Project Site would likely be limited to the area between the existing buildings and the certified shoreline, which is approximately 20 to 30 ft wide. This area currently consists of a combination of landscape features (lawns, shrubs, trees) and hardscape features (walkways, pool decks, showers, water features, and fences). These existing features would likely need to be removed to accommodate a continuous dune along the entire length of Honokōwai Beach. An alternative approach would be to construct a series of discontinuous dunes at specific locations.

Dune construction would not achieve the objective to restore Honokōwai Beach.



Figure 4-6. Example of dune restoration at Kalepolepo Beach Park



Figure 4-7. Example of dune restoration at Kanahā Beach Park.

4.3 Shore Protection

Shore protection typically consists of structures that are intended to provide long-term protection for threatened natural resources, land, and infrastructure, while mitigating risks to public health, safety, and welfare. Shore protection typically consists of engineered structures that retain existing land and prevent erosion due to wave action. Examples of shore protection structures include but are not limited seawalls, revetments, and hybrid seawall-revetments.

Shore protection is a mid-term solution (10 to 50 years) that is typically intended to function for a period of several decades but can remain in place for longer periods when properly maintained. In some cases, shore protection structures can be modified to accommodate sea level rise. Modifications typically involve fortifying foundations to reduce scour due to wave action, increasing the width of the structure to withstand increased wave forces, and/or increasing the height of the structure to reduce wave overtopping and flooding.

Shore protection structures are typically either vertical or sloping structures that are designed to retain soil loads and protect the backshore land and infrastructure from erosion and flooding. Shore protection structures are typically constructed of concrete, concrete rubble masonry (CRM), cement masonry units (CMU), or sheet piles. When properly designed and constructed, shore protection is a proven, durable, and low-maintenance approach to mitigate erosion.

The advantages of shore protection structures are that they effectively mitigate erosion, protect backshore land and infrastructure, and reduce the risks of land loss and infrastructure damage. The disadvantages of shore protection structures are that they can have a large structural footprint along the shoreline, can reduce perpendicular and lateral shoreline access, and are generally not conducive to beach preservation. The existing regulatory framework in Hawaiʻi strictly regulates and, in some cases, prohibits the construction of new shore protection structures. Shore protection would not achieve the objective to restore Honokōwai Beach.

Shore protection at the Project Site could potentially consist of the following:

- Concrete Secant Pile Wall
- Steel Sheet Pile Wall
- Rock Rubble mound Revetment
- Hybrid Seawall-Revetment

Concrete Secant Pile Wall

A seawall is a vertical or sloping wall used to retain soil loads and protect the backshore land and infrastructure from erosion and flooding. Seawalls are commonly constructed of concrete, concrete rubble masonry (CRM), cement masonry units (CMU), or sheet piles. When properly designed and constructed, seawalls are a proven, durable, and low-maintenance method for erosion mitigation. Seawalls also have the advantage of having a relatively small footprint along the shoreline.

Seawalls are rigid structures, and their structural stability is dependent on the design and strength of their foundations. If the foundation of a seawall is breached, hydraulic action can erode sediment behind the wall. With the loss of enough sediment, the ground surface behind the seawall can collapse and sinkholes can form. Sinkholes can compromise the structural integrity of a seawall and may result in failure of the structure. To avoid foundation problems, the seawall foundation should be well below the potential scour depth, which can require extensive excavation. The impervious and vertical face of a seawall results in very little wave energy dissipation. Incident wave energy is deflected upward, downward, and seaward. Reflected wave energy can inhibit accretion of sand seaward of the wall. 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 sandy and eroding shorelines. Ideally, seawalls are constructed on solid, non-erodible substrate.

MKE Associates LLC (MKE, 2019) evaluated two options for a seawall at the Project Site: a concrete secant pile wall, and a steel sheet pile wall (see Appendix B). Secant pile walls are typically constructed of interlocking reinforced concrete piles. Secant pile walls offer increased wall stiffness compared to sheet piles and can be installed in more difficult ground conditions. An example of a concrete secant pile wall is shown in Figure 4-8. The typical installation process for a concrete secant pile wall in shown in Figure 4-9. MKE prepared two conceptual layouts for a buried concrete secant pile wall at the Project Site: one to protect the existing building on the northern portion of the property (Figure 4-10) and one to protect the entire shoreline (Figure 4-11). The structures would be set back from the shoreline to the maximum extent practicable and buried in the ground. Both layouts would require a 12-ft construction offset from the existing building.

An advantage of a concrete secant pile wall is that it would have the smallest structural footprint of the options considered and would not require installation of soil anchors, so it could be constructed without having to modify existing buildings. Also, if a concrete secant pile wall is exposed by erosion, it would be less susceptible to corrosion than a steel sheet pile wall. A disadvantage of a concrete secant pile wall is that it would be wider in section and may require more clearance for installation than a sheet pile wall. Construction would also require demolition of the existing waterslide and small pool adjacent to the shoreline for construction access.



Figure 4-8. Example of a concrete secant pile wall

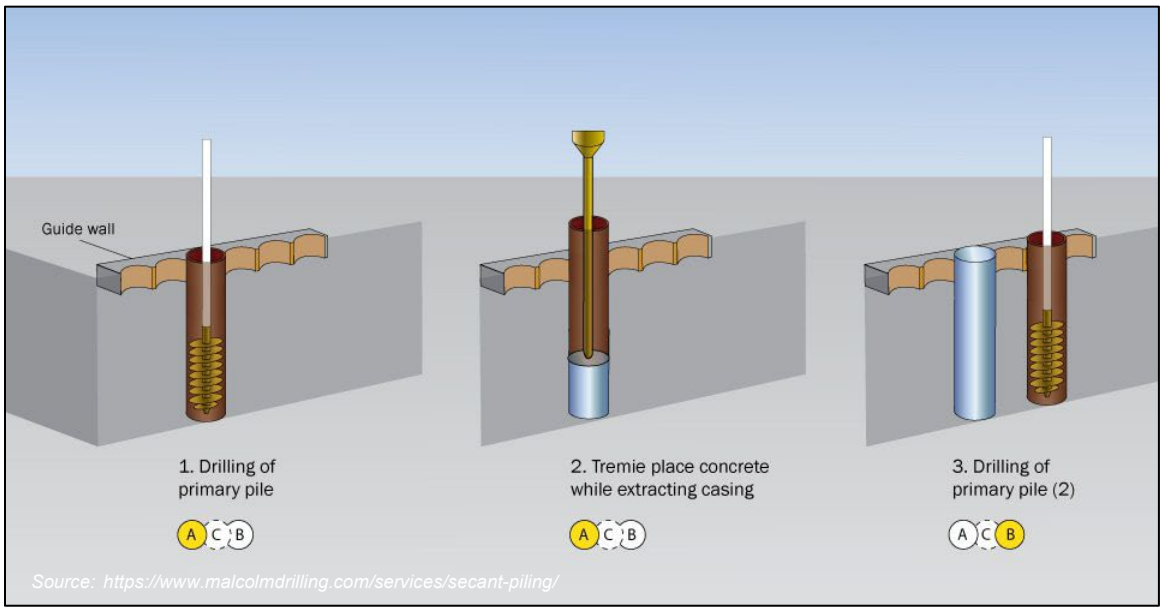


Figure 4-9. Typical installation process for a concrete secant pile wall

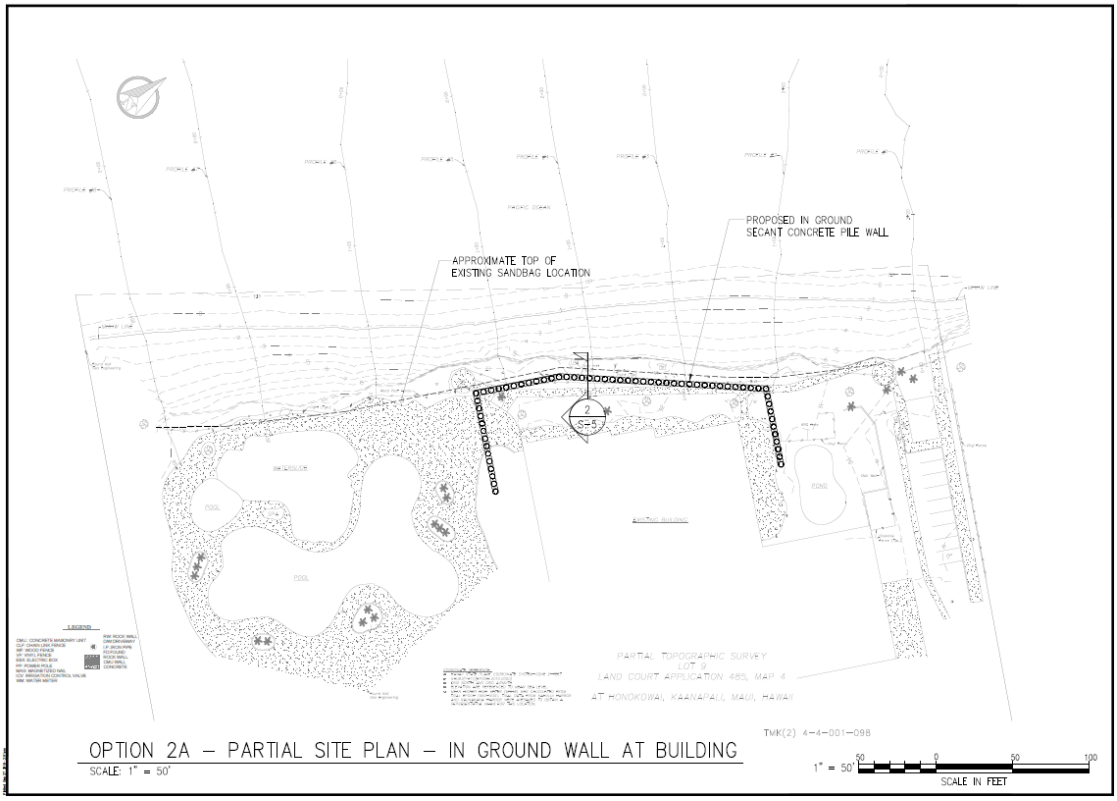


Figure 4-10. Concept plan for concrete secant pile wall to protect existing building (MKE, 2019)

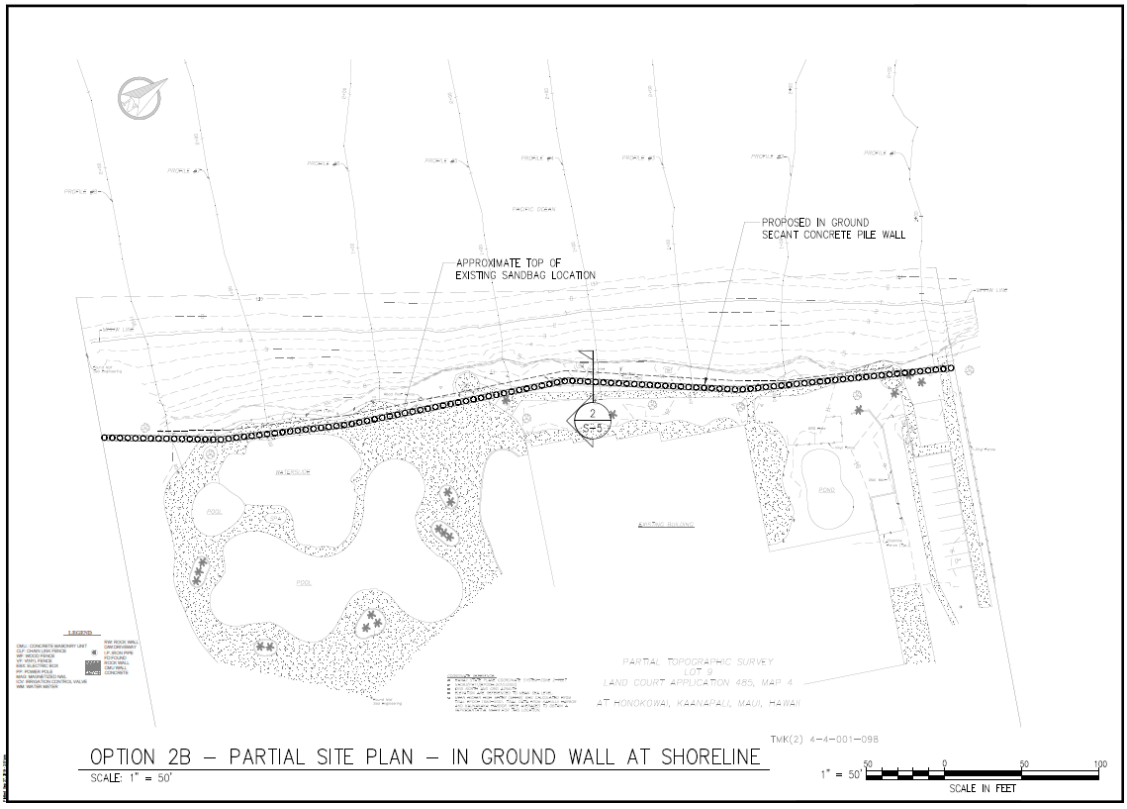


Figure 4-11. Concept plan for concrete secant pile wall to protect entire property (MKE, 2019)

Steel Sheet Pile Wall

Sheet piles are sections of material, typically steel or vinyl, with interlocking edges that are driven into the ground. Steel sheet piles, while very strong, are vulnerable to corrosion in the coastal environment. Often, vinyl sheet pile is used as a substitute for steel; however, the vinyl material is significantly weaker than steel. A steel sheet pile wall often requires an earth anchoring system. An example of a steel sheet pile wall with earth anchors is shown in Figure 4-12.



Figure 4-12. Example of a steel sheet pile wall with earth anchors (Kahana, Maui)

MKE (2019) prepared two conceptual layouts for a buried steel sheet pile wall at the Project Site: one to protect the existing building on the northern portion of the Kāʻanapali Beach Club property (Figure 4-13) and one to protect the entire shoreline fronting Kāʻanapali Beach Club (Figure 4-14). The steel sheet pile wall cross-section is shown in Figure 4-15. The structures would be set back from the shoreline to the maximum extent practicable and buried in the ground. Both layouts require a 12-ft construction offset from the existing building. Based on the geotechnical recommendations for the wall foundation to be embedded below the projected maximum scour depth of -12 ft, the sheet piling would need to extend to -12 ft with a total design retained height of about 24 ft to the current top of embankment of about 12 ft.

An advantage of a steel sheet pile wall is that it would be thinner in section and may require less clearance for installation than a concrete secant pile wall. A steel sheet pile wall would require an earth anchoring system. The distance requirement for the anchoring system is driven by the geotechnical properties of the soil. Several of the soil anchors would likely extend under the existing building. Construction may require demolition of the waterslide and a small pool adjacent to the shoreline for construction access. Also, if a steel sheet pile wall is exposed by erosion, it would be more susceptible to corrosion than a concrete secant pile wall.

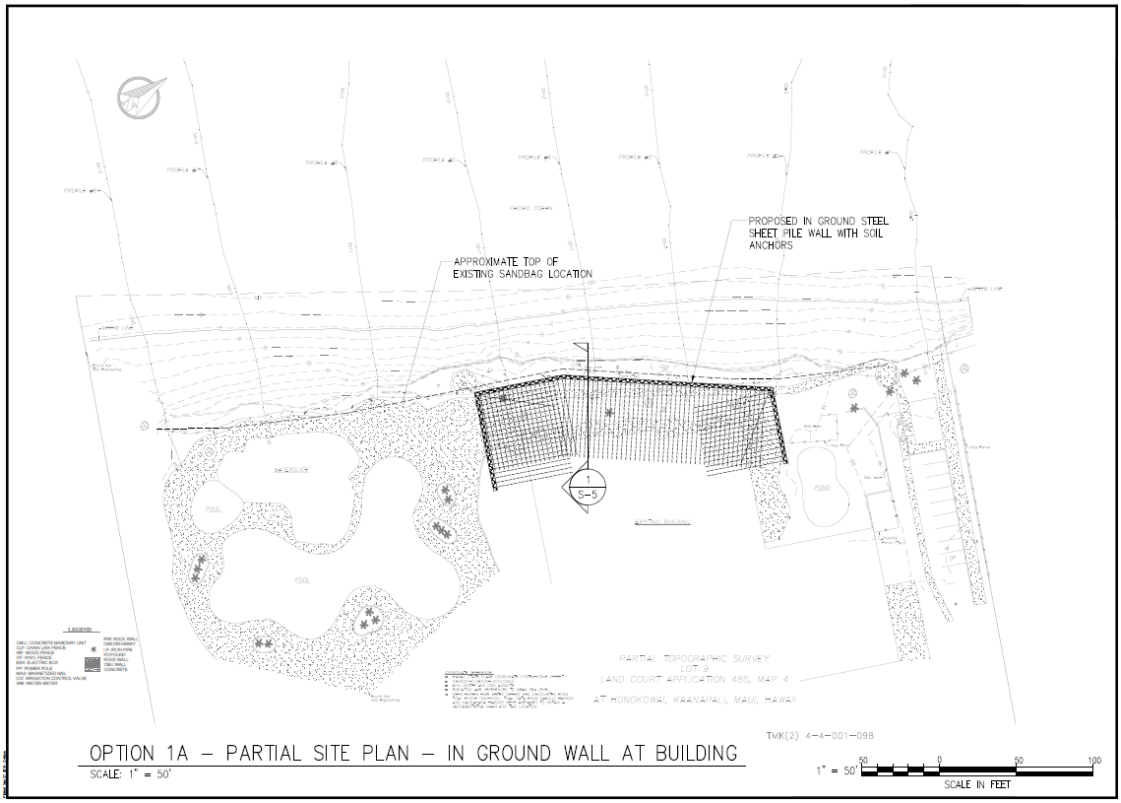


Figure 4-13. Concept plan view for steel sheet pile wall to protect existing building (MKE, 2019)

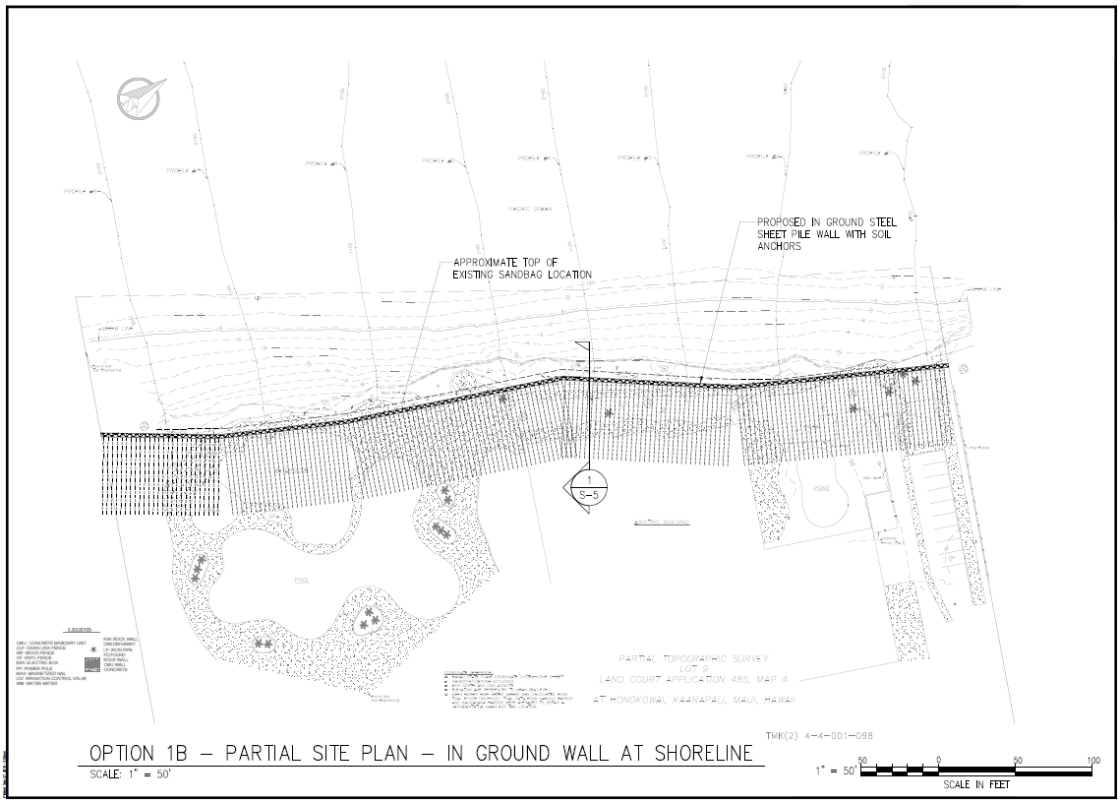


Figure 4-14. Concept plan view for steel sheet pile wall to protect entire shoreline (MKE, 2019)

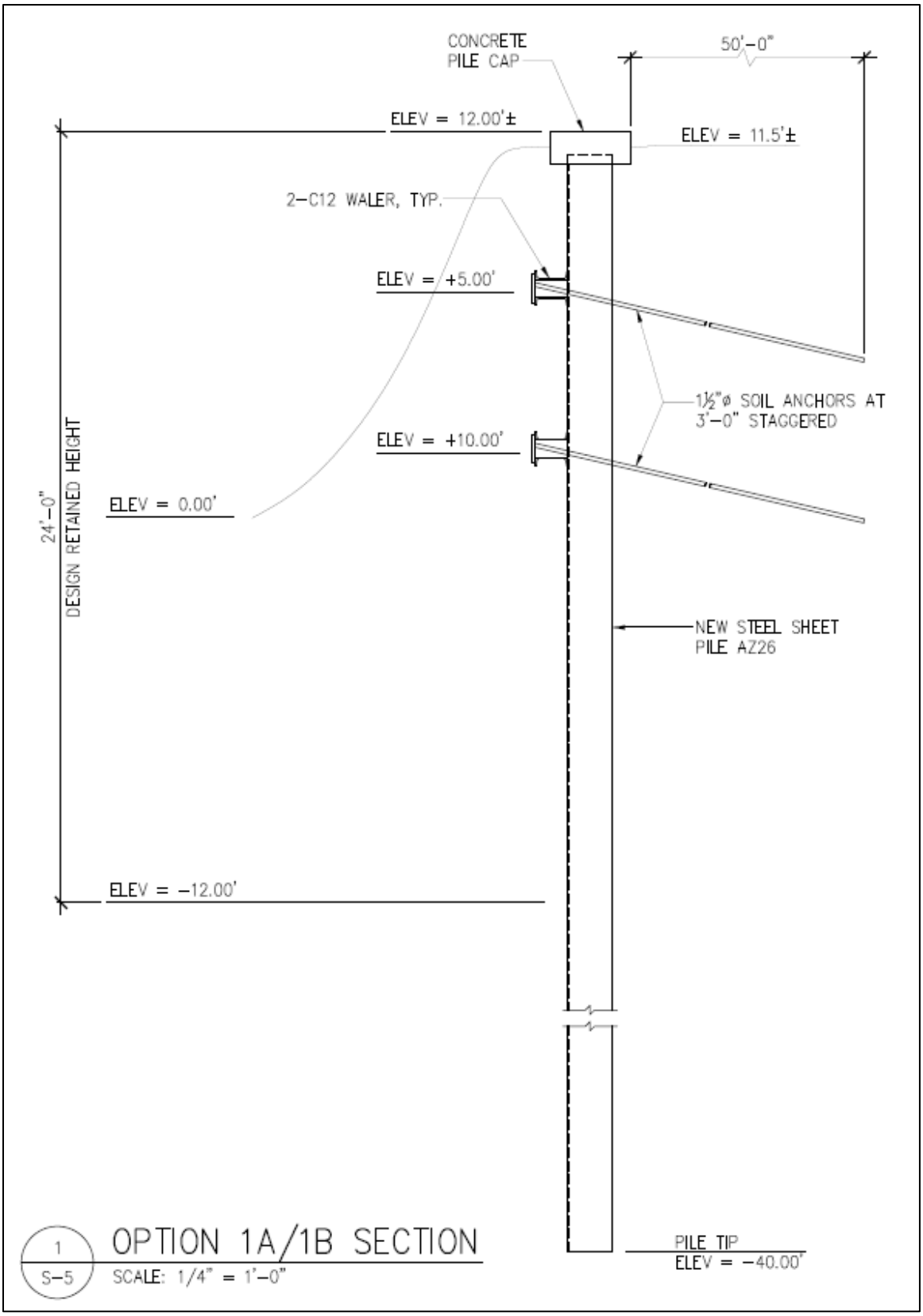


Figure 4-15. Conceptual section view for steel sheet pile wall (MKE, 2019)

Rock Rubble Mound Revetment

A revetment is a sloping, un-cemented structure constructed of wave-resistant material. The most common method of revetment construction is to place a layer of armor stone, sized according to the design wave height, over an underlayer of smaller rock that sits atop filter fabric. The underlayer is designed to distribute the weight of the armor layer and to prevent loss of fine material through voids in the revetment. An example of a rock rubble mound revetment is shown in Figure 4-16.



Figure 4-16. Example of a rock rubble mound revetment (Kahului, Maui)

Revetments in Hawaiʻi 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, constructing the foundation below the maximum depth of anticipated scour, or extending the toe to provide a scour apron of excess stone. For large wave heights, a revetment may be constructed with a two-stone thick armor layer that uses a uniform stone size designed to be stable under the design wave conditions. 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.

An advantage of a revetment is that the rough and porous surface and flatter slope of revetments absorb and dissipate more wave energy than the smooth vertical surfaces of seawalls. Revetments are more effective in reducing wave reflection, runup, and overtopping, which increases the potential for sand accumulation seaward of the structure. Because of its durability, flexibility, and reduced wave reflection, a revetment is often considered the best erosion control/shore protection option for sites where shoreline hardening is considered appropriate. Additional advantages of revetments are that materials are readily available, and localized damage can be easily repaired by placement of additional armor stone.

A disadvantage of a revetment is that it has a large structural footprint, which can be problematic in a coastal setting. The location of the structure would affect the overall cost and permitting requirements. Revetments are typically constructed in areas where infrastructure is already threatened by erosion. In these locations, the erosion is often so severe that there is limited terrestrial area to accommodate a revetment so the structure can only be constructed seaward of the shoreline. Hawaiʻi Revised Statutes discourages construction of shore protection structures seaward of the shoreline in the Conservation District. Construction of a rock rubble mound revetment landward of the shoreline would require extensive excavation of the terrestrial area.

Coastal structures typically have service lives of around 50 years before they need to be modified or repaired. Design heights for shore protection structures typically account for the effects of tides, surges, waves, and relative sea level rise. Accounting for projected sea level rise in the design of shore protection structures often requires increasing the design height of the structure. Sea level driven changes in wave characteristics, and to a lesser extent, tides, amplify the resulting design heights by an average of 48 to 56%, relative to design changes caused by sea level rise alone (Arns et.al., 2017). A rock rubble mound revetment designed to account for sea level rise 50 years in the future would have a larger structural footprint than is required for current conditions. An alternative approach is to design a structure that can be modified as sea level rises.

SE prepared two conceptual layouts for a rock rubble mound revetment at the Project Site: one to protect the existing building on the northern portion of the Kāʻanapali Beach Club property (Figure 4-17), and one to protect the entire shoreline fronting Kāʻanapali Beach Club (Figure 4-18). The rock rubble mound revetment cross-section is shown Figure 4-19. Both layouts would require a 12-ft construction offset from the existing building.

The conceptual plans account for 2.8 ft of sea level rise, which corresponds with the NOAA (2022) *Intermediate* scenario projection for 2080. A closely approaching hurricane was chosen as the design event for the structure. This event would result in a still water level rise of +8.2 ft MLLW at the Project Site, including 2080 sea levels. To account for future sea level rise, the armor stones must be sized to withstand wave events and ocean water levels that might occur between now and the year 2080. This design event would require armor stones that weigh 3 tons and have a nominal diameter of 3.3 ft. They would be placed in two layers with a slope of 1.5H:1V. The crest height would be +12 ft MLLW. To prevent scour and undermining of the structure, a two-stone scour apron would be required. The structure would have a horizontal footprint of 41 ft. A rock rubble mound revetment would require modifications to the adjacent shore protection structures at the Maui Kai Condominiums and Kāʻanapali Shores and the adjacent public access.

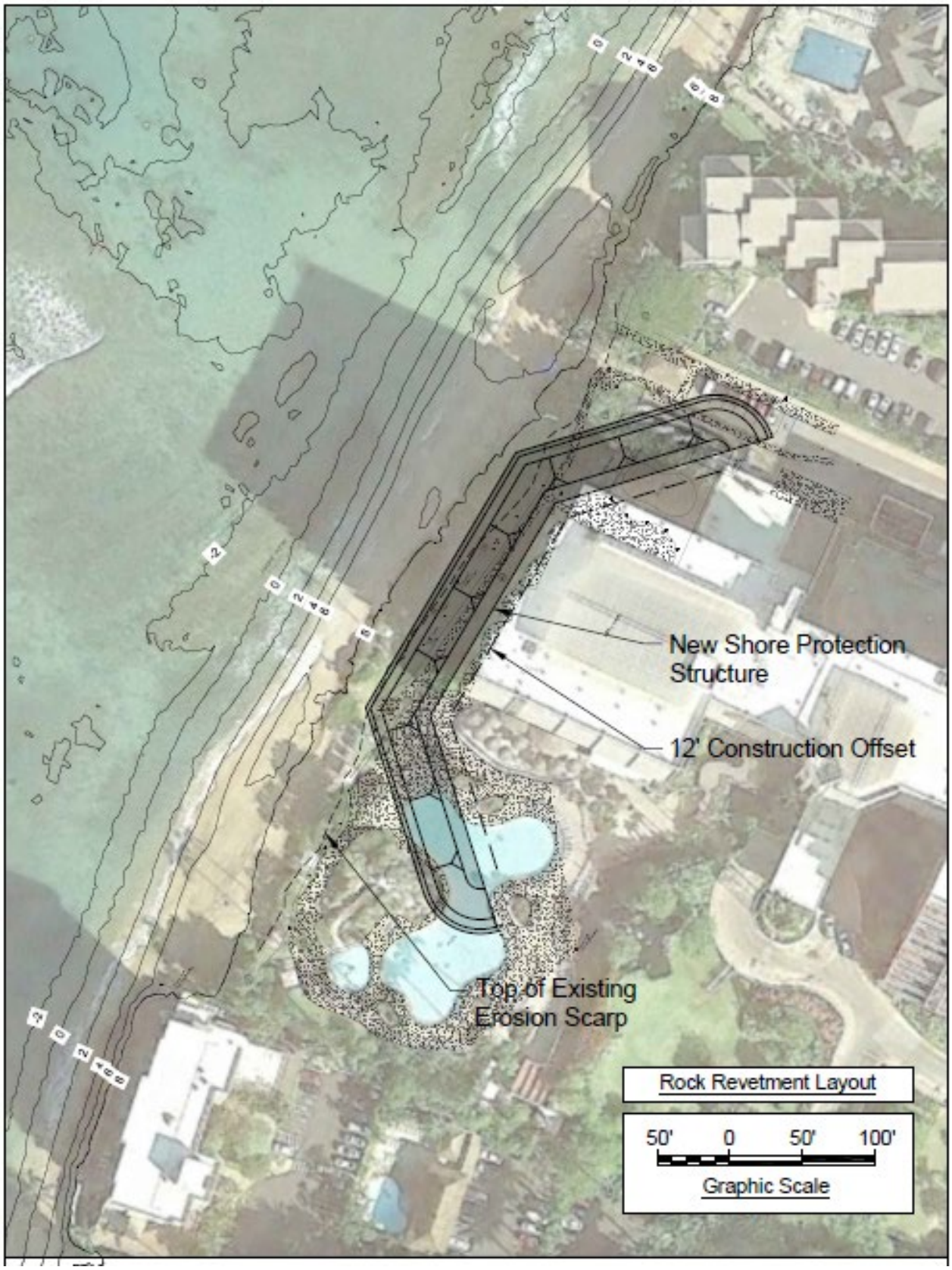


Figure 4-17. Concept plan view for rock rubble mound revetment to protect existing building.



Figure 4-18. Concept plan view for rock rubble mound revetment to protect entire property.

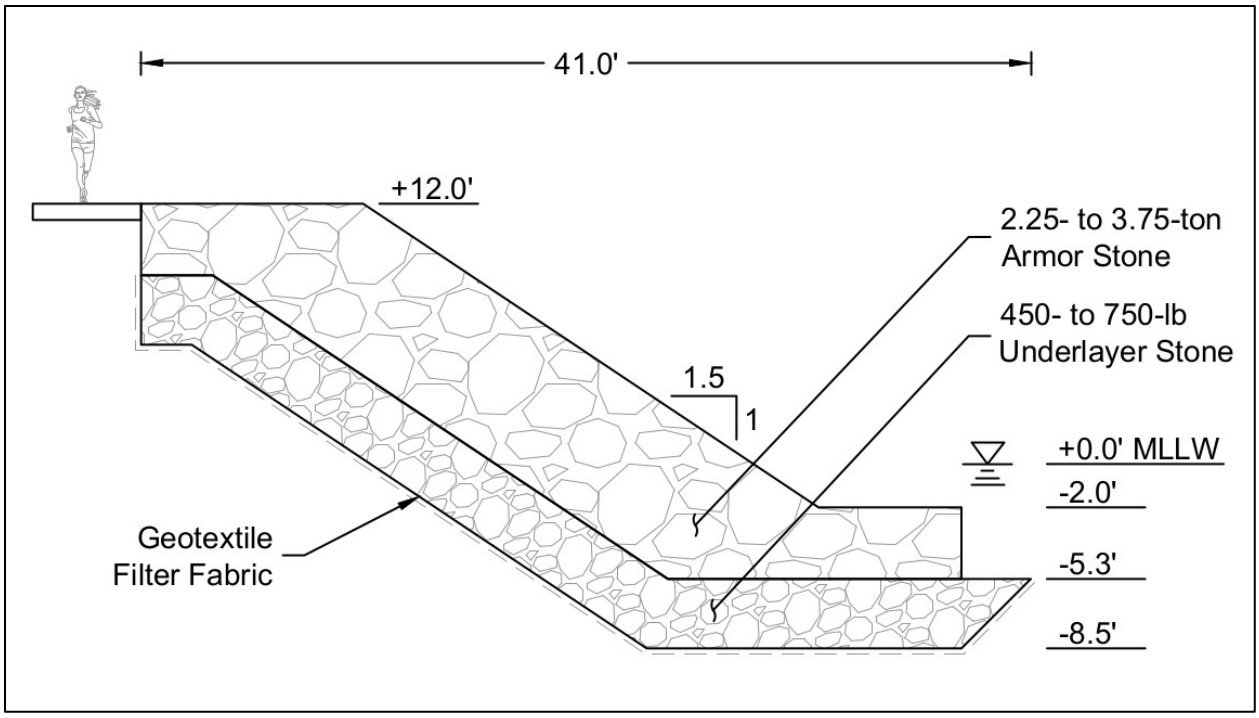


Figure 4-19. Concept section view for rock rubble mound revetment.

Hybrid Seawall-Revetment

Another potential long-term engineering solution for the Project Site is a hybrid seawall-revetment, which is a shore protection structure composed of two primary elements: a seawall (i.e., sheet pile, reinforced concrete, or concrete rubble masonry) and a rock rubble mound revetment. An example of a hybrid seawall-revetment with a concrete rubble masonry wall is shown in Figure 4-20. An example of a hybrid seawall-revetment with a sheet pile wall is shown in Figure 4-21.

An advantage of a hybrid seawall-revetment is that combining a rock rubble mound revetment topped with a low wall provides additional flood protection while reducing the overall footprint of the structure. The structure can also be designed to be modified to withstand changing design wave conditions as sea level rises. Additional advantages of a hybrid seawall-revetment are that materials are readily available and localized damage can be easily repaired by placement of additional armor stone. When properly designed and constructed, hybrid seawall-revetments are durable, flexible, and highly resistant to wave damage. A disadvantage of a hybrid seawall-revetment is that it would have a relatively large structural footprint. The location of the structure would affect the overall cost and permitting requirements. Construction of a hybrid seawall-revetment landward of the shoreline would require extensive excavation of the terrestrial area.



Figure 4-20. Hybrid seawall-revetment with concrete rubble masonry wall (Kapaa, Kauai)



Figure 4-21. Hybrid seawall-revetment with sheet pile wall

SE prepared two conceptual layouts for a hybrid seawall-revetment at the Project Site: one to protect the existing building on the northern portion of the Kāʻanapali Beach Club property (Figure 4-22), and one to protect the entire shoreline fronting Kāʻanapali Beach Club (Figure 4-23). The hybrid seawall-revetment cross-section is shown in Figure 4-24. Both layouts would require a 12-ft construction offset from the existing building.

The wall could be constructed of concrete rubble masonry or sheet pile. The armor stone and underlayer stone would be the same size as the rock rubble mound revetment, but the crest of the revetment component would only be +5 ft MLLW. A hybrid seawall-revetment may also require a scour apron. A hybrid seawall-revetment would require modifications to the adjacent shore protection structures at the Maui Kai Condominiums and Kāʻanapali Shores and the adjacent public access.

The conceptual plans account for 2.8 ft of sea level rise, which corresponds with the NOAA (2022) *Intermediate* scenario projection for 2080. A closely approaching hurricane was chosen as the design event for the structure. This event would result in a still water level rise of +8.2 ft MLLW at the Project Site, including 2080 sea levels. To account for future sea level rise, the armor stones must be sized to withstand wave events and ocean water levels that might occur between now and the year 2080. This design event would require armor stones that weigh 3 tons and have a nominal diameter of 3.3 ft. They would be placed in two layers with a slope of 1.5H:1V. The crest of the revetment component would be +5 ft MLLW. The wall component would consist of a steel sheet pile wall with a concrete splashguard. The crest elevation of the wall would be +12 ft MLLW. The structures would have a combined horizontal footprint of 28.4 ft, which is 30% smaller than the rock rubble mound revetment option.

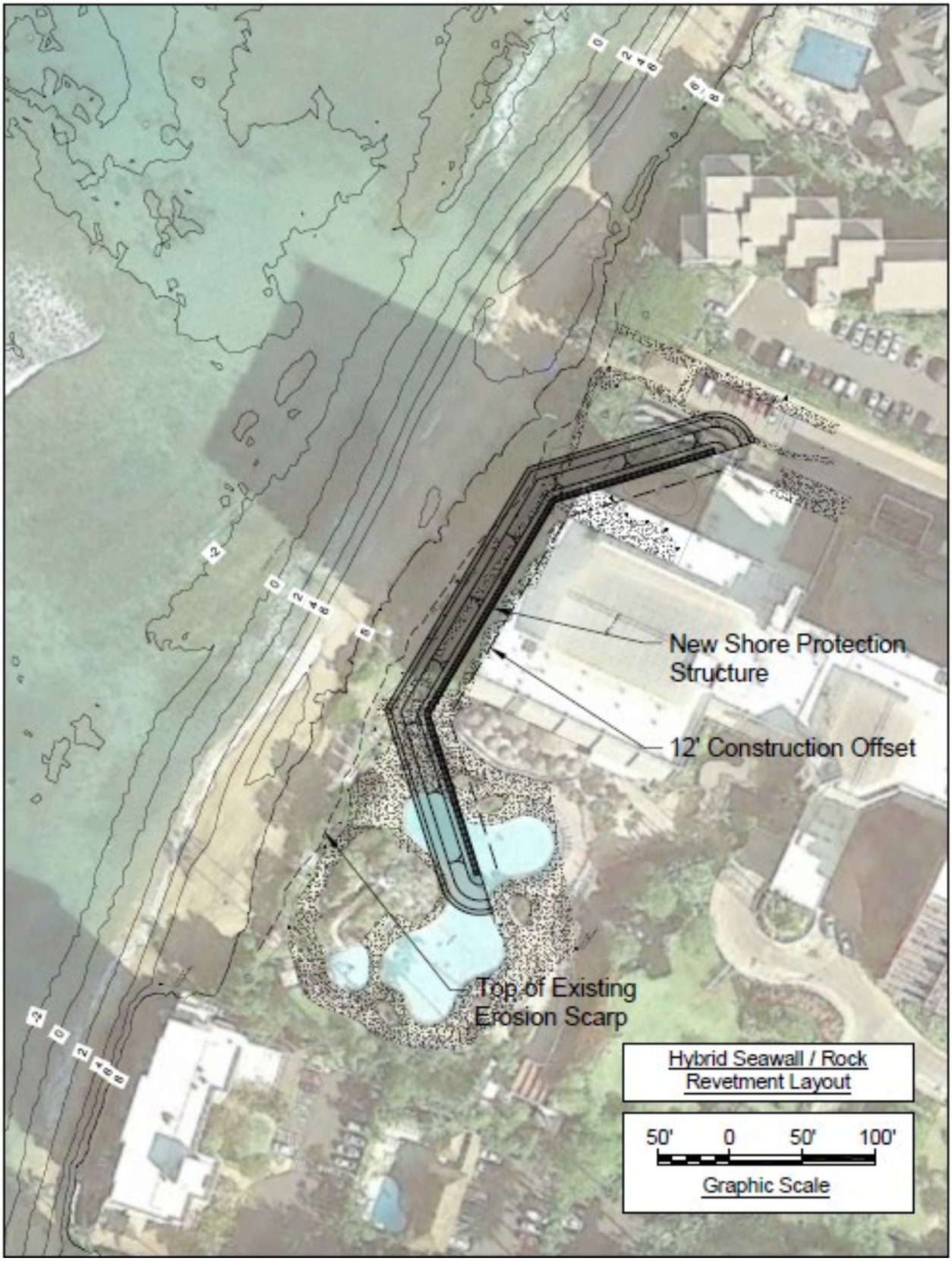


Figure 4-22. Concept plan view for hybrid seawall-revetment to protect existing building.



Figure 4-23. Concept plan view for hybrid seawall-revetment to protect the entire property.

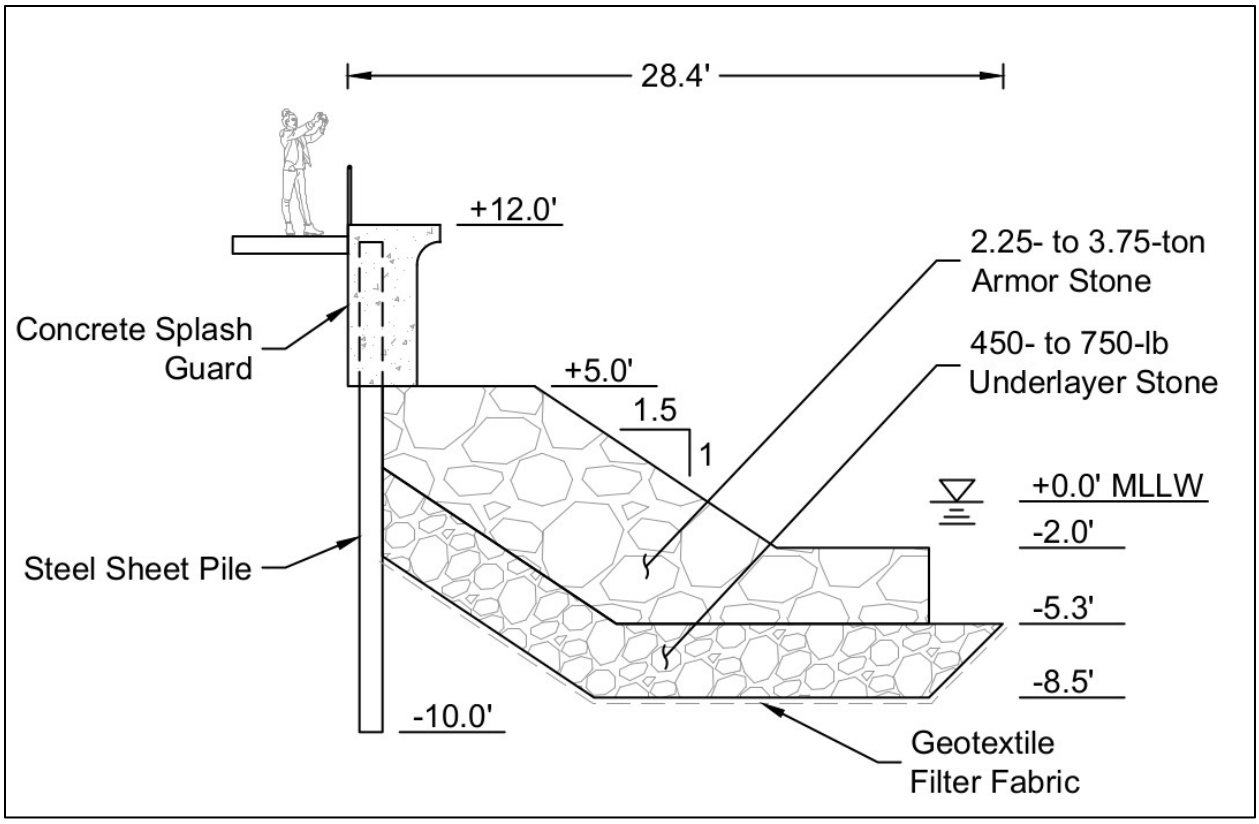


Figure 4-24. Concept section view for hybrid seawall-revetment

4.4 Offshore Breakwaters

Breakwaters are engineered structures that are constructed in the water, typically parallel to shore. Breakwaters absorb and reflect the energy of incoming waves before they reach the shore to create a calmer area of water between the breakwater and the shoreline. Breakwaters are typically designed to mitigate erosion and protect coastal infrastructure. In the context of sandy beaches, breakwaters are different than groins in that they are designed to reduce erosion by decreasing the amount of wave energy reaching the shoreline, whereas groins are designed to stabilize beaches by altering wave patterns and disrupting longshore currents and sediment transport.

There are various types of breakwaters including linear, segmented, attached (connected to shore), detached (not connected to shore). Shore-attached breakwaters are commonly used at harbor facilities in Hawaiʻi to create calm conditions for navigation purposes. Shore-detached breakwaters and segmented breakwaters can be used to reduce erosion but are uncommon in Hawaiʻi (Figure 4-25 and Figure 4-26).

An offshore breakwater at the Project Site may help to reduce wave energy along the shoreline. However, waves primarily approach at an oblique angle to the shoreline, and sediment transport is predominantly alongshore (see Section 7.5), so an offshore breakwater would likely be less effective in terms of decreasing the wave-induced currents that drive sediment transport along the shoreline. An offshore breakwater would extend further offshore than the groins, increasing the potential for impacts to benthic habitat and surfing waves. To mitigate erosion and beach loss, an offshore breakwater would likely need to extend the entire length of the shoreline, which would interfere with ocean access by blocking the channel near the center of the Project Site. Without importation of beach fill, an offshore breakwater would not achieve the objective to restore Honokōwai Beach.



Figure 4-25. Detached segmented breakwater at Sand Island, Oʻahu



Figure 4-26. Detached single breakwater at Haleʻiwa Beach Park, Oʻahu

4.5 Loko Iʻa (Fishponds)

Loko iʻa (fishponds) were constructed by the indigenous people of the Hawaiian archipelago and functioned as aquaculture facilities that produced a steady supply of seafood for the ruling aliʻi. Researchers estimate that prior to James Cook's arrival in 1778, there were 488 loko iʻa throughout the Hawaiian archipelago, the majority of which are no longer functional (DLNR, 2024). While loko iʻa are primarily designed to support aquaculture activities, a loko iʻa could potentially reduce erosion and beach loss at the Project Site by decreasing wave energy along the shoreline, altering wave patterns and wave-induced currents, and inhibiting longshore sediment transport. A loko iʻa at the Project Site could potentially consist of a loko kuapā or loko puʻuone.

Loko kuapā (the most common type of fishpond) are constructed along the shoreline, typically on top of a reef flat, with volcanic rock and/or coral to build a semi-circular kuapā (rock wall). An example of a loko kuapā is shown in Figure 4-27. Similar to an offshore breakwater, a loko kuapā at the Project Site would need to extend the entire length of the shoreline, and the walls would need to be attached to shore. The degree to which a loko kuapā may reduce erosion and beach loss would depend on the design of the structure and its stability under varying wave conditions. A loko kuapā would likely have a large structural footprint and the stability of the structure would depend on the method of construction. The Project Site is exposed to high wave energy from multiple directions, so traditional construction methods (e.g., dry stack technique) may not be stable under high surf conditions, in which case periodic maintenance would likely be required.

Loko puʻuone have a puʻuone (sandbar) separating them from the sea, and an ʻauwai kai (irrigation channel) connects them, allowing sea level inputs to rise and fall with the tide and for fish to self-recruit into the ponds. Loko puʻuone also typically have freshwater inputs from springs, streams, submarine groundwater, or adjacent aquifers. An example of a loko puʻuone is shown in Figure 4-28. A loko puʻuone at the Project Site would need to be recessed landward from the shoreline, which would likely require removal of the existing pool and water features on the Kāʻanapali Beach Club property. A loko puʻuone is unlikely to reduce erosion and beach loss because it would not decrease wave energy along the shoreline, alter wave patterns and wave-induced currents, or inhibit longshore sediment transport.

The West Maui coastline, including the Project Site, is exposed to high wave energy from multiple directions, which may explain the lack of historic or functioning loko iʻa in West Maui. A loko iʻa could potentially reduce erosion and beach loss but would not achieve the objective to restore Honokōwai Beach. Construction of a loko iʻa would fundamentally alter the character of the shoreline and the uses it supports. Depending on the location and design of the structure, a loko iʻa could also potentially inhibit shoreline and ocean access. As a functioning aquaculture facility, a loko iʻa would also require a management structure and staffing to operate as a functional aquaculture facility.



Figure 4-27. Example of loko kuapā at Waimānalo, Oʻahu



Figure 4-28. Example of loko puʻuone at Waikōloa, Hawaiʻi (www.hawaiilife.com)

4.6 Artificial Lagoons

Artificial lagoons are man-made water facilities that are typically designed to mimic the characteristics of natural lagoons and support recreational activities. Examples of artificial lagoons in Hawai‘i include Ko Olina Resort (Figure 4-29) and Hilton Hawaiian Lagoon (Figure 4-30).

An artificial lagoon at the Project Site would need to be recessed landward from the shoreline, which would likely require removal of the existing pool and water features on the Kā‘anapali Beach Club property. An artificial lagoon could be constructed as a semi-enclosed water facility with an engineered connection to the ocean (Figure 4-29), or an enclosed water facility with no direct connection to the ocean (Figure 4-30).

Constructing an artificial lagoon at the Project Site would require extensive excavation in the backshore area, including in close proximity to existing building foundations. Lining and water circulation and filtration systems would likely be required to maintain water quality. Additional structural elements may also be required to protect and stabilize the adjacent building foundations and prevent erosion of terrigenous sediment into the lagoon.

An artificial lagoon could potentially be designed to include an artificial beach; however, due to space limitations within the property, a beach with a typical slope of 1H:7V would occupy nearly the entire lagoon, which would limit opportunities for swimming and other recreational uses within the lagoon. Constructing an artificial beach would require importation of beach fill. The artificial beach within the lagoon may require periodic maintenance and/or renourishment. Pursuant to §13-222, HAR, an artificial lagoon would also be considered a “water facility”, so public access would not be required.

An artificial lagoon is unlikely to reduce erosion and beach loss at the Project Site because it would not decrease wave energy along the shoreline, alter wave patterns and wave-induced currents, or inhibit longshore sediment transport. An artificial lagoon would not achieve the objective to restore Honokōwai Beach.



Figure 4-29. Example of artificial lagoons at Ko Olina Resort, Oʻahu



Figure 4-30. Example of an artificial lagoon at Hilton Hawaiian Village, Oʻahu

5. SAND SOURCES

This section details potential sources of sand that could be used for the Project and alternatives including terrestrial, nearshore, and offshore sources.

5.1 Potential Sand Sources

Beach restoration typically requires a sufficient volume of sand that is similar in character to the existing beach sand. A suitable sand source is needed to support beach restoration at Honokōwai Beach. While sand may seem like a plentiful commodity, beach quality sand is in limited supply in the Hawaiian Islands. There are typically three potential sources of beach quality sand available to support beach restoration: 1) inland dune sand, 2) nearshore sand, and 3) offshore sand. Potential sources of sand must be carefully evaluated in terms of quality, quantity, cost, and feasibility.

5.1.1 Terrestrial Sand Sources

Terrestrial sand sources refer to those that are found on land or underground. Terrestrial sand from commercial quarries has previously been used for beach restoration purposes on the islands of Oʻahu and Maui. Previous beach restoration projects on Maui have used inland grade "A" dune sand that was, for several few decades, commercially available as a result of excavation operations in the Maui Lani area in central Maui. Grade "A" dune sand has previously been used for beach restoration projects at Pāʻia (Figure 5-1), Māʻalaea, Kīhei and Spreckelsville. Though dune sand is primarily marine (carbonate) in origin, some projects using inland dune sand have been required to process (e.g., screen or wash) the sand to remove clay, silt, and organic material before it may be used for beach nourishment, at significant added cost.

In 2006, the County of Maui commissioned a study to assess the existing inventory of dune sand on Maui. The study concluded that available inventories of dune sand may last for another five or six years based upon usage rates at the time (SSFM International Inc., 2006). In January 2018, the County of Maui implemented a moratorium[24] on the mining of Maui inland dune sand in central Maui. The purpose of the moratorium was to allow sufficient time to conduct an updated sand inventory study and establish regulations to preserve existing sand resources and prevent the disturbance of iwi kūpuna (ancestral bones). While the moratorium was a temporary measure, inland dune sand is no longer commercially available on Maui. Due to the lack of availability of high-quality inland sand resources, it is anticipated that sand used for future beach restoration projects on Maui will have to come from offshore resources (SSFM International, Inc., 2018).

SE evaluated several terrestrial sand sources to determine if the sand would be compatible with the existing beach sand at Honokōwai Beach. Terrestrial sand samples were collected from commercial sources in Wailuku, Maui and Waiʻanae, Oʻahu. A grain size analysis was performed and found that the terrestrial sand was either not compatible or not well-suited for beach restoration purposes at Honokōwai Beach (Figure 5-3). The sand that was the most compatible (Pacific Aggregate) contains a higher percentage of finer and coarser sand than the existing beach sand. A more detailed discussion of these sand sources is provided in Appendix C.

[24] https://www.mauicounty.gov/DocumentCenter/View/111441/Ord-4804



Figure 5-1. Beach nourishment using terrestrial sand at Pāʻia, Maui (2016)



Figure 5-2. Excavation of inland dune sand at Maui Lani

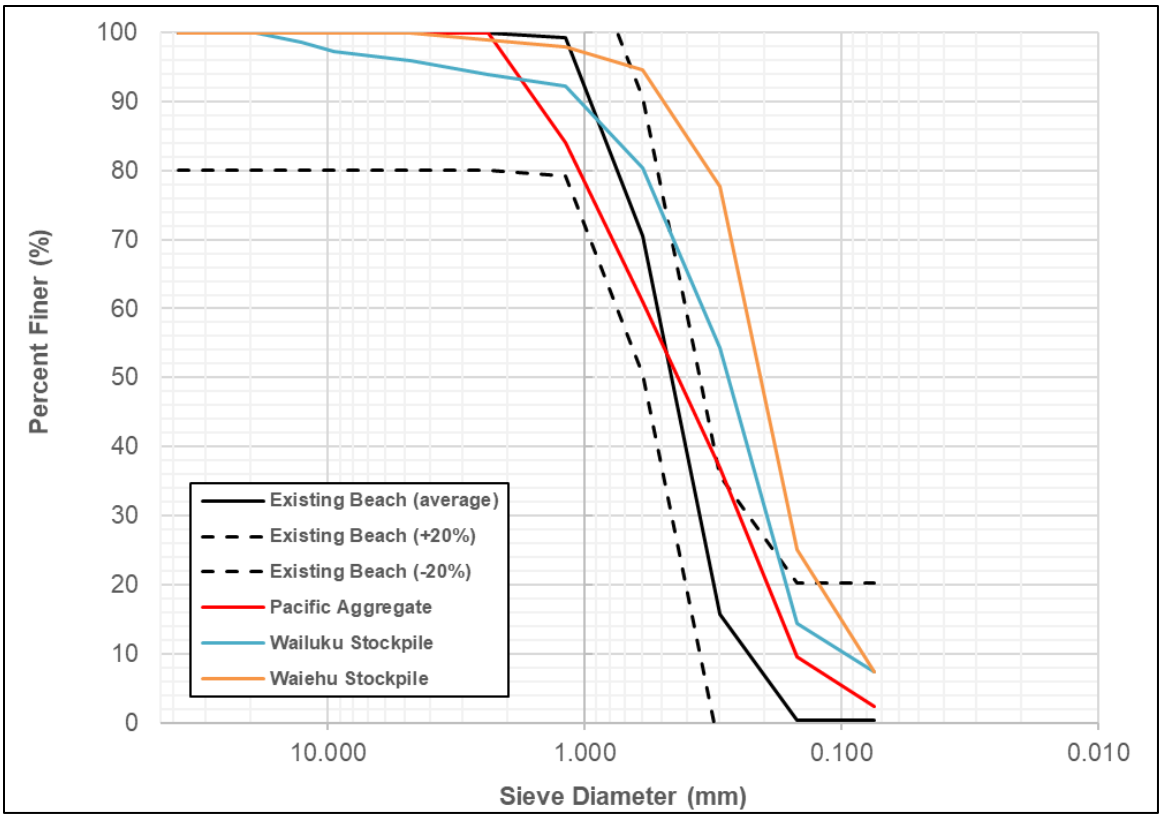


Figure 5-3. Grain size comparison of terrestiral sand sources and existing beach sand

5.1.2 Nearshore Sand Sources

Nearshore sand sources typically consist of sand deposits that are located in the ocean in relatively shallow waters in close proximity to the shoreline. In some cases, nearshore sand can provide a convenient and cost-effective sand source for beach restoration and/or beach maintenance projects. However, nearshore sand deposits are often thin, and the volume of sand volume can be relatively small. Nearshore sand deposits can also be difficult to recover through mechanical dredging due to the shallow water depths. While small-scale dredge systems are commercially available, these systems are typically expensive and less efficient than larger-scale dredging equipment. Nearshore sand has previously been used for beach restoration and beach maintenance purposes on the island of Oʻahu (Figure 5-4). Additional nearshore sand sources are currently being investigated to potentially support future beach maintenance activities in Waikīkī, Oʻahu.

SE investigated the channel fronting the Project Site as a potential nearshore sand source to support beach restoration at Honokōwai Beach. SE divers conducted snorkel and SCUBA reconnaissance to observe conditions in the channel (Figure 5-5). The inner channel, within approximately 1,000 ft of the shoreline, was predominantly rocky with a thin veneer of sand. The outer channel, extending approximately 1,000 to 1,500 ft from the shoreline, was predominantly sandy but interspersed with rock and coral outcrops, which would make sand recovery challenging. The outer channel is also bordered by a robust coral reef with a relatively shallow reef crest. The channel is very narrow and is therefore unlikely to contain an adequate volume of sand to support beach restoration at Honokōwai Beach. Additional information about the channel and the surrounding nearshore environment is provided in Section 7.1.

SE also investigated the barrier beach at the mouth of Honokōwai Stream (Figure 5-6). Based on a review of aerial photographs, the barrier beach is a dynamic but relatively permanent feature that is constantly changing in response to waves, currents, sea levels, and stream flow. The barrier beach is occasionally breached during heavy rain events but typically reforms relatively quickly. The barrier beach prevents Honokōwai Stream from discharging into the ocean. As a result, sediment and debris accumulate at the stream mouth, and algal blooms have also been observed in the lower reaches of the stream. While the dimensions of the barrier beach are constantly changing, SE estimates that approximately 500 cy of sand is typically present in the stream mouth.



Figure 5-4. Beach maintenance using nearshore sand at Ko Olina, Oʻahu



Figure 5-5. Representative photograph of seafloor conditions in the nearshore channel (5/28/2024)



Figure 5-6. Typical conditions at the mouth of Honokōwai Stream (06/07/2024)

5.1.3 Offshore Sand Sources

Offshore sand deposits present an alternative source of sand for beach restoration, particularly when considering the limited availability of suitable, natural sand from terrestrial and nearshore sources. Offshore sand deposits occurring within the same littoral cell tend to have grain size characteristics and compositions that are similar to the existing beach sand. Color and abrasion resistance are also important characteristics of beach fill sand. While natural calcareous beaches range in color from light brown to white, sand in offshore deposits often turns a grayish color as a result of anaerobic conditions typically produced by a lack of wave action and/or accumulation of organic material. Potential offshore sand sources require exploration using marine geophysical survey techniques to characterize deposit area and volume, and extensive sampling and analysis to ensure that grain size characteristics are suitable for beach restoration purposes.

SE completed detailed offshore sand investigations to identify a suitable sand source to support beach restoration at Honokōwai Beach. SE also evaluated the results of previous offshore investigations performed by SE and others. The study area was determined based on a combination of aerial imagery, previous sand investigations (SE, 1994; 2006; 2007; 2008; 2017; 2018 & Moffatt & Nichol, 2016), benthic habitat mapping (NOAA, 2007 & USACE, 2014), and side scan sonar (USGS, 2012). The following section provides a brief summary of the investigations completed for this project. Additional information about the offshore sand investigations is provided in Appendix C.

In October 2019, SE conducted preliminary offshore sand investigations. The study area spanned approximately 6.5 mi of coastline extending from Kāʻanapali to Napili Bay in West Maui. Six (6) offshore sand deposits were investigated, all of which are within approximately 3.5 mi of the Project Site (Figure 5-7). This study also evaluated previous offshore sand investigations that were conducted at Reef Runway, Oahu (SE, 1994; 2017; 2018) and Kahana Bay (Moffatt & Nichol, 2016). The offshore sand investigations included:

- Side scan survey to locate sand deposits and evaluate seafloor conditions.
- Air jet probing to measure sand thickness at selected locations.
- Push coring to collect composite sand samples at selected locations.
- Grain size analysis and photographic analysis of composite sand samples.
- Calculation of overfill ratios based on grain size distributions.

Based on the results of the grain size analysis, it was determined that the Sand Wave offshore sand deposit was the only sand source that is compatible with the existing beach sand at Honokōwai Beach. In April 2021, SE conducted detailed offshore sand investigations at the Sand Wave deposit. The offshore sand investigations included:

- Tow camera survey to evaluate seafloor conditions and the boundaries of the deposit.
- Vibracore sampling to collect composite sand samples at selected locations.
- Grain size analysis and photographic analysis of composite sand samples.
- Calculation of overfill ratios based on grain size distributions.

The results of the offshore sand investigations are summarized in Section 5.2. Additional information is provided in Appendix C.

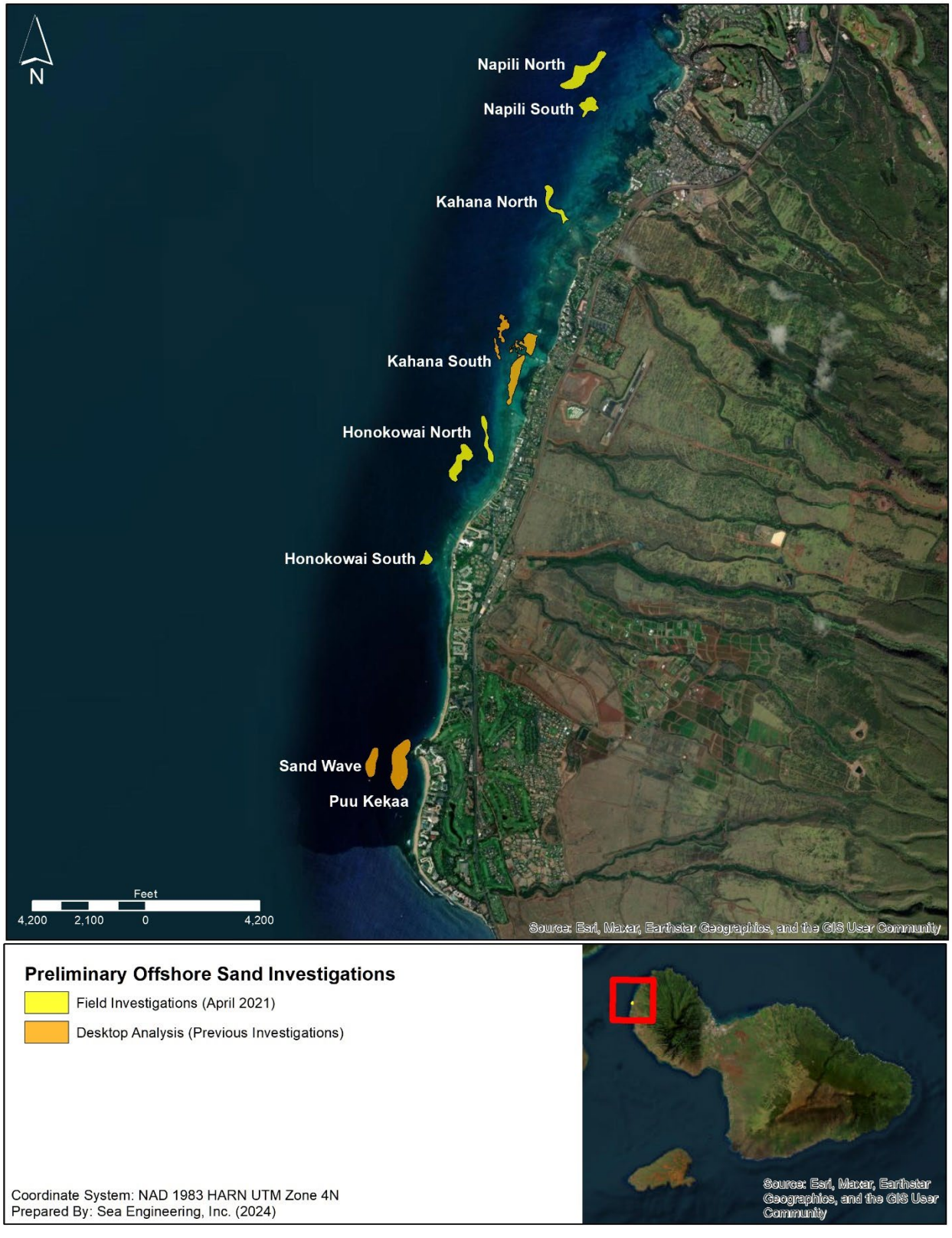


Figure 5-7. Study area for preliminary offshore sand investigations.

5.2 Preferred Sand Source

This section details the preferred sand source including a description of the preferred Sand Recovery Site, physical characteristics of the existing sand at the Sand Recovery Site and the Project Site, and sand fill requirements for the Project and alternatives.

5.2.1 Sand Recovery Site Description

Offshore investigations identified a suitable sand source located approximately 1.5 mi south of the Project Site (Figure 5-8). The offshore sand deposit (referred to herein as the Sand Recovery Site) is located in 120 to 170 ft of water depth and approximately 1,500 to 2,000 ft offshore of Puʻu Kekaʻa (Black Rock) in West Maui. Offshore reconnaissance of the sand deposit included side-scan sonar imaging, sub-bottom profiling, towed video transects, and vibracoring (Figure 5-9). Laboratory analysis of the vibracore samples included dry color comparison, grain size distribution analysis, and fine content analysis. Sand sample analysis confirmed that the sand in the Sand Recovery Site is suitable for placement on Honokōwai Beach.

Based on the sub-bottom and side scan sonar investigations, the Sand Recovery Site is estimated to encompass approximately 12.5 acres with sand thickness ranging from 13 and 59 ft. This corresponds to a total estimated volume of 975,000 cy of sand within the boundaries of the survey area. The Sand Recovery Site is part of a larger sand field that begins near the shoreline and continues offshore to depths greater than 200 ft. The sand field continues parallel to shore north and south of Puʻu Kekaʻa. The presence of sand waves within the deposit indicates that this area is subject to strong tidal currents. Sediment in this area is likely to be dynamic and mobile, so sand volume and thickness could fluctuate as a result of seasonal or event-driven currents.

A tow camera survey was performed to document existing seafloor conditions at the Sand Recovery Site. The only prominent biotic colonizer observed was *Halimeda kanaloana*, a common macroalgae in West Maui. The density of the algae varied throughout the deposit. Several small, isolated patches of sea grass were observed. No coral or hard bottom was observed during the tow camera surveys, or in either side scan sonar or sub-bottom surveys of the site.

It is expected that the benthic infaunal community structure of the Sand Recovery Site is similar to other locations in sandy coastal areas of Hawaiʻi. The typical community in these environments consists of nematodes, (roundworms, phylum Nematoda), oligochaete worms (earthworm relatives, phylum Annelida, subclass Oligochaeta), copepods (tiny crustaceans, phylum Arthropoda), echinoderms (phylum Echinodermata), and mollusks (phylum Mollusca) (Bailey-Brock and Krause, 2008).

The Project includes recovery of 33,000 cy of sand from the Sand Recovery Site for use in restoring Honokōwai Beach. This sand recovery effort represents approximately 3% of the estimated available sand volume in the Sand Recovery Site, leaving 97% of the sand resource in place.

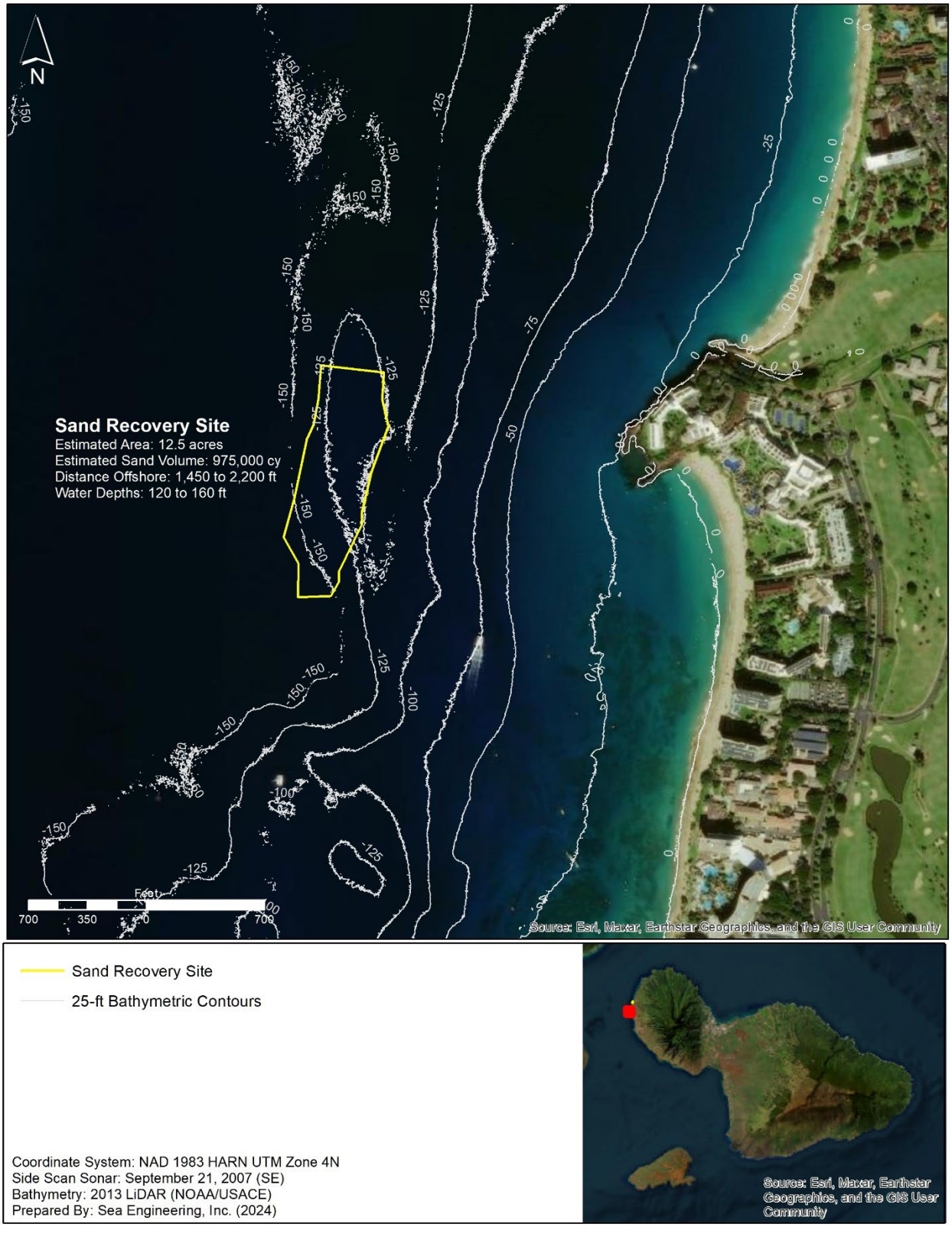


Figure 5-8. Overview map of the Sand Recovery Site

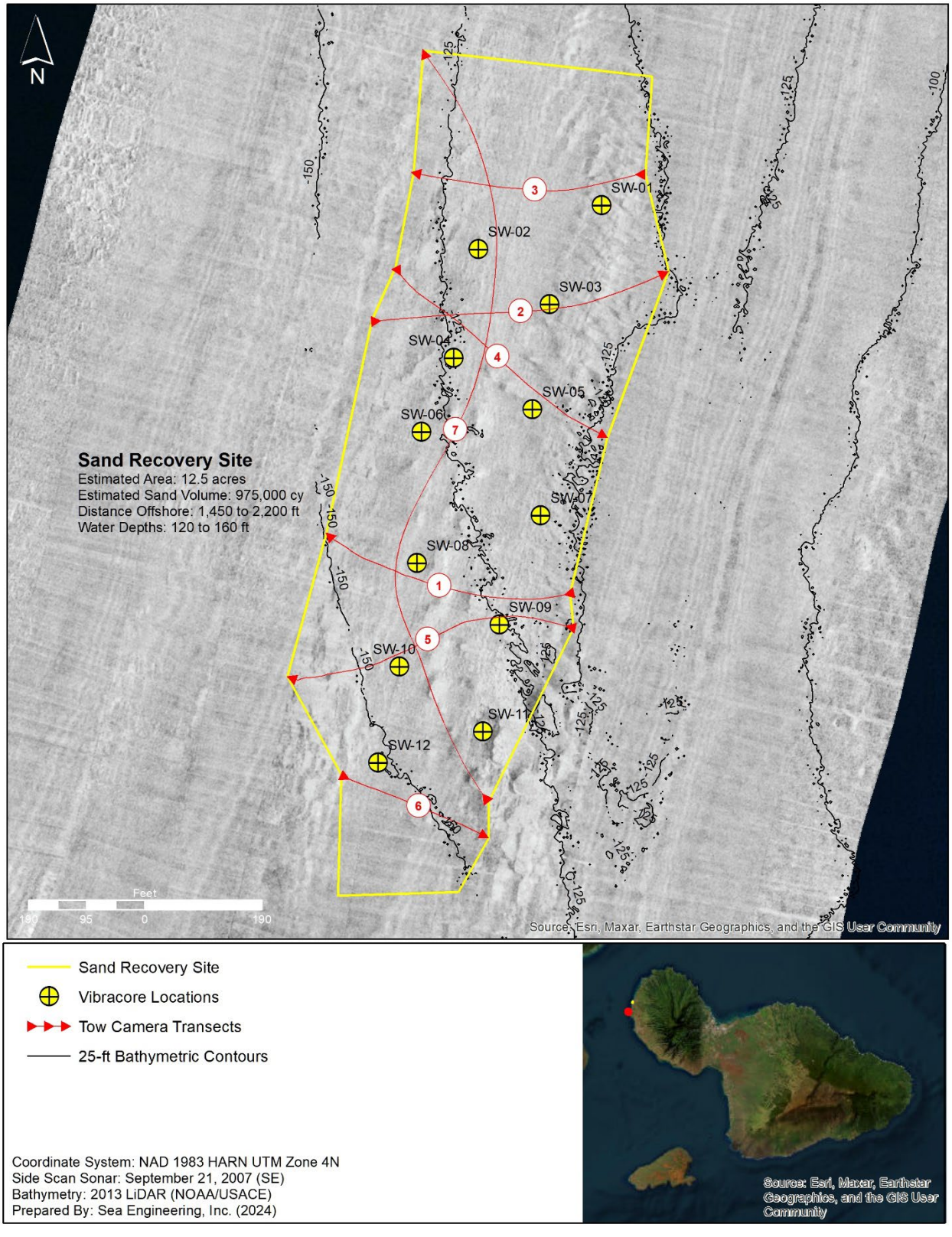


Figure 5-9. Detailed sand investigations at the Sand Recovery Site

5.2.2 Photographic Analysis

Carbonate sands range in color from pure white to yellow, brown, and dark grey. Sand color has an important aesthetic value to beachgoers and should not be ignored when selecting an appropriate sand source for beach nourishment. Beyond the aesthetic value, color also affects temperature, as darker sands achieve higher temperatures under intense tropical sunlight than sands of lighter color. A suitable offshore sand source would preferably closely match the color of the existing beach sand. Composite samples were collected from the vibracores and dried over the course of several days under direct sunlight. The photographs are representative of the typical color and composition of the sand where each vibracore sample was collected. After offshore sand is placed on the beach, the sand color typically lightens with sustained UV exposure. Figure 5-10 shows a dry color comparison of the offshore sand samples and the existing beach sand at the Project Site. Figure 5-11 and Figure 5-12 show a dry color comparison of the existing beach sand with the offshore sand samples from the inner and outer portions of the sand deposit, respectively.

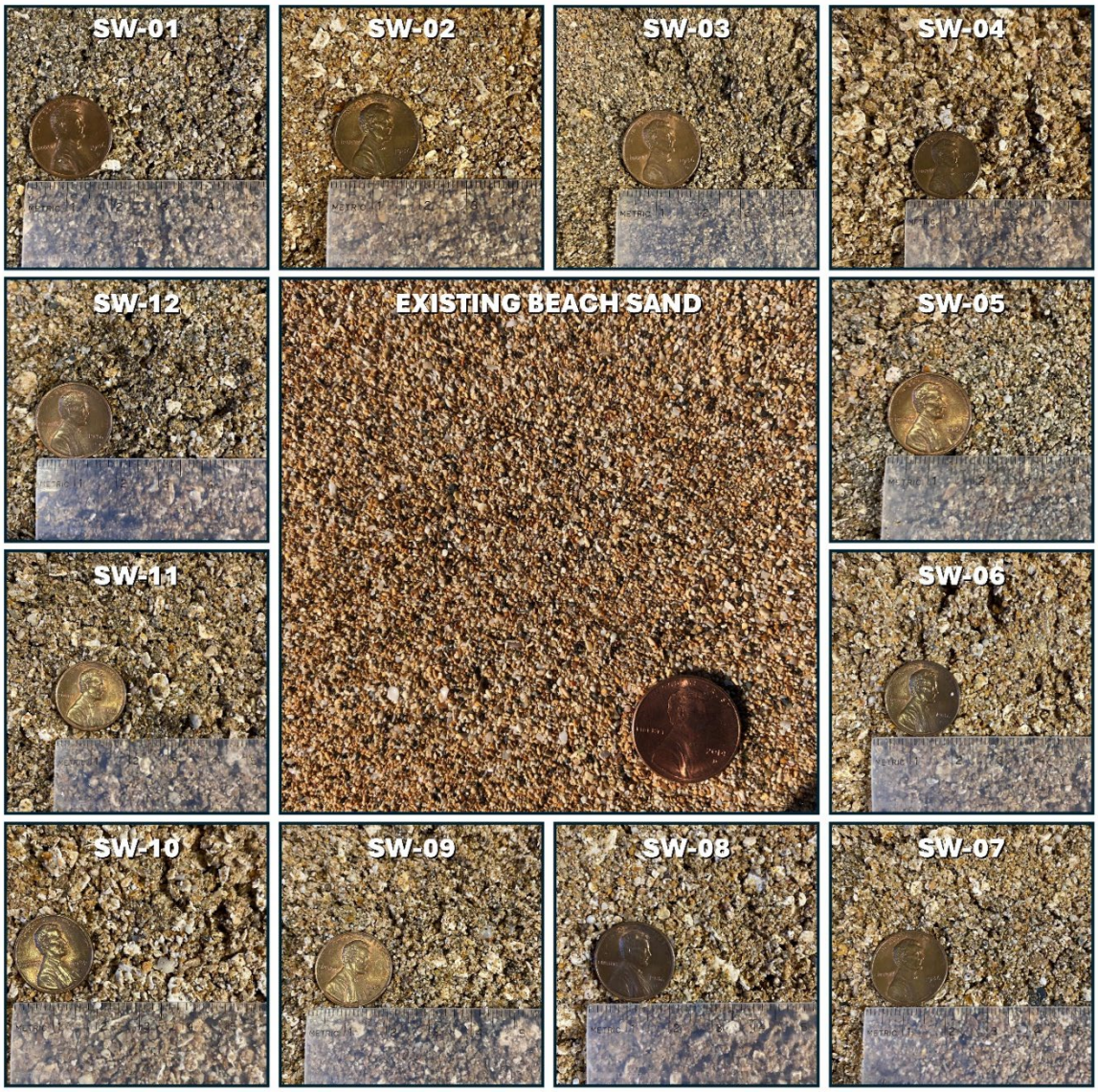


Figure 5-10. Photographic comparison of existing beach sand and *Sand Wave* sand samples

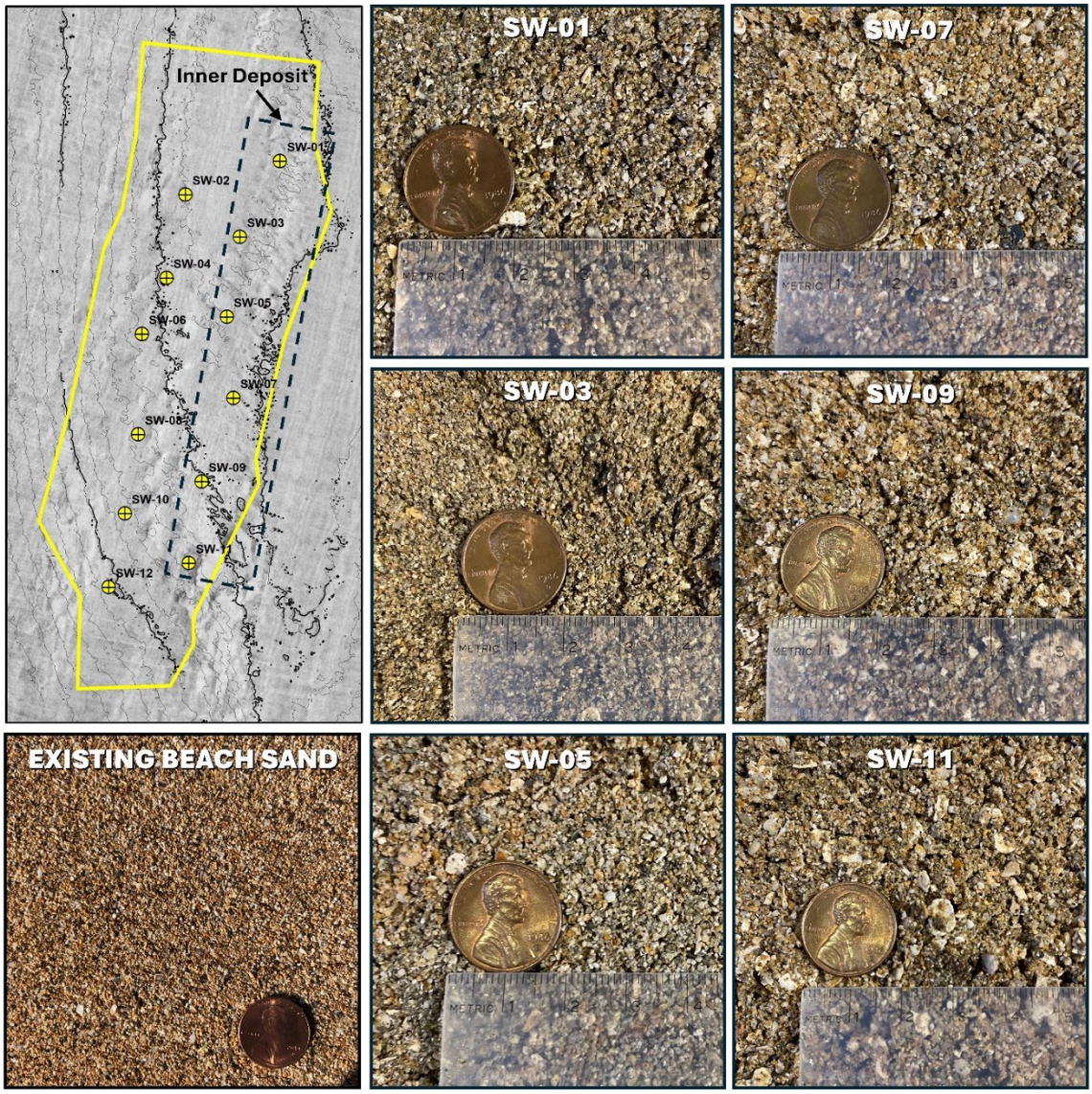


Figure 5-11. Photographic comparison of existing beach sand and inner *Sand Wave* sand samples

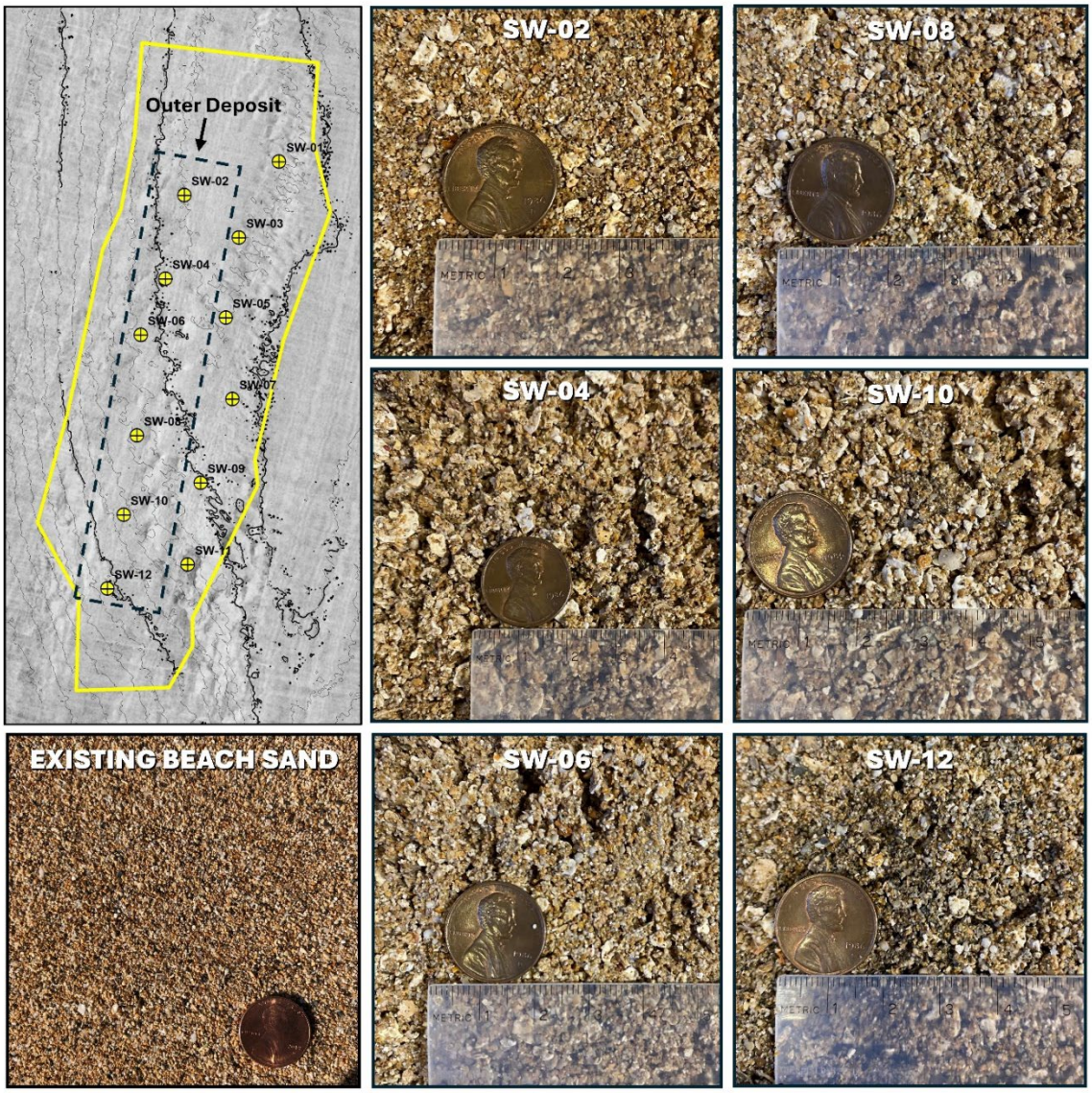


Figure 5-12. Photographic comparison of existing beach sand and outer *Sand Wave* sand samples

5.2.3 Grain Size Analysis

The Hawaiʻi Department of Land and Natural Resources (DLNR) has established the following guidelines for fill sand used for beach nourishment projects:

- Sand shall not contain more than 6% silt material (grain size smaller than 0.074 mm).
- Sand shall not contain more than 10% coarse material (grain size greater than 4.76 mm).
- Grain size distribution will fall within 20% of the existing beach grain size distribution.
- Overfill ratio of fill sand to existing sand shall not exceed 1.5.
- Sand will be primarily composed of naturally occurring carbonate beach or dune sand.
- Sand shall be free of contaminants.

A vibracore was used to obtain twelve (12) composite sand samples from the Sand Recovery Site. An example of a vibracore log for one sample is shown in Figure 5-13. The samples were analyzed using a standard laboratory sieve technique to determine grain size distribution. For any sediment sample, the percentages of grains that fall within different size classes are determined and used to create a grain size distribution curve. The grain size distributions of the offshore sand samples were compared with the existing beach. The results of the grain size analysis are shown in Figure 5-14. In the figure, the results of the grain size analysis use a Log Base 10 scale on the X axis for grain size. The cumulative percentage of grain sizes for each sample is presented on the Y axis. Shown in black in the figure is the average grain size distribution for the existing beach sand at the project site. Also shown in black dashed lines are the ±20% bounds specified in the DLNR beach nourishment guidelines.

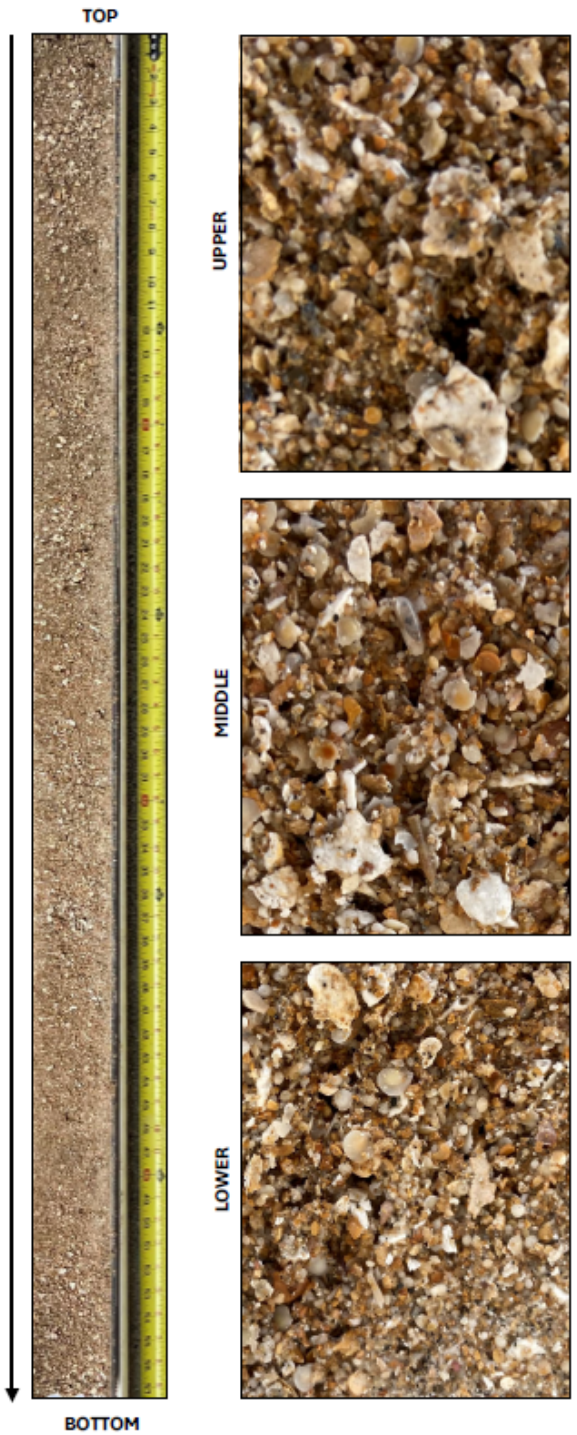
The average grain size of the sand from the Sand Recovery Site (dashed red line) is shown to be only slightly coarser than the existing beach sand (solid black line). The median grain size (D_{50}) at the Sand Recovery Site is 0.55 mm, which is slightly coarser than the D_{50} for the existing beach sand (0.44 mm). The sorting value is 1.02, which categorizes the sand as poorly sorted. The percentage of the sand fill with grain size smaller than 0.074 mm (#200 sieve) is 3%, which means that the sand fill contains a minimal amount of fine material. Sand samples collected from the inner portion of the sand deposit (solid red line) closer to shore are less coarse and within the ±20% DLNR guidelines for coarse material. The Sand Recovery Site is large (estimated 12.5 acres) and contains a substantial volume of sand (estimated 975,000 cy), so dredging can be strategically focused on the inner portion of the deposit to maximize compatibility with the existing beach sand.

Based on the grain size distribution, natural marine carbonate grains, percentage of fine and coarse material, and overfill ratio (see Section 5.2.4), the sand from the Sand Recovery Site is compatible with the existing beach sand and complies with the DLNR guidelines for beach nourishment:

- Sand contains less than 3% material smaller than 0.074mm.
- Sand contains no coarse material greater than 4.76 mm.
- Grain size distribution of inner sand deposit is within ±20% of the existing beach sand.
- Overfill ratio of the fill sand to existing beach sand is 1.0 (no overfill required).
- No physical evidence or events to indicate that the sand contains any contaminants.
- Sand is composed of naturally occurring carbonate sand.

VIBRACORE LOG SW-10

PHOTOGRAPHS



CORE ID:	SW-10
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215190.14 N
EASTING:	1628180.16 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	31-May-21
CORE LENGTH:	58 in (4.8 ft)
WATER DEPTH:	143 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Coarse to Medium
Color:	Tan
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Poorly Sorted

COMMENTS

- Generally uniform tan color.
- No stratigraphy.
- No gradation with depth.
- No coral cobble or large-diameter material.

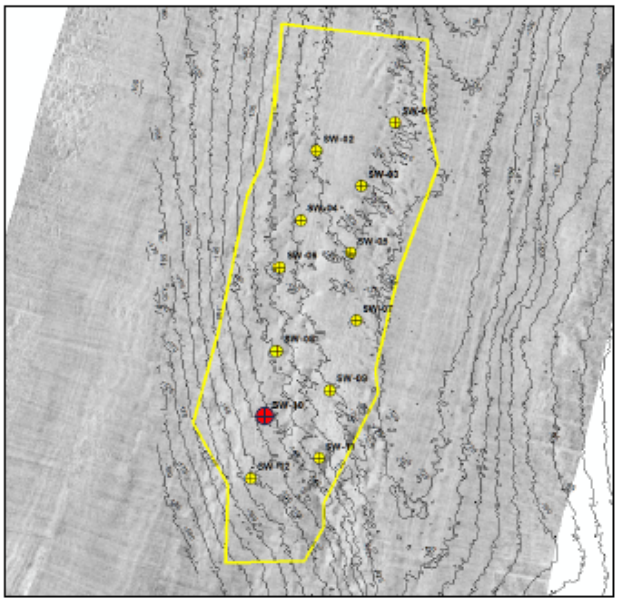


Figure 5-13. Example vibracore log from the Sand Recovery Site

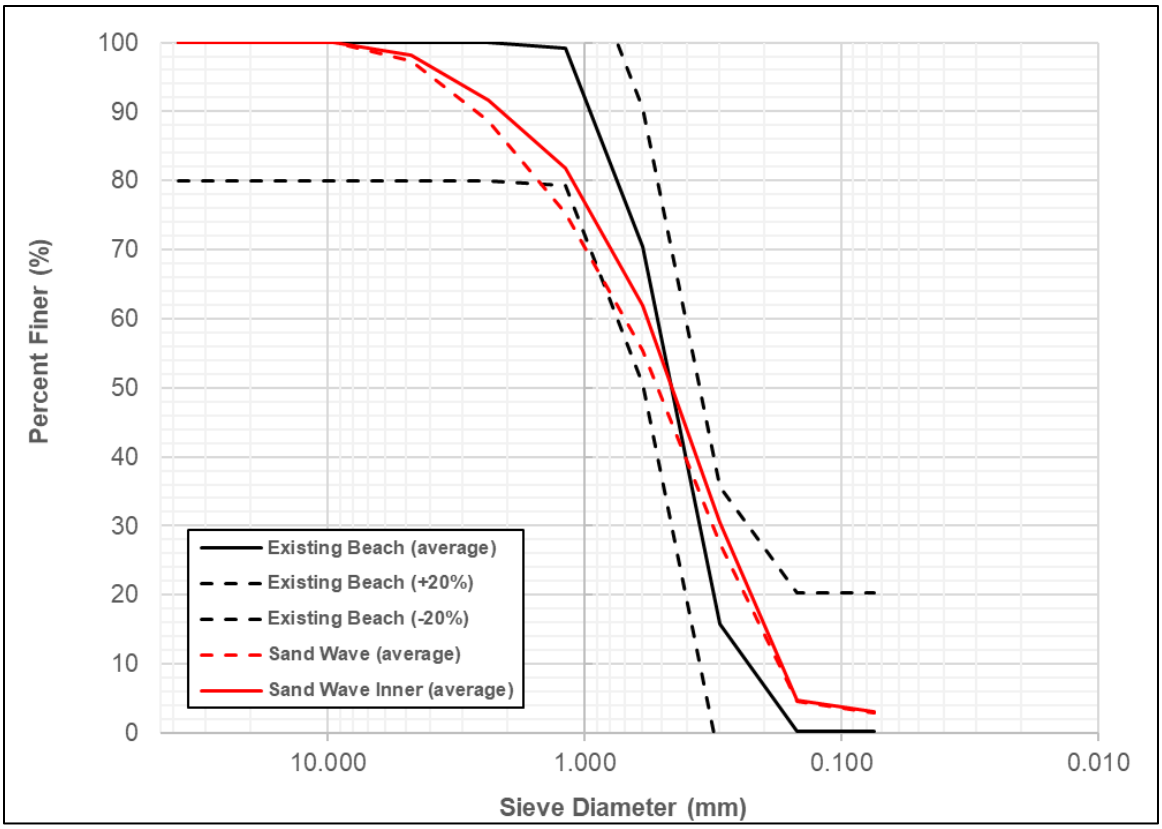


Figure 5-14. Grain size distributions for the Sand Recovery Site and the Project Site

5.2.4 Overfill Factor

A beach undergoes an adjustment period following nourishment. The beach equilibrium profile is achieved as sand moves cross-shore and alongshore and there may be an accompanying decrease in beach volume. This loss of sand is compensated for through an overfill ratio, which describes the compatibility of the existing beach and fill sands in terms of their respective grain size distributions. The overfill ratio is determined based on the grain size characteristics of the two sands and represents the volume of fill necessary to yield the desired beach volumes. An overfill ratio >1.0 means that the volume of sand required exceeds the design beach volume, meaning that additional sand beyond the design volume is required. An overfill calculation was performed for the sand from the Sand Recovery Site using the average grain size distributions of the existing beach sand for comparison (Table 5-1). The overfill ratio for the Sand Recovery Site is 1.0. This means that no sand in addition to the design volume needs to be placed during construction.

Table 5-1. Overfill calculation for beach fill sand from the Sand Recovery Site

M_n	M_b	σ_b	$M_b' - Mn'$	Overfill Factor (K)
1.18	0.74	1.54	-0.29	1.0

5.2.5 Turbidity Analysis

Sand recovered from offshore deposits is often compatible with existing beach sand but, in some cases, may contain higher percentages of fine material that can increase turbidity during sand recovery and placement operations. Turbidity refers to a reduction in water transparency that occurs when fine sediment particles are suspended in the water column. Recovery, transport, and placement of marine carbonate sand can also increase the percentage of fines through mechanical abrasion of the friable sand grains, which can increase turbidity. Fine material is typically winnowed from the beach system by tidal and wave action during the initial equilibration process. Turbidity is a complex phenomenon that is dependent on both the optical and physical properties of suspended particles and is difficult to model or predict. To help evaluate potential impacts, laboratory turbidity analyses were conducted to compare the borrow sand and existing beach sand.

Turbidity During Sand Recovery

Offshore turbidity is typically expected during sand recovery operations. As the clamshell bucket grabs sand from the seafloor, it would disturb fine particles adjacent to the bucket. As the bucket is raised through the water column, small volumes of sand containing fine particles could be released into the water column. Turbidity at the dredge site may be reduced by using an environmental clamshell bucket, which is an industry best practice and has been used to minimize turbidity during dredging of harbor channels in Hawaii. Environmental clamshell buckets typically have tighter seals and overlapping sides. These buckets are designed to minimize sediment loss from within the bucket, resuspension at the dredge site, and water entrainment with each grab. A conservative estimate of the amount of material that leaks from an environmental bucket is only 0.5% (Palermo et al. 2008). This material is expected to fall out of suspension rapidly near the dredge location.

Turbidity generated from dredging operations is expected to be transported with the currents moving parallel to shore. Wave action has the potential to transport turbidity inshore. These water quality impacts are expected to be temporary, lasting only during the actual dredging operations, and are expected to be localized to the immediate vicinity of the dredging. Best Management Practices (BMPs) should be followed throughout the sand recovery work, consistent with Section 404 and Section 401 of the Clean Water Act.

Turbidity During Sand Placement

Beach restoration projects can generate turbidity plumes that can be unsightly and affect water clarity for days. Although sand fill placed on a beach must closely match the existing beach sand with respect to grain size, offshore sand will typically have a higher percentage of fines than native beach sand. Additionally, fines may be generated during dredging and placement of offshore sand onto the beach. After placement, wave action can suspend the fines creating turbidity plumes immediately offshore of the nourished beach.

Silt curtains and containment barriers should be deployed along the shoreline where sand placement is occurring. Following placement of sand on the beach, there will likely be periodic turbidity associated with equilibration of the beach profile and planform and during large wave events, as sand moves along the beach and cross-shore. Larger sand size grains are currently stable along the coastline and make up the existing beach face; however, finer material will likely move in the offshore direction through the channels.

Laboratory Turbidity Analysis

Laboratory turbidity tests were performed on numerous sand samples from the potential borrow areas. Turbidity was determined by measuring the scattering of the light through sample cells that contained distilled water and sand in suspension. A total of twelve (12) composite sand samples were obtained from the Sand Recovery Site and analyzed for turbidity.

Turbidity was measured using a Hach 2100Q Portable Turbidimeter (Figure 5-15). The instrument has an optical laser configuration that measures the scattering of the light passing through the sample cell (Figure 5-16). Turbidity is measured in Nephelometric Turbidity Units (NTUs), a standard turbidity unit for environmental monitoring in the United States. The instrument was calibrated once before the first experiment using the manufacturer's 20, 100, and 800 NTU StablCal primary calibration standards and the 10 NTU primary verification standard. The cells used for the turbidity readings were glass Hach Lab Turbidimeter Sample Cells.

All sample bottles and sample cells were meticulously cleaned prior to use. The sample bottles were vigorously cleaned with tap water. The sample cells were cleaned with tap water and filled with distilled water, then left filled for a minimum of 24 hours. The sample cells remained filled with distilled water until use to avoid oxygen contamination. Before each turbidity test, the cells were emptied, cleaned with tap water, and refilled with distilled water until overflowing. The outside walls were treated with a thin coating of Hach silicone oil to cover imperfections and scratches and to minimize stray light.

Test samples were prepared with one tablespoon of dry sand placed in a 120 mL Polystyrene sample bottle. The bottle was then filled with 100 mL of distilled water. Preceding each turbidity test run, the sample bottle was shaken vigorously to emulate turbulence. The suspension was immediately poured into a cleaned Hach cell, which was then inverted three times following the manufacturer's guidelines and placed in the machine. The turbidity runs began immediately upon cell insertion within the analyzer. A reading was taken for each sample at the following time intervals:

- 30 seconds
- 1 minute
- 2 minutes
- 5 minutes
- 10 minutes
- 15 minutes
- 20 minutes
- 30 minutes
- 1 hour
- 2 hours
- 4 hours
- 6 hours
- 24 hours



Figure 5-15. 2100Q Portable Turbidimeter

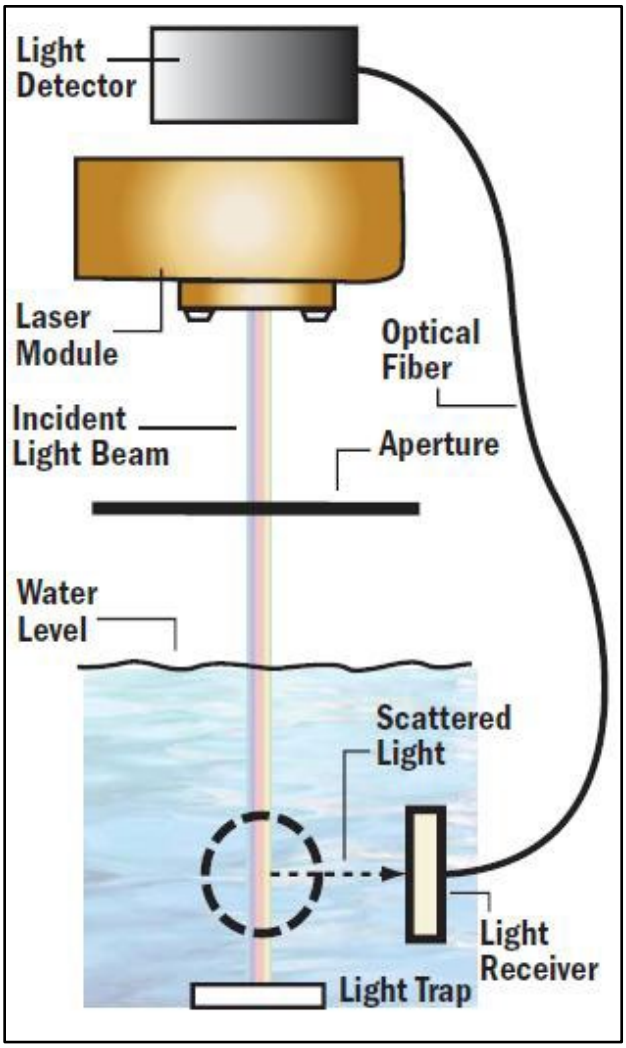


Figure 5-16. Laser Nephelometer Optical Configuration (Sadar, Cason, and Engelhardt; 2009)

Laboratory Turbidity Analysis Results

Results were stored on the device's internal memory and uploaded to a computer for further analysis. Data are plotted as turbidity versus time. The turbidity results should not be considered indicative of turbidity levels that are to be expected during beach restoration because they result from artificial experiments in a small sample bottle. This controlled environment does not simulate the energetic conditions in the marine environment. The turbidity results are, however, useful for evaluating differences between the existing beach sand and the potential sand fill.

The turbidity readings as a function of time for all 12 samples are presented in Figure 5-17, where turbidity levels are presented on the Y axis and time on the X axis. All samples tested showed an initial increase in turbidity that decreased exponentially over time. Initial readings showed turbidity values up to 1,000 NTU; however, the turbidity values decreased over 50% within 30 minutes and over 90% within 2 hours. Within 24 hours, the NTU readings decreased by over 99% with an average of 10 NTU (Figure 5-17, Table 5-2).

A turbidity analysis was also performed for a sample of the existing beach sand at the Project Site. While the beach sand sample had a significantly lower initial turbidity reading (101 NTU), the turbidity reading after 24 hours was 14 NTU, which was 4 NTU higher than the offshore sand samples at that time interval.

Marine Research Consultants, Inc. (MRC, 2021; 2024) conducted water chemistry analysis for water samples collected offshore of the Project Site and found that turbidity values near the shoreline ranged from 0.15 to 1.75 NTU and exceeded DOH criteria at several locations. Hui O Kai Ola (2024) has conducted independent water quality monitoring at a location fronting the Project Site. From 2016 to 2024, turbidity values at this location ranged from 1.6 to 10.1 NTU with an average turbidity value of 4.1 NTU, which is nearly four times the DOH criteria (Table 5-3). It is likely that the elevated values of turbidity in the nearshore zone are a result of resuspension of organic particulate material by wave action.

The results of the turbidity analysis indicate that the offshore sand from the Sand Recovery Site is expected to generate increased turbidity that would temporarily exceed the DOH criteria. However, the increase in turbidity would be expected to decrease exponentially and return to normal background levels within a relatively short period of time. These impacts are anticipated to be minor and temporary in nature and no long-term increase in turbidity is expected.

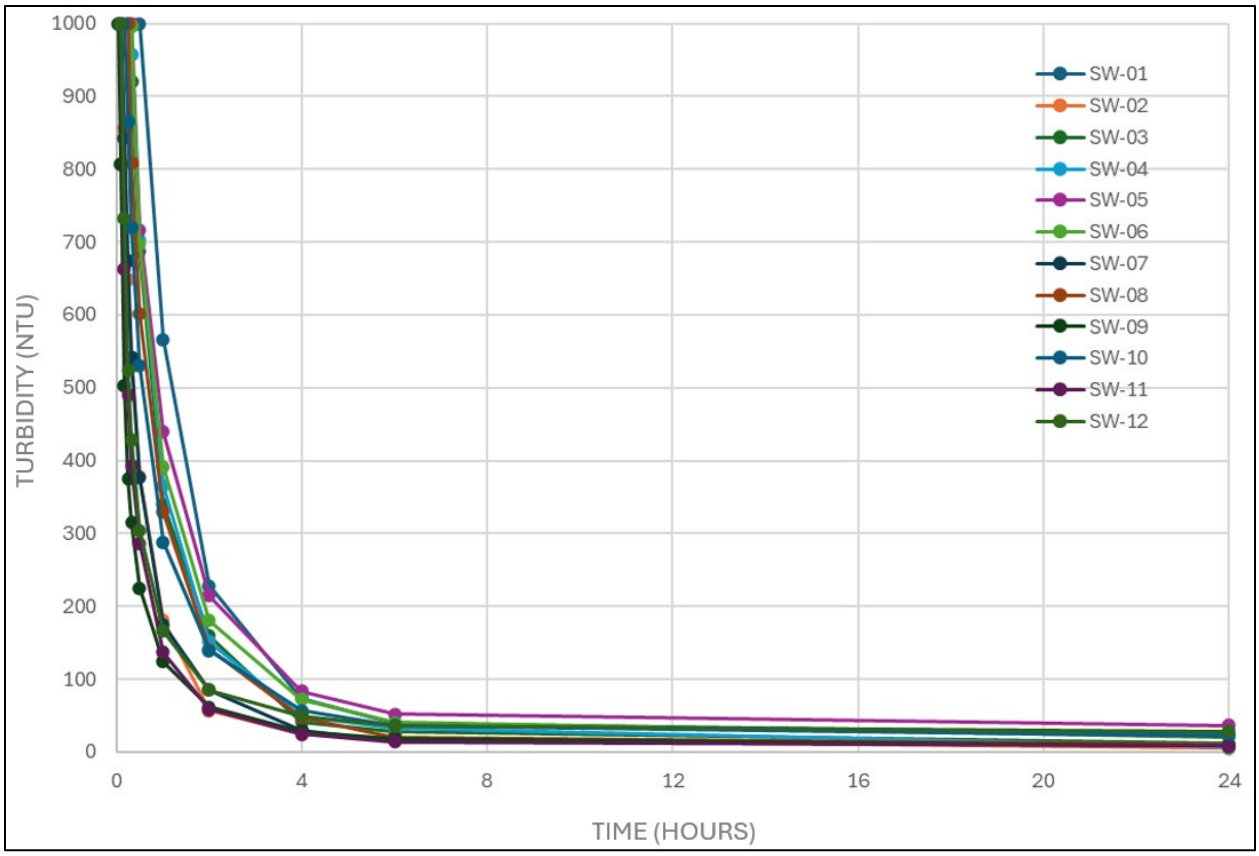


Figure 5-17. Turbidity analysis for offshore sand samples (24 hours)

Table 5-2. Turbidity values (NTU) for offshore sand samples (24 hours)

TIME (H:M:S)	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07	SW-08	SW-09	SW-10	SW-11	SW-12	AVG	% DECREASE
00:00:00	999	999	999	999	999	999	999	999	999	999	999	999	999	0%
00:00:30	999	999	999	999	999	999	999	999	999	999	999	999	999	0%
00:01:00	999	999	999	999	999	999	999	999	999	999	999	999	999	0%
00:02:00	999	999	999	999	999	999	999	999	999	999	999	982	998	0%
00:05:00	999	999	999	999	969	999	999	999	733	999	999	589	940	6%
00:10:00	999	999	999	999	736	999	975	946	415	920	933	409	861	14%
00:15:00	999	969	966	999	598	967	748	749	284	710	741	294	752	25%
00:20:00	999	781	777	999	504	809	600	637	215	566	596	225	642	36%
00:30:00	746	574	554	797	383	597	431	470	141	402	448	147	474	53%
01:00:00	383	298	252	376	207	308	209	255	61	197	231	50	236	76%
02:00:00	159	135	88	153	103	124	48	83	35	66	99	26	93	91%
04:00:00	54	46	35	34	53	47	32	34	23	35	34	17	37	96%
06:00:00	34	39	24	23	39	33	20	24	18	23	29	13	27	97%
24:00:00	9	17	6	5	18	14	6	7	10	8	13	7	10	99%

Table 5-3. Turbidity values (NTU) at Kaanapali Shores site, 2016 to 2024[25] (Hui O Ka Wai Ola, 2024)

	2016	2017	2018	2019	2020	2021	2022	2023	2024
	16.80	3.78	12.40	3.35	3.01	2.97	1.41	2.31	2.02
	9.79	6.31	6.56	5.44	3.36	2.72	1.83	1.38	1.51
	3.90	6.60	2.94	5.02	1.88	1.60	1.66	5.84	1.89
	6.16	8.40	7.93	5.35	2.75	3.77	1.82	2.75	3.29
	5.81	5.24	8.37	2.98	1.53	5.07	2.49	3.12	1.89
	10.63	2.59	2.36	2.86	4.32	1.37	1.80	1.58	1.20
	6.16	2.59	9.42	5.18	2.08	2.14	1.90	1.34	2.80
	12.07	2.80	7.97	1.29	2.51	1.34	0.80	1.19	1.86
	7.76	5.17	4.62	7.81	1.33	7.32	1.79	1.65	0.91
	5.78	1.99	5.53	3.71	2.80	3.32	2.05	4.06	4.50
	3.08	3.17	7.92	5.86	3.02	3.69	2.40	1.67	3.57
	5.67	2.93	15.27	1.99	4.05	1.61	2.39	1.87	3.51
	6.36	6.49	7.39	2.40	1.81	3.18	1.02	1.65	1.63
	5.80	3.22	3.20	5.72	3.24	4.17	1.32	2.05	
	3.78	5.46	3.89	3.44	2.83	3.48	1.78	4.96	
	6.31	2.79	2.95	3.43		1.77	3.19	2.01	
	6.60	10.11	8.71	3.19		3.81	1.98		
	8.40	25.53							
MINIMUM	3.08	1.99	2.36	1.29	1.33	1.34	0.80	1.19	0.91
AVERAGE	7.27	5.84	6.91	4.06	2.70	3.14	1.86	2.46	2.35
MAXIMUM	16.80	25.53	15.27	7.81	4.32	7.32	3.19	5.84	4.50

[25] 2024 monitoring data extends through 9/17/2024.

6. CONCEPT DESIGN ANALYSIS

Restoration of a beach by placing sand in an appropriately designed manner along a shoreline can be an effective and attractive means of mitigating beach loss and providing for recreational and aesthetic enjoyment. Beach restoration can be accomplished by placing sand on the shoreline to nourish or enlarge the beach where erosional forces are weak or by placing sand in conjunction with beach stabilizing structures. The erosion rate for non-stabilized beach fill could be so high that frequent renourishment would be required to maintain the desired beach width. There are limited sources of suitable beach fill sand in Hawaiʻi; thus, the resource is finite and consequently the cost is high. For this project, the use of rock rubble mound groins to compartmentalize the beach and stabilize the sand is recommended.

6.1 Beach and Structure Layout Analysis

The experience gained from studying natural crenulate-shaped bays provides a design tool for coastal engineers to produce stable shorelines. Silvester and Hsu (1993) present methods for determining the stable beach planform between headlands, thus facilitating the engineering use of headlands as shore stabilization structures. Whereas natural beaches obtain a stable shape in response to the wave climate and headland orientation, engineered beaches can be developed by selecting the headland orientation that produces the desired beach shape. Klein et al. (2003) produced a computer program to apply the findings of Silvester and Hsu. The Model of Equilibrium Bay Beaches (MepBay) program uses locations of upcoast and downcoast control points, along with incident wave angle, to approximate the stable shoreline position for a bayed beach. Bodge (2003) proposed the use of T-head groins as artificial headlands to produce stable beaches, an approach that has been implemented successfully on numerous beaches in Florida and the Caribbean (Bodge, 1998), and more recently at Iroquois Point on Oʻahu (Figure 6-1).

The heads of the T-head groins can be aligned, or "tuned," according to the prevailing wave crest orientation, to produce the desired beach configuration. Rubble mound T-head groins are recommended to reduce rip currents and the subsequent offshore sand losses. The beach should be nourished with sand to achieve the predicted shoreline shape. According to Bodge (1998), tuned structures work well in the following situations:

- Erosion is so severe that frequent renourishment would not be economical or practical.
- A wide beach would affect an environmentally sensitive area.
- The shoreline is no longer conducive to having beaches, such as at a hardened shoreline.

These criteria are generally met at Honokōwai Beach.



Figure 6-1. Iroquois Point beach restoration and stabilization during construction (2013)

Key design parameters for T-head groin design include groin length, head length and orientation, gap distance between the heads, and beach shape and width. In general, the beach shape responds more to the gap width (opening) between the groin heads than it does to the structure heads themselves. Thus, the stable beach is a function of the length and orientation of the gaps. Orientation of the gaps is primarily dictated by the shape of the shoreline and the prevailing wave approach direction.

The groin layout and head angles should be oriented such that the gap opening is approximately parallel with the average prevailing wave crest. This "tuning" of the heads helps to ensure the predictability of the beach shape and yields potentially greater shoreline stability within the beach cell. In many cases, it is not possible to achieve a perfect match between gap orientation and incident wave crest, because of the seasonal directional variability of waves approaching the project site. In practice, this difference should be no more than 25 degrees, and differences of up to 15 degrees have been consistently shown to produce a stable beach (Bodge, 2012).

The beach design process thus includes establishing the desired physical characteristics of the beach and then applying coastal engineering analysis and tools to orient structures to achieve the desired beach planform. Deviation of the gap from parallel with the wave crests will result in a less uniform beach in the planform view, and wave modeling may be necessary to approximate the stable beach configuration.

6.2 Beach and Groin Physical Characteristics

Beach physical characteristics include crest height, dry beach width, beach slope, and sand grain size. Standard methodology typically involves trying to match adjacent beach characteristics because this indicates what is naturally stable for local conditions and it is aesthetically more pleasing to match the adjacent beach.

The empirical relationships show that the mean low water (low tide) shoreline will be located between one-third and two-thirds of the gap length (G) behind the groin head (i.e., 0.35G to 0.65G). Larger values in the range are appropriate for:

1) Energetic open coasts directly exposed to wave action.
2) Larger gap openings.
3) Large angles between the wave approach and the gap orientation.
4) Poor beach fill sand compatibility, and.
5) A greater level of conservatism.

The groin head length should be long enough so that the mean low water shoreline approaches the head, while maintaining a minimum ratio of gap width to head width of about 60:40 for aesthetic reasons so that the groins do not appear to dominate viewplanes. A schematic of the components of a tuned T-head groin system is presented as Figure 6-2.

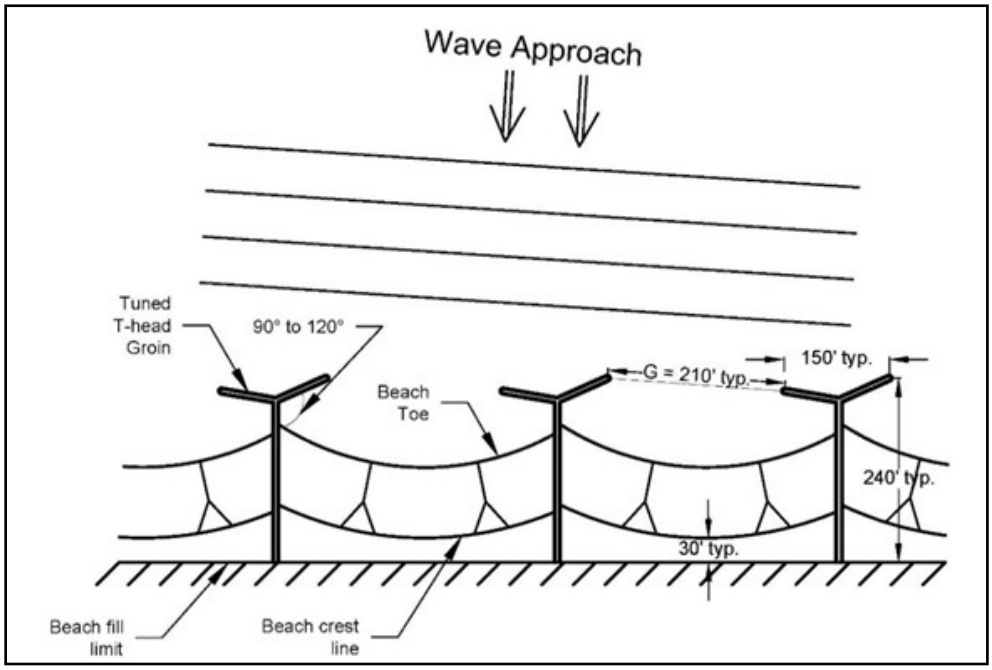


Figure 6-2. Schematic of typical tuned T-head groin system

The groin stems should extend landward of the design beach crest to eliminate flanking and loss of sand from the cell around the back of the groin. The groin crest elevation should be above the high tide elevation and high enough to prevent significant overtopping during typically prevailing (non-storm) water level and wave conditions. Experience at Iroquois Point and consideration of site conditions and sea level rise suggest that a stable beach crest elevation would be at elevation of approximately +8.5 ft MSL and the beach foreshore slope would be about 1V:8H.

6.3 Structure Design Analysis

The concept alternative presented above includes using rock rubble mound for constructing the groins. The oceanographic design parameters presented in Section 4 are applied in this section to determine structure characteristics. Key structure design parameters include crest height, slope, composition, stone size, and crest width.

The groins in this alternative are designed as rock rubble mound structures with side slopes of 1V:1.5H, which is the steepest slope recommended by the USACE Coastal Engineering Manual (USACE, 2006). The groin cross-sections are designed with a two-stone thick armor stone layer over an underlayer and core center of successively smaller stone than the amor layer. Stone, sized according to the design wave conditions, is typically used for groin construction when the required size and quantities are available. Stone armor unit design and construction is tried and proven, along with a long history of testing and structure performance monitoring.

6.4 Armor Stone Size

Armor stone unit size is based on the design wave height during a 50-year northwest swell (see Section 7.4.6.2). The USACE Coastal Engineering Manual (2006) recommends using $H_{1/10}$ instead of H_s for the design of rubble mound structures, where $H_{1/10} = 1.27H_s$ and therefore $H_{1/10} = 8.2$ ft. The required armor stone weight for stability under this design wave height is given by the Hudson Formula (USACE, 2006):

$$W = \frac{\gamma_a H^3}{K_D (S_r - 1)^3 \cot\theta}$$

where:

W = weight in pounds of an individual armor stone
γ_a = unit weight of armor stone, 160 lb/ft^3
$H_{1/10}$ = design wave height, 8.2 ft
K_D = armor stone stability coefficient, 2.0 (*USACE, 2006*)
S_r = specific gravity of the stone relative to seawater, use 2.5
cotθ = cotangent of the revetment slope, 1.5

The resultant median armor stone weight would be approximately 8,700 lbs. A range of ±25% of the median weight is typically utilized, which yields a stone size range of 6,525 to 10,875 lbs. A two-stone thick layer would be about 7.6 ft in thickness. It is recommended that the armor stone for the groins be keyed-and-fit to increase stability.

6.5 Underlayer Stone Size

Underlayer stone is sized at approximately 1/10 the armor stone weight, resulting in underlayer stone size between about 650 to 1090 lbs. The sizing is important for providing porosity to increase wave energy dissipation, decrease wave reflection, achieve interlocking between the armor and underlayer, and prevent the underlayer material from being removed through voids in the armor layer.

6.6 Alternative Armor Units

Concrete Armor Units

Man-made concrete armor units have been developed for use when stone of large enough size is not available to meet the design requirements. These concrete units have larger stability coefficients, i.e., greater interlocking and ability to withstand wave attack, than does stone, thus the concrete units can be smaller than the required stone size for a given wave height. Tribar (Figure 6-3) concrete armor units have been used with considerable success for projects with similar design conditions and are an alternative to stone for this project.

Tribar armor units are implemented as a single layer and like the rubble mound revetment the armor units are placed 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 Tribars. The underlayer is sized at 1/10 the Tribar weight and is at a minimum two stone diameters thick.

Because Tribar units depend on interlocking for stability, their sides, toe, and crest of the revetment must be securely tied in and fixed to the surrounding environment. Typically, the toe of the structure is entrenched and grouted into the seafloor.

Environmentally Friendly Armor Units

Construction of the shoreline improvements results in covering of bottom with either sand or rock. The rock rubble mound structures are expected to increase biodiversity of the area based on the monitoring results following the Iroquois Point project in 2013. Additional steps are being considered to mitigate impacts by providing ecologically sensitive solutions where possible.

One option is to add environmentally friendly armor units to the groins where conditions allow. The discussion below focuses on ECOncrete and their products; however, there are other concrete units available that can be considered during the design phase of the project, including those from Volvo, University of Washington, and Reef Design Lab, amongst others.



Figure 6-3. Tribar concrete armor units in American Samoa

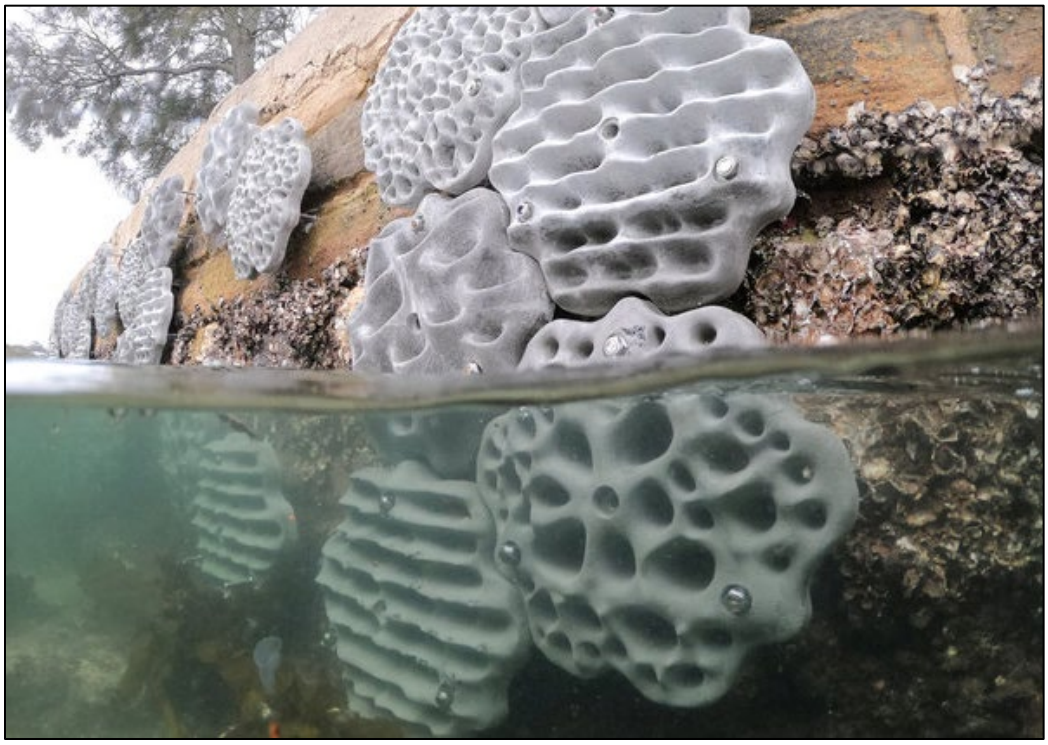


Figure 6-4. "The Living Seawall Project" (www.reefdesignlab.com)

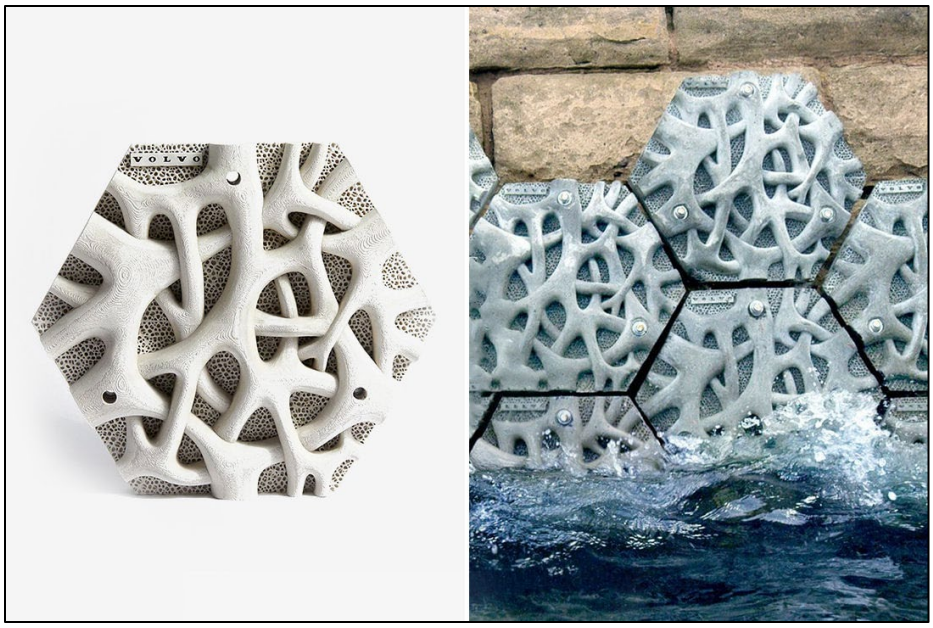


Figure 6-5. Volvo's "3D-Printed Living Seawall" (www.hiconsumption.com)

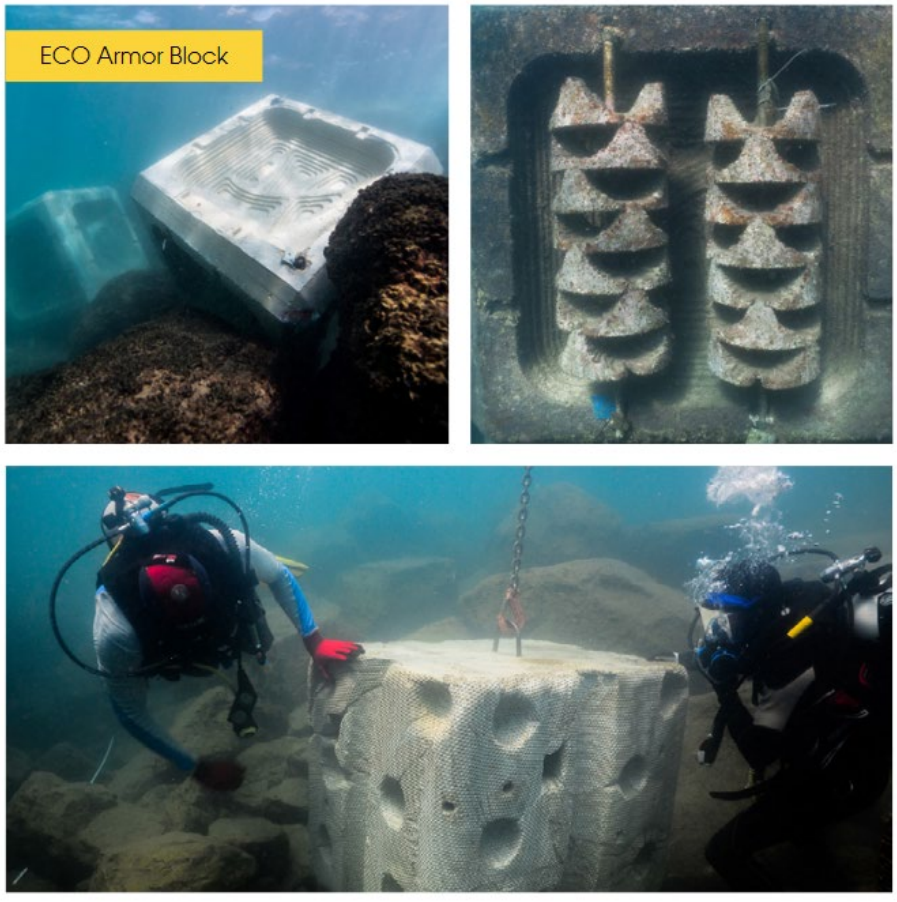


Figure 6-6. ECO Armor Block (www.econcrete.com)



Figure 6-7. ECO Coastalock (www.econcrete.com)

ECOncrete

ECOncrete is marketed as an eco-engineered solution for both marine life and humans. Products include ecological armoring units, seawall panels, designed tidepools, and articulated marine mattresses. ECOncrete reported achieves their success from a combination of concrete additives and unit design and texture.

The concrete armoring units are produced with a proprietary concrete mix with enhancing admixture which complies with marine construction regulations. When compared to standard concrete used in other armor units, ECOncrete provides higher compressive strength and lower pH levels. The low pH levels reportedly promote better coral growth.

Each of the products has unique textured surfaces that reportedly improve marine life and coral structure growth. Production of calcium carbonate from higher levels of marine life provides an additional bond between concrete armoring units, strengthening and stabilizing the structure.

The ECOncrete units have been used in multiple locations in the United States and throughout Europe, and thus far have only been used in calm water with low surf activity. Intense review of hydraulic stability is currently being performed by ECOncrete through computational modeling and physical testing to determine if their concrete armor units are applicable in high surf environments. Cost associated with purchase of ECOncrete units may be similarly priced to standard concrete units if the units can be cast locally. Figure 6-4 to Figure 6-7 show examples of armor units that are marketed as being environmentally friendly.

ECOncrete units have been used in multiple locations in the United States and throughout Europe. Case studies indicate that the armor units have predominantly been placed in harbors or other calm areas with low surf activity. This was confirmed by a company representative who mentioned that intense review of hydraulic stability is currently being performed by ECOncrete through computational modeling and physical testing to determine if their concrete armor units are applicable in high surf environments. In some case studies, blocks were placed outside of the shoreline stabilization along the toe, in what appears to be a non-engineered manner. In these cases, movement of the ECOncrete blocks is not expected to cause instability of the main shore protection structure.

7. OCEANOGRAPHIC CONDITIONS

This section details the existing conditions in the marine environment and evaluates potential impacts associated with the Project and alternatives. This section also discusses the design parameters for the alternative beach restoration methodologies.

7.1 Marine Environment

This section details the existing conditions in the marine environment and evaluates potential impacts associated with the Project and alternatives. This section discusses measures to minimize negative impacts on the marine environment

7.1.1 Bathymetry

Existing Conditions

Regional bathymetry[26] in the vicinity of the Project Site was compiled from the 50-meter resolution Hawai'i Bathymetry and Topography Synthesis obtained from the Hawai'i Mapping Research Group (SOEST, 2016). Nearshore bathymetry was derived from the U.S. Army Corps of Engineers (USACE) Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS).

Honokōwai Beach is located on the leeward (west) coast of the Island of Maui, inshore of the ʻAuʻau channel and south of the Pailolo channel (Figure 7-1). The ʻAuʻau channel is a relatively shallow interisland channel that reaches depths up to 200 ft. It connected West Maui and Lānaʻi as a land bridge during past periods of glacial maxima and resulting low stand in sea level. The northern slope of the ʻAuʻau Channel drops into the deeper Pailolo Channel, which separates West Maui from Molokaʻi and is around 800 ft at its deepest. There are several rises and terraces between the deeper portions of the ʻAuʻau Channel and the Project Site. The regional bathymetry characteristics play a critical role in the complex wave environment in the West Maui region.

Nearshore bathymetry at Honokōwai Beach is complex and consists of three distinct zones: nearshore scour zone, mid-reef platform, and outer reef coral zone. The nearshore scour zone extends approximately 330 ft seaward of Honokōwai Beach with water depths ranging from 0 to 4 ft. A beach rock outcrop runs parallel to shore approximately 75 to 100 ft seaward of the beach toe. The beach rock outcrop is bisected by a channel that runs perpendicular to the shoreline near the center of the beach. The channel provides access to the offshore waters for ocean-based recreational activities, such as swimming, snorkeling, diving, surfing, and paddling. The mid-reef platform begins approximately 330 ft seaward of Honokōwai Beach and is approximately 130 ft wide with water depths ranging from 4 to 10 ft. The seaward boundary of the mid-reef platform zone grades into the outer reef coral zone, which begins approximately 450 ft seaward of Honokōwai Beach with water depths ranging from 10 to 30 ft. Water depths become progressively deeper outside the outer reef coral zone approximately 1,000 ft seaward of Honokōwai Beach.

[26] ***Bathymetry:*** The measurement of the depth of water in oceans, rivers, or lakes.

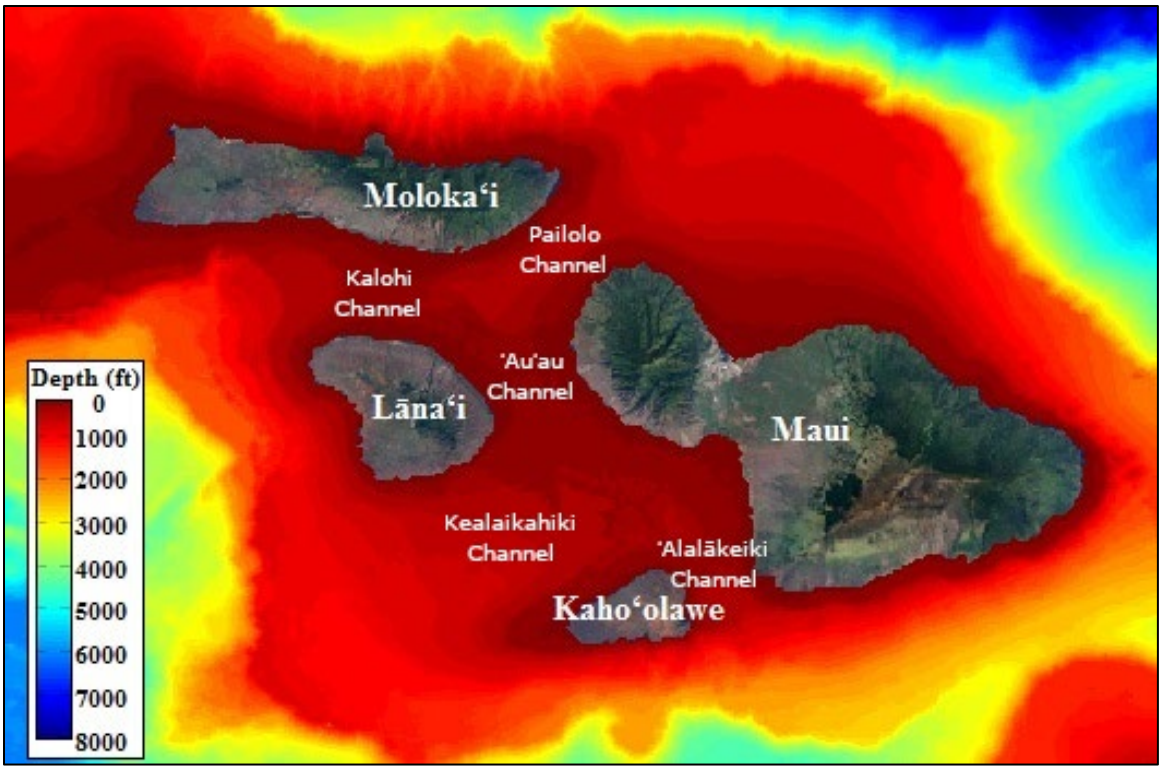


Figure 7-1. Regional bathymetry for the Maui Nui Island Complex

The offshore Sand Recovery Site is approximately 1,500 to 2,200 ft from the shoreline in water depths ranging from 120 to 170 ft (Figure 7-2). A 2008 sub-bottom survey showed offshore morphology consisting of a series of terraces, or shelves formed during ancient low sea level stands by wave-induced erosion of the reef limestone. The terraces have a stair-step appearance, with the horizontal surfaces buried by thick wedge-like deposits of sand. This morphology is common in the Hawaiian Islands. Two primary terraces were identified: one starting at approximately 100 to 115 ft water depth, and another at approximately 175 ft water depth.



Figure 7-2. Bathymetry surrounding the Project Site and Sand Recovery Site

Potential Impacts and Mitigation Measures

Beach restoration has the potential to impact existing bathymetry at the Project Site and the Sand Recovery Site.

Beach Stabilization

Beach Stabilization would require recovery of 33,000 cy of sand, which is approximately 3.4% of the estimated total volume of sand within the Sand Recovery Site (975,000 cy). Dredging during sand recovery operations would temporarily alter existing bathymetry within the dredge extents in the Sand Recovery Site. Dredging would create a depression in the seafloor that would be approximately 2 to 3 ft deep with a side slope of approximately 1V:3H. These depressions would be similar in size to existing depressions that form naturally in this area due to tidal currents. The remaining sand from the surrounding seafloor is expected to naturally fill in the depression, and tidal currents and wave action would smooth the angle of the side slope with time. Infilling is anticipated to occur within weeks to months after dredging is completed. Regional sediment transport through the Sand Recovery Site would also bring additional sand volume to fill into the depression. Impacts on bathymetry are therefore expected to be minor and temporary in nature.

Beach Stabilization would alter the foreshore topography along Honokōwai Beach by increasing dry beach width and elevation compared to the existing shoreline configuration. Impacts to foreshore bathymetry would be limited to the area within the footprint of the groins and sand fill that extend seaward of the pre-erosion beach toe. The groins would extend between 220 and 250 ft from the existing backshore (vegetation line) and would occupy an approximately 46,145 sf area seaward of the pre-erosion beach toe. Existing water depths within the footprint of the groins range from 0 to 4 ft.

The sand fill would occupy approximately 43,395 sf along the beach toe. This would result in an approximately 37% increase in beach width compared to the pre-erosion shoreline conditions in 2007, which is the most recent shoreline position that was mapped prior to the 2016 episodic erosion and beach loss event (Table 7-1). Beach width in the south and middle beach cells would be similar to the pre-erosion beach width in 2007[27] but the arc-shaped beach toe would result in an approximately 18% increase in beach width within these cells. Beach width in the north beach cell would increase approximately 109% when compared to the pre-erosion beach width in 2007. This portion of the beach has historically been narrow and beach width has fluctuated significantly. Increasing beach width is necessary to produce a stable beach in this area.

Table 7-1 Change in beach area for the Beach Stabilization alternative.

Beach Cell	Pre-construction Beach Area (sf)	Post-construction Beach Area (sf)	Total Change (sf)	Percent Change (%)
1 (north)	24,690	51,545	+26,855	+109%
2 (middle)	45,920	53,730	+7,810	+17%
3 (south)	45,425	54,155	+8,730	+19%
Total	**116,035**	**159,430**	**+43,395**	**+37%**

[27] 2007 is the last most recent shoreline position mapped prior to the 2016 episodic erosion and beach loss event (UHCGG, 2021).

Long term impacts on bathymetry and seafloor conditions would be limited to the actual footprints of the groins and sand fill. Honokōwai Beach is bounded by Honokōwai Stream (to the north) and Honokōwai Point (to the south). These features limit sediment exchange between the adjacent shorelines. Constructing rock rubble mound groins would provide superior stability for the beach. The groins heads would help prevent the formation of cross-shore (rip) currents along the groin stems, minimizing the loss of sand due to cross-shore sediment transport. The groins would terminate well inshore of the offshore surf breaks and are not expected to alter the bathymetry or wave formation characteristics of the surrounding seafloor.

Beach Stabilization is expected to significantly reduce chronic beach erosion rates at the Project Site. In addition to these natural phenomena, the beach may also be impacted by large magnitude events such as strong Kona storms, hurricanes, tsunamis, extreme water level changes, sea level anomalies, and other oceanographic and atmospheric events. Any and all of these natural phenomena can alter the beach configuration, as the Project Site is located on an open ocean coastline that is exposed to a wide range of wave and water level events and coastal hazards.

Beach Nourishment

Beach Nourishment would alter the foreshore topography along Honokōwai Beach by increasing beach width and elevation compared to the existing shoreline configuration. Dredging during sand recovery operations would temporarily alter existing bathymetry in a relatively small portion of the Sand Recovery Site. The volume of sand required (27,000 cy) is approximately 2.8% of the estimated total volume of sand within the Sand Recovery Site (975,000 cy).

Impacts to bathymetry would be limited to the 20,540-sf area of beach fill that would be placed seaward of the existing beach toe. This would result in an approximately 22% increase in beach width when compared to the pre-erosion shoreline conditions in 2007 (Table 7-2). This area would continue to be exposed to erosion, so the affected area is expected to decrease over time. With continued erosion, the bathymetry would be expected to return to a similar condition to what existed prior to construction. No long-term impacts to bathymetry are expected.

Table 7-2. Beach area change for Beach Nourishment and Beach Maintenance

Pre-construction Beach Area (sf)	Post-construction Beach Area (sf)	Total Change (sf)	Percent Change (%)
118,600	139,140	+20,540	+22%

Beach Maintenance

Beach Maintenance would alter the foreshore topography along Honokōwai Beach by increasing beach width and elevation compared to the existing shoreline configuration. Dredging during sand recovery operations would temporarily alter existing bathymetry in a relatively small portion of the Sand Recovery Site. 27,000 cy would be required for the initial nourishment, and 5,000 cy of sand would be required for each of the four successive maintenance efforts. The total volume of sand required (47,000 cy) is approximately 4.8% of the estimated total volume of sand within the Sand Recovery Site (975,000 cy).

Impacts to bathymetry would be limited to the 20,540-sf area of beach fill that would be placed seaward of the existing beach toe. This area would continue to be exposed to erosion so impacts to bathymetry would decrease over the life cycle of each maintenance effort. With periodic renourishment, the bathymetry would remain slightly altered for the 50-yr design life of the project.

No Action

No Action would have no immediate impact on existing bathymetry at the Project Site or the Sand Recovery Site as it would not require sand recovery or sand placement. Bathymetry at the Project Site may change over time as sand and alluvium is discharged into the nearshore waters due to natural erosion.

Summary

Beach Restoration is expected to have a temporary impact on bathymetry and seafloor conditions at the Project Site and the Sand Recovery Site. Impacts of dredging on bathymetry are expected to be minor and temporary in nature. Impacts to foreshore topography along Honokōwai Beach would depend on the chosen methodology. Following sand placement, there would be a period of beach equilibration, during which the beach profile and nearshore water depths can be expected to vary as the beach adjusts to the prevailing wave conditions and the beach assumes its stable configuration.

All of the beach restoration alternatives are expected to impact bathymetry at the Project Site and the Sand Recovery Site. The impacts associated with the Beach Nourishment alternative are expected to be minor and temporary in nature. The Beach Maintenance alternative is expected to have a longer-term impact on bathymetry due to the need for periodic sand recovery and sand placement. Beach Stabilization would permanently alter bathymetry within the footprint of the groins. However, the groins are expected to have a positive impact by stabilizing the beach and mitigating potential impacts to bathymetry that could occur due to the discharge of sand and alluvial sediment due to natural erosion, and the loss of sand due to cross-shore sediment transport.

7.1.2 Benthic Conditions

Existing Conditions

The Pacific Island Ocean Observing System's (PacIOOS) *Voyager* mapping program shows the National Oceanographic and Atmospheric Administration's (NOAA) benthic habitat maps in the vicinity of the Project Site and the Sand Recovery Site (Figure 7-3 and Figure 7-4).

At the Project Site, benthic habitat in the nearshore area within approximately 500 ft of the shoreline is characterized as reef flat and reef crest composed of pavement with 10 to <50% macroalgae cover. The area from 500 to 1,000 ft offshore is characterized as fore reef composed of aggregate reef with 10 to <50% coral cover. The area beyond 1,000 ft offshore is characterized as bank/shelf composed of unconsolidated sediment (sand) with 50 to <90% macroalgae cover (NOAA, 2007).

Marine Research Consultants, Inc. (MRC) conducted two (2) assessments of the existing physical composition of marine habitats at the Project Site (MRC, 2021; 2024; Appendix D). Benthic conditions at Honokōwai Beach can be described as three zones: nearshore scour zone, mid-reef platform, and outer reef coral zone.

The nearshore scour zone extends approximately 330 ft seaward of Honokōwai Beach. The physical composition of the nearshore scour zone consists of either sand and rocks or a bed of rocks and cobbles with no corals present. While many of the rock surfaces are covered with a thin veneer of algal turf, filamentous and frondose macroalgae was rare when considering the whole of the survey area. The lack of filamentous algae and corals in the nearshore scour zone are likely due to intense concussive forces from breaking waves, which limits colonization and growth of benthic organisms. The rocks and cobbles present in the nearshore scour zone may be considered "live rock", which is defined as "any natural hard substrate to which marine life is visibly attached or affixed" (Chapter 13-95-1, HAR).

The mid-reef platform begins approximately 330 ft seaward of Honokōwai Beach. Isolated coral colonies and macroalgae are present in this area. The seaward boundary of the mid-reef platform zone grades into the outer reef coral zone, which begins approximately 450 ft seaward of Honokōwai Beach with water depths ranging from 10 to 30 ft. Water depths become progressively deeper outside the outer reef coral zone approximately 1,000 ft seaward of Honokōwai Beach. Coralline algae, turf algae, and the brown alga *Turbinaria ornata* were more abundant on the mid-reef than the outer reef on both transects owing to their ability to successfully occupy higher energy areas.

The Sand Recovery Site is located in 120 to 170 ft of water depth and approximately 1,500 to 2,200 ft offshore of Puʻu Kekaʻa (Black Rock). Benthic habitat at the Sand Recovery Site is characterized as bank/shelf composed of unconsolidated sediment (sand) with 50 to <90% macroalgae cover (NOAA, 2007). No corals have been mapped or identified in the vicinity of the Sand Recovery Site.

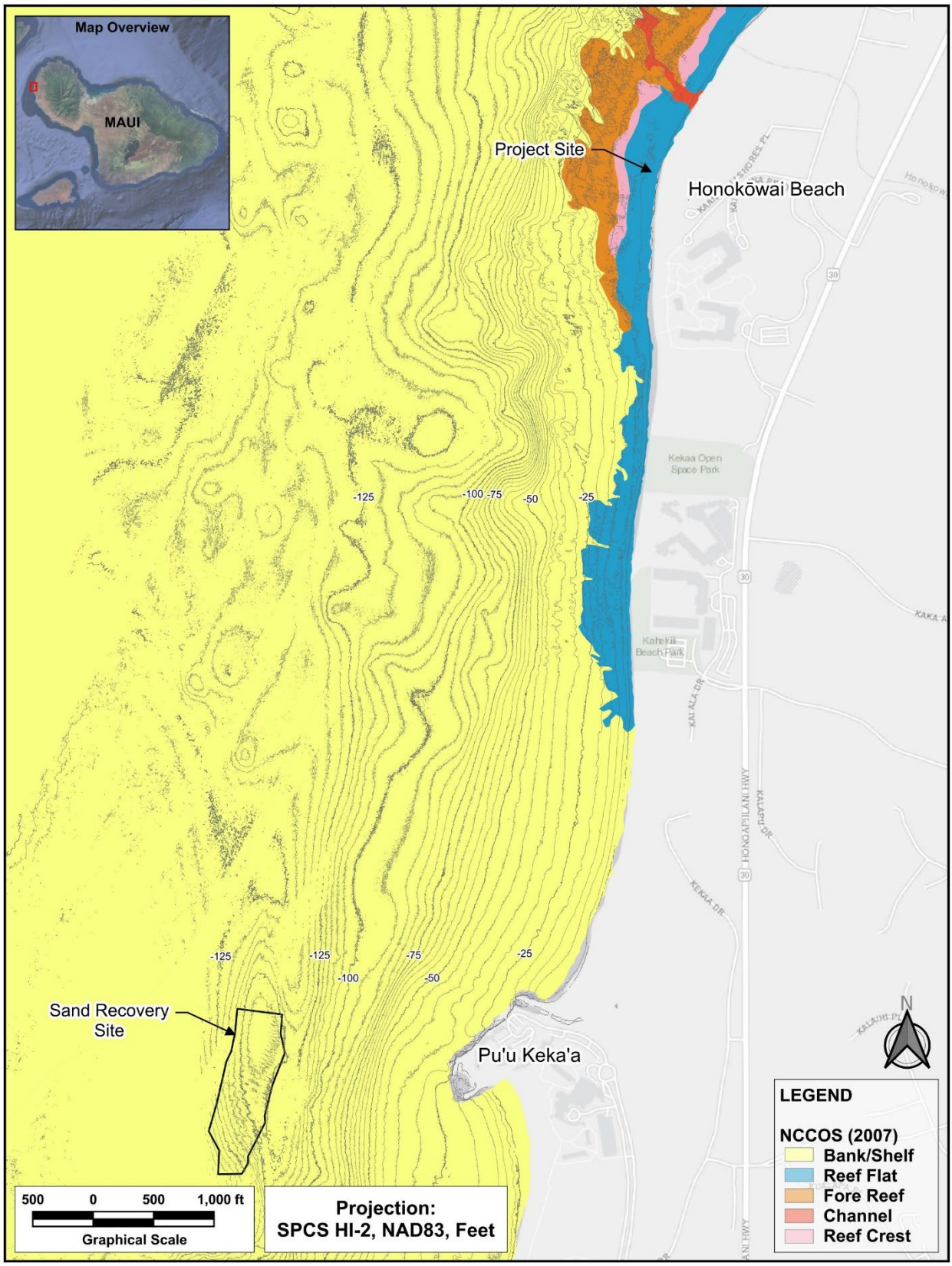


Figure 7-3. Benthic habitat geography surrounding the Project Site and Sand Recovery Site

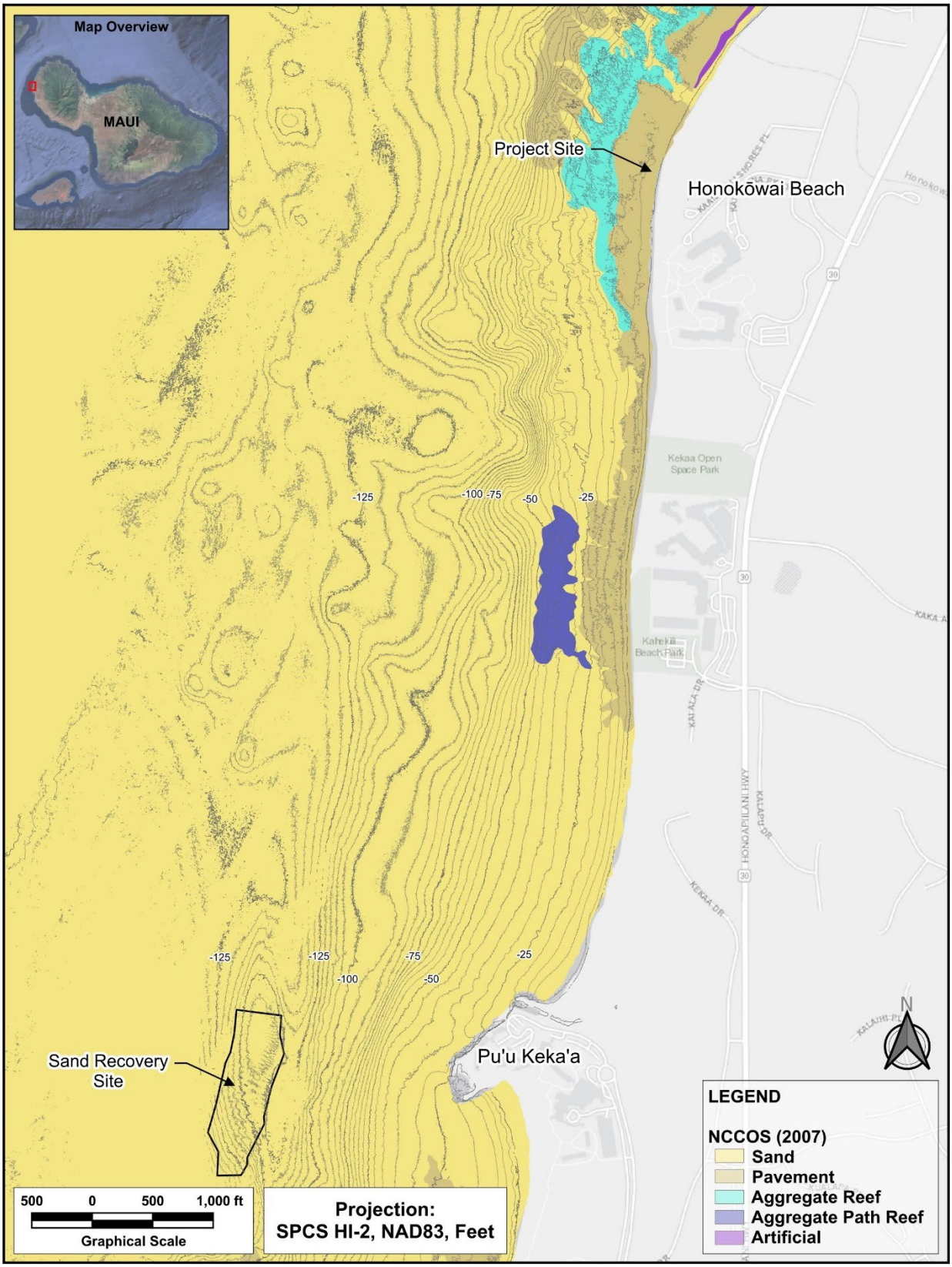


Figure 7-4. Benthic habitat geomorphology surrounding the Project Site and Sand Recovery Site

Potential Impacts and Mitigation Measures

Beach restoration has the potential to impact existing benthic conditions at the Project Site and the Sand Recovery Site.

Beach Stabilization

Beach Stabilization would permanently alter benthic conditions within the structural footprint of the groins. The nearshore area currently consists of a barren scour zone that is composed of pavement, rubble, and sand. The portions of the groins that would be below Mean Sea Level (MSL) would provide new and improved marine habitat by providing bare, stable surfaces for recruitment of corals, algae and other invertebrates. The interstitial spaces between the boulders would provide additional habitat for cryptic benthic (crabs, shrimps, worms, etc.) and sessile organisms (corals and macroalgae), which would provide additional foraging resources for fishes. This new and improved habitat would increase as sea levels continue to rise and the portions of the groins below MSL increase proportionally (Table 7-3, Figure 7-5).

Table 7-3. Groin surface area below sea level (ft)

	Sea Level Rise (ft)				
Groin	**0.0**	**0.5**	**1.1**	**2.0**	**3.2**
1 (north)	1,410	1,755	2,170	2,795	3,635
2	2,465	2,790	3,185	3,790	4,630
3	2,705	3,035	3,440	4,060	4,925
4 (south)	3,435	3,830	4,305	5,025	5,995
Total (sf)	**10,015**	**11,410**	**13,100**	**15,670**	**19,185**
Percent (%)	**22%**	**25%**	**28%**	**34%**	**42%**

Beach Stabilization would also alter benthic conditions within the footprint of the sand fill. The sand fill would occupy approximately 43,395 sf along the beach toe. Benthic habitat in this area currently consists of a barren scour zone that is composed of pavement, rubble, and sand, so no significant loss of benthic habitat is expected.

Benthic conditions at the Sand Recovery Site would be temporarily altered within the dredging extents. This area is predominantly composed of sand with 50 to <90% macroalgae cover. Macroalgae is robust and is expected to repopulate the area quickly after dredging operations are complete.

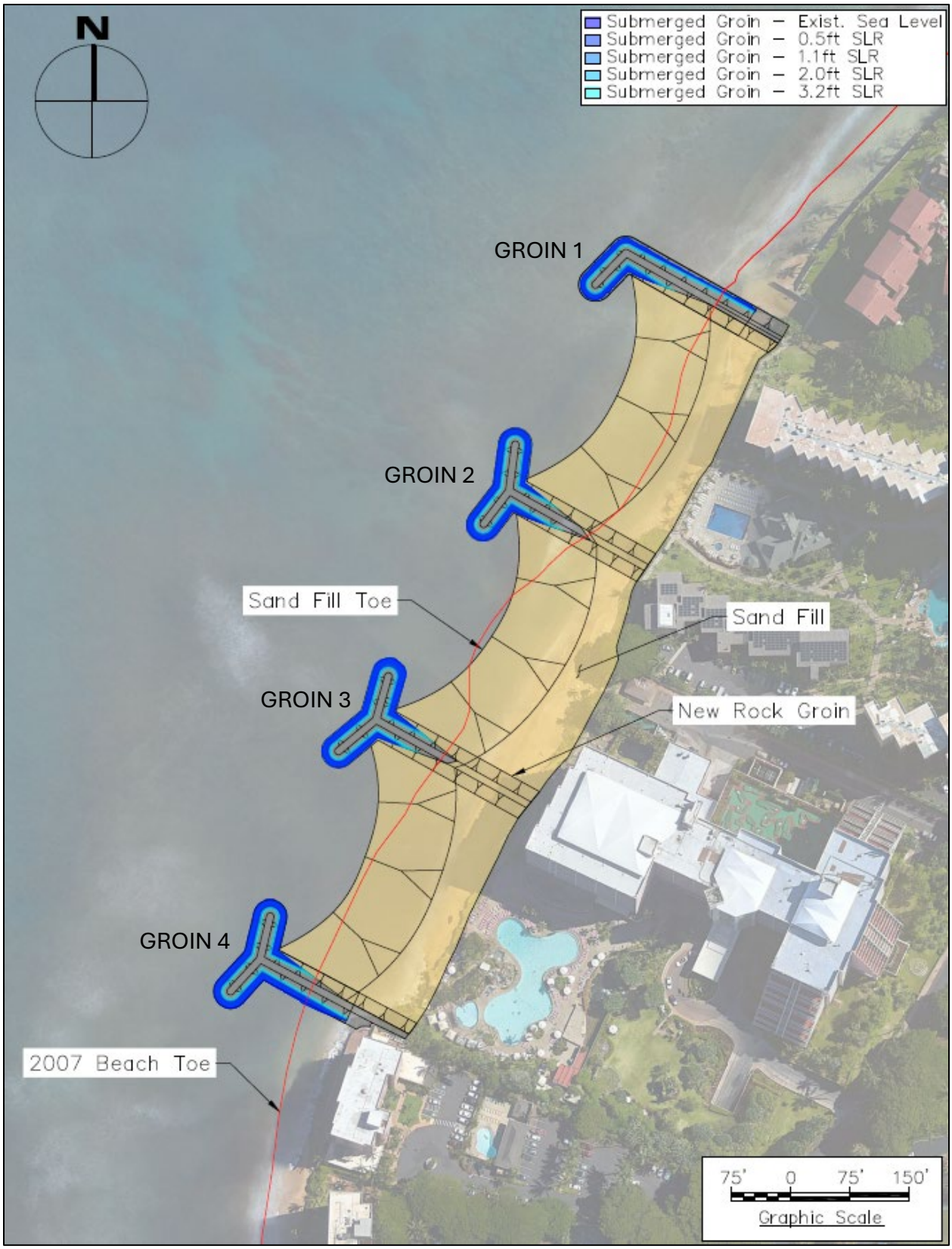


Figure 7-5. Surface area of groins below Mean Sea Level (MSL)

Beach Nourishment

Beach Nourishment would temporarily alter benthic conditions at the Project Site within the footprint of the beach fill. Impacts to benthic conditions would be limited to the 20,540-sf area of beach fill that would be placed seaward of the existing beach toe. This area would continue to be exposed to erosion, so the affected area is expected to decrease over time. With continued erosion, benthic conditions would be expected to return to a similar condition to what existed prior to construction. No long-term impacts to benthic conditions are expected. Impacts to benthic conditions at the Sand Recovery Site would be similar to the Beach Stabilization alternative. This area is predominantly composed of sand with 50 to <90% macroalgae cover. Macroalgae is robust and is expected to repopulate the area quickly after dredging operations are complete.

Beach Maintenance

Beach Maintenance would alter benthic conditions at the Project Site within the footprint of the beach fill. Impacts to benthic conditions would be limited to the 20,540-sf area of beach fill that would be placed seaward of the existing beach toe. This area would continue to be exposed to erosion, so the affected area is expected to decrease over time. With periodic renourishment, the benthic conditions would remain slightly altered for the 50-yr design life of the project. Impacts to benthic conditions at the Sand Recovery Site would be similar to the Beach Stabilization and Beach Nourishment alternatives. However, dredging would occur multiple times over a period of 50 years, so these impacts would occur more frequently.

No Action

No Action would have no immediate impact to existing benthic conditions at the Project Site or the Sand Recovery Site as it would not require sand recovery or sand placement. Benthic conditions at the Project Site may change over time as sediment (sand and alluvium) is discharged into the nearshore waters due to natural erosion. No Action has the potential for long-term impacts to benthic conditions due to erosion and sedimentation (see Section 7.1.7).

Summary

All of the beach restoration alternatives are expected to impact benthic conditions at the Project Site and the Sand Recovery Site. The impacts associated with the Beach Nourishment alternative are expected to be a minor and temporary in nature. The Beach Maintenance alternative is expected to have a longer-term impact on benthic conditions due to the need for periodic sand recovery and sand placement. Beach Stabilization would permanently alter benthic conditions within the footprint of the groins; however, this impact is expected to be positive in that the groins are expected to provide improved habitat that could potentially increase biomass and biodiversity in an area that is currently an uncolonized scour zone. Impacts to benthic conditions at the Sand Recovery Site would occur as a result of dredging; however, these impacts are expected to be minor and temporary in nature.

7.1.3 Marine Biota

Existing Conditions

Marine Research Consultants, Inc. (MRC) conducted two (2) assessments of the existing physical composition of marine habitats at the Project Site (MRC, 2021; 2024; Appendix D). Physical and biotic composition of the survey area was assessed along three (3) transect lines, which were also used for water chemistry sampling. These surveys covered a corridor approximately 330 ft wide centered on the transect line and extended to water depths of approximately 25 ft. During these underwater investigations, notes on species composition were recorded, and numerous digital photographs recorded the existing conditions of the area.

Composition of the reef communities fronting the Project Site are in direct response to several physical factors. The physical setting is on a protruding point (headland) that focuses breaking waves, resulting in concussive forces that prevent settlement and growth of most reef organisms (primarily corals). In addition, resuspension of sand from wave action also prevents settlement and causes destructive abrasion of corals. For discussion purposes, coral reef community structure is divided into three zones: the nearshore scour zone, mid-reef platform 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 sand plain.

The nearshore scour zone extends approximately 330 ft seaward of Honokōwai Beach with water depths ranging from 0 to 4 ft. The physical composition of the nearshore scour zone consists of either sand and rocks or a bed of rocks and cobbles with essentially no corals present. While many of the rock surfaces are covered with a thin veneer of algal turf, filamentous and frondose macroalgae was rare. 22 species of macroalgae were identified in the nearshore scour zone with 18 of these classified as rare and 4 classified as common (Table 7-4). The lack of filamentous algae and corals in the nearshore scour zone are likely due to intense concussive forces from breaking waves, which limits colonization and growth of benthic organisms. The exception to this was a small area near the shoreline along Transect 1 during the 2024 survey containing a community of macroalgae comprised primarily of *Dictyota* sp., *Turbinaria ornata*, and *Halimeda* sp. The occurrence of macroalgae in this area is likely the result of a localized area sheltered from direct wave impacts.

With slightly increasing water depth and distance from shore, the nearshore scour zone transitions to the mid-reef platform zone. The mid-reef platform begins approximately 330 ft seaward of Honokōwai Beach and is approximately 130 ft wide with water depths ranging from 4 to 10 ft. Isolated coral colonies were present, consisting predominantly of *Pocillopora meandrina*, *Porites lobata*, and *Montipora* spp. 29 species of macroalgae were identified in the mid-reef platform zone with 14 of these classified as rare, 12 classified as common, and 3 classified as abundant (Table 7-4).The most conspicuous species of macroalgae were fields of the green calcareous alga *Halimeda* spp, which was present as small fields scattered across the mid-reef platform zone. *Dictyota acutiloba* and *Padina sanctae-crucis* were also classified as abundant as they were commonly observed in tufts and patches scattered across the zone. Other than these three species, no other macroalgae were observed in dense aggregations within the mid-reef platform.

Motile macrobenthos were rare, owing to the force of breaking waves sufficient to prevent these unattached organisms from remaining stable on the reef surface. The exception was *Echinometra mathaei*, the rock boring sea urchin, which can withstand wave forces by excavating cavities in the limestone reef surface.

The seaward boundary of the mid-reef platform zone grades into the outer reef zone, which begins approximately 450 ft seaward of Honokōwai Beach. This transition is mainly in the change in water depth associated with a substantial increase in abundance of live coral colonies. The predominant species in the outer reef zone are large, massive colonies of *Porites lobata*, interconnected mats of *Porites compressa*, and encrusting colonies of *Montipora patula* and *M. capitata*. Many of the coral colonies were up to one meter 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 indicates that the area has not sustained wave stress substantial enough to destroy these coral colonies over a decadal time interval.

8 species of macroalgae were identified in the outer reef coral zone with 5 of these classified as rare and 3 classified as common (Table 7-4). All three species classified as rare were crustose coralline algae (CCA). No species of frondose macroalgae were classified as common or abundant within the outer reef coral zone.

Other macro-invertebrates that were observed on the surface of the outer reef were several species of sea urchins (*Echinometra mathaei*, *Echinothrix diadema*, *Tripneustes gratilla*, and *Heterocentrotus mamillatus*). None of these urchins were particularly abundant but were found most commonly on the bare limestone reef platform rather than on living corals. Green sea turtles (*Chelonia mydas*) are commonly found within the nearshore areas of West Maui. A single female green turtle was observed during the May 2024 survey. The turtle was resting in a carved-out pocket at the base of the limestone fossil reef.

The outer reef zone terminates at a depth of approximately 30 ft in a margin between the limestone platform and sand plain. Seaward of the outer reef margin, bottom composition consists of a gently sloping sand plain devoid of macrobenthos. In many areas of West Maui, the sand plains beyond the reef platform are colonized with vast fields of the calcareous green alga *Halimeda* spp. No such areas of *Halimeda* spp. were observed to the outer limits of the study off Honokōwai Beach.

Four orthomosaic images were acquired to quantify the percentage cover of the reef surface of biotic and abiotic categories on the mid-reef platform and one on the outer reef coral zone (Table 7-5). Benthic cover on the mid-reef platform consisted primarily of hard substrate (limestone fossil reef). Hard substrate was also a major component of bottom cover on the outer reef coral zone, but less than on the mid-reef platform. Unconsolidated abiotic material (sand, cobbles, rubble) comprised small percentages of bottom cover within all orthomosaics. The opposite pattern occurred for coverage of live coral, with the percent coverage of the bottom of all corals being higher on the outer reef coral zone and lower on the mid-reef platform.

Porites lobata was the most abundant on the mid-reef platform. On the outer reef transects, *P. lobata* was the most abundant coral on Transect 3, while *Porites compressa* was most abundant on Transect 1. Other corals that occurred in the orthomosaics included *Montipora capitata*, *M. patula* (maximum of 1% for each species), and *Pocillopora meandrina* (2% on mid-reef transects). Other components of benthic cover included crustose coralline algae, turf algae and the brown alga *Turbinaria ornata*. These algae were more abundant on the mid-reef platform than the outer reef coral zone owing to their ability to successfully occupy high energy areas.

In total, 760 colonies were present, with 247 on the mid-reef platform and 513 on the outer reef coral zone. Corals on the mid-reef platform were smaller with typical diameters ranging from 5 to 20 cm with no corals larger than 80 cm. Larger diameter corals (>40 cm) occurred more frequently on the outer reef coral zone. *Porites lobata* colonies were the most abundant coral species on both the mid-reef platform and the outer reef coral zone. *Porites lobata* and *P. compressa* were the only species with colonies on the outer reef greater than 160 cm in size.

The major factor shaping the composition of the marine communities off Honokōwai Beach is the concussive forces associated with breaking surf. The Project Site is located on a protruding headland, which focuses long-period wave energy, resulting in a particularly unsuitable habitat for most reef organisms. The nearshore physical composition of the marine environment consists of a wide, shallow reef flat, composed predominantly of fossil limestone, rocks, and sand. Nearshore biotic community structure is in response to the combination of shallow unstable substrate and degree of wave energy.

The documented physical structure and the nearshore biotic communities directly off Honokōwai Beach can best be described as a scour zone with no corals present. At distances of about 330 ft from shore, corals begin to occur on the mid-reef platform as isolated colonies. On the order of 500 ft from shore, where water depth increases to levels below destructive wave forces, well-developed coral reefs proliferate. The outer reef coral zone off Honokōwai Beach is considered to represent a similar condition relative to other similar Hawaiian ecosystems with typical coral abundance and diversity and no outward appearance of significant stress. The proposed groins would extend between 220 and 250 ft from the existing backshore (vegetation line). Thus, the seaward terminus of the groins would be within the area where corals only rarely occur, and approximately 250 to 300 ft from where the outer well-developed high coral cover reefs occur.

Table 7-4. Species of macroalgae observed within the nearshore scour zone, mid-reef platform zone, and outer reef coral zone (MRC, 2024)

TYPE	SPECIES	SCOUR	MID	OUTER
Blue-Green	*Leptolyngbya crosbyana*	-	R	R
	Lyngbya majuscula	-	R	-
Brown	*Chrysocystis fragilis*	-	-	R
	Dictyota acutiloba	C	A	-
	Dictyota sandvicensis	R	R	-
	Padina sanctae-crucis	R	A	-
	Sphacelaria spp.	R	C	-
	Turbinaria ornata	C	C	R
CCA	*Hydrolithon spp.*	R	C	C
	Lithophyllum kotschyanum	R	R	C
	Peysonnelia rubra	R	R	-
	Pneophyllum conicum	R	R	C
	Sporolithon erythraeum	R	C	-
Green	*Cladophora catenata*	-	R	-
	Codium arabicum	R	-	-
	Derbesia spp.	R	C	-
	Dictyosphaeria spp.	-	R	-
	Halimeda discoidea	-	R	-
	Halimeda kanaloa	R	A	-
	Neomeris spp.	R	R	-
	Ulva compressa	C	C	-
	Ulva fasciata	R	R	-
	Ulva flexuosa	C	C	-
Red	*Acanthophora spicifera*	-	C	-
	Asparagopsis taxiformis	-	R	R
	Gelidiella acerosa	R	C	-
	Gracilaria salicornia	-	R	-
	Halymenia sp.	R	-	-
	Hypnea cervicornis	R	C	-
	Laurencia spp.	R	C	-
	Liagora spp.	R	C	-
	Tolypiocladia glomerulata	-	-	R
	Wrangelia elegantissima	-	R	-
TOTAL # of SPECIES per ZONE		**22**	**29**	**8**
TOTAL # of SPECIES OVERALL			**33**	

NOTES: "CCA" = Crustose Coralline Algae, "A" = Abundant, "C" = Common, "R" = Rare, and "-" Not Observed.

Table 7-5. Percent cover of bottom types on the mid-reef platform and outer reef coral zone (MRC, 2024)

CATEGORY	SPECIES	PERCENT (%) COVER			
		T1-MID	T3-MID	T1-OUTER	T3-OUTER
ALGAE	Crustose Coralline Algae	15	6	8	5
	Turf Algae	11	8	2	0
	Turbinaria ornata	3	2	0	0
	TOTAL ALGAE	**29**	**16**	**10**	**5**
CORAL	*Montipora capitata*	0	0	1	0
	Montipora patula	0	0	0	1
	Pocillopora meandrina	2	2	0	1
	Porites compressa	0	0	37	3
	Porites lobata	5	4	13	28
	TOTAL CORAL	**7**	**6**	**51**	**33**
NON-CORAL INVERTEBRATES	*Echinometra mathaei*	6	1	0	0
	Palythoa tuberculosa	0	1	0	0
	Tubeworm	1	0	0	0
	Tunicate	1	0	0	0
	TOTAL NON-CORAL INVERTS	**8**	**2**	**0**	**0**
HARD SUBSTRATE	Dead Coral	1	2	0	0
	Limestone Fossil Reef	55	74	33	57
	TOTAL HARD SUBSTRATE	**56**	**76**	**33**	**57**
UNCONSOLIDATED SUBSTRATE	Cobbles	0	0	0	1
	Rubble	0	0	3	1
	Sand	0	0	3	3
	TOTAL UNCON. SUBSTRATE	**0**	**0**	**6**	**5**

Sand Recovery Site

A tow camera survey was performed to document existing seafloor conditions at the Sand Recovery Site. The only prominent biotic colonizer observed was *Halimeda kanaloana*, a common macroalgae in West Maui. The density of the algae varied throughout the deposit. Several small, isolated patches of sea grass were observed. No coral or hard bottom was observed during tow camera investigations, or in either side scan sonar or sub-bottom surveys of the site.

It is expected that the benthic infaunal community structure of the Sand Recovery Site is similar to other locations in sandy coastal areas of Hawaiʻi. The typical community in these environments consists of nematodes, (roundworms, phylum Nematoda), oligochaete worms (earthworm relatives, phylum Annelida, subclass Oligochaeta), copepods (tiny crustaceans, phylum Arthropoda), echinoderms (phylum Echinodermata), and mollusks (phylum Mollusca) (Bailey-Brock and Krause, 2008).

Potential Impacts and Mitigation Measures

Mitigating impacts on marine resources is a sequential process of avoiding impacts, minimizing impacts, and then compensating for unavoidable adverse impacts. The first step is to avoid impacts through project design. The second step, after avoidance measures have been incorporated, is to minimize remaining impacts. If unavoidable impacts still exist after avoidance and minimization, then replacement of lost ecosystem functions and values is appropriate. This last step is called compensatory mitigation (Bentivoglio, 2003). Project design decisions should incorporate measures to avoid and minimize impacts on marine communities associated with beach stabilization to the extent possible. In particular, impacts to corals in the footprint of the Sand Recovery Site should be avoided by excluding those areas from the dredging limits. A tow camera was used to visually assess the existing seafloor conditions at the offshore Sand Recovery Site. No corals were observed within the offshore Sand Recovery Site.

The United States Coral Reef Task Force (USCRTF) has identified a portfolio of compensatory mitigation and restoration options (USCRTF, 2016) and a list of Best Management Practices (BMPs) that could be implemented to offset adverse impacts on coral reef communities from projects. The USCRTF list was reviewed and screened for appropriateness to anticipated project-related impacts, ability to successfully implement, and impacts already minimized by project specific BMPs.

Beach Restoration has the potential to affect marine biota. Potential impacts include:

- Direct physical disturbance of the seafloor and water column during construction.
- Indirect effects associated with project related changes in water quality.
- Indirect effects related to re-colonization patterns as biota re-establishes itself in areas that were disturbed by temporary construction activities following the completion of construction.

Potential biological effects are considered to be significant to the extent that they exceed the following criteria:

- Change environmental conditions (e.g., water quality, ambient noise level, wave energy, etc.) within a substantial part of the range of an important marine community.
- Involve work in a habitat believed to be used by known sensitive species (Federal or State listed endangered, essential fish habitat, etc.) or in a conservation district.
- Substantially affect the spawning area available to a marine species.

Dredging operations have the potential to impact marine biota in the vicinity of the Sand Recovery Site. The removal of sand via mechanical dredging would disturb any existing infaunal organisms within the sand deposit. However, these organisms can be expected to rapidly repopulate the deposits after dredging is complete. The Sand Recovery Site is characterized as bank/shelf composed of unconsolidated sediment (sand) with 50 to <90% macroalgae cover. It is expected that the benthic infaunal community structure of the Sand Recovery Site is similar to other locations in sandy coastal areas of Hawaiʻi. The typical community in these environments consists of nematodes, (roundworms, phylum Nematoda), oligochaete worms (earthworm relatives, phylum Annelida, subclass Oligochaeta), copepods (tiny crustaceans, phylum Arthropoda), echinoderms (phylum Echinodermata), and mollusks (phylum Mollusca) (Bailey-Brock and Krause, 2008). The only prominent biotic colonizer observed in the Sand Recovery Site was *Halimeda kanaloana*, a common macroalgae in West Maui. No corals have been observed in the Sand Recovery Site.

Offshore sand deposits are typically home to relatively small and mobile fish populations. Fish ingestion has not been reported during dredging operations for previous beach restoration projects in Hawaiʻi. The vast majority of fishes are capable of avoiding the equipment used to recover and transport sand from offshore to the shoreline. Sand recovery operations would temporarily displace fish in the vicinity of the operations but are unlikely to injure or kill a substantial number of fish. Consequently, no significant effects to fish are expected.

Public comments received during the EISPN review period included discussion on the presence of Nabeta (Laenihi, *Xyrichtys umbrillatus*) and Kona crab (*Ranina ranina*) in the vicinity of the Sand Recovery Site. It is possible that Nabeta may occur in the vicinity of the Sand Recovery Site. The identified habitat for Nabeta is sandy areas near the shoreline with depths ranging from 60 to 300 ft. While the Sand Recovery Site is relatively far from shore, the sandy bottom and water depths range from 120 ft to 170 ft may provide suitable habitat for Nabeta habitat. Nabeta may be displaced during dredging operations. As Nabeta are typically solitary fish, the scale of displacement in time and number of organisms is not expected to be significant.

Kona crab (*Ranina ranina*) are known to occur in the vicinity of the Sand Recovery Site. The identified habitat for Kona crab is sandy areas near the shoreline with depths ranging from 30 to 300 ft. Kona crab may be injured or displaced during dredging operations. Potential impacts to Kona crab can be minimized by conducting dredging outside of spawning season, which is May to August. The Sand Recovery Site is a small portion of the much larger regional sand field, and less than 5% of the existing sand would be required for beach restoration. As a result, impacts of dredging to marine biota are expected to be minor and temporary in nature.

Beach Stabilization

Beach Stabilization is not expected to have any substantial negative effects on existing biotic communities within the area of sand placement and groin construction. The primary impact would be the temporary displacement of marine biota during construction operations. The nearshore scour zone extends seaward to a distance that is likely beyond the influence of any beach restoration activities. The only foreseeable change may be if beach restoration 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 cobbles.

Beach Stabilization would permanently alter benthic conditions within the structural footprint of the groins; however, the groins would provide new and improved marine habitat in an area that currently consists of a barren scour zone that is composed of pavement, rubble, and sand. Ecological services of reef flat habitat would be lost under the project footprints (sand and groins) but are expected to recover over time as the benthic community re-establishes. Most adult fish in the project vicinity are mobile and would be expected to avoid direct impacts from project activities. There is potential for demersal fish eggs to be buried; however, new hard substrata created by the groins would provide greater surface area for these species to lay eggs in the future. Some impairment of ability of Essential Fish Habitat (EFH) managed species to find prey items could occur, but this effect should be temporary and spatially limited to the immediate vicinity of construction activities. Turbidity containment barriers would effectively isolate the construction activities from the adjacent seafloor and water column; thus, impacts to marine biota would be limited to the immediate construction area. A biological and water quality monitoring program would be implemented to enhance control over construction impacts.

The Iroquois Point Beach Nourishment and Stabilization project, which was completed in 2013, involved the construction of nine rock rubble mound groins very similar in size and construction to the groins proposed at the Project Site. Extensive marine ecosystem monitoring has been conducted for that project (AECOS, 2014). The 1-year post-construction marine ecosystem monitoring shows that the project has resulted in a significant increase in marine species diversity and density. In the vicinity of the groins there has been a 25-fold increase in fish abundance, not counting small baitfish, and a tripling of species richness (number of species). Fish biomass is more than six times greater than prior to construction. Prior to construction of the groins, fish biomass at Iroquois Point was considered low compared to island averages around the state, roughly on par with the shallow reef flats off Waikīkī (AECOS, 2009b, 2011, 2014). After construction, the biomass at the groins is on par with maximum values observed around the state (AECOS, 2014). Other changes in the vicinity of the groins include an increase in crustose coralline algae cover from 1% to 60%, coral cover increase from 0 to 0.6% and macroinvertebrate cover from 1.4% to 6.3%. Coral abundance in the groin vicinity increased from 0 to 16 colonies per 10 m^2, with the most common coral species being *Pocillopora damicornis*. These changes are attributable to the creation of hard, stable habitat for colonization.

Beach Nourishment

Beach Nourishment has the potential to impact marine biota, primarily through direct physical disturbance of the seafloor and water column during construction. Sand recovery and sand placement may also temporarily increase turbidity and indirectly effect re-colonization patterns as marine biota re-establishes itself in areas that were disturbed by temporary construction activities following the completion of construction. Beach Nourishment has a relatively short design life (10 years); therefore, these impacts are expected to be minor and temporary in nature. Beach Nourishment would not provide any new or improved habitat for marine biota.

Beach Maintenance

Beach Maintenance has the potential to impact marine biota in the same ways as Beach Nourishment; however, the frequency and duration of the impacts would increase due to the need for sand recovery and sand placement for periodic maintenance. Beach Maintenance would not provide any new or improved habitat for marine biota.

No Action

No Action would have no immediate impact on existing marine biota at the Project Site or the Sand Recovery Site as it would not require sand recovery or sand placement. Marine biota at the Project Site may change over time as sand and alluvium is discharged into the nearshore waters due to natural erosion, which could impact water quality and benthic habitat.

Summary

Beach restoration is not expected to have any substantial negative impact on existing biotic communities at the Project Site or the Sand Recovery Site. The nearshore scour zone extends seaward to a distance that is likely beyond the influence of any project activities. The only foreseeable change may be if beach restoration 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 cobbles. Impacts to biotic communities at the Sand Recovery Site are expected to be minor and temporary in nature.

7.1.4 Essential Fish Habitat

Existing Conditions

The 1996 Sustainable Fishery Act amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and subsequent Essential Fish Habitat (EFH) Regulatory Guidelines (NOAA, 2002) describe provisions to identify and protect habitats of federally-managed marine and anadromous fish species. Under the various provisions, federal agencies that fund, permit, or undertake activities that may adversely affect EFH are required to consult with the National Marine Fisheries Service (NMFS).

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH is further defined by existing regulations as (MSFCMA, 1996; NOAA, 2002). "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" is defined as required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' life cycle.

The Western Pacific Regional Fishery Management Council (WPRFMC) has restructured its management framework from species-based fishery management plans (FMPs) to place-based fishery ecosystem plans (FEPs). The Hawaiian Archipelago FEP establishes the framework under which the WPRFMC will manage fishery resources and begin the integration and implementation of ecosystem approaches to management in the Hawaiian Archipelago. This FEP does not establish any new fishery management regulations but rather consolidates existing fishery regulations for demersal species. Specifically, this FEP identifies as Management Unit Species (MUS) those species known to be present in waters around the Hawaiian Archipelago and incorporates all of the management provisions of the Bottomfish and Seamount Groundfish FMP, the Crustaceans FMP, the Precious Corals FMP, and the Coral Reef Ecosystems FMP that are applicable to the area.

In addition to EFH, the WPRFMC identifies Habitat Areas of Particular Concern (HAPC) within EFH for all FEPs. Specific subsets of EFH, HAPCs are areas within EFH that are essential to the life cycle of federally managed coral reef species. In determining whether a type or area of EFH should be designated as a HAPC, one or more of the following criteria established by NMFS should be met: (a) the ecological function provided by the habitat is important; (b) the habitat is sensitive to human-induced environmental degradation; (c) development activities are, or will be, stressing the habitat type; or (d) the habitat type is rare. The waters within the Project Site and the Sand Recovery Site are designated as EFH (including water column and all bottom areas) for coral reef ecosystem, bottomfish, pelagic, and crustacean MUS.

The nearshore waters fronting the Project Site are part of the Kahekili Herbivore Fisheries Management Area, which extends approximately 4,000 ft seaward of the shoreline (§13-60.7, HAR). Fishing is permitted for finfish and invertebrates but prohibited for certain species including rudderfish (nenue), parrotfish (uhu), and surgeonfish. Feeding of fish and removal of sea urchins is also prohibited.

Marine Research Consultants, Inc. (MRC) conducted two (2) assessments of the existing physical composition of marine habitats, and biotic community structure at the Project Site. The assessments included observations of fish species and distribution (Table 7-6).

Fish were rare in the nearshore scour zone habitat. When considering both the 2021 and 2024 surveys, eight species of fish were observed in the nearshore scour zone (Table 6). Picasso's triggerfish (*Rhinecanthus rectangulus*), the yellowstripe goatfish (*Mulloidichthys flavolineatus*), and the Hawaiian sergeant (*Abudefduf abdominalis*) were observed during both the 2021 and 2024 surveys, while all other species were observed during only a single survey.

When considering both the 2021 and 2024 surveys, 36 species of fish were observed in the mid-reef platform zone (Table 6). Fifteen species of reef fish were observed on the mid-reef platform during the 2021 survey and 29 were observed during the 2024 survey. The most commonly observed fish included schools of the black triggerfish (*Melichthys niger*) and roving schools of mixed surgeonfishes (Acanthurids) and wrasses (Labrids). Fish biomass and diversity is higher in the mid reef zone when compared to the nearshore zone owing to more complex bottom structure, greater availability of shelter for fishes, and less wave stress.

Reef fish were most common on the outer reef platform with 21 species observed. The most common and conspicuous fish were mixed species of Acanthurids (surgeonfish) occupying the mid-water near the outer margin of the reef platform. Other commonly observed fish were five species of Chaetodontidae (butterfly fishes), Labridae (wrasses) and Pomacentridae (dameselfishes). Green sea turtles (*Chelonia mydas*) are commonly found within the nearshore areas of West Maui. No turtles were observed during the 2021 survey; however, they are known to occur on the reefs offshore of the Project Site.

Fish were common on the outer reef with 38 species observed between the two survey years (Table 7-6). When considering individual surveys, 21 species were observed in 2021 and 30 in 2024. The most common and conspicuous fish were mixed schools (eight species) of Acanthurids (surgeonfish) transiting the reef surface and mid-water near the outer margin of the reef. Other commonly observed fish were seven species of Chaetodontidae (butterflyfishes), Labridae (wrasses) and Pomacentridae (damselfishes). Fish observed in the outer reef coral zone represent typical assemblages found on Hawaiian reefs of similar physical and biotic structure.

Table 7-6. Fish species observed offshore of the Project Site (MRC, 2021; 2024)

Fish Family	ZONE/SURVEY YEAR					
Fish species	Nearshore Scour		Mid-Reef Platform		Outer Reef	
	2021	2024	2021	2024	2021	2024
Acanthuridae (Surgeonfishes)						
Acanthurus blochii				X		
A. leucopareus						X
A. nigrofuscus		X	X	X	X	X
A. triostegus	X		X	X	X	X
A. xanthopterus				X		
Ctenochaetus strigosus					X	X
Naso lituratus					X	X
N. unicornis			X	X	X	
Zebrasoma flavescens			X		X	X
Z. veliifer				X	X	X
Aulostomidae (Trumpetfishes)						
Aulostomus chinensis					X	
Ballistidae (Triggerfishes)						
Cantherines dumerilii				X		
Melichthys niger			X	X	X	X
M. vidua			X			
Rhinecanthus rectangulus	X	X	X	X		X
Sufflamen bursa				X	X	
Carcharhinidae (Sharks)						
Triaenodon obesus						X
Chaetodontidea (Butterflyfishes)						
Chaetodon auriga					X	
C. lunulatus					X	
C. miliaris				X		
C. multicinctus						X
C. ornatissimus					X	X
C. quadrimaculatus						X
C. unimaculatus					X	
Forcipiger sp.					X	X
Cirrhitidae (Hawkfishes)						
Cirrhitus pinnulatus			X			X
Paracirrhites arcatus					X	
P. forsteri						X
Fistularidae (Cornetfishes)						
Fistularia comersonii				X		
Labridae (Wrasses)						
Gomphosus varius			X			X
Stethojulis balteata				X		
Thalassoma duperrey		X	X	X	X	X
T. ballieui			X		X	
Lutjanidae (Snappers)						
Lutjanus fulvus				X		
Monocanthidae (Filefishes)						
Pervagor aspricaudus				X		
Mullidae (Goatfishes)						
Mulloidichthys flavolineatus	X	X		X		
M. vanicolensis						X
Parupeneus multifasciatus		X		X		X
P. porphyreus				X		X
Muraenidae (Eels)						
Echidna nebulosa	X			X		
Gymnothorax steindachneri				X		
Ostracidae (Boxfishes)						
Ostracion meleagris				X		
Pomocentridae (Damselfishes)						
Abudefduf abdominalis	X	X	X	X	X	X
A. sordidus			X			X
A. vaigiensis				X	X	X
Pycnochromis hanui						X
Plectroglyphidodon imparipennis			X			X
P. johnstonianus						X
Pycnochromis vanderbilti						X
Scaridae (Parrotfishes)						
Chlorurus perspicillatus				X		
C. spilurus			X	X	X	X
Scarus psittacus						X
Scorpionidae (Scorpionfishes)						
Sebastapistes ballieui				X		
Syngnathidae (Seahorses)						
Hippocampus kuda				X		
Zanclidae (Moorish Idol)						
Zanclus cornutus				X		
TOTAL BY YEAR	5	6	15	29	21	30
TOTAL SPECIES	8		36		38	

Potential Impacts and Mitigation Measures

Beach restoration has the potential to impact EFH. EFH may be temporarily disrupted during sand recovery and sand placement, which have the potential to impact water quality, increase noise levels, and affect the spawning area available to a marine species. These disruptions are expected to be minor and temporary in nature. EFH consultation would be required during the Department of the Army permit processing for work in the water. Measures to mitigate impacts to EFH may be required.

Beach Stabilization

Beach Stabilization would permanently alter EFH within the structural footprint of the groins, which currently consists of a barren scour zone that is composed of pavement, rubble, and sand. The portions of the groins that would be below Mean Sea Level (MSL) would provide new and improved EFH by providing bare, stable surfaces for the recruitment of corals, algae and other invertebrates. The interstitial spaces between the boulders would provide additional habitat for cryptic benthic (crabs, shrimps, worms, etc.) and sessile organisms (sponges and tunicates), which would provide additional foraging resources for fishes. This new and improved EFH would increase as sea levels continue to rise and the portions of the groins below MSL increases proportionally. EFH at the Sand Recovery Site would be temporarily altered within the dredging extents. This area is predominantly composed of sand with 50 to <90% macroalgae cover.

Beach Nourishment

Beach Nourishment would temporarily alter EFH at the Project Site within the footprint of the beach fill. Impacts to EFH would be limited to the 20,540-sf area of beach fill that would be placed seaward of the existing beach toe. This area would continue to be exposed to erosion, so the affected area is expected to decrease over time. With continued erosion, benthic conditions would be expected to return to a similar condition to what existed prior to construction. Impacts to EFH at the Sand Recovery Site would be similar to the Beach Stabilization alternative. Any existing EFH is expected to recover quickly after dredging operations are complete. No long-term impacts to EFH are expected at the Project Site or the Sand Recovery Site.

Beach Maintenance

Beach Maintenance has the potential to impact EFH in the same ways as Beach Nourishment; however, the frequency and duration of the impacts would increase due to the need for sand recovery and sand placement for periodic maintenance.

No Action

No Action would have no immediate impact to EFH at the Project Site or the Sand Recovery Site as it would not require sand recovery or sand placement. EFH at the Project Site may change over time as sand and alluvium is discharged into the nearshore waters due to natural erosion. No Action has the potential for long-term impacts to EFH due to sedimentation (see Section 7.1.7).

Summary

All of the beach restoration alternatives are expected to impact EFH at the Project Site and the Sand Recovery Site. The impacts associated with the Beach Nourishment alternative are expected to be minor and temporary in nature. The Beach Maintenance alternative is expected to have a

longer-term impact on EFH due to the need for periodic sand recovery and sand placement. Beach Stabilization would permanently alter EFH within the footprint of the groins; however, this impact is expected to be positive in that the groins are expected to provide improved habitat that could potentially increase biomass and biodiversity in an area that is currently an uncolonized scour zone. Impacts to EFH at the Sand Recovery Site would occur as a result of dredging; however, these impacts are expected to be minor and temporary in nature.

7.1.5 Rare, Protected, and Endangered Species

Existing Conditions

The nearshore area off Honokōwai Beach is frequented by the threatened green sea turtle (*Chelonia mydas agassizi*), which feeds on the algae covered bottom. Hawaiian monk seals (*Monachus schauinslandi*) occasionally haul out at Honokōwai Beach. The humpback whale or koholā (*Megaptera novaeangliae*) are frequently observed in deeper waters offshore of Honokōwai Beach, particularly during the months of January through March. No other listed species have been observed at the Project Site.

Green Sea Turtles

The distinct population segment (DPS) of green sea turtle that occurs in Hawaiʻi is federally listed as a threatened species (USFWS and NOAA-NMFS, 2016; UFWS, 2018) and as a threatened subspecies (*Chelonia mydas agassizi*) under Hawaiʻi regulations (DLNR, 2014). Threats to the green sea turtle in Hawaiʻi include disease and parasites, accidental fishing take, boat collisions, entanglement in marine debris, loss of foraging habitat to development, and ingestion of marine debris. Throughout the global range of green sea turtle habitats, nesting and foraging habitats are being altered and destroyed by coastal development, beach armoring, beachfront lighting, vehicle/pedestrian traffic, invasive species, and pollution from discharges and runoff (NOAA & USFWS, 2007a, 2007b).

Adult green sea turtles forage in shallow nearshore areas and on coral reefs. Contamination from effluent discharges and runoff has degraded these environments, and invasive species may reduce native algae species preferred by green sea turtles or could exacerbate susceptibility to, or development of disease (NOAA-NMFS and USFWS, 2007a). Fibropapillomatosis, a disease characterized by the presence of internal and/or external tumors that may grow large enough to hamper swimming, vision, feeding, and potential escape from predators continues to be a major threat to green sea turtles. Extremely high incidence has been reported in Hawaiʻi, where affliction rates peaked at 47-69% in some turtle foraging areas (Murakawa et al., 2000).

Hawksbill Sea Turtles

The Hawksbill sea turtle is distributed across the Pacific, Indian, and Atlantic oceans. Hawksbill sea turtle is much less common in the Hawaiian Islands than green sea turtle and is known to nest only in the southern reaches of the state (NOAA-PIFSC, 2010). Hawksbill sea turtle is federally-listed as endangered and is also listed as an endangered subspecies (*Eretmochelys imbricata bissa*) under Hawaiʻi regulations (HDLNR, 2014). Hawksbill sea turtle faces many of the same threats affecting green sea turtle (see above section; NOAA & USFWS, 2007b).

Hawaiian Monk Seals

The endangered Hawaiian monk seal (*Monachus schauinslandi*) is known to occur at the Project Site. The Hawaiian monk seal was first listed as an endangered species pursuant to the ESA on November 23, 1976 (41 FR 51612) and remains listed as endangered. In that same year, the Hawaiian monk seal population was designated as "depleted" under the Marine Mammal Protection Act (MMPA). The population of Hawaiian monk seals is estimated to be around 1,600 seals. The majority of Hawaiian monk seals (about 1,200 individuals) live in the Northwestern Hawaiian Islands, and a much smaller number (about 400) live in the main Hawaiian Islands (NOAA, 2024). Monk seals live in warm, subtropical waters and generally prefer sandy, protected beaches surrounded by shallow waters for pupping.

Critical habitat for Hawaiian monk seals (Figure 7-6) has been designated and includes the seafloor and marine environment to 10 m above the seafloor from the 200 m depth contour, through the shoreline and extending onto the land 5 m inland from the shoreline between identified boundary points (NOAA-NMFS, 2015). These terrestrial boundary points define preferred pupping areas and significant haul-out areas. Honokōwai Beach is designated as critical habitat for Hawaiian monk seals (Figure 7-7) and monk seals are frequently observed hauling out on the beach (Figure 7-8 and Figure 7-9).

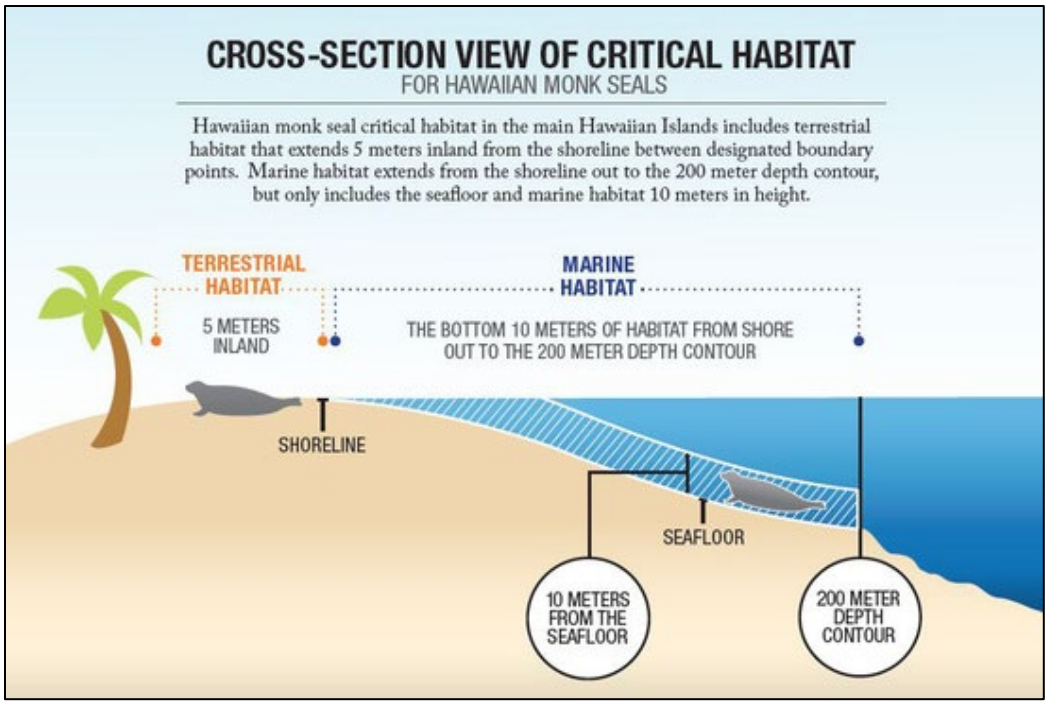


Figure 7-6. Cross-section of Hawaiian monk seal critical habitat

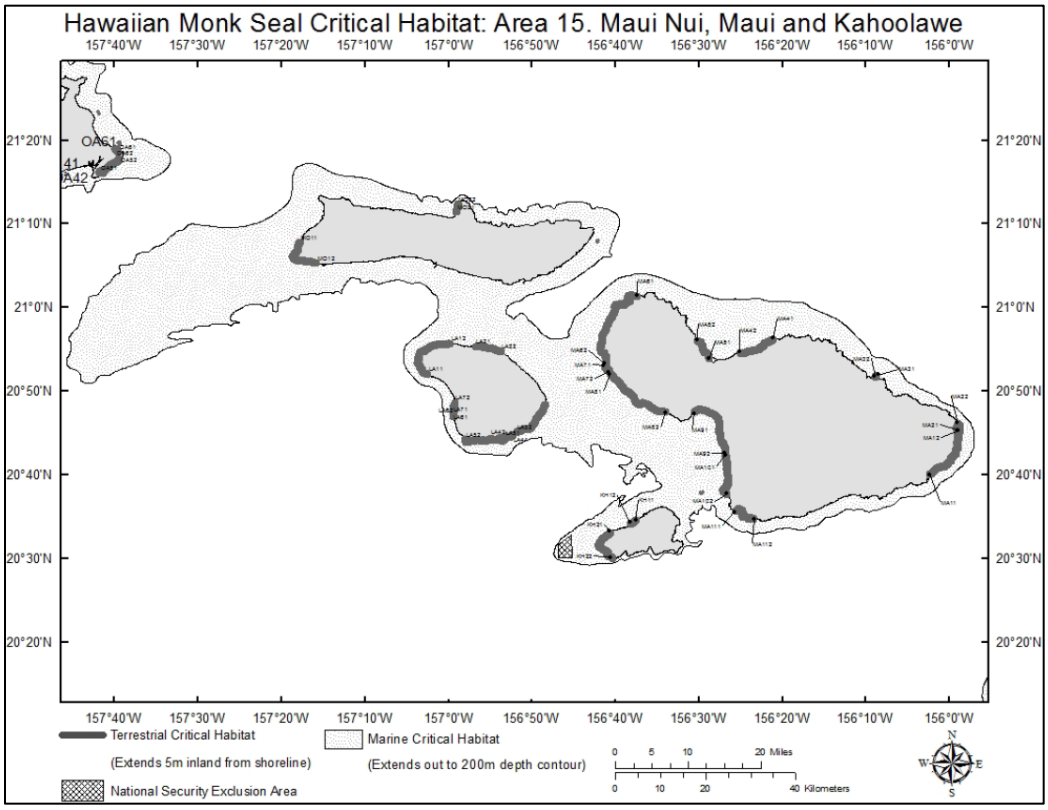


Figure 7-7. Hawaiian monk seal critical habitat: Area 15 (NOAA, 2024)



Figure 7-8. Hawaiian monk seals hauled out at Honokōwai Stream (Don McLeish)



Figure 7-9. Hawaiian monk seal hauled out at Honokōwai Beach

Humpback Whales

The humpback whale, or koholā (*Megaptera novaeangliae*), was listed as endangered in 1970 under the ESA. In 1993 it was estimated that there were 6,000 humpback whales in the North Pacific Ocean, and that 4,000 of these regularly came to the Hawaiian Islands. The population is estimated to be growing at between 4 and 7% per year. Today, as many as 10,000 humpback whales may visit Hawaiʻi each year (HIHWNMS, 2014).

The waters offshore of the Project Site and within the Sand Recovery Site are within the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS). Humpback whales normally occur in Hawaiian waters annually from November to May with the peak between January and March (HIHWNMS, 2014). Beach restoration would not directly affect humpback whales, and sounds generated from sand recovery, sand placement, and groin construction activities are not expected to be substantial enough to cause an acoustic disturbance to protected species.

The effects thresholds currently used by NMFS are marine mammal specific and based on levels of harassment as defined by the Marine Mammal Protection Act (MMPA). For exposure to sounds in water, >180 dB and >190 dB are the thresholds for Level A harassment (i.e., injury and/or PTS) for cetaceans and pinnipeds, respectively. The thresholds for Level B harassment for all marine mammals in the form of TTS and other behavioral impacts are >160 dB for impulsive noises and >120 dB for continuous noises (NOAA, 2013).

Invertebrates

Hawaiʻi Department of Land and Natural Resources (HDLNR) regulates shellfishes such as pearl oysters (HDLNR, 1987) and ʻopihi (HDLNR, 1989). No ʻopihi species or pearl oyster (*Pinctada margaritifera*) have been observed at the Project Site.

Coral species are protected under Hawaiʻi State law, which prohibits "breaking or damaging, with any implement, any stony coral from the waters of Hawaiʻi, including any reef or mushroom coral" (HAR §13-95-70, DLNR, 2010). It is also unlawful to take, break or damage with any implement, any rock or coral to which marine life of any type is visibly attached (HAR §13-95-71, DLNR, 2002).

In February 2010, 83 species of corals world-wide were petitioned for listing as threatened or endangered under ESA (NOAA-NMFS, 2010). In response to the petition, the National Oceanic and Atmospheric Administration (NOAA) completed a status review report (Brainard et al., 2011) in March 2011 and a management report of the candidate species (PIRO-NOAA, 2012) in November 2012. A proposed rule was published in December 2012 (NOAA-NMFS, 2012) with public comment extended through April 6, 2013 (NOAA-NMFS, 2013). On August 27, 2014, NOAA issued a final rule for listing 20 coral species as threatened under the Endangered Species Act (ESA; NOAA-NMFS, 2014), but none of these listed coral species occurs in Hawaiʻi. On September 20, 2018, NOAA issued a proposed rule for listing the cauliflower coral (*Pocillopora meandrina*) as an endangered or threatened species under ESA (NOAA-NMFS, 2018). A global status review has been initiated by NOAA to determine whether listing throughout the species range is warranted. No ESA-listed threatened or endangered corals have been identified at the Project Site or the Sand Recovery Site.

Potential Impacts and Mitigation Measures

Beach restoration has the potential to impact rare, protected, and endangered species. Dredging activities at the Sand Recovery Site would produce an underwater sound that can be perceived by marine creatures. The ears of marine mammals and sea turtles are sensitive to changes in sound pressure which is produced by the amplitude, wavelength, and frequency of a sound wave. While audiograms are not available for Hawaiian monk seals, Humpback whales, or sea turtles, it is generally accepted that 120 dB causes disturbance to these marine creatures.

Grette Associates LLC (2022) evaluated the underwater sound intensity level of a clamshell dredging operation at the Port of Seattle. Underwater noise levels during dredging operations were not measured to be considerably higher than background and were lower than all other observed noise sources. Average noise levels during background recordings were 113.1 dB and during dredging were 118.6 dB at an average distance of 125 m (410 ft) from the dredge. The estimated average dredging noise level when corrected to 10 m (33 ft) from the dredge was 136.4 dB. The maximum noise level recorded during dredging only was 137.9 dB (Grette Associates LLC, 2022).

Propagation losses are primarily caused by spherical spreading and can be calculated using the following relationship:

$$\text{Propagation Losses} = 20\log(r)$$

where

r = radial distance from the source in meters

Using 137.9 dB as the source underwater sound level and using a threshold level of 120 dB for continuous noise for marine creature disturbance, the resulting operational clearance distance is found from:

$$20 \log(r) = 137.9\text{-}120$$

which gives:

r = 8 m (26 ft).

Thus, disturbance to Hawaiian monk seals, Humpback whales, or sea turtles is expected to be limited to within about a 26-ft radius of the sand recovery operations. These marine creatures would be expected to avoid the disturbance, and as the impact area is relatively small and primarily in sandy bottom, it is not anticipated to affect migration patterns or foraging.

The following Best Management Practices (BMPs) as typically recommended by the National Marine Fisheries Service (NMFS), should be adhered to during construction to avoid impacts on protected species:

1. Conduct a survey for marine protected species before any work in the water starts, and if a marine protected species is in the area, a 150-ft buffer must be observed between the protected species and the work zone.
2. Establish a safety zone around the Project Site whereby observers will visually monitor this zone for marine protected species 30 minutes prior to, during, and 30 minutes post project in-water activity. Record information on the species, numbers, behavior, time of observation, location, start and end times of project activity, sex or age class (when possible) and any other disturbances (visual or acoustic).
3. Conduct activities only if the safety zone is clear of turtles.
4. Upon sighting of a turtle within the safety zone during project activity, immediately halt the activity until the animal has left the zone. In the event a marine protected species enters the safety zone and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data.
5. For on-site project personnel that may interact with a protected species potentially present in the Project Site, provide education on the status of any listed species and the protections afforded to those species under Federal laws.

Beach Stabilization

Beach Stabilization has the potential to temporarily disrupt and/or displace rare, protected, and endangered species during construction operations. These impacts are expected to be minor and temporary in nature and can be effectively mitigated with appropriate BMPs. Beach Stabilization is expected to have a long-term positive impact by increasing beach width and volume and improving beach stability, which would restore and preserve designated critical habitat for rare, protected, and endangered species including Green Sea Turtles and Hawaiian monk seals.

Beach Nourishment

Beach Nourishment has the potential to impact rare, protected, and endangered species in the same ways as Beach Stabilization. These impacts are expected to be minor and temporary in nature and can be effectively mitigated with appropriate BMPs. Beach Nourishment is expected to have a short-term positive impact by increasing beach width and volume for a period of 10 years, which would temporarily restore and preserve designated critical habitat for rare, protected, and endangered species including Green Sea Turtles and Hawaiian monk seals. No long-term impacts to rare, protected, and endangered species are expected.

Beach Maintenance

Beach Maintenance has the potential to impact rare, protected, and endangered species in the same ways as Beach Stabilization and Beach Nourishment. However, the frequency and duration of the impacts would increase due to the need for sand recovery and sand placement for periodic maintenance. Beach Maintenance is expected to have a long-term positive impact by increasing beach width and volume for a period of 50 years, which would temporarily restore and preserve designated critical habitat for Green Sea Turtles and Hawaiian monk seals.

No Action

No Action would have no immediate impact to rare, protected, and endangered species at the Project Site or the Sand Recovery Site as it would not require sand recovery or sand placement. The presence of rare, protected, and endangered species at the Project Site may change over time as the shoreline and benthic conditions change due to natural erosion. The continued erosion and eventual loss of Honokōwai Beach would result in the permanent loss of designated critical habitat for Green Sea Turtles and Hawaiian monk seals.

Summary

Beach restoration is expected to have a positive benefit by restoring designated critical habitat for Green Sea Turtles and Hawaiian monk seals. Given the extensive turtle foraging area along the Honokōwai shoreline, and the relatively small percent loss which would result from the Project, the change in turtle foraging habits and habitats is not expected to be significant. No Action has the greatest potential to negatively impact rare, protected, and endangered species through the degradation and loss of designated critical habitat.

7.1.6 Water Quality

Existing Conditions

The waters offshore of Honokōwai Beach are classified in the Hawaiʻi Water Quality Standards (HDOH, 2012) as (a) marine waters, (b) open coastal, (c) reef flat, (d) Class A, and (e) Class II marine bottom ecosystem. It is the objective of Class A waters that their use for recreational purposes and aesthetic enjoyment be protected (§11-54-3(c)(2), HAR). Other uses are permitted as long as they are compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. Class A waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control. Other uses are permitted as long as compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. Class A waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control.

State water quality criteria for open coastal marine waters incorporate “wet” and “dry” criteria values based on average percent of freshwater inflow, where terrestrial freshwater input exceeds three million gallons per day, wet criteria are applied, where freshwater input is less than three million gallons per day, dry criteria apply. In this case, dry criteria apply, based upon the salinity results that show no significant dilution from oceanic salinity (35.2 PSU) for this region of the Pacific (SOEST, 1996). Applicable state water quality criteria for the Project are shown in Table 7-7.

Table 7-7. State water quality criteria (dry season) for open coastal marine waters.

Parameter	Geometric Mean value not to exceed this value	Value not to be exceeded more than 10% of the time	Value not to be exceeded more than 2% of the time
Total Nitrogen (µg N/L)	110.0	180.0	350.0
Ammonia (µg N/L)	2.0	5.0	9.0
Nitrate+Nitrite (µg N/L)	3.5	10.0	20.0
Total Phosphorus (µg/L)	16.0	30.0	45.0
Chlorophyll α (µg/L)	0.15	0.50	1.00
Turbidity (NTU)	0.20	0.50	1.00
Other "standards": • pH units shall not deviate more than 0.5 units from ambient and not lower than 7.0 nor • higher than 8.6. • Dissolved oxygen shall not decrease below 75% of saturation. • Temperature shall not vary more than 1Co from ambient conditions. • Salinity shall not vary more than 10% from ambient.			

Hui O Ka Wai Ola Water Quality Monitoring

Hui O Ka Wai Ola has been conducting water quality monitoring at Honokōwai Beach since 2016. Their monitoring results have confirmed that high levels of turbidity and nitrates are prevalent along the leeward Maui coast (Figure 7-10). Their most recent report (2022) found that turbidity and nitrate levels at Honokōwai Beach far exceed Hawaiʻi Department of Health (DOH) water quality standards, and that turbidity is expected to increase over time in northern West Maui, as coastal erosion worsens with sea level rise. The report notes that erosion of coastal soil deposits contributes to the higher observed turbidity levels and that stabilizing the shoreline is an option to reduce soil erosion and the associated turbidity. The report also notes that recent declines in turbidity levels at Honokōwai Beach may be attributed to the temporary erosion protection structure.

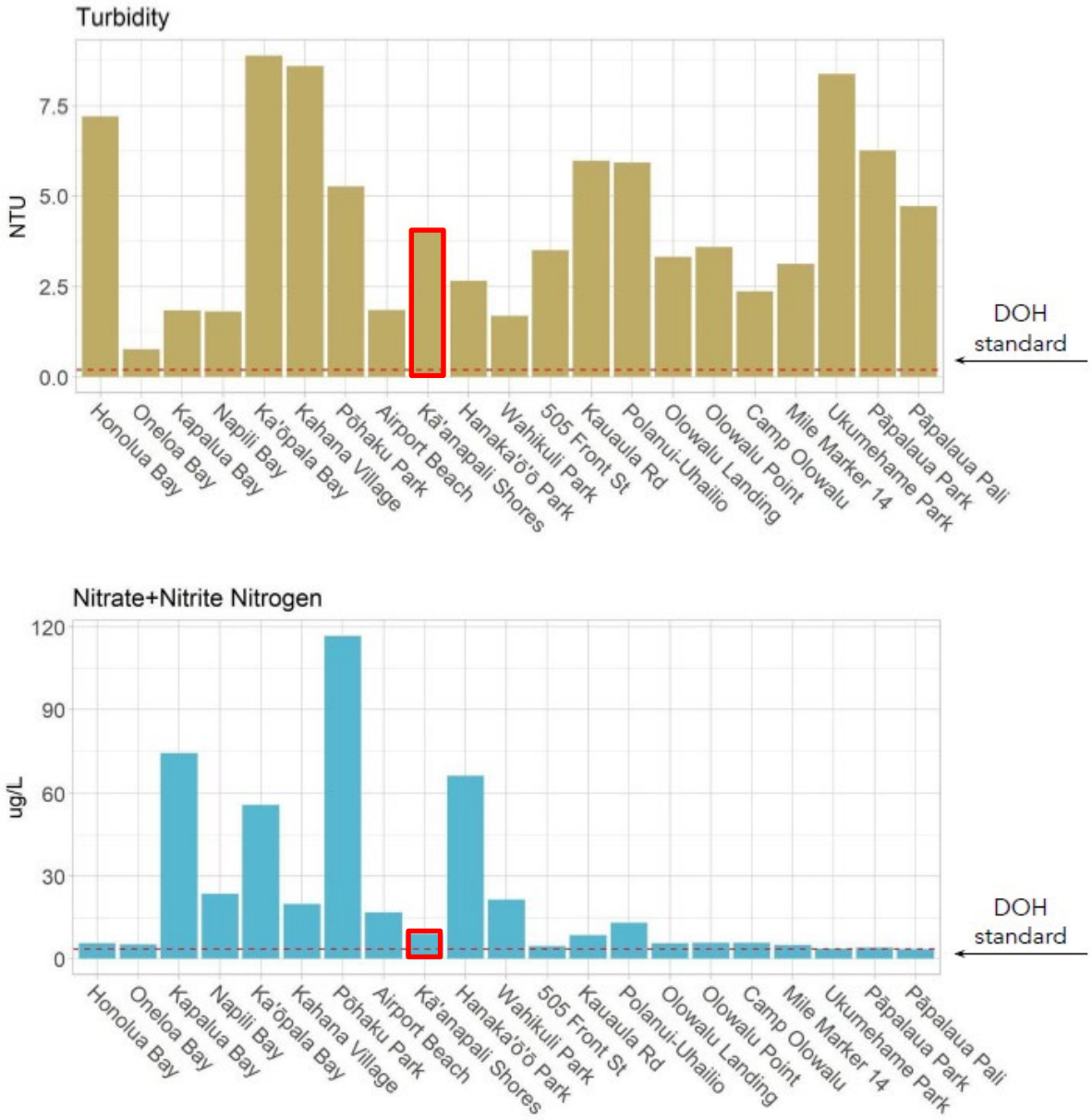


Figure 7-10. Hui O Ka Wai Ola (2024) water quality monitoring results (red box = Project Site)

Marine Research Consultants, Inc. (MRC) conducted two (2) assessments of the existing water chemistry at the Project Site (MRC, 2024). Water chemistry was assessed along three (3) survey transects that extended approximately perpendicular to the shoreline originating at the sand-water interface of the beach and extended approximately 200 m offshore. Water samples were collected at eight locations along each transect at distances of approximately 0.1, 1, 5, 10, 20, 50, 100, and 200 m from the shoreline. Sampling was more concentrated in the nearshore zone because this area receives the most terrestrial input, and hence is most important with respect to identifying the effects of shoreline modification. Water quality constituents evaluated included all specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (b) (Open Coastal waters) of the State of Hawai'i Department of Health (DOH) Water Quality Standards.

The water chemistry analysis identified several patterns of distribution. Dissolved nutrients, Si and NO_3^-, displayed elevated concentrations in the samples collected within 5-10 m from the shoreline. Salinity displayed the opposite trend, with lower concentrations in the nearshore samples. Beyond 5-10 m from the shoreline, concentrations of Si, NO_3^-, and salinity were essentially constant. Over the entire sampling area, the range in NO_3^- was approximately 2 µg/L, while the range of salinity was approximately 0.4 ppt.

As there were no streams discharging to the ocean at the time of the sampling, the horizontal gradients of Si, NO_3^-, and salinity likely represent 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. The gradients in the nearshore zone off the Project Site, however, are comparatively small, indicating only low volume groundwater discharge. PO_4^{-3} was also generally elevated in groundwater relative to ocean water. In the data set collected off the Project Site, there was a very slight decreasing gradient in concentration of PO_4^{-3} with respect to distance from the shoreline. Horizontal gradients of TN/TON and TP/TOP mirror the patterns of $NO_3^-$and PO_4^{-3}, respectively.

As the sampling area off the Project Site is an open coastal area exposed to wind and waves, 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. Ammonium nitrogen (NH_4^+) is usually not elevated in groundwater relative to ocean water. Concentrations of NH_4^+ on the transects off of the Project Site did not show sharp gradients of decreasing values with distance from the shoreline. However, there were anomalously high values at the shoreline stations on Transects 1 and 3.

Similar to the patterns of dissolved inorganic nutrients (Si and NO_3^-), the distributions of Chlorophyll α (Chl α) and turbidity also displayed peaks near the shoreline, with diminishing values moving seaward. Overall, values of Chl α are considered low with all values below 0.54 µg/L. The progressive decrease in values of turbidity and Chl α with distance from shore is likely a response to resuspension of fine-grained particulate material, including plant fragments, stirred by breaking waves in the nearshore zone. With decreasing wave energy and increasing water depth, turbidity in the water column decreases. Temperature displays no gradient of consistent change across the transects.

State of Hawai'i Department of Health Water Quality Standards (HDOH-WQS) that apply to the areas offshore of the Project Site are listed as "open coastal water" in Chapter 11-54-6(b), HRS. 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 Project Site probably receives less than 3 mgd per mile, dry criteria were used for this evaluation.

The HDOH-WQS are also separated into three standards: geometric means, "not to exceed more than 10% of the time," and "not to exceed more than 2% of the time." As these classifications require multiple samplings, they cannot be used for a strict evaluation of whether waters at the sampling site were within compliance standards. However, these values provide a guideline to evaluate the overall status of sampled waters in terms of the relation with State standards. The only nutrient constituent to exceed State of Hawai'i water quality standards for the "not to exceed more than 10% of the time" criteria under dry conditions is ammonium nitrogen (NH_4^+). Six values from each of the three transects exceeded the most stringent DOH criterion. These six values were randomly distributed. The nearshore values of turbidity also exceeded the 10% criterion on all three transects. 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 10 m from shore, all values of turbidity were below the State standards.

Results of the water quality 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 composed of pavement, rubble, and sand. 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 Project.

Potential Impacts and Mitigation Measures

Beach restoration has the potential to impact water quality. Sand recovery and sand placement can generate turbidity plumes that can be unsightly and affect water clarity. Although sand fill placed on a beach must closely match the existing beach sand with respect to grain size, offshore sand would typically have a higher percentage of fines than dry beach sand. Additionally, fines may be generated during dredging and placement of offshore sand onto the beach. After placement, wave action can suspend the fines creating "milky-white" turbidity plumes immediately offshore of the nourished beach. The turbidity decreases over time as fine material is winnowed out of the active beach face. Silt curtains and containment barriers would be deployed along the shoreline during sand placement operations. Following placement of sand on the beach, there would likely be periodic turbidity associated with equilibration of the beach profile and planform and during large wave events, as sand moves along the shoreline and cross-shore.

Offshore turbidity is to be expected at the Sand Recovery Site. As the clamshell bucket recovers sand from the seafloor, it would disturb fine particles adjacent to the bucket. As the bucket is raised through the water column, minor volumes of sand containing fine particles would be released into the water column. Turbidity at the dredging sites would be reduced by using an environmental clamshell bucket, which is an industry best practice and has been used to minimize turbidity during dredging of harbor channels in Hawai'i. Environmental clamshell buckets typically have tighter

seals and overlapping sides. These buckets are designed to minimize sediment loss from within the bucket, resuspension at the dredging sites, and water entrainment with each grab. A conservative estimate of the amount of material that leaks from an environmental clamshell bucket is only 0.5% (Palermo et al., 2008). This material is expected to fall out of suspension rapidly near the dredging sites.

The use of a suction dredge would result in the majority of bottom material disturbed being drawn into the dredge pipeline, with only a small amount of disturbed material escaping the dredge to affect adjacent areas or water quality. Loss rates for suction dredges have been estimated to be less than 0.1% (Hayes and Wu, 2001). Careful placement of anchors and cables would ensure that they do not move about and disturb/suspend bottom material.

Turbidity generated from dredging operations is expected to be transported by currents moving parallel to shore. Wave action has the potential to transport turbidity alongshore and inshore. These water quality impacts are expected to be temporary, lasting only during the actual dredging operations, and are expected to be localized to the immediate vicinity of the dredging. Best Management Practices (BMPs) would be followed throughout the sand recovery work, consistent with the State Department of Health Water Quality Certification that would be required for the project.

Detailed modeling has previously been performed to evaluate the potential impacts of dredging at an adjacent offshore sand deposit located immediately inshore of the Sand Recovery Site (Sea Engineering, Inc., 2022). The potential impacts of dredging at this location are expected to be similar for this project. Based on the results of the previous dredge analysis, no significant impacts to bathymetry are expected at the Sand Recovery Site.

Sand from within the offshore Sand Recovery Site is expected to become well mixed during excavation, transport, and placement on the beach. Average turbidity values for the targeted areas in the deposits are important, as they are representative of the material that would eventually be placed on the beach. Initial elevated turbidity levels are expected during sand placement and periodically during larger wave events.

Temporary increases in turbidity levels can be mitigated with the use of appropriate Best Management Practices (BMPs) and adhering to the requirements of the Hawaiʻi Department of Health Water Quality Certification (WQC), which would be required for the Project. Water quality protection measures typically adhere to the following general requirements:

- Turbidity containment barriers shall be installed and maintained to completely surround the work area so as to control and contain construction generated turbidity.
- The water area affected by construction shall be monitored, and if monitoring indicates that the turbidity standards are being exceeded, construction shall be suspended until the condition is corrected.
- The Contractor shall be required to employ standard BMPs for construction in coastal waters, such as daily inspection of equipment for conditions that could cause spills or leaks; cleaning of equipment prior to operation near the water; proper location of storage, refueling, and servicing sites away from the water; implementation of adequate on site spill response procedures; and stormy weather preparation plans.

- All construction activities shall be confined to the immediate area of construction, and no excess construction material shall be stockpiled in the water.
- Construction materials (e.g., sand, stone, concrete) shall be inert and free of earthen and any other deleterious substances.
- Water quality monitoring would be performed before, during, and after construction.

Beach restoration would require a Clean Water Act Section 401 Water Quality Certification (WQC), which would include an Applicable Monitoring and Assessment Program (AMAP) and Data Quality Objectives (DQO). The AMAP and DQO would be reviewed and approved by the Hawai'i Department of Health, Clean Water Branch. The Contractor would utilize Best Management Practices Plan (BMPs) to minimize potential impacts to water quality during construction including but not limited to sand dewatering, silt fencing, and turbidity curtains.

Beach Stabilization

Beach Stabilization is expected to temporarily impact water quality. A temporary increase in turbidity levels is expected to occur during dredging operations at the offshore Sand Recovery Site, and during sand placement and groin construction operations at the Project Site. Turbidity levels may remain slightly elevated above normal levels after construction is completed as the beach equilibrates and any fine material is winnowed away by wave action. No negative impacts to water quality are expected.

Beach Stabilization is expected to have a long-term positive impact on water quality by stabilizing the beach and mitigating erosion of the foreshore and backshore areas, which would decrease the discharge of sediment (sand, soil) into the nearshore waters. As a result, Beach Stabilization is expected to have a long-term positive impact by mitigating the adverse effects of sedimentation on water quality and benthic habitat. Beach Stabilization would also reduce the volume of sand at the mouth of Honokowai Stream and inhibit future accumulation of sand at this location, which is expected to result in a long-term improvement in stream flow and nearshore water quality.

Beach Nourishment

Beach Nourishment has the potential to impact water quality in the same ways as Beach Stabilization. These impacts are expected to be minor and temporary in nature and can be effectively mitigated with appropriate BMPs. No long-term impacts to water quality are expected. Beach Nourishment would not reduce the volume of sand at the mouth of Honokowai Stream or inhibit future accumulation of sand at this location, so there would be no long-term improvement in stream flow and nearshore water quality.

Beach Maintenance

Beach Maintenance has the potential to impact water quality in the same ways as Beach Nourishment. However, the frequency and duration of the impacts would increase due to the need for sand recovery and sand placement for periodic maintenance. Beach Maintenance would not reduce the volume of sand at the mouth of Honokowai Stream or inhibit future accumulation of sand at this location, so there would be no long-term improvement in stream flow and nearshore water quality.

No Action

No Action would have no immediate impact to water quality at the Project Site or the Sand Recovery Site as it would not require sand recovery or sand placement. Water quality at the Project Site may change over time as sediment (sand and alluvium) is discharged into the nearshore waters due to natural erosion. No Action has the potential for short-term and long-term impacts on water quality due to progressive erosion and increase potential for sedimentation (see Section 7.1.7).

Summary

Beach restoration is expected to have a temporary impact on water quality primarily due to increased turbidity associated with construction activities. However, beach restoration is expected to have a long-term positive impact on water quality by mitigating the potential impacts erosion and sedimentation and restoring natural stream flow at Honokowai Stream. No Action has the greatest potential to negatively impact water quality as progressive erosion, shoreline recession, beach narrowing, and potential beach loss are expected to result in the discharge of large volumes of sediment (sand and alluvium) into the nearshore waters.

7.1.7 Sedimentation

Existing Conditions

Sedimentation refers to the process by which particles settle out of water and accumulate over time. At the Project Site, sedimentation occurs naturally as a result of backshore erosion caused by wave action and the discharge of sediment from Honokowai Stream, particularly during heavy rainfall events. Sedimentation has the potential to negatively impact benthic habitat and coral reefs. Depending on the levels of sediment exposure (i.e., concentration, duration, and frequency), both deposited and suspended sediment can impact coral recruitment, growth, mortality, and the ecosystem services that coral reefs provide (Tuttle et al., 2020).

Podoski et al. (2018) found that Honokōwai Stream delivers a significant amount of fine sediment to the nearshore area over a 2-year rainfall event. Honokōwai Stream is frequently clogged with sand, which allows stagnant water, algal blooms, and terrigenous sediment to accumulate in the stream channel. During heavy rainfall events, these materials are discharged into the ocean. Hui O Ka Wai Ola (2024) found that turbidity and nitrate levels at Honokōwai Beach far exceed Hawaiʻi Department of Health (DOH) water quality standards, and that turbidity is expected to increase over time in northern West Maui, as coastal erosion worsens with sea level rise.

In addition to providing a natural buffer against coastal hazards and sea level rise, sandy beaches prevent the erosion and discharge of materials and pollutants that can negatively impact water quality and benthic habitat. During the 2016 episodic erosion and beach loss event, over 1,000 cy of alluvial sediment (clay, silt, sand, gravel, boulders) was discharged into the ocean. The eroded sediment caused turbidity plumes (brown water) to form in the nearshore waters, which negatively impacted water quality. Erosion and beach loss are expected to continue and accelerate in Hawaiʻi as sea levels continue to rise. Continued erosion of the backshore area (landward of the shoreline) would result in the discharge of substantial volumes of terrigenous sediment into the ocean, which would negatively impact water quality and benthic habitat. Without implementation of beach restoration, the projected erosion could result in the discharge of up to 19,542 cy of terrigenous sediment into the ocean (see Sections 3.1 and 7.1.7).

Potential Impacts and Mitigation Measures

Beach restoration is expected to have a positive impact by mitigating erosion, shoreline recession, beach narrowing, and potential beach loss, and preventing sedimentation in the nearshore environment fronting the Project Site.

Beach Stabilization

Beach Stabilization would produce four (4) stable beach cells in an area that is currently subject to chronic erosion and recently experienced an episodic beach loss event. The groins would stabilize the sand, and the beach and backshore area would be less susceptible to erosion. Restoring Honokōwai Beach and mitigating future erosion is expected to prevent the discharge of up to 19,542 cy of terrigenous sediment into the ocean (see Sections 3.1 and 7.1.7). The terminal groin adjacent to Honokōwai Stream is also expected to decrease the potential for additional sand to accumulate at Honokōwai Stream mouth and is expected to have a positive impact by promoting natural stream flow, reducing the accumulation of sediment and debris in the stream channel, and inhibiting algae growth and stagnant water in the lower stream channel. As a result, Beach Stabilization is expected to have a positive impact by reducing sedimentation caused by erosion and improving water quality in Honokōwai Stream. The degree to which these potential positive secondary impacts are realized will be dependent upon ocean conditions beyond the limits of the Project and therefore cannot be guaranteed.

Beach Nourishment

Beach Nourishment would temporarily delay erosion and sedimentation at the Project Site for a period of 10 years. This area would continue to be exposed to erosion, so sedimentation is expected to increase over time. With continued erosion, Honokōwai Beach would be expected to return to a similar condition to what existed prior to construction, after which erosion is projected to continue and accelerate, potentially resulting in the discharge of up to 19,542 cy of terrigenous sediment into the ocean. Beach Nourishment would not restore natural stream flow or prevent terrigenous sediment from accumulating in Honokōwai Stream. No long-term reduction in sedimentation is expected.

Beach Maintenance

Beach Maintenance has the potential to reduce sedimentation by reducing potential erosion of the backshore area. However, the beach would continue to be exposed to chronic, seasonal, and episodic erosion. Beach Maintenance would not restore natural stream flow or prevent terrigenous sediment from accumulating in Honokōwai Stream.

No Action

No Action would have an immediate impact on sedimentation at the Project Site. Without the implementation of beach restoration, removal of the existing temporary erosion protection structure would expose the underlying escarpment to wave action. Sedimentation would be expected to result in the discharge of up to 19,542 cy of terrigenous sediment into the ocean due to natural erosion. No Action would increase the potential long-term impacts associated with sedimentation.

Summary

Beach restoration is expected to mitigate the potential impacts of sedimentation at the Project Site. Beach Stabilization has the greatest potential to prevent sedimentation from both wave-induced erosion and rainfall-induced flooding. Beach Nourishment and Beach Maintenance may also help to reduce sedimentation from wave-induced erosion, although to a lesser degree and for a shorter duration.

7.2 Water Levels

This section details existing water levels and evaluates potential impacts associated with the Project and alternatives. In addition, this section discusses implementation of management and design measures to minimize negative impacts on water levels. This section also includes a detailed discussion of water levels as a design criterion for the Project.

7.2.1 Astronomical Tides

Existing Conditions

Tides in the Hawaiian Islands are semi-diurnal with pronounced diurnal inequalities (i.e., two high and low tides each 24-hour period with different elevations). Variation of the tidal range results from the relative position of the moon and the sun. During full moon and new moon phases, the moon and sun act together to produce larger "spring" tides; when the moon is in its first or last quarter, smaller "neap" tides occur. The cycle of spring to neap tides and back is half the 27-day period of the moon's revolution around the earth and is known as the fortnightly cycle. The combination of diurnal, semi-diurnal and fortnightly cycles dominate variations in sea level throughout the Hawaiian Islands.

The offshore diurnal tide reaches Hawaiʻi Island (Big Island) first, then sweeps across Maui, Oʻahu, and finally Kauaʻi. Tidal currents result from tidal variations of sea level, and near the shore are often stronger than the large-scale circulation (Rapaport, 2013). Tidal predictions and historical extreme water levels are provided by the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Center for Operational Oceanographic Products and Services (COOPS). The nearest tide station to the Project Site is located at Kahului Harbor on the north coast of Maui. The water level tidal datums from this station are shown in Table 3 1. The mean sea level (MSL) datum is used as the design elevation reference datum in this report.

Table 7-8. Tidal datums at Kahului Harbor, Station 1615680 (1983-2001 Epoch)

Datum	Elevation (ft, MLLW)	Elevation (ft, MSL)
Highest Astronomical Tide (HAT)	+3.12	+2.00
Mean Higher High Water (MHHW)	+2.25	+1.13
Mean High Water (MHW)	+1.90	+0.78
Mean Sea Level (MSL)	+1.11	0.00
Mean Low Water (MLW)	+0.33	-0.79
Mean Lower Low Water (MLLW)	0.00	-1.12
Lowest Astronomical Tide (LAT)	-0.79	-1.91

Tides in West Maui are mixed, semi-diurnal with two high tides and two low tides per day. The tides change approximately every 6 hours. The mean daily tidal range is 1.57 ft, while the diurnal tidal range is 2.25 ft. The highest observed tide at Kahului is 3.59 ft (12/15/2020), and the lowest observed tide is -1.61 ft (06/19/1955)

Potential Impacts and Mitigation Measures

Beach restoration is not expected to have any impact on existing or future tides.

7.2.2 Sea Level Anomalies

Existing Conditions

The ocean surface does not have a consistent elevation. Sea level anomalies (SLA) are defined as the difference between the measured and predicted tides recorded. SLA are caused by climatic and oceanographic processes such as global warming, the El Niño-Southern Oscillation, the Pacific Decadal Oscillation, geostrophic currents due to the rotation of the Earth, and mesoscale eddies that propagate across the ocean.

Hawaiʻi is subject to periodic extreme tide levels due to large oceanic eddies and other oceanographic phenomena that have recently been recognized and that sometimes propagate through the islands. Mesoscale eddies produce tide levels that can be up to 0.5 ft higher than normal for periods up to several weeks (Firing and Merrifield, 2004). An additional temporary sea level rise on the order of 0.5 ft has also been associated with phenomena related to the El Niño / Southern Oscillation.

Sea levels on anomalies result in coastal flooding and are precursors to future flooding due to sea level rise. Table 7-9 lists the 10 highest water levels recorded by the NOAA tide station located in Kahului Harbor excluding tsunami events. This analysis covers the entire span of tides recorded at Kahului Harbor from February 2017 to present. The table shows that the top events occur during the months of December, January, July, and August during times of peak astronomical tides. The media widely reports coastal flooding is the result of *king tides*; however, sea level anomalies during the high-water events ranged from approximately 0.5 ft to 1 ft above the astronomical tide. The occurrence of winter and summer swells during this period of elevated water levels added to the inundation.

Figure 7-11 shows the predicted and measured tides and SLA at Kahului Harbor from January 1, 2016, to December 31, 2024. During this time period, measured tide levels consistently exceeded +3.0 ft MLLW, which are considered extreme water levels with an annual exceedance probability of 1%. Kahului Harbor's highest water level on record of 3.65 feet occurred on December 15, 2020. Table 7-9 shows the corresponding predicted tide and SLA for the daily maximum recorded tide from December 10 to 30, 2020 at the Kahului Harbor tide station. During the summer of 2024, Kahului also experienced a weeklong span of elevated water levels that marked an extended period of large SLA. Figure 7-13 shows the extreme water levels from July 19 to 23, 2024 at the Kahului Harbor tide station.

Potential Impacts and Mitigation Measures

Beach restoration is not expected to have any impact on existing or future sea level anomalies.

Table 7-9. Peak recorded tide levels at Kahului Harbor from 1954 to present.

Date	Recorded Tide (ft MLLW)	Predicted Tide (ft MLLW)	SLA (ft)
12/15/2020	3.65	2.90	0.75
01/12/2024	3.63	2.91	0.72
11/24/1995	3.62	2.89	0.74
08/20/2017	3.57	2.61	0.96
07/20/2024	3.57	2.87	0.70
07/05/2020	3.56	2.78	0.79
08/01/2023	3.55	3.07	0.48
07/19/2024	3.53	2.78	0.75
12/26/2019	3.52	2.64	0.89
12/05/2021	3.52	2.74	0.79

Note: Tidal elevations relative to the 1983-2001 tidal epoch. Record does not include tsunami events.

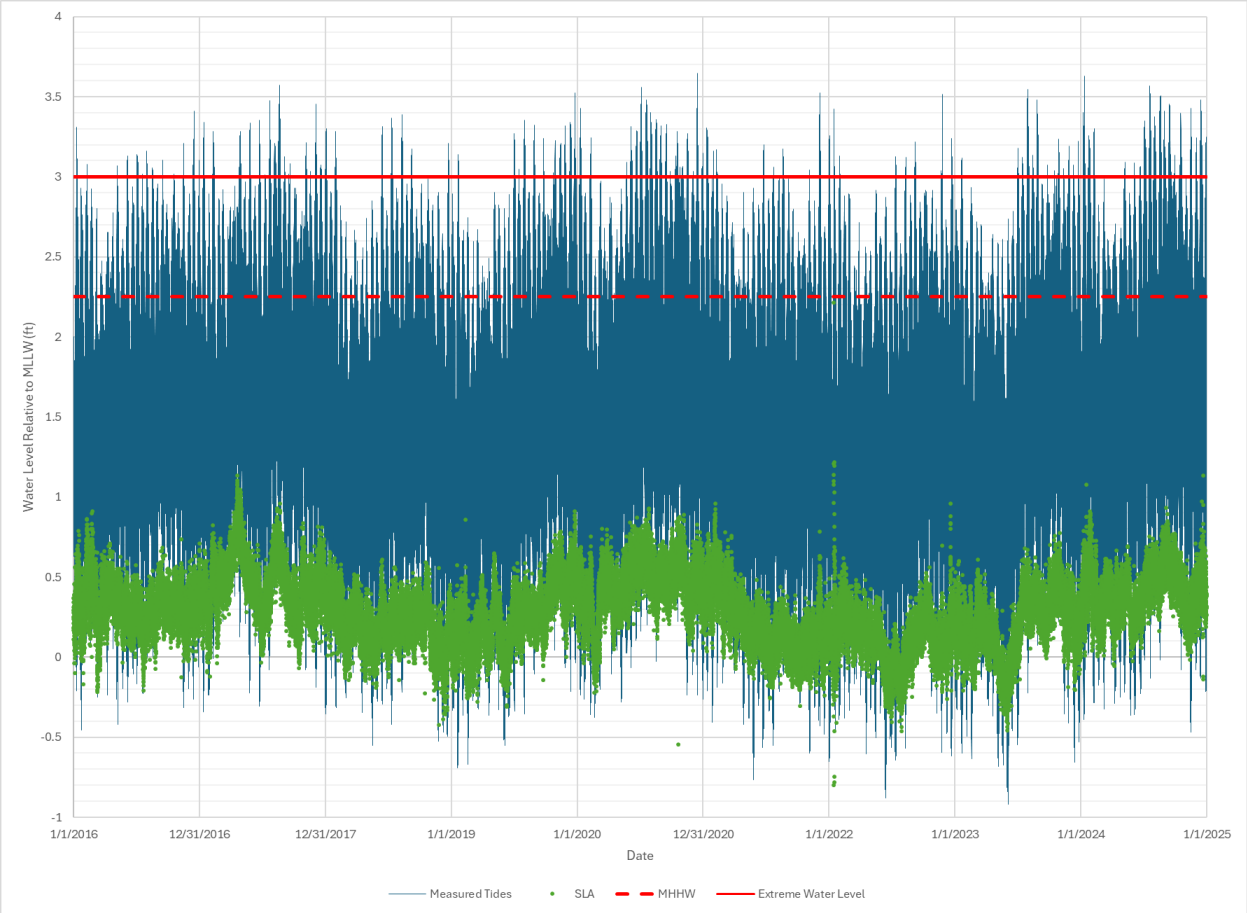


Figure 7-11. Predicted and measured tides and SLA at Kahului Harbor (2016-2024)

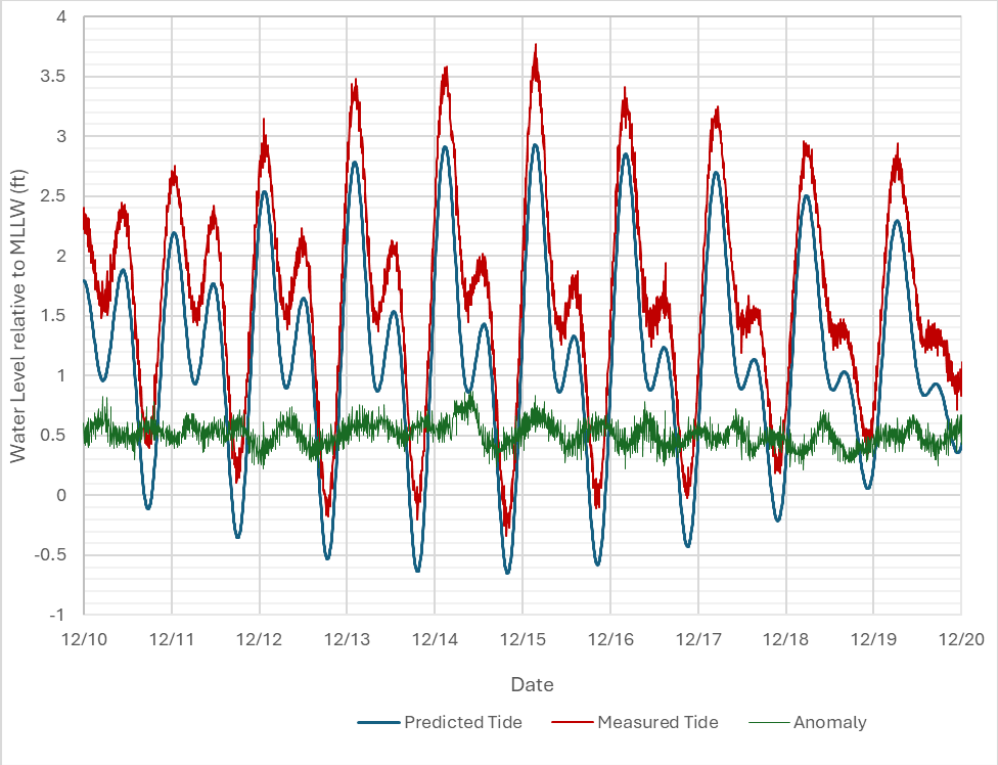


Figure 7-12. Predicted and measured tides and SLA at Kahului Harbor (Dec 10-20, 2020)

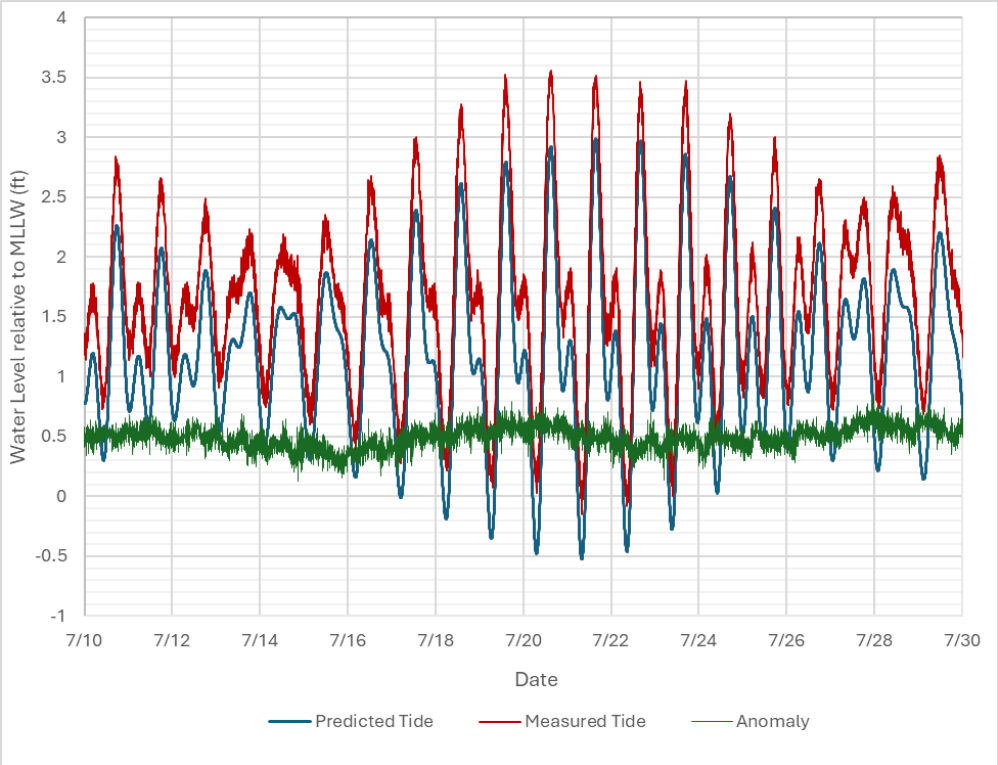


Figure 7-13. Predicted and measured tides and SLA at Kahului Harbor (Dec 24-26, 2019)

7.2.3 Combined Still Water Level

The total water depth at a particular location is composed of the depth below the nearshore bottom relative to sea level datum, plus factors that add to the still water level (SWL) such as the astronomical tide, mesoscale eddies and other oceanographic phenomena, wave setup, storm surge (pressure setup and wind setup), and potential sea level change over the life of a project. The sea level datum used for this project is mean sea level (msl)

Wave models require an estimation of the still water level across the model domain for the modeled conditions. In the present analysis, the total still water level considered is a linear combination of the following components:

1. Astronomical tide
2. Sea level anomaly
3. Wave setup
4. Sea level rise

The aforementioned water level rise phenomena are additive and may occur at a given time. The total still water level, S, at a given time, therefore, can be a linear combination of:

- Astronomical tide and other oceanographic phenomena (S_a)
- Sea level rise due to atmospheric pressure reduction (S_p)
- Wind tide caused by wind stress component perpendicular (S_x) to the coastline and parallel to the coastline (S_y)
- Wave set-up in the breaker zone (S_w)
- Sea level rise (S_{SLR})

or,

$$S = S_a + S_p + S_x + S_y + S_w + S_{SLR}$$

The linear superposition of water level components is an empirical method of determining total still water during a model event. As it does not consider the joint probability of components included, it is a conservative method and can be used to estimate a "worst-case" scenario for water levels.

An astronomical tide of +1.1 ft MSL is used for models of design wave conditions. This is equivalent to the mean higher high water (MHHW) level, relative to MSL, as measured at the Kahului Harbor tidal station and is typical of a high tide condition at the Project Site.

A sea level rise of 3.3 ft is used, which corresponds to the *Intermediate-High* scenario by the year 2075. This value was linearly interpolated from the values listed in Table 7-14 (see Section 7.3.2.2) to the year 2075 which represents the end of the 50-year design life of any beach stabilizing structures assuming construction is completed by the year 2025.

A local sea level anomaly of +0.5 ft MSL is also included as part of the design water level. This is a typical value commonly used for planning and design purposes in Hawaiʻi.

Another design water level component is wave setup which is a complex phenomenon and occurs at the shoreline due to breaking waves offshore. Wave setup is most accurately predicted using the XBeach-NH numerical wave model and is calculated as part of the simulated wave transformation by the model.

The design event is used to size the armor units that make up the structure and/or provide wave forces for structural design. The total still water level used for design conditions is +4.9 ft MSL (Table 7-10) and is a probable worst-case scenario during an extreme wave event.

Table 7-10. Design water level components relative to MSL

Component	Level (ft)
Astronomical Tide	+1.1
Sea Level Rise	+3.3
Sea Level Anomaly	+0.5
TOTAL:	**+4.9**

Potential Impacts and Mitigation Measures

Beach restoration is not expected to impact existing or future water levels. Beach restoration is expected to reduce the negative impacts of increasing water levels by improving beach stability, improving lateral shoreline access, providing a natural buffer to reduce the potential for wave overtopping and marine flooding, and making the beach more resilient to sea level rise.

7.3 Sea Level Rise

This section details existing and projected sea levels and evaluates potential impacts associated with the Project and alternatives. In addition, this section discusses implementation of management and design measures to minimize negative impacts associated with sea level rise.

7.3.1 Global Sea Level Trends and Projections

Existing Conditions

Global mean sea level is the average height of the entire ocean surface. The present rate of global mean sea level change is +3.1 mm/yr (Sweet et al., 2022, Figure 7-14), where a positive number represents a rising sea level. Global mean sea level rise has accelerated over preceding decades compared to the mean of the 20th century. Regional effects cause sea levels to increase in some parts of the planet while decreasing or remaining relatively stable in other areas. In the contiguous United States (U.S.), sea level has risen on average by 6.5 inches (in) since 1950 (Sweet et al., 2018). Factors contributing to the observed rise in sea level include melting of land-based glaciers and ice sheets and thermal expansion of the ocean water column.

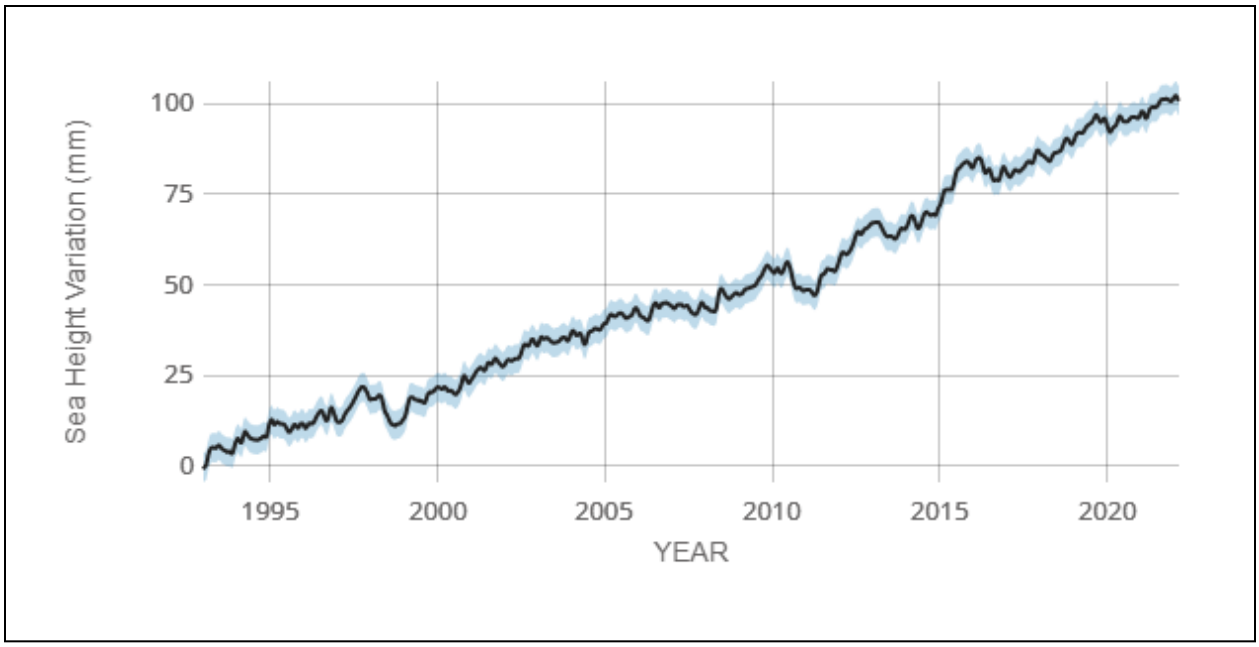


Figure 7-14. Global satellite sea level rise variability from 1993 to 2022 (Sweet et al. 2022)

(Black line shows the average sea level rise during the time period.)

7.3.1.1 IPCC AR6 - Global Sea Level Rise Projections

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations (U.N.) body for assessing the science related to climate change. The IPCC was created to provide policymakers with periodic scientific assessments on climate change, its implications, and potential future risks. As part of this effort, the IPCC surveys and distills the existing body of scientific research and provides consensus projections on future sea levels across the globe under a range of possible future scenarios. The most recent iteration of the IPCC's work, the 6th Assessment Report (AR6), was published on August 9, 2021. Five Shared Socioeconomic Pathways (SSPs) representing future scenarios are described (Figure 7-15) with sea level rise projections for each (Figure 7-16).

SSP1-1.9 Holds warming in 2100 to approximately 1.5°C relative to the years 1850 to 1900 after a slight overshoot (median) and implies net zero CO_2 emissions around the middle of the century.

SSP1-2.6 Stays below 2.0°C warming relative to the years 1850 to 1900 (median) with implied net zero emissions in the second half of the century.

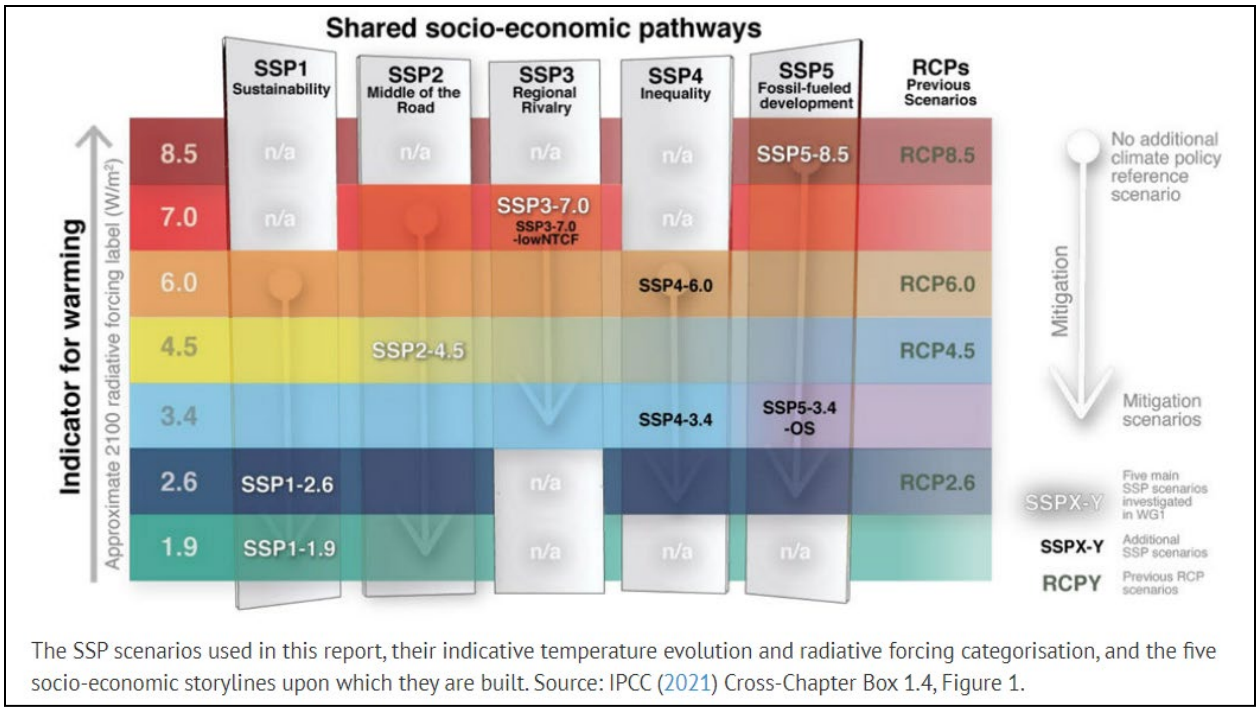
SSP2-4.5 Approximately in line with the upper end of aggregate Nationally Determined Contribution (NDC) emission levels by 2030. SR1.5 assessed temperature projections for NDCs to be between 2.7 and 3.4°C by 2100, corresponding to the upper half of projected warming under SSP2-4.5. New or updated NDCs by the end of 2020 did not significantly change the emissions projections up to 2030, although more countries adopted 2050 net zero targets in line with SSP1-1.9 or SSP1-2.6. The SSP2-4.5 scenario deviates mildly from a "no-additional-climate-policy" reference scenario, resulting in best-estimate warming of around 2.7°C by the end of the 21st century relative to the years 1850 to 1900.

SSP3-7.0 A medium to high reference scenario resulting from no additional climate policy under the SSP3 socio-economic development narrative. SSP3-7.0 has particularly high non-CO_2 emissions, including high aerosol emissions.

SSP5-8.5 A high reference scenario with no additional climate policy. Emission levels as high as SSP5-8.5 are not obtained by Integrated Assessment Models under any of the SSPs other than the fossil-fueled SSP5 socio-economic development pathway.

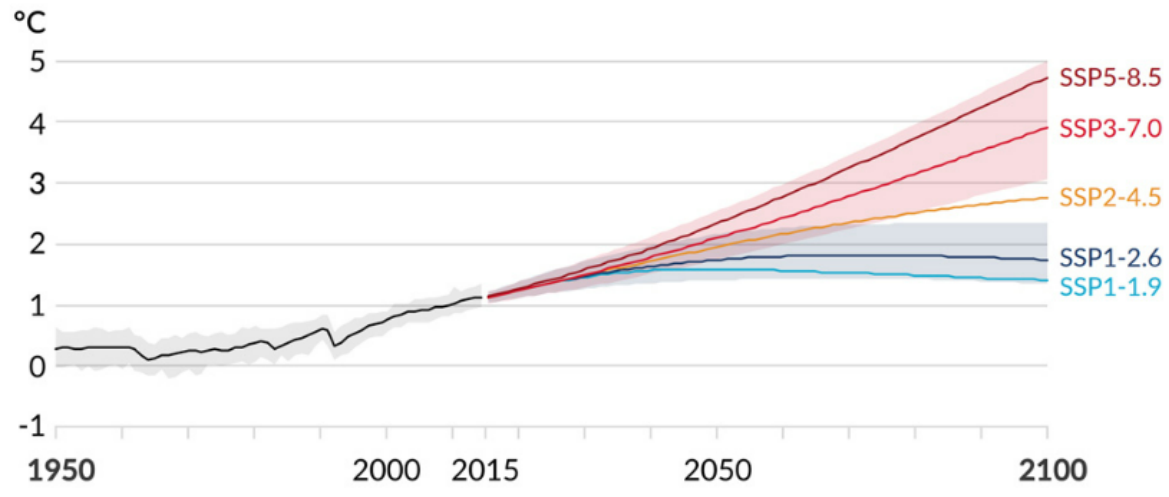
To visualize the AR6 sea level rise projections globally, NASA created the IPCC AR6 Sea Level Projection Tool [28], which allows users to view both global and regional sea level projections from 2020 to 2150 (Figure 7-17 and Table 7-11), along with how these projections differ depending on future scenarios. Users can click on a point anywhere in the ocean to obtain the IPCC projection of sea level for that specific location. The contributions of different physical processes to future sea level rise are also provided, indicating which processes will be the dominant drivers of future sea levels for a given location.

[28] https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool



The SSP scenarios used in this report, their indicative temperature evolution and radiative forcing categorisation, and the five socio-economic storylines upon which they are built. Source: IPCC (2021) Cross-Chapter Box 1.4, Figure 1.

Figure 7-15. IPCC AR6 shared socio-economic pathways (IPCC, 2021)



Global surface temperature changes relative to 1850-1900, degrees C, under the five core emissions scenarios used in AR6. Source: IPCC (2021) Figure SPM.8a.

Figure 7-16. IPCC AR6 global sea level rise projections, 1950 to 2100 (IPCC, 2021)

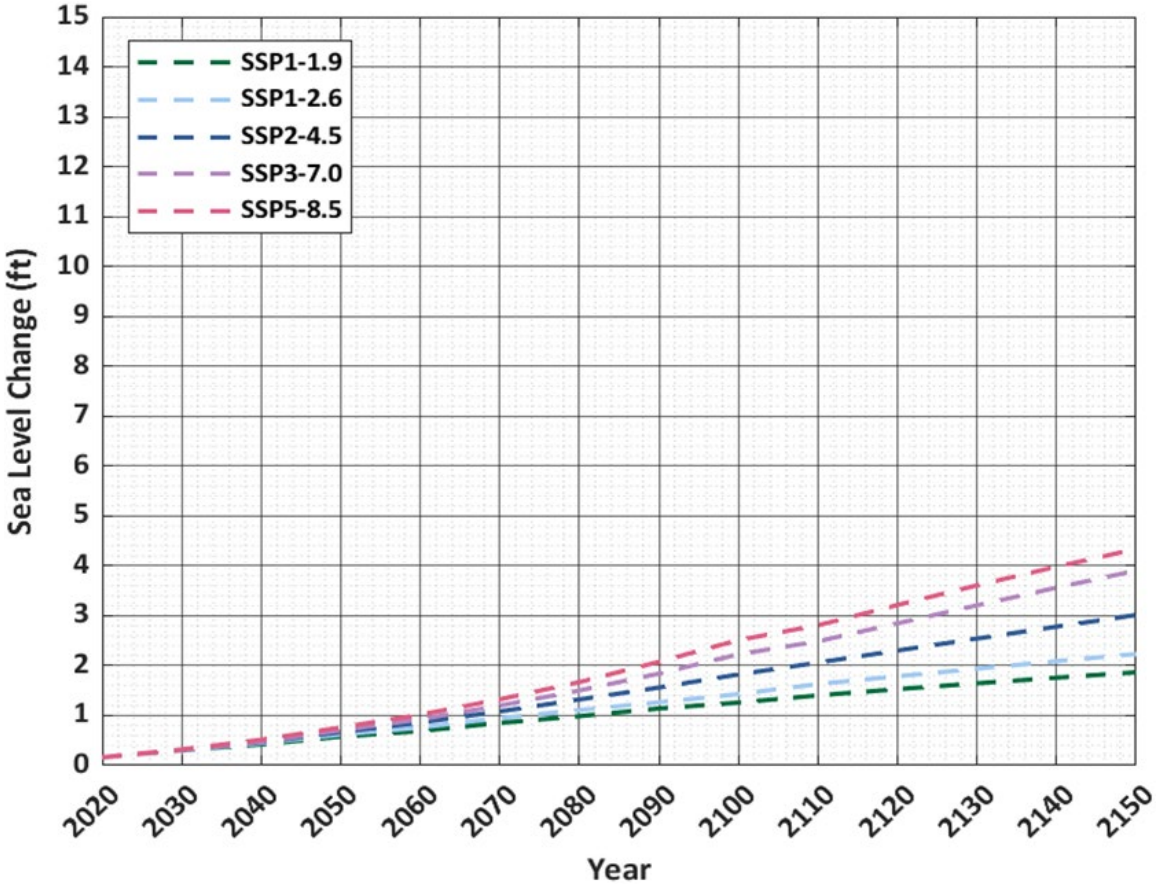


Figure 7-17. IPCC AR6 global sea level rise projections, 2020 to 2150 (IPCC, 2021)

Table 7-11. IPCC AR6 global sea level rise projections, 2020 to 2150 (IPCC, 2021)

Scenario / Year (ft)	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
SSP1-1.9	0.3	0.4	0.6	0.7	0.9	1.0	1.1	1.3	1.4	1.5	1.7	1.8	1.9
SSP1-2.6	0.3	0.5	0.6	0.8	1.0	1.1	1.3	1.4	1.6	1.8	1.9	2.1	2.2
SSP2-4.5	0.3	0.5	0.7	0.9	1.1	1.3	1.6	1.8	2.1	2.3	2.5	2.8	3.0
SSP3-7.0	0.3	0.5	0.7	0.9	1.2	1.5	1.8	2.2	2.5	2.9	3.2	3.6	3.9
SSP5-8.5	0.3	0.5	0.8	1.0	1.3	1.7	2.1	2.5	2.8	3.2	3.6	4.0	4.3

7.3.1.2 U.S. Interagency Task Force - Global Sea Level Rise Projections

The Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Interagency Task Force (Task Force) recently revised their sea level change projections through 2150, considering up-to-date scientific research and measurements. The Task Force consists of representatives from the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), U.S. Army Corps of Engineer (USACE), and additional partners within academia. The most recent report entitled *Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines* (Sweet, et al., 2022), provides the most up to date sea level rise projections for all the U.S. states and territories.

To visualize the Task Force sea level rise projections globally, NASA created the *Task Force Sea Level Projection Tool* [29], which allows users to view both global and regional sea level projections from 2020 to 2150 (Figure 7-18 and Table 7-12), along with how these projections differ depending on future scenarios. Users can select a point anywhere in the ocean to obtain the Task Force sea level rise projections for that specific location. The contributions of different physical processes to future sea level rise are also provided, indicating which processes will be the dominant drivers of future sea levels for a given location.

The Task Force scenarios are different than the IPCC AR6 scenarios but are based on the same underlying science and sea level rise projection framework as the IPCC efforts. The key difference is that the Task Force created scenarios for targeted sea level rise elevations at specific times in the future, rather than emissions pathways. These targeted sea level rise elevations represent unlikely but possible, or plausible, outcomes compared to IPCC AR6, which are considered likely scenarios. The goal of the Task Force projections is to examine the full range of plausible amounts of future sea level to help bound certain risk planning exercises. The result for the Task Force is that the scenarios are based on target elevations for sea level rise in 2100 of 1.0 ft (*Low*), 1.6 ft (*Intermediate Low*), 3.3 ft (*Intermediate*), 4.9 ft (*Intermediate High*), and 6.6 ft (*High*).

Potential Impacts and Mitigation Measures

Beach restoration is not expected to have any impact on the global, Pacific basin, regional, or local sea level. Sea level rise is a byproduct of human-induced climate change, meaning the Project is a nature-based response to human-induced environmental changes. Beach restoration is expected to have a positive impact by improving beach stability, improving lateral shoreline access, providing a natural buffer to reduce the potential for wave overtopping and marine flooding, and making the beach more resilient to sea level rise.

[29] https://sealevel.nasa.gov/task-force-scenario-tool

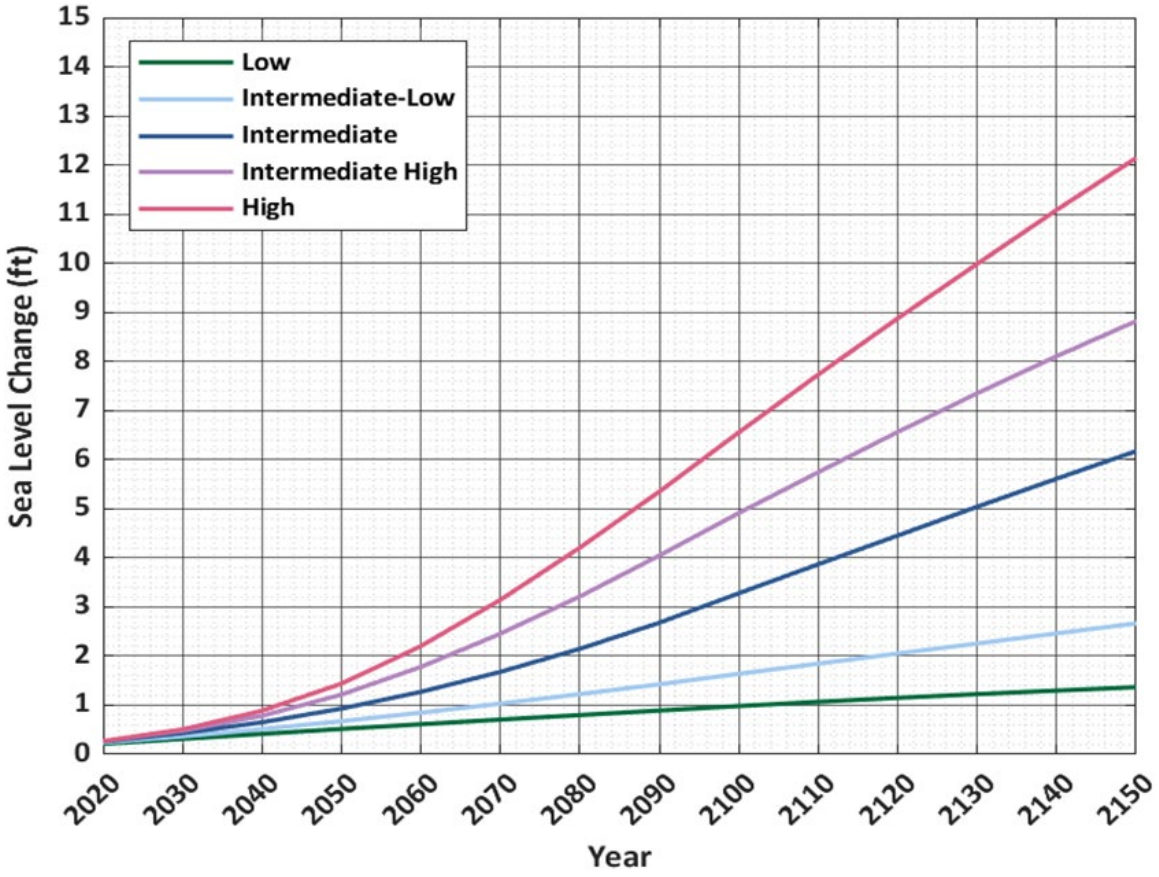


Figure 7-18. Task Force global sea level rise projections, 2020 to 2150 (Sweet, et al., 2022)

Table 7-12. Task Force global sea level rise projections, 2020 to 2150 (Sweet, et al., 2022)

Scenario / Year (ft)	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
Low	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.3	1.4
Int-Low	0.4	0.5	0.7	0.9	1.0	1.2	1.4	1.6	1.9	2.1	2.3	2.5	2.7
Int	0.4	0.7	0.9	1.3	1.7	2.2	2.7	3.3	3.9	4.5	5.0	5.6	6.2
Int-High	0.5	0.8	1.2	1.8	2.5	3.2	4.1	4.9	5.7	6.6	7.4	8.1	8.8
High	0.5	0.9	1.4	2.2	3.2	4.2	5.4	6.6	7.7	8.9	10.0	11.1	12.1

7.3.2 Hawai'i Sea Level Trends and Projections

Existing Conditions

The relative sea level trend for Kahului Harbor for the period of 1947 to 2024 is shown in Figure 7-19, with a value of +2.21 ± 0.37 mm/yr, which is equivalent to a change of 0.73 ft in 100 years (NOAA, 2024). Figure 7-19 also shows interannual anomalies exceeding 0.5 ft (15 cm) in magnitude due to natural oceanic variability from processes such as the El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO).

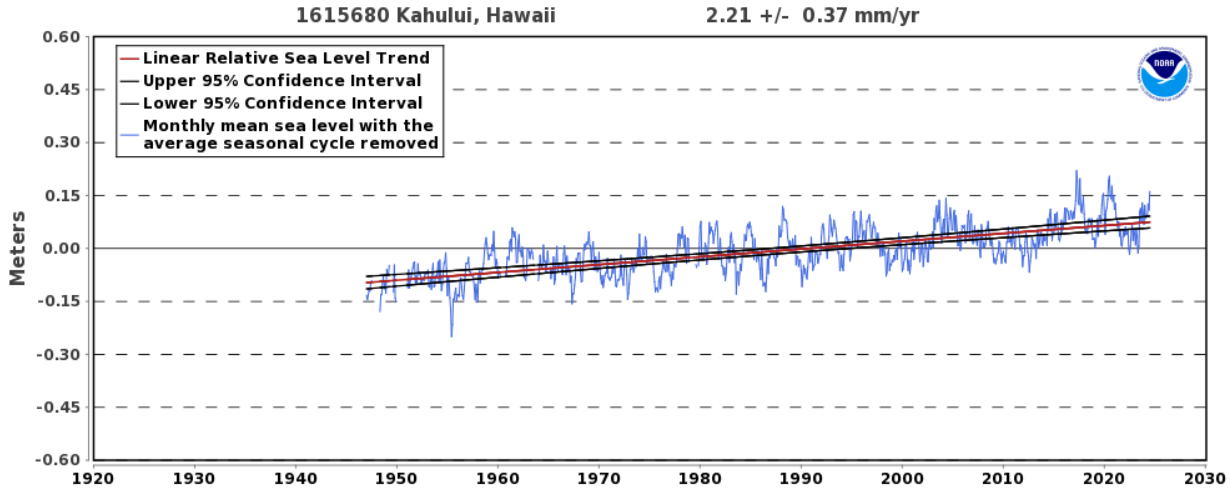


Figure 7-19. Mean sea level trend, Kahului Harbor, Station 1615680, 1947 to present (NOAA, 2024)

7.3.2.1 IPCC AR6 - Kahului Sea Level Rise Projections

The NASA Sea Level Rise Projection Tool [30] for the IPCC AR6 projections provides adjusted sea level rise curves for individual tide stations around the globe. The IPCC AR6 sea level rise curves for Kahului Harbor from 2020 to 2150 are shown in Figure 7-20 and Table 7-13.

7.3.2.2 U.S Interagency Task Force - Kahului Sea Level Rise Projections

The NASA Sea Level Rise Projection Tool [31] for the Task Force projections provides adjusted sea level rise curves for individual tide stations around the globe, however, the baseline year for the future sea level rise curves is 2005. To correct the curves to the local tide station MSL, the USACE Sea Level Rise Analysis Tool[32] (SLAT) was utilized for the Kahului tide station. The Task Force sea level rise curves relative to the local mean sea level datum for Kahului from 2020 to 2150 are shown in Figure 7-21 and Table 7-14.

[30] https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool?psmsl_id=155&data_layer=scenario

[31] https://sealevel.nasa.gov/task-force-scenario-tool?psmsl_id=155

[32] https://www.usace.army.mil/corpsclimate/Public-Tools-Developed-by-USACE/Sea-Level-Change/

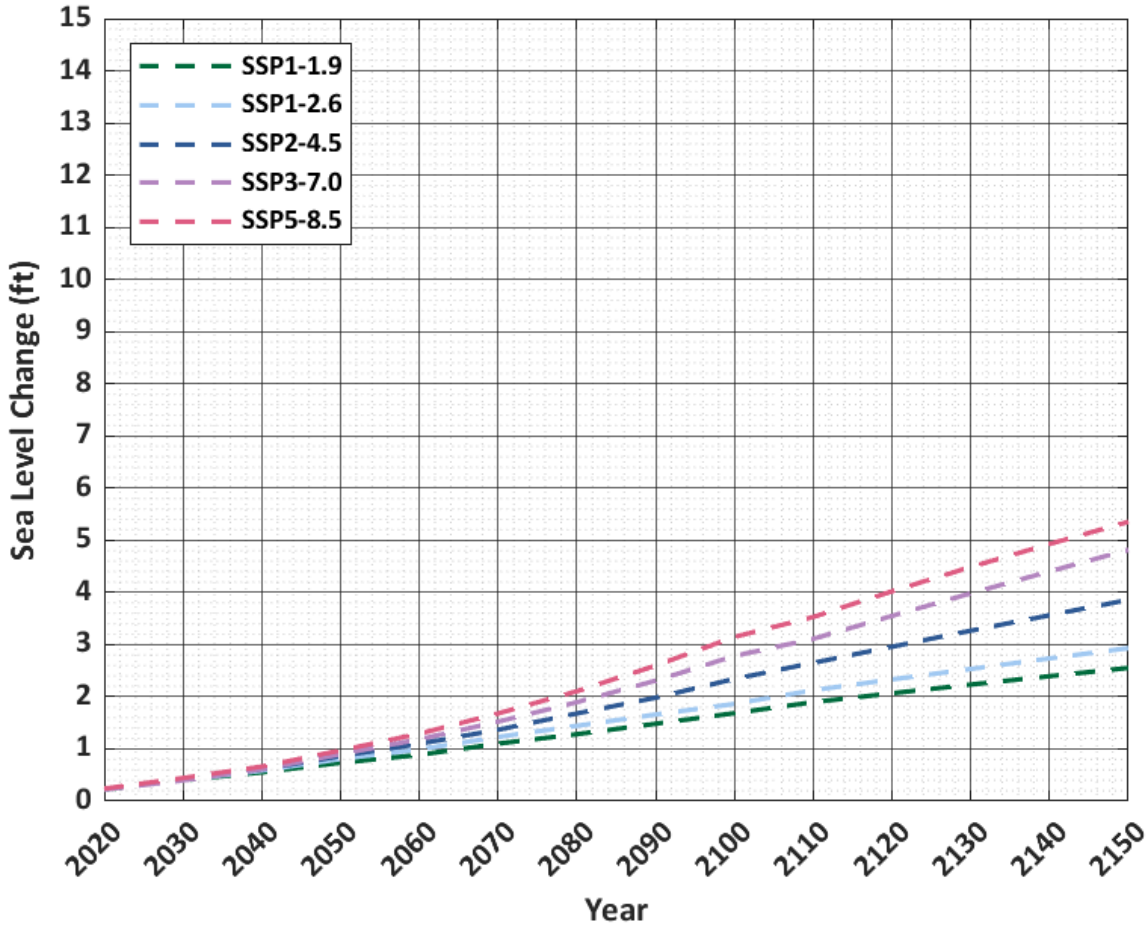


Figure 7-20. IPCC AR6 sea level rise projections for Kahului Harbor, 2020 to 2150 (IPCC, 2021)

Table 7-13. IPCC AR6 sea level rise projections for Kahului Harbor, 2020 to 2150 (IPCC, 2021)

Scenario / Year (ft)	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
SSP1-1.9	0.4	0.6	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.2	2.4	2.6
SSP1-2.6	0.4	0.6	0.8	1.0	1.2	1.4	1.7	1.9	2.1	2.3	2.5	2.7	2.9
SSP2-4.5	0.4	0.6	0.9	1.1	1.4	1.7	2.0	2.3	2.7	3.0	3.3	3.6	3.9
SSP3-7.0	0.4	0.6	0.9	1.2	1.5	1.9	2.3	2.8	3.1	3.5	4.0	4.4	4.8
SSP5-8.5	0.5	0.7	1.0	1.3	1.7	2.1	2.6	3.1	3.5	4.0	4.5	4.9	5.3

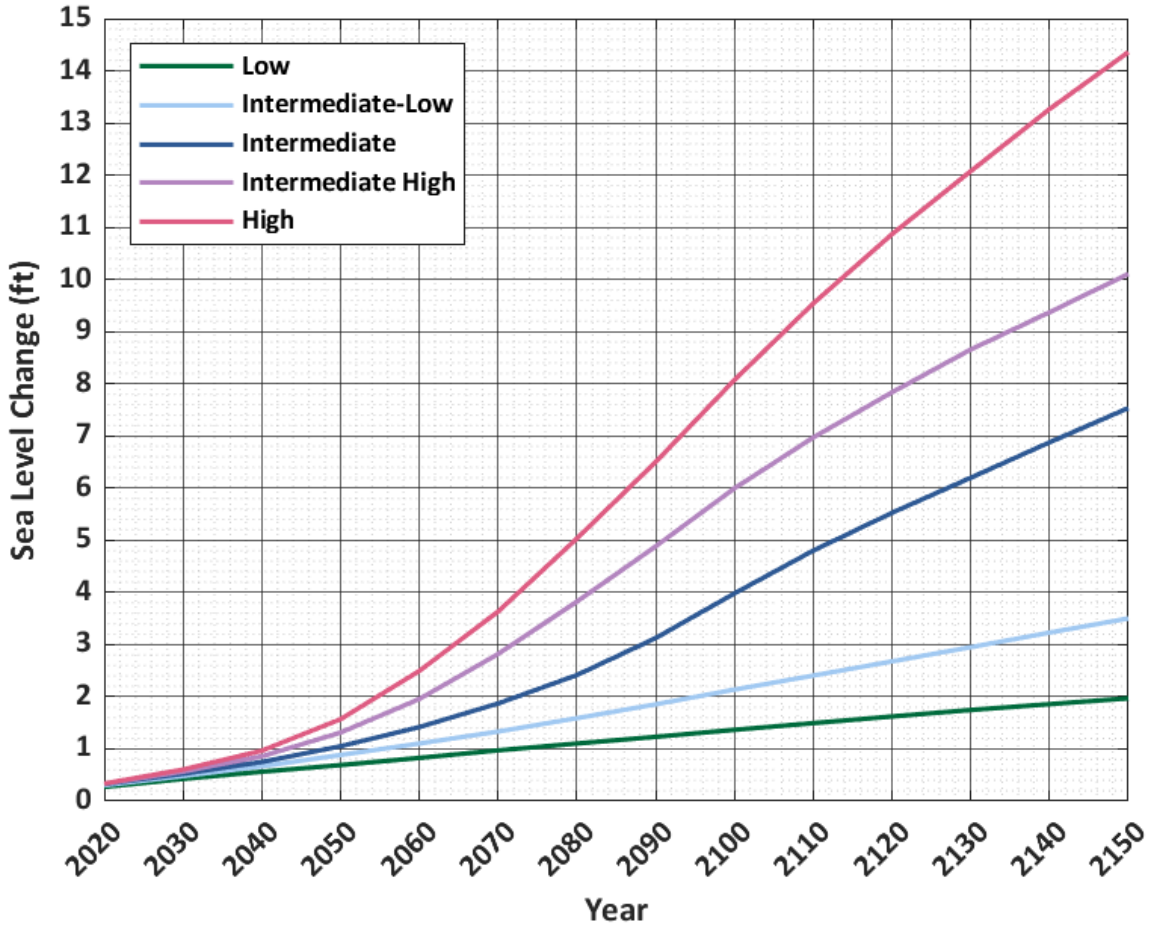


Figure 7-21. Kahului Harbor local mean sea level rise projections (adapted from Sweet et al., 2022)

Table 7-14. Kahului Harbor local mean sea level rise projections (adapted from Sweet et al., 2022)

Scenario / Year (ft)	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
Low	0.5	0.6	0.7	0.9	1.0	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0
Int-Low	0.6	0.7	0.9	1.2	1.4	1.7	1.9	2.2	2.5	2.7	3.0	3.3	3.6
Int	0.6	0.8	1.1	1.5	1.9	2.5	3.2	4.1	4.9	5.6	6.3	6.9	7.6
Int-High	0.6	0.9	1.4	2.1	2.9	3.9	5.0	6.1	7.0	7.9	8.7	9.5	10.2
High	0.7	1.0	1.7	2.6	3.7	5.1	6.6	8.1	9.6	11.0	12.1	13.2	14.4

Potential Impacts and Mitigation Measures

Beach restoration is not expected to have any impact on existing or future sea levels. Rather, beach restoration is expected to have a positive impact by improving beach stability, improving lateral shoreline access, providing a natural buffer to reduce the potential for wave overtopping and marine flooding, and making the beach more resilient to sea level rise.

7.3.3 Vertical Land Motion

Existing Conditions

Sea level measured relative to land is referred to as relative sea level (RSL). In coastal areas, sinking land (referred to as subsidence) leads to higher sea levels and increased flood risk, while uplifting land reduces sea level and promotes the seaward migration of coastlines. Subsidence and uplift are collectively referred to as vertical land motion, or VLM (NASA, 2024). VLM is an important component of RSL and been incorporated into the U.S. Task Force projections for each sea level rise scenario. VLM rates are derived from long-term tide-gauge observations and are assumed to be linear over the past record and to persist linearly into the future over the length of the projected record (Sweet et al. 2022).

This report references the U.S. Task Force sea level rise projections for Kahului, Maui. The Intermediate-High scenario is used for design purposes. Table 7-15 presents the VLM rates for the Intermediate-High scenario for Kahului, Maui. VLM rates are projected as a linear rate that increases approximately 0.02 ft every 10 years. VLM rates range from 0.10 to 0.35 ft from 2030 to 2150, respectively, and account for approximately 18% to 3% of the total projected sea level rise for Kahului, respectively. VLM exerts greater influence over the lower scenarios, which assume lower contributions from other components including glaciers, ice sheets, and land water storage. These components exert greater influence over the higher scenarios and increase progressively over time.

Table 7-15. Contributions to Intermediate-High sea level rise scenario for Kahului, HI (NOAA, 2024)

	2030	2040	2050	2060	2070	2080	2090	2100	2150
Sterodynamic Sea Level	0.16	0.23	0.32	0.43	0.56	0.70	0.85	1.04	1.88
Glaciers	0.12	0.16	0.21	0.27	0.33	0.41	0.49	0.57	1.03
Greenland	0.06	0.12	0.20	0.39	0.58	0.75	0.94	1.15	2.56
Antarctica	0.05	0.11	0.25	0.45	0.58	0.85	1.37	1.79	3.40
Land Water Storage	0.02	0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.18
Vertical Land Motion	0.10	0.12	0.14	0.16	0.19	0.21	0.22	0.25	0.35
Total Sea Level Rise	**0.57**	**0.86**	**1.31**	**1.96**	**2.82**	**3.82**	**4.88**	**6.00**	**10.11**
Vertical Land Motion %	***18%***	***14%***	***11%***	***8%***	***7%***	***5%***	***5%***	***4%***	***3%***

Potential Impacts and Mitigation Measures

Beach restoration is not expected to have any impact on existing or future vertical land motion. VLM is a contributing factor to sea level rise. Beach restoration is expected to have a positive impact by improving beach stability, improving lateral shoreline access, providing a natural buffer to reduce the potential for wave overtopping and marine flooding, and making the beach more resilient to sea level rise.

7.3.4 Projected Impacts of Sea Level Rise

Existing Conditions

Sea level rise is negatively impacting beaches and shorelines in Hawaiʻi. Impacts include beach narrowing and beach loss, loss of land due to erosion, negative impacts to water quality and benthic habitat, and infrastructure damage due to erosion and flooding. Anderson et al. (2015) found that, due to sea level rise, average shoreline recession in Hawaiʻi by 2050 is projected to be nearly twice the historical rates, and nearly 2.5 times the historical rates by 2100. The impacts from anomalous sea level events (e.g., El Niño, king tides, mesoscale eddies, storm surge) are also likely to increase.

The Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report (State of Hawaiʻi, 2017) discusses the projected impacts of sea level rise on coastal hazards, and the potential physical, economic, social, environmental, and cultural impacts of sea level rise in Hawaiʻi. The report concluded that 3.2 ft of sea level rise may have substantial impacts on the island of Maui. A key component of the report was a numerical modeling effort by the University of Hawaiʻi Coastal Geology Group (UH-CGG) to estimate the potential impacts that a 3.2-ft rise in sea level would have on coastal hazards including passive flooding, annual high wave flooding, and coastal erosion. The footprint of these three hazards were combined to map the projected extent of chronic flooding due to sea level rise, referred to as the sea level rise exposure area (SLR-XA).

Figure 7-22 depicts the potential for passive flooding with 3.2 ft of sea level rise. Passive flooding includes areas that are hydrologically connected to the ocean (marine flooding) and low-lying areas that are not hydrologically connected to the ocean (groundwater flooding). The model projects minimal passive flooding within the Project Site with 3.2 ft of sea level rise.

Figure 7-23 depicts the potential for annual high wave flooding with 3.2 ft of sea level rise. The annual high wave flooding model propagates the maximum annually recurring wave, calculated from historical wave buoy data, over the reef and to the shore along 1-dimensional cross-shore profiles extracted from a 1-m digital elevation model. The model depicts the spatial extent of inundation that is greater than 10cm in depth from that annually recurring high wave event with 3.2 ft of sea level rise. The model projects minimal annual high wave flooding within the Project Site with 3.2 ft of sea level rise. The projected flooding is not expected to impact any of the existing buildings or infrastructure and is likely to consist of nuisance-level flooding that would not be life-threatening or impact operations.

Figure 7-24 depicts potential coastal erosion with 0.5 to 3.2 ft of sea level rise. The projected erosion hazard lines for the Project Site are derived from historical erosion rates that are based on shoreline location measurements collected at individual transects located 20 meters apart along the coastline. Each transect is characterized by a unique combination of physical and environmental factors that influence shoreline change at that specific transect. The results of the erosion model represent the combined results of measured historical erosion rates and the compounding impacts of projected higher water levels associated with future sea level rise. The model projects that coastal erosion will impact the Project Site under all of the modeled sea level rise scenarios.

Figure 7-25 depicts the sea level rise exposure area (SLR-XA) with 3.2 ft of sea level rise. While the SLR-XA is intended to show the extent of chronic flooding due to sea level rise, the primary hazard at the project site is erosion. Sea level is projected to rise 3.2 ft by approximately 2075 based on the NOAA (2022) Intermediate-High scenario. The SLR-XA erosion projection model results with 3.2 ft of sea level rise predicts erosion at the project site extending from 105 to 215 ft inland when sea level is 3.2 ft higher than present.

The SLR-XA model indicates that the primary hazard at the Project Site is erosion. However, recent research suggests that current models may significantly underestimate the potential for future coastal flooding with sea level rise. A recent study found that, given established emissions trajectories and sea level rise projections, the odds of extreme coastal flooding in the U.S. will double approximately every 5 years into the future (Taherkhani, Vitousek, Barnard, et al. 2020). The same study found that the present-day 50-year extreme water level (2% annual chance of exceedance) will be exceeded annually before 2050, and the present-day 50-year extreme water level will be exceeded almost every day during peak high tide before the end of the 21st century (Taherkhani, Vitousek, Barnard, et al. 2020). These findings suggest that the vulnerability of the Project Site to marine flooding could increase significantly as sea levels continue to rise. The projections for future erosion and marine flooding with sea level rise further emphasize the need for a mid-term solution to address the erosion problem at the Project Site.

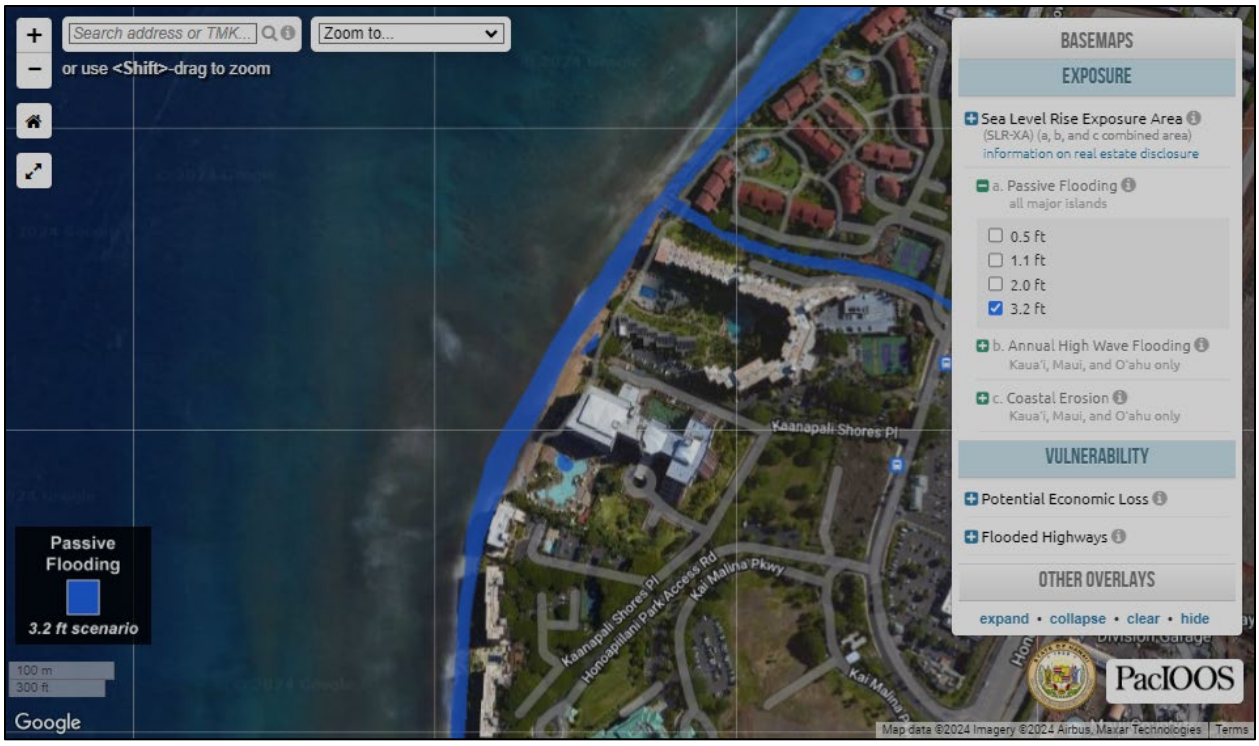


Figure 7-22. Projected passive flooding at the Project Site with 3.2 ft of sea level rise.

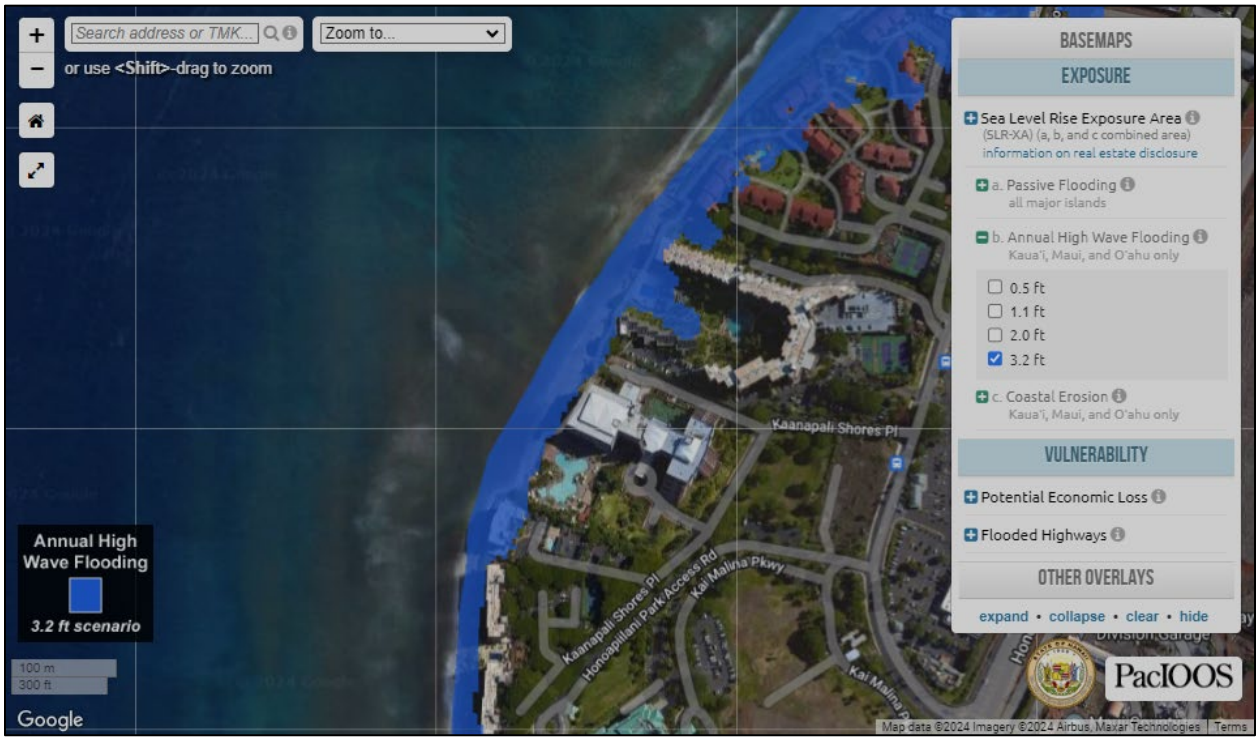


Figure 7-23. Projected annual high wave flooding at the Project Site with 3.2 ft of sea level rise.

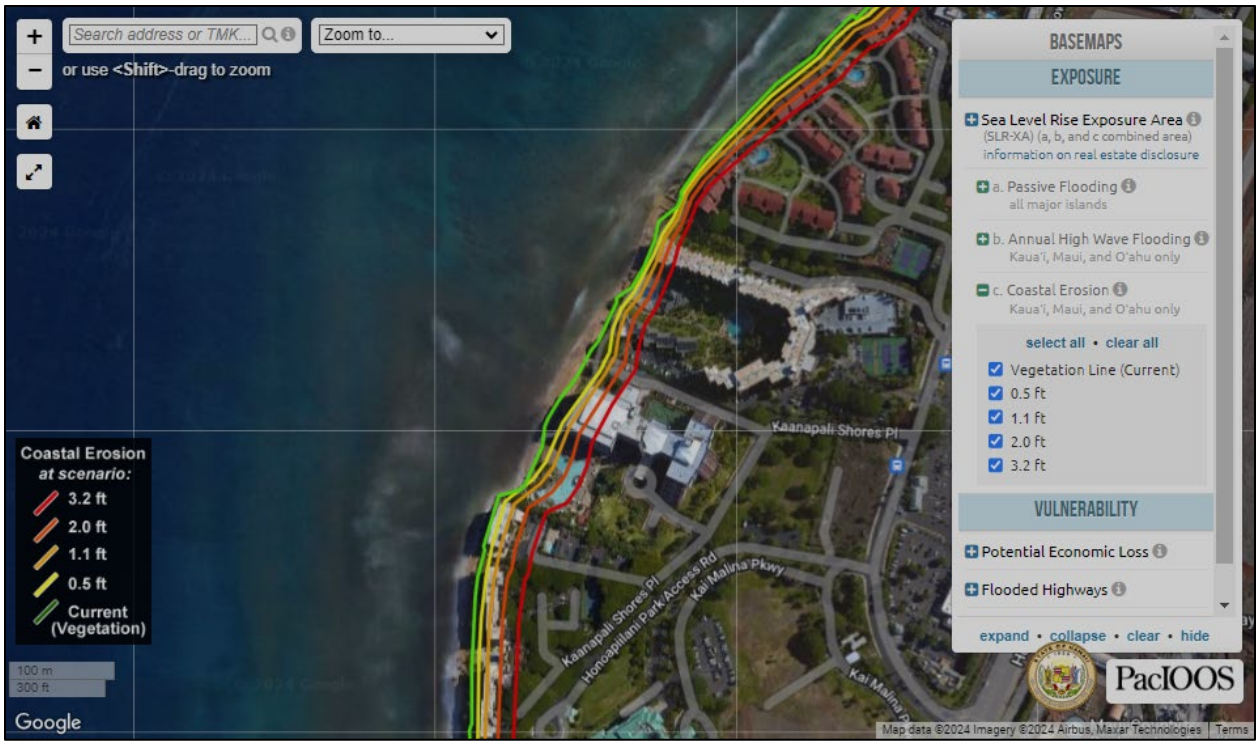


Figure 7-24. Projected coastal erosion at the Project Site with 3.2 ft of sea level rise.

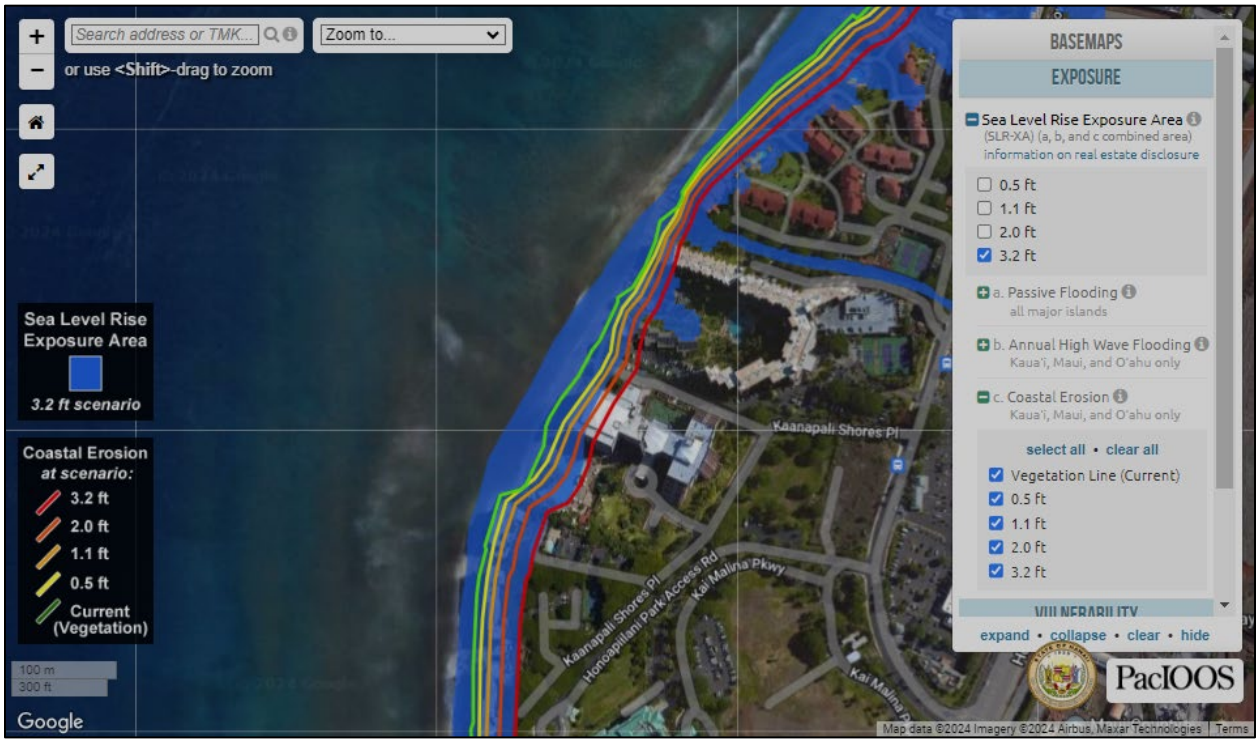


Figure 7-25. Combined Sea Level Rise Exposure Area at the Project Site with 3.2 ft of sea level rise

Potential Impacts and Mitigation Measures

Beach restoration is not expected to have any impact on future sea levels. Beach restoration is intended to mitigate the impacts of sea level rise and is expected to have a positive impact by improving beach stability, improving lateral shoreline access, providing a natural buffer to reduce the potential for wave overtopping and marine flooding, and making the beach more resilient to sea level rise. Increasing beach width and elevation would provide a natural buffer to reduce the potential for wave overtopping and marine flooding.

Beach Stabilization

Beach Stabilization is not expected to have any impact on future sea levels. Beach Stabilization is expected to have a long-term positive impact by restoring the beach and improving beach stability, which would provide a natural buffer to reduce vulnerability coastal hazards and make the beach and the surrounding shoreline area more resilient to sea level rise. Beach Stabilization is also expected to have a long-term positive impact by reducing long-term erosion and mitigating the potential for sedimentation that could adversely impact water quality and benthic habitat.

Beach Nourishment

Beach Nourishment is expected to have a short-term positive impact by temporarily increasing beach width and volume. Beach Nourishment has an estimated design life of 10 years. During this time, the beach would continue to be exposed to erosion, so the protective characteristics of the beach would be expected to decrease over time. With continued erosion, beach width would be expected to return to pre-construction conditions.

Beach Maintenance

Beach Maintenance is expected to have a positive impact by increasing beach width and volume. With periodic renourishment, the beach would be more resilient to sea level rise over the 50-yr design life of the project. However, the beach would remain vulnerable to episodic erosion and beach loss events.

No Action

No Action would increase vulnerability and decrease resilience to sea level rise. Without implementation of beach restoration, erosion and beach loss would result in significant shoreline recession that could substantially alter the configuration of the shoreline at Honokōwai Beach. No Action would result in a range of potential environmental impacts including but not limited to beach narrowing, negative impacts to water quality and benthic habitat, loss of ecosystem services and critical natural habitat, and progressive degradation of the shoreline area.

Summary

Beach restoration is expected to increase the resilience of the beach and the surrounding shoreline area to sea level rise. Beach Stabilization is the most effective approach to mitigate the impacts of sea level rise. Beach Maintenance would have a similar impact on long-term shoreline change rates; however, the beach would remain vulnerable to chronic erosion and episodic beach loss events. Beach Nourishment could temporarily delay the impacts of sea level rise, but these benefits would be temporary in nature.

7.4 Waves

This section details the existing wave climate and evaluates potential impacts associated with the Project and alternatives. In addition, this section discusses implementation of management and design measures to minimize negative impacts on waves. This section also includes a detailed discussion of wave forces as a design criterion for the Project.

7.4.1 General Wave Climate

Existing Conditions

The wave climate in Hawaiʻi is dominated by long period swell generated by distant storm systems, by relatively low amplitude, short period waves generated by more local winds, and the occasional bursts of energy associated with intense local storms. Typically, Hawaiʻi receives five general surface gravity wave types: 1) northeast trade wind waves, 2) southeast trade wind waves 3) South Pacific swell, 4) North Pacific swell, and 5) Kona wind waves. The dominant swell regimes for Hawaiʻi are shown in Figure 7-26.

Trade wind waves occur throughout the year and are most persistent April through September when they usually dominate the local wave climate. They result from the strong and steady trade winds blowing from the northeast quadrant (between 0° and 90°) over long fetches of open ocean. Trade wind deepwater waves are typically between 3 to 8 ft high with periods of 5 to 10 seconds, depending upon the strength of the tradewinds and how far the fetch extends east of the Hawaiian Islands. The direction of approach, like the trade winds themselves, varies between north-northeast and east-southeast and is centered on the east-northeast direction. The project site is well sheltered from the direct approach of trade wind waves by the island itself, and only a portion of the trade wind wave energy refracting and diffracting around the northwest end of the island reaches the Honokōwai shoreline.

South Pacific swell is generated by storms in the southern hemisphere and is most prevalent during the summer months of April through September. Traveling distances of up to 5,000 miles, these waves arrive with relatively low deepwater wave heights of 1 to 4 ft and periods of 14 to 20 seconds. Depending on the positions and tracks of the southern hemisphere storms, south swells approach from between the southeasterly and southwesterly directions. The project site is directly exposed to swell from the southerly direction.

During the winter months in the northern hemisphere, strong storms are frequent in the North Pacific in the mid latitudes and near the Aleutian Islands. These storms generate large North Pacific swells that range in direction from west-northwest to northeast and arrive at the northern shores of the Hawaiian Islands with little attenuation of wave energy. These are the waves that have made surfing beaches on the north shores of the island of Oʻahu and Maui famous. Deepwater wave heights often reach 15 ft and in extreme cases can reach 30 ft. Periods vary between 12 and 20 seconds, depending on the location of the storm. The project site is sheltered by the island of Maui itself for northeasterly swell and by the island of Molokaʻi for swell approaching from the northwest. However, even with island sheltering, the project site is still directly and indirectly exposed to North Pacific swell.

Kona wind waves can also directly and indirectly approach the project site; however, these waves are relatively infrequent, occurring only about 10 percent of the time during a typical year. Kona wind waves typically range in period from 6 to 10 seconds with heights of 5 to 10 ft, and approach from between the southwest and west directions. Deepwater wave heights during the severe Kona storm of January 1980 were about 17 ft. Honokōwai is directly exposed to Kona storm waves that approach from the west between the islands of Lānaʻi and Molokaʻi, or from the southwest between the islands of Lānaʻi and Kahoʻolawe.

Severe tropical storms and hurricanes have the potential to generate extremely large waves, which in turn could potentially result in large waves at the project site. Recent hurricanes impacting the Hawaiian Islands include Hurricane Iwa in 1982 and Hurricane Iniki in 1992. Iniki directly hit the island of Kauaʻi and resulted in large waves along the southern and western shores of all the Hawaiian Islands. Damage from these hurricanes was extensive.

Potential Impacts and Mitigation Measures

Beach restoration is not expected to have any impact on the existing or future wave climate.

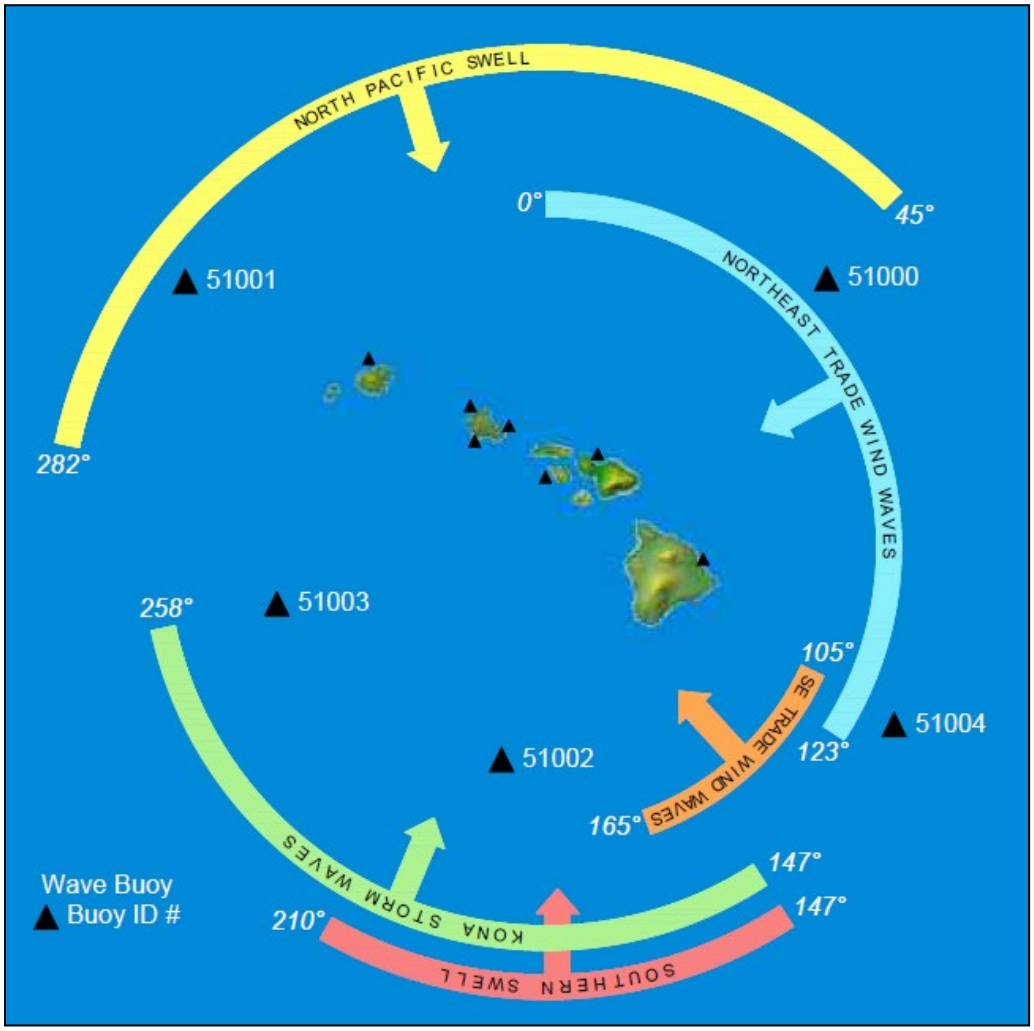


Figure 7-26. Hawaiʻi dominant swell regimes

7.4.2 Local Wave Climate

Existing Conditions

Honokōwai is at the center of the Maui Nui complex, which consists of the islands of Maui, Lānaʻi, Molokaʻi, and Kahoʻolawe. These islands shelter the Honokōwai area from direct exposure to northeast trade wind-generated waves and North Pacific swell from the northwest. However, the area is exposed to South Pacific swell, North Pacific swell, and occasional seas/swell from the west. Figure 7-27 shows the direct wave exposure windows for Honokōwai Beach. Waves diffract and refract around the islands to reach the project site, as well. Long period north swell from just outside the direct exposure window can still deliver high energy waves to the shoreline. This increases overall wave exposure for the site but requires increasingly more powerful waves the farther outside of the direct exposure windows. More powerful waves have been observed at a global scale in the tropics in recent decades, likely as a result of ongoing climate impacts.

Wave conditions for this area have been measured by offshore wave buoys. Each buoy measures and records its motion due to passing waves. This data is used to compute spectral wave energy and direction at half-hour increments and derives important wave parameters such as significant wave height, peak period, and direction from those measurements. The buoy data is provided by the Coastal Data Information Program (CDIP). Three nearby wave buoys, designated as Station 146 (Kaumalapau, Lānaʻi), Station 239 (Kaumalapau Southwest, Lānaʻi), and Station 187 (Pauwela, Maui), were chosen to determine offshore wave parameters and statistics for the project site (Figure 7-27).

Station 146, which is no longer active and was located approximately 1.2 miles west of Kaumalapau Harbor off the island of Lānaʻi in a water depth of roughly 660 ft (200 m), recorded data from 2007 to 2017.

Station 239 replaced Station 146 and is located approximately 2.6 miles south-southwest of Kaumalapau Harbor in a water depth of roughly 770 ft (235 m) and has been recording data since 2018.

Station 187 is located approximately 9 miles north-northeast from Kahului Harbor in a water depth of approximately 656 ft (200 m) and has been recording data since 2011. Stations 146 and 239 were chosen to characterize wave parameters and statistics associated with summer south swell and winter westerly swells along with Kona wind waves approaching from between 180- and 215-degrees true north (TN) and between 265- and 284-degrees TN, respectively.

Station 187 was chosen to characterize waves parameters and statistics associated with winter northerly swell approaching between 21- and 365-degrees TN. Buoy locations relative to the project site, along with the wave exposure windows, are shown in Figure 7-27.

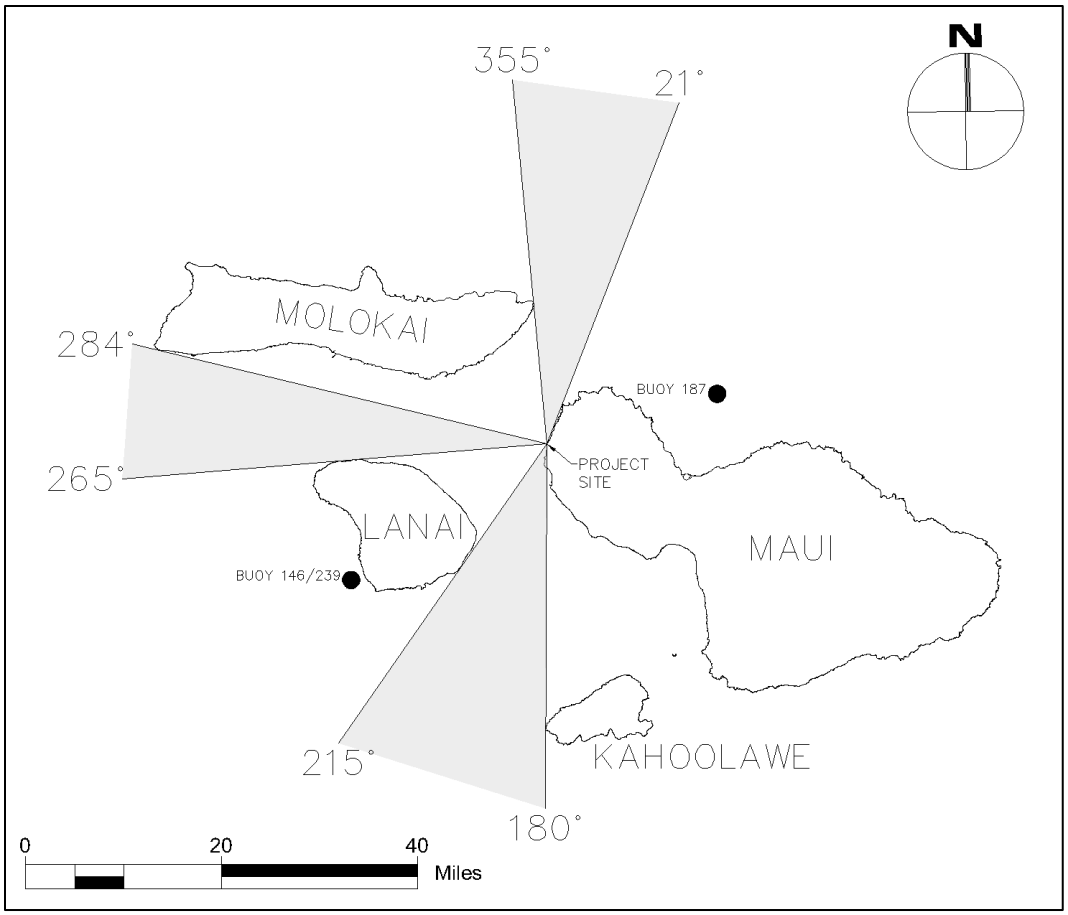


Figure 7-27. Wave exposure windows for Honokōwai Beach and locations of CDIP buoys

The entire datasets from Station 187 and Station 146/239 were utilized to generate wave height and wave period rose plots, which are a form of histogram that conveys a parameter's directional dependence (Figure 7-28 and Figure 7-29). In general, the plots show peak values centered on three primary directions: northwest swell from 355- to 21- degrees TN, western swell from 265- to 284-degrees TN, and south swell from 180- to 215-degrees TN. This indicates that the project site shoreline is susceptible to elevated surf throughout the year due to its exposure to both north (winter), south (summer), and west (summer) swells. The wave period rose plot shows that the northwest and south swell peaks are primarily composed of longer period (>16 seconds) swell, as would be expected.

Wave data from Station 187 was utilized to generate north swell wave height and period rose plots, which are a form of histogram that conveys a parameter's directional dependence (Figure 7-30 and Figure 7-31). Based on the winter data, the prevailing winter north swell approaching between 355 and 21-degrees TN has a significant wave height of 2.9 ft with a period of 12 seconds. The wave period rose plot shows that the northerly swell peaks are primarily composed of longer period (>16 seconds) swell, as would be expected. Wave data from Station 146 and Station 239 was utilized to generate south swell wave height and period rose plots (Figure 7-30 and Figure 7-31). Based on the summer data, the prevailing summer south swell has a direction from 190 degrees and a significant wave height of 1.9 ft with a period of 14 seconds.

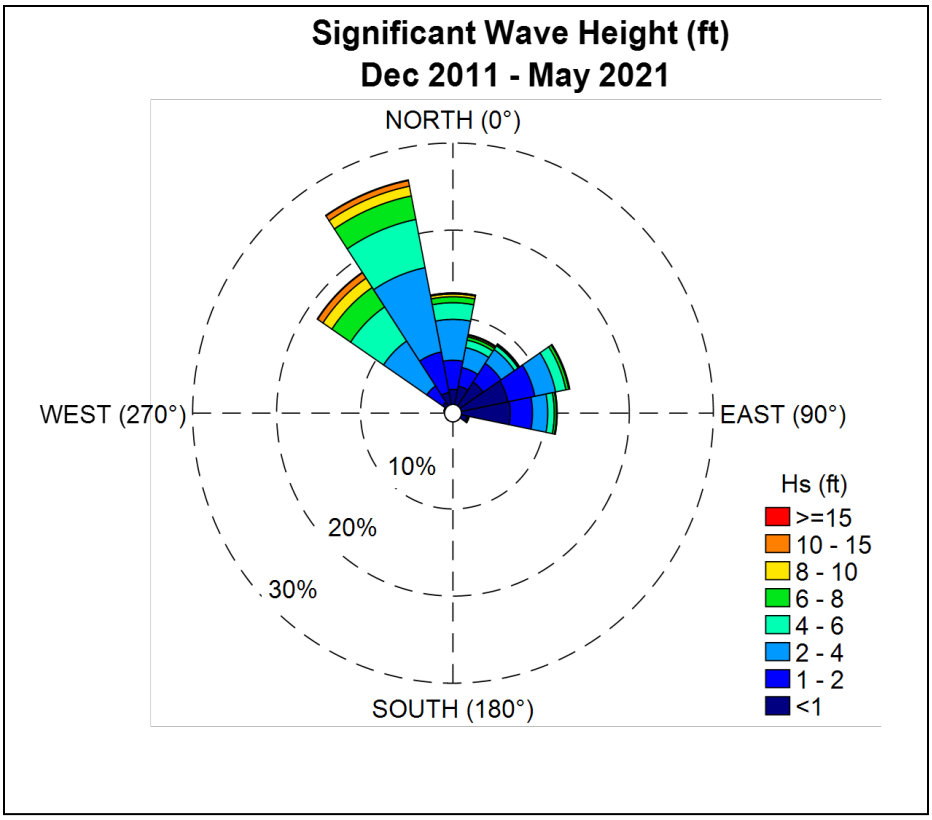


Figure 7-28. CDIP buoy 187 northerly swell wave height rose (Dec 2011 to May 2021)

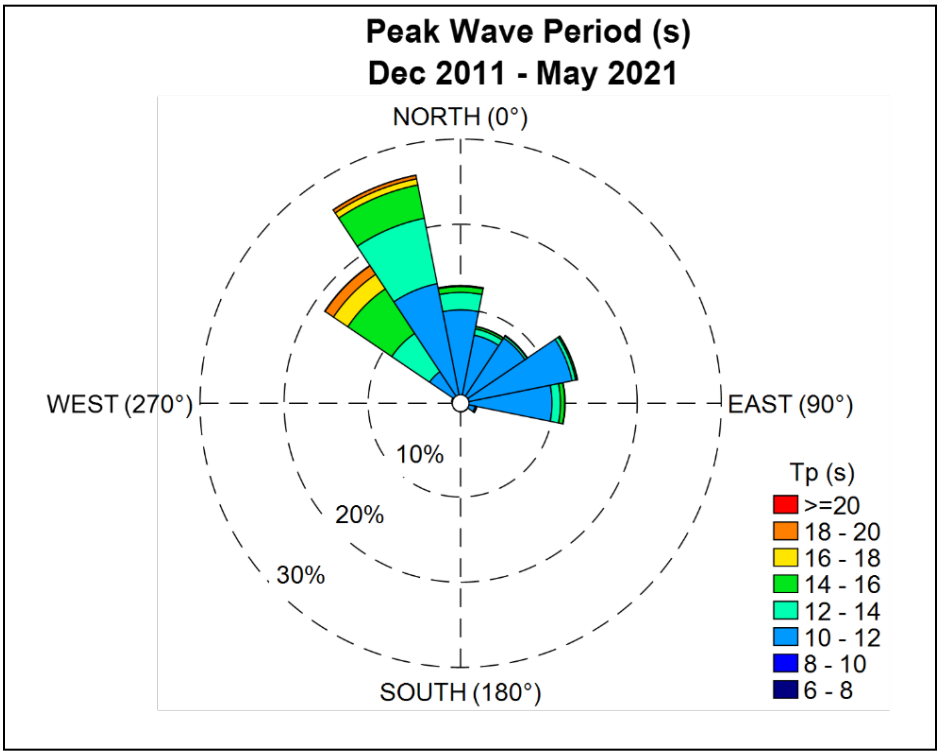


Figure 7-29. CDIP buoy 187 northerly swell wave period rose (Dec 2011 to May 2021)

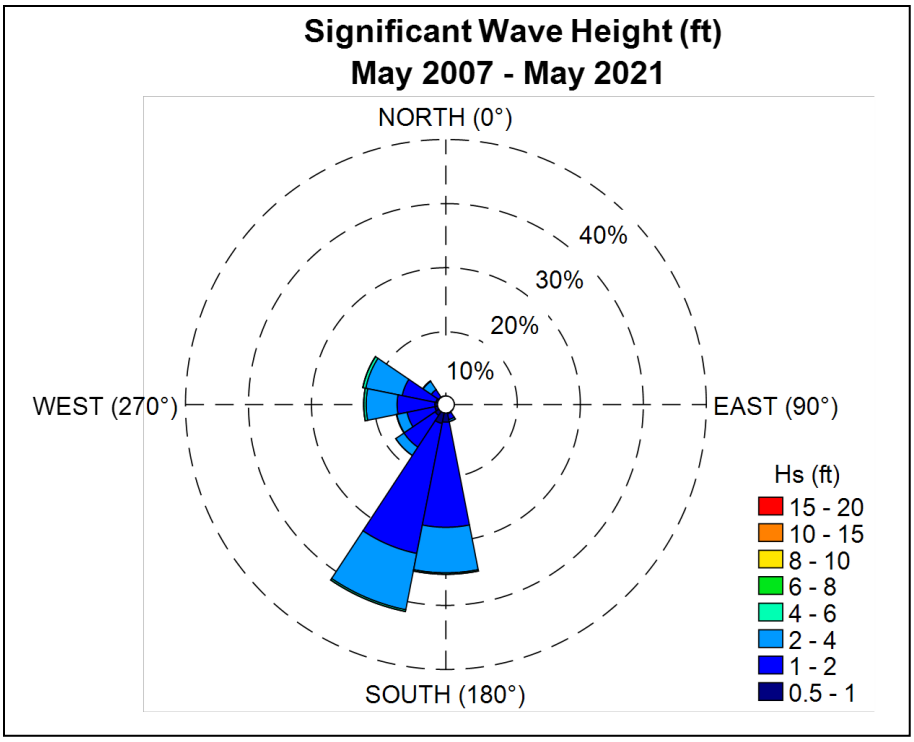


Figure 7-30. CDIP buoy 146 and 239 southern and westerly swell wave height rose (May 2007 to May 2021)

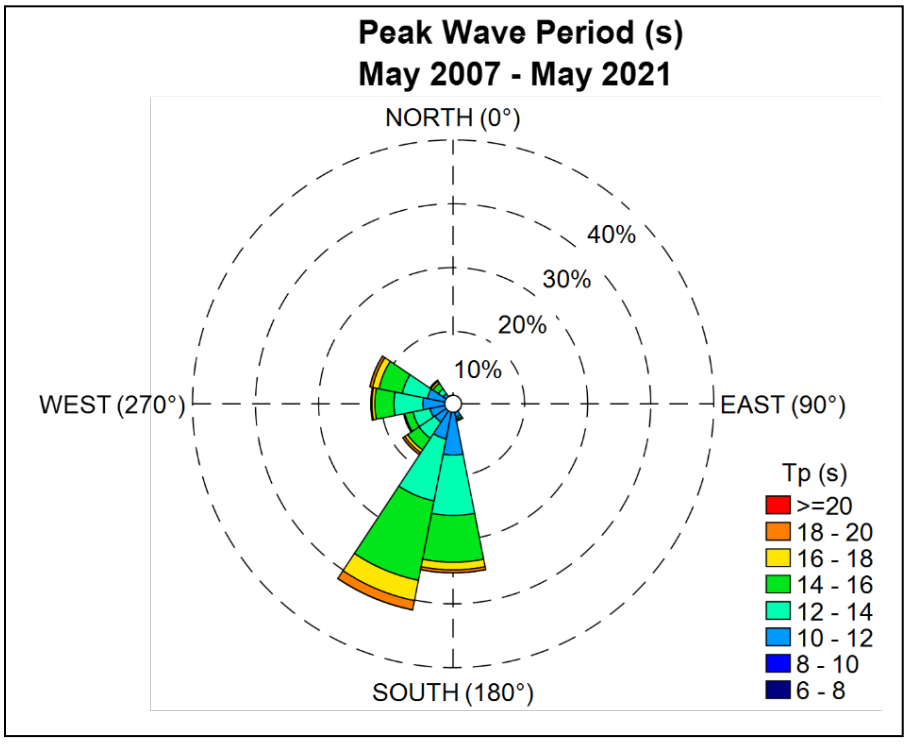


Figure 7-31. CDIP buoy 146 and 239 southern and westerly swell wave period rose (May 2007 to May 2021)

7.4.3 Extreme Deepwater Waves

Existing Conditions

Historical wave buoy and hindcast data allow for the prediction of extreme wave events. These are infrequent, large, powerful, low probability wave events that are typically used for design purposes. For example, a 50-yr return period wave event is an extreme event with a 1/50 (i.e., 2%) chance of occurring in any given year. Because the project site shoreline is vulnerable to multiple wave regimes (northern swell, southern swell, Kona storm waves), extreme deep water wave heights for each event were determined based on available buoy data.

The available buoy wave height data was used to generate a Weibull extreme value distribution for return period wave heights. The Weibull Distribution is a tool for relating the size of wave to the frequency of occurrence at a given location. The analysis requires a long-term dataset with well-documented wave events. These events are then sorted by size, and frequency of occurrence can be assessed by how often these events occur in the record. The relationship is logarithmic, and a linear fit can be established with a best fit linear regression of the data. Though not all wave events will be co-located on the line, its general trend represents the nature of the size and frequency relationship of wave events at a specific location. An extreme wave return period analysis using the Weibull Distribution was performed for waves associated with northwest swell, north swell, south swell, and Kona storm waves. Both northwest and north swell were investigated to determine a worst-case scenario at the project site shoreline because northwest swell, even though sheltered by the island of Molokaʻi, typically produces larger wave heights compared to north swell, which directly approaches the project site shoreline.

7.4.3.1 Hurricane Waves

Existing Conditions

The Hawaiian Islands are annually exposed to severe storms and waves generated by tropical cyclonic storms (hurricanes). Hurricanes, the worst-case tropical cyclones, are caused by intense low-pressure vortices that typically originate in the eastern tropical Pacific Ocean and travel westward. Along with damaging winds and rains, hurricanes bring the threat of elevated sea level, commonly referred to as storm surge.

Storm surge is composed of three elements: wave setup, wind setup, and pressure setup. Wave setup is a phenomenon where the water level inshore of the breaker zone may be elevated above the tide level due to breaking waves offshore. Wind setup is an increase in water level rise due to wind stress acting on the water surface and will only occur when winds are blowing towards the shore. Typically, wind setup is negligible in Hawaiʻi because it requires a long shallow shelf to help hold water against the shore. Pressure setup is an increase in water level due to reduced atmospheric pressure surrounding the storm. Pressure setup is a function of the center pressure of the storm and the distance from the center of the storm.

While it is not uncommon for hurricanes to pass near the Hawaiian Islands, they often change course or deteriorate by the time they reach near Hawaiian waters. Figure 7-32 shows the historical tracks of tropical storms and hurricanes in the central Pacific from 1949 to 2018. While direct hits to the islands are rare, hurricane tracks to the north or south of the Hawaiian Islands are not infrequent and can generate large, damaging waves that can have impacts along the shorelines

throughout the Hawaiian Islands. The historical tracks of hurricanes that have passed near the Hawaiian Islands between 1948 to 2022 are shown in Figure 7-33, and the tracks of tropical storms and tropical depressions that have passed near the Hawaiian Islands are shown in Figure 7-34.



Figure 7-32. Central Pacific historical hurricane tracks from 1949 to 2022 (NOAA,2024)

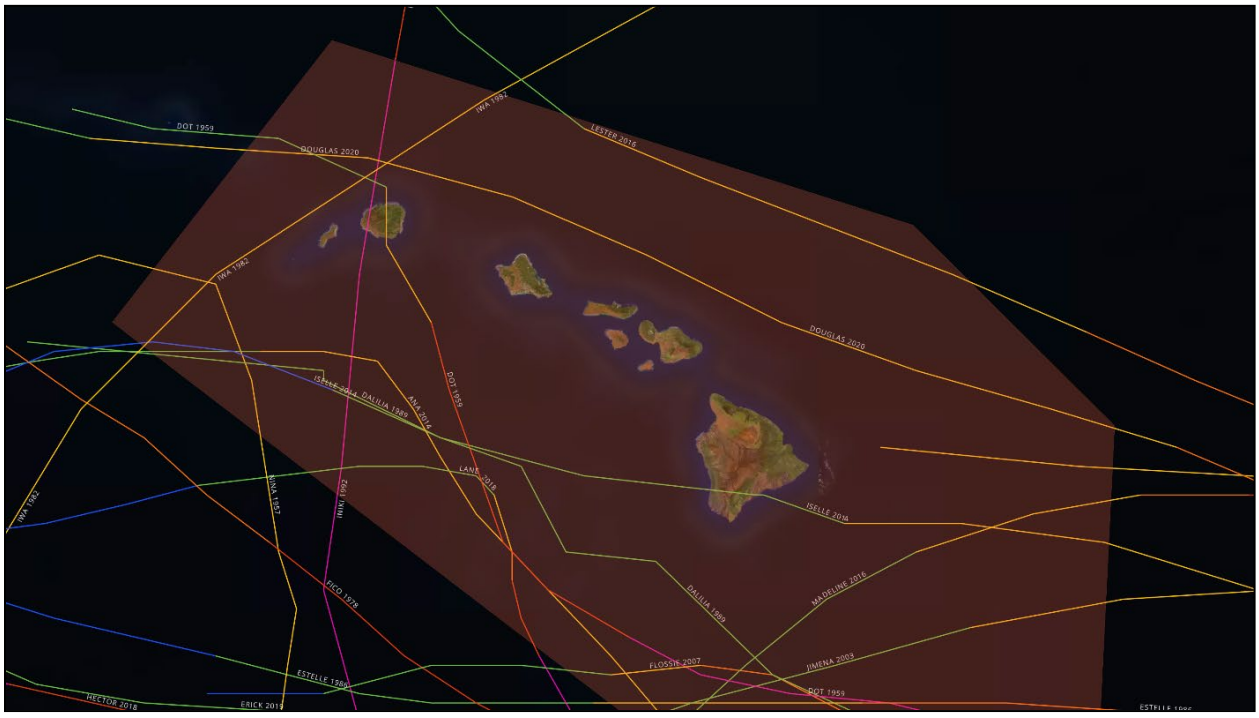


Figure 7-33. Hawai'i historical hurricane tracks from 1949 to 2022 (NOAA,2024)

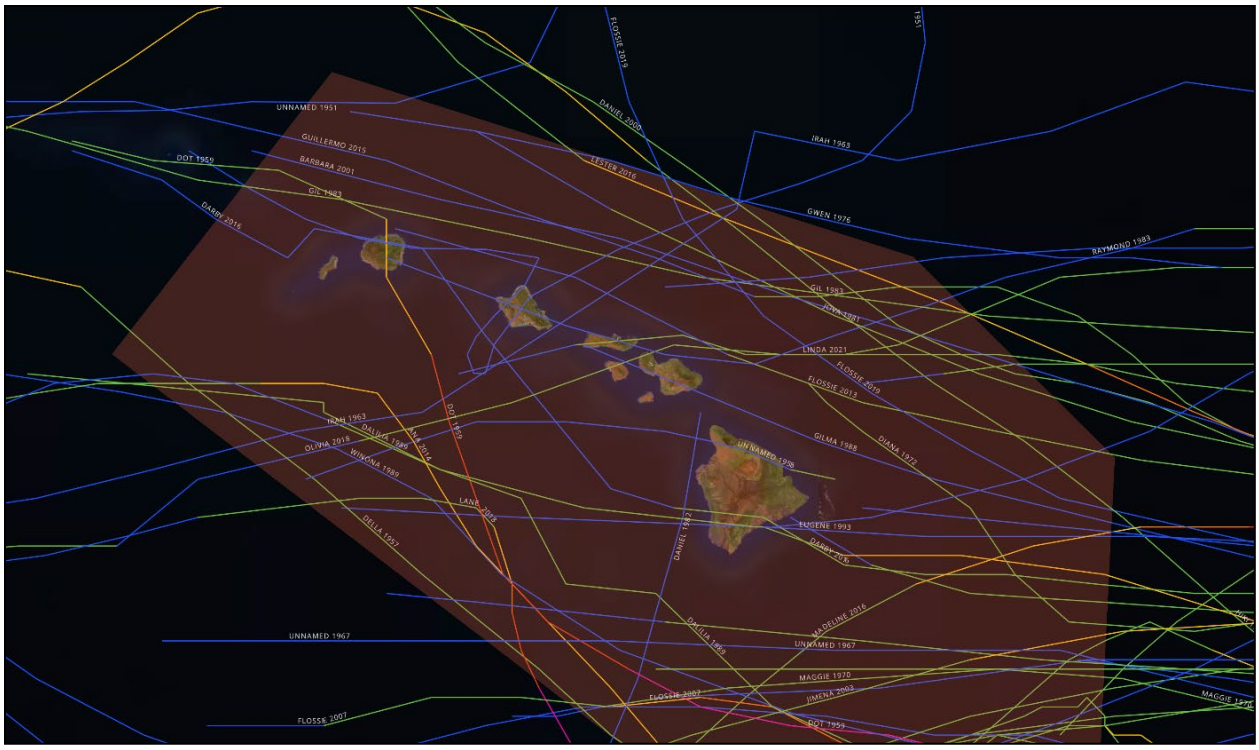


Figure 7-34. Hawai'i historical tropical storms and depressions from 1949 to 2022 (NOAA,2024)

7.4.3.2 Northwest Swell

Existing Conditions

For extreme deepwater waves associated with northwest swell, wave buoy data was compiled from CDIP Buoy Station 106 located approximately 100 miles northwest from Honokōwai Beach. This buoy was chosen for extreme wave analysis instead of CDIP Buoy Station 187 because of the longer data period, which is required for extreme wave analysis (minimum 1/3 of the desired return period (e.g., 50-year return period required a minimum of 16.7 years of data). The exposure window for this buoy is also similar to that for Station 187 and hence is suitable for extreme deepwater wave analyses for the project site. Wave data for this buoy spans a 22-year period between December 2001 and February 2023 and includes significant wave height (Hs), peak period (Tp), and direction from true north (degrees, TN). Extreme wave heights were investigated by filtering the buoy data by direction and period for waves approaching from the north, with periods of 12 seconds or greater. Wave height versus return period is shown in Figure 7-35 and Table 7-16. The ten largest wave events associated with northwest swell during the period of record are shown in Table 7-17.

7.4.3.3 North Swell

Existing Conditions

For extreme deepwater waves associated with north swell, wave buoy data was compiled from CDIP Buoy Station 106. Extreme wave heights were investigated by filtering the buoy data by direction and period for waves approaching from the north direction, with periods of 12 seconds or greater. Wave height versus return period is shown in Figure 7-36 and Table 7-18. The ten largest wave events associated with north swell during the period of record are shown in Table 7-19.

7.4.3.4 South Swell

Existing Conditions

For extreme deepwater waves associated with southern swell, wave buoy data was compiled from CDIP Buoy Stations 146 and 239 located approximately 2.6 miles south-southwest of Kaumalapau Harbor (shown previously in Figure 7-27). Wave data for these buoys spans a 10-year period between October 2010 and February 2023. The data period is less than the required 16.7 years; however, these buoys provide the longest and only available record for south swell within the region. Extreme wave heights were investigated by filtering the buoy data by direction and period for waves approaching from the south to southwest directions, with periods of 12 seconds or greater. Wave height versus return period is shown in Figure 7-37 and Table 7-20. The ten largest wave events associated with south swell during the period of record are shown in Table 7-21.

7.4.3.5 Kona Storm Waves

Existing Conditions

For extreme deepwater waves associated with Kona storm waves (seas), wave buoy data was compiled from CDIP Buoy Stations 146 and 239. Extreme wave heights were investigated by filtering the buoy data by direction and period for waves approaching from the west to south directions, with periods of 10 seconds or less. Wave height versus return period is shown in Figure 7-38 and Table 7-22. The ten largest wave events associated with Kona seas during the period of record are shown in Table 7-23.

Potential Impacts and Mitigation Measures

Beach restoration is not expected to have any impact on existing or future extreme deepwater waves.

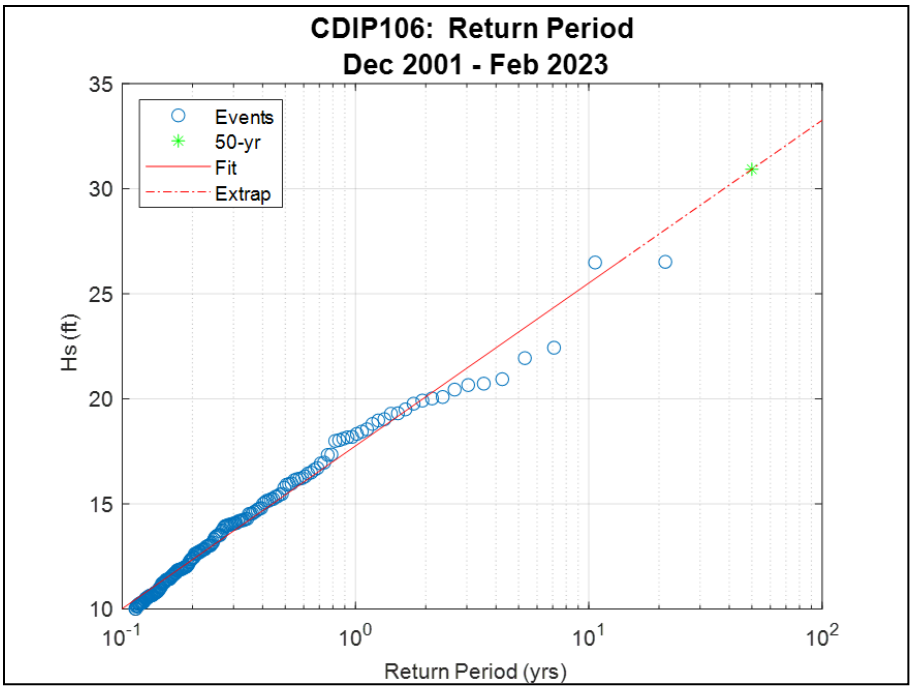


Figure 7-35. Significant wave height vs. return period, CDIP Buoy Station 106, filtered for northwest swell (Dec 2001 to Feb 2023)

Table 7-16. Significant wave height vs. return period, CDIP Buoy Station 106, filtered for northwest swell (Dec 2001 to Feb 2023)

Return Period	Hs (ft)
1	17.8
5	23.2
10	25.5
25	28.6
50	30.9

Table 7-17. Ten largest northwest swell events recorded at CDIP Buoy Station 106

Date	Hs (ft)	Tp (sec)	Dp (deg. TN)
2019-02-11	26.5	15	334
2016-02-22	26.5	17	334
2003-01-05	22.4	18	319
2014-01-23	21.9	18	307
2007-12-04	20.9	15	339
2016-01-16	20.7	17	324
2004-01-10	20.7	18	318
2023-01-23	20.4	18	312
2009-12-08	20.1	18	325
2002-01-07	20.0	18	315

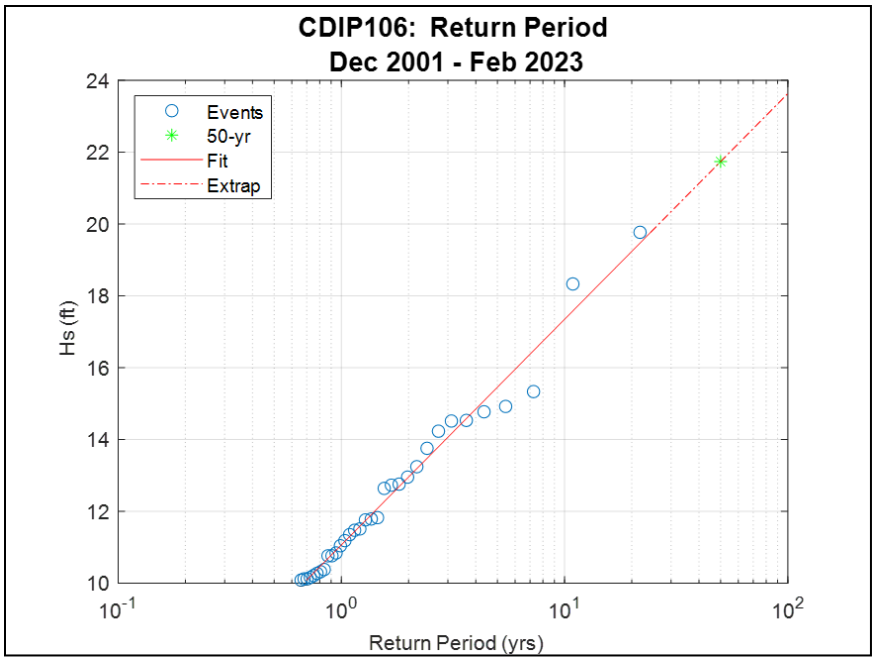


Figure 7-36. Significant wave height vs. return period, CDIP Buoy Station 106, filtered for north swell (Dec 2001 to Feb 2023)

Table 7-18. Significant wave height vs. return period, CDIP Buoy Station 106, filtered for north swell (Dec 2001 to Feb 2023)

Return Period	Hs (ft)
1	11.1
5	15.5
10	17.3
25	19.8
50	21.7

Table 7-19. Ten largest north swell events recorded at CDIP Buoy Station 106

Date	Hs (ft)	Tp (sec)	Dp (deg. TN)
2009-03-14	19.8	15	10
2013-11-13	18.3	17	359
2003-11-29	15.3	13	3
2002-11-30	14.9	17	359
2021-03-14	14.8	12	8
2019-12-02	14.5	14	359
2009-11-12	14.5	13	18
2022-11-25	14.2	17	356
2020-02-08	13.8	13	13
2021-12-05	13.2	15	359

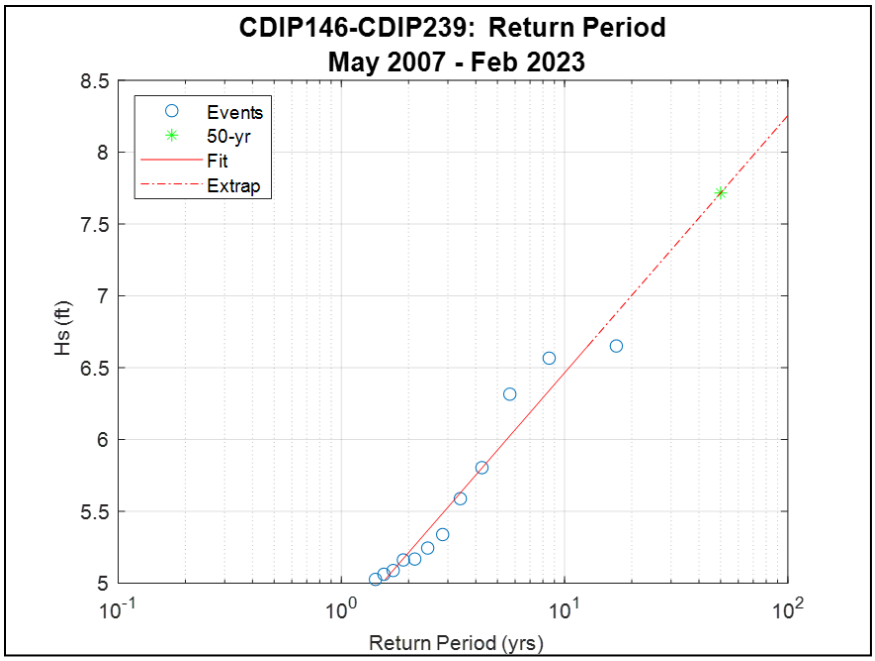


Figure 7-37. Significant wave height vs. return period, CDIP Buoy Station 146/239, filtered for south swell (May 2007 to Feb 2023)

Table 7-20. Significant wave height vs. return period, CDIP Buoy Station 146/239, filtered for south swell (May 2007 to Feb 2023)

Return Period	Hs (ft)
1	4.7
5	5.9
10	6.5
25	7.2
50	7.7

Table 7-21. Ten largest south swell events recorded at CDIP Buoy Station 146/239

Date	Hs (ft)	Tp (sec)	Dp (deg. TN)
2019-07-14	6.7	18	186
2019-05-13	6.6	17	186
2013-05-17	6.3	17	185
2022-07-30	5.8	13	189
2020-12-25	5.6	14	200
2019-08-20	5.3	18	195
2018-10-27	5.2	15	175
2008-09-07	5.2	15	196
2014-05-17	5.2	17	195
2018-08-08	5.1	15	174

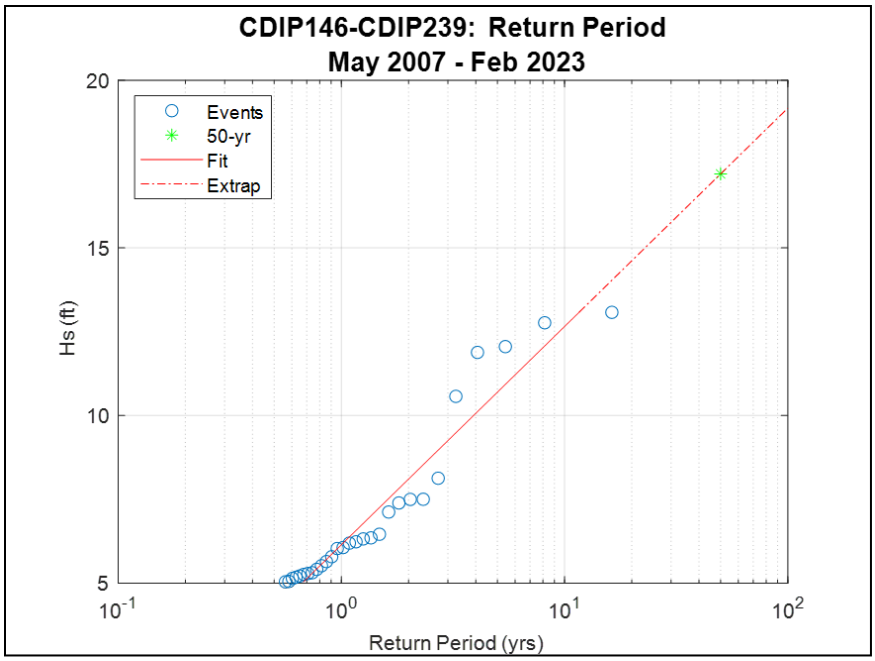


Figure 7-38. Significant wave height vs. return period, CDIP Buoy Station 146/239, filtered for Kona storm waves (May 2007 to Feb 2023)

Table 7-22. Significant wave height vs. return period, CDIP Buoy Station 146/239, filtered for Kona storm waves (May 2007 to Feb 2023)

Return Period	Hs (ft)
1	6.1
5	10.7
10	12.7
25	15.2
50	17.2

Table 7-23. Ten largest Kona storm wave events recorded at CDIP Buoy Station 146/239

Date	Hs (ft)	Tp (sec)	Dp (deg. TN)
2007-12-05	13.1	8	224
2019-02-11	12.8	8	273
2015-01-03	12.1	8	257
2022-12-20	11.9	8	265
2015-02-14	10.6	8	247
2014-01-23	8.1	8	282
2020-03-17	7.5	5	283
2009-01-17	7.5	8	273
2017-02-12	7.4	7	238
2017-02-07	7.1	8	287

7.4.4 Numerical Wave Modeling

The design of coastal structures requires determination of the prevailing and design wave conditions along the project site shoreline. 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 can cause wave crests to converge or diverge and may locally increase or decrease wave heights. Not strictly a shallow water phenomenon, wave diffraction is the lateral transmission of wave energy along the wave crest and would cause the spreading of waves in a shadow zone, such as occurs behind a breakwater or other barrier. Two numerical wave models - SWAN and XBeach-NH - were utilized for this study to simulate the wave transformation from deep water to the project site.

SWAN

Simulating Waves Nearshore (SWAN) is a third-generation wave model developed by Delft University of Technology that computes random, short-crested wind-generated waves in coastal regions and inland waters (*Booij et al, 1999*). The SWAN model can be applied as a steady state[33] or non-steady state model[34] and is fully spectral (over the total range of wave frequencies). Wave propagation is based on linear wave theory, including the effect of wave generated currents. SWAN provides many output quantities, including two-dimensional spectra, significant wave height and mean wave period, and average wave direction and directional spreading. For this project, the SWAN model was used to transform waves from deep water to intermediate water depths just offshore from the project site. SWAN model results were used to provide wave parameter input for a nearshore numerical wave model, XBeach.

XBeach-NH

As waves move into shallow water, bathymetry has a greater influence on wave behavior. Waves interact with the bottom, dissipating more energy through depth-induced breaking and bottom friction. Results of the SWAN model for the prevailing wave and extreme 50-year wave conditions were modeled from just offshore of project site into the nearshore region using the XBeach non-hydrostatic (XBeach-NH) numerical model. XBeach is an open-source numerical wave model originally developed to simulate hydrodynamic and morphological processes along sandy shorelines.

[33] **Steady-state Model:** System variables remain constant over time, or change only in a predictable, fixed way. Assumes the system has reached a point where it no longer experiences significant fluctuations or transient behaviors.

[34] **Non-steady State Model:** System variables change over time, meaning the system is in a dynamic or transient state, not at equilibrium. Assumes conditions fluctuate or evolve in response to external or internal influences, and they do not settle into a constant or predictable pattern.

The XBeach-NH module (*Stelling and Zijlema, 2003*) computes the depth-averaged flow due to waves and currents using the non-linear shallow water equations and includes a non-hydrostatic pressure term. The governing equations are valid from intermediate to shallow water and can simulate most of the phenomena of interest in the nearshore zone and in harbor basins, including shoaling and refraction over variable bathymetry, reflection and diffraction near structures, energy dissipation due to wave breaking and bottom friction, breaking-induced longshore/cross-shore ("rip") currents, and harbor oscillations. XBeach-NH is a phase resolving model, meaning that wave crests and troughs are modeled and propagated in time and space. The result is an accurate representation of wave heights and wave patterns across the domain.

7.4.5 Offshore Wave Transformation

The SWAN wave model was used to simulate the prevailing and design wave conditions presented in Section 7.4.2. An unstructured mesh grid was developed for the SWAN model that covers the island of Maui, Molokaʻi, Lānaʻi, and Kahoʻolawe (see Figure 7-39). Unstructured mesh grids allow for coarse resolution in offshore regions where waves are not influenced by the seafloor and fine resolution nearshore where wave transformation is more of a function of the water depth. The resolution of the SWAN domain varies from 0.6 mi (1 km) offshore in deepwater to 656 ft (200 m) in intermediate water depths within the model domain. The grid resolution is further refined around West Maui to a resolution of 164 ft (50 m).

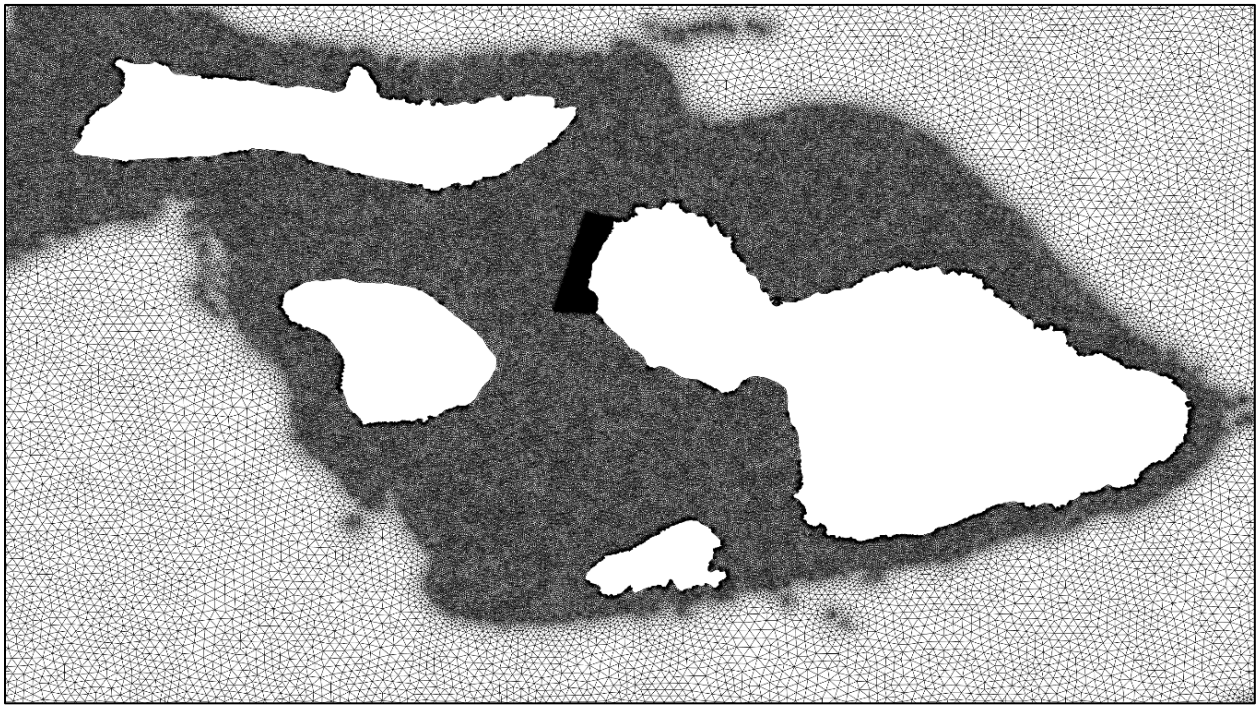


Figure 7-39. SWAN unstructured grid

7.4.5.1 Prevailing Waves

The most prevalent waves at Honokōwai are winter north swells and summer south swells. Table 7-24 lists the deepwater wave parameters (see Section 7.4.2) used as input for the SWAN model for each prevailing wave condition. These parameters are applied along all boundaries of the unstructured SWAN grid. Figure 7-40 and Figure 7-41 show the modeled output for significant wave height near the project site for the prevailing north and south swell, respectively.

Table 7-24. Modeled prevailing wave cases (inputs to SWAN model)

Wave Case	Deepwater Wave Parameters		
	Hs (ft)	Tp (seconds)	Dir. (deg. TN)
North Swell	2.9	12	360
South Swell	1.9	14	190

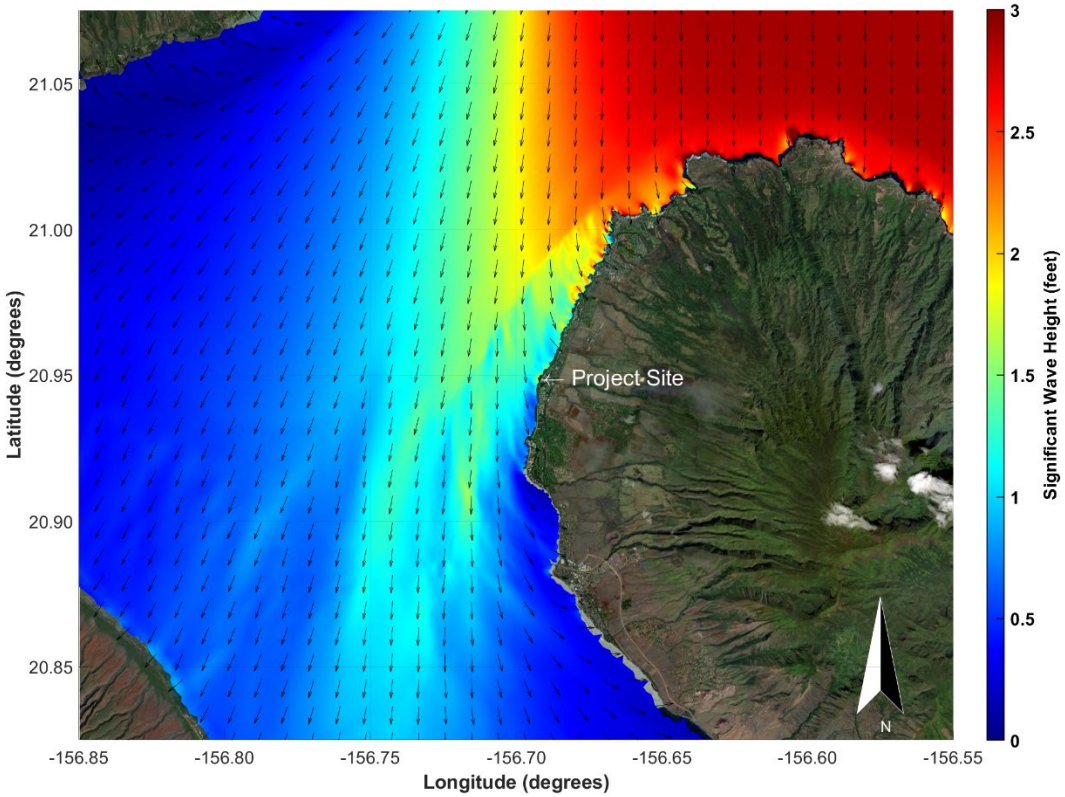


Figure 7-40. Significant wave height from SWAN model for a prevailing north swell

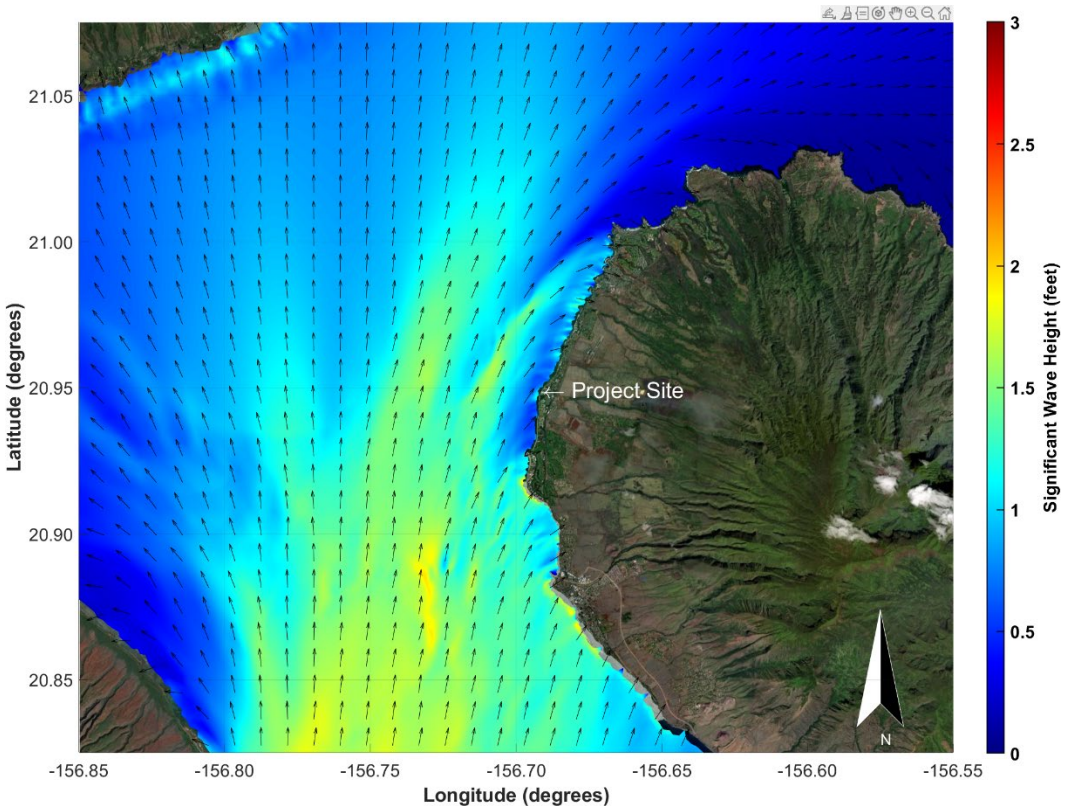


Figure 7-41. Significant wave height from SWAN model for a prevailing south swell

7.4.5.2 Extreme Waves

Table 7-25 lists the deepwater wave parameters (see Section 7.4.3) used as input for the SWAN model for each scenario extreme wave condition. These parameters are applied along all boundaries of the unstructured SWAN grid. Figure 7-42 through Figure 7-45 show the modeled output for significant wave height near the project site for each of the four wave cases.

Table 7-25. Modeled wave cases (inputs to SWAN model)

Wave Case	Deepwater Wave Parameters		
	Hs (ft)	Tp (seconds)	Dir. (deg. TN)
50yr NW Swell	30.9	18	339
50yr N Swell	21.7	17	5
50yr S Swell	7.7	18	195
50yr Kona Seas	17.2	8	275

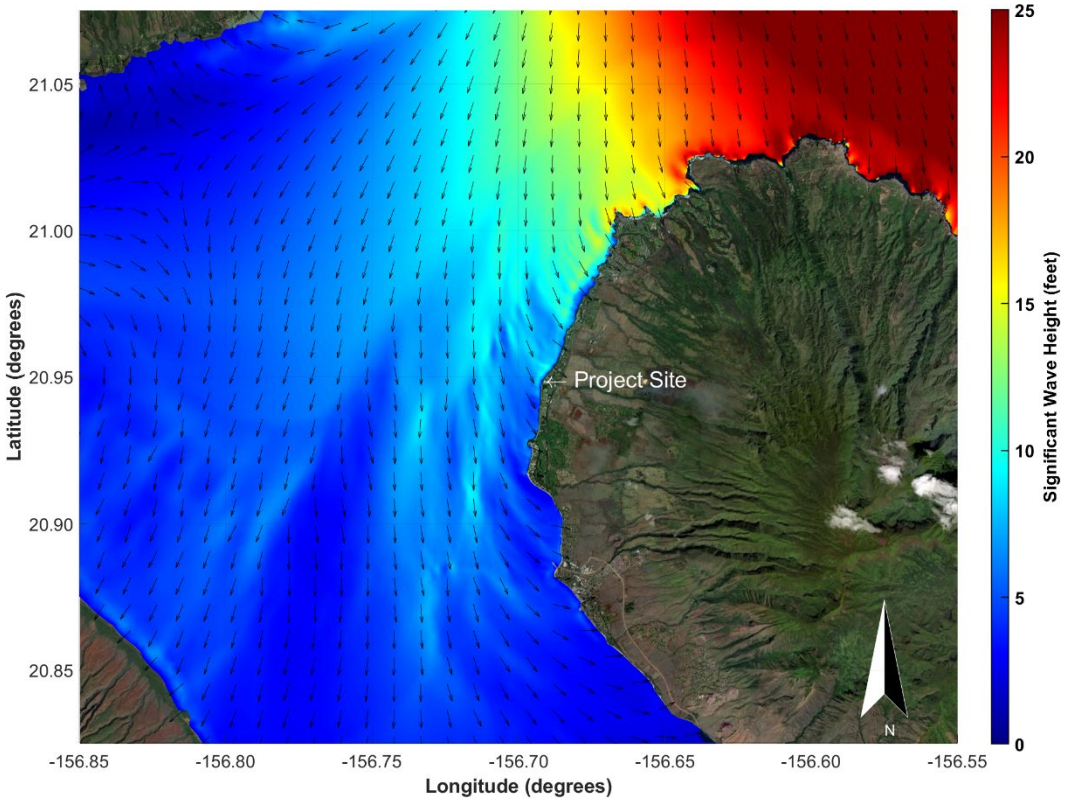


Figure 7-42. Significant wave height from SWAN model for a 50-year northwest swell

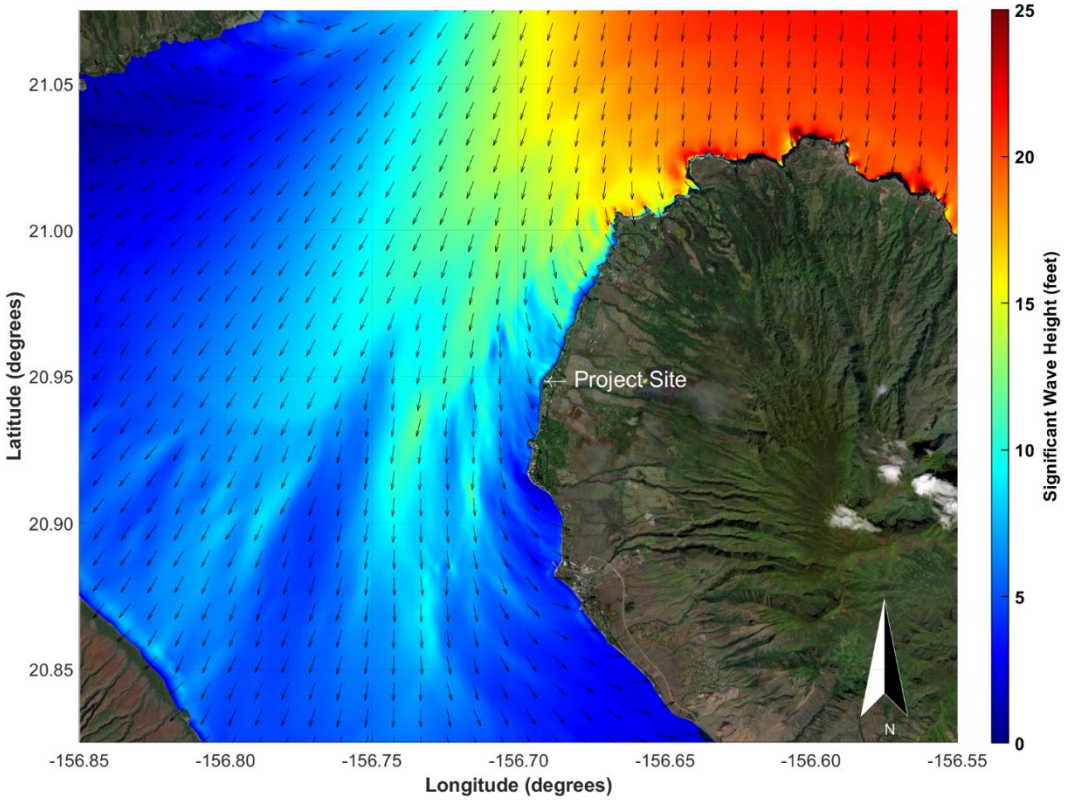


Figure 7-43. Significant wave height from SWAN model for a 50-year north swell

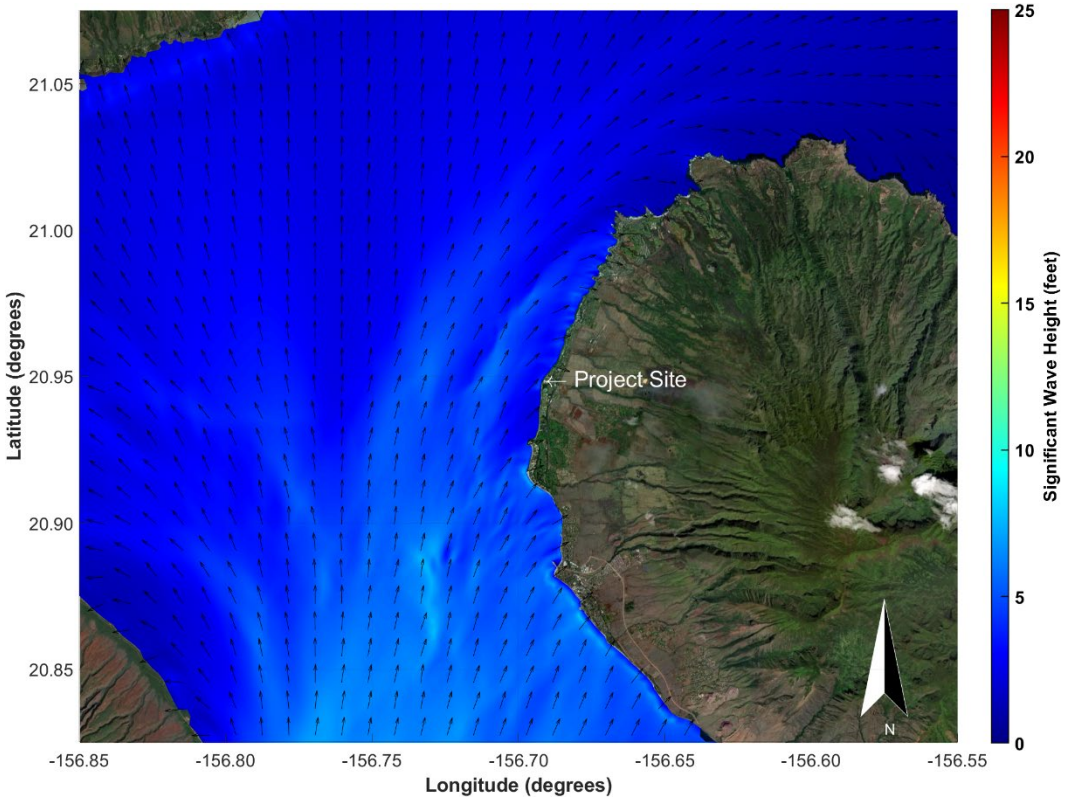


Figure 7-44. Significant wave height from SWAN model output for a 50-year south swell

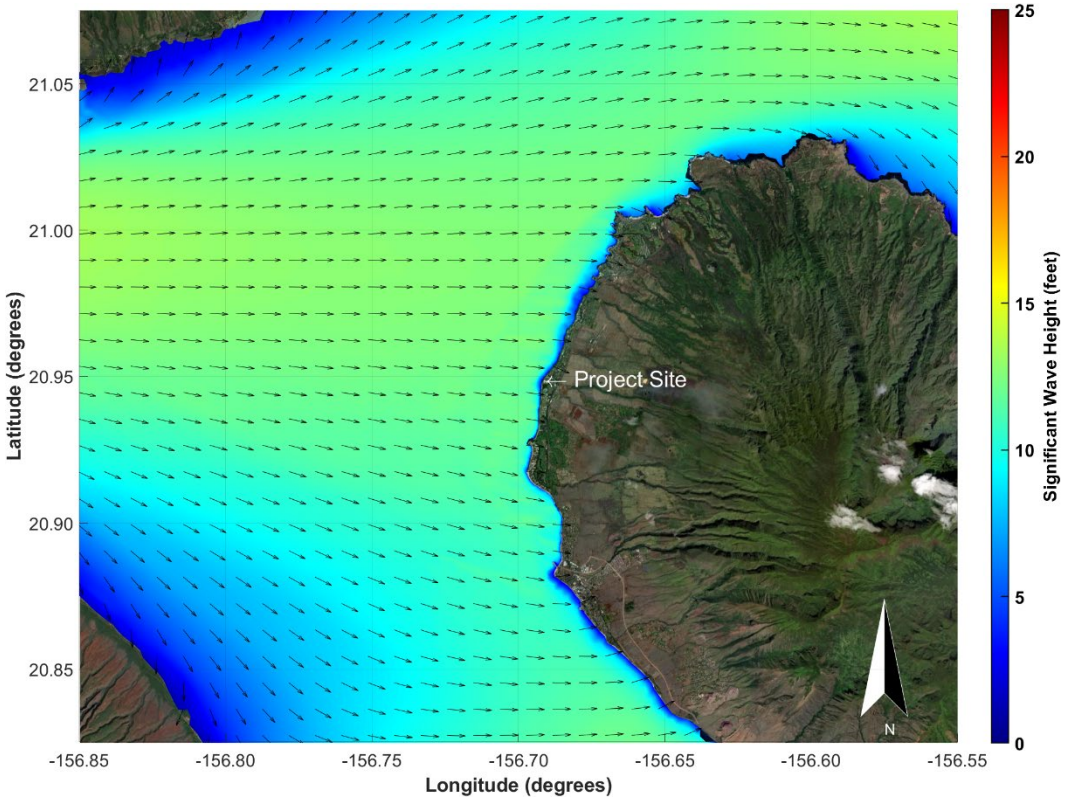


Figure 7-45. Significant wave height from SWAN model for a 50-year Kona storm

7.4.6 Nearshore Wave Transformation

The XBeach-NH model was used to simulate the wave transformation from intermediate water depths to the project site shoreline and surrounding nearshore waters. Model bathymetry was adapted from the USACE SHOALS LiDAR dataset and the *Continuously Updated Digital Elevation Model (CUDEM) - Ninth Arc-Second Resolution Bathymetric-Topographic Tiles for the Hawaiian Islands*. A model resolution of 13 ft (4 m) was chosen. Figure 7-46 shows the XBeach-NH model extent. Results from the SWAN model runs were used as input to the XBeach-NH model runs for prevailing and extreme wave cases. The output parameters from XBeach-NH include water surface elevation, significant wave height, wave setup, and depth-averaged velocity over the model domain.



Figure 7-46. XBeach-NH model domain extent

7.4.6.1 Prevailing Waves

North Swell

Figure 7-47, Figure 7-48, and Figure 7-49 show the XBeach-NH model outputs for water surface elevation (single snapshot), significant wave height, and depth-averaged flow velocity for a prevailing north swell.

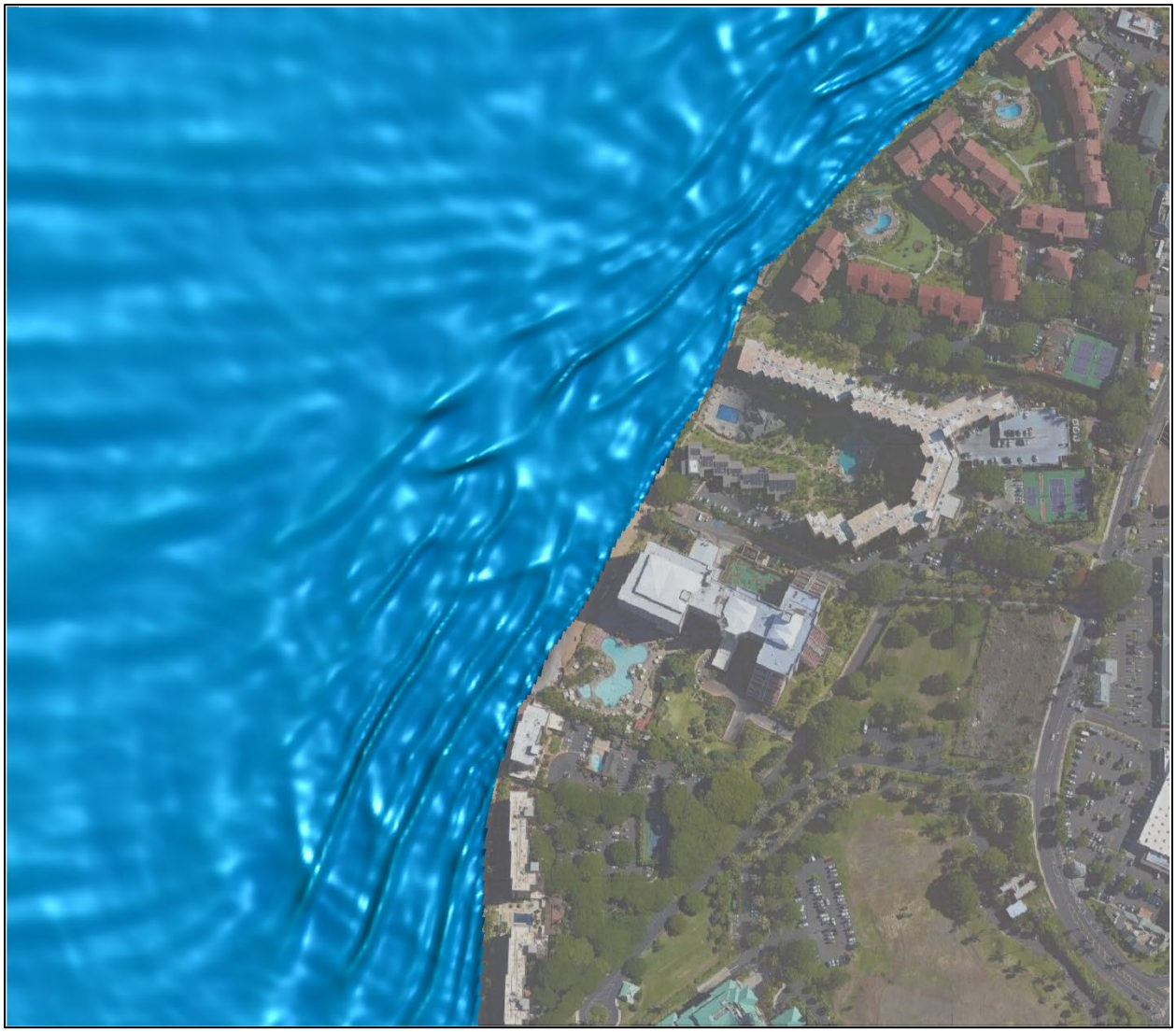


Figure 7-47. Water surface snapshot from XBeach-NH model for a prevailing north swell

The XBeach-NH model output for water surface elevation (single snapshot) for a prevailing north swell is shown in Figure 7-47. The modeled nearshore wave pattern shows an oblique wave crest orientation angle relative to the Project Site shoreline. This difference in wave crest and shoreline orientation may promote longshore sediment transport from north to south during the winter months when North Pacific swell dominates. This general seasonal sediment transport trend has been observed at the project shoreline through historical aerial images and on-site monitoring.

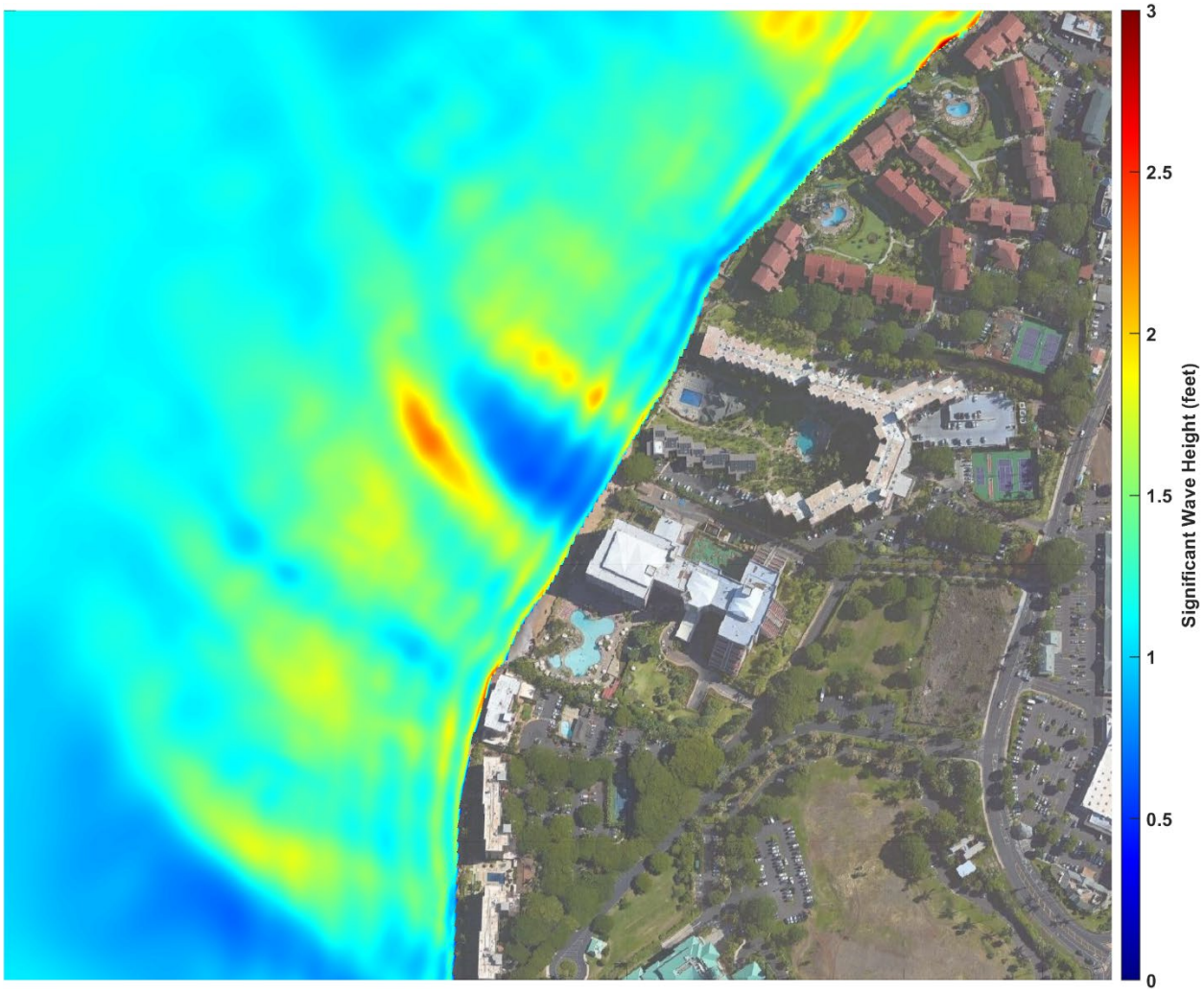


Figure 7-48. Significant wave height from XBeach-NH model for a prevailing north swell

The XBeach-NH model output for significant wave height for a prevailing north swell is shown in Figure 7-48. The modeled significant wave height along the Project Site shoreline varies with wave heights up to 2 ft on the shallow reef flat and wave heights less than 1 ft in the deeper channel. This is expected as the waves in the deeper channel will maintain their speed while waves passing over the shallower reef will decrease in speed. The shallower areas will generally attract more wave energy than the deep channels as waves refract over the complex seafloor. The model results provide a useful tool for identifying areas along the shoreline that attract more energy than other areas.

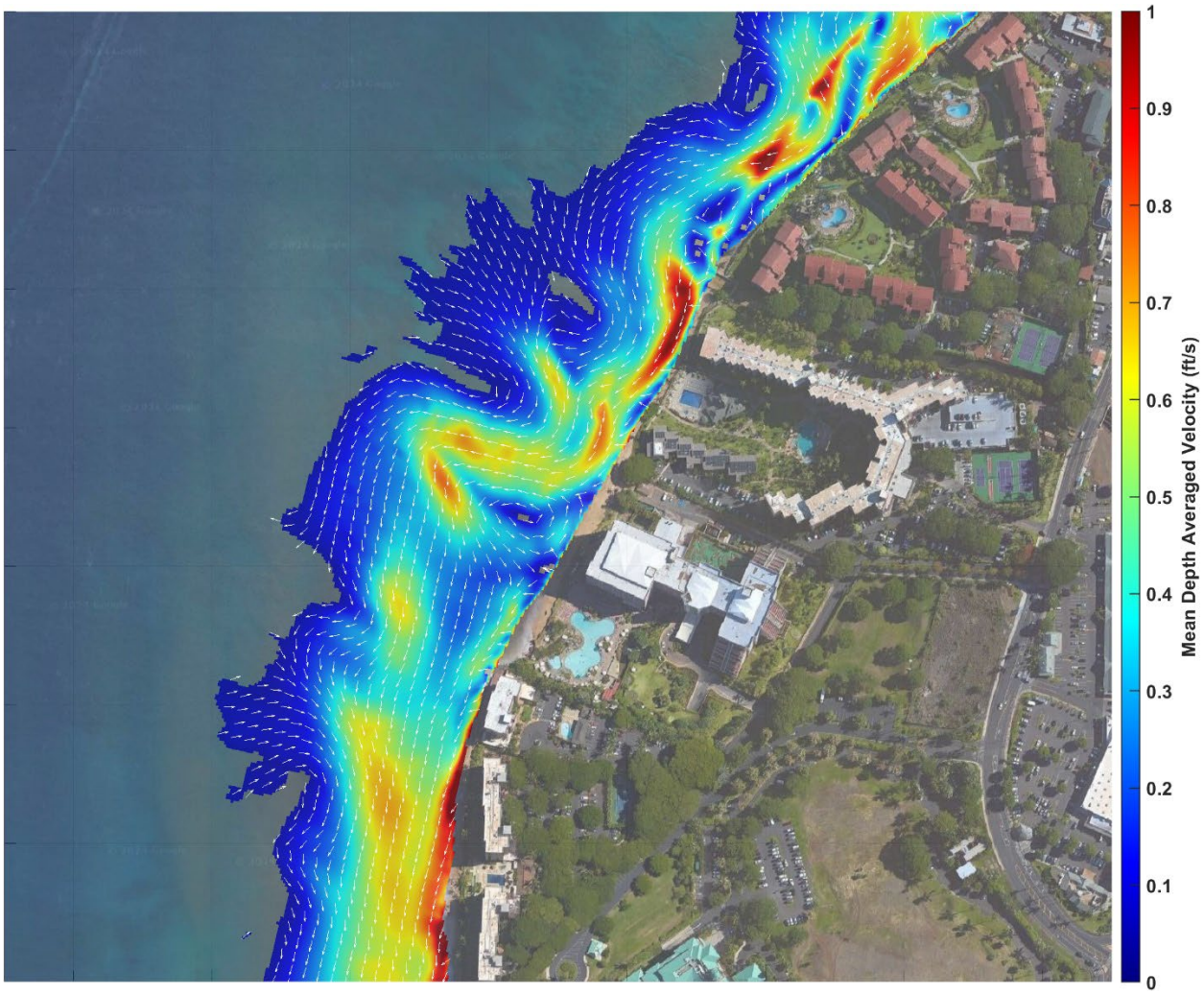


Figure 7-49. Depth-averaged flow velocity from XBeach-NH for a prevailing north swell

The XBeach-NH model output for depth-averaged flow velocity for a prevailing north swell is shown in Figure 7-49. The modeled depth-averaged flow patterns show a north to south flow of water along the shoreline. This trend in nearshore currents is likely attributed to the oblique wave approach discussed previously. This flow of water from north to south may promote longshore sediment transport in this direction during the winter months when North Pacific Swell dominates. Any sediment suspended from the beach and transported by waves into the nearshore waters would be expected to be transported by these nearshore currents until they settle on the seafloor.

South Swell

Figure 7-50, Figure 7-51, and Figure 7-52 show the XBeach-NH model outputs for water surface elevation (single snapshot), significant wave height, and depth-averaged flow velocity for a prevailing south swell.

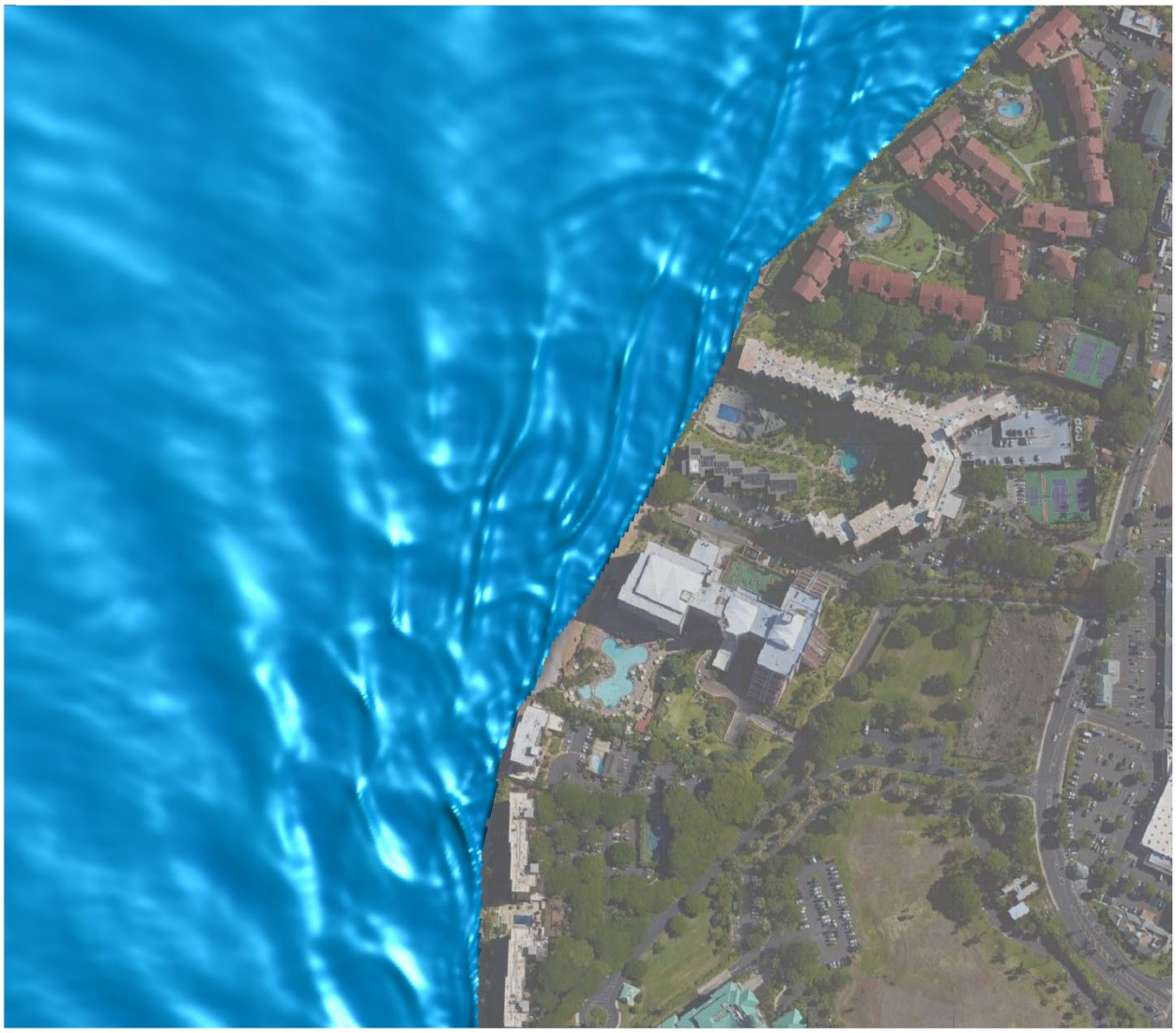


Figure 7-50. Water surface snapshot from XBeach-NH model for a prevailing south swell

The XBeach-NH model output for water surface elevation (single snapshot) for a prevailing south swell is shown in Figure 7-50. The modeled nearshore wave pattern shows an oblique wave crest orientation angle relative to the Project Site shoreline. This difference in wave crest and shoreline orientation may promote longshore sediment transport from south to north during the summer months when South Pacific Swell dominates. This general seasonal sediment transport trend has been observed at the project shoreline through historical aerial images and on-site monitoring.

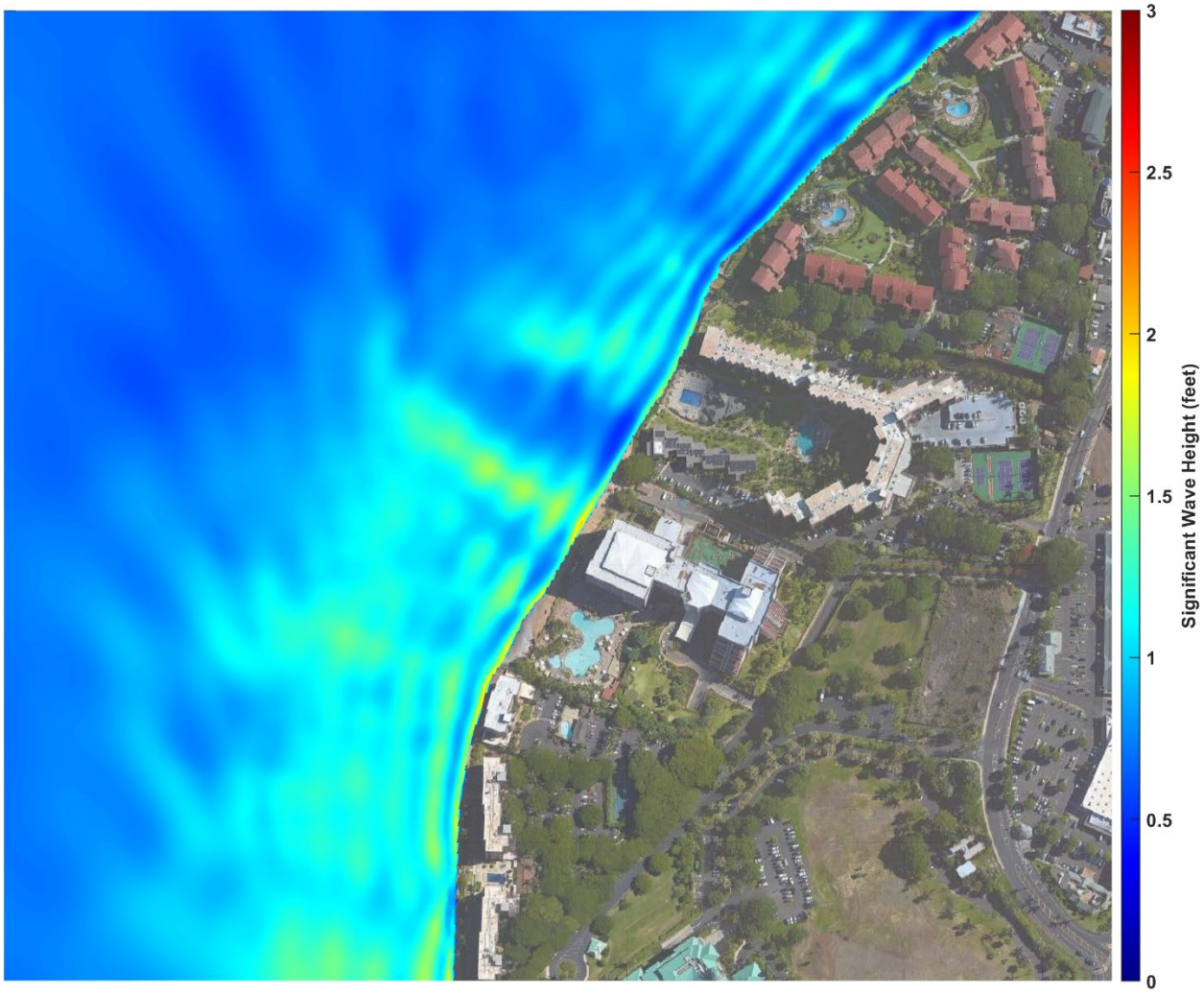


Figure 7-51. Significant wave height from XBeach-NH model for a prevailing south swell

The XBeach-NH model output for significant wave height for a prevailing south swell is shown in Figure 7-51. The modeled significant wave height along the Project Site shoreline varies with wave heights up to 1.5 ft on the shallow reef flat and wave heights less than 1 ft in the deeper channel. This is expected as the waves in the deeper channel will maintain their speed while waves passing over the shallower reef decrease in speed. The shallower areas will generally attract more wave energy than the deep channels as waves refract over the complex seafloor. The model results provide a useful tool in identifying areas along the shoreline that attract more energy than other areas.

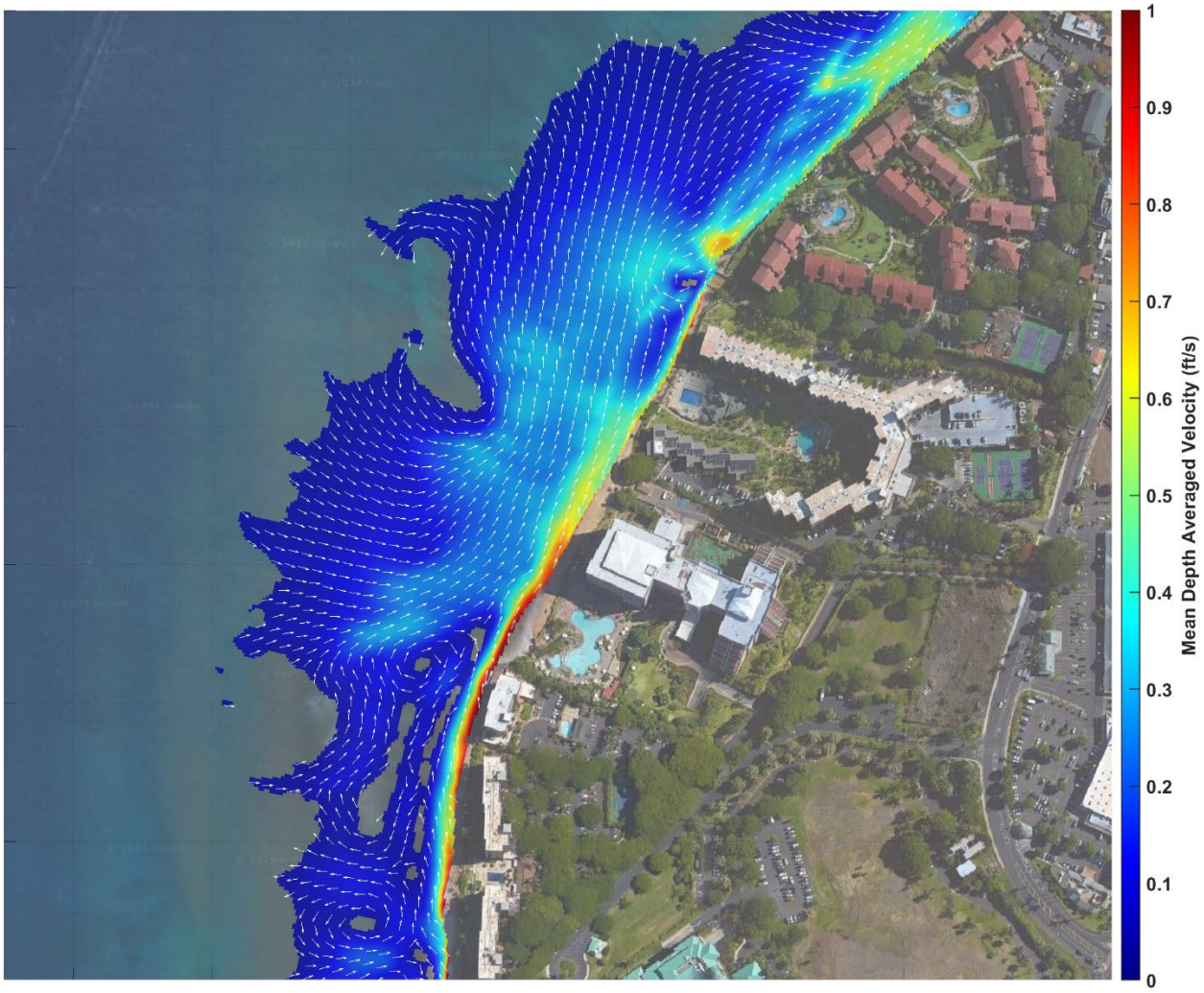


Figure 7-52. Depth-averaged flow velocity from XBeach-NH for a prevailing south swell

The XBeach-NH model output for depth-averaged flow velocity for a prevailing south swell is shown in Figure 7-52. The modeled depth-averaged flow patterns show a south to north flow of water along the shoreline. This trend in nearshore currents is likely attributed to the oblique wave approach discussed previously. This flow of water from south to north may promote longshore sediment transport in this direction during the summer months when South Pacific Swell dominates. Any sediment suspended from the beach and transported by waves into the nearshore waters would be expected to be transported by these nearshore currents until they settle on the seafloor.

7.4.6.2 Extreme Waves

Results from the SWAN model were used as input parameters to the XBeach-NH model for the 50-year return period northwest swell, north swell, south swell, and Kona storm cases. XBeach-NH model outputs for significant wave height for the 50-year northwest swell, north swell, south swell, and Kona storm are shown in Figure 7-53, Figure 7-54, Figure 7-55, and Figure 7-56, respectively.

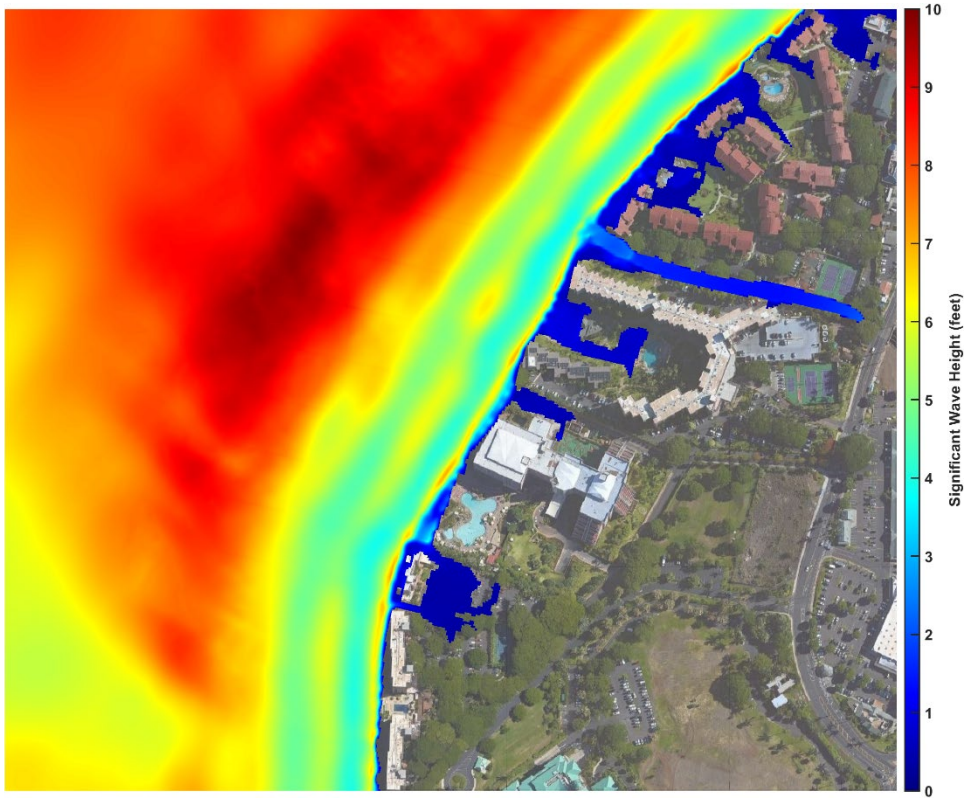


Figure 7-53. Significant wave height from XBeach-NH model for a 50-year northwest swell

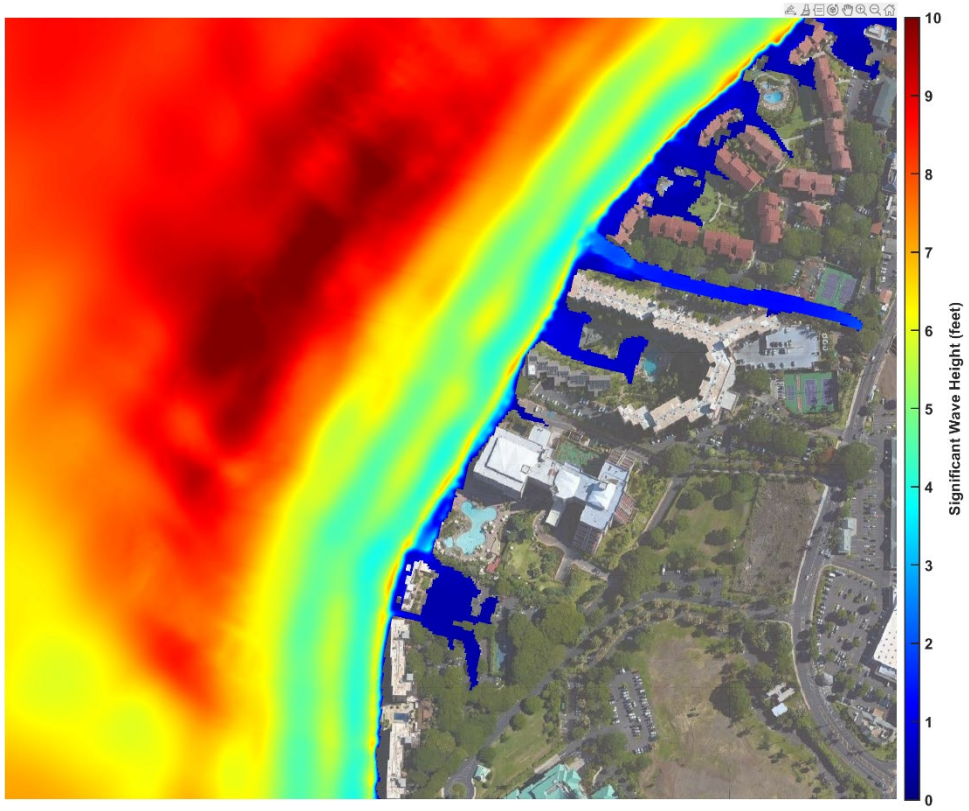


Figure 7-54. Significant wave height from XBeach-NH model for a 50-year north swell

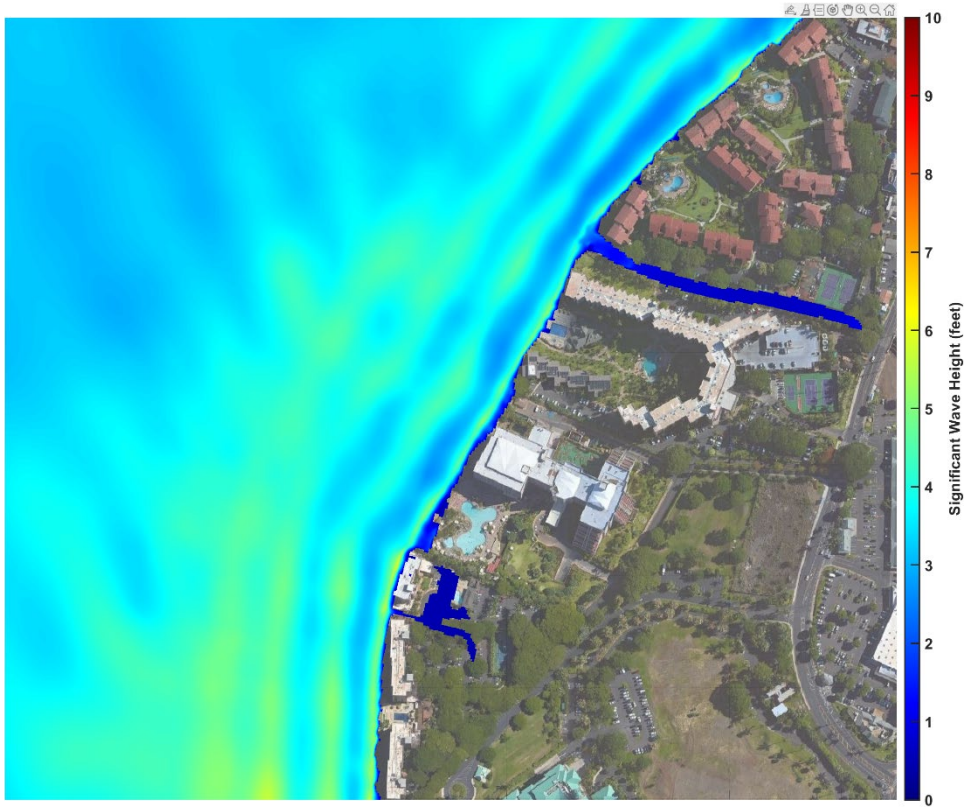


Figure 7-55. Significant wave height from XBeach-NH model for a 50-year south swell

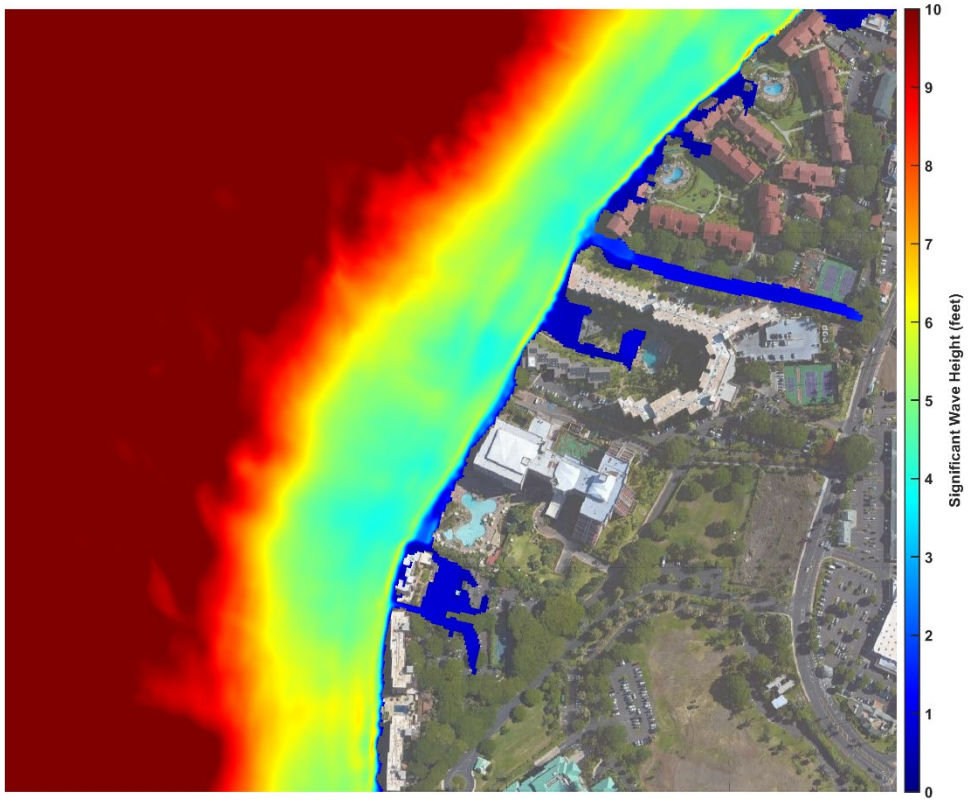


Figure 7-56. Significant wave height from XBeach-NH model for 50-year Kona seas

XBeach-NH modeled wave heights at the groin locations (see Section 3.4) were extracted from each model run. The modeled timeseries of the water surface elevation was analyzed to determine the statistical wave heights including significant wave height, H_s, which represents the highest one-third of waves within a spectrum and $H_{1/10}$ which represents the highest 10% of waves within a spectrum. These statistical wave heights are commonly used for coastal structure stability design. The largest significant wave height, H_s, and $H_{1/10}$ values are summarized below in Table 7-26 and Table 7-27. The largest wave height was found to be associated with the 50-yr northwest swell event and will be used for the design of coastal structures.

Table 7-26. Modeled design wave heights from XBeach-NH

Wave Case	Design Wave Heights	
	H_s (ft)	$H_{1/10}$ (ft)
50-yr Northwest Swell	6.4	8.2
50-yr North Swell	5.9	7.5
50-yr South Swell	4.0	5.1
50-yr Kona Seas	6.1	7.8

Table 7-27. Design conditions

	50-yr Northwest Swell	50-yr North Swell	50-yr South Swell	50-yr Kona Seas
Deepwater Wave Type				
H_s (ft)	30.9	21.7	7.7	17.2
T_p (sec)	18	17	18	8
Dir (deg, TN)	339	5	195	275
Still Water Level Rise				
Astronomical tide (ft)	1.1	1.1	1.1	1.1
Sea level rise (ft)	3.3	3.3	3.3	3.3
Sea level anomaly (ft)	0.5	0.5	0.5	0.5
Total SWL rise (ft)	4.9	4.9	4.9	4.9
Design Wave Height				
H_s (ft)	6.4	5.9	4.0	6.1
$H_{1/10}$ (ft)	8.2	7.5	5.1	7.8

7.4.7 Wave Impacts Analysis

To evaluate the potential for groins to reflect wave energy and alter existing wave patterns, wave modeling with the groins was performed using the XBeach-NH model. Model bathymetry was modified to include the groin field. The model was used to simulate prevailing and annual north and south swell events for the modified shoreline configurations.

Observation points were included in the model and were positioned at two popular surf sites: *Hotels* and *Rainbows*. These sites were selected based on their popularity for surfing and their locations relative to the groins. The *Hotels* surf break is a predominantly left-breaking wave located offshore of the Maui Kai Condominium at Honokōwai Point. The *Rainbows* surf break is a predominantly right-breaking wave located offshore of the Mahana Condominiums south of Honokōwai Point. In addition to these locations, the analysis also evaluated the potential impacts of wave reflection on existing waves in the immediate vicinity of the groins that are not recognized surf sites.

The following sections summarize the model results for the existing and modified shoreline configuration for prevailing and annual winter north and summer south swell. The absolute change in significant wave heights and depth-averaged flow velocity (modified flow field minus existing flow field) are shown with increasing values (red) and decreasing values (blue). A comparison of the modeled wave conditions for prevailing, annual, and design waves is shown in Table 7-28.

For prevailing and annual north swells (Figure 7-57 to Figure 7-68), the model results show a slight increase in wave energy directly offshore of the groin heads, which is likely due to wave reflection. This increase in wave height decays moving seaward from the structures until there is no change in the existing wave field. Leeward (inshore) of the groin heads, the model shows a decrease in wave height due to the sheltering effect of the groin heads.

The model results show both a slight increase and decrease in wave height within the constructed beach cells. The north and south terminal groins show that changes in wave height in the vicinity of the *Hotels* and *Rainbows* surf spots were modeled to be less than 0.5 ft. The model also shows the groin field interrupting the existing nearshore flow patterns as expected for this type of shoreline configuration. Seaward of the groin heads, the model shows an increase in flow velocity which is likely attributed to the redirection of the north to south flow under existing conditions. The model shows a general decrease in flow within each of the beach cells.

For prevailing and annual south swells (Figure 7-69 to Figure 7-80), the model results show a slight increase in wave energy directly offshore of the groin heads, which is likely due to wave reflection. This increase in wave height decays moving seaward from the structures until there is no change in the existing wave field. Leeward (inshore) of the groin heads, the model shows a decrease in wave height due to the sheltering effect of the groin heads.

The model results show both a slight increase and decrease in wave height within the constructed beach cells. The north and south terminal groins show that changes in wave height in the vicinity of the *Hotels* and *Rainbows* surf spots were modeled to be less than 0.5 ft. The model also shows the groin field interrupting the existing nearshore flow patterns as expected for this type of shoreline configuration. Seaward of the groin heads, the model shows an increase in flow velocity which is likely attributed to the redirection of the south to north flow under existing conditions. The model shows a general decrease in flow within each of the beach cells.

Table 7-28. Comparison of modeled wave conditions for prevailing, annual, and design waves

	Hs (ft)	Tp (seconds)	Dir. (deg. TN)
Prevailing Waves			
Prevailing South Swell	1.9	14	190
Prevailing North Swell	2.9	12	360
Annual Waves			
Annual South Swell	4.7	16	190
Annual North Swell	11.1	15	5
Design Waves			
50-yr North Swell	21.7	17	5
50-yr South Swell	7.7	18	195
50-yr Northwest Swell	30.9	18	339
50-yr Kona Seas	17.2	8	275

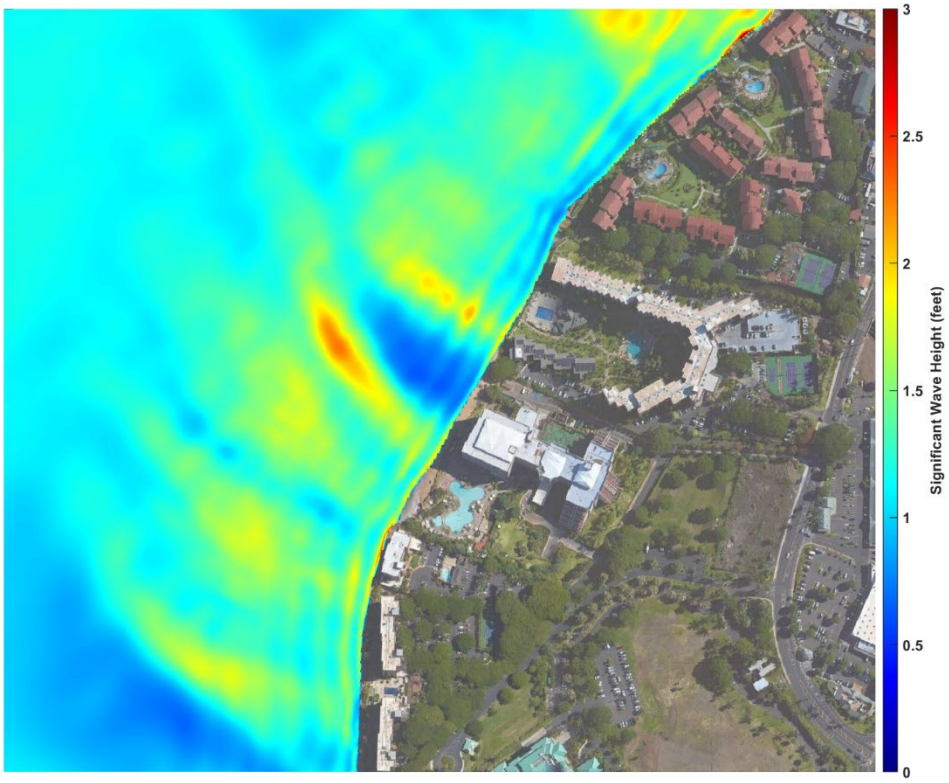


Figure 7-57. XBeach-NH modeled nearshore significant wave height for prevailing north swell (typical winter conditions)

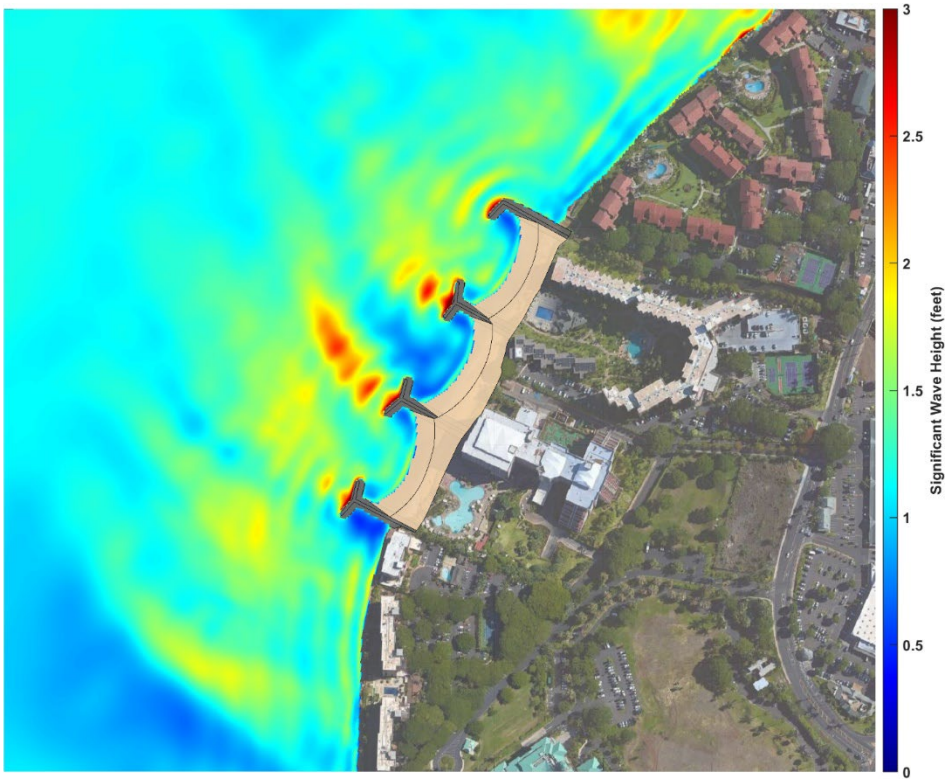


Figure 7-58. XBeach-NH modeled nearshore significant wave height for prevailing north swell (typical winter conditions) with Beach Stabilization

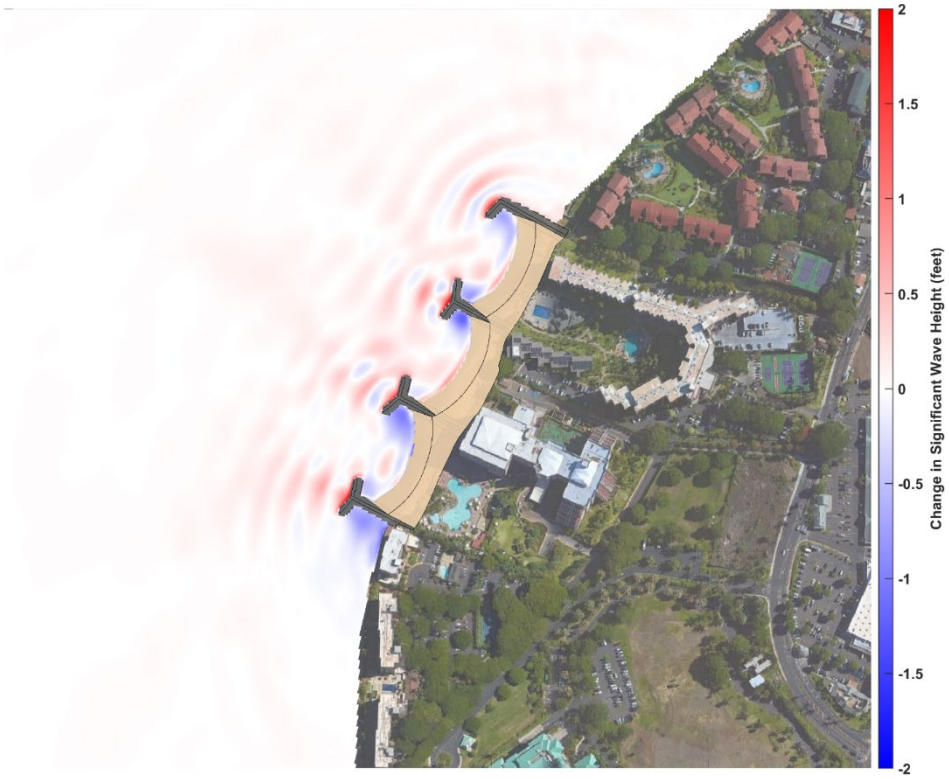


Figure 7-59. XBeach-NH modeled change in nearshore significant wave height for prevailing north swell (typical winter conditions) with Beach Stabilization

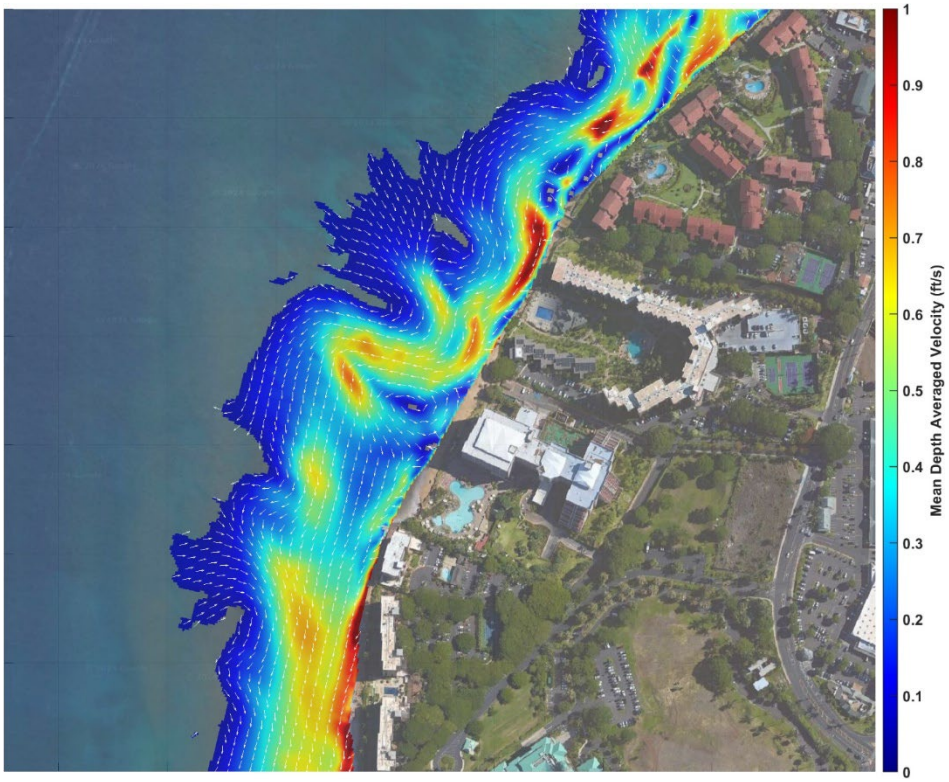


Figure 7-60. XBeach-NH modeled nearshore wave-induced current patterns for prevailing north swell (typical winter conditions)

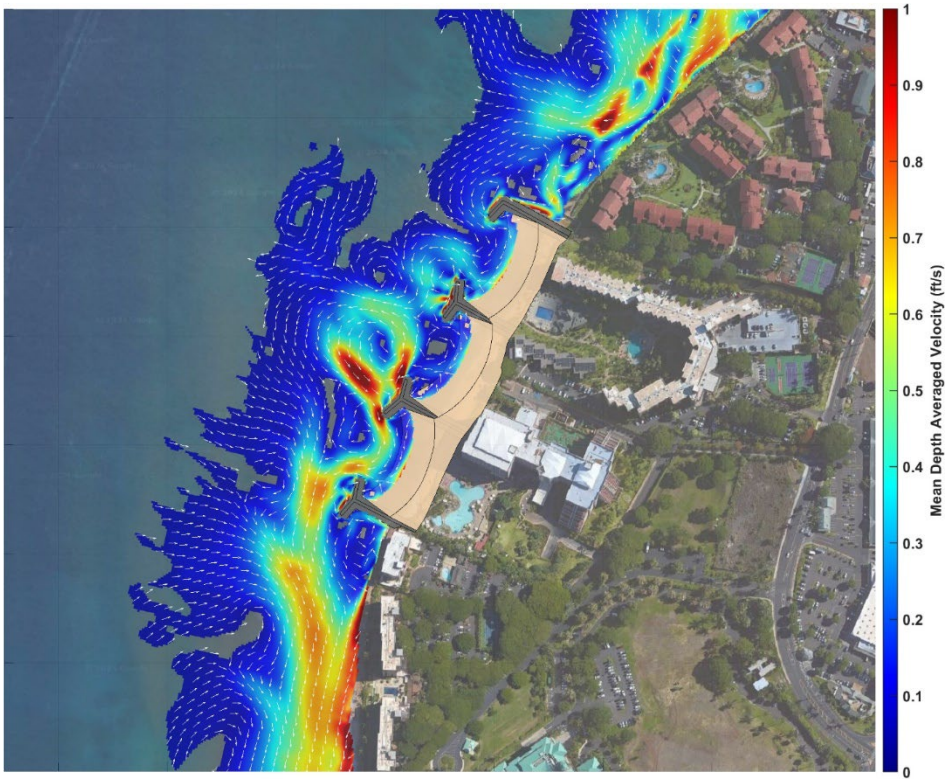


Figure 7-61. XBeach-NH modeled nearshore wave-induced current patterns for prevailing north swell (typical winter conditions) with Beach Stabilization

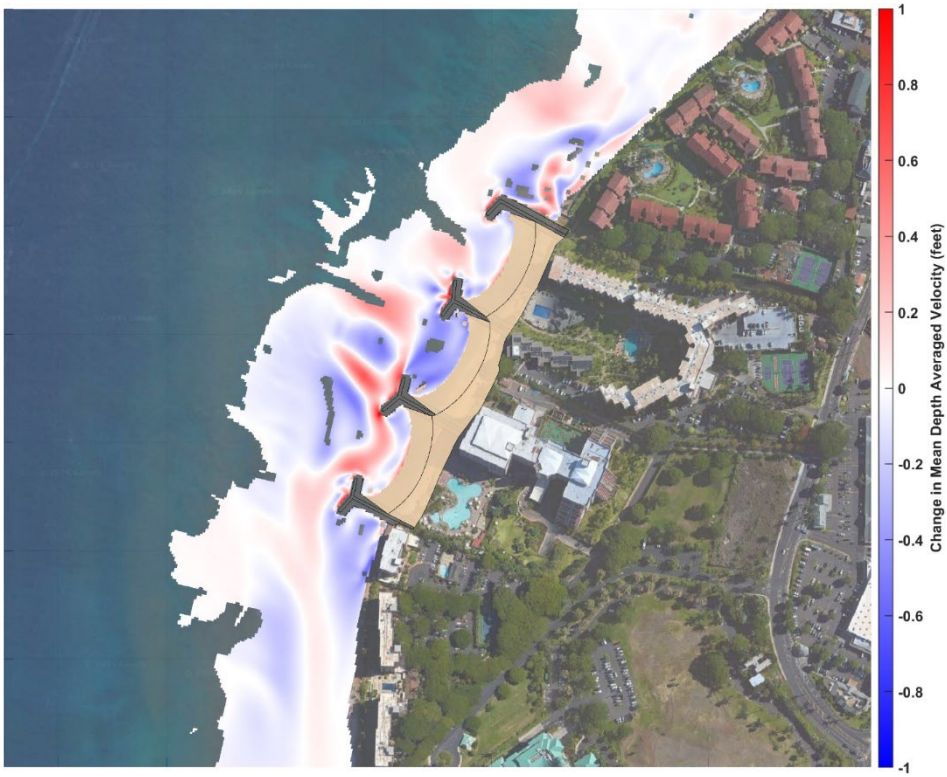


Figure 7-62. XBeach-NH modeled change in nearshore wave-induced current for prevailing north swell (typical winter conditions) with Beach Stabilization

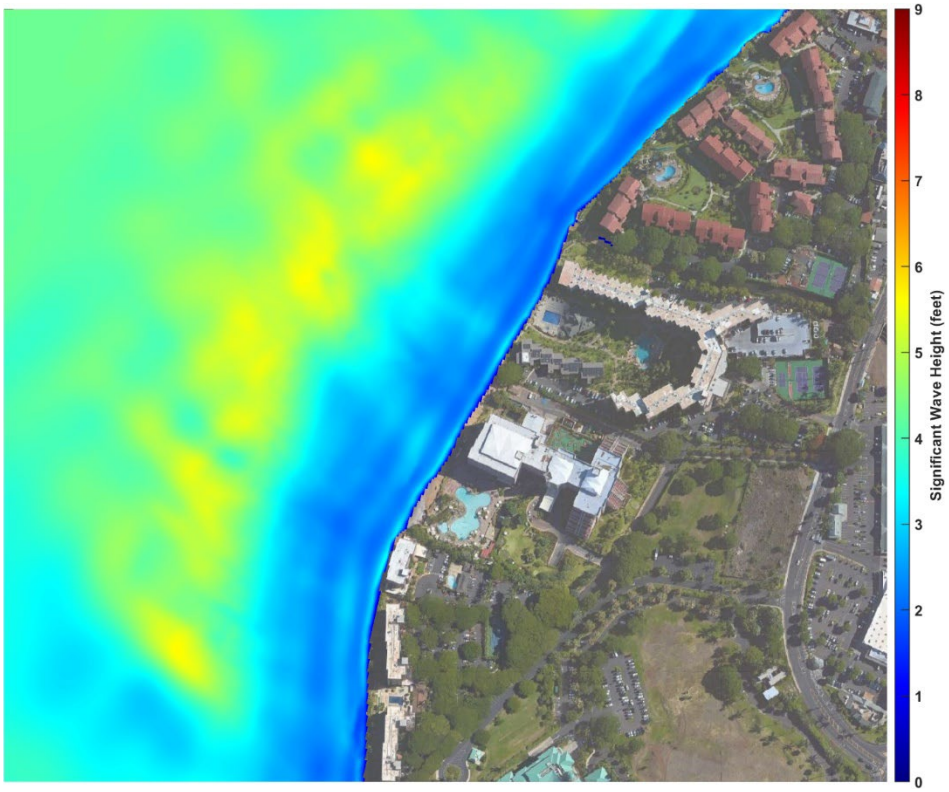


Figure 7-63. XBeach-NH modeled nearshore significant wave height for annual north swell.

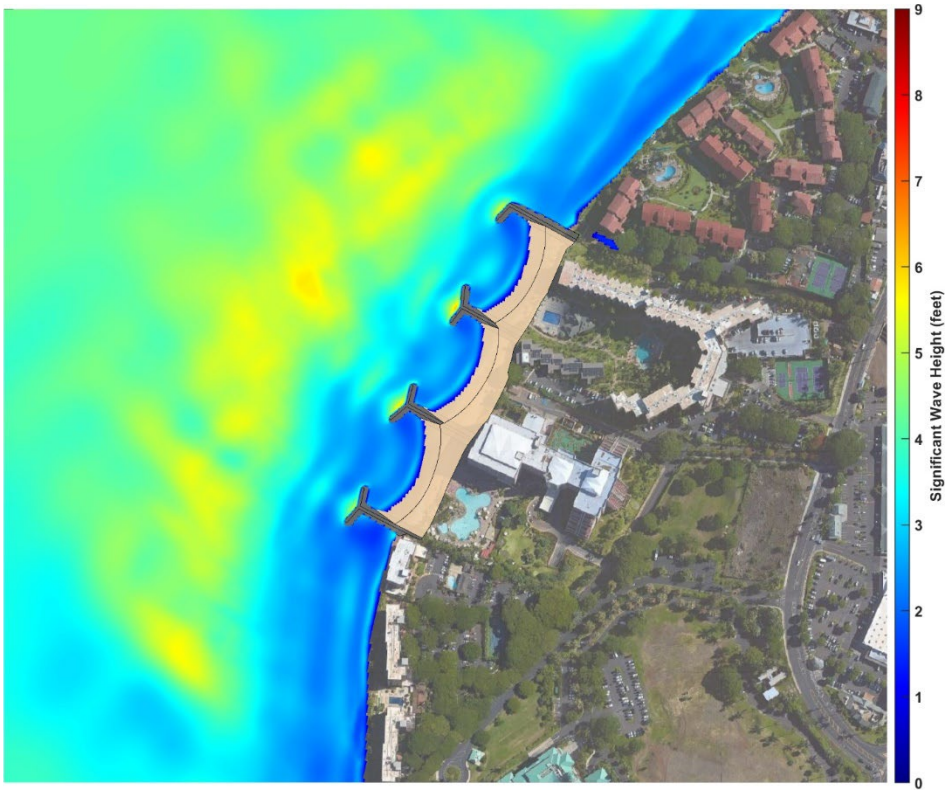


Figure 7-64. XBeach-NH modeled nearshore significant wave height for annual north swell with Beach Stabilization

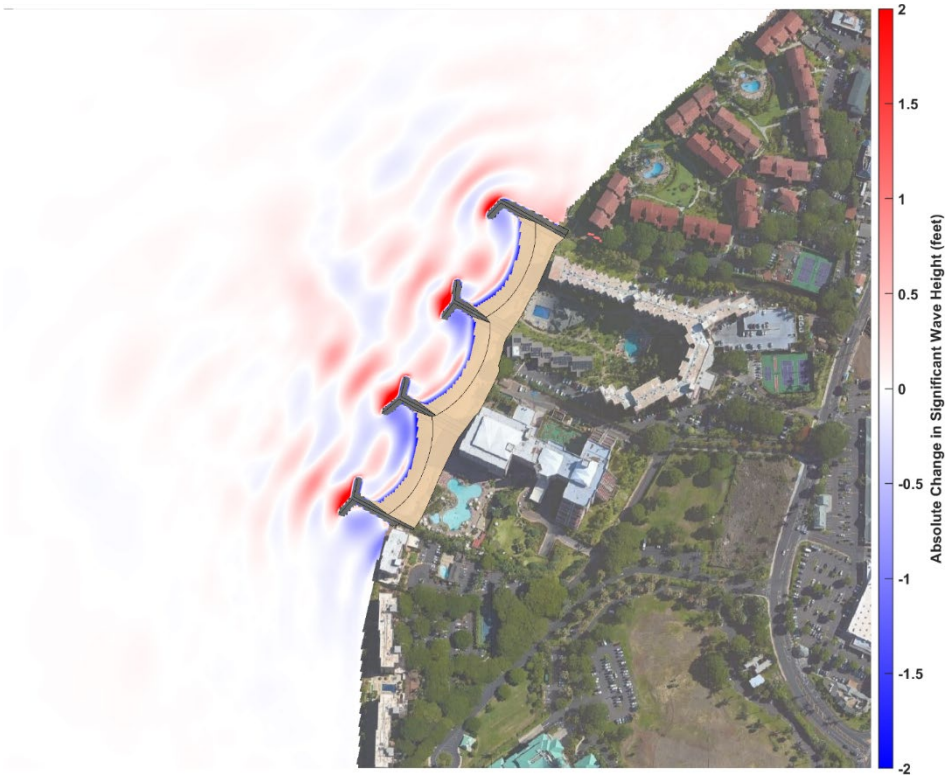


Figure 7-65. Absolute change in XBeach-NH modeled nearshore significant wave height for annual north swell with Beach Stabilization

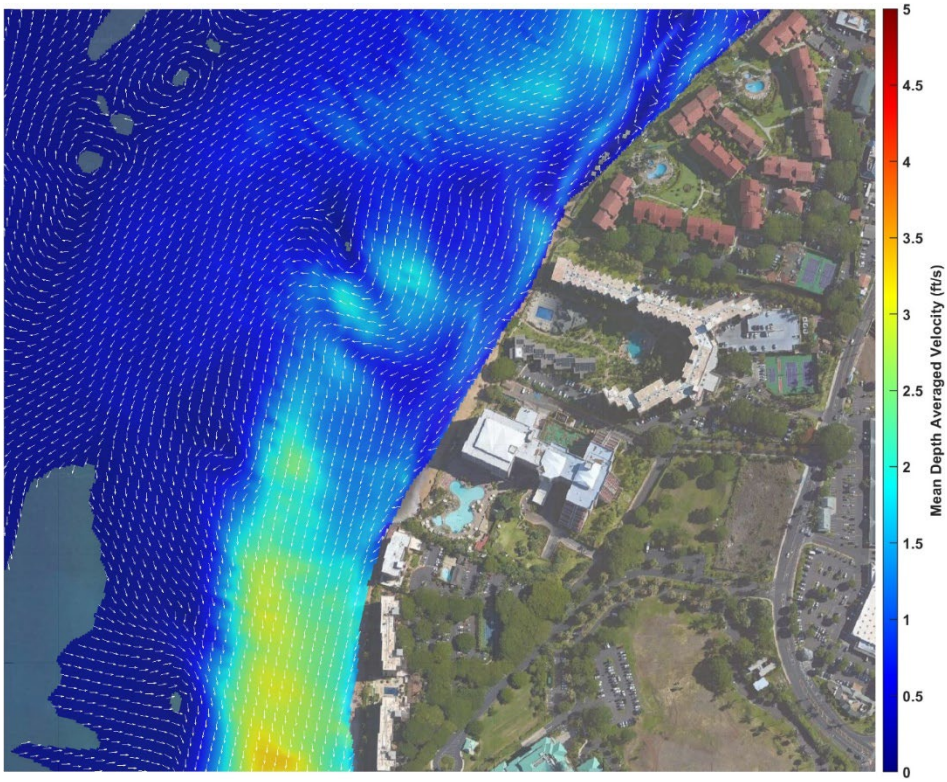


Figure 7-66. XBeach-NH modeled nearshore wave-induced current patterns for annual north swell.

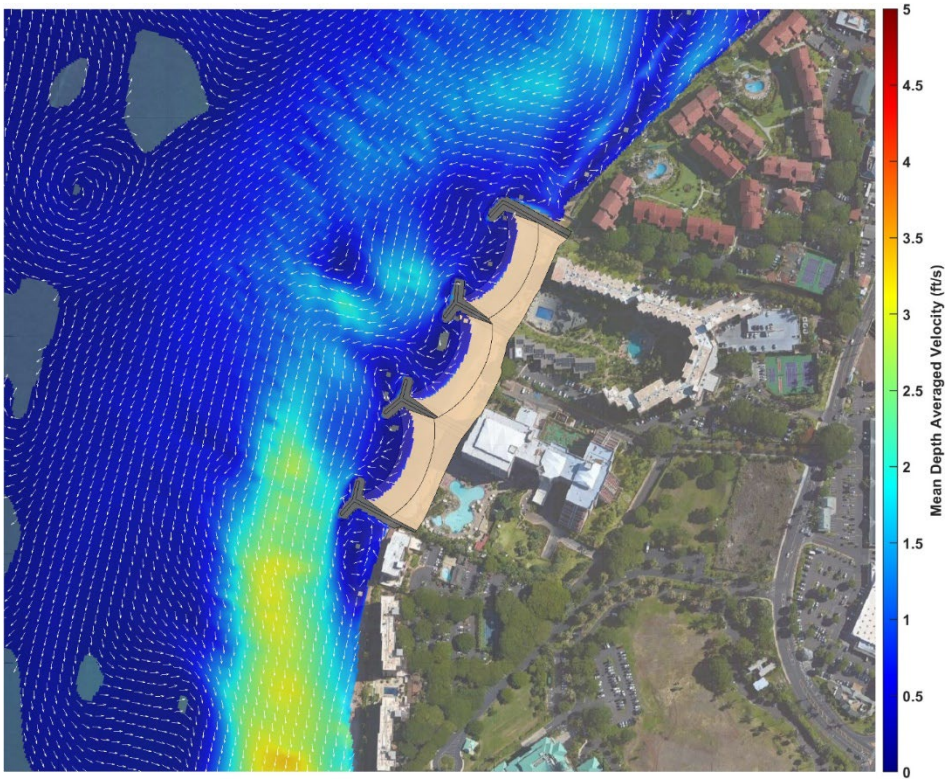


Figure 7-67. XBeach-NH modeled nearshore wave-induced current patterns for annual north swell with Beach Stabilization

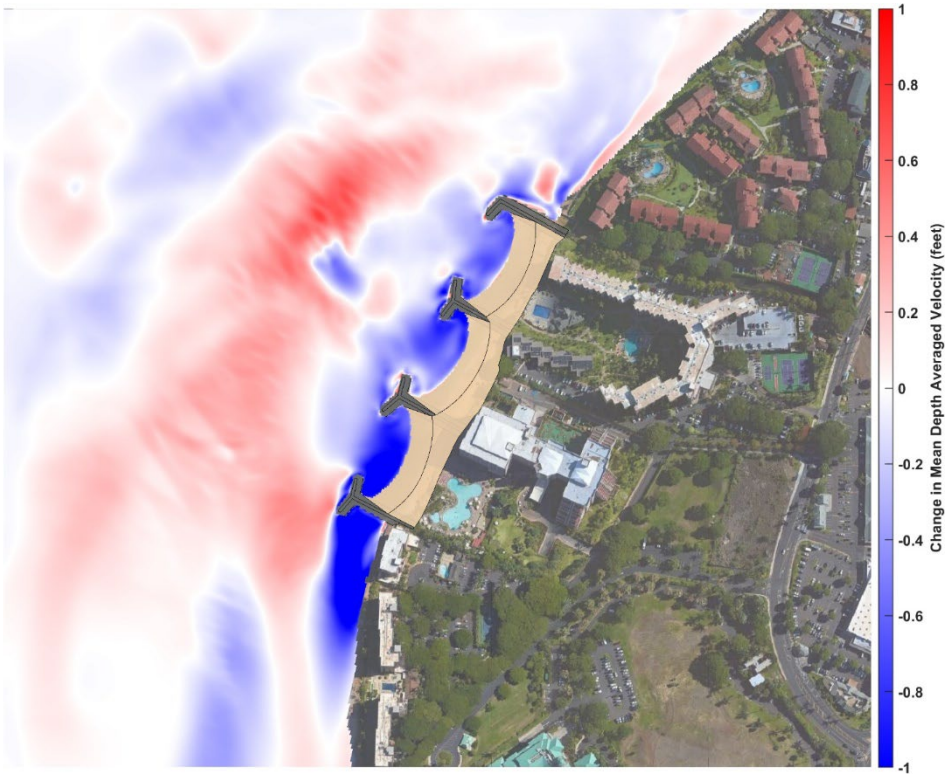


Figure 7-68. Absolute change in XBeach-NH modeled nearshore wave-induced current for annual north swell with Beach Stabilization

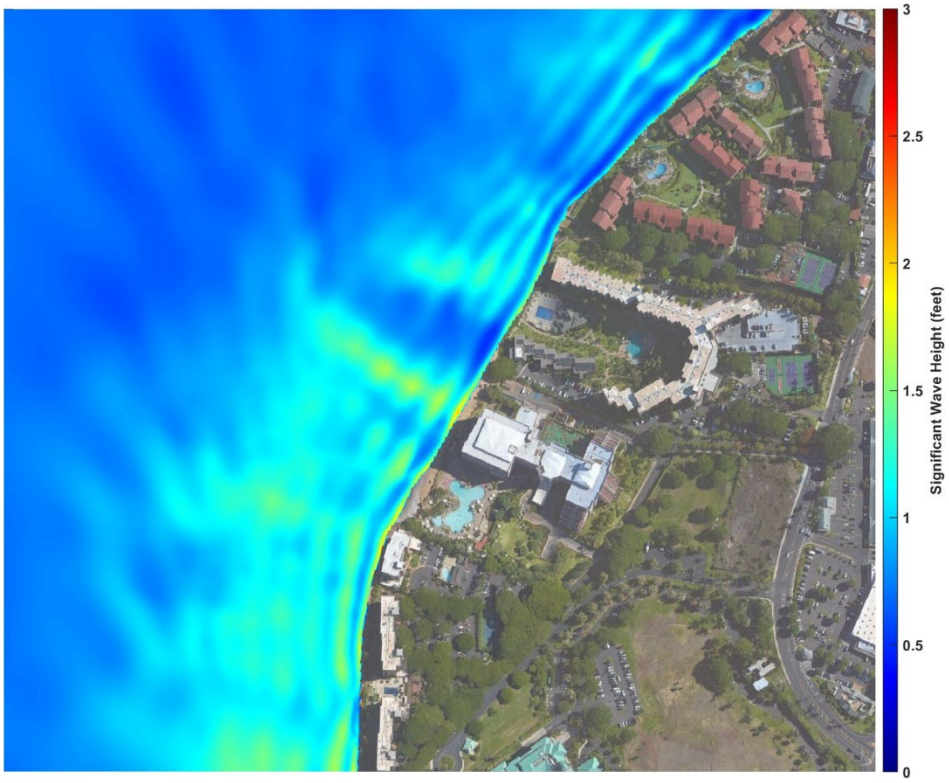


Figure 7-69. XBeach-NH modeled nearshore significant wave height for prevailing south swell (typical summer conditions)

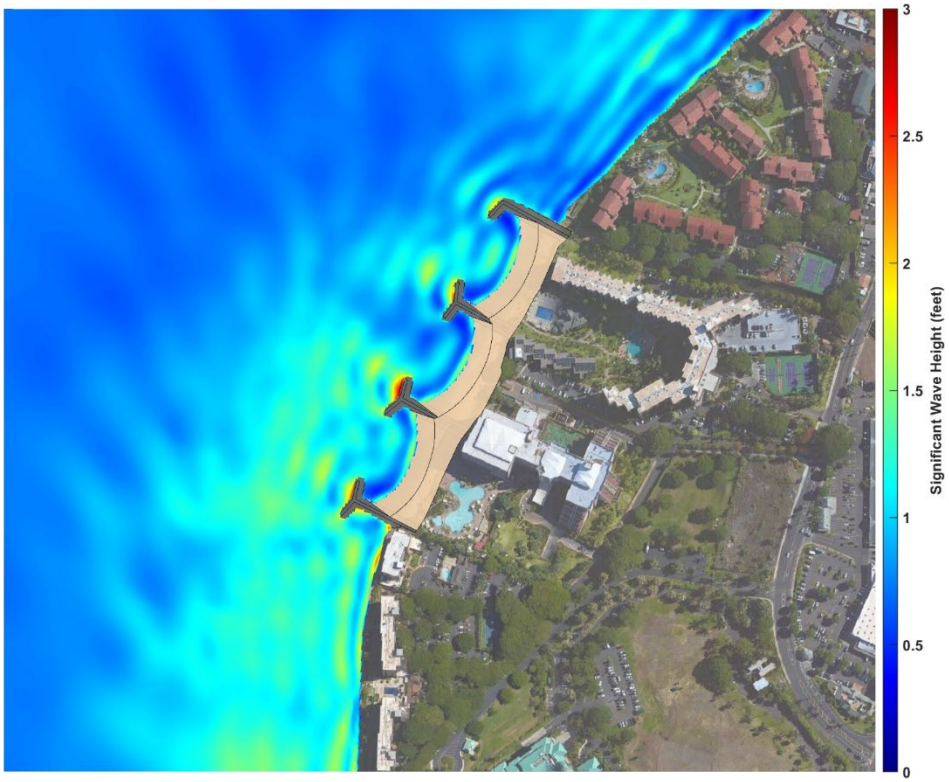


Figure 7-70. XBeach-NH modeled nearshore significant wave height for prevailing south swell (typical summer conditions) with Beach Stabilization

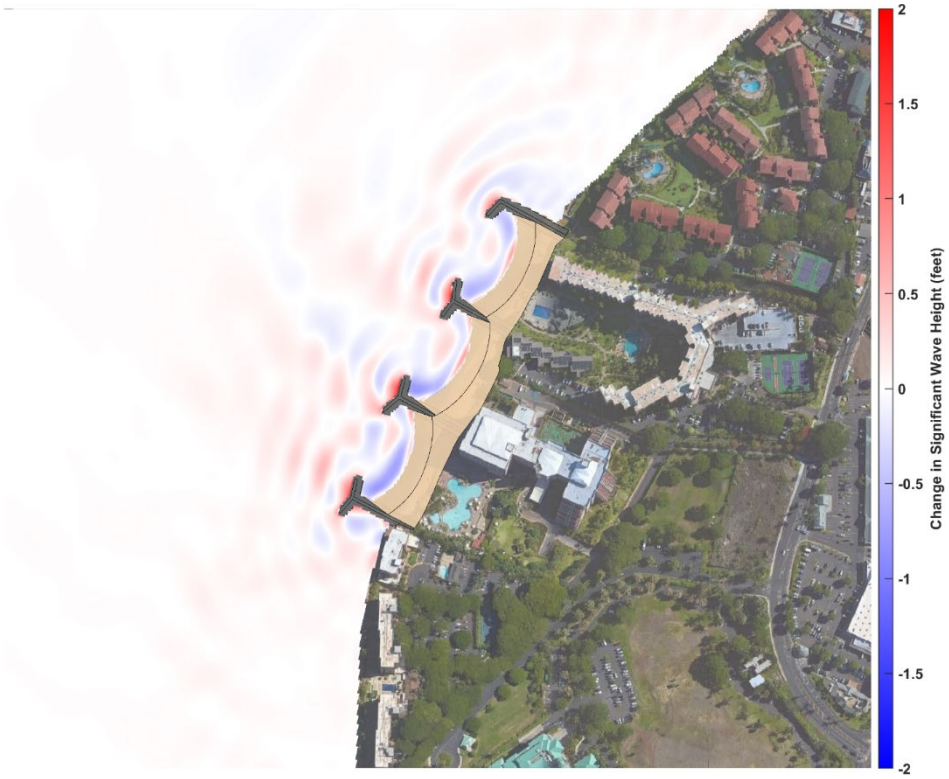


Figure 7-71. XBeach-NH modeled change in nearshore significant wave height for prevailing south swell (typical summer conditions) with Beach Stabilization

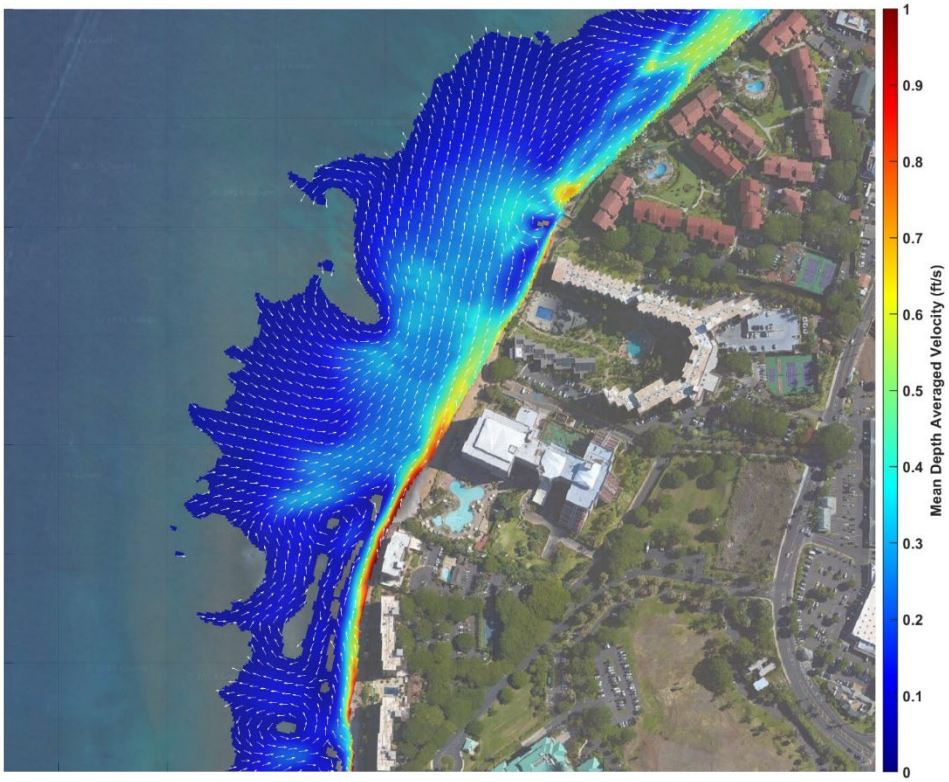


Figure 7-72. XBeach-NH modeled nearshore wave-induced current patterns for prevailing south swell (typical summer conditions)

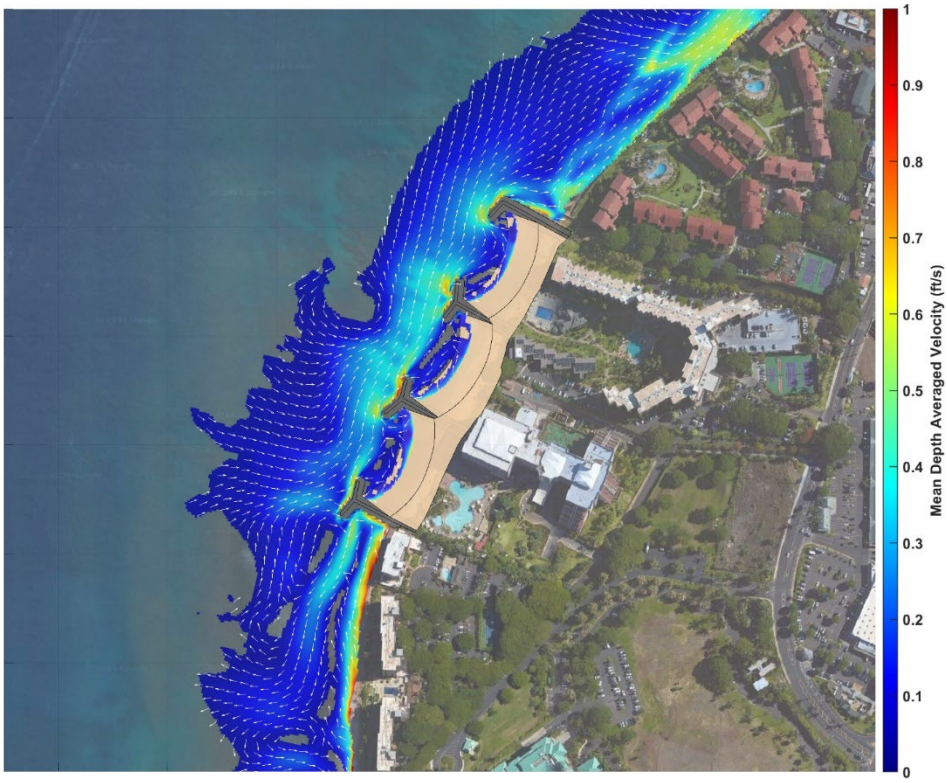


Figure 7-73. XBeach-NH modeled nearshore wave-induced current patterns for prevailing south swell (typical summer conditions) with Beach Stabilization

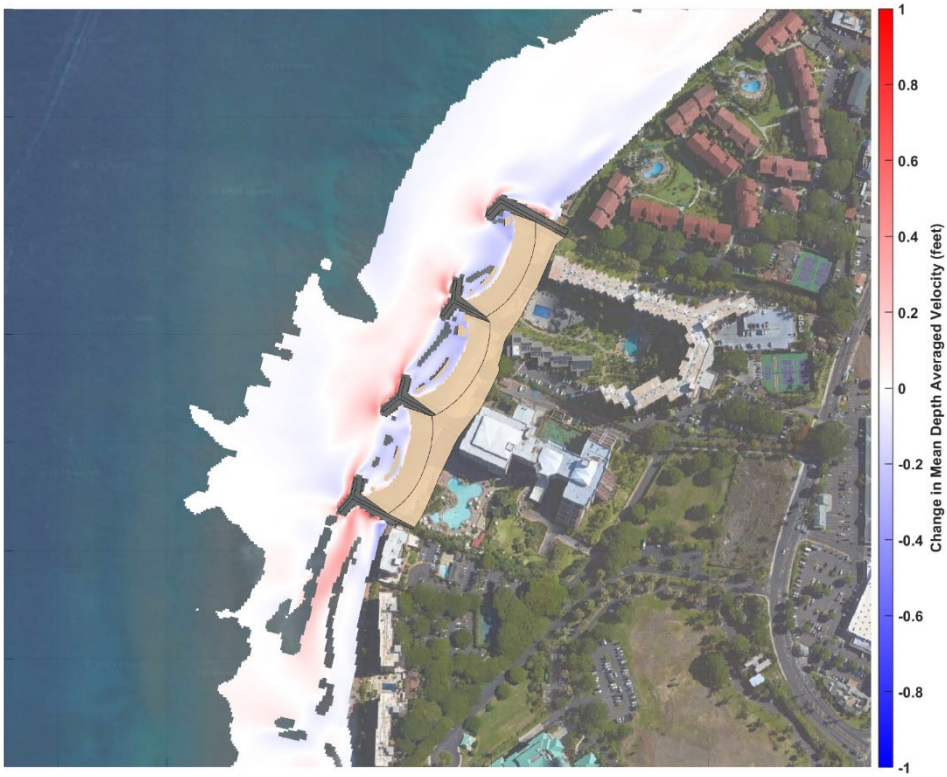


Figure 7-74. XBeach-NH modeled change in nearshore wave-induced current for prevailing south swell (typical summer conditions) with Beach Stabilization

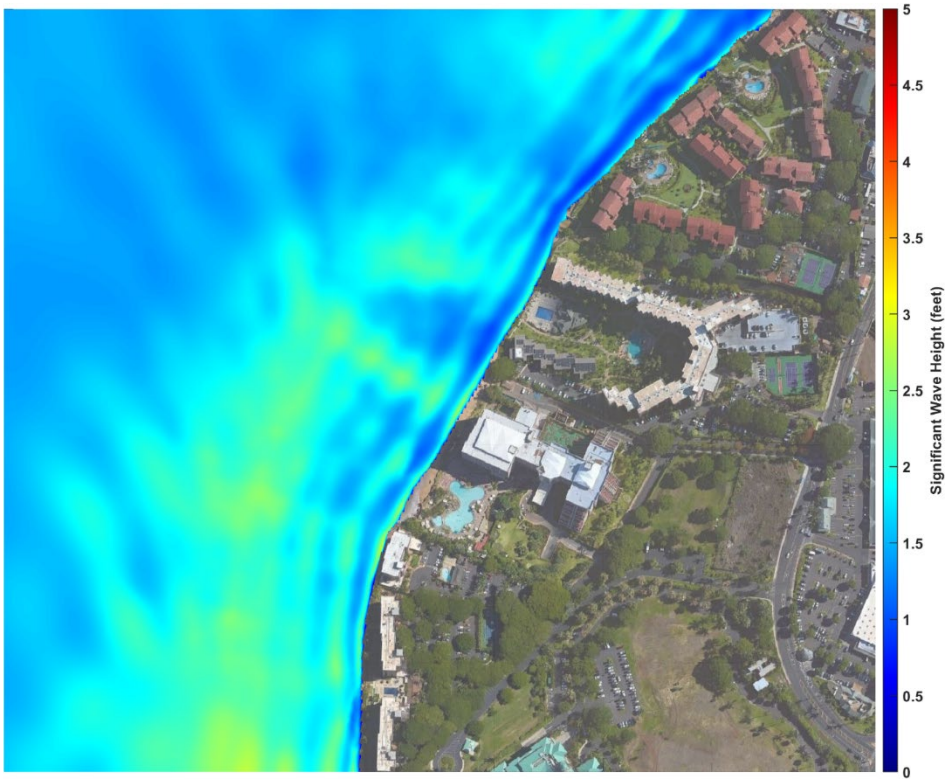


Figure 7-75. XBeach-NH modeled nearshore significant wave height for annual south swell.

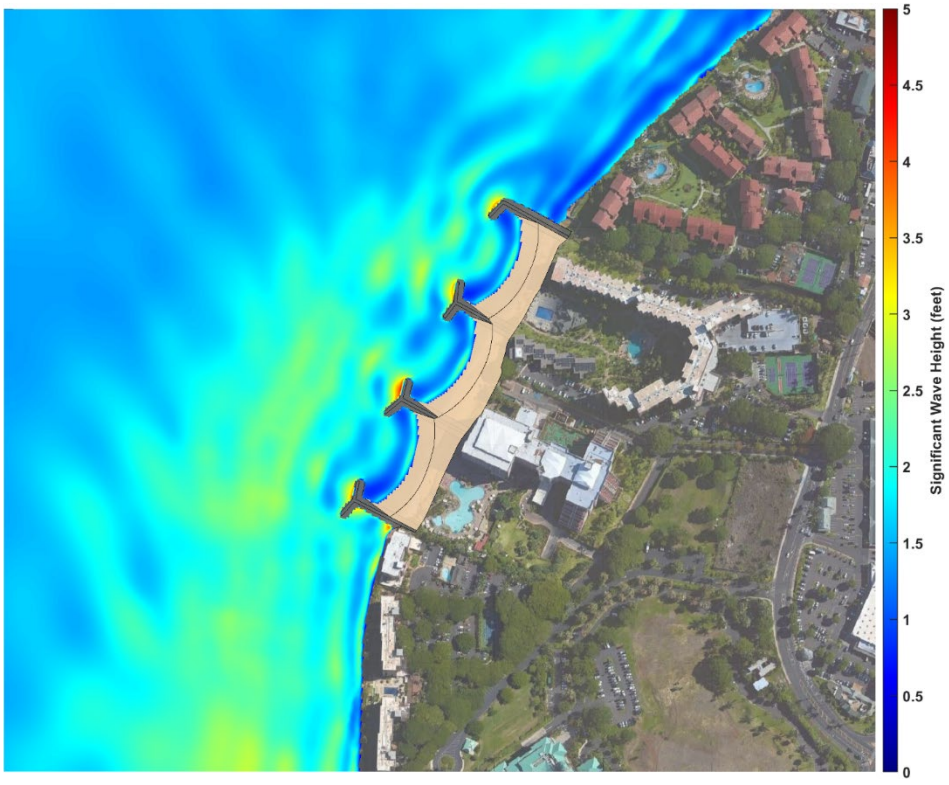


Figure 7-76. XBeach-NH modeled nearshore significant wave height for annual north swell with Beach Stabilization

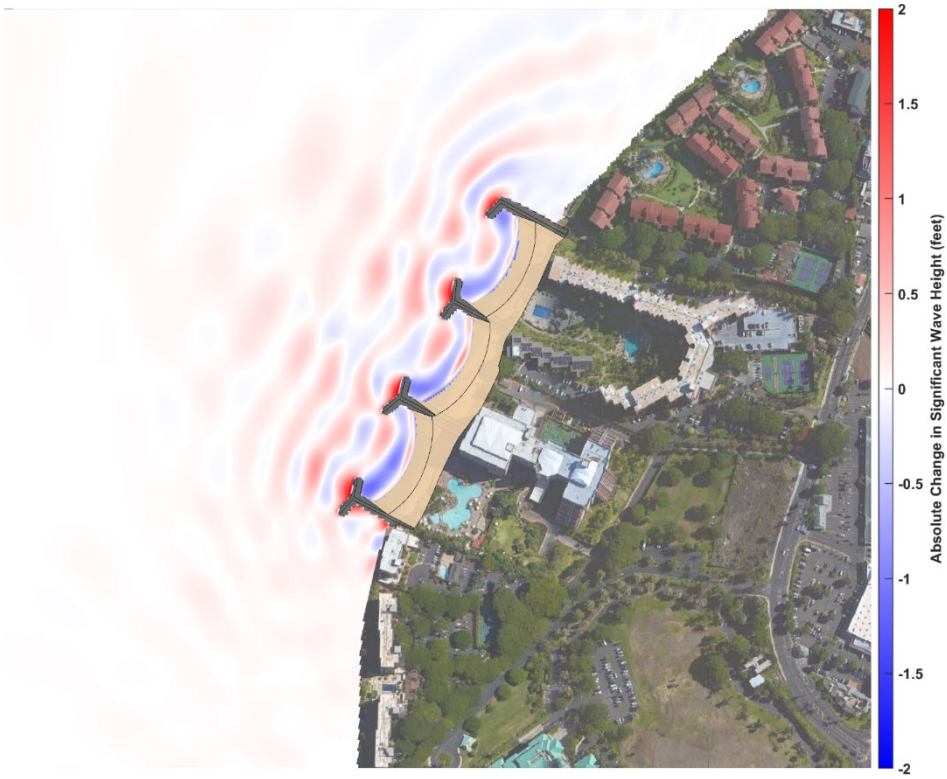


Figure 7-77. Absolute change in XBeach-NH modeled nearshore significant wave height for annual north swell with Beach Stabilization

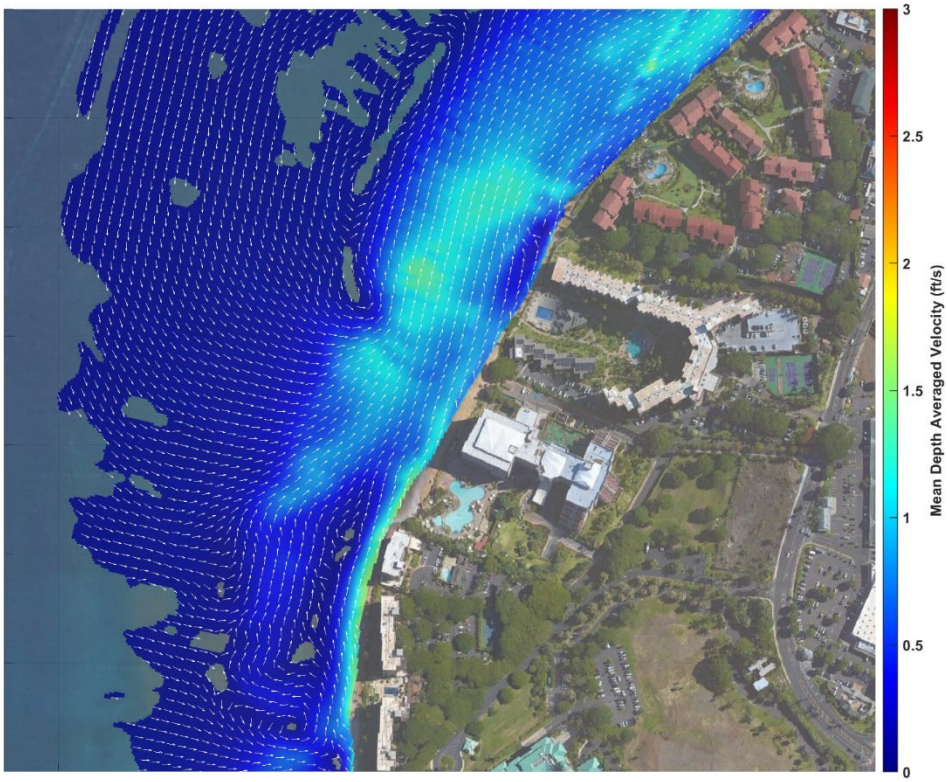


Figure 7-78. XBeach-NH modeled nearshore wave-induced current patterns for annual south swell.

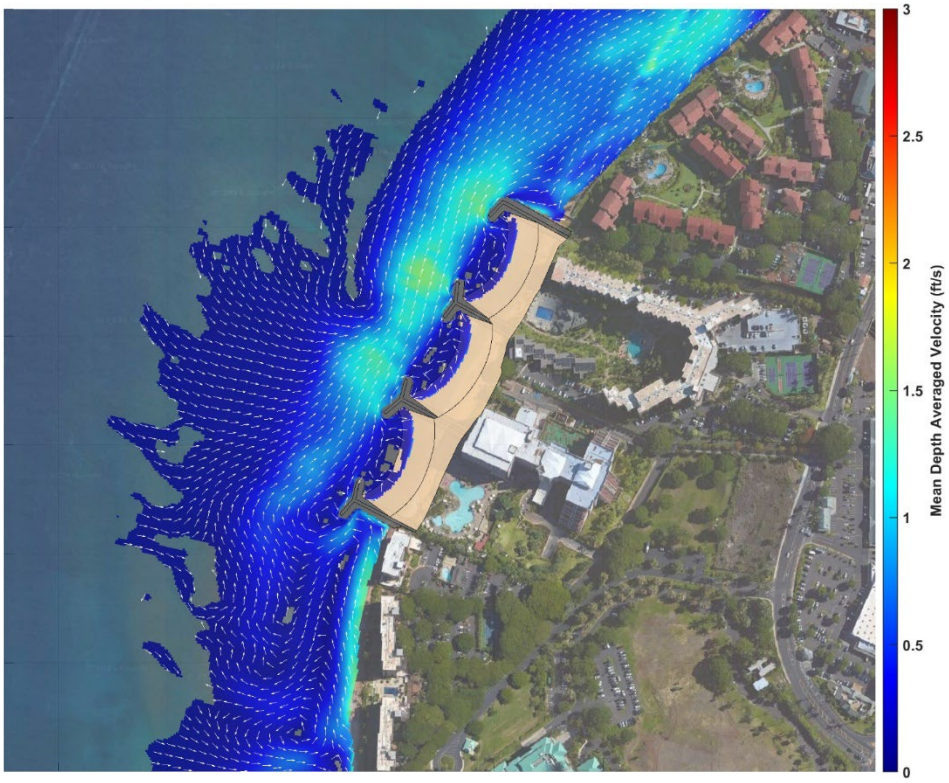


Figure 7-79. XBeach-NH modeled nearshore wave-induced current patterns for annual north swell with Beach Stabilization

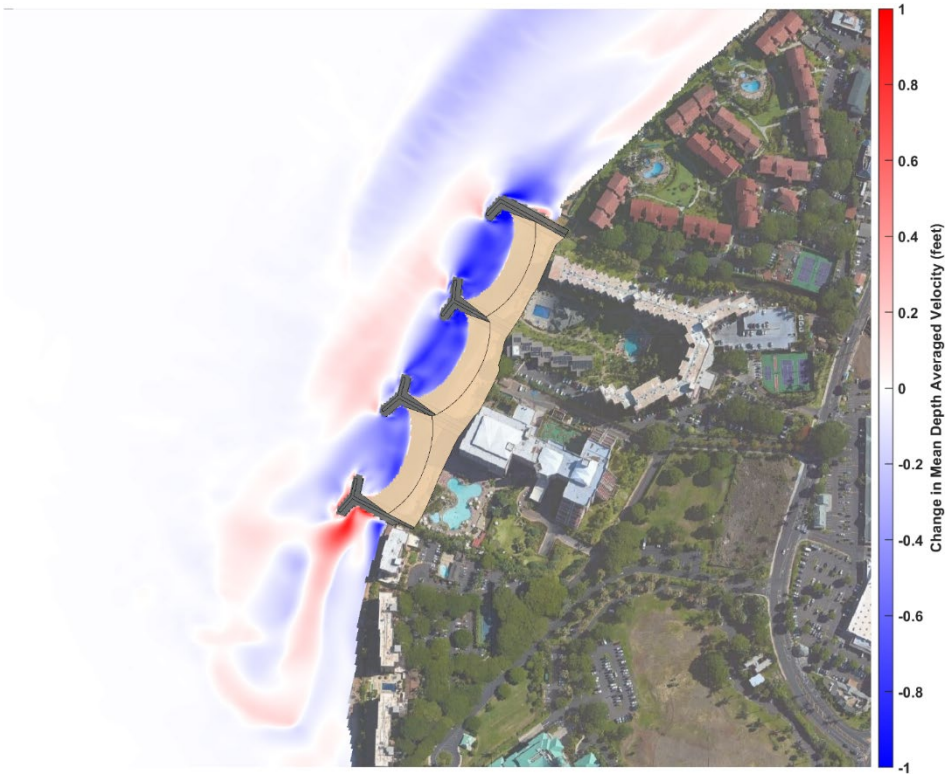


Figure 7-80. Absolute change in XBeach-NH modeled nearshore wave-induced current for annual north swell with Beach Stabilization

Potential Impacts and Mitigation Measures

Beach restoration has the potential to alter existing nearshore wave patterns at the Project Site. The degree to which wave patterns are altered would depend on the selected methodology for beach restoration.

Beach Stabilization

Beach Stabilization is expected to alter existing nearshore wave patterns within the groin cells and in the immediate vicinity of the groins. T-head groins act as artificial headlands that decrease and reorient wave energy approaching the shoreline, and the resulting wave pattern produces an arc-shaped beach planform. Based on the results of the wave modeling, Beach Stabilization is expected to alter wave patterns in the vicinity of the groins but is not expected to have any significant impact on surfing waves at the Project Site.

Model results indicate that wave energy would be expected to increase directly offshore of the groin heads as a result of wave reflection off the groins. However, wave energy would be concentrated closer to the groins and significant wave heights would be less than 1.5 ft and diffuse rapidly with increasing distance from the groins. The groins would terminate well inshore of the offshore surf breaks and are not expected to alter the bathymetry or wave breaking characteristics of the surrounding area. Model results also indicate that the groin field would interrupt existing nearshore flow patterns and significantly decrease wave-induced currents along the shoreline within the groins cells. This is consistent with the purpose of the groins to stabilize the beach fill and inhibit the loss of sand through longshore sediment transport. Wave-induced currents north and south of the groin cells would decrease slightly, which could help to prevent the loss of sand in these areas, as well. The existing channel would be unobstructed and continue to provide ocean access to and from the shoreline.

Beach Nourishment

Beach Nourishment is expected to have a negligible impact on existing nearshore wave patterns as this approach would not require any substantial modification to the existing shoreline configuration.

Beach Maintenance

Beach Maintenance is expected to have a negligible impact on existing nearshore wave patterns as this approach would not require any substantial modification to the existing shoreline configuration.

No Action

No Action is expected to have no impact on existing wave patterns.

Summary

Of the alternatives considered, Beach Stabilization is the only alternative that is expected to alter existing nearshore wave patterns. The impact would be confined to wave patterns within the groin cells and in the immediate vicinity of the groins. The groins would not extend far enough offshore to have any substantial impact on existing wave patterns or wave breaking characteristics in the surrounding area.

7.5 Coastal Processes

This section details existing coastal processes and evaluates potential impacts associated with the Project and alternatives. In addition, this section discusses implementation of management and design measures to minimize negative impacts on coastal processes. This section also includes a detailed discussion of coastal processes as a design criterion for the Project.

7.5.1 Sand Characteristics

Existing Conditions

Honokōwai Beach is composed primarily of carbonate sand with minimal fine material. Carbonate sand is the most common type of beach sand along shorelines of the Hawaiian Islands and is the product of bioerosion and biological production on offshore reefs and marine waters. Carbonate sand can be composed of pieces of coral, algae, sea urchin spines, shells, or other marine organisms that have been tumbled in the surf or along the ocean floor. The composition of sand is determined by the relative abundance of each species in the region and, therefore, varies with location.

Carbonate sands range in color from pure white to yellow, brown, and dark grey. Beyond the aesthetic value, color also affects temperature, as darker sands achieve higher temperatures under the bright tropical sunlight than a lighter shade of sand. The existing beach sand at Honokōwai Beach is gold or tan in color.

Both density and grain size play an important role in how sand behaves on a beach. Grain size in beaches within the Hawaiian Islands can range from a very fine silt to large coral cobbles. The density of calcium carbonate crystals is roughly a constant 2.72 g/cm3; however, microscopic pores and hollow grains make the effective density of individual grains somewhat lower. Smith and Cheung (2002) found the effective density of carbonate sand grains to be 2.4 g/cm3.

The grain size characteristics of sand are typically determined by passing or shaking a sand sample through a series of sieves with successively smaller openings. The amount of sand remaining on each sieve is weighed, and the corresponding percentage that this weight represents of the entire sample weight is computed. The results are presented graphically by plotting the percentage of the sample that is collected at each particular grain size on a logarithmic graph, with grain size plotted on a log base 10 x-axis.

The median diameter (diameter at which 50% of the sample's mass is composed of particles less than this value), or D_{50}, is often used by engineers to represent the grain size of a sample. D_{16} (diameter at which 16% of the sample's mass is composed of particles less than this value) and D_{84} (diameter at which 84% of the sample's mass is composed of particles less than this value) are used to quantify the range of grain sizes present in a sample known as sorting, σ, defined by:

$$\sigma = \frac{\varphi_{84} - \varphi_{16}}{2}$$

where φ= log 2(D), where D is diameter in millimeters. Descriptive sorting values are presented in Table 7-29.

Table 7-29. Sorting value descriptions

Sorting Range (Φ)	Description
0.00 – 0.35	very well sorted
0.35 – 0.50	well sorted
0.50 – 0.71	moderately well sorted
0.71 – 1.00	moderately sorted
1.00 – 2.00	poorly sorted
2.00 – 4.00	very poorly sorted
> 4.00	Extremely poorly sorted

Composite beach samples containing sand from the beach berm, beach crest, beach face, and beach toe were taken at various times and locations along Honokōwai Beach. Grain size analysis of representative sand samples indicates that the average median grain size (D_{50}) of the existing beach sand is 0.44 mm, which is considered medium-grained sand according to the Wentworth Grain Size Classification.

Beaches typically have a higher degree of sorting (i.e., a narrower distribution of grain size) than other environments due to predominant waves, currents, and wind that naturally sort the sediment. In addition, open ocean beaches tend to have a relatively low percentage, by mass, of fines, as wave energy and currents mobilize these smaller grains and transport them away from the beach face into deeper water. Wind can also deliver finer grains across the backshore to dune systems. The existing beach sand at Honokōwai Beach is well to moderately-well sorted with a minimal amount of fine material.

Potential Impacts and Mitigation Measures

A critical component of successful beach restoration projects is the availability of suitable sand fill that is compatible with the existing beach sand. Sand fill should closely match the grain size distribution, color, composition, and density of the existing beach sand. Deviation from these characteristics may result in unpredictable behavior of the beach. The State of Hawai'i Department of Land and Natural Resources (DLNR) established the following guidelines for fill sand used for beach nourishment projects:

- Sand shall contain no more than 6% fine material (grain size < 0.074 mm).
- Sand shall contain no more than 10% coarse material (grain size > 4.76 mm).
- The grain size distribution will fall within 20% of the existing beach sand.
- The overfill ratio of the fill sand to existing sand shall not exceed 1.5.
- Sand will be free of contaminants such as silt, clay, sludge, organic matter, turbidity, grease, pollutants, and others.
- Sand will be primarily composed of naturally occurring carbonate beach or dune sand.

Sand sources that have been determined to be suitable for placement can have undesirable characteristics that are difficult to fully identify prior to sand recovery or mitigate during sand placement. Potential problems include compaction and lithification of placed sand; coral cobbles

in the placed sand; anoxic conditions in the recovered sand; change in beach color; and other issues dependent on the site and conditions.

Compaction occurs when grains are pressed together, reducing pore space between them. Heavily compacted sand can become partially or wholly lithified (solidified), having a consistency ranging from compact but friable (able to be easily broken down into sand grains), to more rock-like. Indurated (hardened) beach rock cannot be easily broken up into individual sand grains.

Sand compaction was observed following the 2012 Waikīkī Beach Maintenance I project along the truck haul route between the dewatering basin and the sand placement area. A hardened berm formed along the seaward edge of the truck haul route. This compaction was likely the result of heavy loaded dump trucks repeatedly traveling over the sand fill. Additionally, chemical processes in the form of carbonate dissolution and precipitation likely contributed to the hardening of the sand fill.

The sand fill for the Project would be transported along the beach using equipment similar to that used for previous beach nourishment projects in Waikīkī. The combination of pressure, dissolution of calcium carbonate material from freshwater, and the presence of fines could increase the chances of induration (hardening) of the placed sand. Compaction from trucks and bulldozers would be minimized by mechanically loosening or turning the sand along the equipment routes at regular intervals. Moreover, equipment routes can be monitored and groomed after project completion, if necessary.

Coral cobbles and rubble, which occur naturally in offshore sand deposits, were an issue during the 2012 Waikīkī Beach Maintenance I project. These larger cobbles accumulated along the beach toe and were uncomfortable for beach users. The potential for coral rubble was addressed during the design process, and efforts were made to reduce the recovery of large pieces of rubble from the offshore sand deposits. However, the amount of rubble reaching the beach still exceeded construction specifications, specifically for long and narrow pieces of rubble that were able to fit through a screen on the hydraulic sand pump. After placement, the rubble became concentrated along the beach toe, just below the waterline. The Contractor removed coral rubble by hand, and the Hawaiʻi Department of Land and Natural Resources (DLNR) organized volunteer rubble removal efforts after construction was completed.

Though the grain size distribution of the sand within the Sand Recovery Site has been thoroughly investigated, coral rubble, or sediment grains that are cobble-sized or larger, may exist sporadically within the deposit. During offshore sand sample recovery, no coral rubble larger than 1 inch in diameter was encountered at the Sand Recovery Site. Additionally, no layers of coral rubble between the sand surface and up to 8 ft below the seafloor were encountered during core sampling. However, rubble deposits may exist in discreet pockets within the deposit.

One of the disadvantages of clamshell dredging is that there is no method to screen larger-diameter material from the recovered sand at the dredge site. The Contractor, therefore, should monitor the sand for coral rubble as the clamshell bucket empties the sand onto the barges, transfers the sand to the shore, and then places the sand on the beach. If excessive larger-diameter material is encountered in an area within the Sand Recovery Site, recovery operations can be moved to a different location within the deposit.

The dewatered sand for the 2021 Waikīkī Beach Maintenance II project was passed through a screen to remove particles larger than 1 in diameter prior to transport to the beach (Figure 7-81). Additionally, sieve testing was performed periodically on the deck barge as sand was being recovered. A relatively small volume of cobbles was effectively screened and removed prior to sand placement. No cobble was placed on the beach. As a mitigation measure, the Contractor would monitor and screen the sand for coral rubble during sand recovery operations. If excessive coral rubble is encountered in an area within the offshore sand deposits, sand recovery operations would move to a different location within the deposits. The Contractor would also monitor and screen the sand for coral rubble prior to and during sand placement operations.

Sand recovered from the Sand Recovery Site would preferably match the color of the existing beach sand. While natural calcareous beaches can range in color, sand in offshore deposits usually turns a gray color as a result of anoxic conditions that occur due to a lack of wave action and associated mixing and aeration of the sand, or with depth within the deposits. Sand samples were taken from various layers in the offshore sand deposits and dried under direct sunlight. The color of the offshore samples, after several days of drying, closely matched the existing beach sand, though some samples had a slightly grayer color. Color comparison tests and drying, and experience with past projects in Hawaiʻi and elsewhere, indicate that the gray color would fade over time due when exposed to direct sunlight. In addition, the mixing of offshore sand and existing beach sand is expected to produce a final color that should be closer to that of the existing beach. Sand recovered from anoxic environments can also have an unpleasant odor. Based on previous sand recovery efforts in Hawaiʻi, any odor from recovered sand is anticipated to diminish with exposure to sun and air.



Figure 7-81. Screening process to remove cobbles from offshore sand.

Fill sand from offshore deposits is not anticipated to contain hazardous materials or contaminants. There have been no significant environmental contamination events in close proximity to the Sand Recovery Site, and there are no known sources of pollution that could potentially contaminate the sand. Thus, there is no reason to anticipate that sand recovered from the offshore deposits would contain contaminants.

Based on previous beach restoration projects in Hawaiʻi, the sand within the Sand Recovery Site could potentially be slightly finer in grain size, initially slightly grayish in color, and may initially have a slight odor. All of these conditions are anticipated to be minor and temporary in nature. As the finer grains are winnowed away by wave action, and the grayish color of the sand is diminished by UV exposure, the texture and appearance of the sand fill would become progressively more similar to the existing beach sand. Any potential odor associated with the sand would be diffused by air and UV exposure, Over the long-term, no discernible difference in the physical composition or appearance of the sand is anticipated. Photographic monitoring of beach conditions would be conducted at specified intervals to document environmental conditions at the Project Site.

Beach Stabilization

Beach Stabilization would involve the placement of 33,000 cy of sand along the shoreline and is expected to have a temporary impact on sand characteristics at the Project Site. Following sand placement, the appearance of the beach fill may be slightly darker than the existing beach sand. There would be a period of beach equilibration, during which the fill sand and existing beach sand mix and the color of the sand would be expected to lighten and achieve a more uniform appearance following with sustained UV exposure. Beach stabilization is expected to prevent the discharge of up to 19,542 cy of terrigenous sediment into the ocean (see Sections 3.1 and 7.1.7) and is therefore expected to have a long-term positive impact on sand characteristics by preventing the introduction of fine material (alluvium) caused by natural erosion of the shoreline. No long-term impacts to sand characteristics are expected.

Beach Nourishment

Beach Nourishment would involve the placement of 27,000 cy of sand along the shoreline and is expected. The impacts of Beach Nourishment on existing sand characteristics would be similar to the Beach Stabilization alternative; however, the timeframe of the impacts would be shorter due to the limited design life of the project.

Beach Maintenance

Beach Maintenance would involve the initial placement of 27,000 cy of sand along the shoreline followed by a series of four renourishment efforts with a total volume of 47,000 cy of sand placed over a period of 50 years. The impacts of Beach Maintenance on existing sand characteristics would be similar to the Beach Stabilization alternative.

No Action

No Action would have no immediate impact on existing sand characteristics at the Project Site or the Sand Recovery Site as it would not require sand recovery or sand placement. Sand characteristics at the Project Site may change over time as alluvium is discharged into the nearshore waters due to natural erosion.

Summary

All of the beach restoration alternatives are expected to have a temporary impact on sand characteristics at the Project Site. Following sand placement, the appearance of the beach fill may be slightly darker than the existing beach sand. There would be a period of beach equilibration, during which the fill sand and existing beach sand mix and the color of the sand would be expected to lighten and achieve a more uniform appearance following with sustained UV exposure.

7.5.2 Currents, Circulation, and Sediment Transport

Existing Conditions

Coastal processes in West Maui are dynamic and complex, with a wave climate affected by underwater topography, wind and island sheltering; current variability; coastal morphology including lāʻe (headlands), and embayments; beaches that are seasonally variable; and a very limited supply of sediment (Podoski et al., 2016). Honokōwai Beach is located in the Honokōwai littoral cell, which extends from Honokōwai Point north to Kahana Bay and spans approximately 6,200 lf (1.15 mi) of shoreline. The North Kāʻanapali littoral cell (south of the Project Site) extends from Honokōwai Point south to Puʻu Kekaʻa (Figure 7-82). Currents, circulation, and sediment transport in West Maui are driven by a combination of wave-induced currents and tide-induced currents. Storlazzi et al. (2006) found that wave- and wind-driven surface flows appear to be the primary control on flow over shallower portions of the reef while tidal and subtidal currents dominate flow over the outer portions of the reef and insular shelf.

Currents and circulation patterns in the offshore waters (more than 1,000 ft from the shoreline) are primarily driven by the cyclic rise and fall of the tides, which generate tide-driven currents that can affect the entire water column from the surface to the seafloor. These currents are more predictable and follow a regular cycle based on the tidal schedule. Storlazzi & Field (2008) found that these tide-driven currents diverge offshore of Puʻu Kekaʻa with offshore currents in the Honokōwai and North Kāʻanapali littoral cells (north of Puʻu Kekaʻa) being predominantly south to north, and offshore currents in the South Kāʻanapali littoral cell (south of Puʻu Kekaʻa) being predominantly north to south (Figure 7-83).

Currents and circulation patterns in the nearshore waters (within 1,000 ft of the shoreline) are primarily driven by wave energy. As waves approach the shoreline and break over the shallow reef, they generate wave-driven currents that transport sediment (sand) alongshore (parallel to shore) and cross-shore (to/from shore). Wave-driven currents are less predictable and more variable due to changes in wave direction, wave energy, and water levels.

Storlazzi & Field (2008) found that nearshore currents in the Honokōwai and North Kāʻanapali littoral cells (north of Puʻu Kekaʻa) are predominantly north to south, and nearshore currents in the South Kāʻanapali littoral cell (south of Puʻu Kekaʻa) are predominantly south to north (Figure 7-83). These nearshore wave-driven currents converge at Puʻu Kekaʻa where extensive sand fields extend several thousand feet offshore. When two flows converge or when a single flow is steered by bathymetry around headlands, semi-permanent eddies are generated that, in the absence of large ocean surface waves, have the potential to accumulate material (Storlazzi et al. 2006).

Two (2) Acoustic Doppler Current Profilers (ADCPs) were previously deployed in the South Kāʻanapali littoral cell between October 30, 2015, and February 9, 2016. The ADCPs measured and recorded current speeds and directions at multiple depths through the water column. ADCP-1 was located 600 ft offshore of Puʻu Kekaʻa in a water depth of 39 ft. The measured current was semi-diurnal (i.e., two northward and two southward peaks per day). Currents at this location averaged 1.5 ft/sec. Peak currents ranged from 1.0 to 2.3 ft/sec and were generally stronger in the southward direction. The measured current had a relatively uniform flow over the bottom, middle, and surface layers. The measurements from ADCP-1 indicate that nearshore currents at this location are predominantly from north to south during the winter months, which aligns with the findings from Storlazzi & Field (2008).

Nearshore hydrodynamics at the Project site are primarily driven by wave-induced currents. Sediment transport is bi-directional and driven by a combination of wave exposure, bathymetry, nearshore currents, and sediment availability. During the summer months (May to October), the dominant direction of sediment transport is from south to north. Summer swells that reach the Honokōwai shoreline break at an oblique angle to the west facing beach, creating wave-induced currents that transport sediment alongshore to the north. This typically causes erosion and beach narrowing at the south end of Honokōwai Beach and accretion and beach widening at the north end of the beach. During the winter months (November to April), when North Pacific Swell dominates, the dominant direction of sediment transport reverses, which causes the north end of the beach to narrow and the south end of the beach to widen. As a result, Honokōwai Beach is seasonally dynamic and subject to seasonal variations in beach width and volume.

Numerical modeling was performed to model nearshore wave patterns, significant wave heights, and wave-induced current patterns in the vicinity of the Project Site and the Sand Recovery Site. Figure 7-84 and Figure 7-85 show the model results for the prevailing north swell (typical winter conditions) and the prevailing south swell (typical summer conditions), respectively. The model results support the findings of previous studies indicating that regional nearshore sediment transport patterns are predominantly alongshore (parallel to shore), seasonally variable, and primarily driven by wave-induced currents,

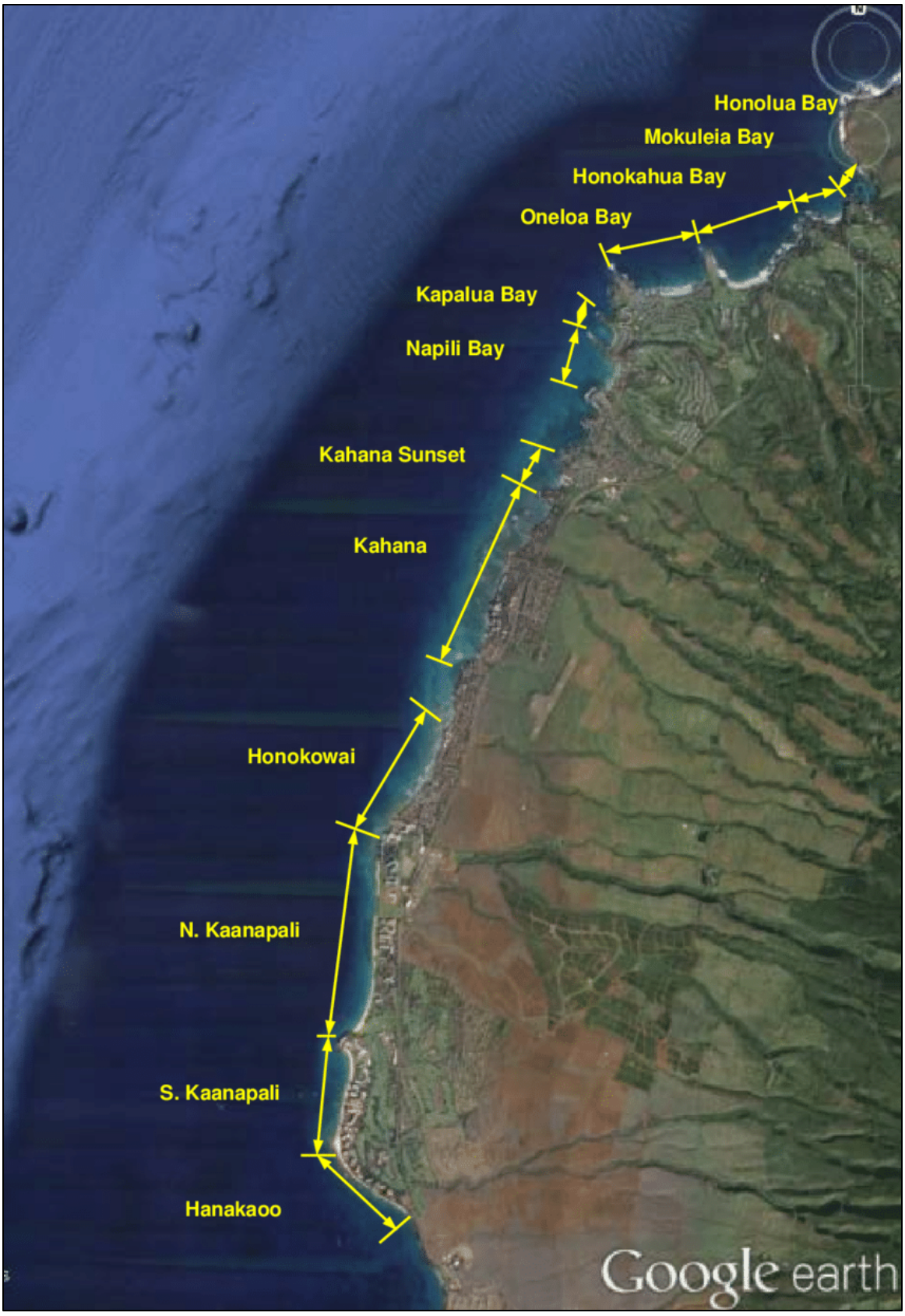


Figure 7-82. Littoral cells in West Maui (USACE, 2015)

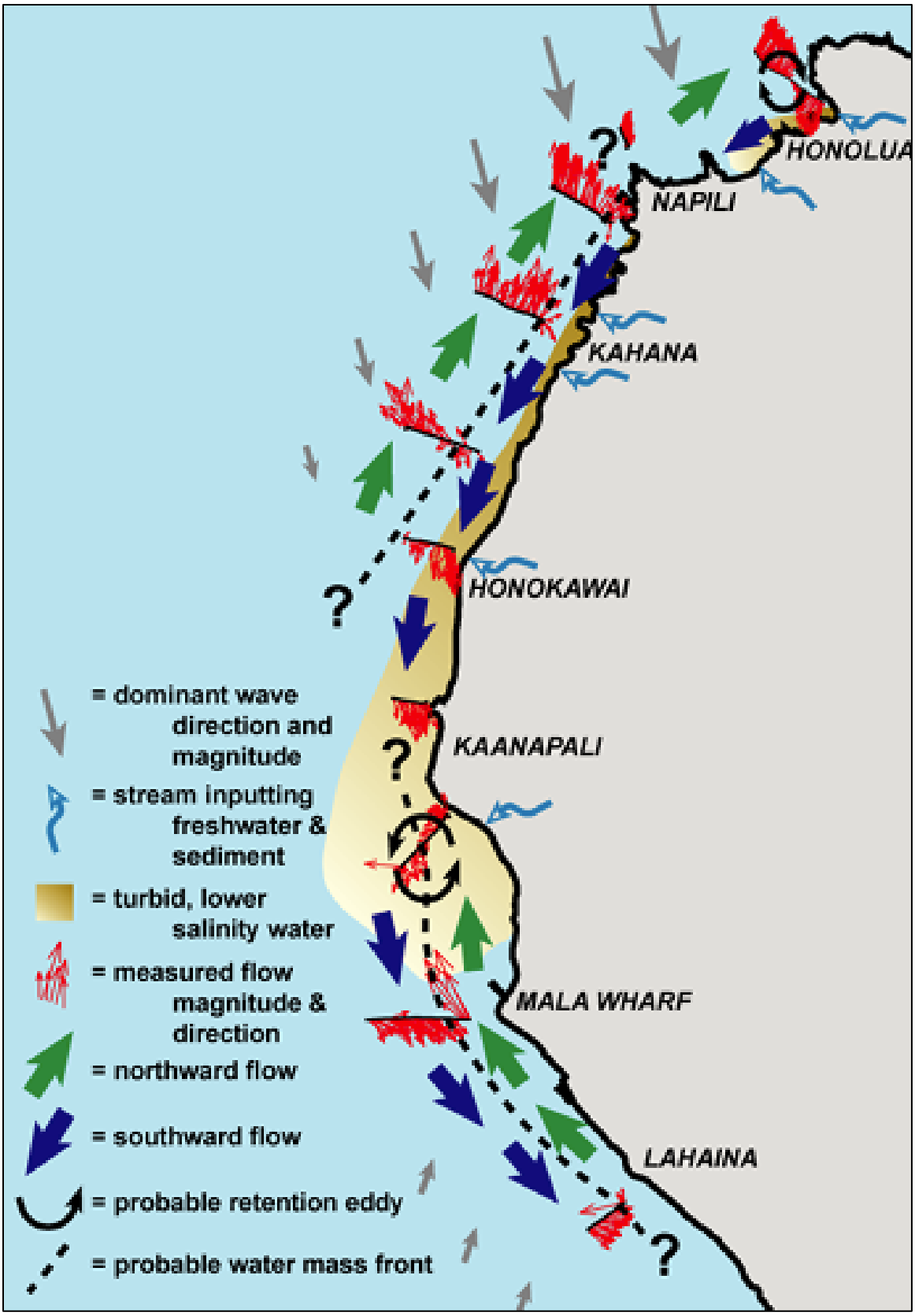


Figure 7-83. Dynamics of flow and turbidity in West Maui (Storlazzi & Field, 2008)

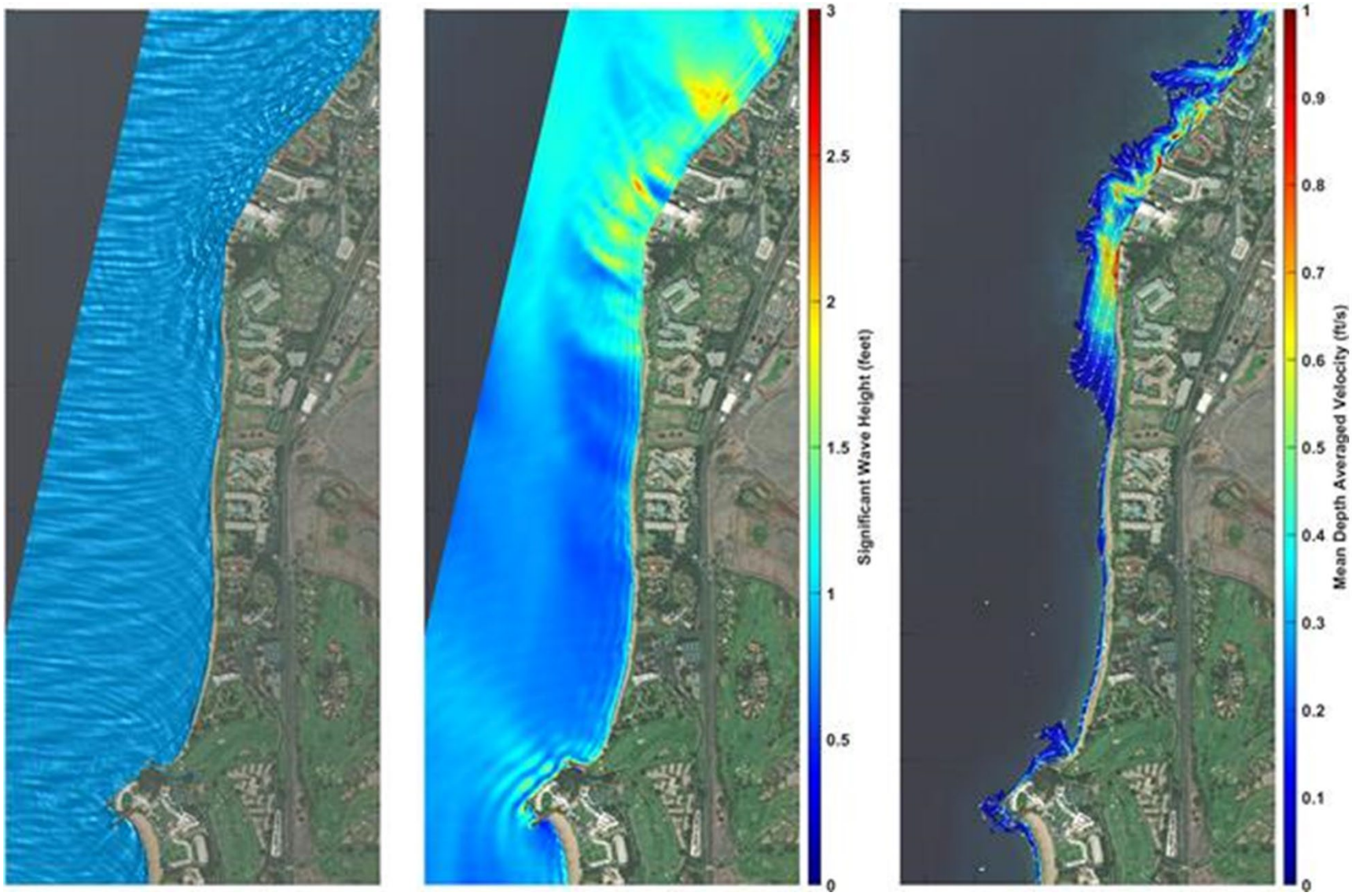


Figure 7-84. XBeach-NH modeled nearshore wave patterns, significant wave heights, and wave-induced current patterns for prevailing north swell (typical winter conditions)

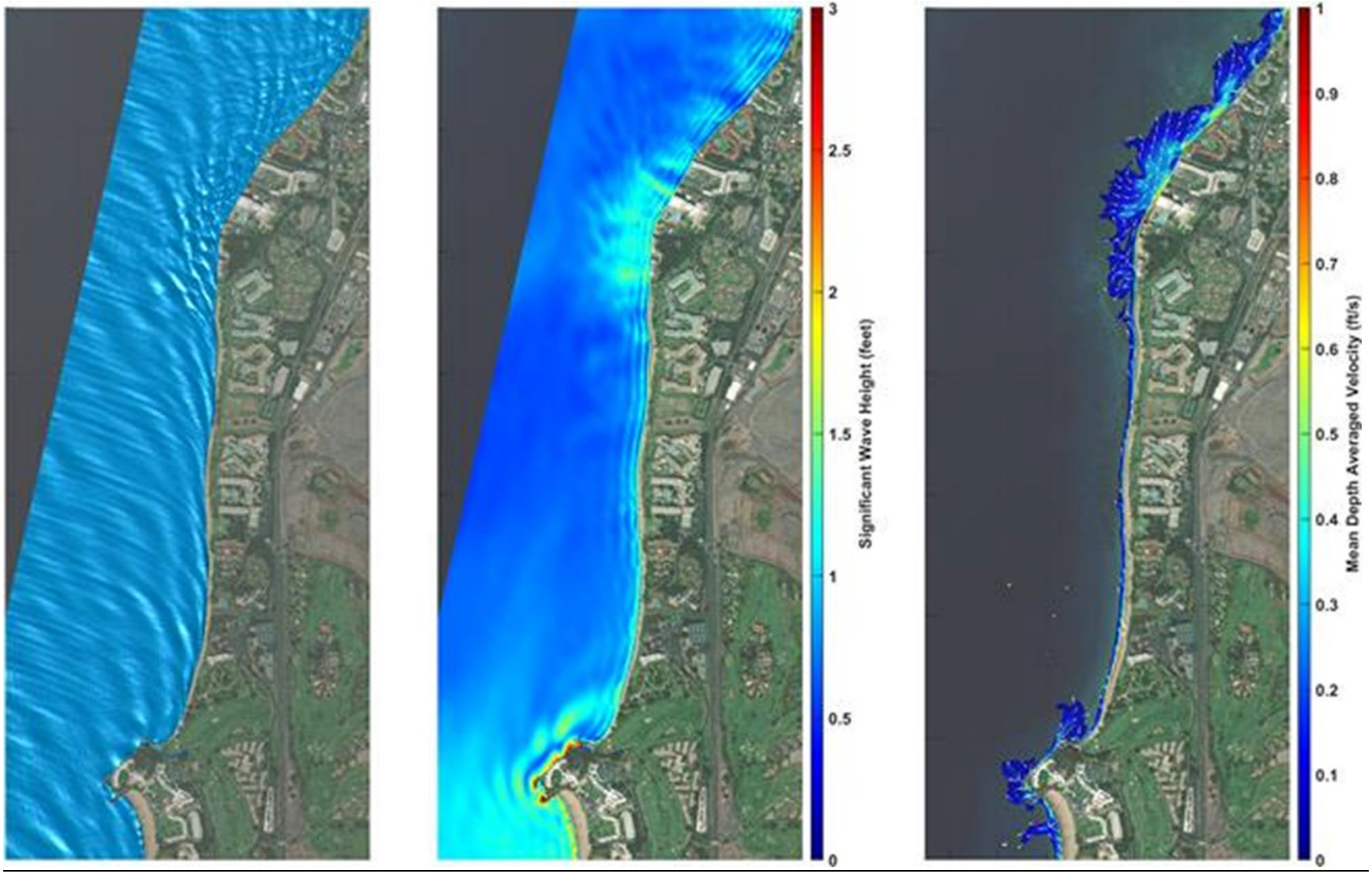


Figure 7-85. XBeach-NH modeled nearshore wave patterns, significant wave heights, and wave-induced current patterns for prevailing south swell (typical winter conditions)

7.5.3 Currents, Circulation, and Sediment Transport Impacts Analysis

To evaluate the potential for groins to alter existing wave-induced nearshore current patterns, wave modeling with the groins was performed using the XBeach-NH model. Model bathymetry was modified to include the groin field. The model was used to simulate prevailing and annual north and south swell events for the modified shoreline configurations. The following section summarizes the model results for the existing and modified shoreline configuration for prevailing and annual winter north and summer south swell.

7.5.3.1 Prevailing North Swell

XBeach-NH model outputs for the wave-induced depth-averaged flow velocity for a prevailing (typical) winter north swell for the existing and modified shoreline configurations are shown in Figure 7-60 and Figure 7-61, respectively. The absolute change in depth-averaged flow velocity (modified flow field minus existing flow field) is shown in Figure 7-62.

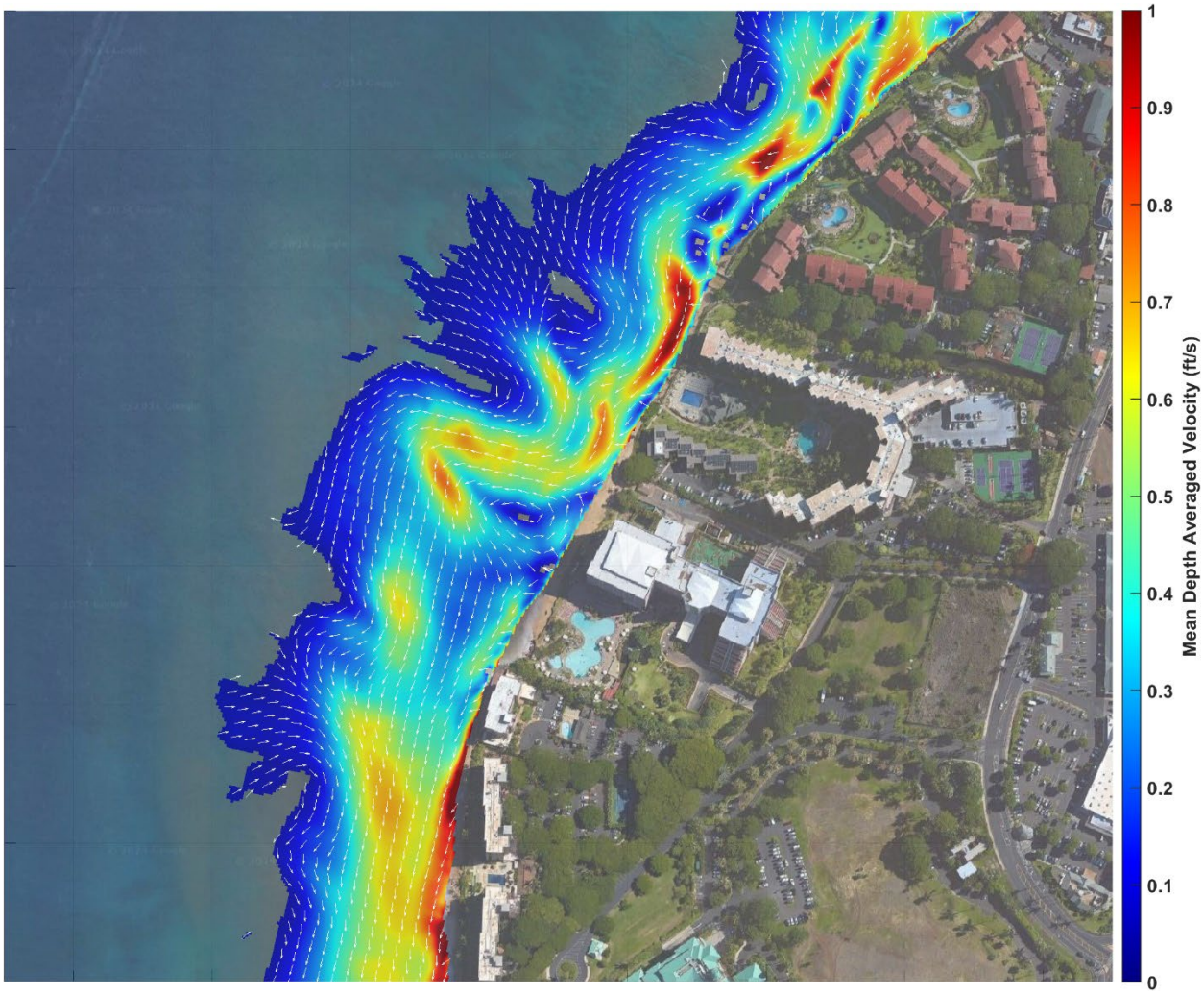


Figure 7-86. XBeach-NH modeled nearshore wave-induced current patterns for prevailing north swell (typical winter conditions)

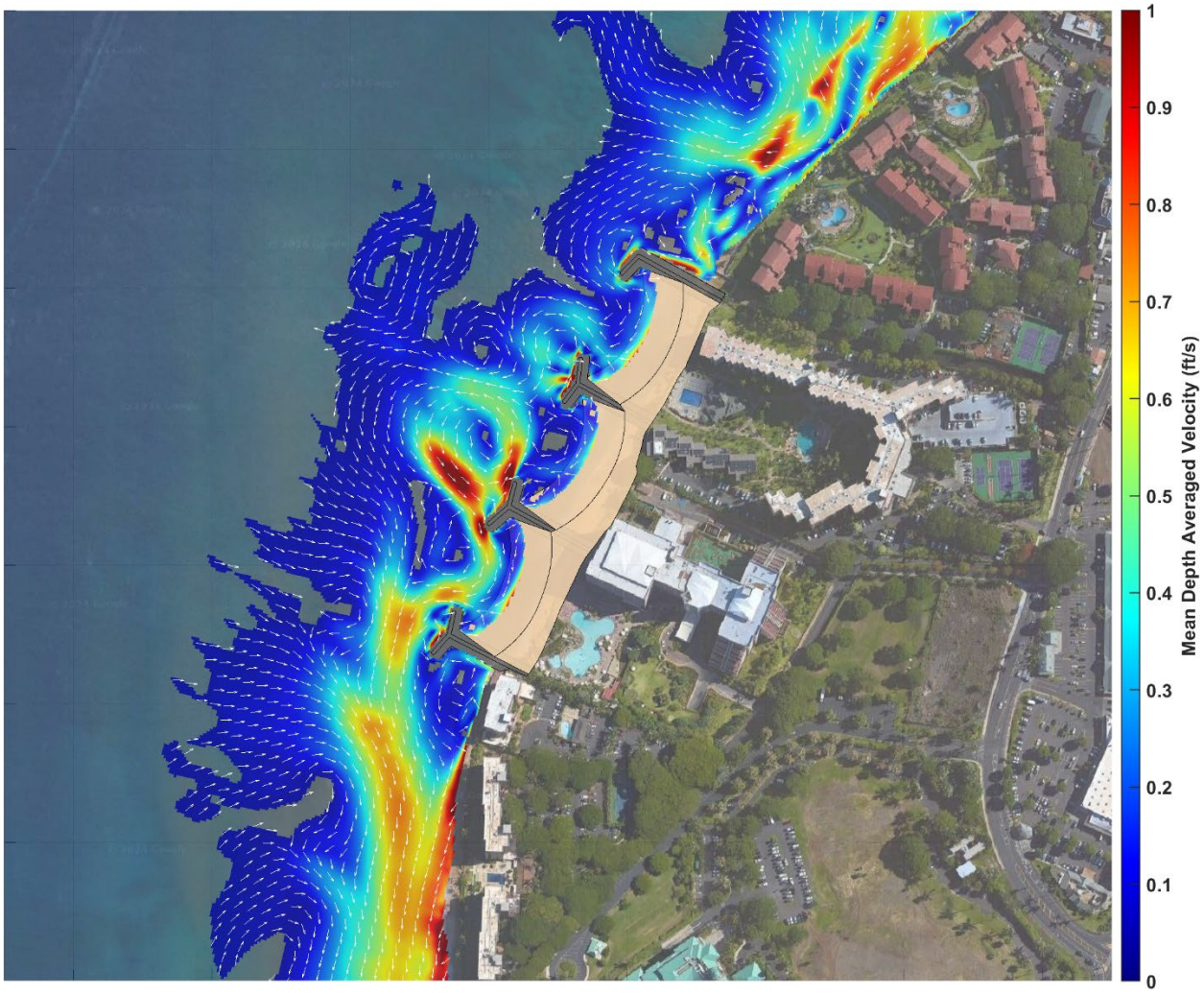


Figure 7-87. XBeach-NH modeled nearshore wave-induced current patterns for prevailing north swell (typical winter conditions) with Beach Stabilization

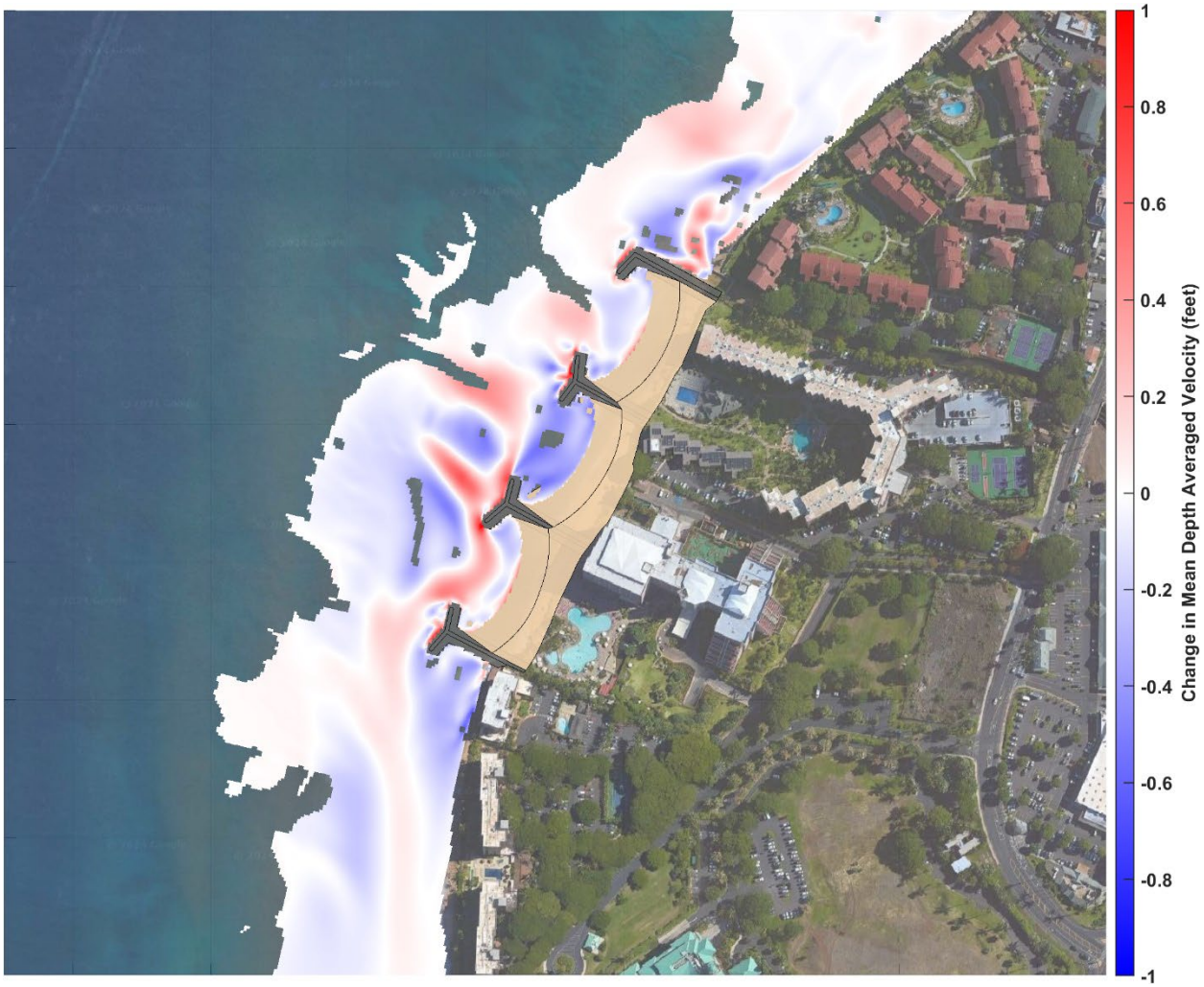


Figure 7-88. XBeach-NH modeled change in nearshore wave-induced current for prevailing north swell (typical winter conditions) with Beach Stabilization

The absolute change in mean depth-averaged flow is shown with increasing values (red) and decreasing values (blue). The model shows the groin field interrupting the existing nearshore flow patterns as expected for this type of shoreline configuration. Seaward of the groin heads, the model shows an increase in flow velocity which is likely attributed to the redirection of the north to south flow under existing conditions. The model shows a general decrease of flow within each of the beach cells.

7.5.3.2 Annual North Swell

XBeach-NH model outputs for the wave-induced depth-averaged flow velocity for an annual winter north swell for the existing and modified shoreline configurations are shown in Figure 7-66 and Figure 7-67, respectively. The absolute change in depth-averaged flow velocity (modified flow field minus existing flow field) is shown in Figure 7-68.

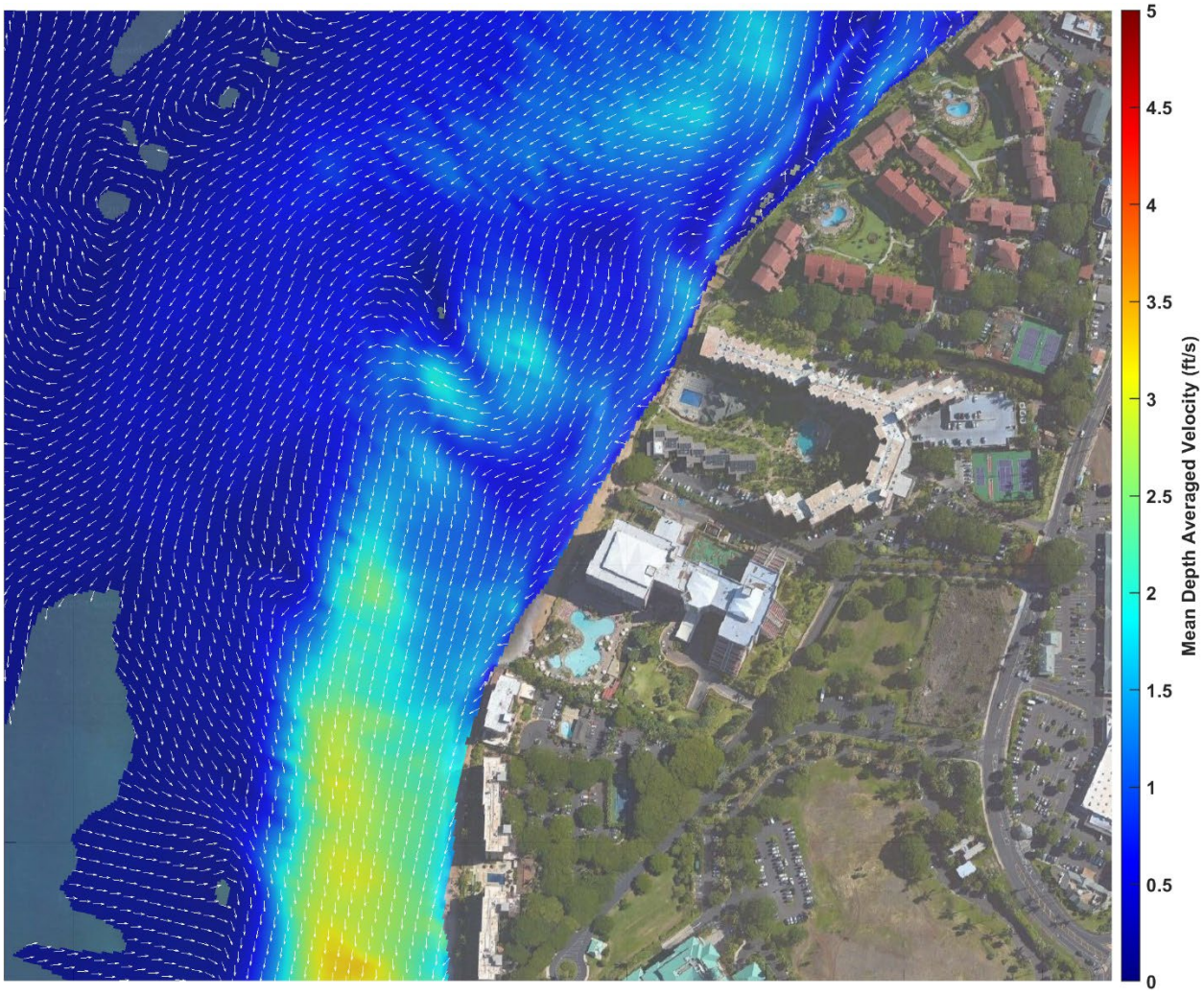


Figure 7-89. XBeach-NH modeled nearshore wave-induced current patterns for annual north swell.

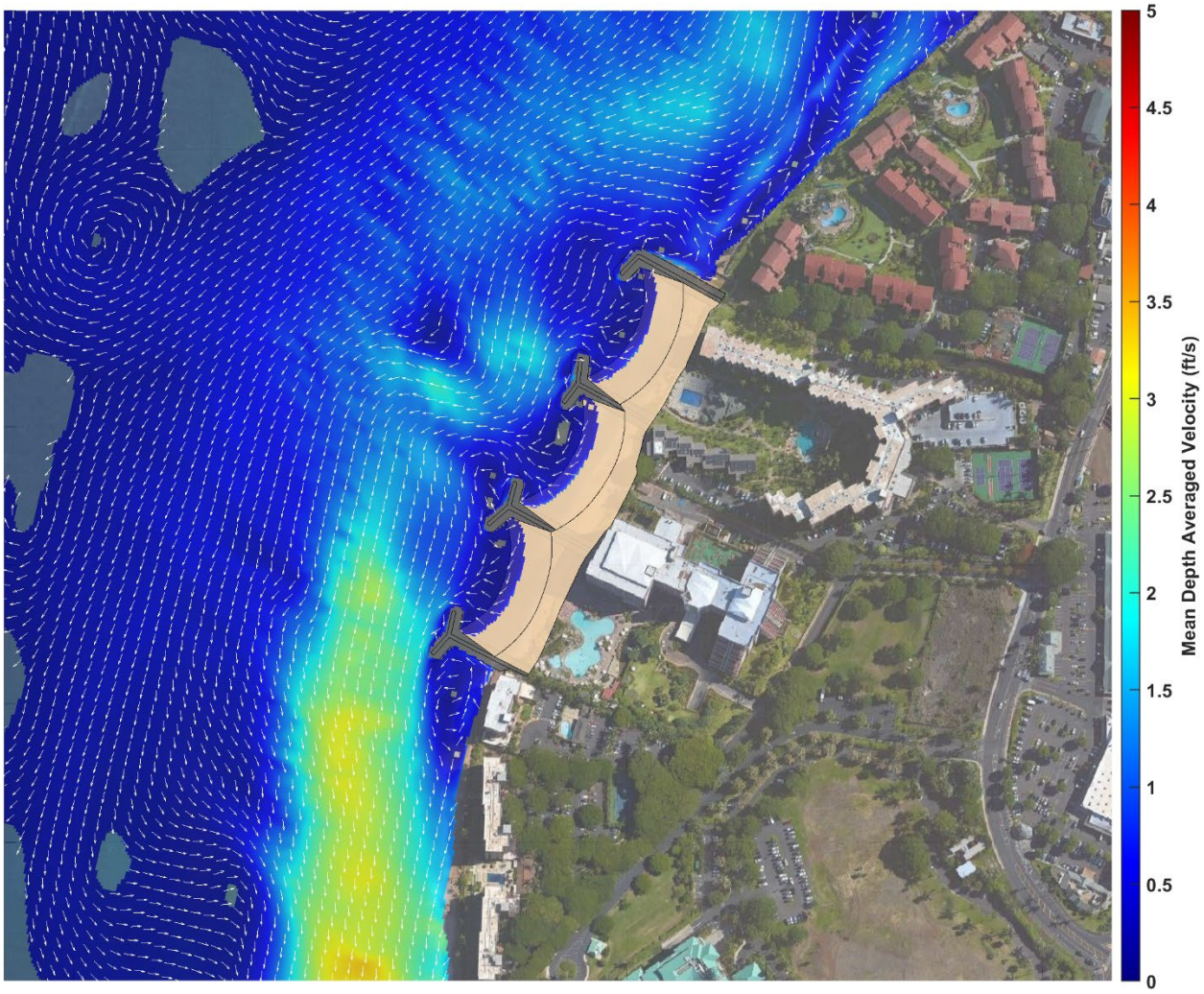


Figure 7-90. XBeach-NH modeled nearshore wave-induced current patterns for annual north swell with Beach Stabilization

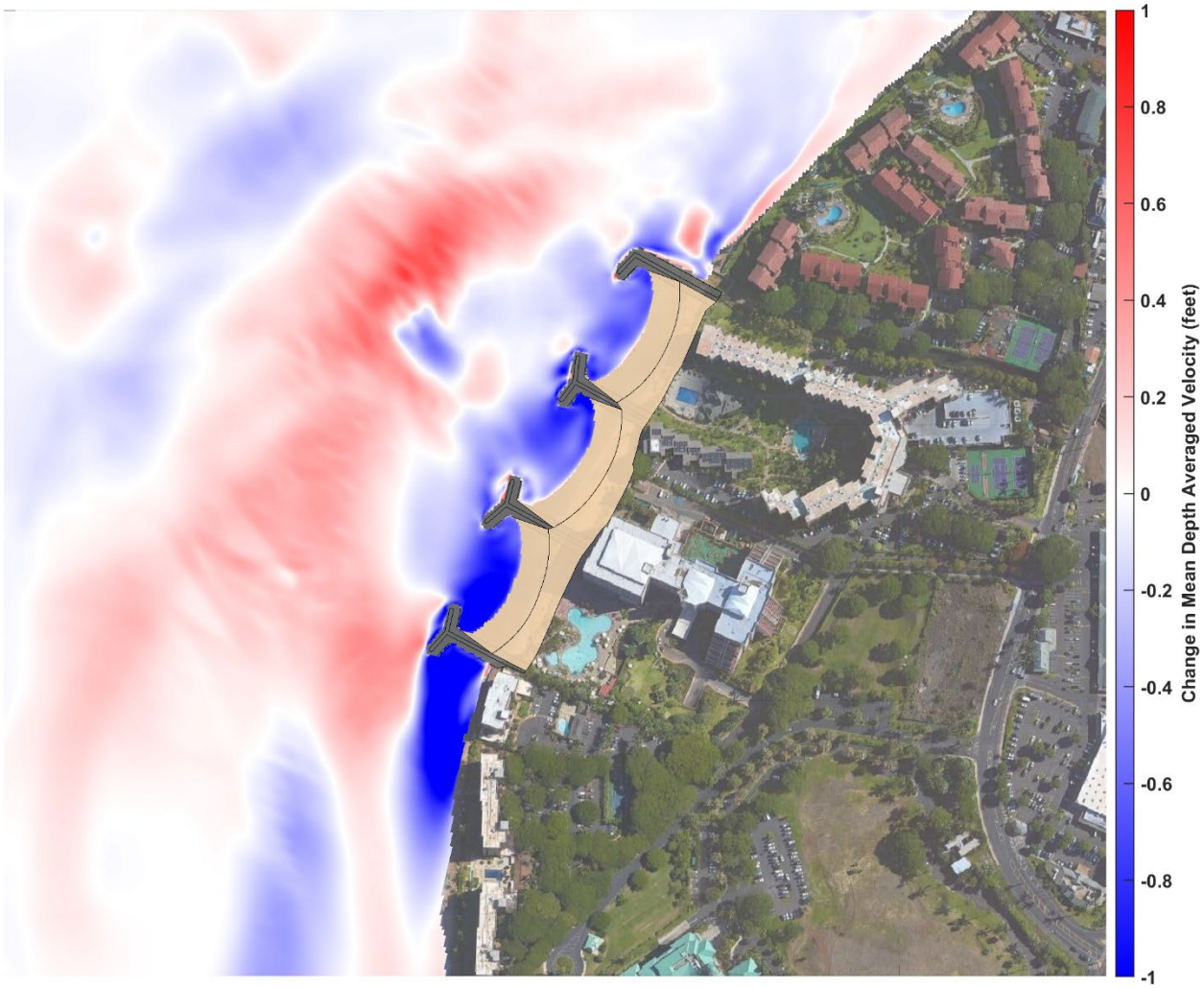


Figure 7-91. Absolute change in XBeach-NH modeled nearshore wave-induced current for annual north swell with Beach Stabilization

The absolute change in mean depth-averaged flow is shown with increasing values (red) and decreasing values (blue). The model shows the groin field interrupting the existing nearshore flow patterns as expected for this type of shoreline configuration. Seaward of the groin heads, the model shows an increase in flow velocity which is likely attributed to the redirection of the north to south flow under existing conditions. The model shows a general decrease of flow within each of the beach cells.

7.5.3.3 Prevailing South Swell

XBeach-NH model outputs for the wave-induced depth-averaged flow velocity for a prevailing south swell (typical summer conditions) for the existing and modified shoreline configurations are shown in Figure 7-72 and Figure 7-73, respectively. The absolute change in depth-averaged flow velocity (modified flow field minus existing flow field) is shown in Figure 7-74.

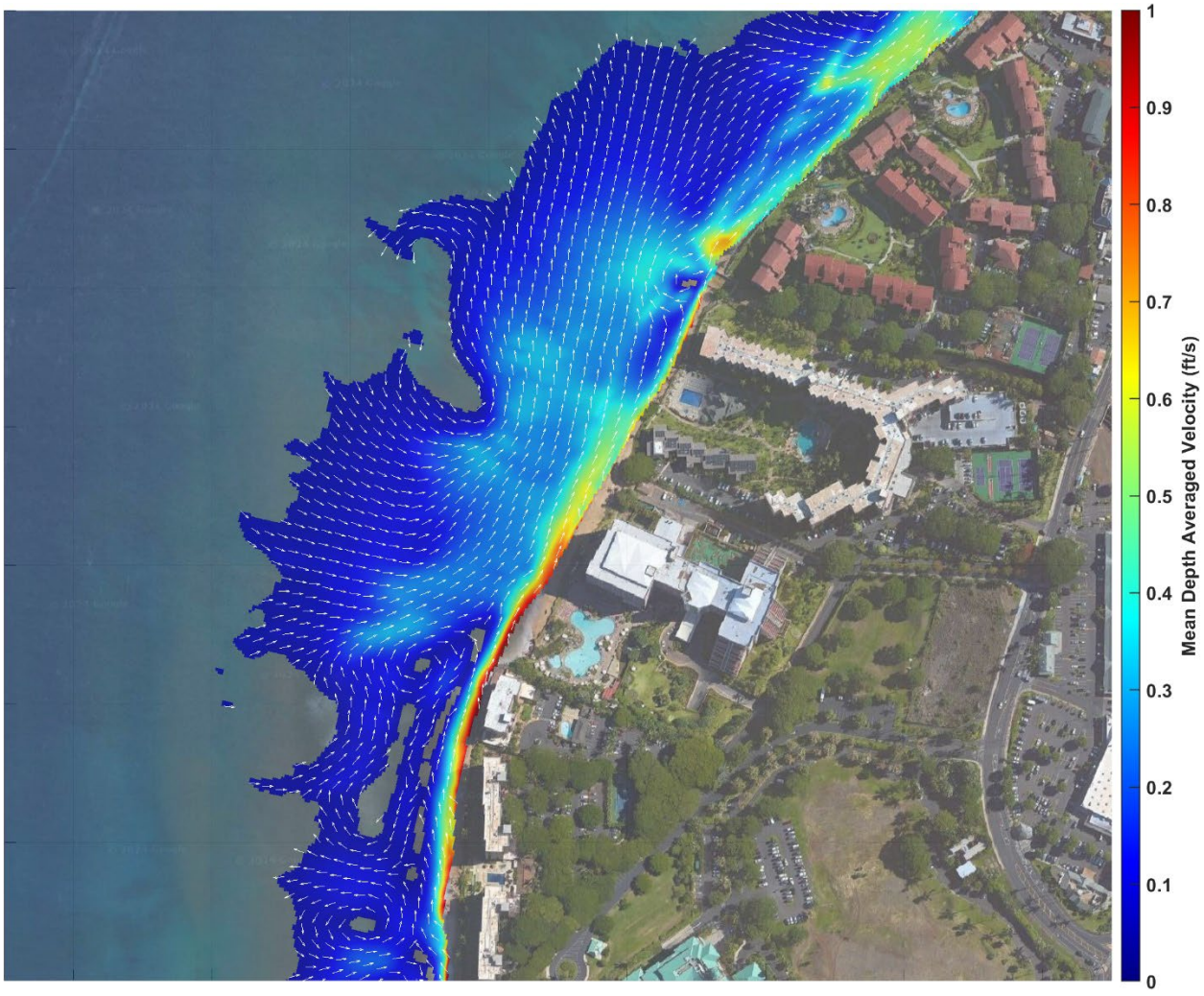


Figure 7-92. XBeach-NH modeled nearshore wave-induced current patterns for prevailing south swell (typical summer conditions)

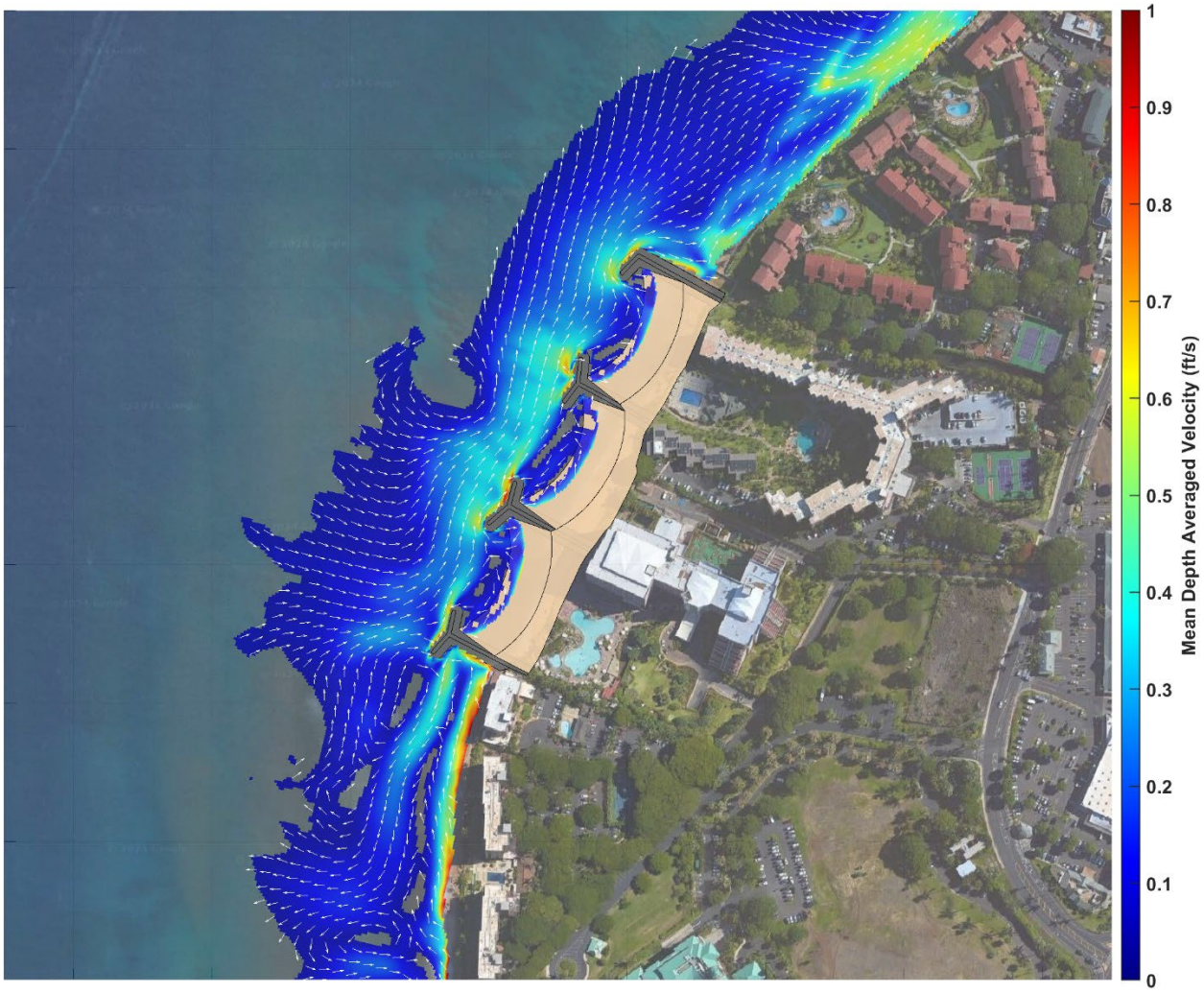


Figure 7-93. XBeach-NH modeled nearshore wave-induced current patterns for prevailing south swell (typical summer conditions) with Beach Stabilization

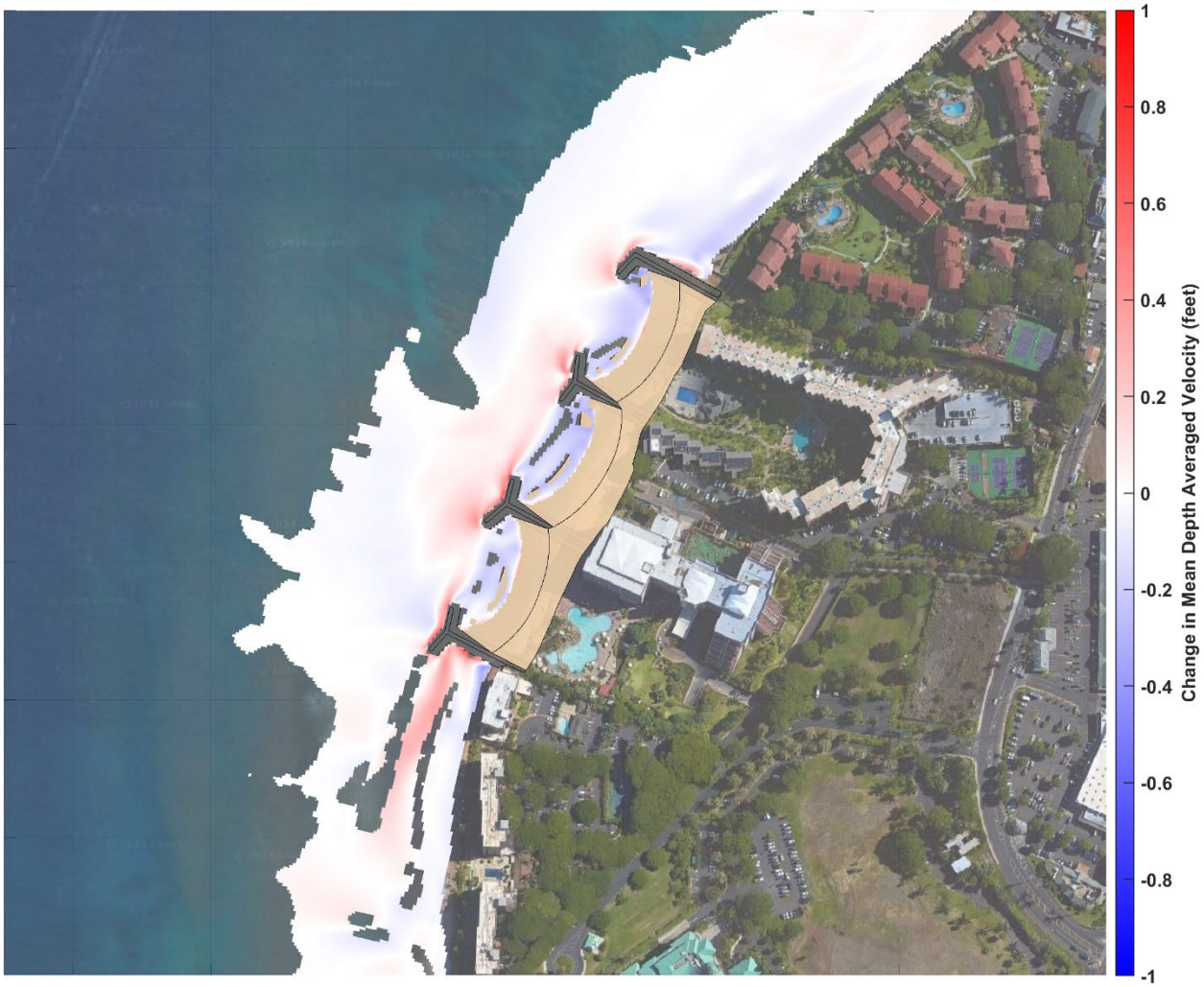


Figure 7-94. XBeach-NH modeled change in nearshore wave-induced current for prevailing south swell (typical summer conditions) with Beach Stabilization

The absolute change in mean depth-averaged flow is shown with increasing values in red and decreasing values in blue. The model shows the groin field interrupting the existing nearshore flow patterns as expected for this type of configuration. Seaward of the groin heads, the model shows an increase in flow velocity which is likely attributed to the redirection of the south to north flow under existing conditions. The model shows generally a decrease of flow within each of the beach cells.

7.5.3.4 Annual South Swell

XBeach-NH model outputs for the wave-induced depth-averaged flow velocity for an annual summer south swell for the existing and modified shoreline configurations are shown in Figure 7-78 and Figure 7-79, respectively. The absolute change in depth-averaged flow velocity (modified flow field minus existing flow field) is shown in Figure 7-80.

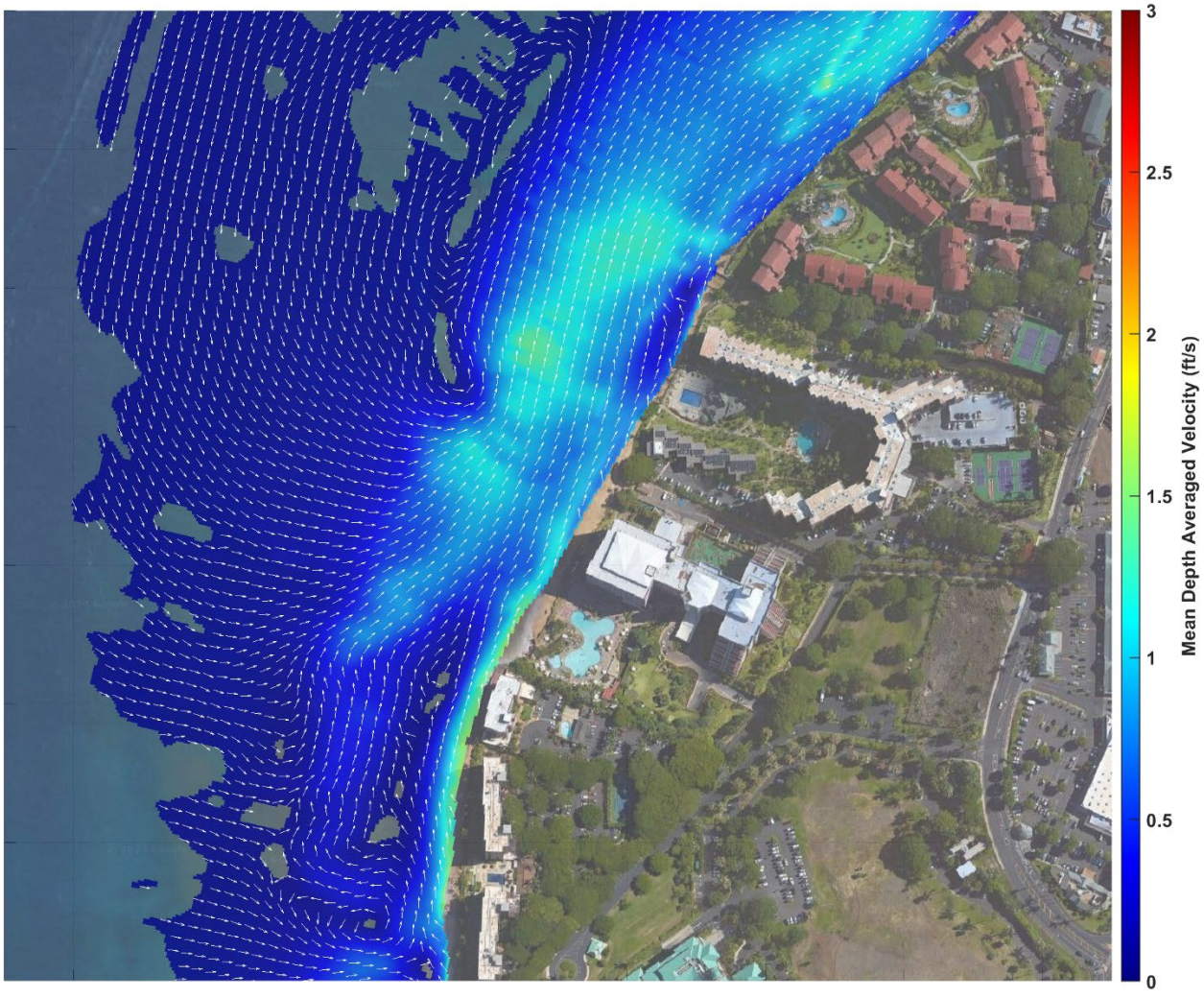


Figure 7-95. XBeach-NH modeled nearshore wave-induced current patterns for annual south swell.

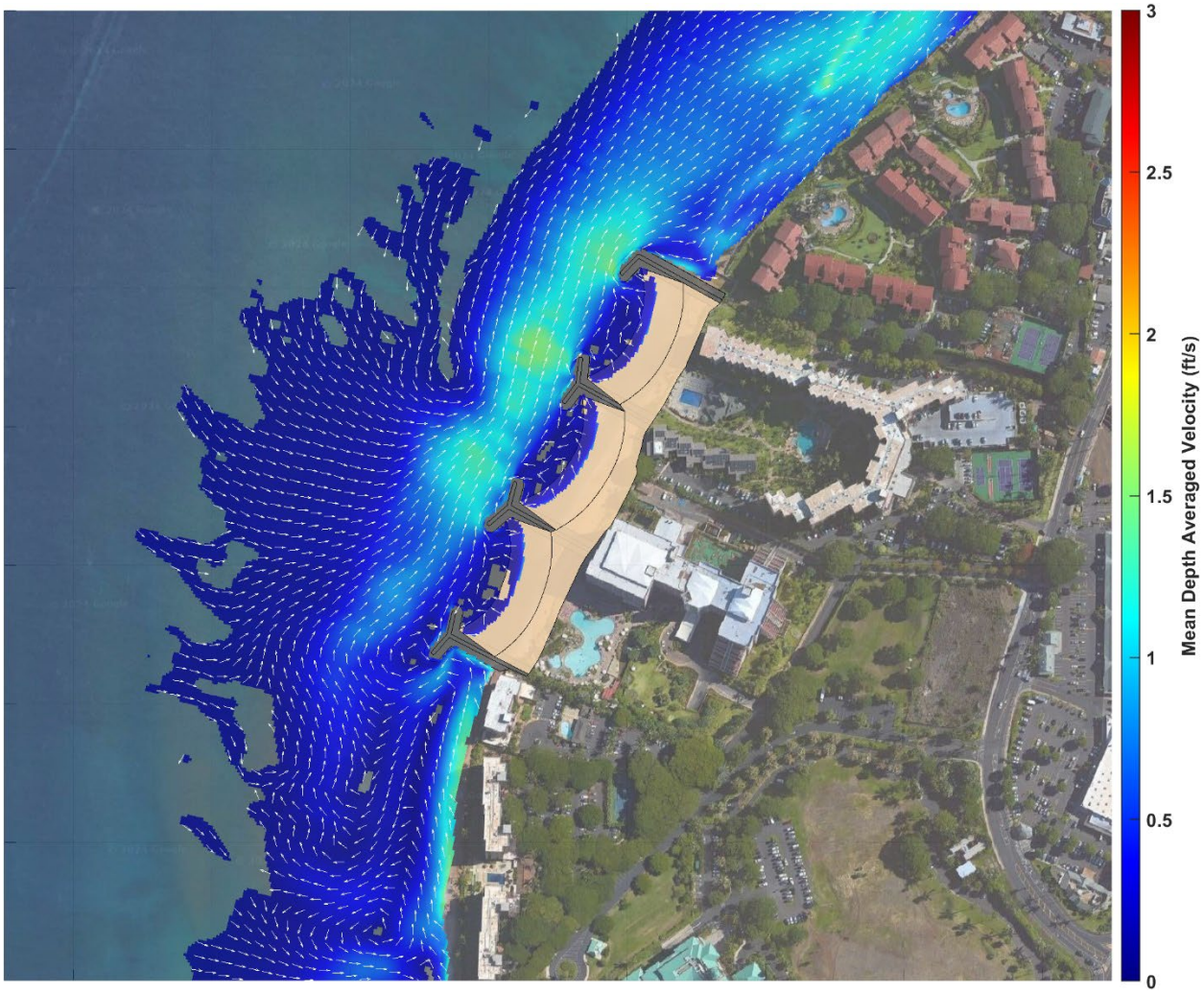


Figure 7-96. XBeach-NH modeled nearshore wave-induced current patterns for annual south swell with Beach Stabilization

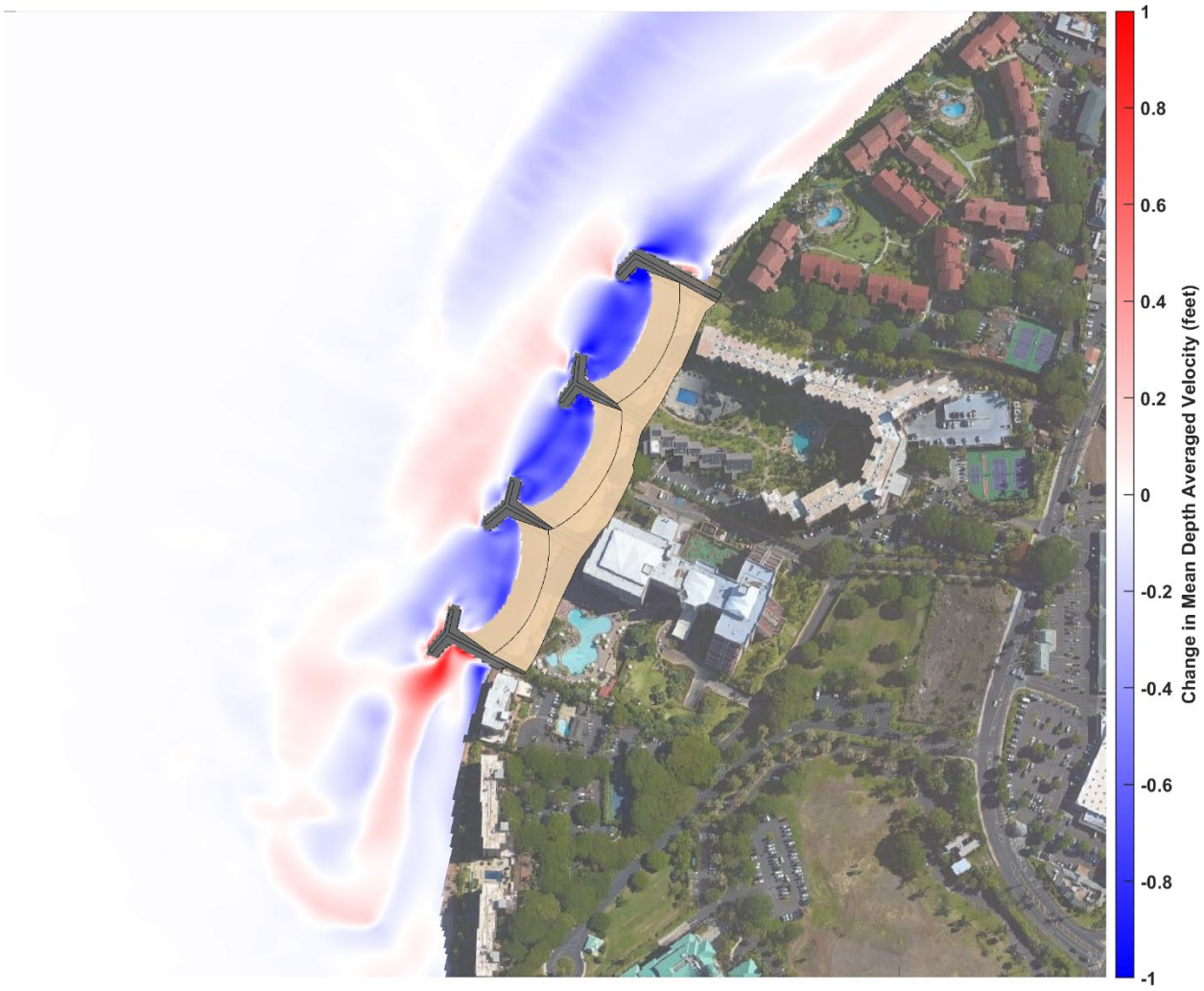


Figure 7-97. Absolute change in XBeach-NH modeled nearshore wave-induced current for annual south swell with Beach Stabilization

The absolute change in mean depth-averaged flow is shown with increasing values in red and decreasing values in blue. The model shows the groin field interrupting the existing nearshore flow patterns as expected for this type of configuration. Seaward of the groin heads, the model shows an increase in flow velocity which is likely attributed to the redirection of the south to north flow under existing conditions. The model shows generally a decrease of flow within each of the beach cells.

Potential Impacts and Mitigation Measures

Beach restoration has the potential to impact currents, circulation, and sediment transport patterns at the Project Site but is not expected to impact these processes at the Sand Recovery Site.

Beach Stabilization

Beach Stabilization would permanently alter existing current and circulation patterns at the Project Site. The groins would inhibit the transport of sand both alongshore (parallel to shore) and cross-shore (perpendicular to shore). As a result, Honokōwai Beach would be more stable and less susceptible to seasonal and episodic variations in beach width and volume. Beach Stabilization would inhibit longshore sediment transport in both the northerly and southerly directions but is not anticipated to have any adverse effects on the shorelines to the north or south.

The shoreline north of the Project Site is predominantly armored by existing shore protection structures (i.e., seawalls and revetments) that extend approximately 1,700 ft from the Project Site to Honokōwai Beach Park. The backshore area along this reach of the shoreline is composed of alluvium and there are no coastal dunes in this area (Sherrod et al. 2007). The nearshore area (seaward of the shoreline) consists of a barren scour zone with thin, discontinuous sand deposits. Due to the limited volume of sand in the littoral system, a sandy beach is typically not present in this area. Wave-induced currents along the shoreline are less energetic in this area and the north end of Honokōwai Beach is bisected by two drainage headwalls that extend seaward from both sides of the Honokōwai Stream mouth. These drainage headwalls act similarly to groins in that they interrupt longshore sediment transport and cause sand to accumulate in the stream mouth, preventing the sand from being transported further to the north. As a result, Beach Stabilization is not expected to result in any downdrift erosion or reduction in sand volume along the shoreline north of the Project Site.

The shoreline in the North Kāʻanapali littoral cell (south of the Project Site) consists predominantly of sandy beaches backed by coastal dunes. The nearshore area is also predominantly sandy. The shoreline immediately south of the Project Site is armored by existing shore protection structures (i.e., seawalls and revetments) that extend approximately 750 ft south of Honokōwai Point. As a result, Beach Stabilization is not anticipated to result in any downdrift erosion along this reach of the shoreline. The shoreline further to the south is predominantly composed of sandy substrate that is dynamic, mobile.

Beach Stabilization would inhibit sediment transport to the south but is not anticipated to result in any downdrift erosion or reduction in sand volume along this reach of the shoreline. Sand that currently exists along this reach of shoreline would remain subject to both longshore and cross-shore sediment transport and would continue to move freely along the shoreline. During the summer months, when sand is transported from south to north by southerly swell, sand is expected to accumulate on the updrift (south) side of the terminal groin at the south end of the Project Site. During the winter months, when northerly swell is dominant, the heads of this terminal groin would create a protective lee to the south that would inhibit this sand from mobilizing and being transported alongshore to the south. As a result, Beach Stabilization has the potential to increase beach width along the shoreline immediately to the south in the vicinity of the terminal groin. The degree to which these potential positive secondary impacts are realized will be dependent upon ocean conditions beyond the limits of the Project and therefore cannot be guaranteed.

Beach Nourishment

Beach Nourishment is not expected to have any direct or long-term impacts on currents or circulation patterns at the Project Site or the Sand Recovery Site. Beach Nourishment may help to temporarily facilitate sediment exchange between the Honokōwai littoral cell and the North Kāʻanapali littoral cell (south of the Project Site). The degree to which sediment exchange increases depends on how the beach equilibrates after construction and the rate of erosion that occurs during the 10-year design life of the project. Based on the projected erosion rates, the degree of sediment exchange would be expected to decrease as the beach gradually narrows due to ongoing erosion. The beach would also remain vulnerable to episodic erosion and beach loss events, such as that which occurred in 2016.

Beach Maintenance

Beach Maintenance is not expected to have any direct or long-term impacts on currents or circulation patterns at the Project Site or the Sand Recovery Site. Beach Maintenance may help to facilitate sediment exchange between the Honokōwai littoral cell and the North Kāʻanapali littoral cell (south of the Project Site). The degree to which sediment exchange increases would depend on how the beach equilibrates after construction and how the beach responds to sea level rise over the 50-year design life of the project. Based on current sea level rise projections, the degree of sediment exchange would be expected to decrease sea levels rise. The beach would also remain vulnerable to episodic erosion and beach loss events, such as that which occurred in 2016.

No Action

No Action would have no immediate impact on currents, circulation, and sediment transport patterns at the Project Site or the Sand Recovery Site as it would not require sand recovery or sand placement. Currents, circulation, and sediment transport patterns at the Project Site may change over time as the beach profile adjusts to rising sea levels. Current projections of future shoreline change in response to sea level rise for Hawaiʻi are based on the R-DA profile model (Davidson-Arnott, 2005). The R-DA model assumes that a sandy beach profile will translate upward and landward as water levels rise. If this were to occur at the Project Site, the beach would be likely to become narrower and more isolated as it is squeezed between the surrounding shore protection structures to the north and south, which would further inhibit sediment exchange between the Honokōwai littoral cell and the North Kāʻanapali littoral cell. The backshore area at the Project Site is also composed of alluvial sediment (clay, silt, sand, gravel, boulders), which is not conducive to beach formation. No Action would be expected to have a long-term negative impact on sediment availability and transport patterns at the Project Site.

Summary

Beach Stabilization is expected to alter existing currents, circulation, and sediment transport, patterns at the Project Site. The groins would inhibit longshore sediment transport and alter wave-driven currents and circulation patterns within the beach cells between the groins. Existing current velocities within the project footprint are relatively weak, therefore Beach Stabilization is not expected to significantly alter wave-driven currents and circulation patterns beyond the immediate vicinity of the groins. The groins would provide superior stability for the beach, and the sand fill would mitigate the reflection of wave energy from the existing seawalls. The groins heads would help prevent the formation of cross-shore (rip) currents along the groin stems, minimizing the loss of sand due to cross-shore sediment transport.

7.5.4 Shoreline Change

7.5.4.1 Historical Shoreline Change

Existing Conditions

The shoreline change history at Honokōwai Beach has been analyzed with aerial photographs by the University of Hawai'i Coastal Geology Group (UH-CGG). The UH-CGG compared the low water marks (LWMs) digitized from aerial photographs between 1912 and 2018. In the project vicinity, photographs from 1912, 1949, 1961, 1963, 1975, 1987, 1988, 1992, 1997, 2007, and 2018 were available for their analyses.

The analyses for the Project Site shoreline are presented as transects 1180 through 1195 shown in Figure 7-98 with the shoreline change rates tabulated in Table 7-30. Negative change rates represent erosion (landward movement of the shoreline). The UH-CGG study determined that, from 1912 to 2018, Honokōwai Beach has experienced erosion at an average annual rate of -0.44 ft/yr with the highest rates of erosion occurring at the south end of the beach.



Figure 7-98. Historical shoreline change transects at Honokōwai Beach (UH-CGG, 2021)

Table 7-30. Historical shoreline change rates at Honokōwai Beach (1912 to 2018)

Transect	Shoreline Change (ft/yr)
1179	-0.58
1180	-0.57
1181	-0.56
1182	-0.54
1183	-0.54
1184	-0.50
1185	-0.45
1186	-0.41
1187	-0.40
1188	-0.51
1189	-0.49
1190	-0.45
1191	-0.41
1192	-0.38
1193	-0.33
1194	-0.25
1195	-0.17
Average:	**-0.44**

7.5.4.2 Projected Shoreline Change

Existing Conditions

The UH-CGG calculated projected future shoreline change at Honokōwai Beach based on the historical rates combined with projected sea level rise using the Davidson-Arnott (R-DA) profile model (Anderson et al., 2015). The RD-A profile model assumes that the beach profile will translate upward and landward as sea levels rise. The RD-A methodology is relatively simple and assumes the beach profile (nearshore and backshore) is composed entirely of sand, which is not consistent with the coastal morphology at Honokōwai Beach where the backshore is primarily alluvial sediment and the nearshore is primarily shallow fringing reef. The RD-A methodology also does not account for future changes to regional wave climate and nearshore hydrodynamics due to climate change and sea level rise, respectively. For planning purposes, however, the RD-A methodology provides the best available information for potential future shoreline change for the Project Site shoreline.

Table 7-31 presents the UH-CGG's future shoreline change rates for each transect along Honokōwai Beach based on SLR values of 0.5, 1.1, 2.0, and 3.2 ft corresponding to mean shoreline change rates of -1.07, -1.27, -1.53, and -1.81 ft/yr, respectively. For this report, the average of the mean projected shoreline change rates (-1.27 ft/yr) over a period of 50 years is used for planning and design purposes. This value represents the anticipated average annual shoreline change rate along Honokōwai Beach over a 50-year design life.

Table 7-31. Projected future shoreline change rates at Honokōwai Beach

Transect	Projected Shoreline Change (ft/yr)			
	0.5 ft SLR	1.1 ft SLR	2.0 ft SLR	3.2 ft SLR
1179	-1.41	-1.67	-2.04	-2.44
1180	-1.40	-1.67	-2.03	-2.44
1181	-1.37	-1.65	-2.01	-2.42
1182	-1.35	-1.62	-1.99	-2.40
1183	-1.32	-1.60	-1.98	-2.39
1184	-1.21	-1.45	-1.77	-2.12
1185	-1.07	-1.26	-1.51	-1.78
1186	-1.01	-1.18	-1.41	-1.64
1187	-1.03	-1.20	-1.41	-1.65
1188	-1.15	-1.32	-1.53	-1.76
1189	-1.09	-1.26	-1.47	-1.70
1190	-1.01	-1.18	-1.40	-1.63
1191	-0.94	-1.10	-1.31	-1.54
1192	-0.87	-1.02	-1.21	-1.43
1193	-0.78	-0.92	-1.10	-1.31
1194	-0.67	-0.80	-0.97	-1.16
1195	-0.59	-0.71	-0.87	-1.05
Average:	**-1.07**	**-1.27**	**-1.53**	**-1.81**

Potential Impacts and Mitigation Measures

Beach restoration is expected to reduce projected future erosion rates by restoring beach width and volume. The degree to which future erosion rates decrease would be dependent on the selected methodology for beach restoration. Beach restoration may also reduce historical erosion rates. As the time series of the Hawaii Shoreline Study[35] is expanded to include additional future shoreline positions, a wider beach would be expected to produce shoreline positions that would be further seaward, which could potentially reduce long-term historical erosion rates.

Beach Stabilization

Beach Stabilization would produce four stable beach cells in an area that is currently subject to chronic and seasonal erosion and recently experienced an episodic erosion and beach loss event. The groins would stabilize the sand and mitigate erosion, so future erosion rates would be significantly reduced when compared to both historical and projected shoreline change rates. Beach Stabilization has a design life of 50 years. Based on the SLR-XA projections for coastal erosion, Beach Stabilization is expected to have a positive impact by mitigating erosion, shoreline recession, beach narrowing, and potential beach loss and infrastructure damage. Beach Stabilization is also expected to have a positive impact by restoring and preserving Honokōwai Beach and making the beach more resilient to sea level rise and episodic wave events.

[35] https://www.soest.hawaii.edu/crc/index.php/hawaii-shoreline-study-web-map/

Beach Nourishment

Beach Nourishment has the potential to temporarily decrease future erosion rates by increasing beach width and volume for a period of 10 years. However, the beach would remain subject to chronic, seasonal, and episodic erosion. Based on the current projections for future shoreline change, future erosion rates would be expected to exceed the historical rates. No long-term impacts to shoreline change rates are expected.

Beach Maintenance

Beach Maintenance has the potential to decrease future erosion rates by increasing beach width and volume for a period of 50 years. However, the beach would remain subject to chronic, seasonal, and episodic erosion. Based on the current projections for future shoreline change, future erosion rates would be expected to exceed the historical rates. No long-term impacts to shoreline change rates are expected.

No Action

No Action would have no impact on historical or projected shoreline change rates. Progressive erosion would be expected to cause shoreline recession, beach narrowing, and potential beach loss.

Summary

Beach Restoration has the potential to reduce future erosion rates when compared to current historical and projected shoreline change rates. Beach Stabilization is the most effective approach to preserve the beach and mitigate long-term erosion. Beach Maintenance may help to reduce long-term erosion rates; however, the beach would remain vulnerable to chronic, seasonal, and episodic erosion. Beach Nourishment could temporarily decrease erosion rates but is not expected to significantly reduce long-term erosion rates.

7.5.4.3 Beach Profile Monitoring

Existing Conditions

Beach profile surveys have been performed at various times to allow for observations of seasonal changes in beach width and volume (Table 7-32). The transect locations for the beach profiles are shown in Figure 7-99, and the combined survey results are shown in Figure 7-100 and Figure 7-101. The survey on March 5, 2017, was performed prior to the installation of the EEPS. The remaining four surveys were completed after installation of the EEPS. A combined topographic/bathymetric LiDAR dataset (USACE, 2013) was used as a reference to represent pre-erosion beach conditions.

Table 7-32. Beach profile survey dates and descriptions

Survey Date	Description
March 5, 2017	Post-Winter
December 18, 2019	Mid-Winter
June 23, 2021	Mid-Summer
January 19, 2023	Mid-Winter
September 16, 2024	Post-Summer

The 2013 LiDAR data shows a series of elevation features that are characteristic of a stable sandy beach including a gently sloping upper beach, multiple berm features, and a steeper lower beach face. These features are generally not apparent in the subsequent beach profile surveys. The 2017, 2019, and 2023 surveys generally reflect winter conditions when the predominant direction of sediment transport is north to south. During these surveys, the south end of the beach was wider and higher in elevation, and the north end of the beach was narrower and lower in elevation. In contrast, the surveys of 2021 and 2024 generally reflect summer conditions when the predominant direction of sediment transport is south to north. During these surveys, the south end of the beach was narrower and lower in elevation, and the north end of the beach was wider and higher in elevation. During the most recent survey on September 16, 2024, the north end of the beach (Transect 7 and Transect 8) was observed to have a more stable profile with a well-defined beach berm and a gently sloping upper beach face.

The beach profile surveys indicate that the beach has experienced partial recovery since the 2016 episodic erosion and beach loss event but remains narrower and lower in elevation along all profiles when compared to pre-erosion conditions. The survey data also confirms that the beach is seasonally variable, and that sediment transport is predominantly alongshore.

The EEPS is located along the landward edge of the beach profile and does not appear to have any significant effect on the natural seasonal variability in beach and elevation, which is primarily driven by wave-induced currents that transport sediment alongshore. The EEPS is intended to reduce direct wave impact on the erosion scarp and prevent terrigenous sediment (alluvium) from entering the nearshore waters. Any wave reflection that may occur when the EEPS is exposed to wave action would be expected to have a negligible effect on sediment transport patterns. In the absence of the EEPS, the existing erosion scarp would be expected to produce a similar amount of wave reflection.



Figure 7-99. Beach profile transect locations.

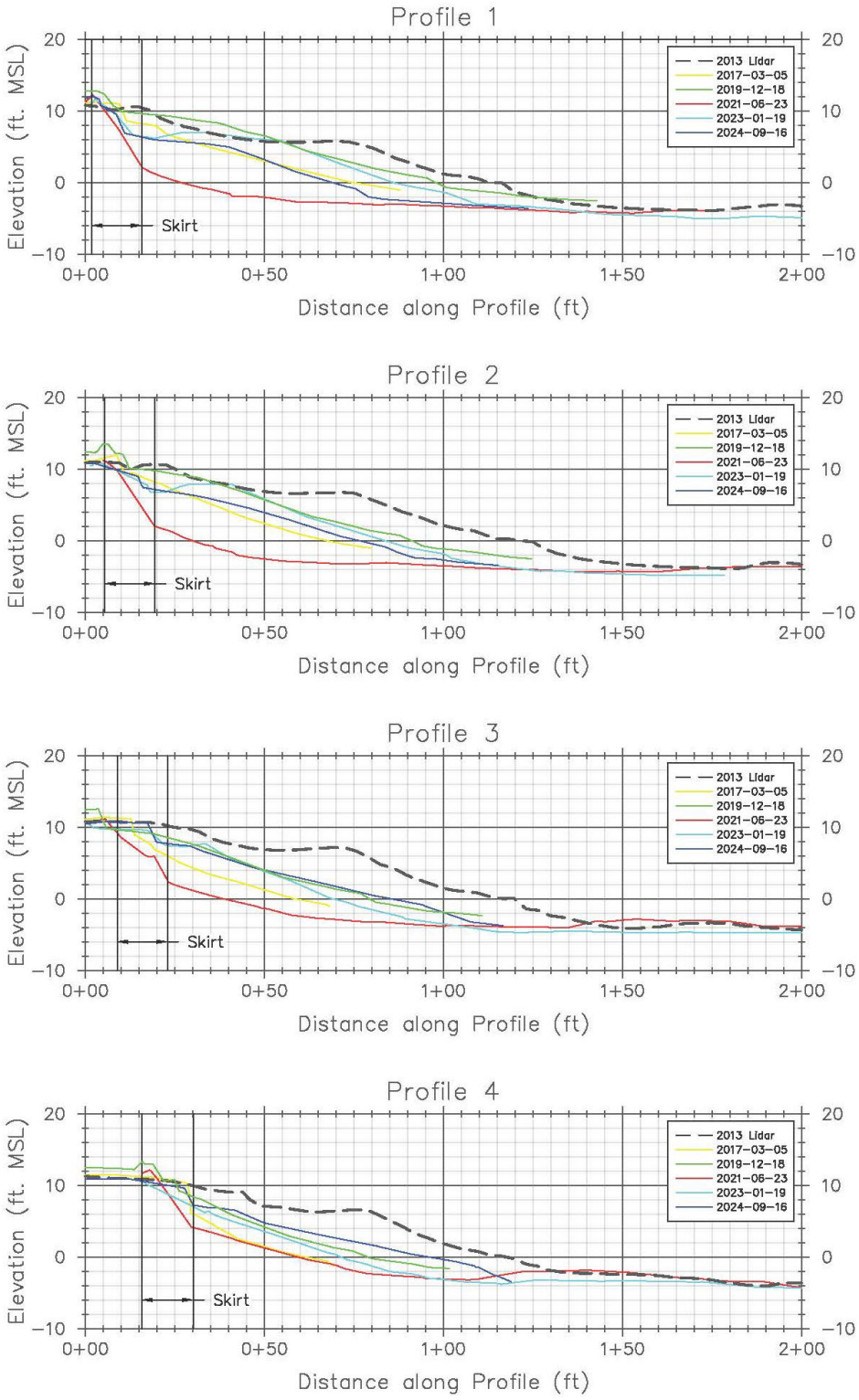


Figure 7-100. Beach profile survey results for Transects 1 to 4 (southern portion of the shoreline)

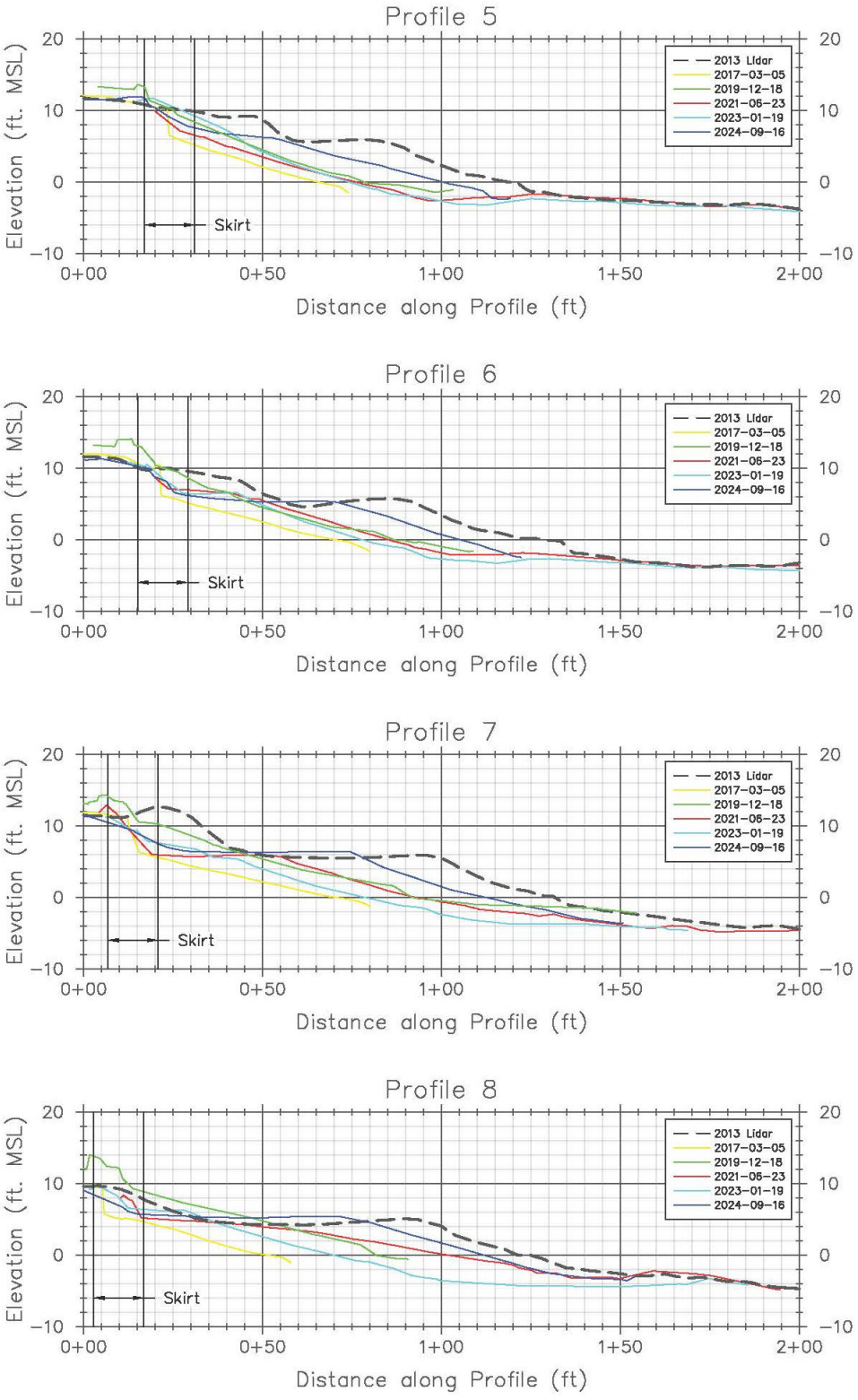


Figure 7-101. Beach profile survey results for Transects 5 to 8 (northern portion of the shoreline)

7.6 Coastal Hazards

This section details existing coastal hazards and evaluates potential impacts associated with the Project and alternatives. In addition, this section discusses implementation of management and design measures to minimize negative impacts associated with coastal hazards.

7.6.1 Coastal Flooding

Existing Conditions

FEMA Flood Zones

The National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency (FEMA), produces maps identifying flood hazards and risks. Figure 7-102 shows the flood hazard map for the Project Site. The map indicates that the area is rated as Flood Zone VE in red. Zone VE designates areas subject to inundation by the 1% annual chance flood event with additional hazards due to storm-induced velocity wave action. The Base Flood Elevation (BFE) is 10 ft. The map indicates that the area inland of the subject shoreline (in blue) is Flood Zone AE. Zone AE designates an area inundated by 1% annual chance flooding, for which BFEs have been determined, but without additional hazards due to storm-induced velocity wave action. The BFE's in Flood Zone AE landward of the Project Site are 10 ft.

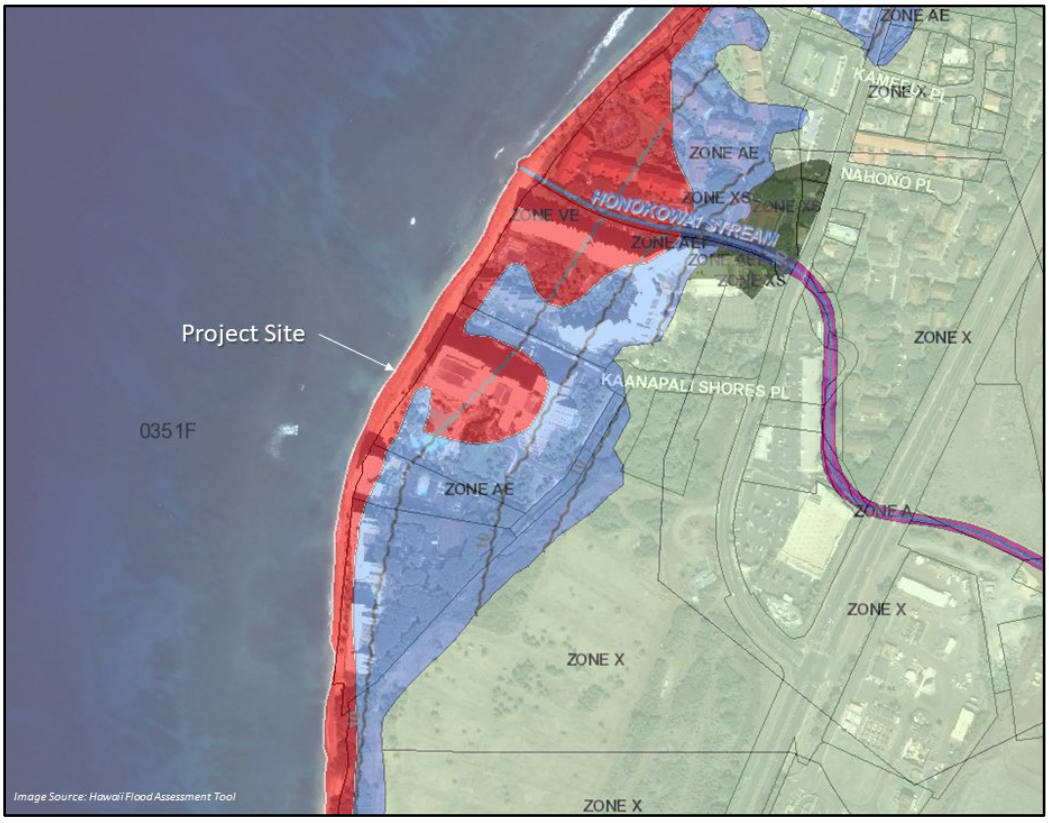


Figure 7-102. Flood zones at the Project Site (FEMA, 2024)

Passive Flooding and Annual High Wave Flooding with Sea Level Rise

The SLR-XA model results for passive flooding and annual high wave flooding with sea level rise were previously discussed in Section 7.3.4. Passive flooding and annual high wave flooding are not projected to have any significant impact on the Project Site over the next 50 years.

Wave-Driven Flooding with Sea Level Rise

Azouri et al. (2022) performed numerical modeling to simulate wave-induced coastal inundation in West Maui using the Boussinesq Ocean and Surf Zone (BOSZ) phase-resolving model (Roeber and Cheung, 2012). The model simulates inundation depth over land for selected combinations of swell amplitudes and directions under different water levels for three (3) different sea level rise scenarios ranging from 0.3m (1 ft) to 2.0 m (6.6 ft). The model results for the annual high wave flooding and maximum annual high wave flooding scenarios are shown in Figure 7-103 and Figure 7-104, respectively. The model results show that annual high wave flooding is not projected to impact on the Project Site with up to 3.3 ft of sea level rise.

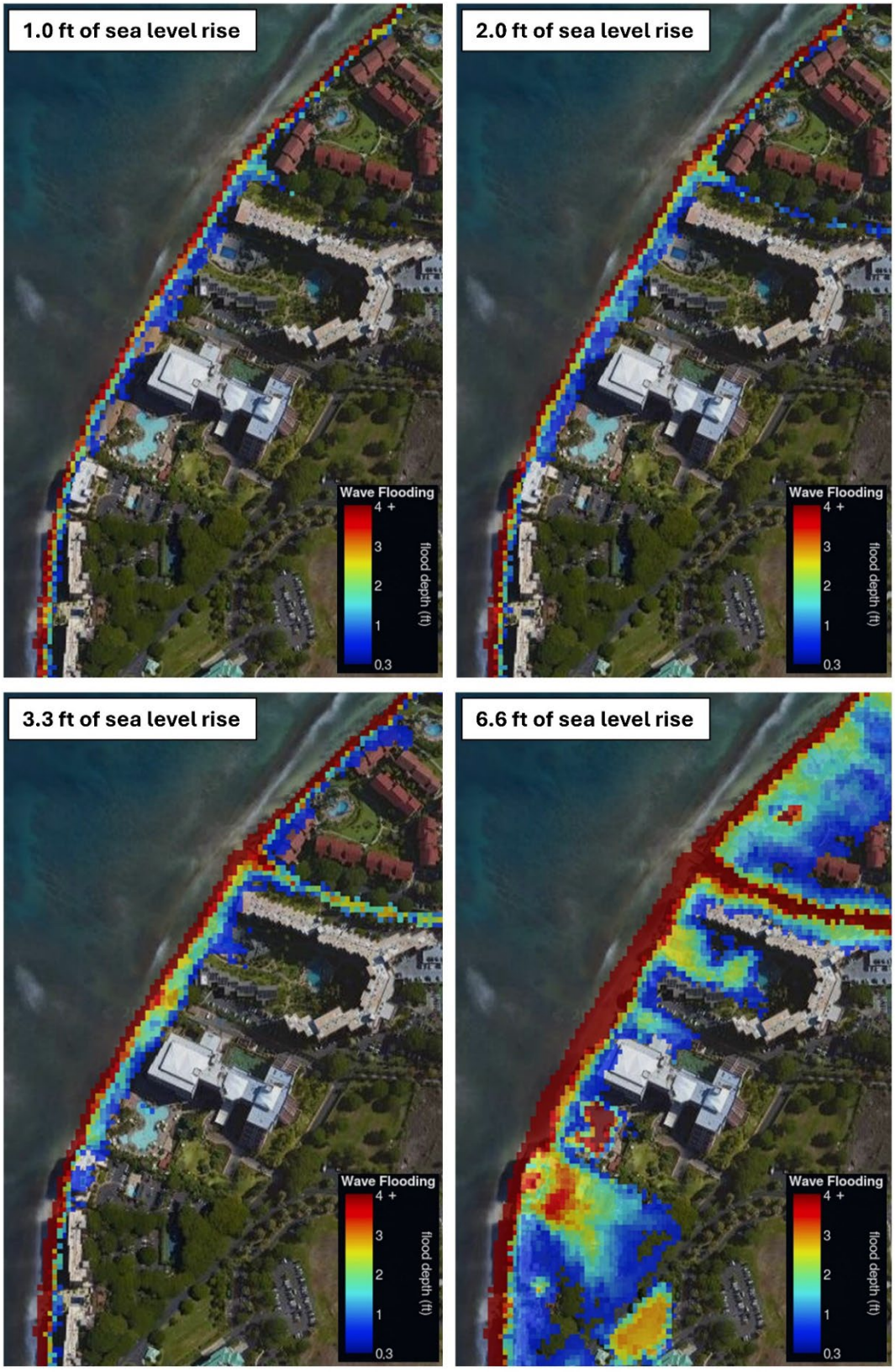


Figure 7-103. Annual high wave flooding with sea level rise (Azouri et al. 2022).

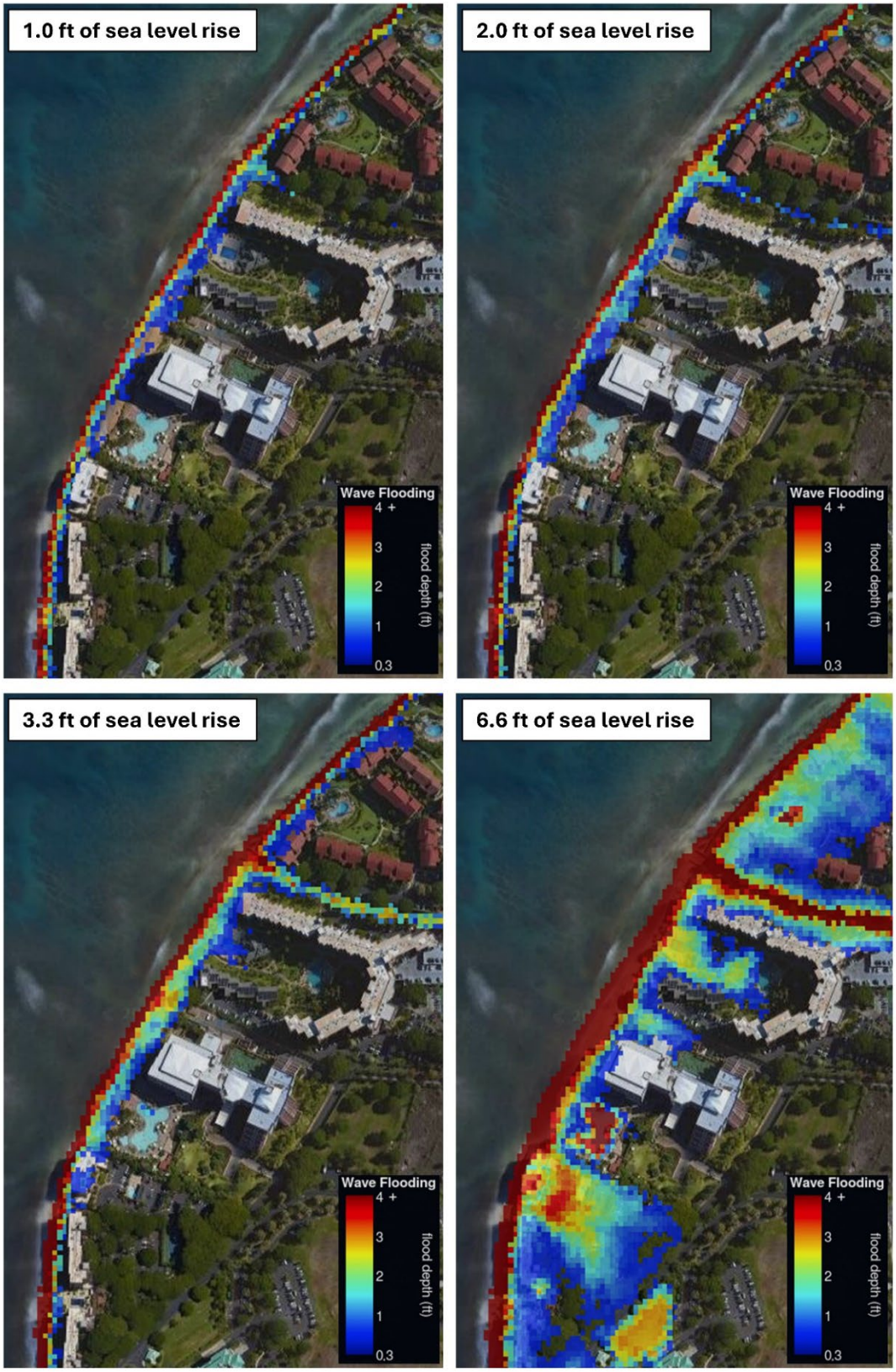


Figure 7-104. Maximum annual high wave flooding with sea level rise (Azouri et al. 2022).

Potential Impacts and Mitigation Measures

Beach restoration would help to reduce the impacts of wave overtopping and flooding by increasing beach width and volume, which would provide a protective buffer between the terrestrial and marine environments. This would increase the wave energy dissipating properties of the beaches and potentially decrease the landward extent of wave runup, reducing the vulnerability of the backshore to marine flooding.

Beach Stabilization

Beach Stabilization is expected to have the most positive impact in terms of potential flood risk reduction as the groins and beach cells would provide a stable and durable buffer between the terrestrial and marine environments. The groins would decrease and reorient the amount of wave energy reaching the backshore and potentially decrease the inland extent of any wave overtopping that may occur.

Beach Nourishment

Beach Nourishment is expected to have a positive impact in terms of enhancing the natural buffer between the terrestrial and marine environments. However, the wave energy dissipating properties of the beach would decrease over time as the beach continues to erode over the 10-year design life of the project. The risk of wave-induced flooding in the backshore area would be expected to increase as the beach gradually narrows over time.

Beach Maintenance

Beach Nourishment is expected to have a similarly positive impact to Beach Nourishment in terms of enhancing the natural buffer between the terrestrial and marine environments. With periodic renourishment, the wave energy dissipating properties of the beach would be preserved over the 50-year design life of the project.

No Action

No Action would have no immediate impact on coastal flooding. However, removal of the temporary erosion skirt would expose the backshore to wave action, which could result in erosion and shoreline recession that could potentially increase flood risk exposure. No Action would have a long-term negative impact by increasing flood risk exposure. Over a period of 50 years, erosion, shoreline recession, and beach narrowing would be expected to increase progressively as sea levels continue to rise. The risk of wave-induced flooding would be expected to increase as the wave dissipating properties of the beach diminish over time.

Summary

All of the beach restoration alternatives have the potential to reduce wave overtopping and wave-induced flooding. Beach Stabilization is the most stable and durable of the beach restoration methodologies considered and is therefore expected to provide the most positive impact in terms of flood risk reduction.

7.6.2 Storm Surge

Existing Conditions

The Hawaiian Islands are annually exposed to severe storms and storm waves generated by passing low-pressure systems (Kona storms) and tropical cyclonic storms (hurricanes). Kona storms occur when the winter low pressure systems that travel across the North Pacific Ocean dip south and approach the Islands. Strong southerly and southwesterly winds generated by these storms result in large waves on exposed shorelines, and often heavy rains.

Storm surge refers to the abnormal rise in sea level that occurs during storm events, measured as the height of the water above the normal predicted astronomical tide. Storm surge is primarily caused by winds pushing water onshore. The amplitude of the storm surge and the extent to which it may cause coastal flooding depends on a variety of factors including but not limited to the orientation of the coastline; the size, speed, and intensity of the storm; and the local bathymetry and topography (NOAA, 2024).

Storm-Induced Coastal Flooding with Sea Level Rise

Storlazzi et al. (2024) modeled potential marine flooding for three (3) storm scenarios with 1-yr , 20-yr, and 100-yr return periods. Each storm event scenario was modeled for seven (7) sea level rise elevations ranging from 25 cm (0.8 ft) to 300 cm (9.8 ft). The model results for the 20-yr and 100-yr storm events with 3.2 ft of sea level rise are shown in Figure 7-105 and Figure 7-106, respectively.

Marine flooding associated with the 1-yr (annual) and 20-yr storm event scenarios is projected to be limited to the foreshore area (seaward of the shoreline) and is not projected to impact the Project Site with up to 100cm (3.2 ft) of sea level rise (Figure 7-105). Marine flooding associated with a 100-yr (annual) storm event scenario is projected to cause minor flooding (less than 25 cm (0.8 ft) in depth) in low-lying portions of the backshore area (landward of the shoreline) (Figure 7-106). The projected impacts of flooding associated with a 100-yr (annual) storm event with up to 100cm (3.2 ft) of sea level are considered negligible at the Project Site. Marine flooding associated with a 100-yr (annual) storm event is not projected to substantially impact the Project Site until sea levels rise by 150cm (5 ft), which is not projected to occur within the timeframe of the Project.

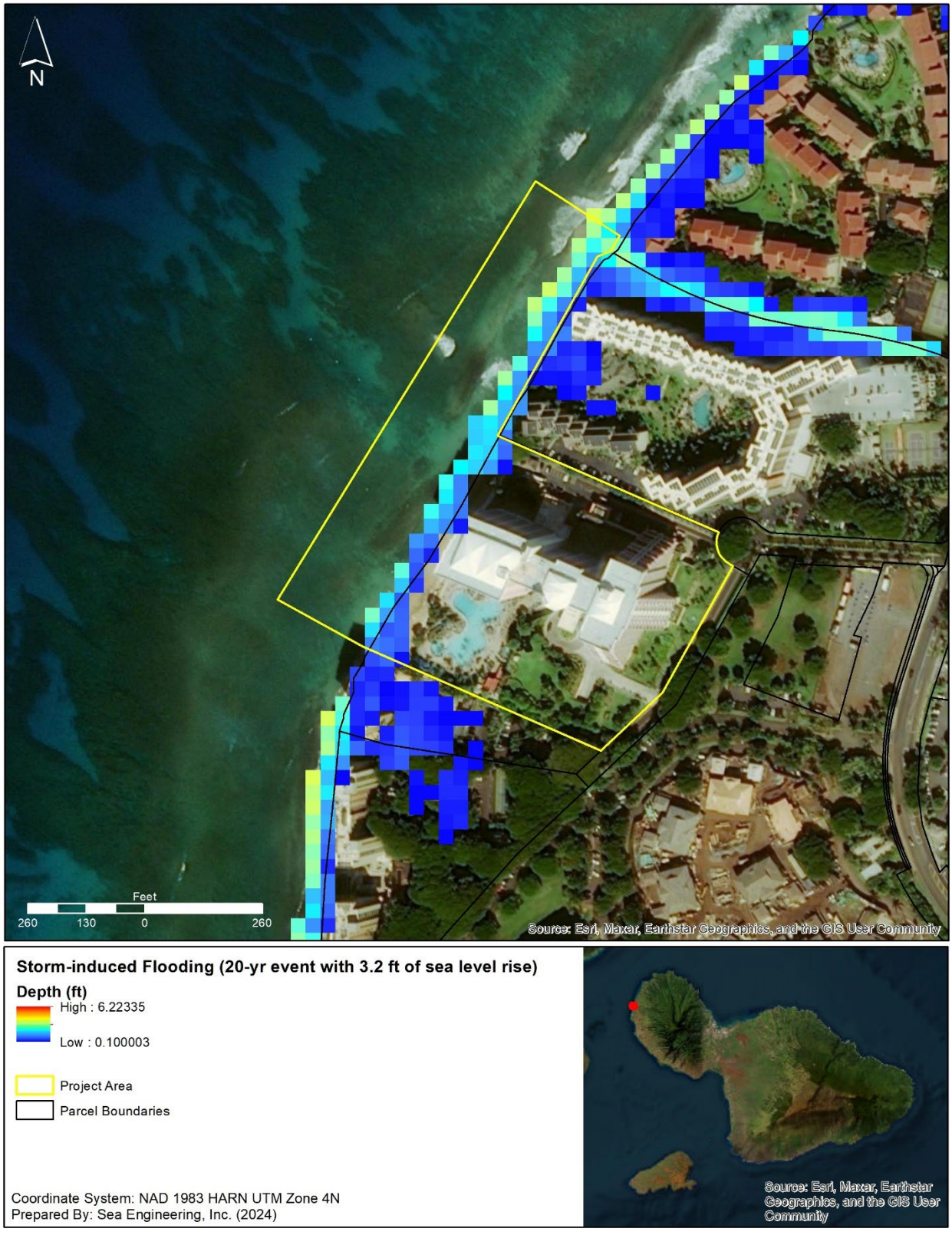


Figure 7-105. Modeled storm surge for 20-yr event with 3.2 ft of sea level rise (Storlazzi et al. 2024).

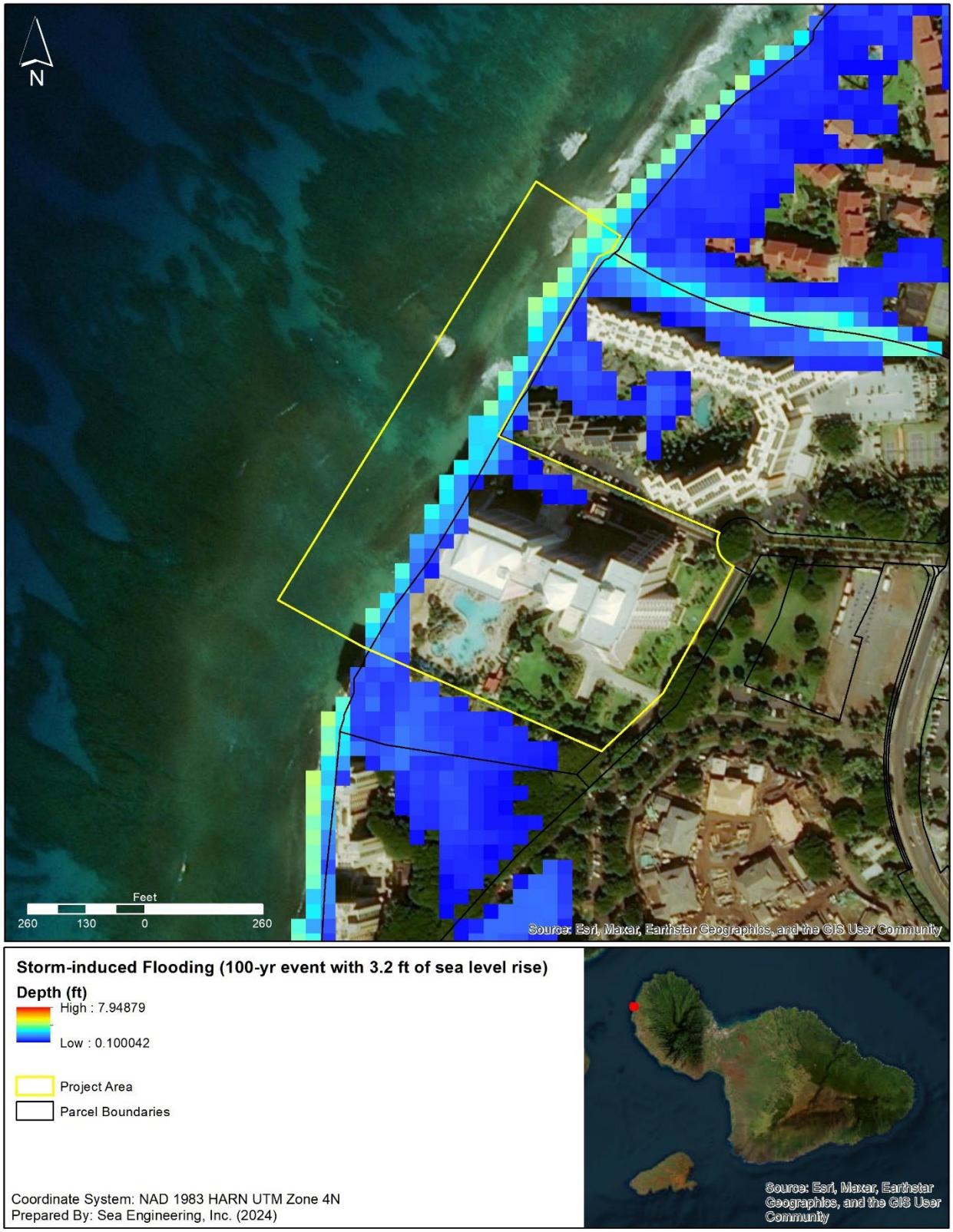


Figure 7-106. Projected storm surge for 100-yr event with 3.2 ft of sea level rise (Storlazzi et al. 2024).

Potential Impacts and Mitigation Measures

Beach restoration would help to reduce the impacts of storm surge by increasing beach width and volume, which would provide a protective buffer between the terrestrial and marine environments. This would increase the wave energy dissipating properties of the beaches and potentially decrease the landward extent of storm surge, reducing the vulnerability of the backshore to marine flooding.

Beach Stabilization

Beach Stabilization is expected to have the most positive impact in terms of potential storm surge risk reduction as the groins and beach cells would provide a stable and durable buffer between the terrestrial and marine environments. The groins would decrease and reorient the amount of wave energy reaching the backshore and potentially decrease the inland extent of any storm surge that may occur.

Beach Nourishment

Beach Nourishment is expected to have a positive impact in terms of enhancing the natural buffer between the terrestrial and marine environments. However, the wave energy dissipating properties of the beach would decrease over time as the beach continues to erode over the 10-year design life of the project. The risk of storm surge in the backshore area would be expected to increase as the beach gradually narrows over time.

Beach Maintenance

Beach Nourishment is expected to have a similarly positive impact to Beach Nourishment in terms of enhancing the natural buffer between the terrestrial and marine environments. With periodic renourishment, the wave energy dissipating properties of the beach would be preserved over the 50-year design life of the project.

No Action

No Action would have no immediate impact on storm surge. However, over a period of 50 years, the beach would be expected to gradually narrows over time due to increasing erosion pressure and rising water levels. The risk of storm surge would be expected to increase as the wave dissipating properties of the beach diminish over time.

Summary

All of the beach restoration alternatives have the potential to reduce wave overtopping and wave-induced flooding caused by storm surge. Beach Stabilization is the most stable and durable of the beach restoration methodologies considered and is therefore expected to provide the most positive impact in terms of storm surge risk reduction.

7.6.3 Tsunamis

Existing Conditions

Tsunamis are waves that result from large-scale displacements of the seafloor. They are most commonly caused by large magnitude earthquakes (typically magnitude 7.0 or greater). 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 seafloor where the earthquake originated. Tsunami waves typically have small wave heights in deep water but can have wavelengths of hundreds of miles and travel at speeds up to 500 mph. A tsunami can travel from one side of the Pacific to the other in less than a day. The speed decreases rapidly as the water shoals. The waves increase greatly in height as they shoal and can push further inland. 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 Hawaiʻi have historically originated from the tectonically active areas located around the Pacific Rim (e.g., Alaska, Japan, and Chile). Waves created by earthquakes in these areas take hours to reach Hawaiʻi, and the network of sensors that are part of the Pacific Tsunami Warning System are able to provide Hawaiʻi with several hours advance warning prior to the arrival of tsunami waves generated from these locations. Less commonly, tsunamis originate from seismic activity in the Hawaiian Islands, and there is little to no advance warning for these locally generated events.

The Project Site is located in a tsunami evacuation zone and has been assigned a high tsunami hazard rating where the coastal slopes are low (Fletcher et al., 2002). Four significant tsunamis have impacted Hawaiʻi in recent history – 1946, 1957, 1960 and 1964. The 1946 tsunami was generated in the Aleutian Islands and was one of the most destructive tsunamis to strike Hawaiʻi. Wave runups along the coastlines of North Kaanapali and Honokōwai during the 1946, 1957 and 1960 tsunamis were 16 ft, 9 ft, and 10 ft, respectively. During the 1946 tsunami, wave runups as high as 24 ft were recorded at Kahana Bay, 2 mi north of the Project Site (Loomis, 1976).

Tsunamis are unpredictable events with no statistical characteristics or recurrence interval for design of coastal structures. Unlike typical ocean waves, tsunamis have very long wavelengths that can span hundreds of miles, so they can travel very long distances with minimal loss of energy. Even smaller tsunami waves can carry immense energy due to the large volume of water involved. The alternatives are not designed to protect against tsunamis.

Potential Impacts and Mitigation Measures

Beach restoration would help to reduce the impacts of tsunami flooding by increasing beach width and volume, which would provide a protective buffer between the terrestrial and marine environments. This would increase the wave energy dissipating properties of the beaches and potentially decrease the landward extent of wave runup, reducing the vulnerability of the backshore to marine flooding. Damage from tsunamis depends on the height of the water level rise relative to the backshore elevation, neither of which would be significantly altered by any of the potential beach restoration methodologies.

Beach Stabilization

Beach Stabilization is expected to have the most positive impact in terms of potential tsunami risk reduction as the groins and beach cells would provide a stable and durable buffer between the terrestrial and marine environments. The groins would decrease and reorient the amount of wave energy reaching the backshore and potentially decrease the inland extent of any tsunami that may occur.

Beach Nourishment

Beach Nourishment is expected to have a positive impact in terms of enhancing the natural buffer between the terrestrial and marine environments. However, the wave energy dissipating properties of the beach would decrease over time as the beach continues to erode over the 10-year design life of the project. The risk of tsunamis impacting the backshore area would be expected to increase as the beach gradually narrows over time.

Beach Maintenance

Beach Nourishment is expected to have a similarly positive impact to Beach Nourishment in terms of enhancing the natural buffer between the terrestrial and marine environments. With periodic renourishment, the wave energy dissipating properties of the beach would be preserved over the 50-year design life of the project.

No Action

No Action would have no immediate impact on tsunamis. However, over a period of 50 years, the beach would be expected to gradually narrows over time due to increasing erosion pressure and rising water levels. The risk of storm surge would be expected to increase as the wave dissipating properties of the beach diminish over time.

Summary

All of the beach restoration alternatives have the potential to reduce wave overtopping and wave-induced flooding caused by tsunamis. Beach Stabilization is the most stable and durable alternative and is therefore expected to provide the most positive impact in terms of tsunami risk reduction.

8. CONSTRUCTION METHODOLOGY

This section details the anticipated construction process and sequencing for the recommended Beach Stabilization alternative including sand recovery, sand transport, sand placement, and groin construction.

8.1 Anticipated Construction Sequencing and Duration

This section details the preferred and secondary methods for recovering sand from the Sand Recovery Site.

Table 8-1. Estimated construction sequencing and duration.

Task	Duration (work days)	Duration (calendar days)
Mobilization	10	14
Sand Recovery & Transport	66	66
Groin Construction & Sand Placement	251	351
Demobilization	10	14
TOTAL DAYS	**337**	**445**

8.2 Sand Recovery: Dredging

This section details the preferred and secondary methods for recovering sand from the Sand Recovery Site (see Section 5.2).

Beach restoration would involve sand recovery (dredging, barging, offloading, and stockpiling), sand transportation (trucking), sand placement, and potentially groin construction (beach stabilization alternative only). Each of these construction phases can be done using different techniques. This section outlines proven construction methodologies and recommends suitable methods for this project.

Dredging systems for beach restoration purposes are designed to recover sand from the seafloor and deliver it to an alternate site. There are various ways to accomplish these operations, some of which store the sand onboard the dredging vessel or deliver it to nearby barges or ships, while others pump the sand through a pipeline directly to shore. Storing the sand on the dredging vessel requires that the vessel return to a commercial harbor on a regular basis to offload the recovered sand, requiring considerable time, energy, and harbor space. If the sand is pumped to shore, booster pumps and additional barges may be necessary if the distance to the receiving beach is excessive.

A third strategy would be placement of the dredged sand on ships or barges that could be cycled through the recovery and delivery process close to the Project Site to increase dredging efficiency. This would allow for simultaneous loading and offloading of pairs of these barges and would allow the dredge barge to remain in place for the duration of the recovery effort. This method would

involve transporting the sand directly to shore approximately 3,000 ft south of the Project Site. Offloading at this site would be technically challenging and the existing beach would need to be widened to accommodate the necessary equipment to transport the sand along the shoreline to the Project Site. Widening of the beach would require an additional 65,000 cy of sand. This method is discussed in Sections 4.1.2 and 4.1.3 but was not further analyzed due to the issues and challenges previously discussed.

All of these techniques require that the dredge barge be anchored with a stable, minimum four-point mooring in the recovery area. Anchors would be placed within the Sand Recovery Site and marked with floats or buoys, as depicted in Figure 8-1. A four-point mooring would allow the barge to change locations within the Sand Recovery Site while remaining securely anchored without having to adjust anchor placement. Potential dredging techniques that might be employed for the project site are discussed in the following sections.

8.2.1 Preferred Methodology: Clamshell Dredging

Clamshell dredging, shown in Figure 8-2, describes the process of mechanically scooping and lifting sediment, in this case sand, from the seafloor. An environmental clamshell bucket, such as the one shown in Figure 8-3, is lowered from a crane in the open position, and upon the clamshell reaching the bottom, the crane operator closes the clamshell jaws and lifts the material out of the water. The operator then rotates the crane and opens the bucket to dispense the material onto a barge, such as a hopper barge (Figure 8-4).

A 15-cy rated bucket would have an open footprint of 13 ft by 13 ft and would penetrate approximately 2 to 6 ft into the seafloor, recovering about 12 cy of sand per bucket. This penetration depth is within the limits in which the composite sand samples were collected (see Section 5.2). Dredging would create a depression in the seafloor that would be approximately 2 to 6 ft deep with a side slope of approximately 1V:3H. These depressions would be similar in size to existing depressions that that form naturally in this area due to tidal currents. The remaining sand from the surrounding seafloor is expected to naturally fill in the depression, and tidal currents and wave action would smooth the angle of the side slope with time.

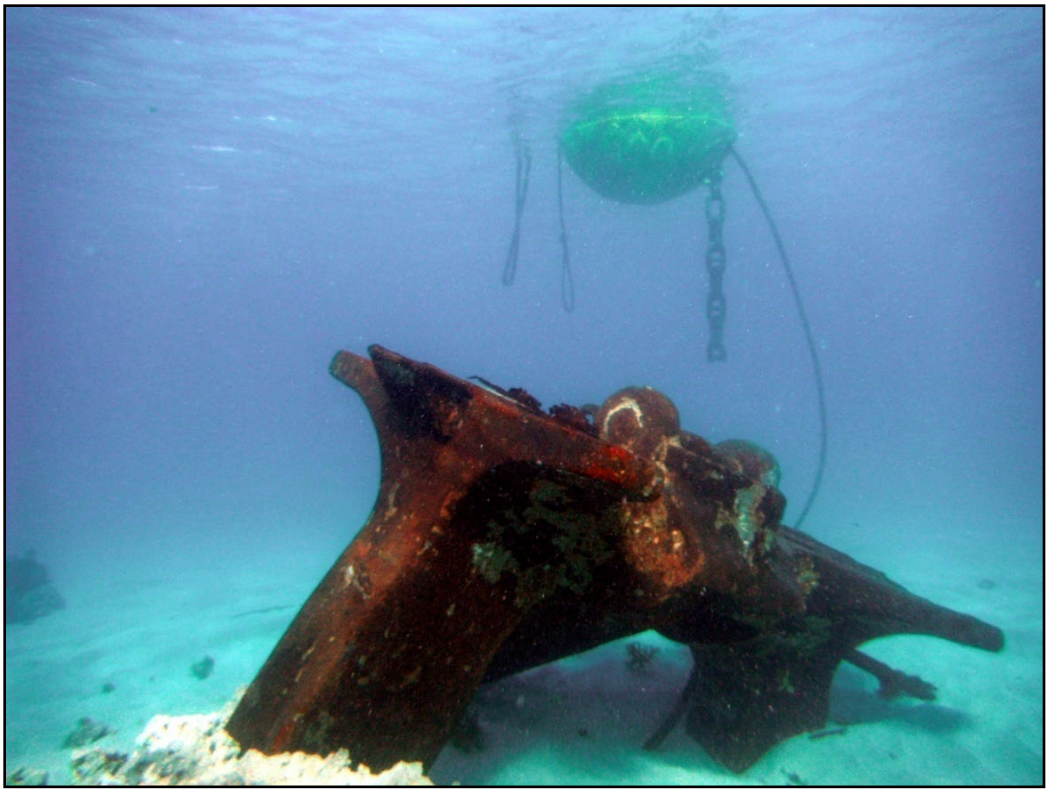


Figure 8-1. Example of anchor and anchor float system

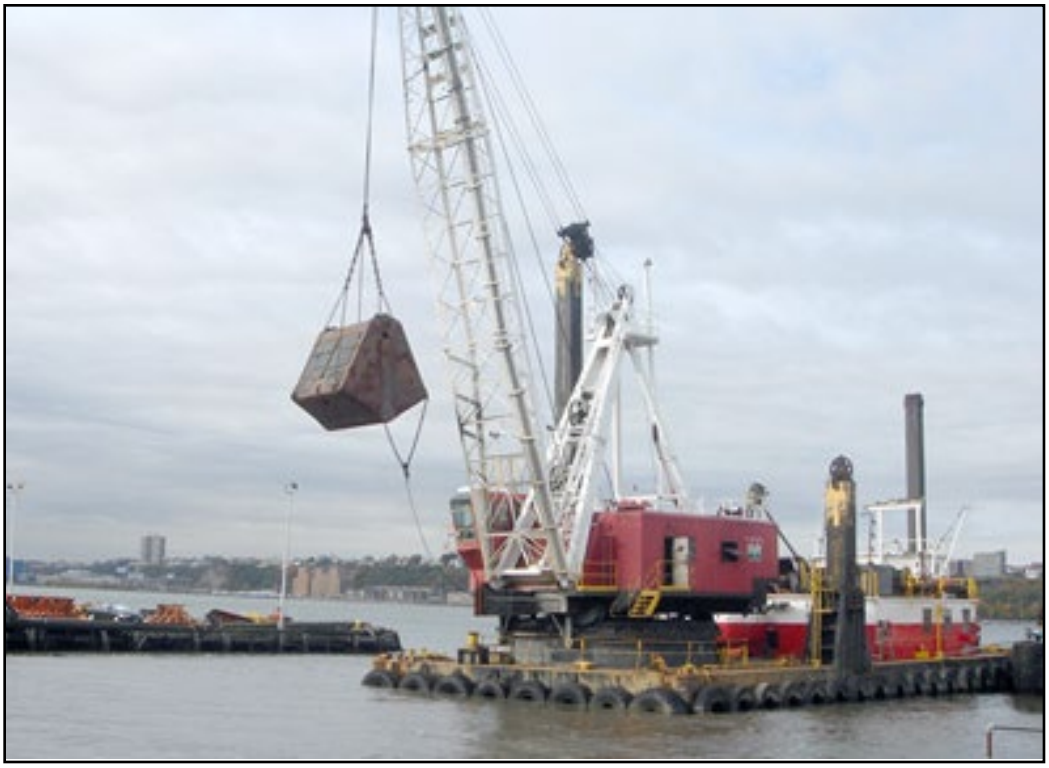


Figure 8-2. Example of barge with environmental clamshell bucket (www.conedison.com)



Figure 8-3. Example of environmental clamshell bucket (www.alibaba.com)



Figure 8-4. Example of hopper barge(www.thecargogroup.net)

Environmental clamshell buckets, also called level-cut buckets, are designed to be able to remove as little as 6 inches of sediment from the seafloor surface, while leaving the lower sediment undisturbed. Figure 8-5 shows a schematic of the level-cut process. The bucket is lowered to the seafloor with the jaws open. Upon reaching the bottom, the jaws are closed, skimming off the upper portion of sediment. Although the bucket does not penetrate deeply into the seafloor, the jaw width is great enough that a 6-inch layer of sediment recovered would still amount to 3 cy of sand.

While recovering a thin surface layer is valuable when dealing with contaminated sediments, in the case of offshore sand recovery, this process allows for recovery of sand from thin deposits. Positioning software allows the operator to precisely place the bucket to recover sediment from the proper location.

Clamshell bucket sizes vary from as small as 1 cy to over 20 cy and can be either sealed or open. Newer technology allows removal of material with only slightly more water content than in the *in situ* sediment. The end plates of the buckets overlap, and rubber seals help to prevent loss of water and sediment as the bucket is raised.

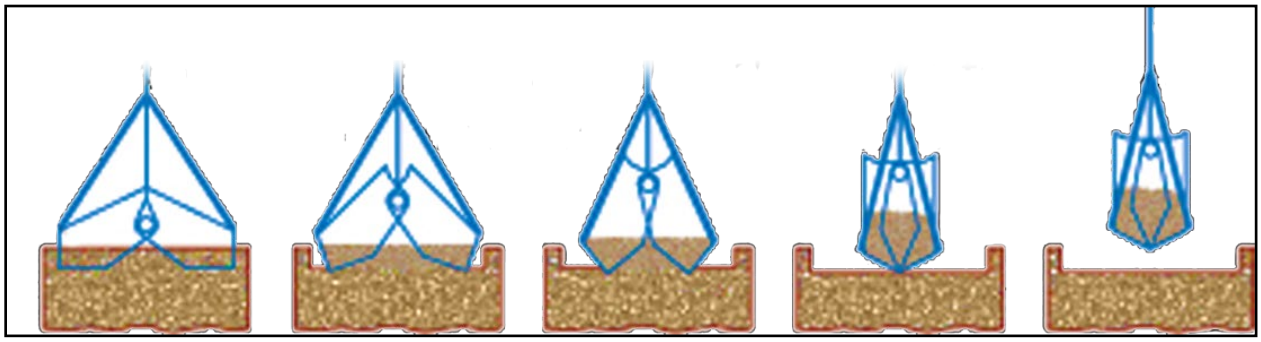


Figure 8-5. Level-cut dredging schematic (www.cablearm.com)

Clamshell dredging is often used in association with a large barge, such as the hopper barge shown in Figure 8-4, on which the sediment is deposited. Once the sediment is loading onto the barge, transport is accomplished by either moving the barge to a dock and offloading or using a waterborne sand delivery system to deliver the sand to the shoreline.

The advantages of using clamshell dredging are that it is very mobile, can operate at any depth that the crane cable can reach, can be used in moderate swell conditions, and can recover a wide variety of material types. Additionally, little specialized equipment beyond the clamshell is needed for dredging operations. The technology of the environmental buckets helps to reduce environmental impacts due to turbidity and increase efficiency in recovering sand, reducing time and cost of the operation. Additionally, the amount of water that is accumulated from the clamshell dredging process is much less than with hydraulic dredging presented in the next section, and the small amount of water can be discharged at an approved location.

The disadvantages of clamshell dredging are that it is less efficient than other dredging systems, such as those utilizing hydraulic or slurry pumps, and requires the sand deposits to be thick enough that the clamshell does not reach hard substrate.

Clamshell dredging is the preferred method of sand recovery for the subject project. Based on the water depths at the Sand Recovery Site (120 to 170 ft), clamshell dredging would have an estimated recovery rate of 500 cy of sand per day. Recovery of 33,000 cy of sand is estimated to require approximately 66 days of dredging, depending on ocean conditions.

8.2.2 Secondary Methodology: Submersible Slurry Pump

Submersible slurry pumps, referred to as "Toyo Pumps" after the largest supplier of such, are distinguishable by the way that they are lowered from overhead and suspended above the sediment they are pumping. The pumps can be hydraulically or electrically driven and are available in a range of sizes. Models are available with up to 400 hp. Toyo DP75B (75hp) hydraulic pumps were used successfully for dredging for the Kūhiō Beach Nourishment project (2007) and Waikīkī Beach Maintenance projects (2012, 2021). Respectively, the projects pumped approximately 10,000 and 24,000 cy of sand from offshore onto the beach within the Kūhiō Beach crib walls.

Several equipment elements are required to successfully recover sand utilizing a submersible pump. A barge and crane are necessary to position a hydraulic or electric powered pump over the sand bottom. The crane can move the pump across a small area, depending on the crane size and length of its boom. Accessing different portions within the recovery area is achieved by repositioning the pump barge using a minimum four-point mooring array. Additionally, depending on the size of the slurry pump, a booster pump may be required if the distance to the shoreline is excessive. An additional piece of equipment called a "jet ring" can be mounted on the pump to aid in entraining sand to increase the percent of sand in the slurry. This jet ring requires a water pump on deck and an additional 4-inch water hose connected to the submersible pump. An illustration of this dredge system is shown on Figure 8-6, taken from the Kūhiō Beach Nourishment project after-action report (American Marine, 2007). Figure 8-7 shows the dredge barge used in the 2012 Waikīkī Beach Maintenance Project.

The benefit of the submersible pump is its precise positioning and ability to reach into tight spaces. Using a crane-tip GPS unit to locate the pump, the operator can accurately position the pump within a few feet of any location to effectively remove the sand from near the edges and corners of the recovery area. In addition, sand recovery with a slurry pump can be more efficient than mechanical recovery when a high sand to water ratio can be achieved.

The primary drawbacks to the submersible pump are that the operation is labor intensive, and it requires dewatering. Operation requires a crane operator, a rigger, and several people to handle the pumps, generators, and pipelines on deck. Additionally, the pump must be held at a relatively constant height above the sand. If the pump is lifted too high it will not entrain the sand, and if it is too low the slurry will become too concentrated, and the pipeline may clog. Maintaining this balance is especially difficult for the crane operator in the presence of swells greater than one to two feet; however, the dredge equipment can be operated from an ocean-going barge, which provides reasonable seaworthiness.

Submersible pumping requires that the slurry be properly dewatered, which increases on-land space requirements. For example, the 2012 Waikīkī Maintenance project utilized a one-acre dewatering basin within Kūhiō Beach Park, requiring the Diamond Head basin to be completely closed to the public. Given the location of the Sand Recovery Site (see Section 5.2), hydraulically

pumping sand to shore is not anticipated to be a viable option. If a submersible pump is used to dredge the sand, the sand and slurry would then have to be contained in a barge until the water can be released into the ocean. Contractor production records for the 2012 Waikīkī Beach Maintenance I project showed that the Contractor recovered 400 to 800 cy of sand in a 10-hour day and placed sand on the beach at a rate of 1,500 to 2,000 cy in a 5-hour day. Submersible slurry pumps are not anticipated to be used to recover sand for this project for the reasons noted above.

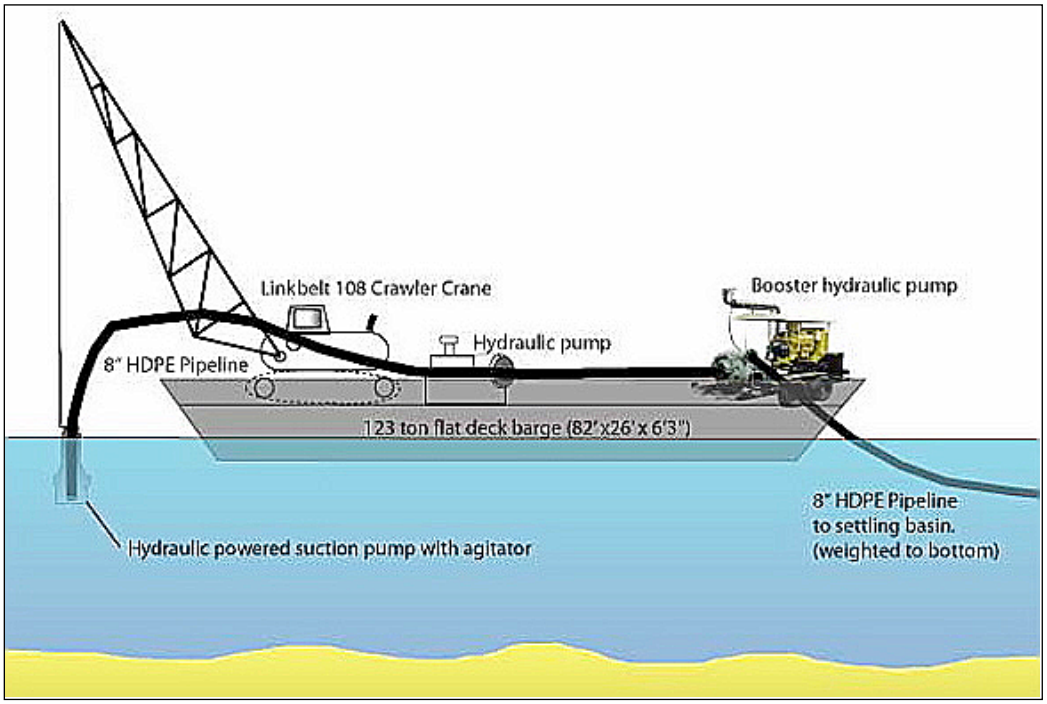


Figure 8-6. Schematic of sand pumping system (American Marine, 2007)



Figure 8-7. Crane barge used during 2012 Waikīkī Beach Maintenance (Waikīkī, Oʻahu)

8.3 Sand Recovery: Barging and Offloading

This section details the preferred method for transporting sand from the Sand Recovery Site to the Temporary Stockpile Site.

The preferred method for transporting sand from the Sand Recovery Site to the Project Site is by barging the dredged sand from the offshore Sand Recovery Site to Kahului Harbor on the north coast of Maui (Figure 8-8).



Figure 8-8. Overview map of preferred sand recovery and transport methodology

8.3.1 Preferred Methodology: On-site Stockpiling

Sand would be offloaded at Kahului Harbor, temporarily stockpiled at a site adjacent to the west breakwater and then trucked to the Project Site. Through pre-consultation with the State of Hawaiʻi, Department of Transportation, Harbors Division, the west breakwater was identified as the preferred offload location. The west breakwater also has the advantage of open space available for stockpiling the sand once offloaded. Trucks transporting the sand from Kahului Harbor to the Project Site are assumed to have a capacity of 12 cy per truckload. On-site stockpiling is the most efficient method to transport the sand and mitigates the need for additional handling of the sand to truck it off site to a temporary storage site. Limiting the number of handlings decreases the potential for sand grains to be fractured, which can increase the potential for turbidity during sand placement. Therefore, on-site stockpiling is the preferred methodology.

8.3.2 Secondary Methodology: Off-site Stockpiling

Sand would be offloaded at Kahului Harbor and trucked to a temporary stockpile site and then to the Project Site to be placed on the shoreline. Trucks transporting the sand from Kahului Harbor to the stockpile site are assumed to have a capacity of 16 cy per truckload. Trucks transporting the sand from the stockpile site to the Project Site are assumed to have a capacity of 12 cy per truckload. Off-site stockpiling requires identification of a suitable stockpile site and requires additional handling of the sand to truck it off site to a temporary storage site. This method increases the number of truckloads required to transport the sand, which could increase potential for traffic impacts and for sand grains to be fractured. Therefore, off-site stockpiling is not the preferred methodology.

8.4 Sand Transport and Sand Placement

This section details the preferred method for transporting sand from the Temporary Stockpile Site to the Project Site and the process for sand placement at the Project Site.

8.4.1 Preferred Methodology: On-site Stockpiling

Trucks transporting the sand from the stockpile site to the Project Site are assumed to have a capacity of 12 cy per truckload. Table 8-2 below summarizes the required volume of sand and corresponding number of truckloads required to transport the sand from Kahului Harbor to the Project Site for each alternative.

Table 8-2. Number of truckloads required for on-site stockpiling (preferred methodology)

Alternative	Sand Volume (cy)	Total Truckloads	Total Distance (mi)[1]
Beach Stabilization	33,000	2,750	159,500
Beach Nourishment	27,000	2,250	130,500
Beach Maintenance	47,000	3,917	227,186

[1] Roundtrip distance from Kahului Harbor to/from Project Site = 58 mi

8.4.2 Secondary Methodology: Off-site Stockpiling

Trucks transporting the sand from the offload site at Kahului Harbor to a temporary off-site storage site are assumed to have a capacity of 16 cy per truckload. Trucks transporting the sand from the temporary off-site storage site to the Project Site, are assumed to have a capacity of 12 cy per truckload. Table 8-2 below summarizes the required volume of sand and corresponding number of truckloads required to transport the sand from Kahului Harbor to an off-site storage site and then the Project Site for each alternative.

Table 8-3. Number of truckloads required for off-site stockpiling (secondary methodology)

Alternative	Sand Volume (cy)	Truckloads to Stockpile Site	Truckloads to Project Site	Total Distance (mi) [1,2]
Beach Stabilization	33,000	2,063	2,750	186,319
Beach Nourishment	27,000	1,688	2,250	152,444
Beach Maintenance	47,000	2,938	3,917	265,380

[1] Roundtrip distance from Kahului Harbor to/from Stockpile Site = 13 mi
[2] Roundtrip distance from Stockpile Site to/from Project Site = 63 mi

As sand is trucked to the Project Site, the sand would be moved directly to the beach and placed to the design lines and grades. There is no dewatering associated with the truck hauling method. Sand movement and placement during the 2012 Waikīkī Beach Maintenance I project was accomplished using standard mechanical equipment, including a front-end bucket loader, dump trucks, and bulldozers (Figure 8-9). This is the preferred method for the Project.

Beach width would be increased from onshore to offshore, thus building dry substrate for machinery to operate on as the beach is extended seaward. Proper beach shape would be verified during construction with surveys and by placing survey stakes with final beach height markings as references. Design beach profiles and volume calculations would be part of the construction drawings. A containment system would be required in the area of active sand placement to reduce the potential for turbidity impacts to coastal waters during sand placement in the water (Figure 8-10). Silt curtains and fences would be required, consistent with previous requirements of the Clean Water Act. Schematics of these containment devices are shown as Figure 8-11 through Figure 8-13. Phasing of the sand placement is not necessary. It is recommended, however, that once placement begins in an area, it continues until it is completed in that area. Working on one area at a time would limit the extent of beach closures during sand placement operations, thereby reducing impacts on beach users.



Figure 8-9. Sand placement during 2012 Waikīkī Beach Maintenance (Waikīkī, Oʻahu).



Figure 8-10. Floating silt curtain used for 2012 Waikīkī Beach Maintenance (Waikīkī, Oʻahu)

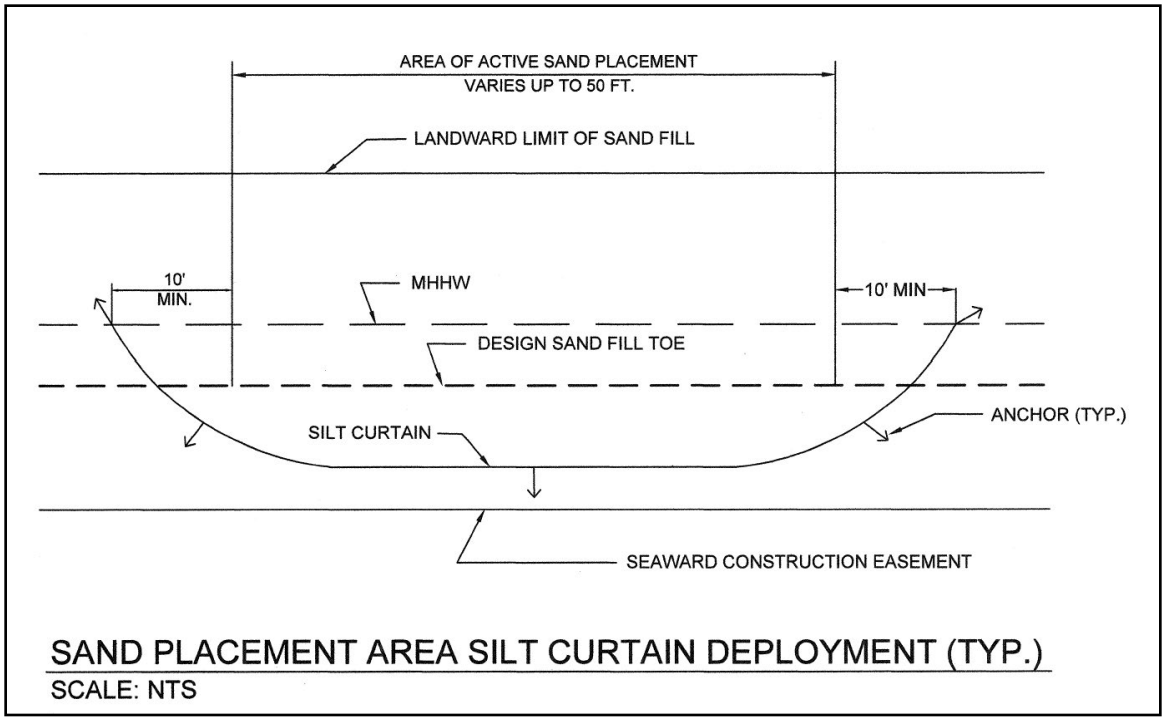


Figure 8-11. Example of silt curtain layout for sand placement

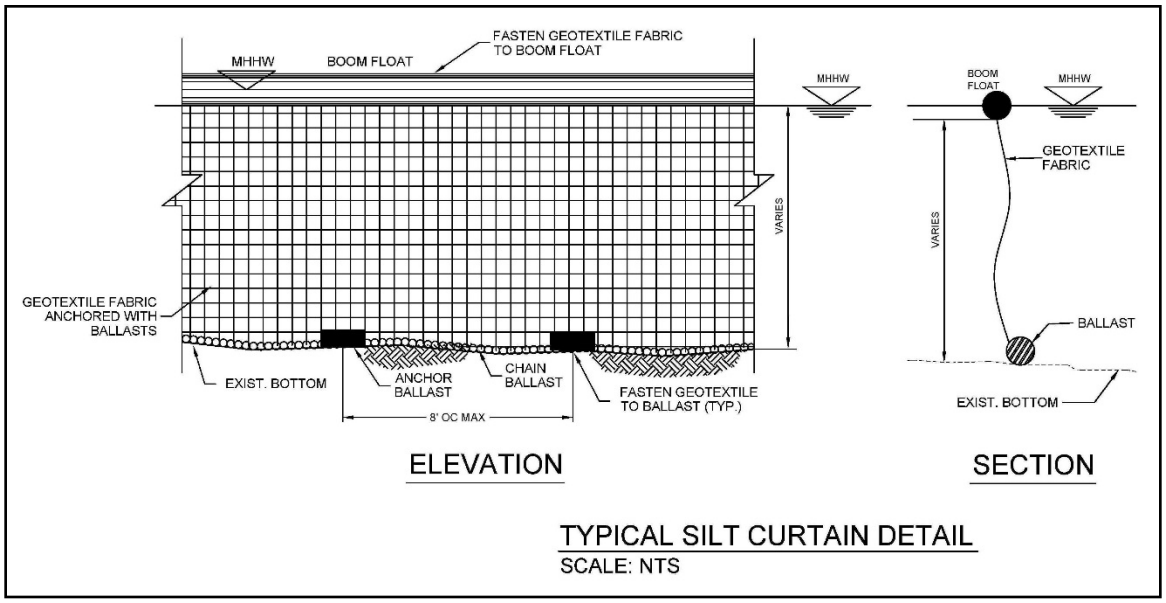


Figure 8-12. Typical silt curtain detail

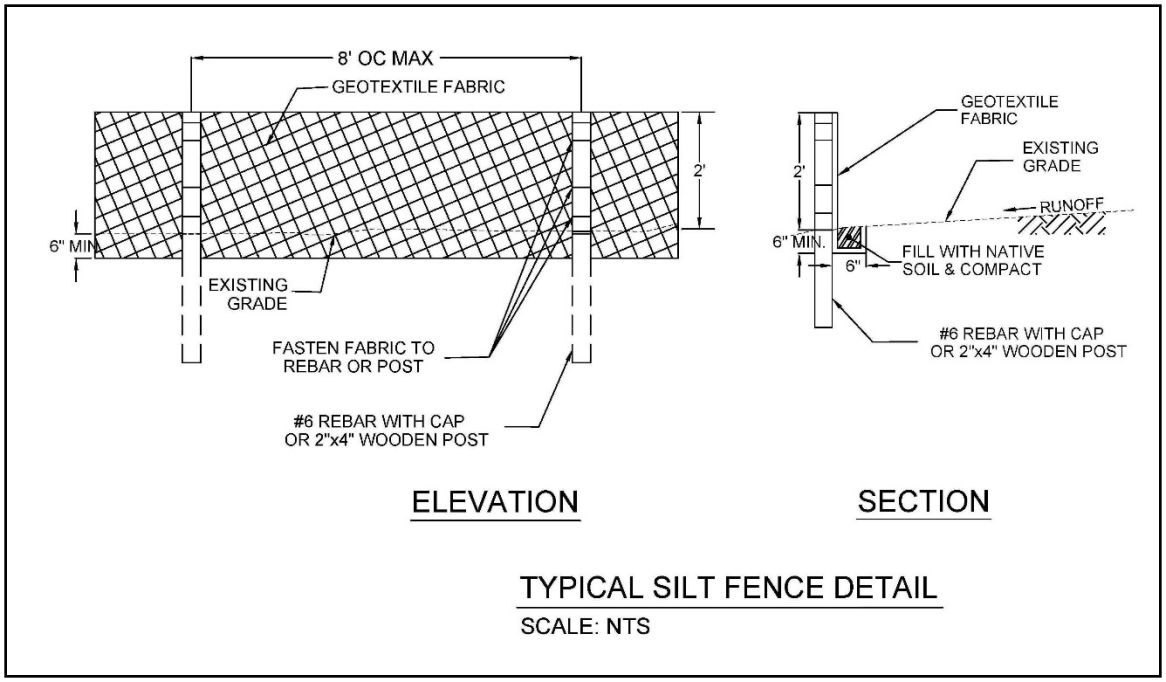


Figure 8-13. Typical silt fence detail

8.5 Stone Transport and Groin Construction

This section details the preferred process for groin construction at the Project Site.

The construction of the rock rubble mound groins is a relatively straightforward marine project. The primary challenges are related to access – both to get equipment and material to the site and to establish a work platform to construct from. The shallow reef flat and wave action prohibit access to the Project Site from the ocean. The stone would have to be transported by truck to the Project Site and then moved to the shoreline via available accessways between buildings. Direct access to the shoreline is available via a paved road between Kāʻanapali Beach Club and Kāʻanapali Shores. Access to the shoreline could also be achieved through the Maui Kai Condominium property to the south. This access point has been previously used for shoreline work at the Project Site; however, access would require approval from the Maui Kai Condominium prior to construction.

Approximately 1,400 truckloads would be required to transport the 22,442 tons of stone required to construct the groins. The groin stem and head sections would be overbuilt to approximately 15 ft in width to provide equipment access, and the groins would be completed working from the heads to shore, removing excess stone as the work proceeds landward. Groin construction would proceed one at a time, working back toward the access. Sand would be placed as each beach cell is completed. Photographs of similar groin construction projects at Iroquois Point, Oʻahu (2013) and Waikīkī, Oʻahu (2021) are shown in Figure 8-14 and Figure 8-15, respectively.



Figure 8-14. Example of groin construction at Iroquois Point, Oʻahu (2013)



Figure 8-15. Example of groin construction at Waikīkī, Oʻahu (2020)

9. MONITORING AND ASSESSMENT PLANS

This chapter discusses monitoring that would be performed before, during, and after construction of the Project. Monitoring programs are anticipated to be required for cultural and archaeological resources, beach and structure conditions, water quality, and marine biology. General guidelines for these monitoring programs are presented below. The specific requirements, methodologies, and timeframes for each of these monitoring programs would be finalized and potentially expanded upon a during the final design and permitting phase, in coordination with key regulatory and resource agencies at the Federal, State, and County levels.

9.1 Performance Monitoring

Periodic monitoring is essential to evaluate project performance. A performance monitoring program would likely consist of topographic surveys, beach profile surveys, condition inspections, and collection of aerial and ground photographs. A beach monitoring program would provide information to determine the performance and impacts of the project and provide information that may be useful for determining monitoring requirements and timeframes for potential future beach restoration projects.

Topographic Surveys

A topographic survey should be completed prior to and immediately following construction. A pre-construction topographic survey would provide a baseline from which to measure changes in topography that occur as the result of sand placement and groin construction (if applicable). A post-construction survey would be used to produce a high-resolution 3-dimensional digital elevation model (DEM) to measure any future changes to project elevations. Topographic surveys should be performed every 2 years (5 surveys over 10 years).

Beach Profile Monitoring

Beach profiles are a common measurement technique used to investigate coastal processes and shoreline change. Beach profiles should be collected immediately prior to construction to establish a baseline for monitoring beach width and volume of sand after placement. Post-construction project performance and beach stability should be monitored by periodically surveying beach profiles. These monitoring efforts should include periodic topographic surveys of the beach to monitor shoreline change before and after beach restoration. The cumulative volume of elevation data for the beach provides a strong foundation for pre- and post-construction monitoring efforts.

Beach profiles should be collected by measuring the beach along a transect perpendicular to the shoreline and should extend as far mauka (landward) or makai (seaward) as necessary to capture specific beach features (e.g., toe, berm, crest). These measurements are vital for both ensuring the correct placement of sand on the beach and documenting pre-construction beach conditions. Recoverable benchmarks should be established at each profile location to ensure that all profiles are measured at the same location, azimuth, and with the same elevation controls. The survey methodology and profile locations and extents would be confirmed during the final design and permitting phase.

Condition Inspections

For the Beach Stabilization alternative, a qualified engineer should perform annual inspections of the groins to verify the condition of the structures relative to previous inspections, identify areas of concern on each structure that are degraded beyond the condition reported in the previous inspection, compare current inspections results with the condition documented in the previous inspection report, and identify and recommend future maintenance requirements. The inspections should be conducted by physically walking the length of each structure and inspecting areas including the crest, slopes, and toe of each structure. The inspector should note the physical condition of the structure, document the location of any findings, take photographs to document findings, and provide the information needed to evaluate the condition of the structure.

Photographic Monitoring

Photographic monitoring should consist of collecting a combination of ground and aerial photographs at specified intervals to document environmental conditions at the Project Site. Data collection should be conducted concurrently with the beach profile surveys previously discussed. Recoverable benchmarks should be established at various locations to ensure that all photographs are taken from the same location, azimuth, and elevation. Ground photographs should also be taken from various locations to capture additional information that may be relevant for monitoring purposes. Photographs could also be collected by installing a rooftop camera on one of the existing buildings at or adjacent to the Project Site.

An Unmanned Aerial System (UAS) should be flown on a programmed route to obtain a series of aerial photographs of the beach and nearshore area at the Project Site. The UAS should capture both orthogonal and oblique imagery. Orthogonal imagery provides a true top-down view and can be used to produce a georeferenced image to allow for precise measurements. Oblique imagery is captured at an angle, which provides a more natural perspective and makes objects easier to recognize and interpret.

Performance Monitoring Schedule

The performance monitoring program could potentially consist of forty (40) individual monitoring events over a period of 10 years. A typical schedule for performance monitoring is shown in Table 9-1 and summarized below.

- Pre-Construction: A pre-construction topographic survey should be completed within 3 months prior to construction. Beach profiles and ground and aerial photographs should be collected within 1 month prior to construction.
- Post-Construction: A post-construction topographic survey should be completed within 1 month following completion of construction. Beach profiles and ground and aerial photographs should be collected within 1 week following completion of construction.
- Months 3-12: Beach profiles and ground and aerial photographs should be collected on a quarterly basis at months 3, 6, and 12.
- Years 2-10: Beach profiles and ground and aerial photographs should be collected on a quarterly basis for a period of 10 years. Topographic surveys should be performed every 2 years (5 surveys over 10 years).

Table 9-1. Typical schedule for performance monitoring

Year	Month	Topographic Survey	Condition Inspection	Beach Profiles	Ground Photographs	Aerial Photographs
0	0	P		P	P	P
1	1		P	P	P	P
	3			P	P	P
	6			P	P	P
	12		P	P	P	P
2	15			P	P	P
	18			P	P	P
	21			P	P	P
	24	P	P	P	P	P
3	27			P	P	P
	30			P	P	P
	33			P	P	P
	36		P	P	P	P
4	39			P	P	P
	42			P	P	P
	45			P	P	P
	48	P	P	P	P	P
5	51			P	P	P
	54			P	P	P
	57			P	P	P
	60		P	P	P	P
6	63			P	P	P
	66			P	P	P
	69			P	P	P
	72	P	P	P	P	P
7	75			P	P	P
	78			P	P	P
	81			P	P	P
	84		P	P	P	P
8	87			P	P	P
	90			P	P	P
	93			P	P	P
	96	P	P	P	P	P
9	99			P	P	P
	102			P	P	P
	105			P	P	P
	108		P	P	P	P
10	111			P	P	P
	114			P	P	P
	117			P	P	P
	120	P	P	P	P	P

9.2 Water Quality Monitoring

Water quality monitoring would be required before, during, and after construction. The monitoring methodology and frequency would be reviewed and approved by the Hawai'i Department of Health, Clean Water Branch (DOH-CWB), pursuant to the Clean Water Act, Section 401 Water Quality Certification (WQC) process. The WQC would require an Applicable Monitoring and Assessment Program (AMAP), and Data Quality Objectives (DQO) define the sample sites, parameters, frequency, and thresholds for evaluation of test results for the water quality monitoring program.

The intent of the AMAP is to conduct water quality sampling and analysis to effectively monitor potential impacts caused by in-water work, including sand recovery, transport, and placement, and groin construction (if applicable). The AMAP would include detailed specifications for baseline (pre-construction), during construction, and post-construction monitoring. Data collected as part of the AMAP would be used to assess the adequacy of Best Management Practices (BMPs) utilized during construction and quantify the impacts of the Project on water quality. If shown to be necessary by the monitoring data, the BMPs would be modified during construction to better protect water quality. A preliminary AMAP is provided as Appendix E.

The water quality monitoring program would largely follow the *General Monitoring Guidelines for Section 401 Water Quality Certification Projects* (HDOH, 2000). Typical parameters to be tested as part of the AMAP include pH, turbidity, dissolved oxygen (DO), salinity, and temperature.

9.3 Marine Biological Monitoring

A comprehensive marine biological assessment should be completed during the final design phase to provide the basis for evaluating marine biological monitoring results for the project areas and control areas. The methods, extents, and timeframes for marine environmental monitoring would be coordinated with the relevant resource agencies during the final design and permitting phase. Typical requirements for marine biological monitoring for beach restoration projects in Hawai'i are listed below:

<u>Pre-construction Monitoring</u>

- Monitoring should be conducted prior to commencement of construction to establish a baseline for pre-construction conditions and a basis for evaluating potential impacts.
- Monitoring stations should be established at selected sites to allow for a comprehensive assessment of pre- and post-construction conditions.
- Monitoring stations should be established in the vicinity of the groins (if applicable).

<u>During Construction Monitoring</u>

- Monitoring should include photomosaics of biological conditions at the monitoring sites.
- Visual comparison and analysis of the photomosaics should be conducted to identify any changes or impacts associated with the project.

Post-Construction Monitoring

- Photomosaics should be collected and analyzed at 30-day, 1-month, 6-month and 12-month intervals post-construction.
- After the first year, post-construction marine biological monitoring should be conducted annually for 3 years and may be collected for up to 10 years. The need for additional monitoring should be based on the results of the initial 3 years of monitoring data.

9.4 During Construction Mitigation and Monitoring

9.4.1 Monitoring of Dredged Sand

Operational controls should include monitoring dredged sand for impurities and material larger than 1 in diameter. Monitoring should be conducted during all phases of the operation (sand recovery, transport, stockpiling, and placement) to identify any impurities or excessive content of larger diameter material at the earliest possible opportunity. If impurities or excessive content of larger diameter material are observed, then the sand recovery operation should be relocated to an alternate location within the Sand Recovery Site. The area where the material was dredged should be marked and should not be utilized again for the remainder of the project.

9.4.2 Protection of Endangered Species

The following endangered species BMPs, as recommended by the NOAA National Marine Fisheries Service (NMFS), should be adhered to during construction:

- Project footprints shall be limited to the minimum area necessary to complete the authorized work.
- The project area shall be flagged to identify sensitive resource areas, such as seagrass beds, ESA-listed terrestrial plants, and turtle nests.
- The authorized work shall be timed to minimize effects on ESA-listed species and their habitats.
- The authorized work shall cease under unusual conditions, such as large tidal events and high surf conditions, except for efforts to avoid or minimize damage to aquatic resources.
- Constant vigilance shall be kept for the presence of ESA-listed species during all phases of the authorized work.
- A responsible party, i.e., permittee/site manager/project supervisor, shall designate a competent observer to survey work sites and the areas adjacent to the authorized work area for ESA-listed species.
- The Contractor shall establish a safety zone around the project area whereby observers shall visually monitor for marine protected species 30 minutes prior to, during, and 30 minutes post daily project activity. Record information on the species, numbers, behavior, time of observation, location, start and end times of project activity, sex or age class (when possible), and any other disturbances (visual or acoustic).
- If a marine protected species is in the area, either hauled out onshore or in nearshore waters, a 150-foot buffer must be observed with no humans approaching it. If a monk seal/pup pair is seen, a minimum 300-foot buffer must be observed.

- In the event that a marine protected species enters the safety zone, and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals contact the Marine Mammal Response Coordinator, at (808) 944-2269, as well as the monk seal hotline at (808) 220-7802. For turtles, contact the turtle hotline at (808) 983-5730.
- No one shall attempt to feed, touch, ride, or otherwise intentionally interact with any ESA-listed species.
- For on-site project personnel that may interact with a listed species potentially present in the action area, provide education on the status of any listed species and the protections afforded to those species under Federal laws. NMFS may be contacted for scheduling educational briefings to convey information on marine mammal behavior and explain why and when to call NMFS and other resource agencies.
- A pollution and erosion control plan for the authorized work site and adjacent areas shall be prepared and carried out. At a minimum, this plan shall include and require:
    - Proper installation and maintenance of silt fences, sausages, equipment diapers, and/or drip pans;
    - A contingency plan to control and clean spilled petroleum products and other toxic materials;
    - Appropriate materials to contain and clean potential spills will be stored at the work site, and be readily available;
    - All project-related materials and equipment placed in the water will be free of pollutants;
    - Daily pre-work inspections of heavy equipment for cleanliness and leaks, with all heavy equipment operations postponed or halted until leaks are repaired and equipment is cleaned;
    - Fueling of project-related vehicles and equipment will take place at least 50 feet away from the water, preferably over an impervious surface;
    - A plan to prevent trash and debris from entering the marine environment during the project; and
    - All construction discharge water (e.g., vehicle wash water) must be treated before discharge.
    - Any necessary and appropriate erosion controls shall be properly installed before undertaking the authorized work.
- Temporary access roads and drilling pads shall avoid steep slopes, where grade, soil types, or other features suggest a likelihood of excessive erosion or failure; existing access routes shall be utilized or improved whenever possible, in lieu of construction of new access routes.
- All disturbed areas must be immediately stabilized following the cessation of activities for any break in work longer than 4 days.
- The authorized work shall comply with all applicable NWP General and Regional Conditions.
- With the exception of the actual dredging apparatus (e.g. clamshell buckets, or the scoop and articulated arm of a backhoe, etc.), heavy equipment will be operated from above and out of the water.
- The portions of the equipment that enter the water will be clean and free of pollutants.
- Any form of blasting is not authorized.

The following endangered and threatened species BMPs, as recommended by the US Fish and Wildlife Service (USFWS), should be adhered to during construction of the Project:

Hawaiian Hoary Bat

- Do not disturb, remove, or trim woody plants greater than 15 feet tall during the bat birthing and pup rearing season (June 1 through September 15).
- Do not use barbed wire for fencing.

Hawaiian Goose

- Do not approach, feed, or disturb Hawaiian geese (nēnē).
- If Hawaiian geese are observed loafing or foraging within the project area during the breeding season (September through April), have a biologist familiar with the nesting behavior of Hawaiian geese conduct a survey to identify nests or potential nesting areas in and around the project area prior to the resumption of any work. Repeat surveys after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest).
- Cease all work immediately and contact the Service for further guidance if a nest is discovered within a radius of 150 feet of proposed work, or a previously undiscovered nest is found within said radius after work begins.
- In areas where Hawaiian geese are known to be present, post and implement reduced speed limits, and inform project personnel and contractors about the presence of endangered species on-site.

Green and Hawksbill Sea Turtles

- We recommend you consult with the Service prior to project commencement to obtain the latest information on sea turtle activity in the area. Should there be any sea turtle activity occurring in the area, we recommend monitoring timeline and plan be discussed with the Service.
- Incorporate applicable Best Management Practices regarding Work in Aquatic Environments into the project design.
- Have a project team member familiar with sea turtles conduct a visual survey of the project site to ensure no basking sea turtles are present.
    - If a basking sea turtle is found within the project area, cease all mechanical or construction activities within 100 feet until the animal voluntarily leaves the area.
    - Cease all activities between the basking turtle and the ocean.
- Remove any project-related debris, trash, or equipment from the beach if not actively being used.
- Do not stockpile project-related materials in the intertidal zone, reef flats, or stream channels.
- Create a designated staging area for land equipment off of the sand/beach at the end of each work day.
- Minimize the use of lighting and shield all project-related lights so the light is not visible from any beach.
    - If lights can't be fully shielded or if headlights must be used, fully enclose the light source with light filtering tape or filters.

- Incorporate design measures into the construction or operation of buildings adjacent to the beach to reduce ambient outdoor lighting such as:
    - Tinting or using automatic window shades for exterior windows that face the beach;
    - Reducing the height of exterior lighting to below 3 feet and pointed downward or away from the beach; and
    - Minimize light intensity to the lowest level feasible and, when possible, include timers and motion sensors.

Wedge-Tailed Shearwater

- Conduct surveys throughout the project area during the species' breeding season (March through November) to determine the presence and location of nesting areas.
- If wedge-tailed shearwaters nest within the proposed project area and ground disturbance is expected to occur, time project construction outside of the breeding season.
- Install automatic motion sensor switches and controls on all outdoor lights or turn off lights when human activity is not occurring in the lighted area.

Hawaiian Petrel, Newell's Shearwater, and Band-Rumped Storm Petrel

- Fully shield all outdoor lights so the bulb can only be seen from below bulb height and only use when necessary.
- Install automatic motion sensor switches and controls on all outdoor lights or turn off lights when human activity is not occurring in the lighted area.

Hawaiian Yellow-Faced Bee

- If an action will occur in or adjacent to known occupied habitat, a buffer area around the habitat may be required and can be worked out on a site-specific basis through consultation with the Service.
- For coastal species, protect all coastal strand habitat from human disturbance, including:
    - No fires or wood collecting.
    - Leave woody debris in place.
    - Post educational signs to inform people of the presence of sensitive species.

9.4.3 Historical, Cultural and Archaeological Monitoring

Monitoring may be required to prevent potential impacts on historical, cultural, and archaeological resources. The methodology, extents, and timeframes for monitoring should be developed by a qualified consultant with specific expertise in Hawaiʻi and coordinated with the relevant agencies during the final design and permitting phase.

9.5 Best Management Practices

Best Management Practices (BMPs) should be implemented to ensure that adequate protective measures are in place to prevent, if possible, or minimize adverse impacts on the environment and public health, safety, and welfare. A detailed Best Management Practices Plan should be prepared during the final design and permitting phase and should include the following:

- Vehicle, Equipment, and Materials Management
- Waste Management
- Monitoring Procedures and Protocols
- Turbidity Containment
- Erosion and Sediment Control
- Oil and Spill Containment
- Noise Control
- Dust Control
- Air Pollution Control
- Operational Controls
- Structure, Authority, and Responsibilities
- Training
- Health and Safety
- Inspection and Monitoring
- Emergency Procedures, Spill Response Plan, and Contacts
- Contingency Plan
- Suspension of Work
- Record Keeping and Documentation

A preliminary Best Management Practices Plan is provided as Appendix F.

10. REFERENCES

Anderson, T.R., Fletcher, C.H., Barbee, M.M., Frazer, L.N., and Romine, B.M. 2015. Doubling of coastal erosion under rising sea level by mid-century in Hawai'i. Natural Hazards. DOI 10.1007/s11069-015-1698-6.

Arns, A., Dangendorf , S., Jensen, J. et al. 2017. Sea-level rise induced amplification of coastal protection design heights. Scientific Reports 7, 40171.

Azouri, A., M. Guiles, and D.S. Luther. 2022. BOSZ Wave-Driven Sea Level Rise Inundation: West Maui. Distributed by the Pacific Islands Ocean Observing System (PacIOOS). Retrieved from: http://pacioos.org/metadata/bosz_westmaui.html.

Babcock, R., Bateni, S., Francis, O., Falinski, K., Nielson, J., Harada, B., Smith, K. and Li, Y. 2014. Sediment retention at Honokowai Structure #8; Wahikuli-Honokowai priority site, engineering analysis and development of retrofit designs. DRAFT. Prepared for State of Hawai'i, Department of Land and Natural Resources, Division of Aquatic Resources, Honolulu, HI: University of Hawai'i, Water Resources Research Center.

Balazs G.H. 1996. Behavioral changes within the recovering Hawaiian green turtle population. Proceedings of the 15th Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC0387, p. 16-20.

Balazs G.H., Forsyth R.G., Kan, A.H. 1987. Preliminary Assessment of Habitat Utilization By Hawaiian Green Turtles In Their Resident Foraging Pastures. Prepared for National Marine Fisheries Service, Honolulu, HI. Technical Report NOAA-NMFS-SWFSC-71. 116 pp.

Barry, J. 1993. Beach Nourishment Viability Study. Sea Engineering, Inc. Prepared for the Office of State Planning, Coastal Zone Management Program.

Bennett, P., Bennett, U.K. 2013. An Underwater History of Honokowai (1988-1995) Algae Blooms, Coral Heads, and Sea Turtles. http://www.turtles.org/.

Bodge, K. 1998. Beach Fill Stabilization with Tuned Structures: Experience in the Southeastern U.S.A. and Caribbean. Proc. Coastlines, Structures, and Breakwaters '98, Thomas Telford Publishing, London, p. 82-93.

Bodge, K.R. 2003. Design Aspects of Groins and Jetties. Advances in Coastal Structure Design. ASCE, p. 181-199.

Bodge, K.R. 2006. Alternative Computation of Dean's Overfill Ratio. Journal of Waterway, Port, Coastal, and Ocean Engineering, Vol. 132, No. 2, p133-138.

Booij, N., Ris, R. C., Holthuijsen, L. H. 1999. A third-generation wave model for coastal regions: 1. Model description and validation, Journal of Geophysical Research., 104(C4), 7649–7666, doi:10.1029/98JC02622.

Bridges, T. S., J. K. King, J. D. Simm, M. W. Beck, G. Collins, Q. Lodder, and R. K. Mohan, eds. 2021. Overview: International Guidelines on Natural and Nature-Based Features for Flood Risk Management. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Bridges, T. S., E. M. Bourne, J. K. King, H. K. Kuzmitski, E. B. Moynihan, and B. C. Suedel. 2018. Engineering With Nature: An Atlas ERDC/EL SR-18-8. Vicksburg, MS: U.S. Army Engineer Research and Development Center. http://dx.doi.org/10.21079/11681/27929.

Bridges, T. S., E. M. Bourne, B. C. Suedel, E. B. Moynihan, and J. K. King. 2021. Engineering With Nature: An Atlas, Volume 2. ERDC SR-21-2. Vicksburg, MS: U.S. Army Engineer Research and Development Center. http://dx.doi.org/10.21079/11681/40124.

Bruun, P. 1962. Sea-level rise as a cause of shoreline erosion. J Waterw Harb Div Am Soc Civ Eng 88:117–130.

Bruun, P. 1988. The Bruun Rule of erosion by sea level rise: a discussion on large-scale and two- and three-dimensional usages. J Coast Res 4(4):627–648.

Chu, P., and Clark, J.D. 1999. Decadal variations of tropical cyclone activity over the central North Pacific. Bulletin of the American Meteorological Society, 80(9), 1875–1881.

Clark, J. R. K. 1980. The Beaches of Maui County. Univ. Hawaiʻi Press , Honolulu, 161 p.

Coastal Geology Group in the School of Ocean and Earth Science and Technology (SOEST) at the University of Hawaiʻi. 2021. Hawaiʻi Shoreline Study. Retrieved from https://www.soest.hawaii.edu/crc/index.php/hawaii-shoreline-study-web-map

Codiga , D. and Wager, K. 2011. Sea-Level Rise and Coastal Land Use in Hawaiʻi: A Policy Tool Kit for State and Local Governments. Center for Island Climate Adaptation and Policy. Honolulu, HI. Retrieved from: http://icap.seagrant.soest.hawaii.edu/icap-publications.

Collini, R.C., J. Carter, L. Auermuller, L. Engeman, K. Hintzen, J. Gambill, R.E. Johnson, I. Miller, C. Schafer, and H. Stiller. 2022. Application Guide for the 2022 Sea Level Rise Technical Report. National Oceanic and Atmospheric Administration Office for Coastal Management, Mississippi–Alabama Sea Grant Consortium (MASGP-22-028), and Florida Sea Grant (SGEB 88). Retrieved from: https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nos-techrpt02-global-regional-SLR-scenarios-US-application-guide.pdf.

Courtney, C.A; Romine, B.M.; Lander, M.; Hintzen, K.D.; Owens, T.M.; Pap, R.A. 2020. Guidance for Addressing Sea Level Rise in Community Planning in Hawaiʻi. Prepared by Tetra Tech, Inc. for the University of Hawaiʻi Sea Grant College Program and State of Hawaiʻi Department of Land and Natural Resources and Office of Planning, with funding from National Oceanic and Atmospheric Administration Office for Coastal Management Award No. NA16NOS4730016.

Defeo, O., McLachlan, A., Schoeman, D. S., Schlacher, T. A., Dugan, J., Jones, A., Lastra, M., & Scapini, F. 2009. Threats to sandy beach ecosystems: a review. Estuarine, Coastal and Shelf Science, 81, 1-12

Deltares. 2017. Delft3D-FLOW Simulation of multi-dimensional hydrodynamic flows and transport phenomena, including sediments. User Manual version 3.15.
Federal Emergency Management Agency (FEMA). 2021. Building Community Resilience with Nature-Based Solutions.
Retrieved from: https://www.fema.gov/sites/default/files/documents/fema_riskmap-nature-based-solutions-guide_2021.pdf

Firing, Y. L. and M. A. 2004. Merrifield. Extreme sea level events at Hawaiʻi: influence of mesoscale eddies. Geophysical Research Letters, 31:L24306.

Fletcher, C.H., Romine, B.M., Genz, A.S., Barbee, M.M., Dyer, M., Anderson, T.R., Lim, S.C., Vitousek, S., Bochicchio, C., and Richmond, B.M., 2012. National Assessment of Shoreline Change: Historical Shoreline Change in the Hawaiian Islands: U.S. Geological Survey Open-File Report 2011–1051, 55 p.

Fletcher, C.H. 2009. Sea Level by the End of the 21st Century: A Review. Shore & Beach, v. 77, no. 4, pp. 1-9.

Fletcher, C.H. III, Eric E. Grossman, E.E., Richmond, B.M., and Gibbs, A.E. 2002. Atlas of Natural Hazards in the Hawaiian Coastal Zone. Investigations Series I-2761. U.S. Geological Survey: Washington, D.C.

Forsman, Zac H., Peyton, Kimberly A., Knapp Ingrid S.S., Toonen, Robert J. 2012. Benthic Surveys for the 2012 Waikīkī Beach Sand Replenishment Project. The Effects of Beach Sand Replenishment on Benthic Communities in Waikīkī.

Glenn, Craig R. et al. 2013. Lāhainā Groundwater Tracer Study. Prepared for State of Hawaiʻi Department of Health, U.S. EPA, U.S Army Engineer Research and Development Center.

Grette Associates LLC. 2022. T-5 Dredge Monitoring: Hydroacoustic Monitoring Report. Prepared for: Port of Seattle. May 2022.

Hanzawa, H. 2006. Maui Inland Sand Resource Quantification Study. Prepared for County of Maui Department of Public Works & Environmental Management. SSFM International.

Hawaiʻi Climate Change Mitigation and Adaptation Commission. 2017. Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report. Prepared by Tetra Tech, Inc. and the State of Hawaiʻi Department of Land and Natural Resources, Office of Conservation and Coastal Lands, under the State of Hawaiʻi Department of Land and Natural Resources Contract No: 64064. December 2017.

Hawaiʻi Climate Change Mitigation and Adaptation Commission. 2021. State of Hawaiʻi Sea Level Rise Viewer. Version 1.13. Prepared by the Pacific Islands Ocean Observing System (PacIOOS) for the University of Hawaiʻi Sea Grant College Program and the State of Hawaiʻi

Department of Land and Natural Resources, Office of Conservation and Coastal Lands, with funding from National Oceanic and Atmospheric Administration Office for Coastal Management Award No. NA16NOS4730016 and under the State of Hawai'i Department of Land and Natural Resources Contract No. 64064. http://hawaiisealevelriseviewer.org. Accessed August 12, 2024.

Hawai'i Dune Restoration Manual, 2022. University of Hawai'i Sea Grant College Program. National Sea Grant Office, Rapid Response Funds Funding opportunity NOAAOAR-SG-2019-2005864 (HH-21-01).

Hawai'i Shore & Beach Preservation Association (HSBPA). 2014. Beach Restoration in Hawai'i: Challenges and Opportunities. Outcomes from the Hawai'i Shore and Beach Preservation Association (HSBPA) 2014 Hawai'i Beach Restoration Workshop.

Hsu, J.R.C, and C. Evans. 1989. Parabolic Bay Shapes and Applications. Proc. Institution of Civil Engineers, Vol. 87, No. 4, pp557-570.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007, The Physical Science Basis. Cambridge University Press, Cambridge.

Intergovernmental Panel on Climate Change (IPCC): Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp. 2014.

Kaha, S. and Abraham Fornander. 1872. Relating to Keka'a. In Fornander Collection of Hawaiian Antiquities and Folk-Lore: The Hawaiians' Account of the Formation of their Islands and Origin of their Race, with the Traditions of their Migrations, Etc., as Gathered from Original Sources, Vol. V:iii, edited by T. G. Thrum, pp. 540-544. Bishop Museum Press, Honolulu, HI.

Kahā'ulelio, Daniel. 2006. Ka 'Oihana Lawai'a - Hawaiian Fishing Traditions, edited by M. P. Nogelmeier. Translated by M. K. Pukui. Bishop Museum Press, Honolulu, HI.

Kennedy, Ed. 1997. Pu'u Keka'a is still a spiritual place. The Honolulu Advertiser, January 19, 1997.F-F2, Honolulu, HI.

Klein, A.F., Vargas, A., Raabe, A.A., and Hsu, J.C. Visual assessment of bayed beach stability with computer software. Computers and Geosciences, vol. 29, p. 1249-1257. 2003.

Komar, P.D. Beach Processes and Sedimentation. Second Edition. Prentice-Hall, Inc. 1998.

Landsberg, J. H., G. H. Balazs, K. A. Steidinger, D. G. Baden, T.M. Work and D. J. Russell. 1999. The potential role of natural tumor promoters in marine turtle fibropapillomatosis. Journal of Aquatic Animal Health. 11:199-210.

Loomis, H. 1976. Tsunami Wave Runup Heights in Hawai'i. Hawai'i Institute of Geology and Geophysics and NOAA Joint Tsunami Research Effort, Pacific Marine Environmental Laboratory. NOAA-JTRE-161. HIG-76-5. Honolulu, Hawai'i.

Makai Ocean Engineering, Inc. and Sea Engineering, Inc. 1991. Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui and Hawai'i. Prepared for the State of Hawai'i, Office of State Planning, Coastal Zone Management Program.

Magruder, W. H., and J. H. Hunt. 1979. Seaweeds of Hawai'i. 116 pages. The Oriental Publishing Company, Honolulu.

Maly, Kepā and Onaona Maly. 2003 Ka Hana Lawai'a a me Nā Ko'a o na Kai 'Ewalu : A History of Fishing Practices and Marine Fisheries of the Hawaiian Islands Compiled from: Oral History Interviews with Kūpuna and Kama'āina. Prepared for The Nature Conservancy, Honolulu, HI. Kumu Pono Associates, Hilo, HI.

National Aeronautics and Space Administration (NASA). 2017, June 12. Global Climate Change. Retrieved from: http://climate.nasa.gov/

National Aeronautics and Space Administration (NASA). 2024, November 15. Understanding Sea Level.
Retrieved from: https://sealevel.nasa.gov/understanding-sea-level/regional-sea-level/subsidence/

National Oceanic and Atmospheric Administration (NOAA). 2024, November 15. Relative Sea Level Trend 1615680 Honolulu, Hawai'i.
Retrieved from: https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=1615680.

National Oceanic and Atmospheric Administration (NOAA). 2024, November 15. Interagency Sea Level Rise Scenario Tool. Kahului Harbor, Maui Island.
Retrieved from: https://sealevel.nasa.gov/task-force-scenario-tool?psmsl_id=521

National Oceanic and Atmospheric Administration (NOAA). 2012. Wahikuli-Honokōwai Watershed Management Plan, Volume 1: Watershed Characterization. Prepared for NOAA Coral Reef Conservation Program. Prepared by Sustainable Resources Group International, Inc.

National Oceanic and Atmospheric Administration (NOAA). 2017. Global and Regional Sea Level Rise Scenarios for the United States. NOAA Technical Report NOS CO-OPS 083, Silver Spring, Maryland.

Norcross, Z.M.; Fletcher, C.H.; Rooney, J.; Eversole, D.N., and Miller, T.L. 2003. Hawaiian beaches dominated by longshore transport. Coastal Sediments '03 Proceedings, Clearwater Beach, Florida.

Ocean Innovators. 1991. Development of a Remotely Operable Jet Probe and Other Investigations related to Ocean Sand Resources. Prepared for the Marine Mineral Technology Center, Ocean Basins Division, Honolulu, Hawai'i.

Podoski, J.H. 2013. Hawai'i Regional Sediment Management: Application of SBAS for ArcGIS 10 to Develop Regional Sediment Budgets for the Island of Maui, HI. U.S. Army Corps of Engineers. ERDC/CHL CHETN-XIV-31.

Podoski, J.H., Smith, T.D., Demirbilek, Z., Lin, L., Lillycrop, L.S. 2016. Hawaiʻi Regional Sediment Management (RSM): Regional Sediment Budget for the West Maui Region. U.S. Army Corps of Engineers. ERDC/CHL TR-16-5.

Ruppenthal, Sarah M. 2016. Making waves, saving lives at Honokowai Point. The Maui News. https://www.mauinews.com/news/people-who-made-a-difference/2016/12/don-mcleish/. December 27, 2016.
School of Ocean and Earth Science and Technology (SOEST). 1996. The Ocean Atlas of Hawaiʻi. Available online at URL: http://oos.soest.hawaii.edu; last accessed April 6, 2015.

Sea Engineering, Inc. 2010. Final Environmental Assessment: Waikīkī Beach Maintenance. Waikīkī, Oʻahu, Hawaiʻi.

Sea Engineering, Inc. 2016. Final Environmental Assessment: Royal Hawaiian Groin Replacement Project. Waikīkī, Oʻahu, Hawaiʻi.

Sea Engineering, Inc. 2022. Second Final Environmental Impact Statement: Kāʻanapali Beach Restoration and Berm Enhancement. Kāʻanapali, Oʻahu, Hawaiʻi.

Sherrod, D. R., Sinton, J.M., Watkins, S.E., and Brunt, K.M. 2007. U.S. Geological Service. Geologic Map of the State of Hawaiʻi, Sheet 7 – Island of Maui.

SSFM International, Inc. 2006. Maui Inland Sand Resource Quantification Study. Prepared for County of Maui Department of Public Works & Environmental Management. Retrieved from: https://www.mauicounty.gov/DocumentCenter/View/4139/Maui-Inland-Sand-Quantity-Study?bidId=

SSFM International, Inc. 2018. 2018 Update: Maui Inland Sand Resource Quantification Study. Prepared for County of Maui Department of Public Works, Engineering Division. Retrieved from: https://www.mauicounty.gov/DocumentCenter/View/115412/Maui-Sand-Study-2018-Update

State of Hawaiʻi, Department of Business, Economic Development and Tourism, Office of Planning, Coastal Zone Management Program. 2019. Assessing the Feasibility and Implications of Managed Retreat Strategies for Vulnerable Coastal Areas in Hawaiʻi: Final Report.

State of Hawaiʻi, Department of Business, Economic Development and Tourism, Monthly Visitor Statistics. 2022. http://dbedt.hawaii.gov/visitor/tourism/.

State of Hawaiʻi, Department of Business, Economic Development and Tourism. State of Hawaiʻi Data Book. 2019. State of Hawaiʻi Department of Business, Economic Development & Tourism.

State of Hawaiʻi, Department of Business, Economic Development and Tourism. 2018. Population and Economic Projections for the State of Hawaiʻi to 2045. State of Hawaiʻi Department of Business, Economic Development & Tourism.

Stelling, G. and M. Zijlema. 2003. An accurate and efficient finite-difference alogorithm for non-hydrostatic free-surface flow with application to wave propagation, International Journal of Numerical Methods in Fluids. 43(1): 1-23.

Storlazzi, C.D. and Jaffe, B.E., 2003. Coastal Circulation and Sediment Dynamics Along West Maui, Hawai'i, PART I: Long-term measurements of currents, temperature, salinity and turbidity off Kahana, West Maui: 2001-2003. U.S. Geological Survey Open-File Report 03-482, 28 p.

Storlazzi, C.D., McManus, M.A., Logana, J.B., McLaughlin, B.E., 2006. Cross-shore velocity shear, eddies and heterogeneity in water column properties over fringing coral reefs: West Maui, Hawai'i. US Geological Survey, Pacific Science Center, Santa Cruz, CA 95064, USA

Storlazzi, C.D., Reguero, B.G., Gaido L., C., Alkins, K.C., Lowrie, C., Nederhoff, K.M., Erikson, L.H., O'Neill, A.C., and Beck, M.W. 2024. Forecasting storm-induced coastal flooding for 21st century sea-level rise scenarios in the Hawaiian, Mariana, and American Samoan Islands: U.S. Geological Survey Data Report 1184, 21 p., https://doi.org/ 10.3133/dr1184. https://pubs.usgs.gov/dr/1184/dr1184.pdf

Suedel, B.C., McQueen, A.D., Wilkens, J.L., and Fields, M.P. 2019. Evaluating Effects of Dredging-Induced Underwater Sound on Aquatic Species: A Literature Review. U.S. Army Corps of Engineers, Environmental Research Laboratory. ERDC/EL TR-19-18.

Sustainable Resources Group International, Inc. 2012. Wahikuli-Honokōwai watershed management plan: Volume 1, Watershed characterization; Volume 2, Strategies and implementation. Prepared for National Oceanic and Atmospheric Administration, Coral Reef Conservation Program, Silver Spring, MD. Kailua, HI: Sustainable Resources Group International, Inc. http://www.srgii.com.

Sweet, W.V., R.E. Kopp, R.E. Weaver, J. Obeysekera, R.M. Horton, E.R. Thieler, and C. Zervas. 2017. Global and Regional Sea Level Rise Scenarios for the United States. Silver Spring, MD: NOAA Technical Report NOS CO-OPS 083.

Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak. 2022. Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD, 111 pp. https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nos-techrpt01-global-regional-SLR-scenarios-US.pdf.

Silvester, R., and J.R.C. Hsu. 1993. Coastal Stabilization, Innovative Concepts. Prentice Hall, New Jersey. 578 pp.

Taherkhani, M., Vitousek, S., Barnard, P.L. et al. 2020. Sea-level rise exponentially increases coastal flood frequency. Sci Rep 10, 6466. https://doi.org/10.1038/s41598-020-62188-4.

Tarallo-Jensen, Lucia. 1987. Following the Great Maui Highway: Road Alive with “Golden Age” History from Days of Dominance in Chain" The Honolulu Advertiser, February 17, 1987.26, Honolulu, HI.

Tuttle, L.J., Johnson, C., Kolinski, S. et al. 2020. How does sediment exposure affect corals? A systematic review protocol. Environ Evid 9, 17 (2020). https://doi.org/10.1186/s13750-020-00200-0

U.S. Environmental Protection Agency. 2009. Coastal Sensitivity to Sea-level Rise: A Focus on the Mid-Atlantic Region.

U.S. Army Corps of Engineers. 1998. Depth of Closure in Beach-fill Design. CETN II-40.

U.S. Army Corps of Engineers. 2006. Coastal Engineering Manual. Washington, D.C. EC 1110-2-1100.

U.S. Army Corps of Engineers. 2009. Incorporating Sea-Level Change Considerations in Civil Works Programs. EC 1165-2-211. Washington, DC.

U.S. Army Corps of Engineers. 2011. Sea-Level Change Considerations for Civil Works Programs. EC 1165-2-212.

U.S. Global Research Program. 2019. National Climate Assessment: Climate Change Impacts in the United States. Retrieved from: https://nca2014.globalchange.gov/.

U.S. Naval Weather Service Command, 1971. Summary of Synoptic Meteorological Observations, Hawaiian and Selected North Pacific Island Coastal Areas, Vol. 1. Area 1 – Hawaiian Windward.

Vitousek, S., C.H. Fletcher, M.A. Merrifield, G. Pawlak, and C.D. Storlazzi. 2007. Model Scenarios of Shoreline Change at Kaanapali Beach, Maui, Hawai‘i: Seasonal and Extreme Events. Proceedings, Coastal Sediments ’07, ASCE.

Walker, D.A. 2013. Runups in the Hawaiian Islands for Large, Pacific-Wide, 20th and Early 21st Century Tsunamis; International Tsunami Information Center, NOAA National Weather Service.

Webb, B., Dix, B., Douglass, S., Asam, S., Cherry, C., and Buhring, B. 2019. Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide. FHWA-HEP-19-042.

Wren, J., Kobayashi, D., Jia, Y., Toonen, R. 2016. Modeled Population Connectivity across the Hawaiian Archipelago. Retrieved from: https://doi.org/10.1371/journal.pone.016762.

11. APPENDICES

APPENDIX A

Emergency Erosion Protection Skirt

Hoʻāla Honokōwai
Lahaina, Maui, Hawaiʻi
Tax Map Key Nos. (2) 4-4-001:097, 098, and 100

Prepared By: Sea Engineering, Inc.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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AQUATIC RESOURCES
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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

File : Emergency MA-17-30

MAY 25 2017

Mr. Jim Hunsucker, General Manager
Ka'anapali Beach Vacation Resort
Association of Apartment Owners
104 Ka'anapali Shores Place, Unit C483
Lahanina, Maui 96761

Dear Mr. Hunsucker,

Subject: Request for Emergency Temporary Shoreline Protection at Ka'anapali Beach Vacation Resort at 104 Ka'anapali Shores Place, Lahaina, Maui; TMK (2) 4-4-001:098; (Owner: Diamond Resorts International).

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is responding to your May 8, 2017 request to place an "erosion protection skirt" as temporary erosion control along approximately 500 feet of the shoreline fronting the Ka'anapali Beach Vacation Resort ("Ka'anapali Beach Club") at 104 Ka'anapali Shores Place, Lahaina, Maui; TMK (2) 4-4-001:098. The proposed project is intended to protect the subject property and resort infrastructure from further coastal erosion and land loss and protect the safety of the public and resort guests while a longer-term solution is devised.

A long-term trend of beach erosion, accompanied by seasonal and episodic erosion from high waves has created an erosion scarp that, according to your letter, is now within approximately thirty feet of the twelve-story resort building in the northern half of the property and within several feet of a pool deck, water slide, waterfall, and pump house in the south of the property. A chronic trend of beach erosion and loss has been documented in this area of North Ka'anapali and Honokowai Point over the past century[1]. Large waves and high tides over the past year have eroded and undercut a steep and concave scarp (eroded embankment). According to your letter, the shoreline retreated as much as 10 feet in just a few months over this past winter.

The shoreline to the north of the subject property is armored (seawalls, revetments) with an narrow, intermittent beach fronting the neighboring property and little or no beach remaining to the north. The adjoining property to the south is armored by a rock revetment, which extends out into the beach. Ka'anapali Beach extends to the south from Honokowai Point.

[1] Hawai'i Coastal Erosion Website: http://www.soest.hawaii.edu/coasts/erosion/oahu/

According to your letter and enclosed photos, the erosion has exposed and damaged an outdoor shower pad, concrete walkway, in-ground utilities, and drainage infrastructure. Continued erosion would impact the concrete pool deck and walkway and other resort infrastructure, and could affect the 12-story resort building if recent high rates of erosion continue.

The scarp was between four and eight feet high at the time of writing of your letter. The scarp and backshore appears to be comprised primarily of volcanic soil, clay, and rock, with little or no carbonate beach sand. The erosion has undercut the clay bank resulting in collapse of large sections of the upper bank and loss of several trees. This has created a safety hazard for the public and resort guests on the beach and in the grassy area above the scarp. The area is now cordoned off for safety reasons. Erosion of the volcanic soil and clay is also increasing turbidity in the nearshore waters during high waves.

The DLNR understands that most or all of the proposed activities will occur on State land, seaward of where the shoreline would likely be determined based on Hawaii Administrative Rules (HAR) §13-222 *Shoreline Certifications*. The proposed plan is to install a temporary erosion protection skirt over the face of the scarp (eroded embankment) along 500 feet of the Ka'anapali Beach Club property shoreline.

The proposed structure would be constructed from geotextile fabric, sand-filled coconut fiber (coir) mattresses, and polypropylene and geotextile sandbags. All sandbags and coir mattresses would be filled with clean, screened, "Class A" Maui carbonate inland dune sand. The face of the existing scarp would be cut or smoothed as needed to provide an approximately linear and vertical contour. Any excavated soil or materials would be removed from the shoreline and properly disposed of off-site. Sand would be temporarily pushed away from the toe of the scarp to form a protective berm while work is being completed. Silt and debris fences and other temporary barriers would be installed to prevent sand and sediment from reaching marine waters.

A geotextile cloth would be laid over the scarp and at the foot of the scarp to provide an underlayment for the sand-filled coir mattresses. Five sections of 100-foot long by 20-foot wide heavy geotextile fabric skirt would be sewn together and draped along the scarp over the stacked mattresses. The skirt would be anchored at the top by buried soil anchors installed in the yard and secured at the base by pre-sewn pockets filled with polypropylene sandbags buried in the beach at the toe of the structure. The seams joining the 100-foot sections of skirt would be held in place using additional anchors and cables and with additional weight from polypropylene sandbags within the overlapping seam. According to your letter, failure of the terminal ends of the skirt by wave action is a particular concern. For this reason, you are requesting to place 6 to 8 large ElcoRock sandbags along each end of the skirt to help anchor the ends of the structure.

The proposed structure would be approximately 500 feet long, between 5 and 8 feet tall (depending on height of the scarp), and between 8 and 12 feet wide at the base, over a total area of approximately 9,800 square feet of the public beach.

The DLNR authorizes the temporary emergency structure as described above for three (3) years along approximately 500 feet of the erosion scarp fronting the subject property while the applicant develops long-term options in an effort to protect public health, welfare, and safety on the subject property under Hawaii Administrative Rules (HAR) §13-5-35, *Emergency*

Permits (a) "Notwithstanding any provision of this chapter, the chairperson or deputy director of the department in the absence of the chairperson may authorize through an emergency permit any land use deemed to be essential to alleviate any emergency that is a threat to public health, safety, and welfare, including natural resources, and for any land use that is imminently threatened by natural hazards. These actions shall be temporary in nature to the extent that the threat to public health, safety, and welfare, including natural resources, is alleviated (e.g., erosion control, rockfall mitigation). The emergency action shall include contingencies for removal methods, estimates for duration of the activity, and future response plans if required by the department."

In addition, the structure may be considered an exempt action under State environmental laws under HAR §11-200-8 and as provided in the approved Exemption List for the DLNR, *Exemption Class 1: 1. Mitigation of any hazardous conditions that present imminent danger as determined by the Department Director and that are necessary to protect public health, safety, welfare, or public trust resources; and 2. Upon determination by the Department Director that an emergency exists, emergency mitigation and restoration work to prevent damage from continuing to occur and to restore the topographical features and biological resources.* The DLNR Department of Engineering has provided concurrence on this exemption.

The erosion skirt is intended to provide temporary mitigation of the erosion problem and reduce hazards while pursuing a longer-term strategy. Your letter indicates that you are committed to a long-term solution for erosion management at the property and are currently working with consultants, engineers, neighboring properties, and government agencies to assess short and long-term options. This temporary authorization is contingent on your continued progress toward a long-term erosion management strategy.

The DLNR is requiring that you complete a Draft Environmental Assessment for a long-term plan for erosion management at the subject property within one (1) year following the date of this emergency authorization. Please review the following terms and conditions carefully.

Terms and Conditions

The DLNR has no objections to the Emergency Temporary Shoreline Protection as described above fronting the subject property, at TMK (2) 4-4-001:098, provided that you adhere to the following Terms and Conditions:

1. It is understood that the Emergency Temporary Shoreline Protection is a temporary response to address safety hazards at the subject property, which is threatened by both chronic and seasonal beach erosion. **The material is authorized as a temporary erosion control measure for three (3) years** from the date of issuance of this letter. Subsequent erosion control efforts that call for modification, other than maintenance of the proposed structure will require a new application. At the end of the authorization period, the materials shall be removed;
2. **The permittee shall complete a Draft Environmental Assessment (DEA) for a long-term plan for erosion management at the subject property within one (1) year from the date of the issuance of this letter.** The DEA should assess all reasonable

alternatives for long-term erosion management at the site, including but not limited to beach restoration. Failure to complete the DEA within one year will render this temporary authorization void;

3. The permittee shall contact the DLNR Maui Land Division and/or Division of Boating and Ocean Recreation and secure a Right of Entry Permit incorporating the most current terms and conditions for the use of State lands for this structure;
4. The permittee will submit a completion report for the project to the OCCL within ninety (90) days of completion of construction of the temporary structure. It will summarize the construction and detail any deviation from the proposed plans and provide a summary of the beach conditions since installation. The report will also include a photo summary of the temporary structure and beach conditions with documentation of any alterations or repairs;
5. 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;
6. 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;
7. Unless otherwise authorized, any work or construction to be done on the land shall be completed within 180 days of the approval of such use. The permittee shall notify the department in writing at least 24 hours prior to initiating construction and when it is completed;
8. Work shall be conducted at low tide to the most practical extent possible and no work shall occur during high surf or ocean conditions that will create unsafe work or beach conditions;
9. 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;
10. 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. All

barriers shall be removed once the project is complete to allow full public access laterally along the beach and alongshore walkway;

11. 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;
12. 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;
13. The permittee understands and agrees that the permit does not convey any vested right(s) or exclusive privilege;
14. Transfer of ownership of the subject property includes the responsibility of the new owner to adhere to the terms and conditions of this authorization;
15. In issuing the permit, the Department and the Chairperson 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;
16. 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;
17. 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;
18. 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 Hawaii Revised Statutes (HRS) §205A-1;
19. 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;
20. 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;
21. No contamination of the marine or coastal environment (trash or debris) shall result from project-related activities authorized under this letter;
22. 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 HRS §205A-71. All exterior lighting shall be shielded to protect the night sky;

23. 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;
24. 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 the State Historic Preservation Division (692-8015), which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary;
25. The DLNR reserves the right to impose additional terms and conditions on projects authorized under this letter, if it deems them necessary;
26. Failure to comply with any of these conditions shall render a permit void under the chapter, as determined by the Chairperson or BLNR.

Should you have any questions pertaining to this letter, please contact Brad Romine, Hawaii Sea Grant Extension Agent in the OCCL at (808) 587-0049 or Bradley.M.Romine@Hawaii.gov.

Sincerely,

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

CC: Maui County Planning Department, Keith Scott
Maui Land Division Office
DOBOR Maui District Office, Paul Sensano
Thorne Abbott, Coastal Planners LLC

I concur with the conditions of this letter:

_____ Date_____

Applicant

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
DEPUTY DIRECTOR - WATER

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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

DLNR:OCCL:SL

Re: Emergency MA-17-30

Mr. Andy Bohlander
Sea Engineering, Inc.
Makai Research Pier
41-305 Kalanianaole Hwy
Waimanalo, Hawaii 96795-1820

OCT 16 2017

Dear Mr. Bohlander,

Subject: Request to Use Lahaina Small Boat Harbor Dredge Sand for Emergency Temporary Shoreline Protection at Ka'anapali Beach Vacation Resort at 104 Ka'anapali Shores Place, Lahaina, Maui; TMK (2) 4-4-001:098; (Owner: Diamond Resorts International).

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is responding to your October 2, 2017 request on behalf of Ka'anapali Beach Vacation Resort (the Applicant) to use marine sand from an ongoing dredging project at Lahaina Small Boat Harbor to construct an "erosion protection skirt" as temporary erosion control along approximately 500 feet of the shoreline fronting the Ka'anapali Beach Vacation Resort ("Ka'anapali Beach Club") at 104 Ka'anapali Shores Place, Lahaina, Maui; TMK (2) 4-4-001:098. The project is intended to protect the subject property and resort infrastructure from further coastal erosion and land loss and protect the safety of the public and resort guests while a longer-term solution is devised. The emergency erosion control measures were authorized by DLNR on May 25, 2017 (Ref. Emergency MA-17-30).

DLNR's authorization specified that sandbags and coconut fiber (coir) mattresses would be filled with "Class A" Maui carbonate inland dune sand. Installation of the emergency erosion control measures at Ka'anapali Beach Club has been delayed due to a lack of available beach-quality sand. Due to circumstances unrelated to this project, carbonate inland dune sand is no longer available for purchase. The Maui County Council is considering bills to limit and regulate mining, extraction, or stockpiling of inland sand. As a result, sand suppliers on Maui have halted excavation and sale of inland dune sand indefinitely. Erosion of the subject property has continued in the meantime resulting in further land loss and release of fine terrigenous sediments from the eroded bank creating turbidity plumes in the nearshore waters.

Approximately 1,350 cubic yards of sand is needed to construct the temporary erosion control measures. According to your letter, you have explored various potential sources of sand on Maui and the only readily available source of sand appears to be from an ongoing maintenance dredging project at Lahaina Small Boat Harbor. Also according to the your letter, the DLNR

Division of Boating and Ocean Recreation and American Marine Corporation, who are conducting the dredging project, are supportive of providing an adequate quantity of dredge sand to support emergency erosion control at Ka'anapali Beach Club.

You have provided comparative sand grain analysis for the proposed dredge sand and existing beach sand along with a physical sample of the proposed dredge sand. The proposed dredge sand is finer and appears to contain a higher fraction of volcanic sand compared to carbonate sand than the existing beach sand based on visual inspection.

The DLNR has no objections to the use of the proposed Lahaina Harbor dredge sand for construction of emergency erosion control measures as authorized under Emergency MA-17-30. While the sand is not an ideal match to the existing beach it appears to be the best available source of marine carbonate sand for the emergency project at this time and should provide an improvement over the existing conditions, which include frequent turbidity plumes in the nearshore waters from the exposed and eroding volcanic clay bank. The work will be subject to the Terms and Conditions of Emergency MA-17-30 and the following:

- The Applicant shall act as quickly as possible to repair any damage to the erosion control structure so as to limit release of the placed sand from the structure to the beach and marine environment.

- At the end of the authorization period, the materials including placed sand remaining within the structure shall be removed from the beach.

Should you have any questions pertaining to this letter, please contact Brad Romine, Hawaii Sea Grant Extension Agent in the OCCL at (808) 587-0049 or Bradley.M.Romine@Hawaii.gov.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

CC: Maui County Planning Department, Keith Scott
Maui Land Division Office
DOBOR Maui District Office, Paul Sensano

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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HONOLULU, HAWAII 96809

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Re: Emergency MA-17-30

Mr. Andy Bohlander
Sea Engineering, Inc.
Makai Research Pier
41-305 Kalanianaole Hwy
Waimanalo, Hawaii 96795-1820

DEC - 8 2017

Dear Mr. Bohlander,

Subject: Request for Modification of Authorization for Emergency Temporary Shoreline Protection at Ka'anapali Beach Vacation Resort at 104 Ka'anapali Shores Place, Lahaina, Maui; TMK (2) 4-4-001:098; (Owner: Diamond Resorts International).

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is responding to your December 4, 2017 request on behalf of Ka'anapali Beach Vacation Resort (the Applicant) to modify DLNR Emergency Authorization MA-17-30. The request is to use Tencate Marafi® geotextile fabric rather than coconut fiber (coir) material as originally requested to construct sand filled mattresses within the proposed "erosion protection skirt." The temporary erosion control structure is intended to protect the subject property from further coastal erosion and land loss and protect the safety of the public and resort guests while a longer-term solution is devised.

The DLNR has no objections to the use of the Marafi geotextile fabric in place of the coir fabric for construction of emergency erosion control measures as authorized under Emergency MA-17-30. This modification should help contain the sand, recovered from a dredge project at Lahaina Harbor, within the structure and reduce the need for maintenance to the structure. The work will be subject to the Terms and Conditions of Emergency Authorization MA-17-30 and the following:

- The Applicant shall act as quickly as possible to repair any damage to the erosion control structure so as to limit release of geotextile fabric from the structure to the beach and marine environment.

- At the end of the authorization period, the materials including any placed sand remaining within the structure shall be removed from the beach.

Should you have any questions pertaining to this letter, please contact Brad Romine, Hawaii Sea Grant Extension Agent in the OCCL at (808) 587-0049 or Bradley.M.Romine@Hawaii.gov.

Sincerely,

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

CC: Maui County Planning Department, Keith Scott
Maui Land Division Office

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

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DEPARTMENT OF LAND AND NATURAL RESOURCES
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DLNR:OCCL:SL

Re: Emergency MA-17-30

Mr. Andy Bohlander
Sea Engineering, Inc.
Makai Research Pier
41-305 Kalanianaole Hwy
Waimanalo, Hawaii 96795-1820

AUG 13 2019

Dear Mr. Bohlander,

Subject: Request for Emergency Maintenance (Emergency MA-17-30)
Kaanapali Beach Club
Modification of Authorization for Emergency Temporary Shoreline Protection at 104 Ka'anapali Shores Place, Lahaina, Maui; TMK (2) 4-4-001:098; (Owner: Diamond Resorts International).

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is responding to your August 1, 2019 request on behalf of Ka'anapali Beach Club (the Applicant) to repair damaged sections of the existing emergency erosion protection skirt (DLNR Ref. Emer. CDUA MA-17-30). The skirt sustained damage in August 2018 during swell events associated with Hurricane Hector and by elevated water levels associated with summer king tide events. Incurred damages include tears along multiple sections of the geotextile skirt fabric and failure along one section of geotextile mattress. In response to the damages the DLNR authorized placement of one hundred twenty (120) 0.75m^3 ElcoRock sandbags to stabilize damaged sections of the structure. The work was not yet been completed and the DLNR authorization for the repairs has now expired.

Your letter states that the structure has sustained additional damage such that repairs are needed to prevent the southern portion of the erosion protection skirt from failing. The proposed project would entail placement of one-hundred twenty (120) 0.75 m^3 ELCOROCK sand containers within the footprint of the existing structure to stabilize failing sections of the erosion protection skirt. The sand containers would be filled with sand recovered during maintenance dredging of Lahaina Small Boat Harbor in 2018. A layer of Tencate Geotube ® fabric would be placed over the stacked ELCOROCK sand containers, extending from the top of the embankment to a shallow trench at the base of the structure. Damaged sections of the erosion protection skirt and any other loose debris present along the shoreline would be removed prior to installation. No changes to the design or dimensions of the structure are being proposed.

The DLNR has no objection to the repair of the erosion control structure by the proposed placement of ELCOROCK sand containers and anchored Tencate Geotube ® fabric material. The repair is necessary to mitigate further release of terrigenous sediment into nearshore waters and to minimize environmental impacts during the beach restoration project planned to take place fronting Kaanapali Beach Club. The work will be subject to the Terms and Conditions of Emergency Authorization MA-17-30. Additionally, at the end of the authorization period, the materials including any placed sand remaining within the structure shall be removed from the beach.

Should you have any questions on the matter, please feel free to contact Shellie Habel, Hawaii Sea Grant Extension Agent in the DLNR Office of Conservation and Coastal Lands at (808) 587-0049 or via email at Shellie.L.Habel@Hawaii.gov.

Sincerely,

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

CC: Maui County Planning Department
Maui Land Division Office

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

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

REF:OCCL:SS

Emergency CDUP MA 21-06

FEB -3 2021

Diamond Resorts International
c/o Kā'anapali Beach Club
ATTN: Fred Mayo, General Manager
104 Kā'anapali Shores Place
Lāhainā, HI 96761

SUBJECT: Emergency Conservation District Use Permit Regarding a Request for Repairs to Emergency Temporary Erosion Control Seaward of the Kā'anapali Beach Club at 104 Kā'anapali Shores Place, Lāhainā, Maui; TMK (2) 4-4-001:098, and seaward

Dear Landowner:

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is in receipt of your request to repair and maintain the erosion protection skirt that currently sits in the shoreline area makai of the subject property in Lāhainā, Maui. According to the information provided to our office, the existing subject erosion protection skirt was authorized by OCCL on May 25, 2017 as Emergency CDUP MA 17-30, attached as ***Exhibit A***, but the erosion protection skirt was not placed until May of 2018. The approved structure in Emergency CDUP MA 17-30 consisted of geotextile fabric, sand-filled geotextile mattresses, and polypropelene sandbags along roughly 500 linear feet of shoreline fronting the subject property that had a total footprint of roughly 9,800 square feet.

Within a few months of its installation in 2018, the erosion protection skirt sustained damage due to heavy wave events. In the two years since its installation, this area has seen continued heavy wave events that has caused the damage to exacerbate even further. Your information packet sent to our office states that at the current time the damaged section of the erosion protection skirt is roughly 140 feet long (***Figures 1 & 2***, on next page).

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Figure 1 – Damaged Skirt as of August 2020, Provided by Applicant

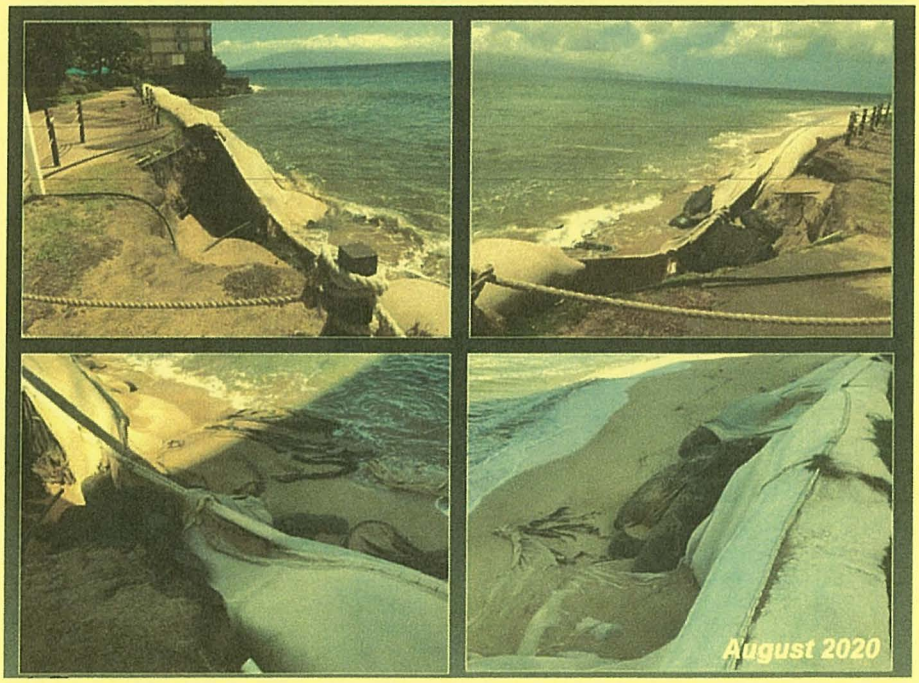


Figure 2 – Damaged Skirt as of August 2020, Provided by Applicant

The adjacent properties to both the north and south of the subject property are armored with revetments and/or seawalls.

The damage to the existing erosion protection skirt as shown above in ***Figures 1 & 2*** has prompted your client to request authorization to repair these damaged sections of the erosion control skirt while a long-term strategy to address the erosion problem at the subject property is formed. A long-term trend of beach erosion is accompanied by seasonal and episodic erosion from high waves events in this area of west Maui (***Figures 3 & 4)***, prompting a need for action to address the erosion problem in the area.

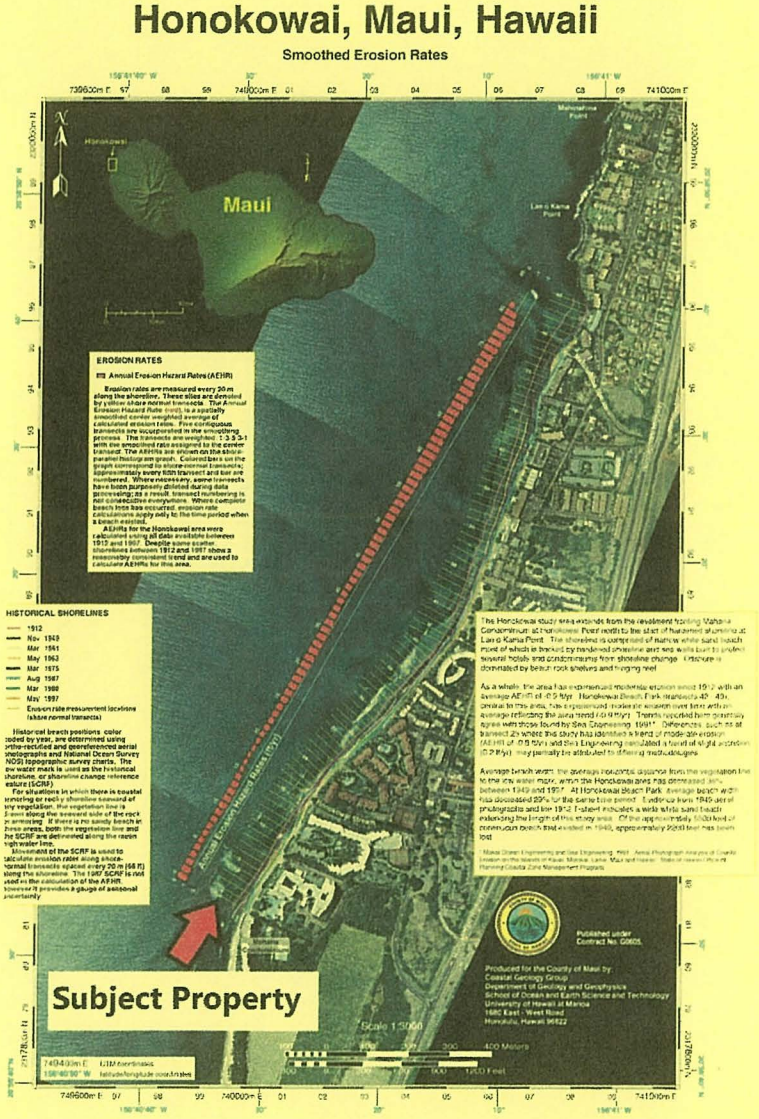


Figure 3 – Erosion Map for Subject Area, Showing Subject Property



Figure 4 – Inset of Erosion Map for Subject Area, Showing Subject Property

The subject property is facing chronic erosion, as visible on ***Figures 3 and 4,*** with the information and graphs provided by the University of Hawai'i's Coastal Geology Group. According to this data, the shoreline in the subject area is moving inland at an annual rate of roughly one foot in some areas of the property. A screenshot of the Hawai'i Sea Level Rise Viewer, provided by the University of Hawai'i's Coastal Geology Group for the subject property as shown on the next page in ***Figure 5,*** reveal the serious threat that sea level rise and both chronic and episodic coastal erosion pose to the subject property and the surrounding area as a whole.

[the rest of this page intentionally left blank]



Figure 5 – Sea Level Rise Exposure Area Map for Subject Property

Based on Figures 3-5 above, the subject property is in serious danger of coastal erosion due to both accelerating sea level rise as well as seasonal high-energy wave events and will likely see significant adverse effects due to the combination of these occurrences in the future. In light of the subject property's significantly threatened status, actions will need to be taken in the near future to protect the structures on the property and to simultaneously ensure the protection of natural shoreline processes.

In the meantime, you are requesting authorization to repair a previously approved erosion protection skirt in the shoreline area fronting the subject property. The existing subject erosion protection skirt was authorized by OCCL on May 25, 2017 as Emergency CDUP MA 17-30, attached to this document as ***Exhibit A***, but this authorization expired on May 25, 2020. Therefore, our office is processing this request as a new Emergency Conservation District Use Application (CDUA).

Proposed Action

The proposed action that is the subject of this request would consist of repairing the damaged section of the existing erosion protection skirt, the length of which is stated to be approximately 140 linear feet, but may be up to as much as 300 feet. Your application notes that this would be a like-to-like replacement, with no expansion or additional improvements to the existing erosion protection skirt proposed, and that the means, methods, and materials would be similar to (with an exception as explained below) that used in the construction of the existing erosion control skirt in 2018. These same materials would include Tencate Mirafi geotextile fabric that would be filled with sand dredged from Lāhainā Harbor in 2017. This is the same sand used in the original construction.

Due to the severe damage sustained by the sand-filled mattresses that were placed for the original construction, these damaged mattresses would be replaced with geotextile sand containers. The information provided notes that this change is proposed because the geotextile containers can be stacked and oriented to withstand higher wave energy than the mattresses, which have sustained heavy damage since their installation. The application also notes that the geotextile sand containers can be constructed in a shorter time period and are less labor intensive than the mattresses in addition to having reduced impact to the beach and shoreline during construction.

The paved road and parking lot of the Kā'anapali Beach Club would be used as access as well as a staging area for the project. The information provided states that this staging area would be roughly 3,500 square feet and that Best Management Practices (BMPs) would be used to store and maintain all equipment within the staging area throughout the duration of the project. The application states that the project is expected to take roughly 25 days to complete depending on ocean conditions.

The damaged sand-filled mattresses would first be removed from the area and subsequently be replaced by geotextile sand containers constructed of Tencate Mirafi geotextile fabric, which is the same material that was used for the existing erosion control skirt. Approximately 432 cubic yards of sand would be used to fill these containers, and the sand used for this project would be the same sand used in the original construction in 2018 (dredged from Lāhainā Harbor in 2017). The information provided states that the sand-filled containers will be constructed and sewn within the staging area and then transported to the shoreline for placement via skid steer. Upon placement in the shoreline area, a 238 Komatsu excavator would be used to place the sand containers along the erosion scarp according to design specifications.

Upon installation of the sand-filled containers, an erosion control skirt – consisting of a single layer of Tencate Mirafi geotextile fabric, the same material as the existing skirt – would be draped over the mattresses. The top of the skirt would be anchored to the top of the erosion scarp while the bottom would be anchored within a shallow trench at the base of the sand-filled containers. Materials used to anchor the skirt at the base of the containers would consist of pre-sewn pockets filled with sandbags, while the skirt's anchoring to the top of the scarp would consist of platypus earth anchors connected to a 4-inch galvanized pipe that slides into a sleeve at the top of the structure, fastened using wire ropes and clamps. The application notes that the backshore anchoring would be buried at a shallow depth to avoid potential tripping hazards for the general public. Upon completion of these actions, all materials, work equipment, and BMPs that were installed for the project would be removed, and the area would be restored to its pre-project state.

Both seasonal and long-term conditions have resulted in erosion of the shoreline fronting the subject property that has prompted repeated requests to address the situation. After much consideration on the potential impacts of the proposed structure, as well as the feasibility of other designs to adequately protect the area from its high erosion rates, our office has decided to approve the proposed design for emergency temporary erosion control while a long-term solution to the chronic erosion problem at the subject property is formed.

However, this authorization is temporary. The Kā'anapali Beach Club must develop a longer-term plan to address the situation. This emergency authorization will include a condition that requires them to do this.

The DLNR authorizes the temporary emergency erosion control measures as described above for three (3) years along the shoreline fronting the subject property while the applicant develops long-term options in an effort to protect public health, welfare, and safety on the subject property under Hawai'i Administrative Rules (HAR) §13-5-35, *Emergency Permits (a) "notwithstanding any provision of this chapter, the chairperson or deputy director of the department in the absence of the Chairperson may authorize through an emergency permit any land use deemed to be essential to alleviate any emergency that is a threat to public health, safety, and welfare, including natural resources, and for any land use that is imminently threatened by natural hazards. These actions shall be temporary in nature to the extent that the threat to public health, safety, and welfare, including natural resources, is alleviated (e.g., erosion control, rockfall mitigation). The emergency action shall include contingencies for removal methods, estimates for duration of the activity, and future response plans if required by the department."*

In addition, the temporary structure may be considered an exempt action under State environmental laws under HAR §11-200.1-15(c), Exemption Class (4): *Minor alterations in the condition of land, water, or vegetation,* and DLNR Exemption List Class 4, Part 2 (1): *Upon determination by the Department Director that an emergency exists, emergency mitigation and restoration work to prevent further damage from occurring and to restore the topographical features and biological resources.* The Office of Conservation and Coastal Lands consulted with the Maui County Planning Office, who concurred with this exemption for the proposed project.

The erosion control measures are intended to provide temporary mitigation of the erosion problem and reduce hazards to the subject property while you pursue a long-term strategy. The DLNR requests that you remove and properly dispose of any debris encountered on the beach during the installation of the erosion control measures. Any materials that come loose from the temporary erosion control measures shall be repaired or discarded as soon as possible so they do not end up in the beach or marine environment. The beach-compatible sand used to fill the geotextile containers must be pre-approved by OCCL before use. Additionally, a land disposition is required from the Maui District Land Office.

Please review the following Terms and Conditions carefully and return a signed copy to the DLNR.

Terms and Conditions

The DLNR has no objections to the emergency temporary erosion control as described above fronting the subject property at 104 Kā'anapali Shores Place, Lāhainā, Maui, Tax Map Key (2) 4-4-001:098, provided that you adhere to the following terms and conditions:

1. It is understood that the emergency temporary shoreline protection is a temporary response to address chronic beach erosion that is persistent in the subject area until a long-term solution is formed. **The material is authorized as a temporary erosion control measure for three (3) years** from the date of issuance of this letter. Subsequent

erosion control efforts that call for modification, other than routine maintenance of the proposed structure, will require a new application. At the end of the authorization period, the materials shall be removed;

2. Unless otherwise authorized, any work or construction to be done on the land shall be completed within 180 days of the approval of such use. The permittee shall notify the department in writing at least 24 hours prior to initiating construction and when it is completed;

3. The permittee shall obtain a land disposition for the structure;

4. The permittee will submit a completion report for the project to the OCCL within ninety (90) days of completion of construction of the temporary structure. It will summarize the construction and detail any deviation from the proposed plans as well as provide a summary of the beach conditions since installation. The report will also include a photo summary of the temporary structure and beach conditions with documentation of any alterations or repairs;

5. The permittee shall obtain necessary county permits for proposed the use, as necessary;

6. 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 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;

7. 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;

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

9. Any materials that become liberated during construction activities must be immediately removed from the beach or ocean;

10. Work shall be conducted at low tide to the most practical extent possible and no work shall occur during high surf or ocean conditions that will create unsafe work or beach conditions;

11. 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. All barriers shall be removed once the project is complete to allow full public access laterally along the beach and alongshore walkway;

12. Obstruction of lateral shoreline access shall be avoided or minimized;

13. During construction, appropriate mitigation measures shall be implemented to minimize impacts to the aquatic environment, off-site roadways, utilities, and public facilities;

14. 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;

15. 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;

16. 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 HRS §205A-71. All exterior lighting shall be shielded to protect the night sky;

17. 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 Hawai'i and by Hawai'i statutory and case law;

18. 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 the State Historic Preservation Division (692-8015), which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary;

19. 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;

20. For all landscaped and vegetated 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 Hawai'i Revised Statutes (HRS) §205A-1;

21. 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;

22. The permittee shall comply with all applicable Department of Health Administrative Rules;

23. The permittee, their successors and assigns, shall indemnify and hold the State of Hawai'i 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;

24. The permittee understands and agrees that the permit does not convey any vested right(s) or exclusive privilege;

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

26. In issuing the permit, the Department and the Chairperson have relied on the information and data that the permittees have 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;

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

28. **A long-term plan to address erosion at the subject property must be submitted to the OCCL within one (1) year of the date of issuance of this emergency permit. The plan must include timeframes for implementation;**

29. Other terms and conditions as prescribed by the Chairperson; and

30. Failure to comply with any of these conditions shall render a permit void under the chapter, as determined by the Chairperson or BLNR.

Please review these Terms and Conditions carefully and return a signed copy to the DLNR. Should you have any questions pertaining to this letter, please contact Salvatore Saluga of our office at (808) 798-6147 or salvatore.j.saluga@hawaii.gov.

Sincerely,

Suzanne D. Case

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

I concur with the conditions of this letter:

KA Wheeler

Signature of Applicant or Representative

Date: February 12, 2021

Kathy A. Wheeler Authorized Representative

Print Name & Title

CC: Sea Engineering, Inc.
c/o Andy Bohlander
MDLO
County of Maui, Planning Department

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
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AQUATIC RESOURCES
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DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DLNR:OCCL:SL

File : Emergency MA-17-30

MAY 25 2017

Mr. Jim Hunsucker, General Manager
Ka'anapali Beach Vacation Resort
Association of Apartment Owners
104 Ka'anapali Shores Place, Unit C483
Lahanina, Maui 96761

Dear Mr. Hunsucker,

Subject: Request for Emergency Temporary Shoreline Protection at Ka'anapali Beach Vacation Resort at 104 Ka'anapali Shores Place, Lahaina, Maui; TMK (2) 4-4-001:098; (Owner: Diamond Resorts International).

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is responding to your May 8, 2017 request to place an "erosion protection skirt" as temporary erosion control along approximately 500 feet of the shoreline fronting the Ka'anapali Beach Vacation Resort ("Ka'anapali Beach Club") at 104 Ka'anapali Shores Place, Lahaina, Maui; TMK (2) 4-4-001:098. The proposed project is intended to protect the subject property and resort infrastructure from further coastal erosion and land loss and protect the safety of the public and resort guests while a longer-term solution is devised.

A long-term trend of beach erosion, accompanied by seasonal and episodic erosion from high waves has created an erosion scarp that, according to your letter, is now within approximately thirty feet of the twelve-story resort building in the northern half of the property and within several feet of a pool deck, water slide, waterfall, and pump house in the south of the property. A chronic trend of beach erosion and loss has been documented in this area of North Ka'anapali and Honokowai Point over the past century[1]. Large waves and high tides over the past year have eroded and undercut a steep and concave scarp (eroded embankment). According to your letter, the shoreline retreated as much as 10 feet in just a few months over this past winter.

The shoreline to the north of the subject property is armored (seawalls, revetments) with an narrow, intermittent beach fronting the neighboring property and little or no beach remaining to the north. The adjoining property to the south is armored by a rock revetment, which extends out into the beach. Ka'anapali Beach extends to the south from Honokowai Point.

[1] Hawai'i Coastal Erosion Website: http://www.soest.hawaii.edu/coasts/erosion/oahu/

Exhibit A – OCCL's Emergency CDUP MA 17-30

According to your letter and enclosed photos, the erosion has exposed and damaged an outdoor shower pad, concrete walkway, in-ground utilities, and drainage infrastructure. Continued erosion would impact the concrete pool deck and walkway and other resort infrastructure, and could affect the 12-story resort building if recent high rates of erosion continue.

The scarp was between four and eight feet high at the time of writing of your letter. The scarp and backshore appears to be comprised primarily of volcanic soil, clay, and rock, with little or no carbonate beach sand. The erosion has undercut the clay bank resulting in collapse of large sections of the upper bank and loss of several trees. This has created a safety hazard for the public and resort guests on the beach and in the grassy area above the scarp. The area is now cordoned off for safety reasons. Erosion of the volcanic soil and clay is also increasing turbidity in the nearshore waters during high waves.

The DLNR understands that most or all of the proposed activities will occur on State land, seaward of where the shoreline would likely be determined based on Hawaii Administrative Rules (HAR) §13-222 *Shoreline Certifications*. The proposed plan is to install a temporary erosion protection skirt over the face of the scarp (eroded embankment) along 500 feet of the Ka'anapali Beach Club property shoreline.

The proposed structure would be constructed from geotextile fabric, sand-filled coconut fiber (coir) mattresses, and polypropylene and geotextile sandbags. All sandbags and coir mattresses would be filled with clean, screened, "Class A" Maui carbonate inland dune sand. The face of the existing scarp would be cut or smoothed as needed to provide an approximately linear and vertical contour. Any excavated soil or materials would be removed from the shoreline and properly disposed of off-site. Sand would be temporarily pushed away from the toe of the scarp to form a protective berm while work is being completed. Silt and debris fences and other temporary barriers would be installed to prevent sand and sediment from reaching marine waters.

A geotextile cloth would be laid over the scarp and at the foot of the scarp to provide an underlayment for the sand-filled coir mattresses. Five sections of 100-foot long by 20-foot wide heavy geotextile fabric skirt would be sewn together and draped along the scarp over the stacked mattresses. The skirt would be anchored at the top by buried soil anchors installed in the yard and secured at the base by pre-sewn pockets filled with polypropylene sandbags buried in the beach at the toe of the structure. The seams joining the 100-foot sections of skirt would be held in place using additional anchors and cables and with additional weight from polypropylene sandbags within the overlapping seam. According to your letter, failure of the terminal ends of the skirt by wave action is a particular concern. For this reason, you are requesting to place 6 to 8 large ElcoRock sandbags along each end of the skirt to help anchor the ends of the structure.

The proposed structure would be approximately 500 feet long, between 5 and 8 feet tall (depending on height of the scarp), and between 8 and 12 feet wide at the base, over a total area of approximately 9,800 square feet of the public beach.

The DLNR authorizes the temporary emergency structure as described above for three (3) years along approximately 500 feet of the erosion scarp fronting the subject property while the applicant develops long-term options in an effort to protect public health, welfare, and safety on the subject property under Hawaii Administrative Rules (HAR) §13-5-35, *Emergency*

Permits (a) "Notwithstanding any provision of this chapter, the chairperson or deputy director of the department in the absence of the chairperson may authorize through an emergency permit any land use deemed to be essential to alleviate any emergency that is a threat to public health, safety, and welfare, including natural resources, and for any land use that is imminently threatened by natural hazards. These actions shall be temporary in nature to the extent that the threat to public health, safety, and welfare, including natural resources, is alleviated (e.g., erosion control, rockfall mitigation). The emergency action shall include contingencies for removal methods, estimates for duration of the activity, and future response plans if required by the department."

In addition, the structure may be considered an exempt action under State environmental laws under HAR §11-200-8 and as provided in the approved Exemption List for the DLNR, *Exemption Class 1: 1. Mitigation of any hazardous conditions that present imminent danger as determined by the Department Director and that are necessary to protect public health, safety, welfare, or public trust resources; and 2. Upon determination by the Department Director that an emergency exists, emergency mitigation and restoration work to prevent damage from continuing to occur and to restore the topographical features and biological resources.* The DLNR Department of Engineering has provided concurrence on this exemption.

The erosion skirt is intended to provide temporary mitigation of the erosion problem and reduce hazards while pursuing a longer-term strategy. Your letter indicates that you are committed to a long-term solution for erosion management at the property and are currently working with consultants, engineers, neighboring properties, and government agencies to assess short and long-term options. This temporary authorization is contingent on your continued progress toward a long-term erosion management strategy.

The DLNR is requiring that you complete a Draft Environmental Assessment for a long-term plan for erosion management at the subject property within one (1) year following the date of this emergency authorization. Please review the following terms and conditions carefully.

Terms and Conditions

The DLNR has no objections to the Emergency Temporary Shoreline Protection as described above fronting the subject property, at TMK (2) 4-4-001:098, provided that you adhere to the following Terms and Conditions:

1. It is understood that the Emergency Temporary Shoreline Protection is a temporary response to address safety hazards at the subject property, which is threatened by both chronic and seasonal beach erosion. **The material is authorized as a temporary erosion control measure for three (3) years** from the date of issuance of this letter. Subsequent erosion control efforts that call for modification, other than maintenance of the proposed structure will require a new application. At the end of the authorization period, the materials shall be removed;
2. **The permittee shall complete a Draft Environmental Assessment (DEA) for a long-term plan for erosion management at the subject property within one (1) year from the date of the issuance of this letter.** The DEA should assess all reasonable

alternatives for long-term erosion management at the site, including but not limited to beach restoration. Failure to complete the DEA within one year will render this temporary authorization void;

3. The permittee shall contact the DLNR Maui Land Division and/or Division of Boating and Ocean Recreation and secure a Right of Entry Permit incorporating the most current terms and conditions for the use of State lands for this structure;
4. The permittee will submit a completion report for the project to the OCCL within ninety (90) days of completion of construction of the temporary structure. It will summarize the construction and detail any deviation from the proposed plans and provide a summary of the beach conditions since installation. The report will also include a photo summary of the temporary structure and beach conditions with documentation of any alterations or repairs;
5. 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;
6. 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;
7. Unless otherwise authorized, any work or construction to be done on the land shall be completed within 180 days of the approval of such use. The permittee shall notify the department in writing at least 24 hours prior to initiating construction and when it is completed;
8. Work shall be conducted at low tide to the most practical extent possible and no work shall occur during high surf or ocean conditions that will create unsafe work or beach conditions;
9. 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;
10. 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. All

barriers shall be removed once the project is complete to allow full public access laterally along the beach and alongshore walkway;

11. 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;
12. 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;
13. The permittee understands and agrees that the permit does not convey any vested right(s) or exclusive privilege;
14. Transfer of ownership of the subject property includes the responsibility of the new owner to adhere to the terms and conditions of this authorization;
15. In issuing the permit, the Department and the Chairperson 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;
16. 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;
17. 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;
18. 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 Hawaii Revised Statutes (HRS) §205A-1;
19. 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;
20. 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;
21. No contamination of the marine or coastal environment (trash or debris) shall result from project-related activities authorized under this letter;
22. 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 HRS §205A-71. All exterior lighting shall be shielded to protect the night sky;

23. 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;
24. 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 the State Historic Preservation Division (692-8015), which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary;
25. The DLNR reserves the right to impose additional terms and conditions on projects authorized under this letter, if it deems them necessary;
26. Failure to comply with any of these conditions shall render a permit void under the chapter, as determined by the Chairperson or BLNR.

Should you have any questions pertaining to this letter, please contact Brad Romine, Hawaii Sea Grant Extension Agent in the OCCL at (808) 587-0049 or Bradley.M.Romine@Hawaii.gov.

Sincerely,

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

CC: Maui County Planning Department, Keith Scott
Maui Land Division Office
DOBOR Maui District Office, Paul Sensano
Thorne Abbott, Coastal Planners LLC

I concur with the conditions of this letter:

_____ Date_____

Applicant

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
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

REF:OCCL:SS

Emerg. CDUP MA 21-6: Time Ext.

JAN - 7 2021

West Maui Resort Partners, L.P.,
c/o Hilton Grand Vacations, Inc.
ATTN: Michael Elliot, SVP Design & Construction
5323 Millenia Lakes Blvd.
Orlando, FL 32839

SUBJECT: Time Extension and Amendment of Emergency Conservation District Use Permit MA 21-6 for Repairs to Emergency Temporary Erosion Control Seaward of the Kā'anapali Beach Club at 104 Kā'anapali Shores Place, Lāhainā, Maui; TMK (2) 4-4-001:098, and seaward

Dear Landowner:

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is in receipt of your two (2) requests dated December 27, 2021 regarding the above referenced Emergency CDUP MA 21-6, which authorized repairs to an existing emergency temporary erosion control structure seaward of the subject property. The two requests as stated in your letters were as follows:

(1) To change the name of the applicant on Emergency CDUP MA 21-6 from the previous owner (Kā'anapali Beach Vacation Resort) to the new landowner (West Maui Resort Partners, L.P.) in order to conform with other documents obtained for the project, notably the Revocable Permit that was approved by the Board of Land and Natural Resources (Board) at its meeting on November 12, 2021, and

(2) To amend Conditions 1 and 2 of Emergency CDUP MA 21-6 to account for delays in the permitting process that occurred largely due to the delays in obtaining a Revocable Permit for the work.

Proposed Request – Amendments & Time Extension

The requests that were the subject of this letter did not contain any changes to the actual means and methods of the work authorized under Emergency CDUP MA 21-6; rather, the two amendments that were requested were to (1) change the name of the applicant to conform with other permits and documents, and (2) to extend the time period of authorization in Condition 2 of the original permit to reflect the delays in obtaining other necessary authorizations.

Request 1 – Applicant Name Change: The first requested amendment is to change the applicant name on Emergency CDUP MA 21-6 from the previous owner (Kā'anapali

Beach Vacation Resort) to the new landowner (West Maui Resort Partners, L.P.) in order to conform with other documents obtained for the project. **The Department has no objections to this request.**

Request 2 – Time Extension and Amendment of Conditions 1 and 2: The second request received by our office was to extend the authorization period as laid out in Conditions 1 and 2 of Emergency CDUP MA 21-6. Condition 1 states in part, "*The material is authorized as a temporary erosion control measure for three (3) years following the date of issuance of this letter.*" You are requesting a modification to this condition that would change its authorization period to "three (3) years following the completion of construction". Condition 2 states "*Unless otherwise authorized, any work or construction to be done on the land shall be completed within 180 days of the approval of such use.*" You are requesting a modification to this condition that would change Condition 2 to state that "any work or construction to be done on the land shall be completed within one year of the approval of such use."

Pursuant to the Hawaii Administrative Rules (HAR), §13-5-43, TIME EXTENSIONS (b), "time extension may be granted as determined by the Chairperson on all departmental permits and on the first request for extension of a board permit of up to two years to initiate or complete a project, based on supportive documentation from the applicant."

Our office acknowledges that the proposed project was unable to be initiated until the proper documents and authorization were received from other agencies, notably a Revocable Permit granted to perform the subject work. According to the information provided, the necessary approvals to obtain this Revocable Permit were given by the Board of Land and Natural Resources at its meeting on November 12, 2021. Sea Engineering, Inc., the consultant on this project, has submitted documentation that shows that they have made a good faith effort to comply with the deadlines contained in the permit, and **the Department has no objections to issuing a time extension. However, the time frames contained within Conditions 1 and 2 will remain the same and not be amended as requested, as the Revocable Permit has now been secured, and other required permits appear to be in place.** The time extension granted is that the starting dates of each condition will now begin on the date of this amended authorization.

The DLNR authorizes the amendments to the previously approved temporary emergency erosion control measure repairs as described within for three (3) years along the shoreline fronting the subject property while the applicant develops long-term options in an effort to protect public health, welfare, and safety on the subject property under Hawai'i Administrative Rules (HAR) §13-5-35, *Emergency Permits (a) "notwithstanding any provision of this chapter, the chairperson or deputy director of the department in the absence of the Chairperson may authorize through an emergency permit any land use deemed to be essential to alleviate any emergency that is a threat to public health, safety, and welfare, including natural resources, and for any land use that is imminently threatened by natural hazards. These actions shall be temporary in nature to the extent that the threat to public health, safety, and welfare, including natural resources, is alleviated (e.g., erosion control, rockfall mitigation). The*

emergency action shall include contingencies for removal methods, estimates for duration of the activity, and future response plans if required by the department."

The permit will thus be amended so that the name of the applicant reflects the current owner to conform with other authorizations. Additionally, the time extension request authorized under this letter now has new expiration dates for Conditions 1 and 2:

> Condition 1: The material is authorized for three (3) years following the date of issuance of this letter; the new expiration date of Condition 1 will expire on January 7, 2025; and
>
> Condition 2: Construction and work authorized under this letter shall be completed within 180 days of the approval of such use; the new deadline to complete construction for this project is now July 6, 2022.

Should you have any questions pertaining to this letter, please contact Salvatore Saluga of our office at salvatore.j.saluga@hawaii.gov.

Sincerely,

Suzanne D. Case

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

I concur with the conditions of this letter:

Signature of Applicant or Representative

Date: 1.13.22

MICHAEL ELLIOTT

Print Name & Title SVP DESIGN & CONSTRUCTION

CC: Sea Engineering, Inc.
c/o Andy Bohlander
MDLO
County of Maui, Planning Department

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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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

RE:OCCL:SS

Emergency CDUP MA 21-06

FEB - 3 2021

Diamond Resorts International
c/o Kā'anapali Beach Club
ATTN: Fred Mayo, General Manager
104 Kā'anapali Shores Place
Lāhainā, HI 96761

SUBJECT: Emergency Conservation District Use Permit Regarding a Request for Repairs to Emergency Temporary Erosion Control Seaward of the Kā'anapali Beach Club at 104 Kā'anapali Shores Place, Lāhainā, Maui; TMK (2) 4-4-001:098, and seaward

Dear Landowner:

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is in receipt of your request to repair and maintain the erosion protection skirt that currently sits in the shoreline area 'makai of the subject property in Lāhainā, Maui. According to the information provided to our office, the existing subject erosion protection skirt was authorized by OCCL on May 25, 2017 as Emergency CDUP MA 17-30, attached as ***Exhibit A***, but the erosion protection skirt was not placed until May of 2018. The approved structure in Emergency CDUP MA 17-30 consisted of geotextile fabric, sand-filled geotextile mattresses, and polypropelene sandbags along roughly 500 linear feet of shoreline fronting the subject property that had a total footprint of roughly 9,800 square feet.

Within a few months of its installation in 2018, the erosion protection skirt sustained damage due to heavy wave events. In the two years since its installation, this area has seen continued heavy wave events that has caused the damage to exacerbate even further. Your information packet sent to our office states that at the current time the damaged section of the erosion protection skirt is roughly 140 feet long (***Figures 1 & 2***, on next page).

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Exhibit A – OCCL's Emergency CDUP MA 21-6



Figure 1 – Damaged Skirt as of August 2020, Provided by Applicant



Figure 2 – Damaged Skirt as of August 2020, Provided by Applicant

The adjacent properties to both the north and south of the subject property are armored with revetments and/or seawalls.

The damage to the existing erosion protection skirt as shown above in ***Figures 1 & 2*** has prompted your client to request authorization to repair these damaged sections of the erosion control skirt while a long-term strategy to address the erosion problem at the subject property is formed. A long-term trend of beach erosion is accompanied by seasonal and episodic erosion from high waves events in this area of west Maui (***Figures 3 & 4***), prompting a need for action to address the erosion problem in the area.

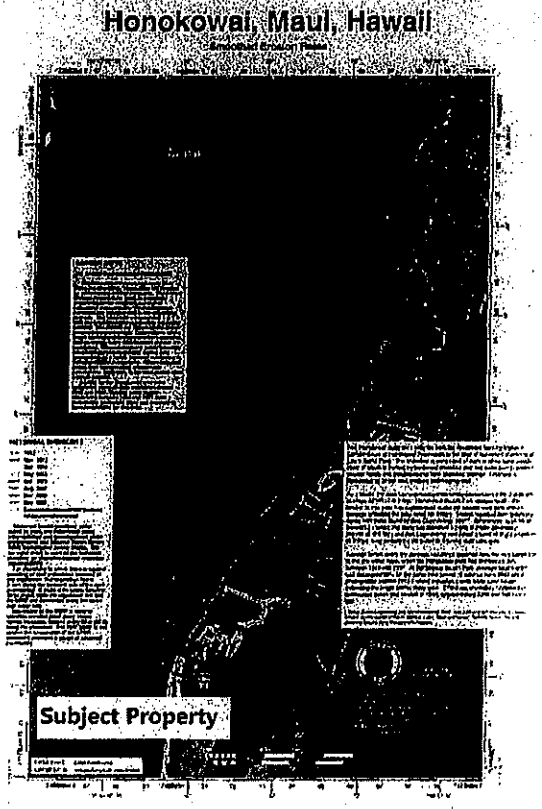


Figure 3 – Erosion Map for Subject Area, Showing Subject Property

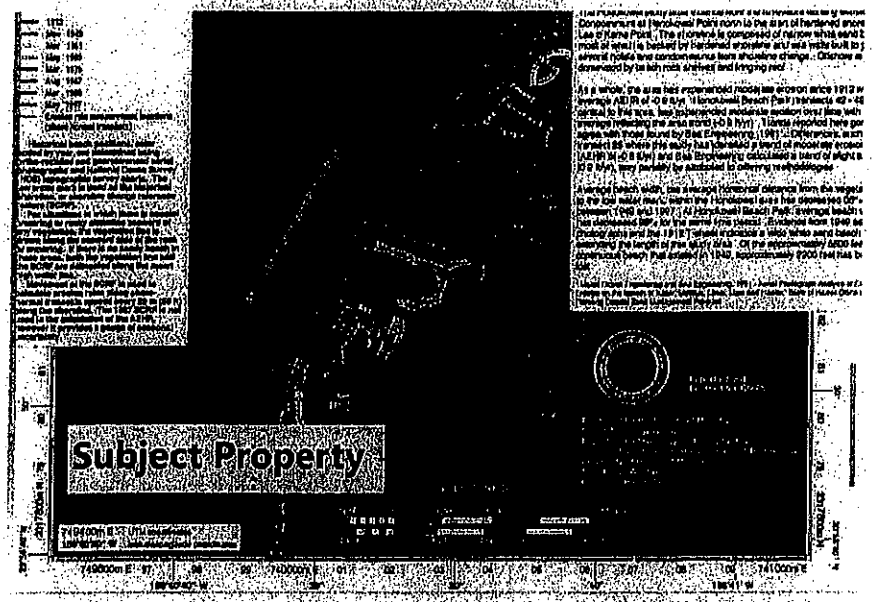


Figure 4 – Inset of Erosion Map for Subject Area, Showing Subject Property

The subject property is facing chronic erosion, as visible on ***Figures 3 and 4,*** with the information and graphs provided by the University of Hawai'i's Coastal Geology Group. According to this data, the shoreline in the subject area is moving inland at an annual rate of roughly one foot in some areas of the property. A screenshot of the Hawai'i Sea Level Rise Viewer, provided by the University of Hawai'i's Coastal Geology Group for the subject property as shown on the next page in ***Figure 5,*** reveal the serious threat that sea level rise and both chronic and episodic coastal erosion pose to the subject property and the surrounding area as a whole.

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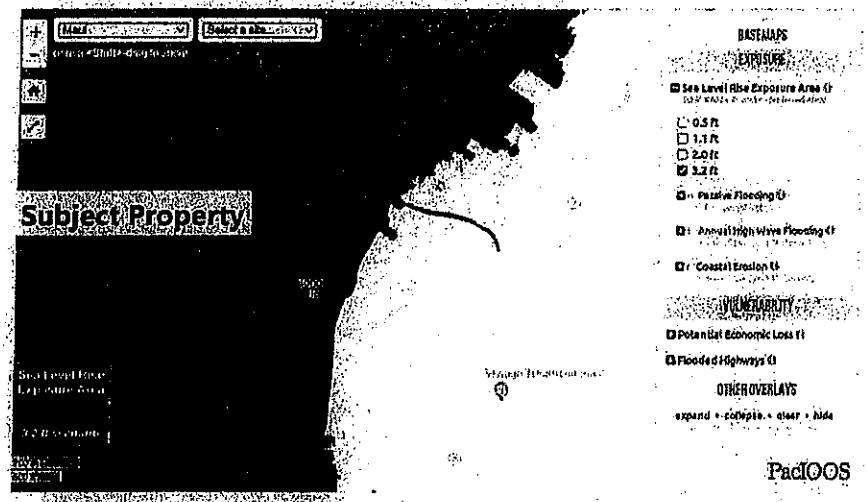


Figure 5 – Sea Level Rise Exposure Area Map for Subject Property

Based on Figures 3-5 above, the subject property is in serious danger of coastal erosion due to both accelerating sea level rise as well as seasonal high-energy wave events and will likely see significant adverse effects due to the combination of these occurrences in the future. In light of the subject property's significantly threatened status, actions will need to be taken in the near future to protect the structures on the property and to simultaneously ensure the protection of natural shoreline processes.

In the meantime, you are requesting authorization to repair a previously approved erosion protection skirt in the shoreline area fronting the subject property. The existing subject erosion protection skirt was authorized by OCCL on May 25, 2017 as Emergency CDUP MA 17-30, attached to this document as ***Exhibit A***, but this authorization expired on May 25, 2020. Therefore, our office is processing this request as a new Emergency Conservation District Use Application (CDUA).

<u>Proposed Action</u>

The proposed action that is the subject of this request would consist of repairing the damaged section of the existing erosion protection skirt, the length of which is stated to be approximately 140 linear feet, but may be up to as much as 300 feet. Your application notes that this would be a like-to-like replacement, with no expansion or additional improvements to the existing erosion protection skirt proposed, and that the means, methods, and materials would be similar to (with an exception as explained below) that used in the construction of the existing erosion control skirt in 2018. These same materials would include Tencate Mirafi geotextile fabric that would be filled with sand dredged from Lāhainā Harbor in 2017. This is the same sand used in the original construction.

Due to the severe damage sustained by the sand-filled mattresses that were placed for the original construction, these damaged mattresses would be replaced with geotextile sand containers. The information provided notes that this change is proposed because the geotextile containers can be stacked and oriented to withstand higher wave energy than the mattresses, which have sustained heavy damage since their installation. The application also notes that the geotextile sand containers can be constructed in a shorter time period and are less labor intensive than the mattresses in addition to having reduced impact to the beach and shoreline during construction.

The paved road and parking lot of the Kā'anapali Beach Club would be used as access as well as a staging area for the project. The information provided states that this staging area would be roughly 3,500 square feet and that Best Management Practices (BMPs) would be used to store and maintain all equipment within the staging area throughout the duration of the project. The application states that the project is expected to take roughly 25 days to complete depending on ocean conditions.

The damaged sand-filled mattresses would first be removed from the area and subsequently be replaced by geotextile sand containers constructed of Tencate Mirafi geotextile fabric, which is the same material that was used for the existing erosion control skirt. Approximately 432 cubic yards of sand would be used to fill these containers, and the sand used for this project would be the same sand used in the original construction in 2018 (dredged from Lāhainā Harbor in 2017). The information provided states that the sand-filled containers will be constructed and sewn within the staging area and then transported to the shoreline for placement via skid steer. Upon placement in the shoreline area, a 238 Komatsu excavator would be used to place the sand containers along the erosion scarp according to design specifications.

Upon installation of the sand-filled containers, an erosion control skirt – consisting of a single layer of Tencate Mirafi geotextile fabric, the same material as the existing skirt – would be draped over the mattresses. The top of the skirt would be anchored to the top of the erosion scarp while the bottom would be anchored within a shallow trench at the base of the sand-filled containers. Materials used to anchor the skirt at the base of the containers would consist of pre-sewn pockets filled with sandbags, while the skirt's anchoring to the top of the scarp would consist of platypus earth anchors connected to a 4-inch galvanized pipe that slides into a sleeve at the top of the structure, fastened using wire ropes and clamps. The application notes that the backshore anchoring would be buried at a shallow depth to avoid potential tripping hazards for the general public. Upon completion of these actions, all materials, work equipment, and BMPs that were installed for the project would be removed, and the area would be restored to its pre-project state.

Both seasonal and long-term conditions have resulted in erosion of the shoreline fronting the subject property that has prompted repeated requests to address the situation. After much consideration on the potential impacts of the proposed structure, as well as the feasibility of other designs to adequately protect the area from its high erosion rates, our office has decided to approve the proposed design for emergency temporary erosion control while a long-term solution to the chronic erosion problem at the subject property is formed.

However, this authorization is temporary. The Kā'anapali Beach Club must develop a longer-term plan to address the situation. This emergency authorization will include a condition that requires them to do this.

The DLNR authorizes the temporary emergency erosion control measures as described above for three (3) years along the shoreline fronting the subject property while the applicant develops long-term options in an effort to protect public health, welfare, and safety on the subject property under Hawai'i Administrative Rules (HAR) §13-5-35, *Emergency Permits (a) "notwithstanding any provision of this chapter, the chairperson or deputy director of the department in the absence of the Chairperson may authorize through an emergency permit any land use deemed to be essential to alleviate any emergency that is a threat to public health, safety, and welfare, including natural resources, and for any land use that is imminently threatened by natural hazards. These actions shall be temporary in nature to the extent that the threat to public health, safety, and welfare, including natural resources, is alleviated (e.g., erosion control, rockfall mitigation). The emergency action shall include contingencies for removal methods, estimates for duration of the activity, and future response plans if required by the department."*

In addition, the temporary structure may be considered an exempt action under State environmental laws under HAR §11-200.1-15(c), Exemption Class (4): *Minor alterations in the condition of land, water, or vegetation*, and DLNR Exemption List Class 4, Part 2 (1): *Upon determination by the Department Director that an emergency exists, emergency mitigation and restoration work to prevent further damage from occurring and to restore the topographical features and biological resources.* The Office of Conservation and Coastal Lands consulted with the Maui County Planning Office, who concurred with this exemption for the proposed project.

The erosion control measures are intended to provide temporary mitigation of the erosion problem and reduce hazards to the subject property while you pursue a long-term strategy. The DLNR requests that you remove and properly dispose of any debris encountered on the beach during the installation of the erosion control measures. Any materials that come loose from the temporary erosion control measures shall be repaired or discarded as soon as possible so they do not end up in the beach or marine environment. The beach-compatible sand used to fill the geotextile containers must be pre-approved by OCCL before use. Additionally, a land disposition is required from the Maui District Land Office.

Please review the following Terms and Conditions carefully and return a signed copy to the DLNR.

Terms and Conditions

The DLNR has no objections to the emergency temporary erosion control as described above fronting the subject property at 104 Kā'anapali Shores Place, Lāhainā, Maui, Tax Map Key (2) 4-4-001:098, provided that you adhere to the following terms and conditions:

1. It is understood that the emergency temporary shoreline protection is a temporary response to address chronic beach erosion that is persistent in the subject area until a long-term solution is formed. **The material is authorized as a temporary erosion control measure for three (3) years** from the date of issuance of this letter. Subsequent

erosion control efforts that call for modification, other than routine maintenance of the proposed structure, will require a new application. At the end of the authorization period, the materials shall be removed;

2. Unless otherwise authorized, any work or construction to be done on the land shall be completed within 180 days of the approval of such use. The permittee shall notify the department in writing at least 24 hours prior to initiating construction and when it is completed;

3. The permittee shall obtain a land disposition for the structure;

4. The permittee will submit a completion report for the project to the OCCL within ninety (90) days of completion of construction of the temporary structure. It will summarize the construction and detail any deviation from the proposed plans as well as provide a summary of the beach conditions since installation. The report will also include a photo summary of the temporary structure and beach conditions with documentation of any alterations or repairs;

5. The permittee shall obtain necessary county permits for proposed the use, as necessary;

6. 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 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;

7. 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;

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

9. Any materials that become liberated during construction activities must be immediately removed from the beach or ocean;

10. Work shall be conducted at low tide to the most practical extent possible and no work shall occur during high surf or ocean conditions that will create unsafe work or beach conditions;

11. 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. All barriers shall be removed once the project is complete to allow full public access laterally along the beach and alongshore walkway;

12. Obstruction of lateral shoreline access shall be avoided or minimized;

13. During construction, appropriate mitigation measures shall be implemented to minimize impacts to the aquatic environment, off-site roadways, utilities, and public facilities;

14. 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;

15. 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;

16. 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 HRS §205A-71. All exterior lighting shall be shielded to protect the night sky;

17. 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 Hawai'i and by Hawai'i statutory and case law;

18. 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 the State Historic Preservation Division (692-8015), which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary;

19. 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;

20. For all landscaped and vegetated 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 Hawai'i Revised Statutes (HRS) §205A-1;

21. 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;

22. The permittee shall comply with all applicable Department of Health Administrative Rules;

23. The permittee, their successors and assigns, shall indemnify and hold the State of Hawai'i 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;

24. The permittee understands and agrees that the permit does not convey any vested right(s) or exclusive privilege;

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

26. In issuing the permit, the Department and the Chairperson have relied on the information and data that the permittees have 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;

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

28. **A long-term plan to address erosion at the subject property must be submitted to the OCCL within one (1) year of the date of issuance of this emergency permit. The plan must include timeframes for implementation;**

29. Other terms and conditions as prescribed by the Chairperson; and

30. Failure to comply with any of these conditions shall render a permit void under the chapter, as determined by the Chairperson or BLNR.

Please review these Terms and Conditions carefully and return a signed copy to the DLNR. Should you have any questions pertaining to this letter, please contact Salvatore Saluga of our office at (808) 798-6147 or salvatore.j.saluga@hawaii.gov.

Sincerely,

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

I concur with the conditions of this letter:

Signature of Applicant or Representative *Date:* 1.13.22

MICHAEL ELLIOT.

Print Name & Title SVP DESIGN + CONSTRUCTION

CC: Sea Engineering, Inc.
c/o Andy Bohlander
MDLO
County of Maui, Planning Department

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
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

REF:OCCL:SS

Emerg. CDUP MA 21-6: Time Ext.

JAN 20 2022

West Maui Resort Partners, L.P.,
c/o Hilton Grand Vacations, Inc.
ATTN: Michael Elliot, SVP Design & Construction
5323 Millenia Lakes Blvd.
Orlando, FL 32839

SUBJECT: Clarification Letter Regarding Time Extension and Amendment of Emergency Conservation District Use Permit (CDUP) MA 21-6 for Repairs to Emergency Temporary Erosion Control Seaward of the Kāʻanapali Beach Club at 104 Kāʻanapali Shores Place, Lāhainā, Maui; TMK (2) 4-4-001:098, and seaward

Dear Landowner:

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is reaching out to you regarding the above referenced Time Extension and Amendment of Emergency Conservation District Use Permit MA 21-6 for repairs to emergency temporary erosion control fronting the subject property in Lāhainā, Maui.

Within the previous Time Extension and Amendment of Emergency Conservation District Use Permit MA 21-6 transmitted to you, dated January 7, 2021 and sent via hard copy on January 7, 2022 and email on January 11, 2022, there was a clerical error that resulted in the misdating of the document. The letter was inadvertently dated as last year's, and the proper date of the document should be January 7, 2022.

In light of this, the permit received by your office during the week of January 10, 2022 should be dated January 7, 2022, and thus the authorization period of the permit runs through **January 6, 2025**.

All terms, conditions, and language within the originally authorized Time Extension and Amendment of Emergency CDUP MA 21-6 remain valid and active. For clarification, the time extension request's new expiration dates for Conditions 1 and 2 are:

> Condition 1: The material is authorized for three (3) years following the date of issuance of this letter; the new expiration date of Condition 1 will expire on January 6, 2025; and

Condition 2: Construction and work authorized under this letter shall be completed within 180 days of the approval of such use; the new deadline to complete construction for this project is now July 6, 2022.

Should you have any questions pertaining to this letter, please contact Salvatore Saluga of our office at salvatore.j.saluga@hawaii.gov.

Sincerely,

Suzanne D. Case

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

I concur with the conditions of this letter:

Signature of Applicant or Representative

Date: 2.2.22

MICHAEL ELLIOTT, SVP DESIGN & CONSTRUCTION

Print Name & Title

CC: Sea Engineering, Inc.
c/o Andy Bohlander
MDLO
County of Maui, Planning Department

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

REVOCABLE PERMIT NO. S-7943

KNOW ALL MEN BY THESE PRESENTS:

This Agreement (hereinafter referred to as the "Permit") is executed this 11th day of MARCH, 20 22, by and between the STATE OF HAWAII, hereinafter referred to as the "State," by its Board of Land and Natural Resources, hereinafter called the "Board," and WEST MAUI RESORT PARTNERS, L.P., a Delaware limited partnership, hereinafter called the "Permittee," whose mailing address is 104 Kaanapali Shores Place, Lahaina, Hawaii 96761, and whose billing address is West Maui Resort Partners c/o Hilton Grand Vacations, Attn: Michael Elliott, SVP Design & Construction, 5323 Millenia Lakes Blvd, Orlando, FL 32839. The parties agree that commencing on the 11th day of MARCH, 20 22, ("commencement date"), Permittee is permitted to enter and occupy, on a month-to-month basis only, pursuant to section 171-55, Hawaii Revised Statutes, that certain parcel of public land (and any improvements located thereupon) situate at Honokowai, Lahaina, Maui, Hawaii, tax map key no. (2) 4-4-001:seaward of 098, as indicated on the maps attached hereto, if any, and made a part hereof, containing an approximate area of 9,800 square feet, more or less, which parcel is hereinafter referred to as the "Premises."

THIS PERMIT IS GRANTED UNDER THE FOLLOWING CONDITIONS:

A. The Permittee shall:

1. Occupy and use the Premises for the following specified purposes only:

   For purposes of entering submerged lands to repair an existing temporary erosion control structure. The temporary erosion control structure is located on State submerged land and occupies an area of 9,800 square feet, more or less. See Exhibit A.

2. Pay, at the Department of Land and Natural Resources Fiscal Office, P.O. Box 621, Honolulu, Hawai'i 96809, monthly rent in the sum of ONE THOUSAND NINE HUNDRED SIX AND NO/100 DOLLARS ($1,906.00) payable in advance by the first of each and every month.

   The interest rate on any unpaid or delinquent rentals shall be at one per cent (1%) per month.

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If monthly rent is not received at the above address on or before the first day of the month for which it is due, then a service charge of FIFTY AND NO/100 DOLLARS ($50.00) a month for each delinquent payment shall be assessed and payable. The service charge is in addition to interest on unpaid or delinquent rentals. Interest shall not accrue on the service charge.

Payment of such service charge shall not excuse or cure any default by Permittee under this Permit.

3. Upon execution of this Permit, deposit with the Board an amount equal to two times the monthly rental stated above in paragraph 2, as security for the faithful performance of all of these terms and conditions. The deposit will be returned to the Permittee upon termination or revocation of this Permit, if and only if all of the terms and conditions of this Permit have been observed and performed to the satisfaction of an authorized representative of the Department of Land and Natural Resources ("DLNR"). Otherwise, the deposit may, at the option of an authorized representative of the DLNR be applied toward payment of any amounts owed hereunder, without waiving any of the Board's other rights hereunder.

4. At the Permittee's own cost and expense, keep any government-owned improvements located on the Premises insured against loss by fire and other hazards, casualties, and contingencies, for the full insurable value of those improvements. The policies shall name the State of Hawaii as an additional insured and loss payee and shall be filed with the DLNR. In the event of loss, damage, or destruction of those improvements, the DLNR shall retain from the proceeds of the policies those amounts it deems necessary to cover the loss, damage, or destruction of the government-owned improvements and the balance of those proceeds, if any, shall be delivered to the Permittee.

5. Give the Board twenty-five (25) calendar days notice, in writing, before vacating the Premises.

6. Pay all real property taxes assessed against the Premises from the commencement date of this Permit.

7. At its own cost and expense, observe, perform and comply with all laws, ordinances, rules and regulations of all governmental authorities now or at any future time during the term of this Permit applicable to the Premises, including, without limiting the generality of the foregoing, the Americans with Disabilities Act of 1990 and all regulations promulgated with respect thereto, as well as any other laws, ordinances, rules and regulations imposing any requirements that the Premises be made accessible to

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persons with disabilities; and, release and indemnify the State of Hawaii against all actions, suits, damages and claims by whomsoever brought or made by reason of the nonobservance or nonperformance of any of said laws, ordinances, rules and regulations or of this covenant.

8. Repair and maintain all buildings or other improvements now or hereafter on the Premises.

9. Obtain the prior written consent of the Board before making any major improvements.

10. Keep the Premises and improvements in a clean, sanitary, and orderly condition.

11. Pay all charges, assessments, or payments for water, other utilities, and the collection of garbage as may be levied, charged, or be payable with respect to the Premises.

12. Not make, permit, or suffer, any waste, strip, spoil, nuisance or unlawful, improper, or offensive use of the Premises.

13. At all times with respect to the Premises, use due care for public safety.

14. Procure and maintain, at its own cost and expense, in full force and effect throughout the term of this Permit, general liability insurance, or its equivalent, with an insurance company or companies licensed or authorized to do business in the State of Hawaii with an AM Best rating of not less than "A- VIII" or other comparable and equivalent industry rating, in an amount of at least $1,000,000.00 for each occurrence and $2,000,000.00 aggregate, and with coverage terms acceptable to the Chairperson of the Board. The policy or policies of insurance shall name the State of Hawaii as an additional insured and a copy of the policy or other documentation required by the State shall be filed with the DLNR. The insurance shall cover the entire Premises, including all buildings, improvements, and grounds and all roadways or sidewalks on or adjacent to the Premises in the use or control of the Permittee.

    Prior to entry and use of the Premises or within fifteen (15) days after the commencement date of this Permit, whichever is sooner, furnish the State with a policy(s) or other documentation required by the State showing the policy(s) to be initially in force, keep the policy(s) or other documentation required by the State on deposit during the entire Permit term, and furnish a like policy(s) or other documentation required by the State upon each renewal of the policy(s). This insurance shall not be cancelled, limited in scope of coverage, or nonrenewed until after thirty (30) days written notice has been given to the State. The State may at any time require the

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Permittee to provide the State with copies of the insurance policy(s) that are or were in effect during the permit period.

The State shall retain the right at any time to review the coverage, form, and amount of the insurance required by this Permit. If, in the opinion of the State, the insurance provisions in this Permit do not provide adequate protection for the State, the State may require Permittee to obtain insurance sufficient in coverage, form, and amount to provide adequate protection. The State's requirements shall be reasonable but shall be designed to assure protection for and against the kind and extent of the risks which exist at the time a change in insurance is required. The State shall notify Permittee in writing of changes in the insurance requirements and Permittee shall deposit copies of acceptable insurance policy(s) or other documentation required by the State thereof, with the State incorporating the changes within thirty (30) days after receipt of the notice.

The procuring of the required policy(s) of insurance shall not be construed to limit Permittee's liability under this Permit nor to release or relieve the Permittee of the indemnification provisions and requirements of this Permit. Notwithstanding the policy(s) of insurance, Permittee shall be obligated for the full and total amount of any damage, injury, or loss caused by Permittee's or the Permittee's employees, agents, officers, or invitees' negligence or neglect connected with this Permit. It is agreed that any insurance maintained by the State will apply in excess of, and not contribute with, insurance provided by Permittee's policy.

The insurance policy(s) or other documentation required by the State shall be mailed to:

State of Hawaii
Department of Land and Natural Resources
Land Division
Box 621
Honolulu, Hawaii 96809

15. In case the State shall, without any fault on its part, be made a party to any litigation commenced by or against the Permittee (other than condemnation proceedings), the Permittee shall pay all costs, including reasonable attorney's fees, and expenses incurred by or imposed on the State.

16. The Permittee shall pay all costs, including reasonable attorney's fees, and expenses which may be incurred by or paid by the State in enforcing the covenants and agreements of this Permit, in recovering possession of the Premises, or in the collection of delinquent rental, taxes, and any and all other charges.

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B. Additional Conditions:

1. This Permit is issued and effective on a month-to-month basis. The Permit shall automatically terminate one year from the commencement date, unless earlier revoked as provided below, provided further that the Board may allow the Permit to continue on a month-to-month basis for additional one year periods. Any such extension shall have the same terms and conditions as this Permit, except for the commencement date and any amendments to the terms, as reflected in the Board minutes of the meeting at which the Board acts. Permittee agrees to be bound by the terms and conditions of this Permit and any amendments to this Permit so long as Permittee continues to hold a permit for the Premises or continues to occupy or use the Premises.

2. The Board may revoke this Permit for any reason whatsoever, upon written notice to the Permittee at least thirty (30) calendar days prior to the revocation; provided, however, that in the event payment of rental is delinquent for a period of ten (10) calendar days or more, this Permit may be revoked upon written notice to the Permittee at least five (5) calendar days prior to the revocation.

3. If the Permittee fails to vacate the Premises upon expiration, revocation or termination of the Permit, the Permittee shall be liable for and shall pay the previously applicable monthly rent, computed and prorated on a daily basis, for each day the Permittee remains in possession.

4. If the Permittee fails to vacate the Premises upon expiration, revocation or termination of the Permit, the Board, by its agents, or representatives, may enter upon the Premises, without notice, and at Permittee's cost and expense remove and dispose of all vehicles, equipment, materials, or any personal property remaining on the Premises, and the Permittee agrees to pay for all costs and expenses of removal, disposition, or storage.

5. The Board may at any time increase or decrease the monthly rental by written notice at least thirty (30) business days prior to the date of change of rent. Upon such notice, the Permittee shall deposit with the Board any additional monies required to maintain an amount equal to two times the new monthly rental as security for the faithful performance of all of these terms and conditions.

6. Any major improvements, including but not limited to buildings and fences, erected on or moved onto the Premises by the Permittee shall remain the property of the Permittee and the Permittee shall have the right, prior to the expiration, termination or revocation of this Permit, or within an additional period the Board in its discretion may allow, to remove the improvements from the Premises; provided, however, that in the event the

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Permittee shall fail to remove the improvements prior to the expiration, termination or revocation of this Permit or within an additional period the Board in its discretion may allow, the Board may, in its sole discretion, elect to retain the improvements or may remove the same and charge the cost of removal and storage, if any, to the Permittee.

7. The Board reserves the right for its agents or representatives to enter or cross any portion of the Premises at any time.

8. This Permit or any rights hereunder shall not be sold, assigned, conveyed, leased, mortgaged, or otherwise transferred or disposed of.

9. Permittee has inspected the Premises and knows the conditions thereof and fully assumes all risks incident to its use.

10. The acceptance of rent by the Board shall not be deemed a waiver of any breach by the Permittee of any term, covenant, or condition of this Permit nor of the Board's right to declare and enforce a forfeiture for any breach, and the failure of the Board to insist upon strict performance of any term, covenant, or condition, or to exercise any option herein conferred, in any one or more instances, shall not be construed as a waiver or relinquishment of any term, covenant, condition, or option of this Permit.

11. The use and enjoyment of the Premises shall not be in support of any policy which discriminates upon any basis or in any manner that is prohibited by any applicable federal, state, or county law.

12. Permittee shall not cause or permit the escape, disposal, or release of any hazardous materials except as permitted by law. Permittee shall not allow the storage or use of such materials in any manner not sanctioned by law or by the highest standards prevailing in the industry for the storage and use of such materials, nor allow to be brought onto the Premises any such materials except to use in the ordinary course of Permittee's business, and then only after written notice is given to the Board of the identity of such materials and upon the Board's consent, which consent may be withheld at the Board's sole and absolute discretion. If any lender or governmental agency shall ever require testing to ascertain whether or not there has been any release of hazardous materials by Permittee, then the Permittee shall be responsible for the costs thereof. In addition, Permittee shall execute affidavits, representations and the like from time to time at the Board's request concerning the Permittee's best knowledge and belief regarding the presence of hazardous materials on the Premises placed or released by Permittee.

Permittee agrees to release, indemnify, defend, and hold the State of Hawaii, the Board, and their officers, employees, and agents harmless

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from and against all liability, loss, damage, cost, and expense, including all attorneys' fees, and all claims, suits, and demands therefor, arising out of or resulting from the use or release of hazardous materials on the Premises occurring while Permittee is in possession, or elsewhere if caused by Permittee or persons acting under Permittee. These covenants shall survive the expiration, revocation, or termination of the Permit.

For the purpose of this Permit "hazardous material" shall mean any pollutant, toxic substance, hazardous waste, hazardous material, hazardous substance, or oil as defined in or pursuant to the Resource Conservation and Recovery Act, as amended, the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, the Federal Clean Water Act, or any other federal, state, or local environmental law, regulation, ordinance, rule, or bylaw, whether existing as of the date hereof, previously enforced, or subsequently enacted.

13. Prior to expiration, termination or revocation of the subject Permit, Permittee shall conduct a Phase I environmental site assessment and conduct a complete abatement and disposal, if necessary, satisfactory to the standards required by the Federal Environmental Protection Agency, the Department of Health, and the DLNR. Failure to comply with the provisions of this paragraph shall not extend the term of this Permit or automatically prevent expiration, termination or revocation of the Permit. The Board, at its sole option, may refuse to approve termination or revocation unless this evaluation and abatement provision has been performed. In addition or in the alternative, the Board may, at its sole option if Permittee does not do so, arrange for performance of the provisions of this paragraph, all costs and expenses of such performance to be charged to and paid by Permittee.

14. Permittee shall release, indemnify, defend, and hold harmless the State of Hawaii, its officers, agents, and employees from and against all liability, loss, damage, cost, and expense, including all attorneys' fees, and all claims, suits, and demands therefor, arising out of or resulting from the acts or omissions of the Permittee or the Permittee's employees, agents, officers, or invitees under this Permit. The provisions of this paragraph shall remain in full force and effect notwithstanding the revocation, expiration, or termination of this Permit. The purchase of liability insurance shall not relieve Permittee of the obligations described herein.

15. Unless otherwise agreed by the Board in its sole discretion, payments received will be applied first to attorneys' fees, costs, assessments, real property taxes, or other costs incurred or paid by the Board with respect to the Premises, next to service charges or interest, next to any other charges due or owing under the Permit, next to delinquent monthly rent, and next to current rent.

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16. Any notice required or permitted to be given hereunder shall be in writing, given by personal delivery or by first class mail, postage prepaid. Notice to Permittee shall be delivered or addressed to the address stated above.

Notice to State of Hawai'i shall be delivered or addressed to the Chairperson of the Board at 1151 Punchbowl Street, Room 130, Honolulu, Hawai'i 96813. Mailed notices shall be deemed given upon actual receipt, or two business days following deposit in the mail, postage prepaid, whichever occurs first. Either party may by written notice to the other specify a different address for notice purposes, provided that Permittee's mailing address shall at all times be the same for both billing and notice. In the event there are multiple Permittees hereunder, notice to one Permittee shall be deemed notice to all Permittees.

17.. The Permittee shall adhere to the terms and conditions set forth in the State of Hawaii, Department of Land and Natural Resources, Office of Conservation and Coastal Lands Emergency CDUP MA 21-06 dated February 3, 2021, as extended by that certain Time Extension and Amendment of Emergency Conservation District Use Permit MA 21-6.

18. The Permittee shall post a removal bond in the amount of FOUR HUNDRED THIRTY SIX THOUSAND EIGHT HUNDRED TEN AND NO/100 DOLLARS ($436,810.00) to cover the cost of the removal of the erosion protection structure located on State submerged lands in the event Permittee does not remove it by January 6, 2025.

19. The Permittee shall obtain any required County of Maui permits for the repair work prior to commencing work.

20. Unless the text indicates otherwise, the use of any gender shall include all genders and, if the Permittee includes more than one person, the singular shall signify the plural and this Permit shall bind the persons, and each of them jointly and severally.

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Department of the
Attorney General

IN WITNESS WHEREOF, the STATE OF HAWAII, by its Board of Land and Natural Resources, has caused the seal of the Department of Land and Natural Resources to be hereunto affixed and the parties hereto have caused these presents to be executed the day, month and year first above written.

STATE OF HAWAII

Approved by the Board of Land and Natural Resources at its meetings held on October 8, 2021 and November 12, 2021.

By _____
SUZANNE D. CASE
Chairperson of the Board of Land and Natural Resources

APPROVED AS TO FORM:

STATE

_____
COLIN J. LAU
Deputy Attorney General

Dated: 2/22/22

WEST MAUI RESORT PARTNERS, L.P., a Delaware limited partnership

By _____
MICHAEL ELLIOT
Its SR. VICE PRESIDENT

By _____
_____
Its _____

PERMITTEE

PRELIM. APPR'D.
Department of the Attorney General

STATE OF Hawaii)
City &) SS.
COUNTY OF Honolulu)

On this 23rd day of February, 2022, before me personally appeared Michael Elliott, to me personally known, who, being by me duly sworn or affirmed, did say that such person executed the foregoing instrument as the free act and deed of such person, and if applicable in the capacity shown, having been duly authorized to execute such instrument in such capacity.

EUGENIO S. DOYLE NOTARY PUBLIC No. 06-425 STATE OF HAWAII

Notary Public, State of Hawaii.

Eugenio S. Doyle

My commission expires: July 16, 2022

Doc. Date: 2/23/22 # Pages: 13

EUGENIO S. DOYLE, First Circuit

Doc Description: Revocable Permit

2/23/22

NOTARY SIGNATURE

NOTARY CERTIFICATION

EUGENIO S. DOYLE NOTARY PUBLIC No. 06-425 STATE OF HAWAII

PRELIM. APPR'D. Department of the Attorney General

STATE OF)
) SS.
COUNTY OF)

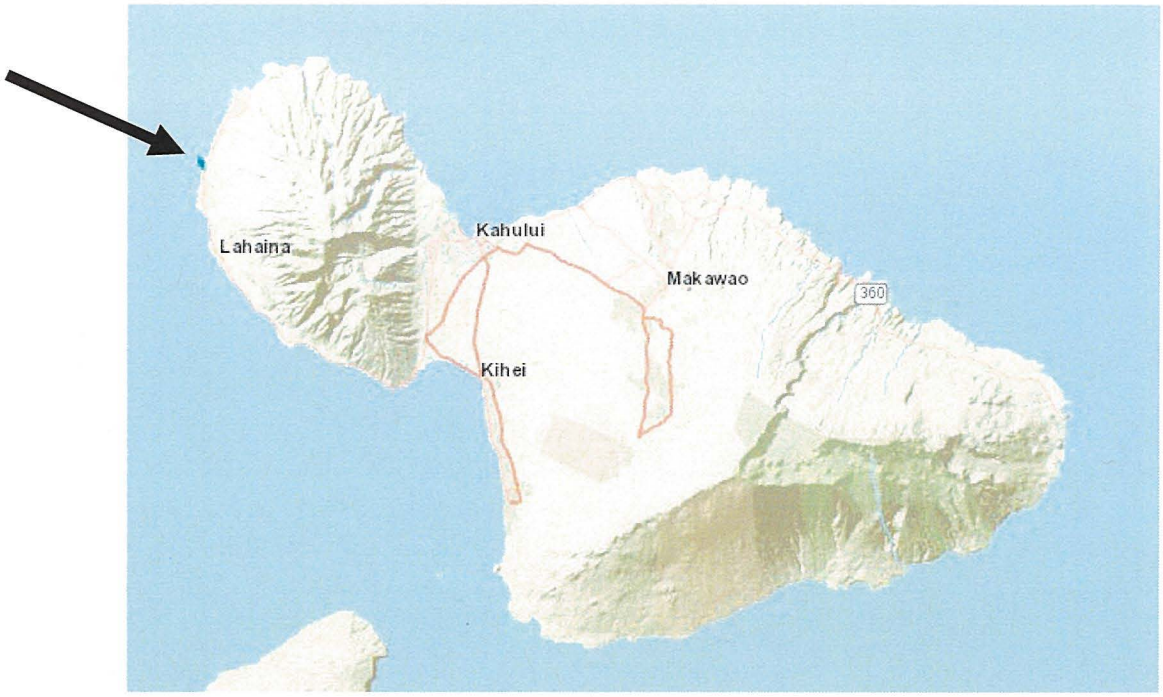
On this _____ day of _____, 20___, before me personally appeared _____, to me personally known, who, being by me duly sworn or affirmed, did say that such person executed the foregoing instrument as the free act and deed of such person, and if applicable in the capacity shown, having been duly authorized to execute such instrument in such capacity.

_____
Notary Public, State of

_____

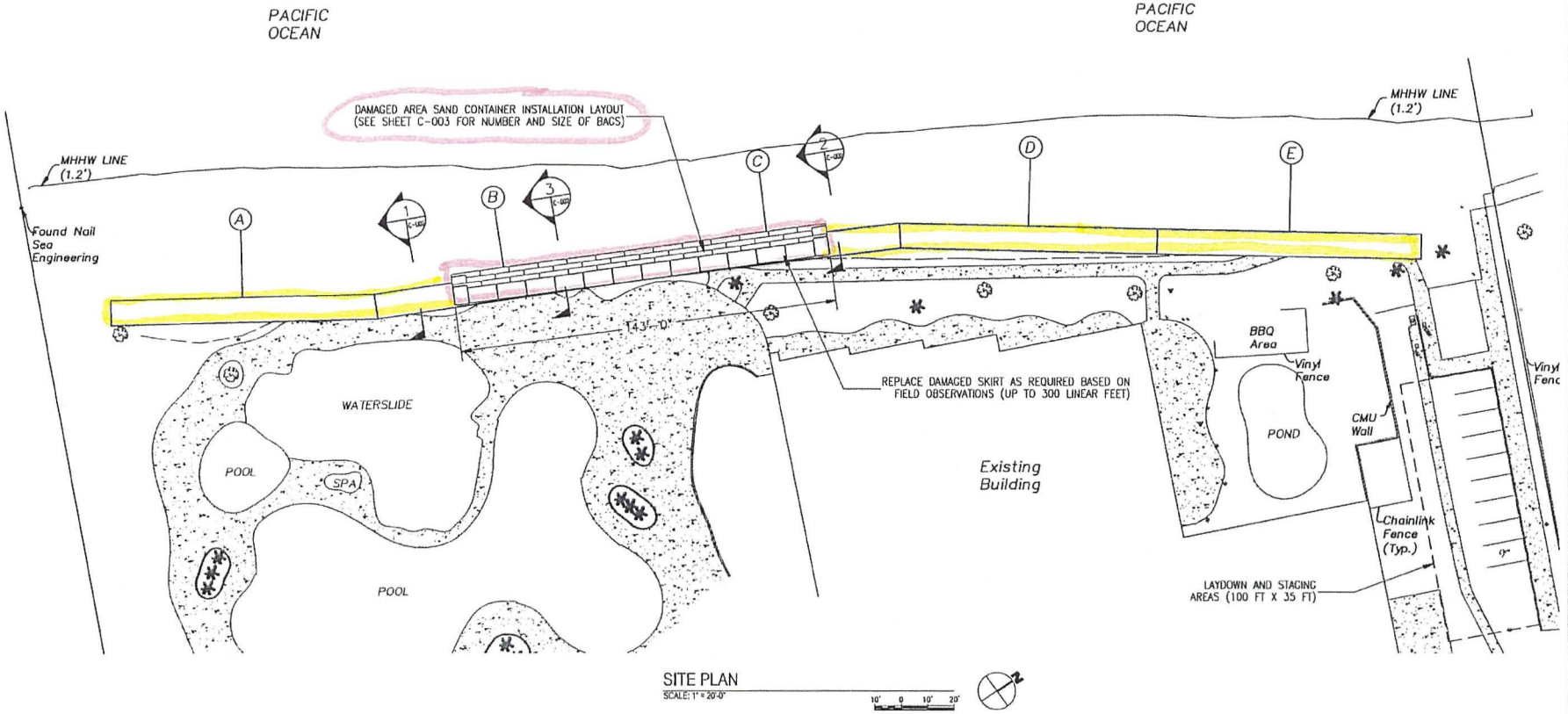
My commission expires:_____

PRELIM. APPR'D.
Department of the
Attorney General





PRELIM. APPR'D.
Department of the
Attorney General



SITE PLAN
SCALE: 1" = 20'-0"

10' 0 10' 20'

PRELIM. APPR'D. Department of the Attorney General

60% DESIGN DRAWINGS NOT FOR CONSTRUCTION

Sea Engineering, Inc.
MAKAI RESEARCH PIER
41-305 KALANIANAOLE HWY
WAIMANALO, HI 96795
808.259.7966
WWW.SEAENGINEERING.COM

REVISION	DATE

KAANAPALI BEACH CLUB
EMERGENCY EROSION CONTROL
HONOKOWAI, MAUI, HI

PROJECT NUMBER	25787
CLIENT	KBC
PROJECT ENGINEER	DS
DRAWN BY	GT
CHECKED BY	DS
SCALE	NTS
SHEET SIZE	ANSI D (22"X34")
DATE	SEPTEMBER 15, 2020

SITE PLAN

DRAWING NO.	SHEET NO.
C-001	3 of 5

EXHIBIT A -- page 2 of 2

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
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

November 30, 2022

County of Maui

WEST MAUI RESPRT PARTNERS, L.P.
C/O HILTON GRAND VACATIONS
ATTN: MICHAEL ELLIOT
SVP DESIGN & CONSTRUCTION
5323 MILLENIA LAKES BLVD.
ORLANDO, FL, 32839

Dear Permittee:

Subject: Revocable Permit No. 7943

Please disregard our previous Revocable Permit letter dated October 5, 2022.

The Board of Land and Natural Resources ("Board") at its meeting on September 23, 2022, under agenda item D-4 (Amended), approved the continuation of your Revocable Permit ("RP") on a month-to-month basis for an additional year up to December 31, 2023 effective January 1, 2023. Accordingly, your rent will be $1963.18 per month. The Board additionally reserved the right at any time to review and establish new rental charges for any RP to reflect market conditions or the fair rental for the rights and privileges granted by such RP. Therefore, during the additional year up to December 31, 2023, please understand that your RP rent is subject to further review.

Please be advised that pursuant to the terms and conditions of your RP, you are responsible for providing a security deposit in the sum of $3926.36, which is equivalent to two months' rent. You currently have $3812.00 deposited with us. Therefore, if you agree to the new rent, our Fiscal Office will bill you the balance of $114.36. If we do not hear from you by December 28, 2022, we will assume that you have accepted the new rent and will instruct our Fiscal Office as such. If you do not agree with the new rent, please notify us in writing of your intent to terminate the RP and vacate the premises by December 31, 2022.

Please contact your District Land Office at (808) 984-8103 if you have any questions.

Sincerely,

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

DAWN N. S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA 'OIHANA KUMUWAIWAI 'ĀINA
LAND DIVISION

P.O. BOX 621
HONOLULU, HAWAII 96809

October 20, 2023

County of Maui

WEST MAUI RESORT PARTNERS
C/O GERI KEAHI
104 KAANAPALI SHORES PLACE
LAHAINA, HI 96761

Dear Permittee:

Subject: Revocable Permit No. S-7943

The Board of Land and Natural Resources ("Board") at its meeting on October 13, 2023, under agenda item D-5, approved the continuation of your Revocable Permit ("RP") on a month-to-month basis for an additional year up to December 31, 2024 effective January 1, 2024. Accordingly, beginning January 1, 2024 your rent will be $2,022.08 per month. The Board additionally reserved the right at any time to review and establish new rental charges for any RP to reflect market conditions or the fair rental for the rights and privileges granted by such RP. Therefore, during the additional year up to December 31, 2024, please understand that your RP rent is subject to further review.

If we do not hear from you by November 20, 2023, we will assume that you have accepted the new rent and will instruct our Fiscal Office to bill you accordingly and collect any additional security deposit due. If you do not agree with the new rent, please notify us in writing of your intent to terminate the RP and vacate the premises by December 31, 2023.

Please contact your District Land Office at (808) 984-8103 if you have any questions.

Sincerely,

Russell Y. Tsuji
ADMINISTRATOR

cc: Central Files

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

DAWN N. S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA 'OIHANA KUMUWAIWAI 'ĀINA
LAND DIVISION

P.O. BOX 621
HONOLULU, HAWAII 96809

October 24, 2024

Maui

WEST MAUI RESORT PARTNERS
C/O GERI KEAHI
104 KAANAPALI SHORES PLACE
LAHAINA, HI 96761

Dear Permittee:

Subject: Revocable Permit No. S-7943

The Board of Land and Natural Resources ("Board") at its meeting on September 27, 2024, as amended, under agenda item D-11, approved the continuation of your Revocable Permit ("RP") on a month-to-month basis for an additional year up to December 31, 2025 effective January 1, 2025. Accordingly, beginning January 1, 2025 your rent will be $2,082.74 per month. Please note, however, that the Board retains authority to adjust your rent in accordance with the terms and conditions of the RP and additionally reserved to the Chairperson the authority to correct typographical or mathematical errors in the monthly rent of no more than $75.00. Therefore, during the additional year up to December 31, 2025, please understand that your RP rent is subject to further review.

Additionally, the Board directed that any permits that are in arrears of rental payment for 60 days or more, or delinquent in the payment of real property taxes, or have been approved for forfeiture by a separate Board action shall not be renewed. Please be sure your rent and real property taxes remain current.

If we do not hear from you within 30 days of this letter, we will assume that you have accepted the new rent and will instruct our Fiscal Office to bill you accordingly and collect any additional security deposit due. If you do not agree with the new rent, please notify us in writing of your intent to terminate the RP and vacate the premises by December 31, 2024.

Please contact your District Land Office at (808) 984-8103 if you have any questions.

Sincerely,

Russell Y. Tsuji
ADMINISTRATOR

cc: Central Files

Geraldine Keahi

From: Iwamasa, Wendee <wendee.m.iwamasa@hawaii.gov>
Sent: Tuesday, October 29, 2024 1:07 PM
To: Geraldine Keahi
Subject: [EXTERNAL] RE: RP # S-7943

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Geri,

Good afternoon!

So as of today 10/28/24, as we spoke on the phone, the Account RP S-7943 for West Maui Resort Partners,
11/1/24 balance in the account has a credit of $3,985.26.
The letter that you just received from our Fiscal Office doesn't show any increase in your rent, then $2,022.08/month is what you owe.
You've mentioned that you wanted to pay for the whole year of 2025.
So, take $2,022.08 x 12= 24,264.96 is what you will pay.

Hope this helps you.

Thank you,
Wendee

From: Geraldine Keahi <Geri.Keahi@hgv.com>
Sent: Tuesday, October 29, 2024 9:47 AM
To: Butihi, Ebony V <ebony.v.butihi@hawaii.gov>
Cc: Iwamasa, Wendee <wendee.m.iwamasa@hawaii.gov>
Subject: [EXTERNAL] RP # S-7943
Importance: High

Aloha Ebony or Wendee

I am getting ready to start processing payment for our Revocable Permit for West Maui Resort Partners (Kaanapali Beach Club)
I need to get information, so if someone can call me, I'd appreciate it very much.

Geri Keahi-808-667-1324.

Much MAhalo 😊

AUG - 2 2021

MICHAEL P. VICTORINO
Mayor

MICHELE CHOUTEAU MCLEAN, AICP
Director

JORDAN E. HART
Deputy Director



DEPARTMENT OF PLANNING
COUNTY OF MAUI
ONE MAIN PLAZA
2200 MAIN STREET, SUITE 315
WAILUKU, MAUI, HAWAII 96793

July 2, 2021

Mr. Bryan Esmeralda
Munekiyo Hiraga
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Esmeralda:

SUBJECT: SPECIAL MANAGEMENT AREA (SMA) EMERGENCY PERMIT APPROVAL AND SHORELINE SETBACK APPROVAL (SSA) FOR REPAIR OF AN AUTHORIZED TEMPORARY EROSION CONTROL STRUCTURE IN A LIKE-FOR-LIKE MANNER AT THE SHORELINE LOCATED AT THE KAANAPALI BEACH VACATION RESORT (AKA KAANAPALI BEACH CLUB), 104 KAANAPALI SHORES PLACE, LAHAINA, ISLAND OF MAUI, HAWAII; TMK: (2) 4-4-001:098 (SM3 2020/0014) (SSA 2020/0062) (EAE 2021/0003)

This letter supersedes the approval issued by the County of Maui Department of Planning (Department) on January 21, 2021 and is based on your revised Application dated April 29, 2021, which supersedes your original submissions on November 10, 2020.

The Department has reviewed your revised application for a SMA Emergency Permit and Shoreline Setback Approval to complete emergency repairs to a failed section of a temporary protective erosion control structure at the shoreline. The consolidated Application is deemed complete, and constitutes an emergency with imminent and substantial harm to the health, safety, or welfare of the general public.

In consideration of the foregoing, you are hereby granted a Special Management Area Emergency Permit (SM3 2020/0014) subject to the following conditions:

1. That the Applicant shall develop the project in substantial compliance with representations made to the Department during this Application process, including supplemental studies and approvals and schedule described within the April 29, 2021 Application submittal.

2. That full compliance with all other governmental requirements shall be rendered.

3. That the repairs shall be limited to the damaged sections of the temporary bank stabilization structure, as determined by the contractor, and shall be according to plans titled, "Kahana Beach Club Emergency Erosion Control," prepared by Sea Engineering, dated September 15, 2020, with 5 sheets labeled T-001, G-001 (General Notes and Geotextile Container Placement), C-001, C-002 and C-003.

4. That since conditions at the shoreline may change due to winter storm events, any changes to the plans deemed necessary by the contractor may be communicated to the Department in advance for approval of a modified Scope of Work.

5. That parking for the public continue to be provided in order to access the shoreline.

6. That any time-extension requests will be based on conditions at the site and efforts and progress on representations made by the Applicant in the April 29, 2021 Application submittal.

7. That the scope of work shall comply with all stated and agreed-to conditions as authorized by the Hawaii Department of Land and Natural Resources – Offices of Conservation and Coastal Lands (DLNR-OCCL) permit CDUP MA 21-06 and any extension thereto.

Furthermore, in accordance with the *Shoreline Rules for the Maui Planning Commission* (Shoreline Rules) you are hereby granted a Shoreline Setback Approval (SSA 2020/0062) subject to the following conditions:

1. That the Applicant shall develop the project in substantial compliance with representations made to the Department during this Application process, including supplemental studies and approvals and schedule described within the April 29, 2021 Application submittal.

2. That full compliance with all other governmental requirements shall be rendered.

3. That the repairs shall be limited to the damaged sections of the temporary bank stabilization structure, as determined by the contractor, and shall be according to plans titled, "Kahana Beach Club Emergency Erosion Control," prepared by Sea Engineering, dated September 15, 2020, with 5 sheets labeled T-001, G-001 (General Notes and Geotextile Container Placement), C-001, C-002 and C-003 as submitted by the Applicant. Any non-substantial variations to these plans deemed necessary by the contractor due to shoreline conditions observed or further observed deterioration of the existing protective structure may be undertaken as part of this emergency permit. The Department requires advanced notice via email to any changes in the submitted and referenced Scope of Work, which must be approved prior to the work being performed.

4. That the temporary bank stabilization structure shall be repaired in compliance with existing conditions required by the DLNR-OCCL permit CDUP MA 21-06 and any extension thereto.

5. That repairs of the temporary bank stabilization structure shall be initiated by October 30, 2021, and shall be completed within four months of said initiation.

6. That Best Management Practices shall be implemented to ensure water quality and marine resources are protected. No construction materials shall be stockpiled in the aquatic environment. All construction-related materials shall be free of pollutants and placed or stored in ways to avoid or minimize disturbance. No debris, petroleum products or deleterious materials or wastes shall be allowed to fall, flow, leach, or otherwise enter near shore waters. Any turbidity and siltation generated from activities proposed at the site shall be minimized and contained in the immediate vicinity of construction through the use of effective silt containment devices. Construction during adverse weather conditions shall be curtailed to minimize the potential for adverse water quality impacts.

Appropriate measures to minimize dirt and water runoff, noise, and dust shall be used. No vehicles or heavy machinery shall enter the high wash of the waves without prior notification of the Department in writing, followed by consent and permission in writing from the Department, to include appropriate additional conditions.

7. That work shall be conducted at low tide to the most practical extent possible, and no work shall occur during high surf or ocean conditions that will create unsafe work or beach conditions.

8. At the start of every work day, the workers shall observe the beach area for basking sea turtles. Any sea turtles shall not be disturbed and, shall be allowed to leave the area under their own volition.

9. That any remedial trimming of vegetation at the shoreline that is not described in this Scope of Work, but is designed to achieve continued public safety at the shoreline, may be conducted as part of this permit.

10. That additional reasonable fencing or post-and-rope guideposts, designed to guide the public out of harm's way, as well as to ensure public beach access, may be constructed at the shoreline as part of this permit.

11. That the Applicant post at the property entrance the subject permit numbers and issuance date in a visible location for the public and area residents to see for the entire construction time period.

12. That the Applicant provide hard copies of this subject permit to the manager of the construction crew for access at all times for viewing by the public, if requested.

13. That in the event historic resources, including human skeletal remains, structural remains, cultural deposits, or lava tubes are identified during construction activities, all work shall cease in the immediate vicinity of the find, the find shall be protected from additional disturbance, and the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD), Maui Section, shall be contacted immediately at (808) 243-1285. Work shall not continue until cleared by DLNR-SHPD.

14. That Kaanapali Beach Club monitor shoreline conditions of its property and submit a report, consisting of dated photographs, documenting such conditions to the Department on the first day of each month, starting upon commencement of the work continuing each month thereafter. Included shall be a site map showing from where and in what direction such pictures are taken. Of particular interest is the integrity of the temporary erosion control measure and sand levels in front of it.

15. That Kaanapali Beach Club shall submit to the Department, within ninety (90) days of completion of construction, a detailed report addressing its compliance with the conditions established with this SSA Permit.

Moreover, the Department finds that the proposed action triggers compliance with environmental review because it includes the use of a shoreline area. However, the project qualifies for an exemption, specifically: Exemption Category 4, "Minor alterations in the conditions of land, water, or vegetation."

In light of the above determination, you are granted an Environmental Assessment Exemption (EAE 2021/0003).

In summary, the Department grants a Special Management Area Emergency Permit (SM3 2020/0014), Shoreline Setback Approval (SSA 2020/0062) and Environmental Assessment Exemption (EAE 2021/0003) for the work described in your SMA Assessment Application (SM3 2020/0014).

Thank you for your cooperation. If additional clarification is required, please contact Coastal Resource Planner James Buika by email at James.Buika@mauicounty.gov or by phone at (808) 270-6271.

Sincerely,

MICHELE MCLEAN, AICP
Planning Director

cc: Jordan E. Hart, Deputy Director (PDF)
Clayton I. Yoshida, Planning Program Administrator (PDF)
John S. Rapacz, Planning Program Administrator (PDF)
James A. Buika, Coastal Resource Planner (PDF)
Development Services Administration (PDF)
Sam Lemmo, Administrator, DLNR-OCCL (PDF)
Fred Mayo, Manager, Kaanapali Beach Vacation Resorts (PDF)
Bryan Esmeralda, Applicant's Representative (PDF)
The Honorable Tamara Paltin, Maui County Council (PDF)
Project File

MCM:JAB:th
K:\WP_DOCS\PLANNING\SM3\2020\0014_KaanapaliBchClub\REVISED APPLICATION 4.30.21\SM3_Kaanapali Beach Club, FINAL 06.30.21.doc

Bryan Esmeralda

From: Diego Sanchez-Gomez <Diego.Sanchez-Gomez@co.maui.hi.us>
Sent: Friday, May 21, 2021 10:41 AM
To: fred.mayo@diamondresorts.com; Bryan Esmeralda; Lynne Hiromoto
Subject: FDP T2020/0106 now approved ---> FDP 2021/0038 (KBC Temp Erosion Control Project)

Hello,

Just wanted to inform you that your FDP has been approved. The approved permit number is now **FDP 2021/0038**.

Let me know if you have any other questions or have any other pending FDPs. We are trying to catch up with all of our pending reviews, greatly appreciate your patience. Mahalo!

Diego A. Sanchez, CFM
Staff Planner | Floodplain Manager
Department of Planning | ZAED
Phone: 808-270-7139

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
DEVELOPMENT SERVICES ADMINISTRATION
250 SOUTH HIGH STREET
WAILUKU, HAWAII 96793
Ph: (808) 270-7242 Fax: (808) 270-7972 Inspector: (808) 270-7366

GRADING AND GRUBBING PERMIT APPLICATION

PROJECT/PROPERTY INFORMATION

PROJECT NAME	Kaanapali Beach Club Temporary Erosion Control
TAX MAP KEY	(2) 4-4-001:098
ADDRESS	104 Kaanapali Shores Place, Lahaina, HI 96761

OWNER / PERMITTEE INFORMATION

DECLARATION: *The undersigned accepts the permit subject to conditions described in the General Provisions, construction plans, County Code Section 20.08, and any other document associated with the permit.*

OWNER NAME	Kaanapali Beach Club (Diamond Resorts International)		
ADDRESS	104 Kaanapali Shores Place, Lahaina, HI 96761		
PHONE	808-667-1359	EMAIL	fred.mayo@diamondresorts.com
SIGNATURE	FMJ	PRINT NAME	Fred Mayo
If Permittee different from owner:			
PERMITTEE NAME			
ADDRESS			
PHONE		EMAIL	
SIGNATURE		PRINT NAME	

PERMIT INFORMATION

☑ GRADING PERMIT	Fill:	432	(cubic yards)
	Excavate:	0	(cubic yards)
	Graded Area:	625	(☐ acres ☑ sq. ft.)
	Maximum height/depth of excavation or fill:	Maximum Height = 10	(feet)
☐ GRUBBING PERMIT	Grubbed Area:	0	(☐ acres ☑ sq. ft.)

IDENTIFY CRITICAL AREAS LOCATED ON OR AFFECTING THE PROPERTY

- ☑ Yes ☐ No Is any portion of the property located in the Special Management Area?
- ☑ Yes ☐ No Are there Special Flood Hazard Areas or drainageways on the property?
- ☑ Yes ☐ No Is the property located along the shoreline?
- ☐ Yes ☑ No Are there wetlands located on the property?
- ☐ Yes ☑ No Are there known burials, cemeteries, or other historic sites on the property?
- ☐ Yes ☑ No Will grading affect an existing slope with a height greater than 15 feet and with a grade steeper than 35% (10H:3.5V)?

Estimated Dates: Start: December 2021 Completion: January 2022

PERMIT APPROVAL *(For county use only)*

APPLICATION NUMBER: GT2020/0316

Fee $ 300 Bond $

SPECIAL CONDITIONS

APPROVED BY: Jan Nakamura

For: Department of Public Works

PERMIT NUMBER: G2021/0194

DATE OF ISSUANCE: 9/14/2021

GENERAL PROVISIONS are considered a part of this permit and are included herein by reference. Hard copy is available at Development Services Administration or can be viewed/downloaded online at County website: www.co.maui.hi.us

(Rev. 1/12)

MICHAEL P. VICTORINO
Mayor

MICHELE CHOUTEAU MCLEAN, AICP
Director

JORDAN E. HART
Deputy Director

DEPARTMENT OF PLANNING
COUNTY OF MAUI
ONE MAIN PLAZA
2200 MAIN STREET, SUITE 315
WAILUKU, MAUI, HAWAII 96793

October 21, 2021

Mr. Bryan Esmeralda
Munekiyo Hiraga
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Esmeralda:

SUBJECT: AMENDMENT TO THE SPECIAL MANAGEMENT AREA (SMA) EMERGENCY PERMIT APPROVAL AND SHORELINE SETBACK APPROVAL (SSA) FOR REPAIR OF AN AUTHORIZED TEMPORARY EROSION CONTROL STRUCTURE IN A LIKE-FOR-LIKE MANNER AT THE SHORELINE LOCATED AT THE KAANAPALI BEACH VACATION RESORT (AKA KAANAPALI BEACH CLUB), 104 KAANAPALI SHORES PLACE, LAHAINA, ISLAND OF MAUI, HAWAII; TMK: (2) 4-4-001:098 (SM3 2020/0014) (SSA 2020/0062) (EAE 2021/0003)

The Department and has reviewed your application for an amendment to the subject SMA Emergency Permit and Shoreline Setback Approval for a 180-day time extension until **June 27, 2022** in order to complete the scope of work to repair a failed section of temporary protective erosion control structure at the shoreline. The reason for the time extension request is that the required Revocable Permit from the Board of Land and Natural Resources was not granted until October 9, 2021. In addition, a Building Permit and Grading Permit are still under agency review.

Applications for Amendment to Permit Terms, Conditions, and Time Stipulation forms and relevant submittals for both the Emergency SMA Permit and SSA are included as part of this application request as Exhibits B and C, respectively.

In response to your amendment request application received on August 26, 2021, the Department has reviewed your request and grants the following amendment to the Conditions of Approval for the Emergency SMA Permit to include the following time extension to complete the project, as follows:

1. That the Emergency SMA Permit approval be extended for an additional 180 days, or until **June 27, 2022**.

Additionally, the Shoreline Setback Approval (SSA 2020/0062) is applicable to this application. The conditions of approval of SSA 2020/0062 are still in full force and effect, to include the following amendment:

5. That repairs of the temporary bank stabilization structure shall be initiated by **February 28, 2022**, and shall be completed within four months of said initiation.

Thank you for your cooperation. If additional clarification is required, please contact Staff Planner James Buika, Coastal Resource Planner, at james.buika@mauicounty.gov or at (808) 270-6271.

Sincerely,

CLAYTON I. YOSHIDA
Planning Program Administrator

for MICHELE MCLEAN, AICP
Planning Director

Copy to: Jacky Takakura, Acting Planning Program Administrator (PDF)
James A. Buika, Coastal Resource Planner (PDF)
Development Services Administration (PDF)
Acting Administrator, Department of Land and Natural Resources-Office of Conservation and Coastal Lands (PDF)
Fred Mayo, Manager, Kaanapali Beach Vacation Resorts (PDF)
Bryan Esmeralda, Applicant's Representative, (PDF)
The Honorable Tamara Paltin, Maui County Council (PDF)
Project File

MCM:CIY:JAB:rma
K:\WP_DOCS\Planning\SM3\2020\0014_KaanapaliBchClub\2021 Time Extension SM3 & SSA\TIME EXTENSION SM3_Kaanapali Beach Club, vFINAL, 10.15.21.doc

BUILDING PERMIT

DEVELOPMENT SERVICES ADMINISTRATION
DEPARTMENT OF PUBLIC WORKS, COUNTY OF MAUI

BUILDING PERMIT NO.:	**B 2021-1283**	**DATE ISSUED:**	**NOVEMBER 04, 2021**
OWNER:	**KAANAPALI BCH VAC RESORT - CONDO MASTER**	**LESSEE/TENANT:**	
ADDRESS:	**104 KAANAPALI SHORES PLACE LAHAINA HI 96761**	**TMK:**	**(2) 4-4-001:098-0000**
BUILDER:	**WORTHY C SCOTT**		
FOR:	**SEAWALL REPAIR**		
CONSTRUCTION TYPE:	**V-B**	**OCCUPANCY GROUP:**	**U(06)**

This permit shall expire and become null and void if work authorized under this permit is not started within 1 year from date of issuance or if work authorized under this permit is suspended or abandoned at any time after work is commenced for a period of 1 year. Revisions/changes to approved drawings will require approval by the building inspector. An additional building permit may be required. Electrical and plumbing permits are issued separately. This permit shall be posted in a conspicuous place on the job site during the progress of work as required by law.

THE STAMPED JOB SITE PLANS SHALL BE AVAILABLE DURING INSPECTIONS.

FOR BUILDING OFFICIAL

INSPECTION CARD: BUILDING OFFICIAL USE ONLY

Certificate of Occupancy or Release Letter required upon completion of construction work authorized by this permit:

Select One:	**X**	**NO**	**or**		**YES, refer to CO Application #:**

REQUIRED BUILDING INSPECTIONS	**[Inspection requests: email: dsa.building@mauicounty.gov]**		
1.	Foundation/concrete slab or under-floor	Approved by:	Date:
2.	Framing	Approved by:	Date:
3.	Lath or gypsum board	Approved by:	Date:
4.	Final	Approved by:	Date:

ELECTRICAL PERMIT NO.		**ELECTRICAL CONTRACTOR:**	
REQUIRED ELECTRICAL INSPECTIONS	**[Inspection requests: email: dsa.electrical@mauicounty.gov]**		
1.	Rough-in Partly/slab or trench	Approved by:	Date:
2.	Rough-in Partly/ceilings and walls	Approved by:	Date:
3.	Rough-in Complete/service	Approved by:	Date:
4.	Final	Approved by:	Date:

PLUMBING PERMIT NO:		**PLUMBING CONTRACTOR:**	
REQUIRED PLUMBING INSPECTIONS	**[Inspection requests: email: dsa.plumbing@mauicounty.gov]**		
1.	Rough-in Partly/waste, drain, piping, stub up	Approved by:	Date:
2.	Rough-in Complete/vent through roof	Approved by:	Date:
3.	Final	Approved by:	Date:

BUILDING PERMIT

DEVELOPMENT SERVICES ADMINISTRATION
DEPARTMENT OF PUBLIC WORKS
COUNTY OF MAUI

Kalana Pakui Building, 1st Floor, Room 110
250 South High Street
Wailuku, Hawaii 96793
Phone: (808) 270-7250
Office Hours 8:00-4:00 (M-F)

BUILDING PERMIT NO.:	**B 2021-1283**	**DATE ISSUED:**	**NOVEMBER 04, 2021**
OWNER:	**KAANAPALI BCH VAC RESORT - CONDO MASTER**	**LESSEE/TENANT:**	
ADDRESS:	**104 KAANAPALI SHORES PLACE LAHAINA HI 96761**	**TMK:**	**(2) 4-4-001:098-0000**
DESIGNER:	**DAVID A SMITH**		
BUILDER:	**WORTHY C SCOTT**		
FOR:	**SEAWALL REPAIR**		
CONSTRUCTION TYPE:	**V-B**	**OCCUPANCY GROUP:**	**U(06)**
VALUE:	**$414,800**		
ZONE:	**STATE URB SMA HOTEL**		

This permit shall expire and become null and void if work authorized under this permit is not started within 1 year from date of issuance or if work authorized under this permit is suspended or abandoned at any time after work is commenced for a period of 1 year. Revisions/changes to approved drawings will require approval by the building inspector. An additional building permit may be required.

FOR BUILDING OFFICIAL

APPENDIX B

Geotechnical Investigations

Hoʻāla Honokōwai
Lahaina, Maui, Hawaiʻi
Tax Map Key Nos. (2) 4-4-001:097, 098, and 100

Prepared By: Shinsato Engineering, Inc.

REPORT
GEOTECHNICAL INVESTIGATION

PROPOSED SHORELINE PROTECTION
KAANAPALI BEACH CLUB
104 KAANAPALI SHORES PLACE
LAHAINA, MAUI, HAWAII 96761
TMK: (2) 4-4-001: 098

for

SEA ENGINEERING, INC.

Project No. 19-0077
September 24, 2019

SHINSATO ENGINEERING, INC.
98-747 KUAHAO PLACE, #E
PEARL CITY, HI 96782

SHINSATO ENGINEERING, INC.
CONSULTING GEOTECHNICAL ENGINEERS

98-747 KUAHAO PLACE, SUITE E
PEARL CITY, HAWAII 96782
PHONE: (808) 487-7855
FAX: (808) 487-7854

September 24, 2019
Project No. 19-0077

Sea Engineering, Inc.
Attention: Andy Bohlander
41-305 Kalanianaole Highway Makai Research Pier
Waimanalo, Hawaii 96795

Dear Mr. Bohlander:

This report presents the data, conclusions and recommendations of a geotechnical engineering investigation for the proposed shoreline protection at the Kaanapali Beach Club in Lahaina, Maui, Hawaii. An in-ground seawall and potential revetment are being considered to provide a long-term solution to protect the shoreline and the back shore infrastructures.

A summary of the investigation is as follows:

1) The subsurface condition at the site was explored by drilling 4 test borings to depths of 18.7 to 34.5 feet below existing grade.

   In general, the borings disclosed the shoreline area of the property to be underlain by stiff to very stiff CLAY to depths of 6.0 to 9.0 feet, followed by soft to stiff SILT to depths of 9.0 to 13.0 feet, then by loose to medium dense silty SAND to the final depths of the borings. Groundwater was encountered in each of the borings at depths ranging from 7.8 to 11.0 feet below grade at the time of the field investigation.

2) In addition to the current test borings, logs of previous test borings drilled near the shoreline area of the property (for the Embassy Suites project) were reviewed. These included the logs of Borings 1, 4, 7 and 11. The ground elevation at these borings was at 5.5 to 7.8 feet and the depth to groundwater was 4 to 7 feet below grade. These borings encountered loose to medium dense silty SAND and SAND, and medium stiff to stiff sandy SILT to the groundwater level followed by medium dense to loose SAND and GRAVEL, and soft to stiff SILT to depths of 75 to 92 feet then by hard to very hard BASALTIC ROCK to the final depths of the borings.

3) The options under consideration for the shoreline protection include:

   a) Seawall:

      For a seawall, the foundation should be embedded below the projected scour depth or sheetpiling should be used to protect the supporting soil under the seawall foundation from undermining. A rock toe protection may be considered along the toe of the wall to provide protection from scour and undermining.

   b) Revetment:

      For a proposed revetment, the revetment should be designed in general conformance with the methods described in the US Army Corps of Engineers - Shore Protection Manual or

other acceptable design method. A non-woven geotextile filter fabric, such as Mirafi 180N, should be provided beneath a rock armored revetment as a means of further stabilizing the subgrade soils from the effects of erosion and scour.

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,

SHINSATO ENGINEERING, INC.

Lawrence S. Shinsato, P.E.
President

LSS:ks



This work was prepared by me
or under my supervision.
License Expires 04/30/20

1.0 INTRODUCTION

This investigation was made for the purpose of obtaining information on the subsurface conditions from which to base geotechnical engineering recommendations for the proposed shoreline protection at the Kaanapali Beach Club in Lahaina, Maui, Hawaii. The location of the site, relative to the existing streets and landmarks, is shown on the Vicinity Map, Plate 1.

2.0 SCOPE OF WORK

From the information provided, over the past few years the property has experienced severe shoreline erosion. Kaanapali Beach Club is seeking assistance in developing a long-term solution to protect the shoreline and the back-shore infrastructure.

The services provided in this investigation included:

- Drilling 4 test borings to the depths of 18.7 to 34.5 feet below existing grade.
- Obtaining samples of the underlying soils.
- Performing laboratory tests to determine pertinent engineering properties of the representative soil samples.
- Performing an engineering analysis to determine foundation design parameters.

The following information is provided for use by the Client and/or Engineer:

1) General subsurface conditions, as disclosed by the test borings.
2) Physical characteristics of the soils encountered.
3) Recommendations for foundation design, including bearing values, lateral earth pressure, coefficient of friction, and unit weight.
4) Recommendations for placement of fill and backfill.
5) Special considerations.

3.0 PLANNED DEVELOPMENT

The proposed shoreline protection options under consideration include an in-ground seawall and a revetment that is to be situated along the entire rear (ocean side) limits of the property.

4.0 FIELD INVESTIGATION

4.1 Drilling

The subsurface explorations consisted of drilling test borings at the locations shown on the Plot Plan, Plate 2. The test borings were advanced with a Badger drill rig using continuous flight augers.

The augers are 4 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.

Probing was done to determine the soil consistency at deeper depths. The probe consists of a 2 inch diameter steel tip that is attached to AW drilling rods. The probe was driven into the underlying material with a 140 pound safety hammer falling from a height of 30 inches. The number of blows required to drive the sampler at 12 inch intervals are shown on the boring logs.

4.2 Soil Sampling

Samples of the underlying soils were obtained from the boring by driving a soil sampler into the subsurface material using a 140 pound safety hammer falling from a height of 30 inches. The sampler was driven approximately 18 inches into the soil (or until refusal is encountered) and the number of blows required to drive the sampler was recorded at 6 inch intervals. The blow count for the last 12 inches of sampling are shown on the boring log.

The sampler was retracted from the bore hole and a section of the retrieved soil was placed in a close-fitting waterproof container in order to retain field conditions until completion of the laboratory tests. Samples were then transported to the laboratory for testing.

Soil samples were obtained using a modified California Sampler which is a 3 inch outside diameter, 2-1/2 inch inside diameter steel sampler with an interior lining of one-inch long, thin brass rings, or a split spoon sampler which is a 2 inch outside diameter, 1-3/8 inch inside diameter steel sampler.

4.3 Field Logging

During the subsurface explorations, continuous logs of the borings were kept. The logs included visual classification of the soils encountered using the Unified Soil Classification System as well as other pertinent information which were gathered during the drilling process. The final boring logs included in this report incorporates engineering analysis and results of the laboratory tests.

5.0 SITE CONDITIONS

5.1 Surface

The property is situated on the northwest side of Kaanapali Shores Place and is bordered by commercial lots to the north and south, Kaanapali Shores Place to the east, and ocean to the west.

The proposed shoreline improvement is located along the entire beach front at the back of the property. The back area of the property is presently occupied by swimming pools, water slide, concrete deck and walkways, and lawn.

According to the previous survey plan, the MHHW (mean higher high water) line is approximately 30 to 80 feet away from the edge of the lawn. The surface elevations at the lawn and concrete deck areas vary from approximately 10 to 12 feet.

At the time of the field investigation, the shoreline was generally protected by sandbags. In certain areas, the sandbags appear to have settled and sinkholes have formed.

5.2 Subsurface

The subsurface condition at the site was explored by drilling 4 test borings to depths of 18.7 to 34.5 feet below existing grade. The locations of the borings are shown on the Plot Plan, Plate 2. Detailed logs of the borings

are presented in the Log of Borings, Plates 3 through 6.

In general, the borings disclosed the shoreline area of the property to be underlain by stiff to very stiff CLAY to depths of 6.0 to 9.0 feet, followed by soft to stiff SILT to depths of 9.0 to 13.0 feet, then by loose to medium dense silty SAND to the final depths of the borings. Groundwater was encountered in each of the borings at depths ranging from 7.8 to 11.0 feet below grade at the time of the field investigation.

In addition to the current test borings, logs of previous test borings drilled near the shoreline area of the property (for the Embassy Suites project) were reviewed. These included the logs of Borings 1, 4, 7 and 11. The ground elevation at these borings was at 5.5 to 7.8 feet and the depth to groundwater was 4 to 7 feet below grade. These borings encountered loose to medium dense silty SAND and SAND, and medium stiff to stiff sandy SILT to the groundwater level followed by medium dense to loose SAND and GRAVEL, and soft to stiff SILT to depths of 75 to 92 feet then by hard to very hard BASALTIC ROCK to the final depths of the borings.

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 silt loam, 0 to 3 percent slopes (PpA). This series consists of well-drained soils on alluvial fans and stream terraces and in basins on the islands of Lanai, Maui, Molokai, and Oahu. These soils developed in alluvium washed from basic igneous rock. *This soil has a profile like that of Pulehu clay loam, 0 to 3 percent slopes (PsA), except that the texture is silt loam. On this soil, permeability is moderate. Runoff is slow, and the erosion hazard is no more than slight* (USDA, 1972, pg. 115, Plate 93).

6.0 LABORATORY TESTING

6.1 General

Laboratory tests are performed on various soil samples to determine their engineering properties. Descriptions of the various tests are listed below.

6.2 Unit Weight and Moisture Content

The in-situ unit weight and moisture content 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 moisture content.

6.3 Penetrometer Test

Penetrometer tests are performed on cohesive soils to directly approximate the compressive strength of a soil. The penetrometer test is performed by an operator pushing a 1/4 inch diameter spring loaded piston into a soil sample to a depth of 1/4 inch. The piston measures a resistance which is converted to a compressive strength. Data from this test may be used to indirectly measure the consistency and undrained shear strength of a soil sample.

6.4 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 stages of the test. By repeating

the test with varying normal load conditions, the angle of internal friction and cohesion can be determined.

6.5 Expansion Test - Ring Swell

Expansion tests are performed on clayey soils to determine the expansion potential of the sample. The test is performed using either a remolded or relatively undisturbed field sample. The sample is placed in an expansion apparatus with a one (1) psi surcharge. The sample is saturated and the change in vertical height is recorded. The initial moisture content is varied (field moisture or air-dried) to determine the variation in expansion potential with moisture changes. The data is used to determine the expansion potential of the soil.

6.6 Classification Tests

The terms and symbols used to describe the soil materials are based on the Unified Soil Classification System which provides a basis for classifying soils using either visual methods or laboratory test results. Laboratory tests include sieve and hydrometer analysis for particle size distribution, and Atterberg Limits test for liquid limit, and plasticity index determination.

Grain-size distribution of the soil is determined by passing the soil through a series of sieves. If 50 percent or more of the soil by dry weight passes the #200 sieve, the soil is classified as fine-grained. If more than 50 percent of the soil by dry weight is retained on the #200 sieve, the soil is classified as coarse grained.

Coarse grained soils are described as follows:

Boulder	Material retained on a 12 inch square sieve
Cobble	Material passing a 12 inch sieve but retained on a 3 inch sieve
Gravel	Material passing a 3 inch sieve but retained on a #4 sieve
Sand	Material passing a #4 sieve but retained on a #200 sieve

Fine-grained materials are silts and clays. The liquid limit and plastic limit results from an Atterberg Limits test are used to determine if the soil is a silt or clay.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 General

The options under consideration for the shoreline protection include a seawall and a rock revetment.

For a seawall, the foundation should be embedded below the projected scour depth or sheetpiling should be used to protect the supporting soil under the seawall foundation from undermining. A rock toe protection may be considered along the toe of the wall to provide protection from scour and undermining.

For a proposed revetment, the revetment should be designed in general conformance with the methods described in the US Army Corps of Engineers - Shore Protection Manual or other acceptable design method. A non-woven geotextile filter fabric, such as Mirafi 180N, should be provided beneath a rock armored revetment as a means of further stabilizing the subgrade soils from the effects of erosion and scour.

7.2 Foundation Design Parameters

a) Conventional Spread Footing Design:

Allowable soil bearing value:

- 2,000 psf for footings bearing on firm on-site soils or properly compacted fill and embedded a minimum of 12-inches below the depth of scour and/or the lowest adjacent finished grade where scour is not a factor.
- The soil bearing value may be increased by 250 psf for each additional foot of embedment to a maximum of 4,000 psf.
- The bearing value may be increased by one-third (1/3) for momentary loads due to wind or seismic forces.

b) Deep Foundations:

Deep foundations such as driven piles, caissons, or auger cast-in-place piles may be used to support the seawall in the event that conventional spread footings are not feasible. The recommended design values are as follows:

- Allowable Skin-Friction: 1,000 pounds per square foot of sidewall contact area
- Allowable End-Bearing: 4,000 pounds per square foot for the underlying sand and clayey soils; 150,000 psf for foundations bearing on the underlying rock estimated at 70 to 90 feet below the existing grade.

c) Estimated foundation settlement:

- less than 1-inch

d) Earth pressure coefficients:

- On-site clayey soil:
  Kp = 2.50
  Ka = 0.40 (unrestrained)
  Ko = 0.60 (restrained, at-rest)
  soil unit weight: 100 pcf (dry)
  40 pcf (submerged)
  coefficient of friction: 0.4 x DL

- On-site sandy soil:
  Kp = 3.00
  Ka = 0.30 (unrestrained)
  Ko = 0.45 (restrained, at-rest)
  soil unit weight: 110 pcf (dry)
  50 pcf (submerged)
  coefficient of friction: 0.5 x DL

- Imported structural (granular) fill:
  Kp = 3.50
  Ka = 0.27 (unrestrained)

Ko = 0.42 (restrained, at-rest)
soil unit weight: 140 pcf (dry)
80 pcf (submerged)
coefficient of friction: 0.7 x DL

e) Site Class and coefficients:

- D: stiff soil profile (2006 IBC)

7.3 Anticipated Scour Depth, Rock Toe Protection and Revetment Design

a) Anticipated Scour Depth:

For the determination of the anticipated scour depths, the U.S. Army Corps of Engineers - Shore Protection Manual, Vol I, 1984, p. 5-5, indicates that the anticipated maximum depth of scour should be taken as "...equal to the height of the maximum unbroken wave that can be supported by the original depth of water at the toe of the structure..."

b) Rock Toe Protection:

A rock toe protection may be used to mitigate the effects of scour and erosion of soils fronting the base of the seawall. The rock toe protection should generally be composed of boulder material of sufficient size to resist the wave forces. A non-woven geotextile filter fabric, such as Mirafi 180N, may be provided beneath the rock toe protection to further armor the subgrade soils from potential scour and erosion.

For the design of the rock toe protection, the following parameters may be assumed:

- Unit weight of basaltic rock = 180 pcf
- Specific Gravity of basaltic rock = 2.88

Sheetpiling may also be considered as a means of providing protection of the foundation soil beneath the seawall from soil erosion and scour.

c) Revetment:

For the design of a revetment, the methods described in the U.S. Army Corps of Engineers - Shore Protection Manual or other acceptable design method should be used. A non-woven geotextile filter fabric, such as Mirafi 180N, should be provided beneath a rock armored revetment as a means of minimizing the loss of the subgrade soils from the effects of the wave action.

7.4 Earthwork

It is recommended that the site preparation and grading be prepared in the following manner:

a) Clearing and Grubbing:
In all areas to receive fill and in structural areas, all vegetation, weeds, brush, roots, stumps, rubbish, debris, soft soil and other deleterious material shall be removed and disposed of off-site.

b) Preparation of Ground to Receive Fill:
The exposed surface shall then be scarified to a depth of 6 inches, moisture conditioned to near optimum moisture (ASTM D1557) and then compacted to the degree of compaction specified below. If soft or loose spots are encountered, the loose/soft areas shall be removed to firm material and the resulting depression shall be filled with properly compacted fill.

c) Types of Fill and Backfill Material:
Structural fill and backfill shall be described as material placed beneath buildings and extending a horizontal distance of 3 feet beyond the edge of the building line. Non-structural fill shall be described as material placed beyond 3 feet from the building line.

d) Material Quality:
Fill and backfill material shall consist of soil which is free of organics and debris. The maximum size particle for fill and backfill material shall be as follows:

Structural Fill	
Top 2 feet below finished subgrade (FSG)	3"
Below 2 feet from FSG	6"
Non-structural fill and Pavement areas	
Top 2 feet from FSG	3"
2 to 6 feet from FSG	6"
Below 6 feet from FSG	12"

Structural fill shall have a Unified Soil Classification of either GW, GM, SW, or SM. The plasticity index of the fine portion as determined by the ASTM D4318 test shall be less than 15.

e) Placement of Fill and Backfill:
Each layer of fill and backfill material shall be placed in lifts not exceeding the following (loose thickness):

Structural Fill (including pavement areas)	
Top 2 feet below finished subgrade (FSG)	8"
Below 2 feet from FSG	12"
Non-structural fill	
Top 6 feet from FSG	12"
Below 6 feet from FSG	*

*The loose thickness of this layer shall not exceed 1.5 times the largest size particle; this is predicated upon proper compaction of each lift.

Prior to placing of fill and backfill material, the material shall be aerated or moistened to near optimum moisture content (ASTM D1557 test procedure).

Where fill is placed on existing ground that is steeper than 5 horizontal to 1 vertical, the existing ground surface shall be benched into firm soil as the fill is placed.

f) Degree of Compaction:
Each layer of fill and backfill shall be thoroughly compacted from edge to edge using conventional compaction equipment designed for the purpose. The minimum degree of compaction for each layer (as determined by the ASTM D1557 test procedure) shall be as follows:

Structural Fill (under and 3 feet beyond the edge of buildings)	95 %
Non-structural fill	* 90 %

*Where compaction tests are not practical due to the size of the material, each layer shall be compacted by track rolling until it does not weave or creep under the weight of the track rolling equipment (D-8 dozer or larger).

It is particularly important to see that all fill and backfill soils are properly compacted in order for the design parameters to remain applicable.

g) Preparation of Footing Excavations:
Footing excavations shall be cleaned of loose material and soils disturbed by the excavation prior to placing of steel or pouring of concrete. Any soft soil encountered at the bottom of the footing excavation shall be removed to firm material. The resulting depression shall then be backfilled with properly compacted structural fill.

h) Site Drainage:
During construction, drainage shall be provided to minimize ponding of water adjacent to or on foundation and pavement areas. Ponded areas shall be drained immediately. Any subgrade soil that has become soft due to ponding shall be removed to firm material and replaced with compacted structural fill.

8.0 INSPECTION

During the progress of construction, so as to evaluate compliance with the design concepts, specifications and recommendations contained in this report, it is recommended that a representative from Shinsato Engineering be present to observe the following operations:

1) Site preparation and grading. This includes testing and approval of the use of fill materials and periodic field density tests for soil compaction. A Final Grading Report may be required by the County to close a grading permit.

2) The continuous monitoring of the installation and testing of deep foundations.

3) Foundation excavations to verify that suitable bearing material has been encountered at the bottom of foundation excavations.

9.0 REMARKS

The conclusions and recommendations contained herein are based on the findings and observations made at the test boring 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 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.

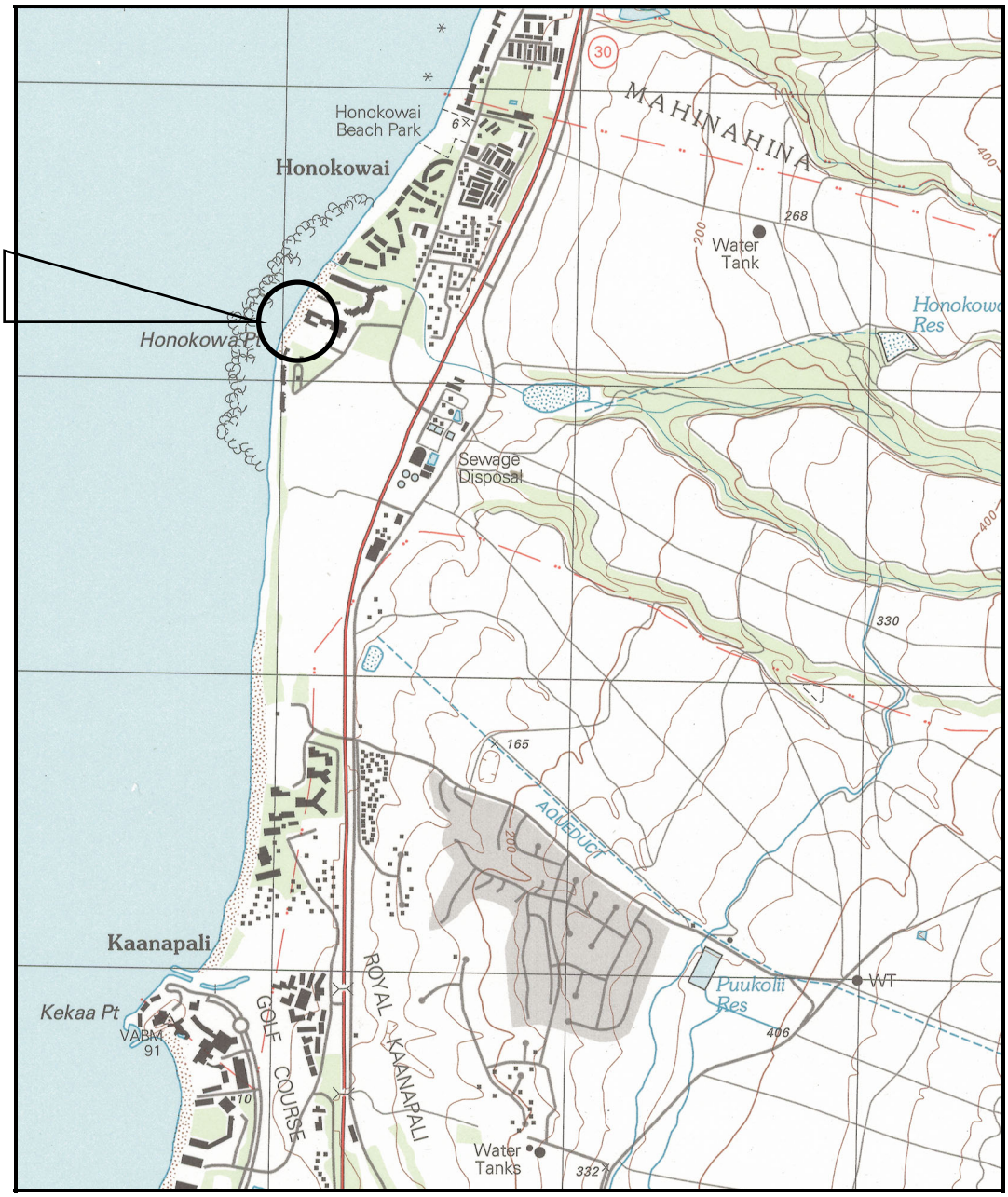
Samples obtained in this investigation will deteriorate with time and will be unsuitable for further laboratory tests within one (1) month from the date of this report. Unless otherwise advised, the samples will be discarded at that time.

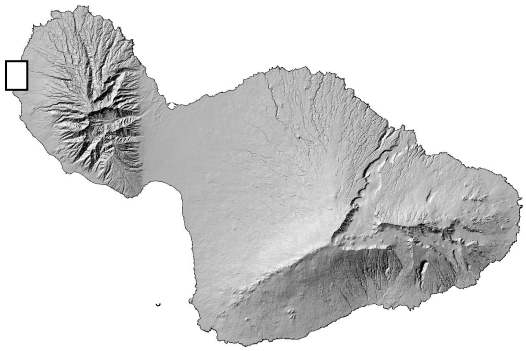
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The following are included and complete this report:

Appendix	Plate
Vicinity Map	1
Plot Plan	2
Logs of Test Borings	3 through 6
Results of Laboratory Tests	7 through 13

VICINITY MAP





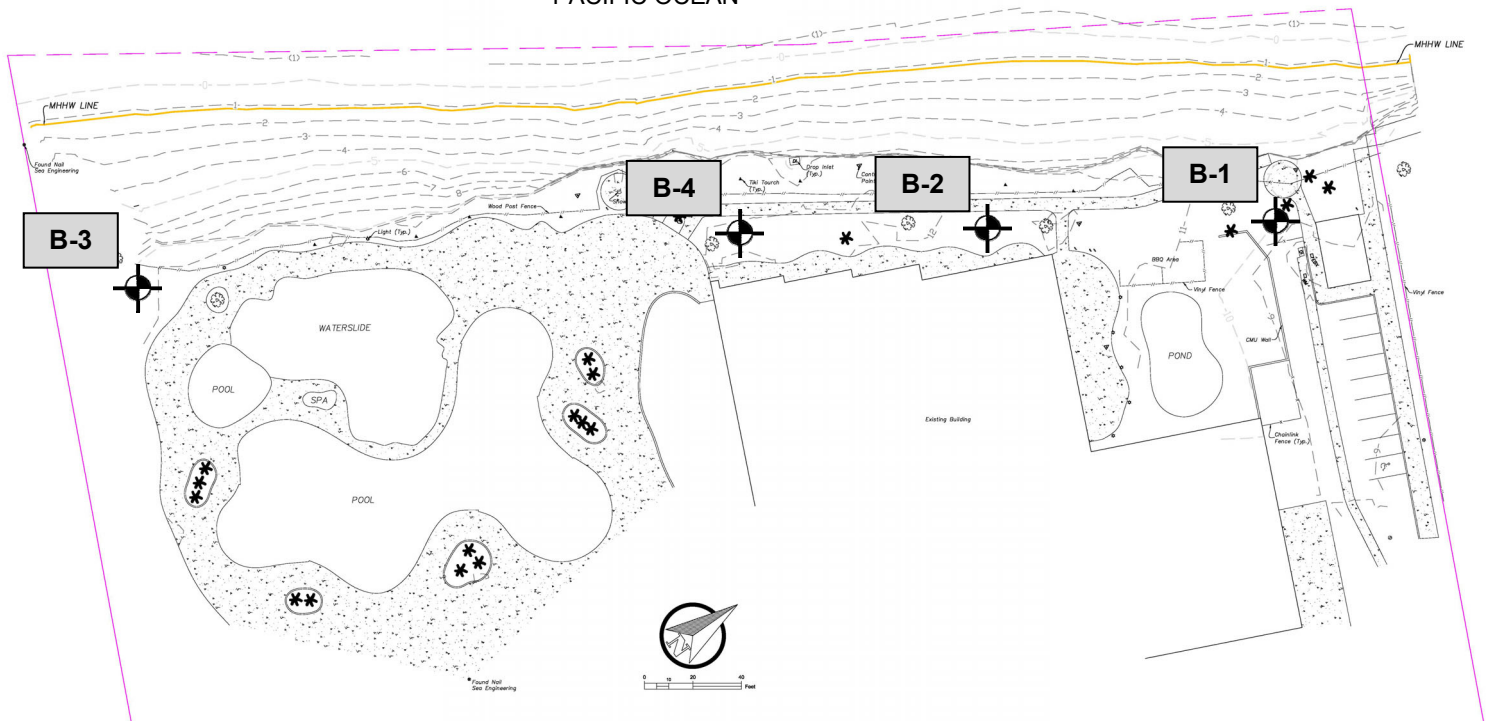
REFERENCE:
USGS TOPOGRAPHIC MAP
LAHAINA QUADRANGLE
DATED 1992
SCALE: 1"=2000'

Project: SHORELINE IMPROVEMENTS KAANAPALI BEACH CLUB Project No.: 19-0077	**SHINSATO ENGINEERING, INC.** CONSULTING GEOTECHNICAL ENGINEERS 98-747 KUAHAO PL. #E, PEARL CITY, HI 96782	**PLATE 1**

Notes:

1) Original image provided by Ailana Surveying & Geomatics LLC, Dated March 5, 2017.
2) Actual conditions may differ.
3) TMK: (2) 4-4-001: 098.

PACIFIC OCEAN



PLOT PLAN

SCALE: 1" = 80'

LEGEND:

APPROXIMATE TEST BORING LOCATION

0 40' 80' 160'

Project: SHORELINE IMPROVEMENTS KAANAPALI BEACH CLUB Project No.: 19-0077	**SHINSATO ENGINEERING, INC.** CONSULTING GEOTECHNICAL ENGINEERS 98-747 KUAHAO PL. #E, PEARL CITY, HI 96782	**PLATE 2**

LOG OF BORING NO. 1

DRILLING METHOD: **Badger Drill Rig**
HAMMER WEIGHT (lbs): **140**
HAMMER DROP (in): **30**

ELEVATION (FT.): **+10 (approx)**
DEPTH OF BORING (FT.): **34.5**
DEPTH TO GROUNDWATER (FT.): **7.8**
DATE DRILLED: **July 30, 2019**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		**CH**	CLAY; with gravel and sand			brown red	moist	very stiff				
					33				103.0	17.9	4.8	
3			--no sample recovery		12			medium stiff				
6		**ML**	SILT;		8				88.6	29.5	1.3	
9		**SM**	silty SAND (calcareous, fine to medium grain); with gravel		10	gray brown		loose	85.9	32.8		
12												
		(PRB)	PROBE TO DETERMINE SOIL CONSISTENCY		4							
15					6							
					12			medium dense				
					19							
18					11							
					26							
					16							
21					17							
					9							
					16							
24					12							
					18							
					13							
27					10							
					1							
					10							
30					14							
					11							
					2			loose				
33					3							
					3							
			END OF BORING									
36												
39												
42												
45												

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB
Project No.: 19-0077

SHINSATO ENGINEERING, INC.
CONSULTING GEOTECHNICAL ENGINEERS
98-747 KUAHAO PL. #E, PEARL CITY, HI 96782

PLATE 3

LOG OF BORING NO. 2

DRILLING METHOD: **Badger Drill Rig**
HAMMER WEIGHT (lbs): **140**
HAMMER DROP (in): **30**

ELEVATION (FT.): **+12 (approx)**
DEPTH OF BORING (FT.): **34**
DEPTH TO GROUNDWATER (FT.): **9.4**
DATE DRILLED: **July 30, 2019**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		**CH**	CLAY; with gravel and sand			brown	moist	stiff				
					30				90.5	31.1	3.8	
3			--few gravel									
					19				80.9	37.0	3.3	
6		**ML**	SILT;					medium stiff				
					8				67.8	40.8	1.5	
9		**SM**	silty SAND (calcareous, fine to			tan	▼	loose				
			medium grain);		10				81.6	39.9		
12												
					8				63.1	63.7	1.0	
15		**(PRB)**	PROBE TO DETERMINE SOIL		4					49.7		
			CONSISTENCY		14			medium dense				
					8							
18					20							
					20							
					14							
21					3			loose				
					6							
					22			medium dense				
24					11							
					18							
					26							
27					22							
					22							
					17							
30					15							
					11							
					17							
33					18							
					11/6"							
			END OF BORING									
36												
39												
42												
45												

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB
Project No.: 19-0077

SHINSATO ENGINEERING, INC.
CONSULTING GEOTECHNICAL ENGINEERS
98-747 KUAHAO PL. #E, PEARL CITY, HI 96782

PLATE 4

LOG OF BORING NO. 3

DRILLING METHOD: **Badger Drill Rig**
HAMMER WEIGHT (lbs): **140**
HAMMER DROP (in): **30**

ELEVATION (FT.): **Unknown**
DEPTH OF BORING (FT.): **18.7**
DEPTH TO GROUNDWATER (FT.): **9.3**
DATE DRILLED: **July 31, 2019**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		**CH**	CLAY; with sand			brown	moist	stiff				
					20				86.4	17.6		
3					19				95.5	23.9		
6					35			very stiff	98.4	21.0	6+	
9		**ML**	SILT;		5		▼	soft	67.4	56.3	1.0	
12		**SM**	silty SAND (calcareous, fine to medium grain);		10	brown gray tan		loose	71.2	54.7		
15		**(PRB)**	PROBE TO DETERMINE SOIL CONSISTENCY		9 19 22			medium dense				
18			--probe refusal		37 26/2"			dense very dense				
			END OF BORING									
21												
24												
27												
30												
33												
36												
39												
42												
45												

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB
Project No.: 19-0077

SHINSATO ENGINEERING, INC.
CONSULTING GEOTECHNICAL ENGINEERS
98-747 KUAHAO PL. #E, PEARL CITY, HI 96782

PLATE 5

LOG OF BORING NO. 4

DRILLING METHOD: **Badger Drill Rig**
HAMMER WEIGHT (lbs): **140**
HAMMER DROP (in): **30**

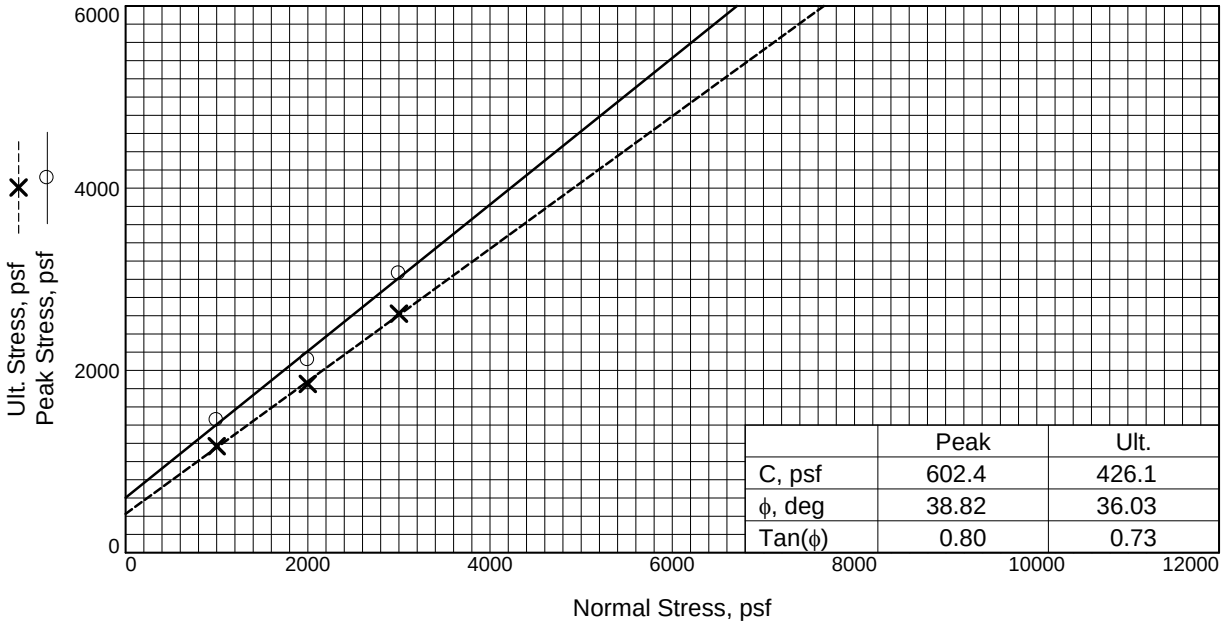
ELEVATION (FT.): **+12 (approx)**
DEPTH OF BORING (FT.): **34.5**
DEPTH TO GROUNDWATER (FT.): **11.0**
DATE DRILLED: **July 31, 2019**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		**CH**	CLAY; few sand	■	22	brown	moist	stiff	99.8	25.7	2.6	
3				■	13			medium stiff	79.3	36.6		
6			--some sand	■	33			very stiff	91.9	32.0	2.8	
9		**ML**	SILT;	■	21		▼	stiff	87.8	82.4	4.3	
12		**SM**	silty SAND (calcareous, fine to medium grain);	■	6	tan		loose	82.4	25.8		
15		**(PRB)**	PROBE TO DETERMINE SOIL CONSISTENCY		6					42.1		
					6							
					7							
18					7							
					9							
					7							
21					12			medium dense				
					21							
					22							
24					17							
					18							
					16							
27					21							
					22							
					22							
30					12							
					7							
					19							
33					12							
					15							
			END OF BORING									
36												
39												
42												
45												

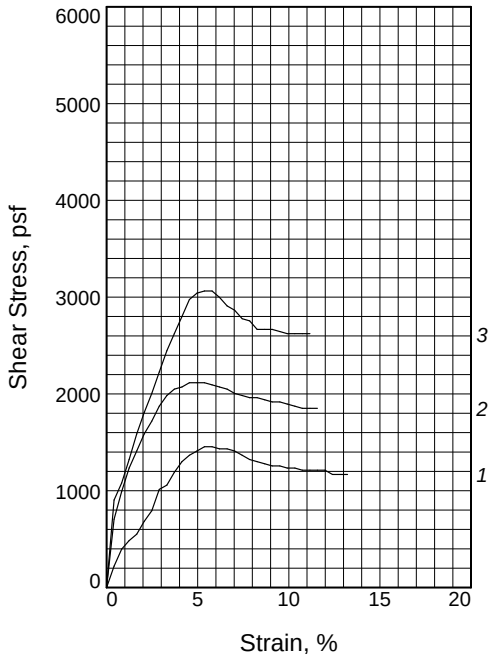
Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB
Project No.: 19-0077

SHINSATO ENGINEERING, INC.
CONSULTING GEOTECHNICAL ENGINEERS
98-747 KUAHAO PL. #E, PEARL CITY, HI 96782

PLATE 6



	Peak	Ult.
C, psf	602.4	426.1
ϕ, deg	38.82	36.03
Tan(ϕ)	0.80	0.73



Sample No.		1	2	3
Initial	Water Content, %	N/A	N/A	N/A
	Dry Density, pcf	N/A	N/A	N/A
	Saturation, %	N/A	N/A	N/A
	Void Ratio	N/A	N/A	N/A
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	N/A	N/A	N/A
	Dry Density, pcf			
	Saturation, %			
	Void Ratio			
	Diameter, in.			
	Height, in.			
Normal Stress, psf		1000.0	2000.0	3000.0
Peak Stress, psf		1454.6	2115.9	3063.6
Strain, %		5.4	4.5	5.4
Ult. Stress, psf		1168.1	1851.4	2622.8
Strain, %		12.4	10.7	9.9
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: CH
Description: CLAY with gravel and sand

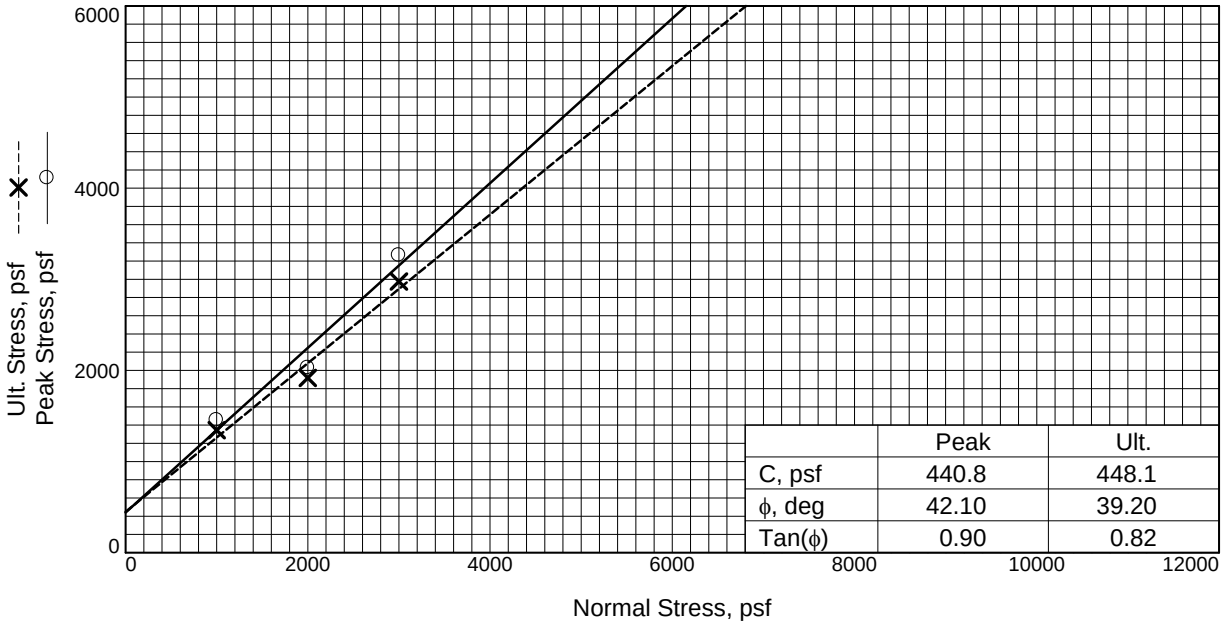
Specific Gravity=
Remarks:

Figure 7

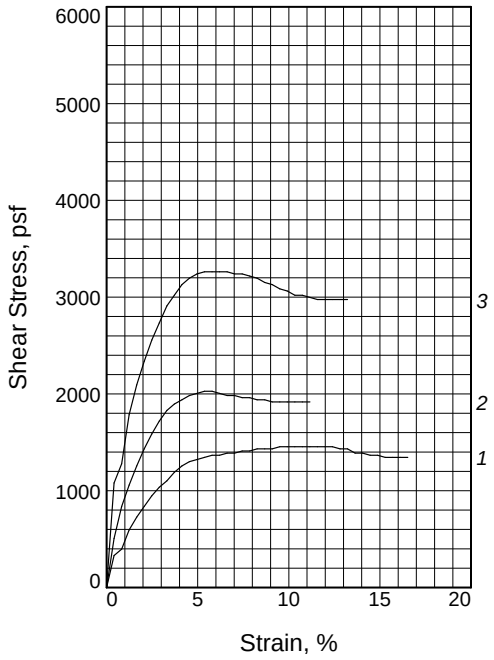
Client:

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB
Source of Sample: 2 **Depth:** 4
Sample Number: 2
Proj. No.: 19-0077 **Date Sampled:**

DIRECT SHEAR TEST REPORT
SHINSATO ENGINEERING, INC.
Pearl City, HI



	Peak	Ult.
C, psf	440.8	448.1
ϕ, deg	42.10	39.20
Tan(ϕ)	0.90	0.82



Sample No.		1	2	3
Initial	Water Content, %	N/A	N/A	N/A
	Dry Density, pcf	N/A	N/A	N/A
	Saturation, %	N/A	N/A	N/A
	Void Ratio	N/A	N/A	N/A
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	N/A	N/A	N/A
	Dry Density, pcf			
	Saturation, %			
	Void Ratio			
	Diameter, in.			
	Height, in.			
Normal Stress, psf		1000.0	2000.0	3000.0
Peak Stress, psf		1454.6	2027.7	3261.9
Strain, %		9.5	5.4	5.4
Ult. Stress, psf		1344.4	1917.5	2975.4
Strain, %		15.3	9.1	11.6
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: CH
Description: CLAY with sand

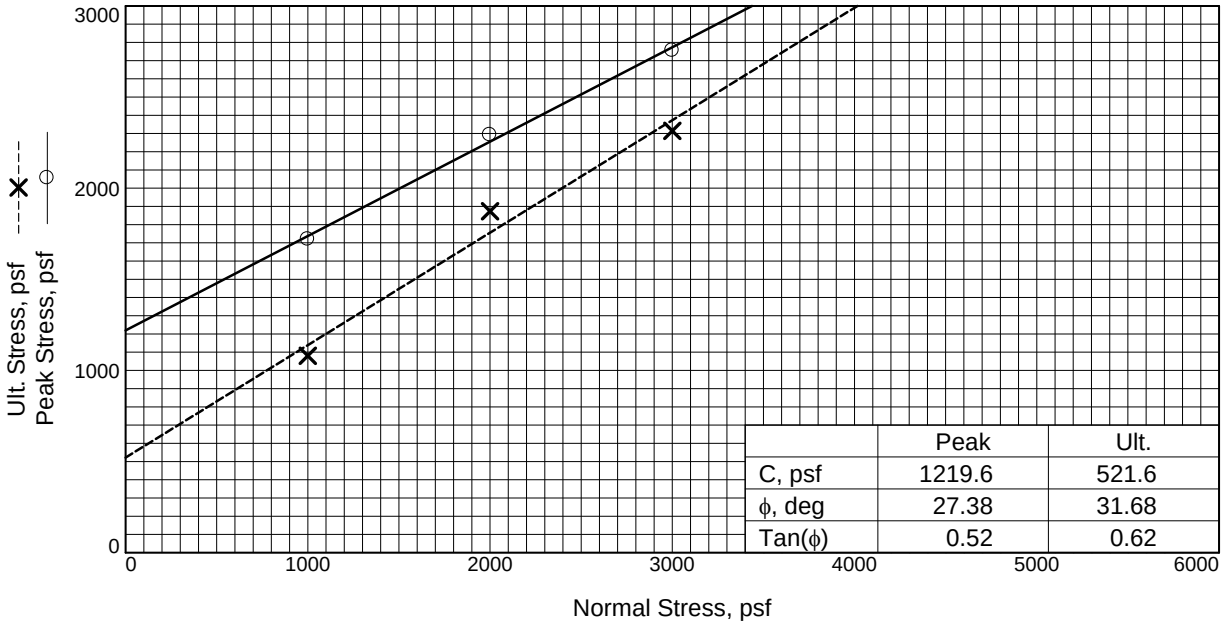
Specific Gravity=
Remarks:

Figure 8

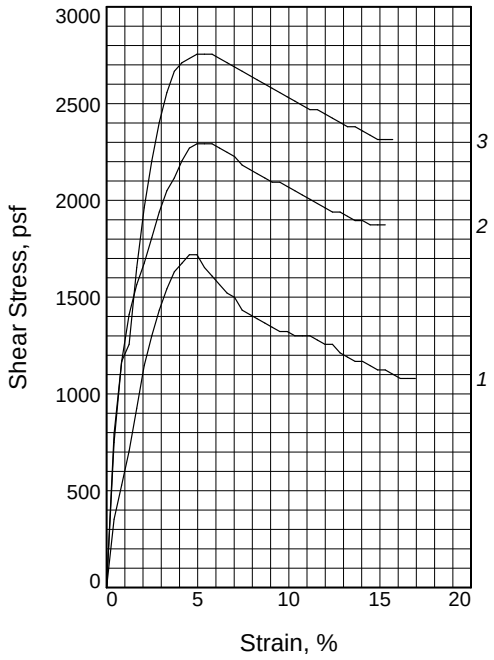
Client:

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB
Source of Sample: 3 **Depth:** 4
Sample Number: 2
Proj. No.: 19-0077 **Date Sampled:**

DIRECT SHEAR TEST REPORT
SHINSATO ENGINEERING, INC.
Pearl City, HI



	Peak	Ult.
C, psf	1219.6	521.6
ϕ, deg	27.38	31.68
Tan(ϕ)	0.52	0.62



Sample No.		1	2	3
Initial	Water Content, %	N/A	N/A	N/A
	Dry Density, pcf	N/A	N/A	N/A
	Saturation, %	N/A	N/A	N/A
	Void Ratio	N/A	N/A	N/A
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	N/A	N/A	N/A
	Dry Density, pcf			
	Saturation, %			
	Void Ratio			
	Diameter, in.			
	Height, in.			
Normal Stress, psf		1000.0	2000.0	3000.0
Peak Stress, psf		1719.1	2292.2	2755.0
Strain, %		4.5	5.0	5.0
Ult. Stress, psf		1080.0	1873.4	2314.2
Strain, %		16.1	14.5	14.9
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: CH
Description: CLAY with sand

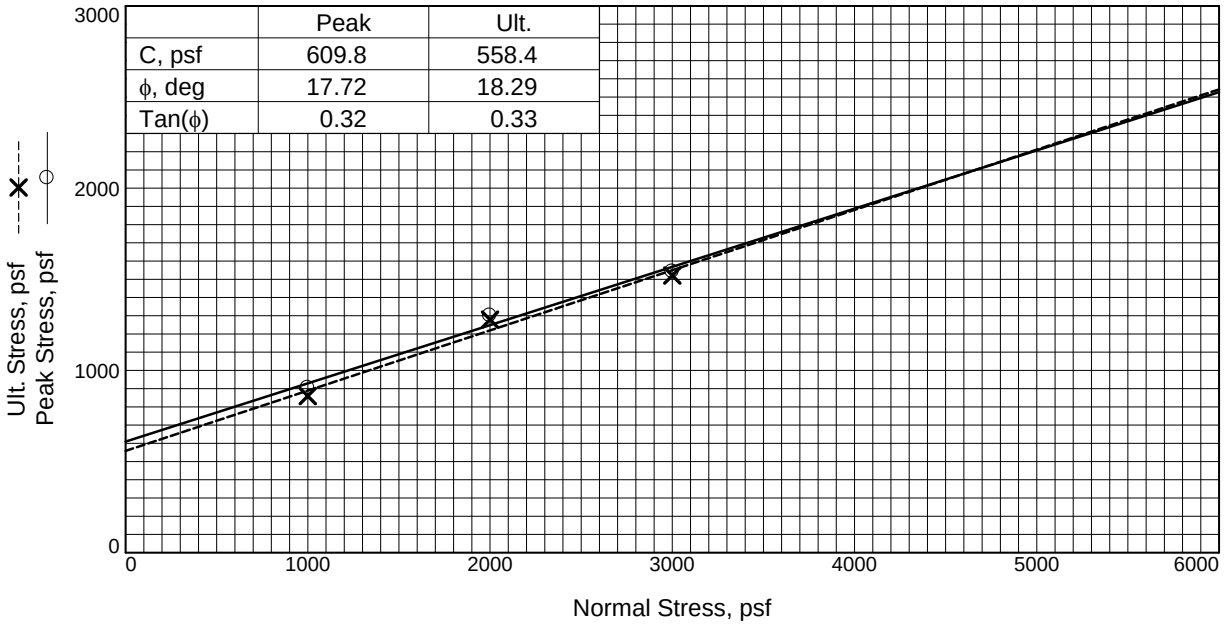
Specific Gravity=
Remarks:

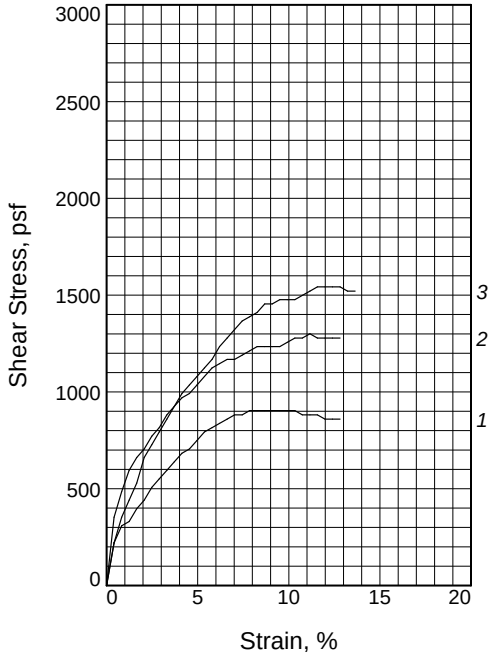
Figure 9

Client:

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB
Source of Sample: 4 **Depth:** 7
Sample Number: 3
Proj. No.: 19-0077 **Date Sampled:**

DIRECT SHEAR TEST REPORT
SHINSATO ENGINEERING, INC.
Pearl City, HI





Sample No.		1	2	3
Initial	Water Content, %	N/A	N/A	N/A
	Dry Density, pcf	N/A	N/A	N/A
	Saturation, %	N/A	N/A	N/A
	Void Ratio	N/A	N/A	N/A
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	N/A	N/A	N/A
	Dry Density, pcf			
	Saturation, %			
	Void Ratio			
	Diameter, in.			
	Height, in.			
Normal Stress, psf		1000.0	2000.0	3000.0
Peak Stress, psf		903.6	1300.4	1542.8
Strain, %		7.9	11.2	11.6
Ult. Stress, psf		859.6	1278.3	1520.8
Strain, %		12.0	11.6	13.2
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: SM
Description: silty SAND

Specific Gravity=
Remarks:

Figure 10

Client:

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB
Source of Sample: 4 **Depth:** 14
Sample Number: 6
Proj. No.: 19-0077 **Date Sampled:**

DIRECT SHEAR TEST REPORT
SHINSATO ENGINEERING, INC.
Pearl City, HI

EXPANSION TEST REPORT

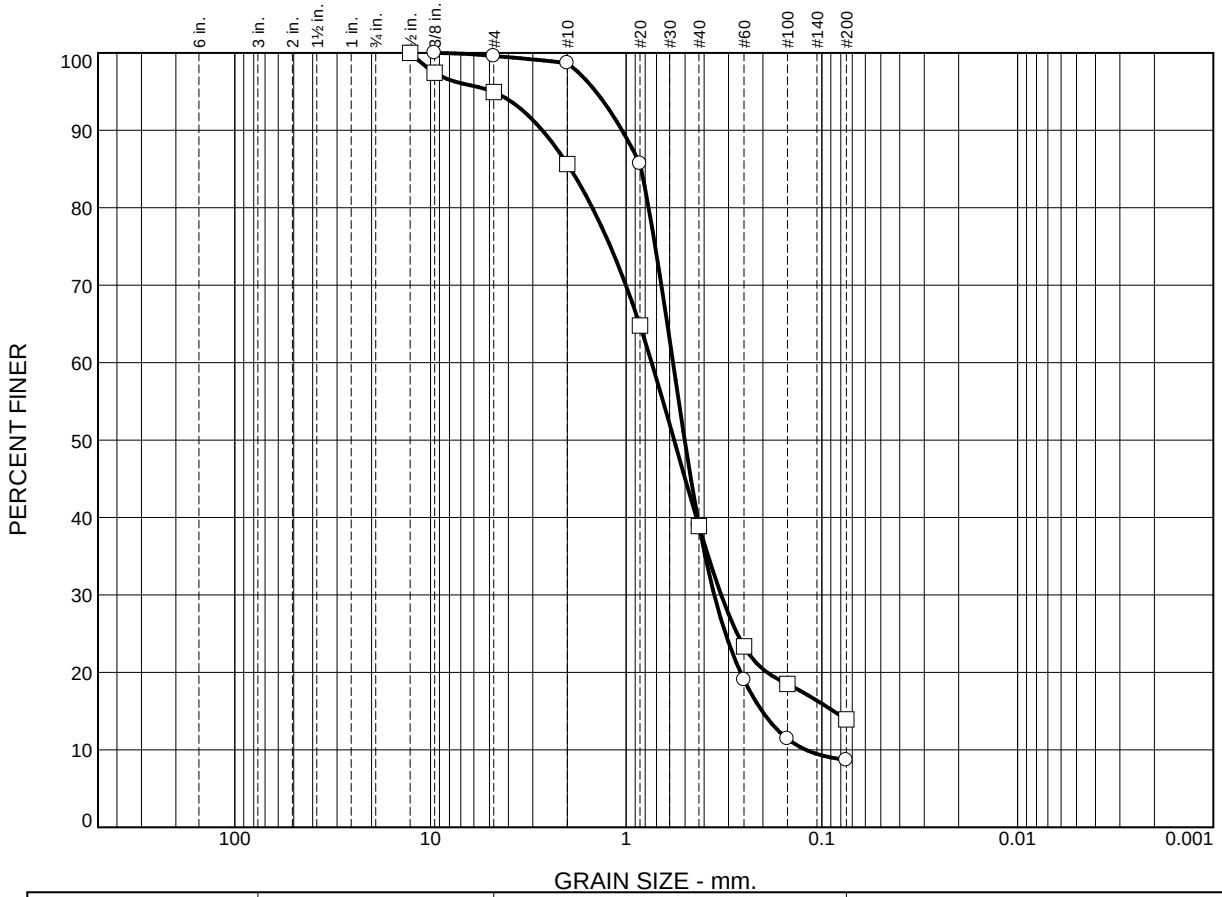
LOCATION	DEPTH (ft)	TEST DRY DENSITY (pcf)	MOISTURE CONTENT (%)			SWELL (%)	TEST CONDITION	SWELL POTENTIAL
			BEFORE	AIR DRIED	SATURATED			
Boring 2, Sample 1	2.0	97.3	24.4	12.6	29.9	3.7	field density, air dried to saturation	moderate
Boring 3, Sample 1	2.0	105.9	21.6	11.4	24.8	0.7	remolded, air dried to saturation	low

NOTES:

1) 1 psi surcharge.

PERCENT SWELL	SWELL POTENTIAL
<2	low
2-6	moderate
6-10	high
>10	very high

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	60	30	9	
□	0	0	5	9	47	25	14	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	2	6	14.5	poorly graded SAND with silt	SP-SM
□	3	5	14	silty SAND	SM

SHINSATO ENGINEERING, INC.

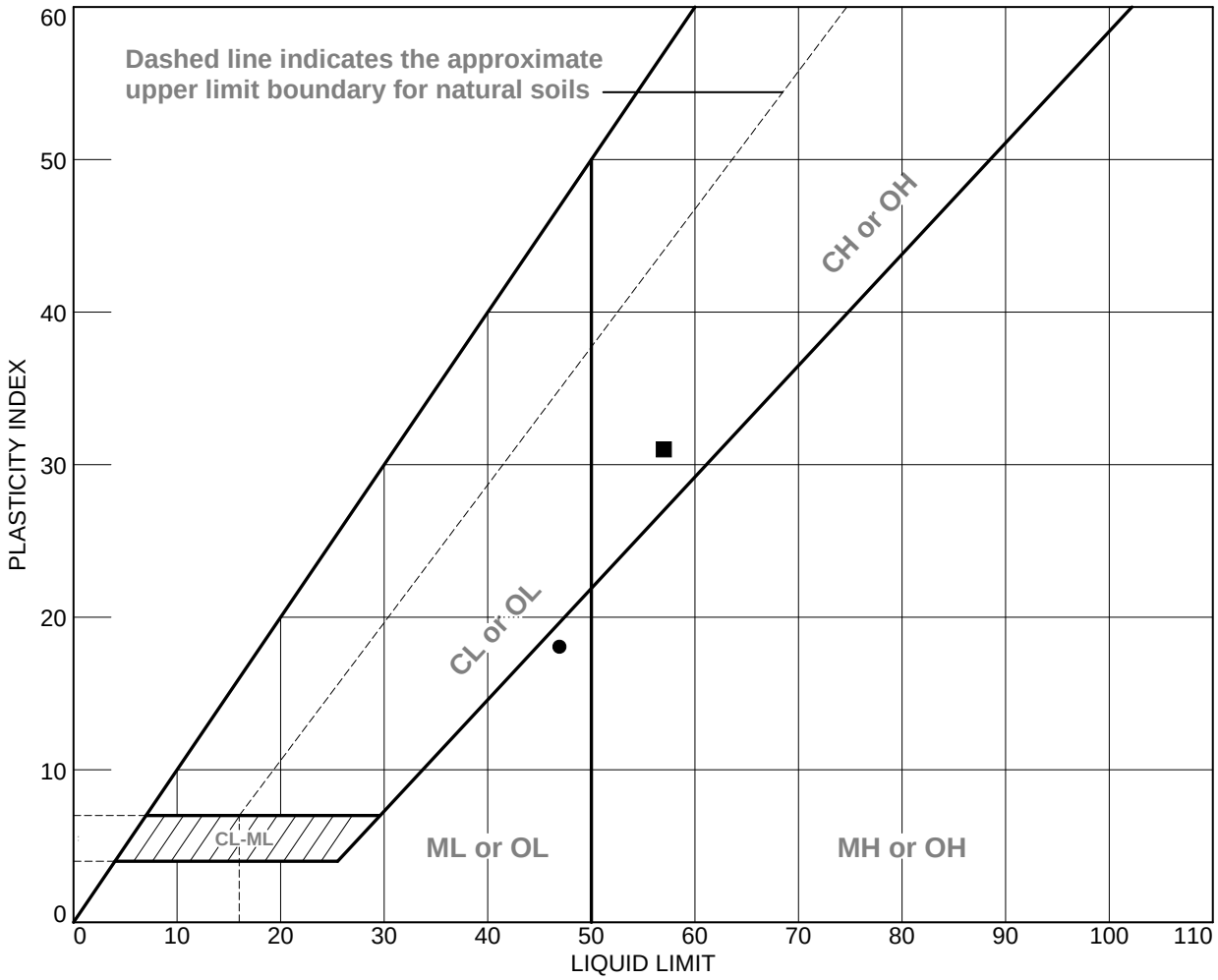
Pearl City, HI

Client:

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB

Project No.: 19-0077 **Figure** 12

ATTERBERG LIMITS



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	1	2	6.5	29.5	29	47	18	ML
■	4	2	4	36.6	26	57	31	CH

SHINSATO ENGINEERING, INC.

Pearl City, HI

Client:

Project: SHORELINE IMPROVEMENTS
KAANAPALI BEACH CLUB

Project No.: 19-0077 **Figure** 13

APPENDIX C

Structural Engineering Assessment

Hoʻāla Honokōwai
Lahaina, Maui, Hawaiʻi
Tax Map Key Nos. (2) 4-4-001:097, 098, and 100

Prepared By: MKE Associates LLC

MKE ASSOCIATES LLC
Structural Engineers

Aiea Commercial Center
Suite 205
99-205 Moanalua Road
Aiea, HI 96701

Phone: (808) 488-7579
Fax: (808) 488-7818
E-Mail: mke@mkellc.com

September 28, 2019

Andy Bohlander
Sea Engineering, Inc.
41-305 Kalanianaole Highway
Makai Research Pier
Waimanalo, Hawaii 96795

Re: Preliminary Design of In-Ground Wall Option
Kaanapali Beach Club Shoreline Improvements

Dear Mr. Bohlander:

At your request, we had the opportunity to review the shoreline conditions at the Kaanapali Beach Club, located at 104 Kaanapali Shores Place, Lahaina, Maui, Hawaii. It was requested we assist Sea Engineering (SEI) in providing a preliminary design of an in-ground wall option to protect the building and property from shoreline erosion. This letter reports our findings.

DESCRIPTION AND SCOPE OF WORK

The shoreline is approximately 600 ft long and consists of a sandy beach and soil embankment fronting the west end of a 12-story post-tension concrete building towards the north end of the property and the recreation deck area containing in-ground swimming pools and waterslide feature towards the south end of the property. The building foundation consists of precast concrete piles. Due to ongoing shoreline erosion, temporary erosion control measures have been implemented and it is requested that a more permanent measure be designed and installed. Our scope of work for this Phase 1 concept design consisted of the following items:

- Perform a site observation visit on July 23, 2019 to observe existing conditions and to discuss various repair options and related concerns with SEI and Shinsato Engineering (geotechnical engineering consultant).
- Review topographic survey of the shoreline dated March 5, 2017, provided by SEI and original building drawings for the Embassy Suites project dated March 27, 1987.
- Review geotechnical investigation report for the Proposed Shoreline Protection at Kaanapali Beach Club dated September 24, 2019 by Shinsato Engineering.
- Perform preliminary structural calculations to develop a functional concept design describing the rationale and technical requirements for the recommended engineering solution
- Provide a design, including plan and section of the wall option.
- Provide a short report summarizing the wall option.

OBSERVATIONS

From our review, we have the following observations:

- From a review of the topographic survey, it appears a significant amount of the shoreline embankment has eroded away from wave action since the survey was performed. Temporary erosion protection consisting of sand filled bags stacked on the sloping bank to a height of about 3 to 4 ft on the north end and increasing

to a height of about 11 to 12 ft on the south end has been installed on the beach and embankment (Photos 1 and 2).

- The top of the sandbags are roughly located to the west of a concrete slab-on-grade walkway oriented along the shoreline. An approximate location of the top of these sandbags is shown overlayed on the 2017 topographic survey in the attached Figure S-1.
- The sandbags are located about 25 ft at the north side to about 40 ft on the south side from the approximately 150 ft long west end of the building (Photo 3).
- At about 200 ft from the south end of the property, sandbags have broken away over an approximately 30 ft length of shoreline, resulting in further erosion of the shoreline (Photo 4).
- From their geotechnical investigation, Shinsato Engineering reported that in general, their borings disclosed the shoreline area of the property to be underlain by stiff to very stiff clay to depths of 6 to 9 ft, followed by soft to stiff silt to depths of 9 to 13 ft, then by loose to medium dense silty sand to the final depths of the borings. They also reported borings from the Embassy Suites project encountered loose to medium dense silty sand and sand and medium stiff to stiff sandy silt to the ground water level followed by medium dense to loose sand and gravel, and soft to stiff silt to depths of 75 to 92 ft, and then hard to very hard basaltic rock below.
- For the in-ground wall option, Shinsato Engineering recommended that the foundation should be embedded below the projected scour depth or sheetpiling should be used to protect the supporting soil under the seawall foundation from undermining. As stated in the Shinsato report, from the U.S. Army Corps of Engineers – Shore Protection Manual, Vol I, 1984, the anticipated maximum depth of scour should be take as "… equal to the height of the maximum unbroken wave that can be supported by the original depth of water at the toe of the structure…".
- SEI has provided a preliminary estimate of this maximum unbroken wave that can be supported by the original depth of water at the toe of the structure as 12 ft. Therefore, maximum depth of scour is estimated to be at an elevation of -12 ft.

ASSESSMENT AND PRELIMINARY RECOMMENDATIONS

We were asked to consider the following two alternatives for the in-ground wall:

- Alternative A: Wall fronting the building with returns on both ends of the building to provide erosion protection for the building
- Alternative B: Wall along the entire shoreline to provide erosion protection for the entire property.

Based on the geotechnical recommendations for the wall foundation to be embedded below projected scour depth or to be protected by sheetpiling, and a maximum scour depth of -12 ft, the wall foundation or sheetpiling protection needs to extend to -12 ft with a total design retained height of about 24 ft to the current top of embankment of about 12 ft. For this amount of retained height it is our opinion that a deep foundation wall such as a steel sheetpile wall with soil anchor support near the top of wall (Option 1), or a freestanding reinforced concrete secant wall (Option 2) are viable alternatives. Schematic plans and sections for these options are shown on Sheets S-1 through S-5.

A sheetpile wall will be thinner in section and may require less clearance for installation than a secant wall. However, both walls may require demolition of the waterslide and small pool adjacent to the shoreline for construction access. In addition, the sheetpile wall will require installation of soil anchors, several of which may likely extend under the building and will need to avoid the pile foundations. Erosion will also expose a steel sheetpile face that is more susceptible to corrosion than the concrete secant pile wall.

The opinions and comments formulated during this assessment are based on observations made at the time of the investigation. No guarantee or warranty as to future life, performance, or need for repair of any reviewed conditions is expressed or implied. This assessment does not include an assessment of geotechnical or other nonstructural conditions. Structural analysis or physical testing for compliance with any specifications and legal or code requirements is excluded from this assessment.

Sincerely,
MKE Associates LLC



Glenn H. Miyasato
Its member

Enclosures: Photos 1 through 4, Sheets S-1 through S-5



Photo 1



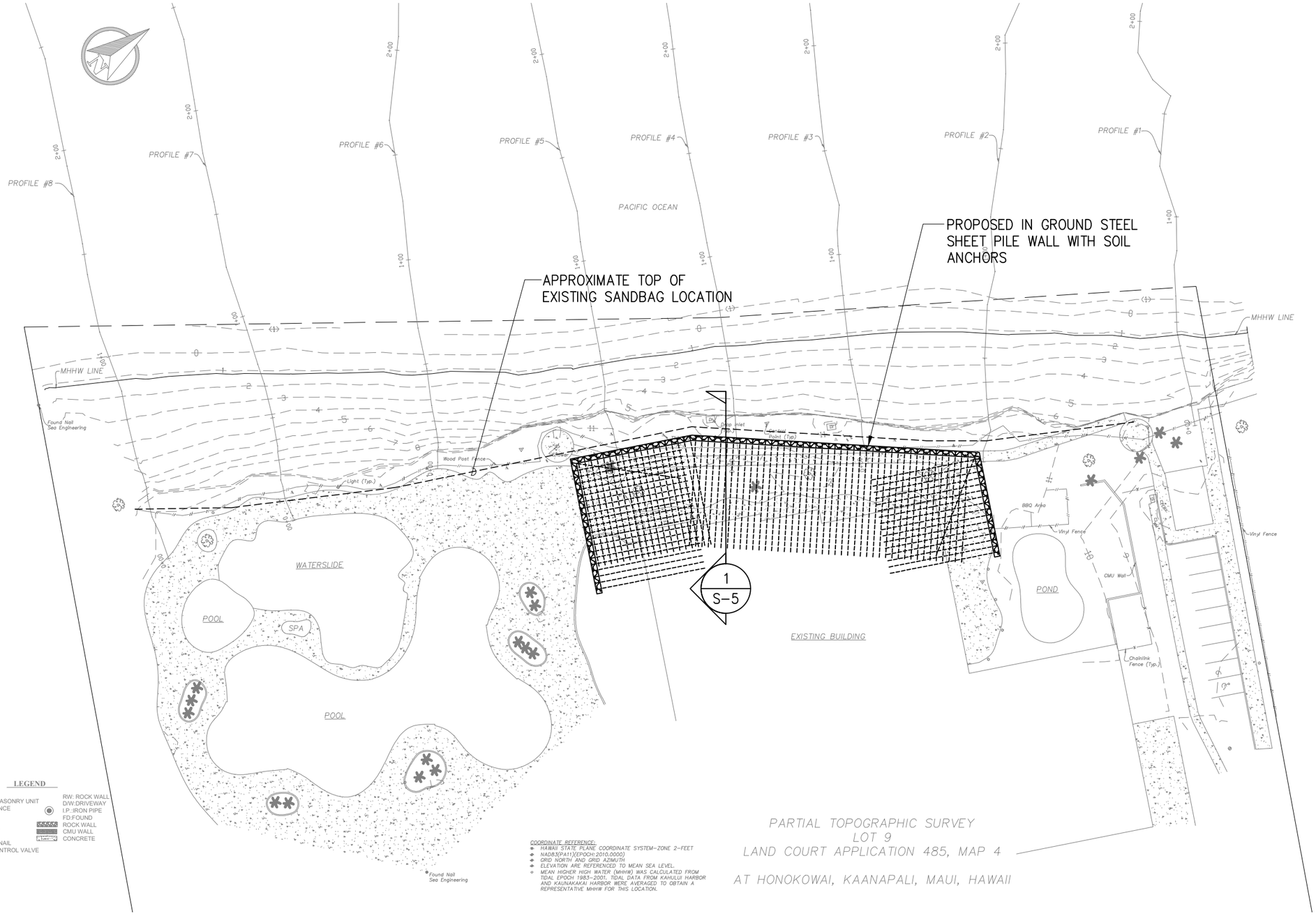
Photo 2



Photo 3



Photo 4



OPTION 1A – PARTIAL SITE PLAN – IN GROUND WALL AT BUILDING

SCALE: 1" = 50'

MKE ASSOCIATES LLC
Structural Engineers

Aiea Commercial Center
Suite 205
99-205 Moanalua Road
Aiea, HI 96701

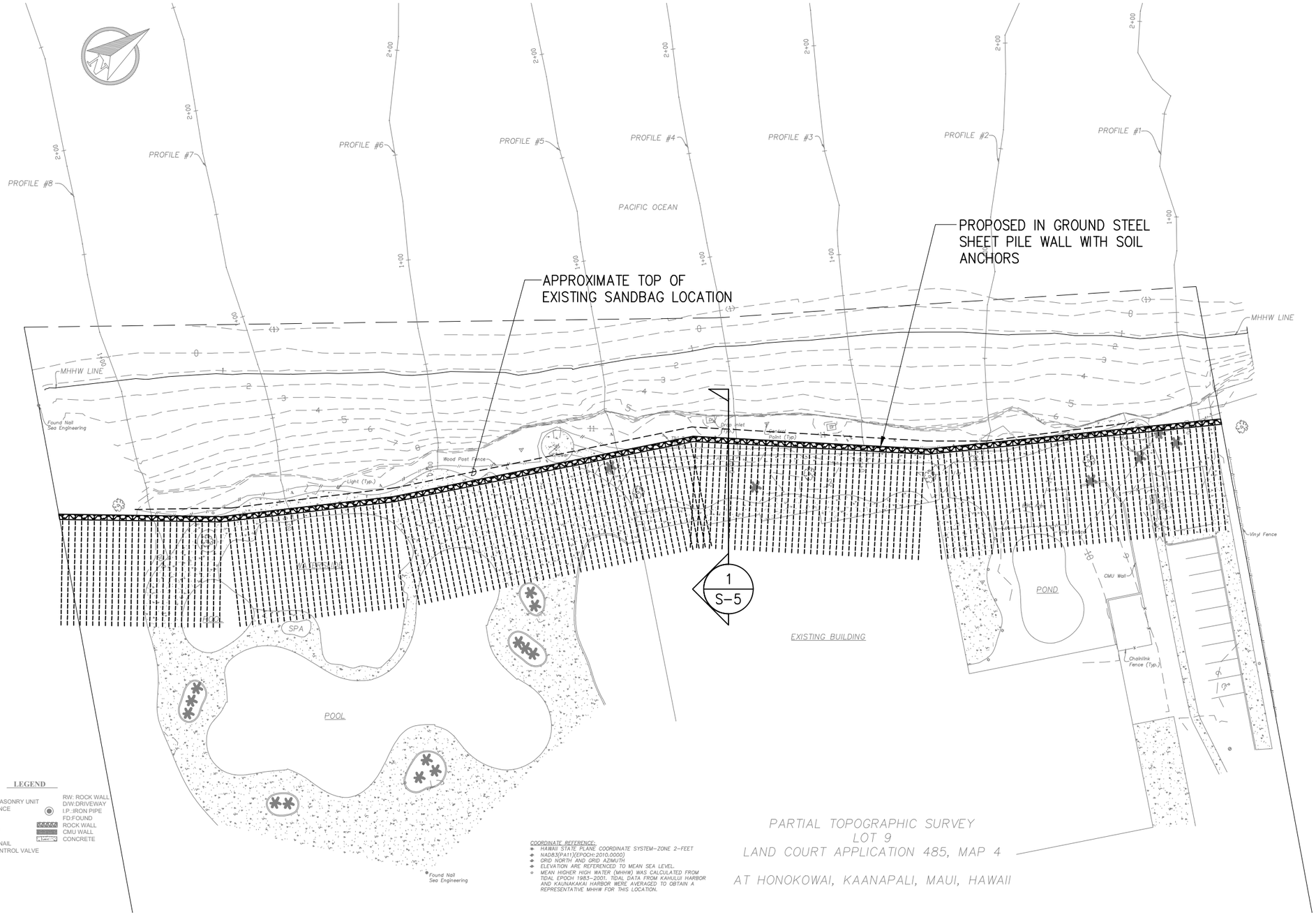
Phone: (808) 488-7579
Fax: (808) 488-7818
E-Mail: mke@mkellc.com

KAANAPALI BEACH CLUB
SEAWALL ASSESSMENT

OPTION 1A – PARTIAL SITE PLAN – IN GROUND WALL AT BUILDING

Date	SEPT 2019
Scale	AS NOTED
Project No.	2397
Drawn	DL
Sheet No.	S-1
Sheet	1 of 5

Plotted: Sep 27, 2019 2:40pm



OPTION 1B – PARTIAL SITE PLAN – IN GROUND WALL AT SHORELINE

SCALE: 1" = 50'

MKE ASSOCIATES LLC
Structural Engineers

Aiea Commercial Center
Suite 205
99-205 Moanalua Road
Aiea, HI 96701

Phone: (808) 488-7579
Fax: (808) 488-7818
E-Mail: mke@mkellc.com

KAANAPALI BEACH CLUB SEAWALL ASSESSMENT

OPTION 1B – PARTIAL SITE PLAN – IN GROUND WALL AT SHORELINE

Date SEPT 2019

Scale AS NOTED

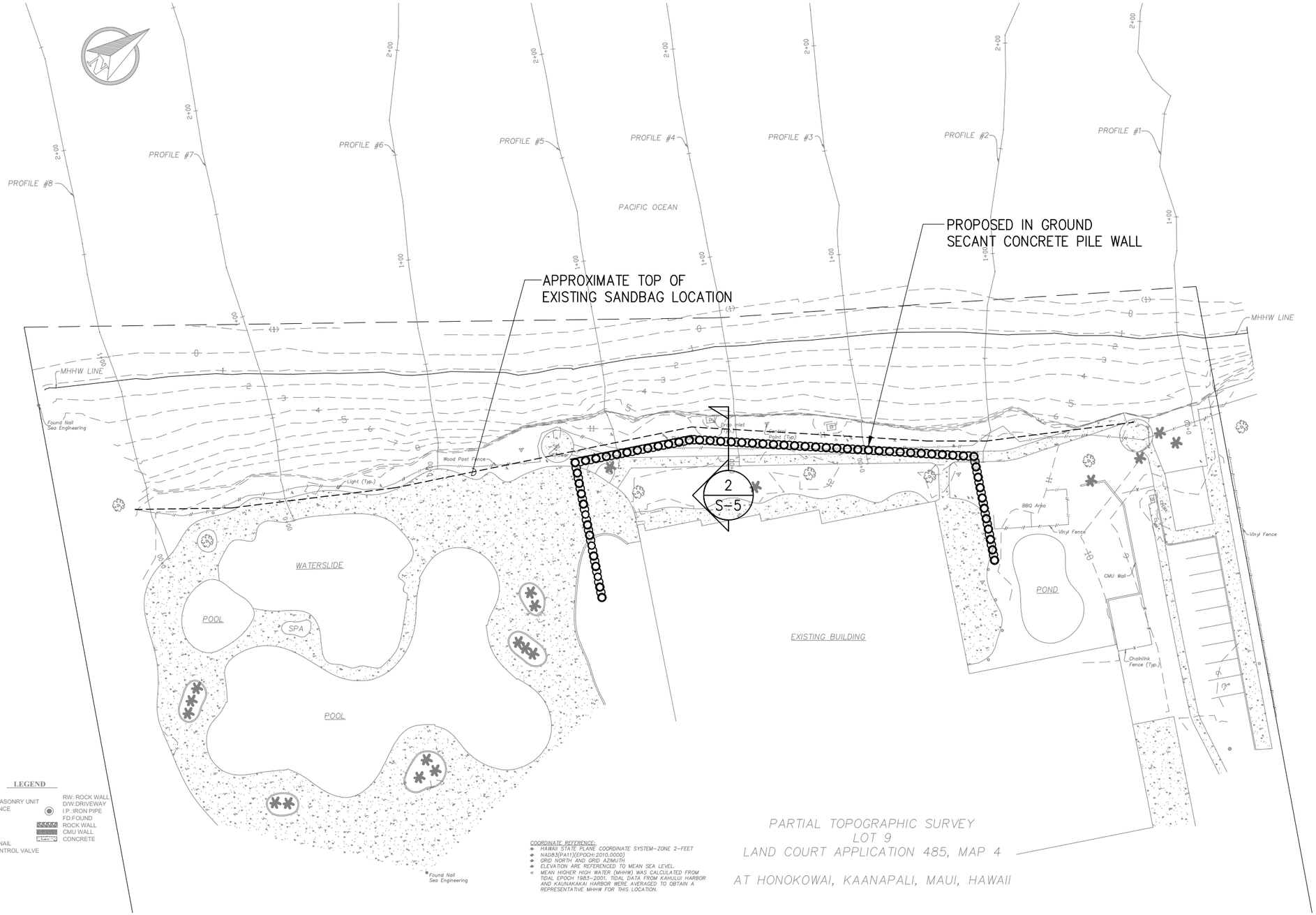
Project No. 2397

Drawn DL

Sheet No.

S-2

Added Sep 27, 2019 2:20pm



LEGEND

CMU.: CONCRETE MASONRY UNIT	RW: ROCK WALL
CLF: CHAIN LINK FENCE	DW:DRIVEWAY
WF: WOOD FENCE	I.P.:IRON PIPE
VF: VINYL FENCE	FD:FOUND
EBX: ELECTRIC BOX	ROCK WALL
PP: POWER POLE	CMU WALL
MAG: MAGNETIZED NAIL	CONCRETE
ICV: IRRIGATION CONTROL VALVE	
WM: WATER METER	

COORDINATE REFERENCE:
- HAWAII STATE PLANE COORDINATE SYSTEM-ZONE 2-FEET
- NAD83(PA11)(EPOCH:2010.0000)
- GRID NORTH AND GRID AZIMUTH
- ELEVATION ARE REFERENCED TO MEAN SEA LEVEL.
- MEAN HIGHER HIGH WATER (MHHW) WAS CALCULATED FROM TIDAL EPOCH 1983-2001. TIDAL DATA FROM KAHULUI HARBOR AND KAUNAKAKAI HARBOR WERE AVERAGED TO OBTAIN A REPRESENTATIVE MHHW FOR THIS LOCATION.

PARTIAL TOPOGRAPHIC SURVEY
LOT 9
LAND COURT APPLICATION 485, MAP 4

AT HONOKOWAI, KAANAPALI, MAUI, HAWAII

TMK(2) 4-4-001-098

OPTION 2A – PARTIAL SITE PLAN – IN GROUND WALL AT BUILDING

SCALE: 1" = 50'

1" = 50' 50 0 50 100
SCALE IN FEET

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KAANAPALI BEACH CLUB
SEAWALL ASSESSMENT

OPTION 2A – PARTIAL SITE PLAN – IN GROUND WALL AT BUILDING

Date SEPT 2019

Scale AS NOTED

Project No. 2397

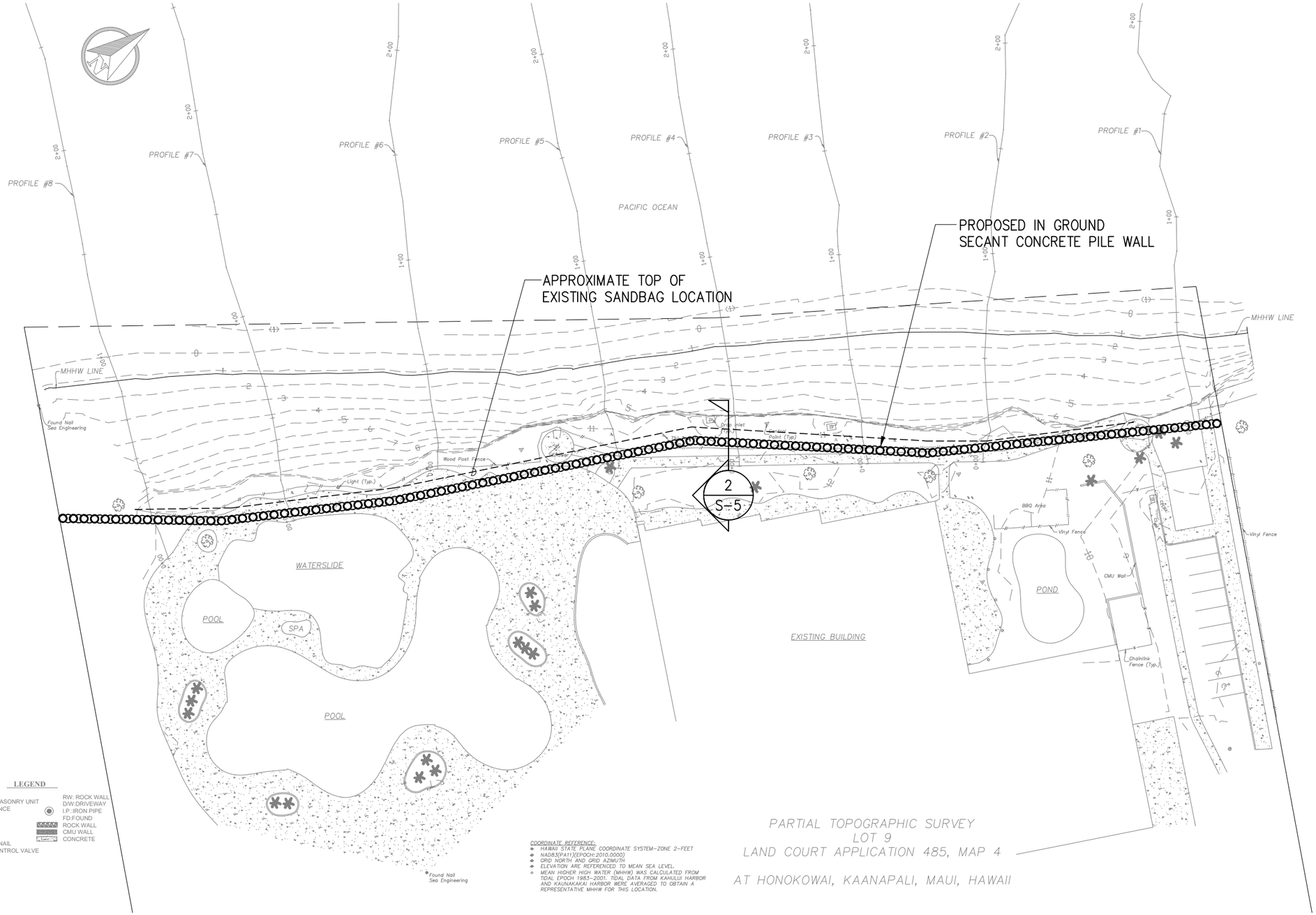
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Sheet 3 of 5

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PARTIAL TOPOGRAPHIC SURVEY
LOT 9
LAND COURT APPLICATION 485, MAP 4

AT HONOKOWAI, KAANAPALI, MAUI, HAWAII

TMK(2) 4-4-001-098

OPTION 2B – PARTIAL SITE PLAN – IN GROUND WALL AT SHORELINE

SCALE: 1" = 50'

1" = 50'

50 0 50 100

SCALE IN FEET

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SEAWALL ASSESSMENT

OPTION 2B – PARTIAL SITE PLAN – IN GROUND WALL AT SHORELINE

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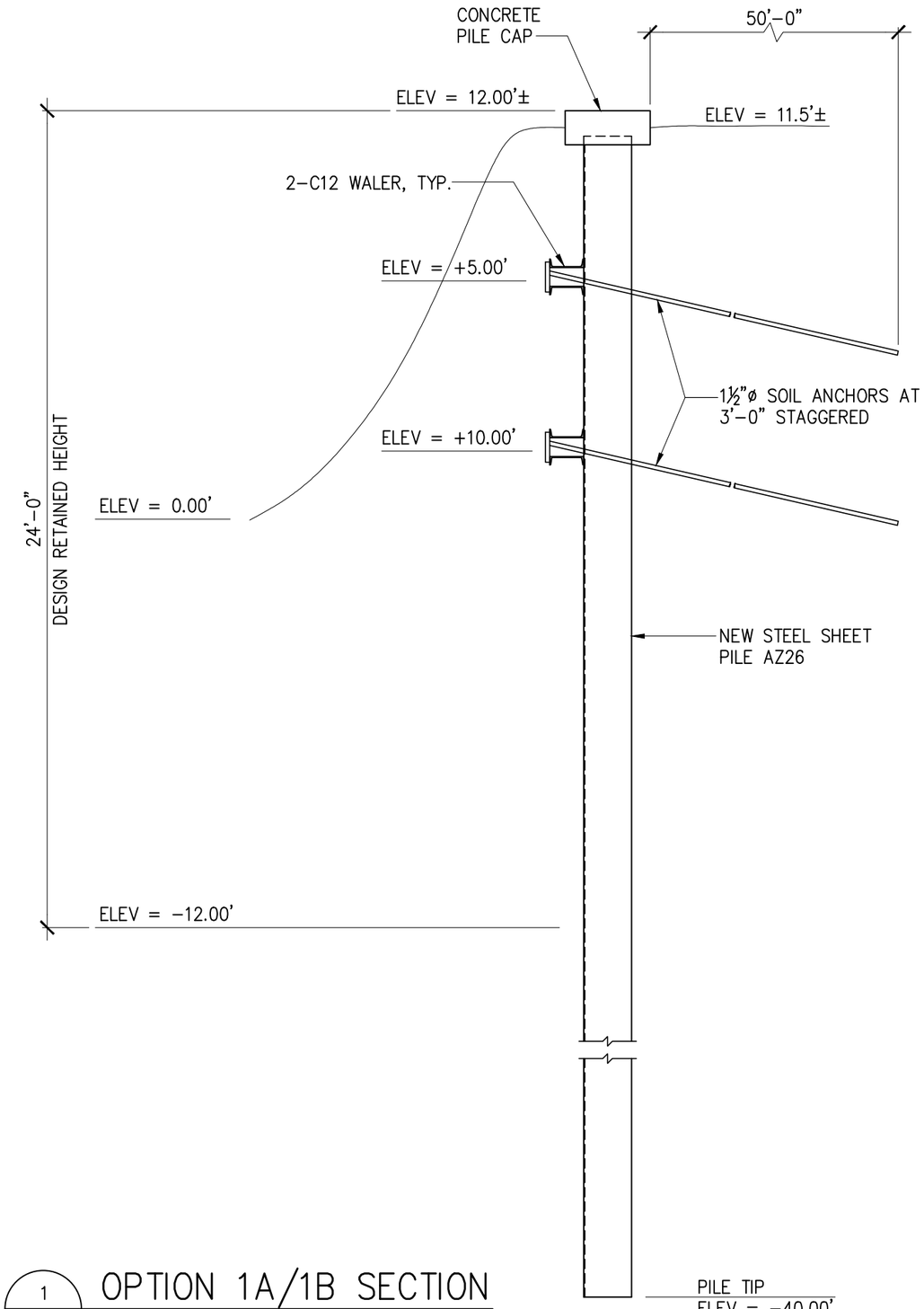
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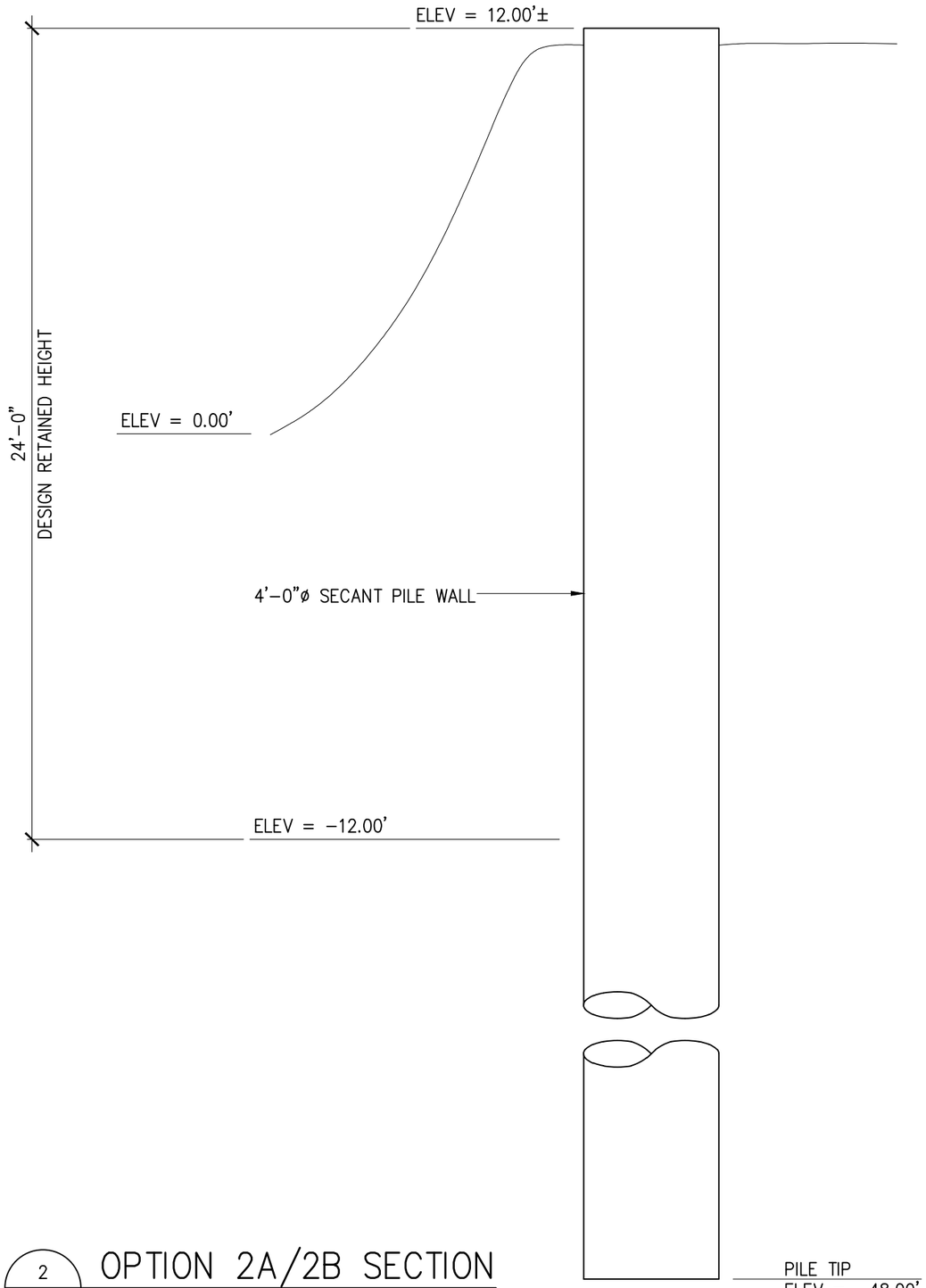
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1 S–5 OPTION 1A/1B SECTION

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2 S–5 OPTION 2A/2B SECTION

SCALE: 1/4" = 1'–0"

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KAANAPALI BEACH CLUB
SEAWALL ASSESSMENT

SECTIONS

Date SEPT 2019

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Project No. 2397

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APPENDIX D

Sand Source Investigations Report

Hoʻāla Honokōwai
Lahaina, Maui, Hawaiʻi
Tax Map Key Nos. (2) 4-4-001:097, 098, and 100

Prepared By: Sea Engineering, Inc.

Sand Source Investigations Report

Hoʻala Honokōwai

Honokōwai, Maui, Hawai'i

September 2025



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1. INTRODUCTION

1.1 Background

The Project Site, Honokōwai Beach, is located north of Kā'anapali and south of Kahana Bay on the west coast of the island of Maui (Figure 1-1). The beach supports a wide range of cultural and recreational uses and is a popular destination for beach goers, shoreline fisherman, spear fishers, divers, snorkelers, swimmers, surfers, and paddlers.

Honokōwai Beach is located at the southern end of the Honokōwai littoral cell[1], which extends from Honokōwai Point north to Kahana Bay and spans approximately 6,200 linear feet (lf) (1.15 miles (mi) of shoreline. The Project Site is located where the shoreline transitions from predominantly sandy beaches, dunes, and unarmored shoreline (south of Honokōwai Point) to predominantly rocky or armored shoreline (north of Honokōwai Point) and consists of 1,000 lf of shoreline that is fronted by a sandy beach, locally referred to as Honokōwai Beach (Figure 1-2).

In 2016, a combination of persistent North Pacific swell and elevated water levels produced high waves, strong currents, and abnormally high tides that caused significant erosion and beach loss that dramatically altered the configuration and appearance of Honokōwai Beach. The erosion and beach loss that occurred in 2016 caused extensive environmental damage and negatively impacted the range of beneficial uses of Honokōwai Beach. The erosion caused substantial beach loss, structural damage, and created risks to public health, safety, and welfare, and impeded access to and along the shoreline. The erosion and discharge of alluvial material (i.e., clay, dirt, and boulders) from the backshore caused the formation of large turbidity plumes that negatively impacted water quality.

West Maui Resort Partners, LP (WMRP) is proposing to restore and preserve Honokōwai Beach. The objectives of the Ho'āla Honokōwai project are to:

- Restore beach width and improve beach stability;
- Preserve and enhance cultural and shoreline access;
- Increase resilience to coastal hazards and sea level rise; and
- Enable planning for long-term adaptation to sea level rise.

It is anticipated that restoring Honokōwai Beach and preventing further erosion of the backshore would have a positive net beneficial impact on the environment, including preserving the beach and improving water quality. It is also anticipated that beach restoration would help to preserve and enhance the fundamental character of Honokōwai Beach by maintaining shoreline access and supporting existing uses along the shoreline.

The purpose of this study is to investigate and characterize terrestrial, nearshore, and offshore sand sources to identify a suitable sand source to support beach restoration at Honokōwai Beach.

[1] "Littoral Cell" is a coastal compartment that contains a complete cycle of sedimentation including sediment sources, transport paths, and sinks.



Figure 1-1. Aerial photographs of the Project Site (Google Earth)





Figure 1-2. Oblique aerial photographs of the Project Site (06/07/2024)

2. POTENTIAL SAND SOURCES

Beach restoration typically requires a sufficient volume of sand that is similar in character to the existing beach sand. A suitable sand source is needed to support beach restoration at Honokōwai Beach. While sand may seem like a plentiful commodity, beach quality sand is in limited supply in the Hawaiian Islands. There are typically three potential sources of beach quality sand available to support beach restoration: 1) inland dune sand, 2) nearshore sand, and 3) offshore sand. Potential sources of sand must be carefully evaluated in terms of quality, quantity, cost, and feasibility.

2.1 Terrestrial Sand Sources

Terrestrial sand sources refer to those that are found on land or underground. Terrestrial sand from commercial quarries has previously been used for beach restoration purposes on the islands of O'ahu and Maui. Previous beach restoration projects on Maui have used inland grade "A" dune sand that was, for several few decades, commercially available as a result of excavation operations in the Maui Lani area in central Maui. Grade "A" dune sand has previously been used for beach restoration projects at Pā'ia (Figure 2-1), Mā'alaea, Kīhei and Spreckelsville. Though dune sand is primarily marine (carbonate) in origin, some projects using inland dune sand have been required to process (e.g., screen or wash) the sand to remove clay, silt, and organic material before it may be used for beach nourishment, at significant added cost.

In 2006, the County of Maui commissioned a study to assess the existing inventory of dune sand on Maui. The study concluded that available inventories of dune sand may last for another five or six years based upon usage rates at the time (SSFM International Inc., 2006). In January 2018, the County of Maui implemented a moratorium[2] on the mining of Maui inland dune sand in central Maui. The purpose of the moratorium was to allow sufficient time to conduct an updated sand inventory study and establish regulations to preserve existing sand resources and prevent the disturbance of iwi kūpuna (ancestral bones). While the moratorium was a temporary measure, inland dune sand is no longer commercially available on Maui. Due to the lack of availability of high-quality inland sand resources, it is anticipated that sand used for future beach restoration projects on Maui will have to come from offshore resources (SSFM International, Inc., 2018).

[2] https://www.mauicounty.gov/DocumentCenter/View/111441/Ord-4804



Figure 2-1. Beach nourishment using terrestrial sand at Pā'ia, Maui (2016)



Figure 2-2. Excavation of inland dune sand at Maui Lani (The Sierra Club)

SE evaluated several terrestrial sand sources to determine if the sand would be compatible with the existing beach sand at Honokōwai Beach. Terrestrial sand samples were collected from commercial sources in Wailuku, Maui and Wai'anae, O'ahu. A grain size analysis was performed found that the terrestrial sand was too fine to be suitable for beach restoration purposes at Honokōwai Beach.

Class A Maui Dune Sand

SE previously analyzed samples of Class A dune sand that was commercially available through HC&D (formerly Ameron) on Maui. The grain size comparison for the Class A dune sand and the existing beach sand is shown in Figure 2-3. Class A dune sand is within ±20% of the existing beach sand and complies with the DLNR guidelines for beach nourishment. However, as previously discussed, this sand source has not been available for purchase on Maui since 2017.

Waiehu, Maui

SE previously analyzed sand samples that were obtained from a sand stockpile located in Waiehu, Maui. The sand stockpile was owned by a private individual and contained an estimated 3,500 cy of sand. The grain size comparison for the Waiehu sand and the existing beach sand is shown in Figure 2-4. The Waiehu sand was found to be significantly finer than the existing beach sand and did not comply with the DLNR guidelines for beach nourishment. The volume of sand available was also not sufficient to support beach restoration at Honokōwai Beach.

Wailuku, Maui

SE previously analyzed sand samples that were obtained from a sand stockpile located in Wailuku, Maui. The sand stockpile was owned by a private contractor and contained an estimated 5,000 cy of sand. The Wailuku sand was available as unscreened and unwashed, or screened and washed. The grain size comparison for the screened and washed Wailuku sand and the existing beach sand is shown in Figure 2-5. The Waiehu sand was found to be significantly finer than the existing beach sand and did not comply with the DLNR guidelines for beach nourishment. The volume of sand available was also not sufficient to support beach restoration at Honokōwai Beach.

Wai'anae, Oahu

SE recently analyzed sand samples that were obtained from Pacific Aggregate, a commercial quarry located in Wai'anae, O'ahu. The sand is actively being excavated from relic inshore beach and reef deposits and has been utilized for several small-scale beach nourishment beach projects in Hawai'i. The grain size comparison for the Pacific Aggregate sand and the existing beach sand is shown in Figure 2-6. The Pacific Aggregate sand is coarser than the existing beach sand but complies with the DLNR guidelines for beach nourishment. However, the volume of sand currently available is unconfirmed and may not be sufficient to support beach restoration at Honokōwai Beach.

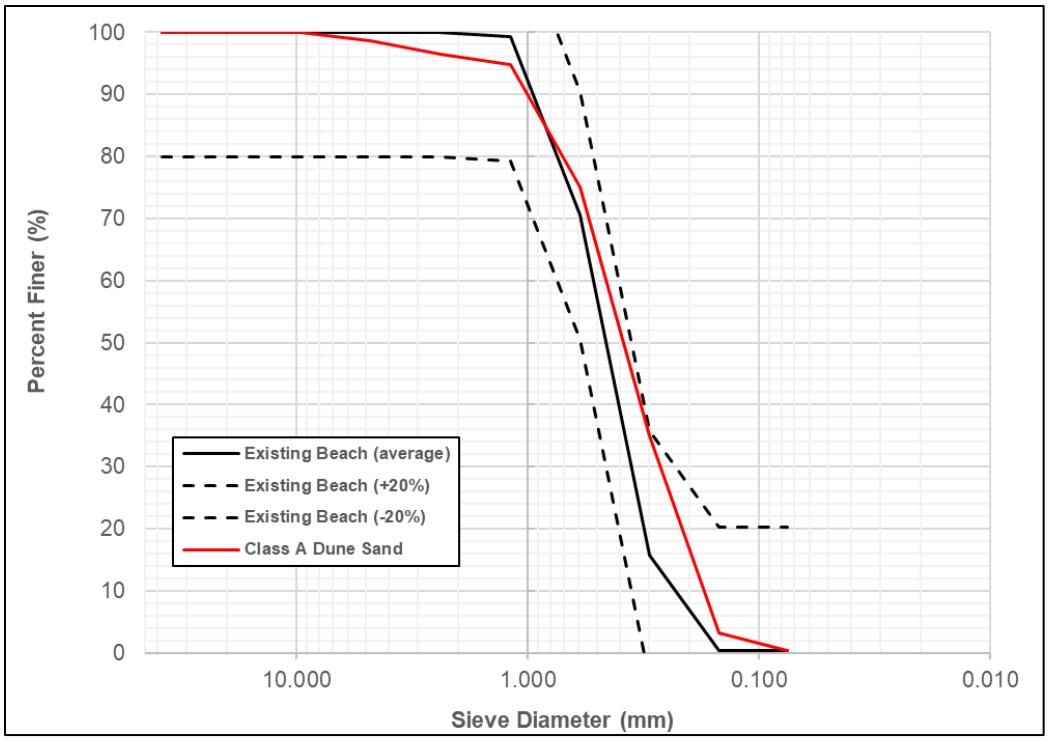


Figure 2-3 Grain size comparison for HC&D Class A dune sand and existing beach sand.

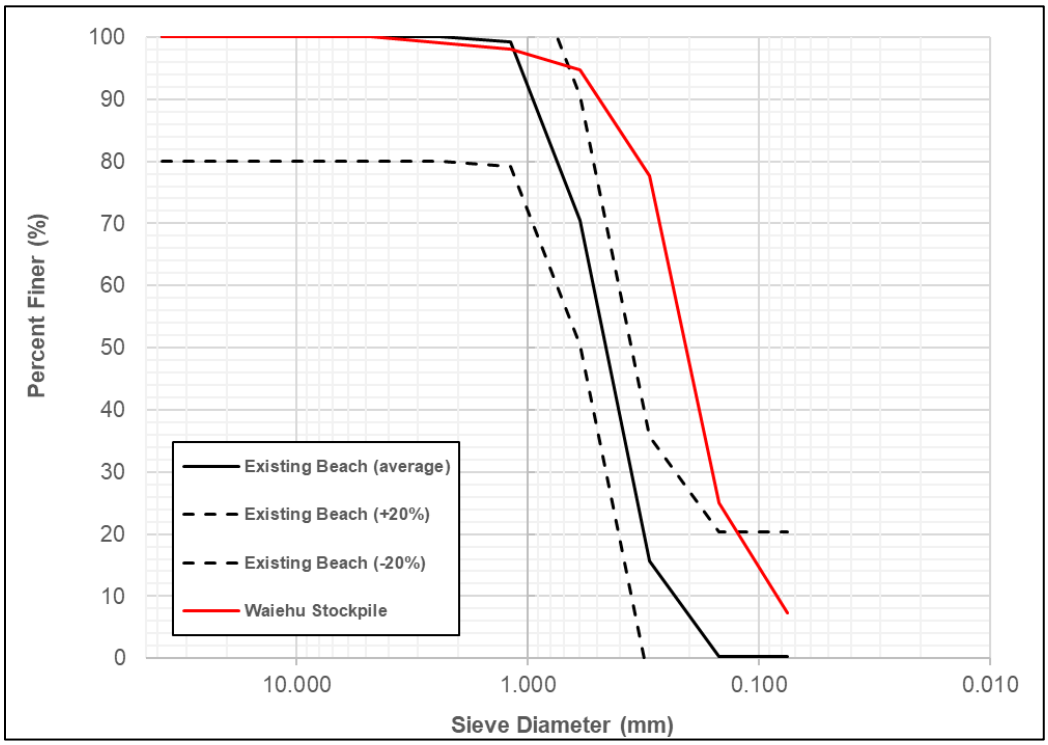


Figure 2-4 Grain size comparison for Waiehu sand and existing beach sand.

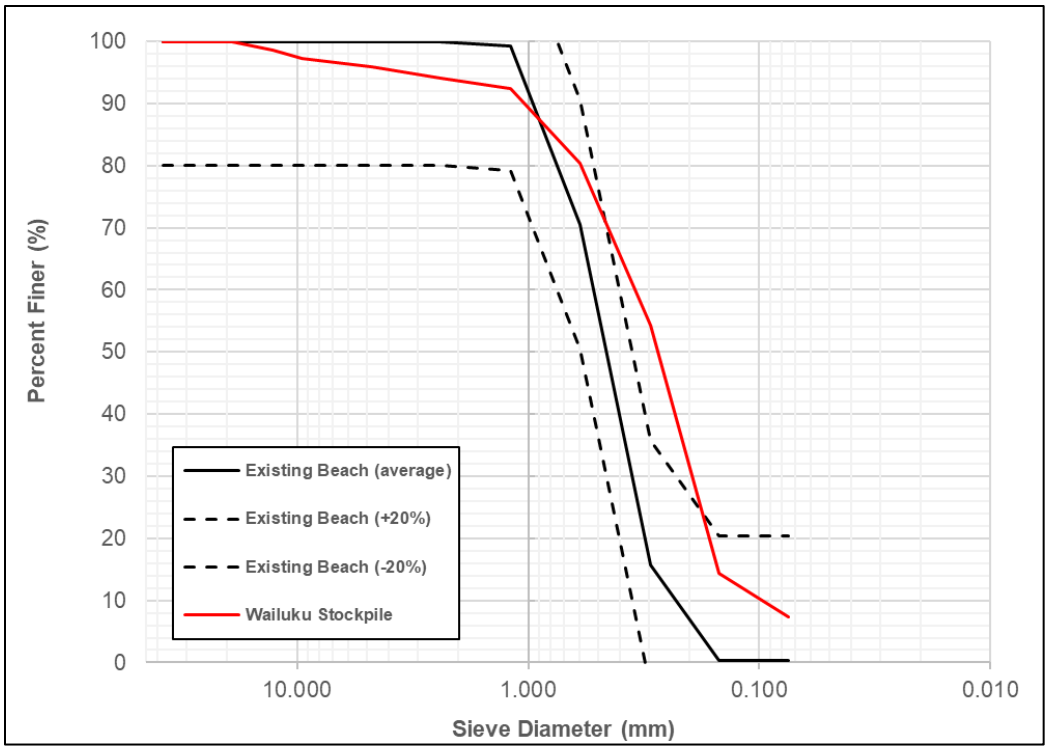


Figure 2-5 Grain size comparison for Wailuku sand and existing beach sand.

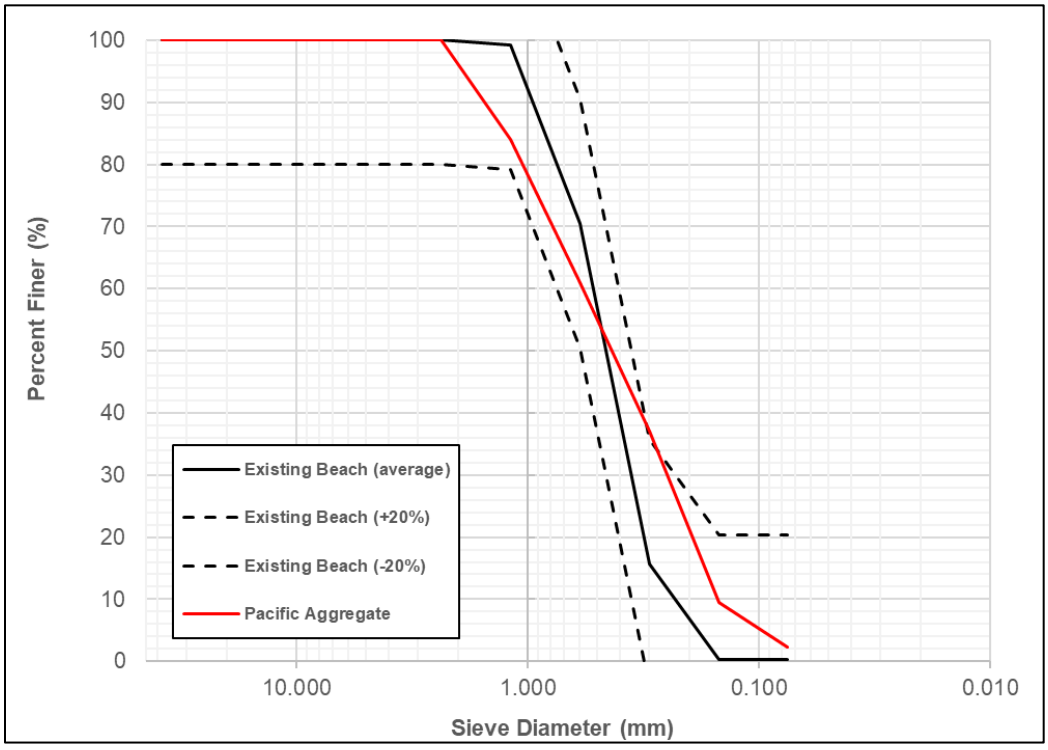


Figure 2-6 Grain size comparison for Pacific Aggregate sand and existing beach sand.

2.2 Nearshore Sand Sources

Nearshore sand sources typically consist of sand deposits that are located in the ocean in relatively shallow waters in close proximity to the shoreline. In some cases, nearshore sand can provide a convenient and cost-effective sand source for beach restoration and/or beach maintenance projects. However, nearshore sand deposits are often thin, and the volume of sand volume can be relatively small. Nearshore sand deposits can also be difficult to recover through mechanical dredging due to the shallow water depths. While small-scale dredge systems are commercially available, these systems are typically expensive and less efficient than larger-scale dredging equipment. Nearshore sand has previously been used for beach restoration and beach maintenance purposes on the island of O'ahu (Figure 2-7). Additional nearshore sand sources are currently being investigated to potentially support future beach maintenance activities in Waikīkī, O'ahu.

SE investigated the channel fronting the Project Site as a potential nearshore sand source to support beach restoration at Honokōwai Beach. SE divers conducted snorkel and SCUBA reconnaissance to observe conditions in the channel (Figure 2-8). The inner channel, within approximately 1,000 ft of the shoreline, was predominantly rocky with a thin veneer of sand. The outer channel, extending approximately 1,000 to 1,500 ft from the shoreline, was predominantly sandy but interspersed with rock and coral outcrops, which would make sand recovery challenging. The outer channel is also bordered by a robust coral reef with a relatively shallow reef crest. The channel is very narrow and is therefore unlikely to contain an adequate volume of sand to support beach restoration at Honokōwai Beach. Additional information about the channel and the surrounding near-shore environment is provided in Section 7.1.

SE also investigated the barrier beach at the mouth of Honokōwai Stream (Figure 2-9). Based on a review of aerial photographs, the barrier beach is a dynamic but relatively permanent feature that is constantly changing in response to waves, currents, sea levels, and stream flow. The barrier beach is occasionally breached during heavy rain events but typically reforms relatively quickly. The barrier beach prevents Honokōwai Stream from discharging into the ocean. As a result, sediment and debris accumulate at the stream mouth, and algal blooms have also been observed in the lower reaches of the stream.

While the dimensions of the barrier beach are constantly changing, SE estimates that approximately 500 cy of sand is typically present in the stream mouth. This sand is part of the natural beach system at Honokōwai Beach and could therefore potentially be used for beach maintenance purposes. Clearing sand from stream mouths is an identified land use in the Conservation District, provided that the sand is placed on adjacent shoreline areas and would not result in significant turbidity. Clearing sand from the mouth of Honokōwai Stream could potentially help to restore stream flow and prevent the accumulation of sediment and debris in the stream channel.



Figure 2-7. Beach maintenance using nearshore sand at Ko Olina, O'ahu

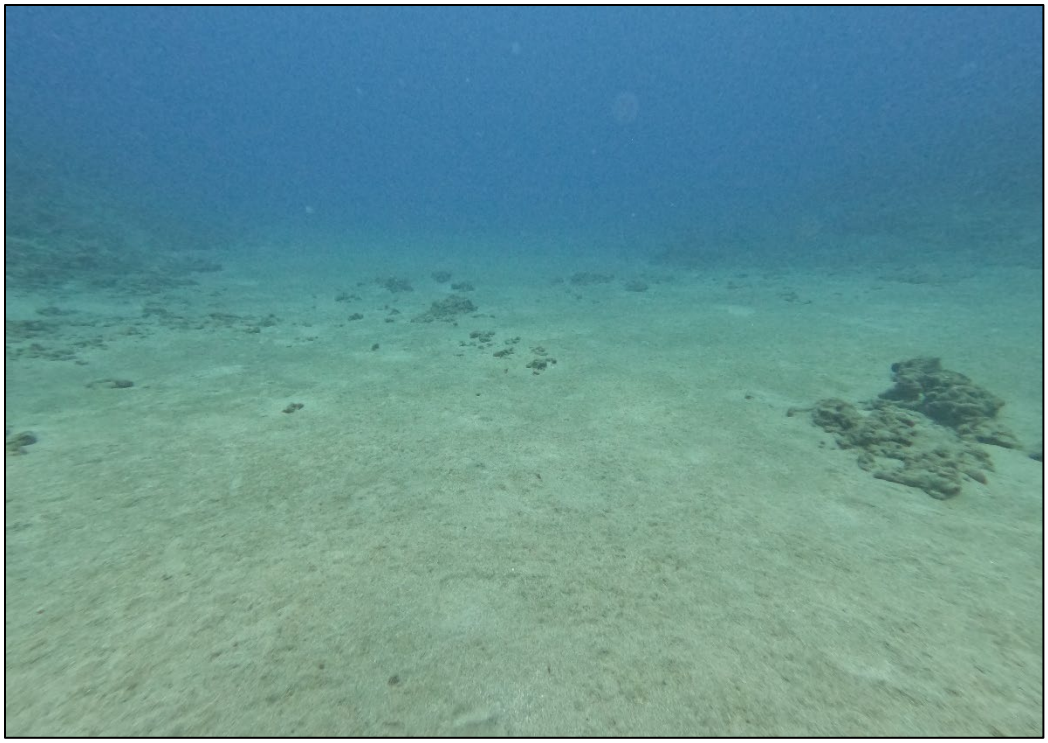


Figure 2-8. Representative photograph of seafloor conditions in the nearshore channel (5/28/2024)



Figure 2-9. Typical conditions at the mouth of Honokōwai Stream (06/07/2024)

2.3 Offshore Sand Sources

Offshore sand deposits present an alternative source of sand for beach restoration, particularly when considering the limited availability of suitable, natural sand from terrestrial and nearshore sources. Offshore sand deposits occurring within the same littoral cell tend to have grain size characteristics and compositions that are similar to the existing beach sand. Color and abrasion resistance are also important characteristics of beach fill sand. While natural calcareous beaches range in color from light brown to white, sand in offshore deposits often turns a grayish color as a result of anaerobic conditions typically produced by a lack of wave action and/or accumulation of organic material. Potential offshore sand sources require exploration using marine geophysical survey techniques to characterize deposit area and volume, and extensive sampling and analysis to ensure that grain size characteristics are suitable for beach restoration purposes.

SE completed detailed offshore sand investigations to identify a suitable sand source to support beach restoration at Honokōwai Beach. SE also performed a desktop analysis to evaluate the results of previous offshore investigations performed by SE and others. The study area was determined based on a combination of aerial imagery, previous sand investigations (SE, 1994, 2001, 2006; 2007, 2017, 2018; 2008 & Moffatt & Nichol, 2016), benthic habitat mapping (NOAA, 2007 & USACE, 2014), and side scan sonar (USGS, 2012).

3. PREVIOUS SAND INVESTIGATIONS

In October 2019, SE conducted preliminary offshore sand investigations. The study area spanned approximately 6.5 mi of coastline extending from Kā'anapali to Napili Bay in West Maui. Six (6) offshore sand deposits were investigated, all of which are within approximately 3.5 mi of the Project Site (Figure 3-1). This study also evaluated previous offshore sand investigations that were conducted at Kahana Bay (Moffatt & Nichol, 2016).

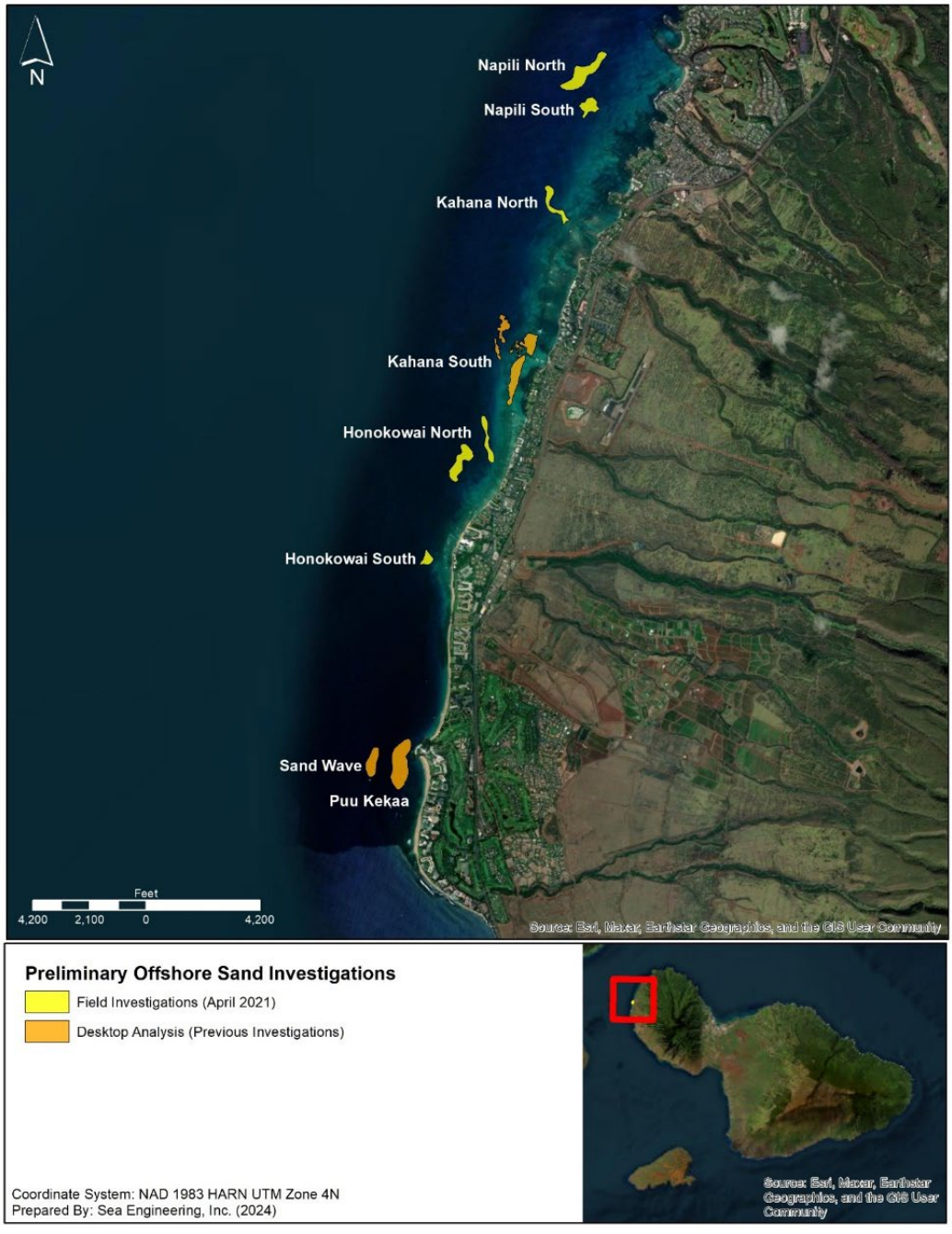


Figure 3-1. Study area for preliminary offshore sand investigations.

3.1 Methods

The offshore sand source investigations included:

- Side scan survey to locate sand deposits and evaluate seafloor conditions.
- Air jet probing to measure sand thickness at selected locations.
- Push coring to collect composite sand samples at selected locations.
- Grain size analysis and photographic analysis of composite sand samples.
- Calculation of overfill ratios based on grain size distributions.

3.1.1 *Jet Probing*

Air jet probing is used to acquire indirect physical information on subsurface lithology by surveying the thickness and stratigraphic layering of marine sediments. It provides a rapid means for determining the nature of unconsolidated sedimentary deposits. Air jet probing can also help to differentiate layers of materials that are present below the surface of the seafloor. The air jet probe consists of an eight-foot length of pipe connected to a scuba tank by a flexible hose. A diver jets the pipe vertically into the sand deposit until "refusal" is encountered or the end of the probe is reached. The refusal can be described as hard, crunchy, or soft; hard indicates a solid bottom, crunchy indicates a cobble or gravel layer, and soft indicates that the hole is collapsing and seizing the pipe or that there is insufficient hose to penetrate further. Scuba divers used an air jet probe to measure sand thickness (Figure 3-2). Fourteen (14) air jet probe measurements were taken, with probe depths ranging from 0.5 to 8 feet (Table 3-1). Jet probing was limited to sites with water depths less than 100 ft.

3.1.2 *Push Coring*

Push core samples are a cost-effective means of recovering relatively undisturbed cores to assess the composition, stratigraphy, and grain sizes of the sand. The push core consists of a threaded pipe connected to a plastic core tube (barrel). The push core is positioned vertically, and a sliding weight is used to pound the barrel through the sandy substrate. A one-way valve at the head of the core assembly creates a vacuum upon retrieval of the core barrel and sediment, which retains the sediment during extraction. Composite samples are collected by taking equal quantities of sand from the upper, middle, and lower sections of each core tube. Scuba divers used a push core to collect composite sand samples (Figure 3-3). Fourteen (14) push core samples were collected, with core depths ranging from 1.2 to 3.0 feet (Table 3-1). Push coring was limited to sites with water depths less than 100 ft.



Figure 3-2 Diver-operated air jet probe.



Figure 3-3 Diver-operated push core.

Table 3-1 Summary of jet probe and push core measurements

Deposit	Sample	Water Depth (feet)	Probe Depth (feet)	Core Depth (feet)
North Honokōwai	1.1	48	4.0	1.5
North Honokōwai	1.2	40	3.0	1.5
North Honokōwai	1.3	41	4.0	1.5
North Honokōwai	1.4	46	4.0	1.3
North Honokōwai	1.5	47	8.0	1.3
North Honokōwai	1.6	54	5.5	1.2
North Honokōwai	1.7	50	4.0	3.0
South Honokōwai	2.1	33	8.0	1.7
South Honokōwai	2.2	32	8.0	1.4
South Honokōwai	2.3	30	8.0	1.8
South Honokōwai	2.4	39	8.0	1.9
South Honokōwai	2.5	31	8.0	1.5
North Kahana	4.5	42	7.0	1.1
Napili	5.2	49	7.5	1.0

3.1.3 *Grain Size Analysis*

The Hawai'i Department of Land and Natural Resources (DLNR) beach nourishment guidelines specify that fill sand used to nourish a beach must meet several specific requirements:

- Sand shall contain not more than 6% silt material (grain size smaller than 0.074 mm).
- Sand shall contain not more than 10% coarse material (grain size greater than 4.76 mm).
- Grain size distribution shall fall within 20% of the existing beach grain size distribution.
- Overfill ratio of the fill sand to existing sand shall not exceed 1.50.
- Sand shall be free of contaminants such as silt, clay, sludge, organic matter, turbidity, grease, pollutants, and others.
- Sand shall be primarily composed of naturally occurring carbonate beach or dune sand.

The majority of the current fill sand requirements are related to grain size. To ascertain the grain size characteristics, a sieve analysis is performed, which involves using a mechanical shaker to filter sand samples through a series of sieves of decreasing screen size (diameter). The material captured on each sieve is weighed, which establishes the grain size distribution curves. The median diameter (grain diameter that is finer than 50% of the sample), referred to as D_{50}, is often used by engineers to quantify the grain size of a sample. Similarly, D_5, D_{16}, D_{84}, and D_{95} values are obtained to quantify the range of grain sizes present in a sample known as sorting, σ, defined by:

$$\sigma = \frac{(\phi_{84} - \phi_{16})}{4} + \frac{(\phi_{95} - \phi_5)}{6}$$

where ϕ = -$\log_2$(D in mm). Descriptive sorting values are presented in Table 3-2.

Table 3-2 Sorting value descriptions.

Sorting Range	Description
0.00 – 0.35 Φ	very well sorted
0.35 – 0.50 Φ	well sorted
0.50 – 0.71Φ	moderately well sorted
0.71 – 1.00 Φ	moderately sorted
1.00 – 2.00 Φ	poorly sorted
2.00 – 4.00 Φ	very poorly sorted
> 4.00 Φ	extremely poorly sorted

Six (6) offshore sand samples were analyzed using a standard laboratory sieve technique to determine particle size distribution. For any sediment sample, the percentages of grains that fall within different size classes are determined and used to create a grain size distribution curve like the one that was created for the existing sand in the beach nourishment area.

Grain size distributions of the offshore sand samples were compared with the existing beach (Figure 3-4). The results of the grain size analysis are shown in Figure 3-5 and Table 3-3. In each figure, the results of the grain size analysis use a Log Base 10 scale on the X axis for grain size. The cumulative percentage of grain sizes for each sample is presented on the Y axis. Shown in black in the figures is the average grain size distribution for the existing sand at Honokowai Beach. Also shown in black dashed lines are the ±20% bounds specified in the DLNR beach nourishment guidelines.

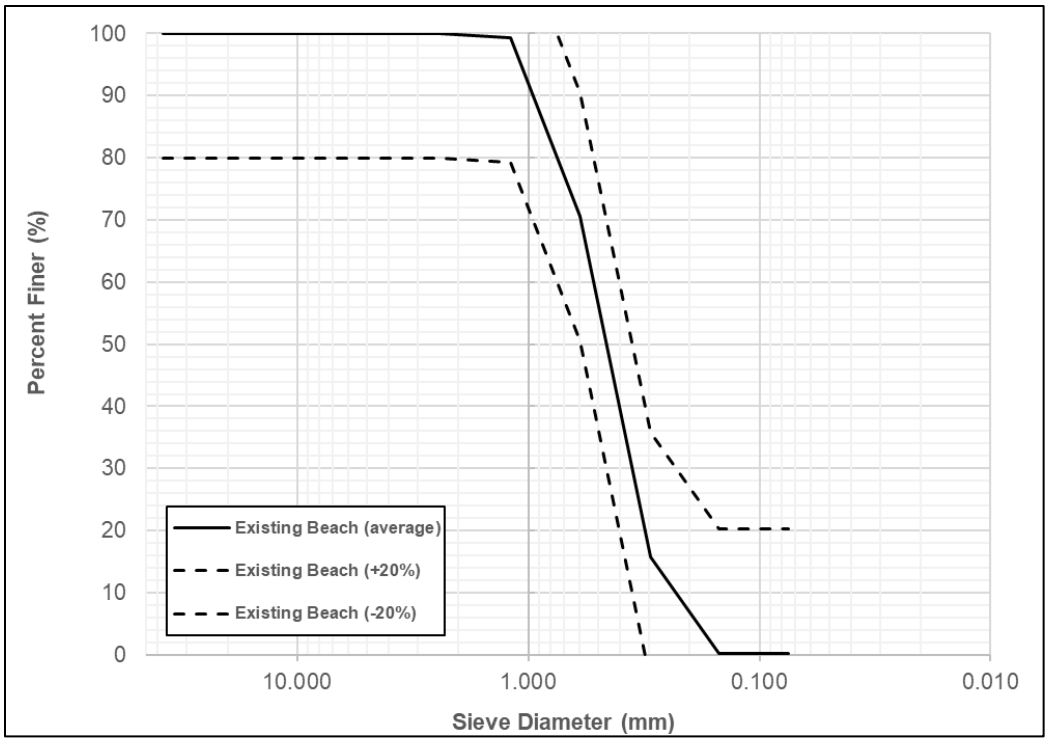


Figure 3-4 Grain size distribution for existing beach sand.

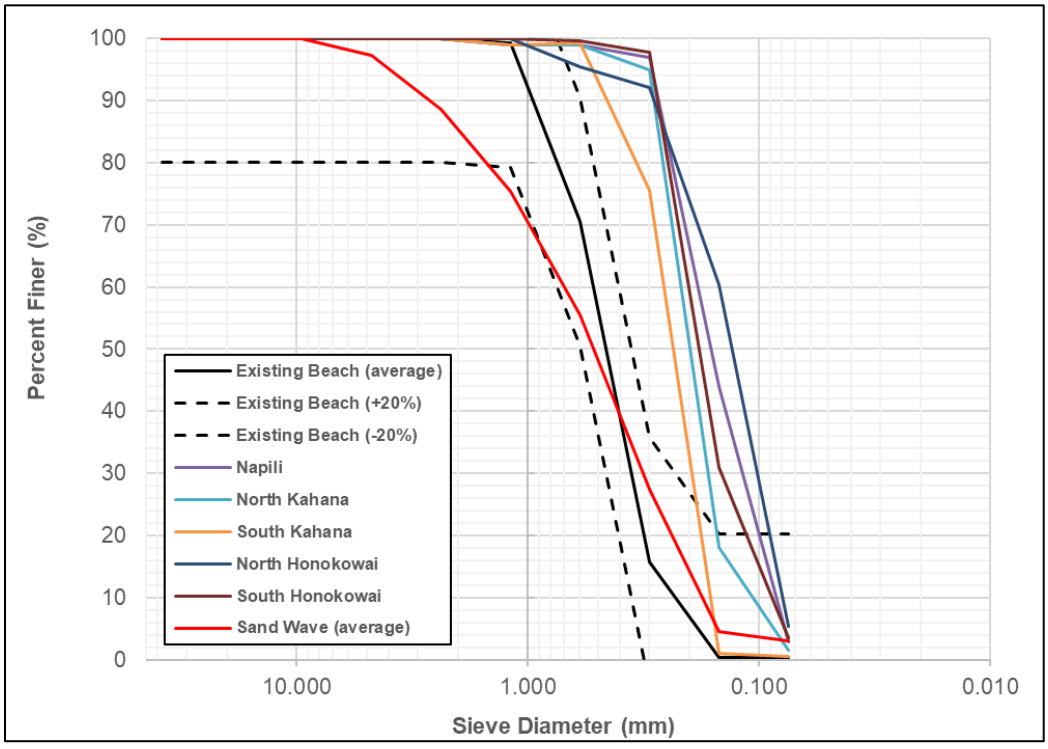


Figure 3-5 Grain size comparison of offshore sand and existing beach sand

Table 3-3 Summary of grain size analysis results

Sieve no.	1/2"	3/8"	#4	#5	#8	#10	#16	#18	#30	#35	#40	#45	#50	#60	#100	#120	#200
Size (mm)	**12.70**	**9.51**	**4.76**	**4.000**	**2.38**	**2.000**	**1.19**	**1.000**	**0.60**	**0.500**	**0.420**	**0.355**	**0.30**	**0.250**	**0.15**	**0.125**	**0.075**
Existing Beach Sand	-	100.0	100.0	-	100.0	-	99.4	-	76.4	-	-	-	18.4	-	0.4	-	0.3
Napili	100.0	100.0	100.0	-	100.0	-	99.0	-	99.0	-	-	-	97.0	-	44.0	-	2.8
North Kahana	-	100.0	100.0	-	100.0	-	99.0	-	99.0	-	-	-	95.0	-	18.0	-	1.6
South Kahana	100.0	100.0	100.0	-	-	99.9	-	-	99.3	-	80.8	-	75.5	-	1.1	-	0.6
North Honokōwai	-	100.0	100.0	-	99.1	-	97.7	-	95.4	-	-	-	92.1	-	60.4	-	5.3
South Honokōwai	-	-	100.0	-	100.0	-	100.0	-	99.6	-	-	-	97.8	-	31.0	-	3.5
Sand Wave	-	-	-	95.5	-	87.4	-	78.5	-	61.2	-	48.0	-	30.7	-	1.7	0.4

3.1.4 *Photographic Analysis*

Carbonate sands range in color from pure white to yellow, brown, and dark grey. Sand color has an important aesthetic value to beachgoers and should not be ignored when selecting an appropriate sand source for beach nourishment. Beyond the aesthetic value, color also affects temperature, as darker sands achieve higher temperatures under intense tropical sunlight than sands of lighter color. A suitable offshore sand source would preferably closely match the color of the existing beach sand.

Figure 3-6 shows a dry color comparison of the offshore sand samples and the existing beach sand at the project. Composite samples were collected from the push cores and dried over the course of several days under direct sunlight. All samples pictured represent a typical color for the locations at which the push core samples were collected. After offshore sand is placed on the beach, the sand may lighten with sustained UV exposure.

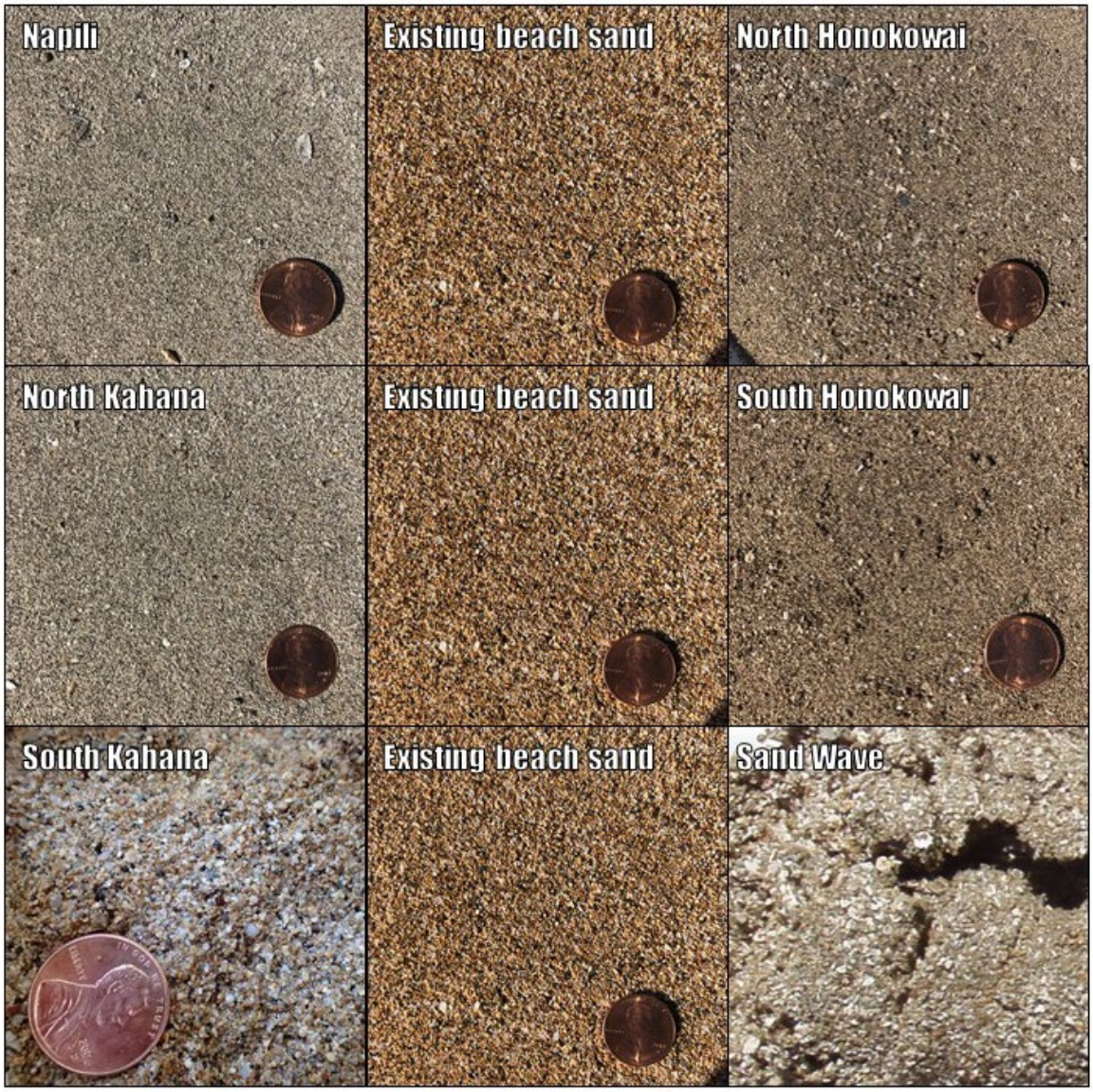


Figure 3-6 Dry photographic comparison of existing beach sand and offshore sand samples.

3.1.5 *Overfill Ratios*

A beach undergoes an adjustment period following nourishment. The beach equilibrium profile is achieved as sand moves cross shore and alongshore and there may be an accompanying decrease in beach volume. This loss of sand is compensated for through an *overfill ratio*, which describes the compatibility of the existing beach and nourishment (borrow) sands and is dependent on the size distributions of the existing and nourishment (borrow) sand.

The overfill ratio provides an estimate for how much material is needed to augment the littoral cell to reach a final residual volume of placed sand. The DLNR guidelines specify that overfill ratios shall not exceed 1.50. The overfill ratio is determined based on the grain size characteristics of the two sands and represents the volume of fill necessary to yield the desired design beach volumes calculated previously. Bodge (2006) developed an expression to calculate overfill factors.

The mean grain size, *M*, and sorting, σ, for the native and borrow sands are calculated as presented in the Coastal Engineering Manual (2006) as

$$M = \frac{(\phi_{16} + \phi_{50} + \phi_{84})}{3}$$

$$\sigma = \frac{(\phi_{84} - \phi_{16})}{4} + \frac{(\phi_{95} - \phi_{5})}{6}$$

The dimensionless grain size difference is calculated as

$$M_b' - M_n' = \frac{M_b - M_n}{\sigma_b}$$

where subscripts *n* and *b* refer to the native and borrow sand, σ_b refers to the sorting value of the borrow material, and the overfill ratio is read from Figure 3-7.

Overfill calculations were performed for the offshore sand deposits using the average grain size distributions of the existing beach sand for comparison. Calculations were completed by comparing the mean diameter of the existing beach sand (M_n) with the mean diameter (M_b) and sorting parameter Sigma (σ_b) of the offshore sand. The result is then applied to the graphs shown in Figure 3-7 to determine the overfill ratio. Table 3-4 displays the results for the overfill ratio analysis for the offshore sand samples. Discussions of the overfill ratios for the specific offshore deposits are presented in later sections; however, it should be noted here that the sand deposits with overfill ratios greater than about 1.5 are considered to be unsuitable for beach restoration at Honokōwai Beach.

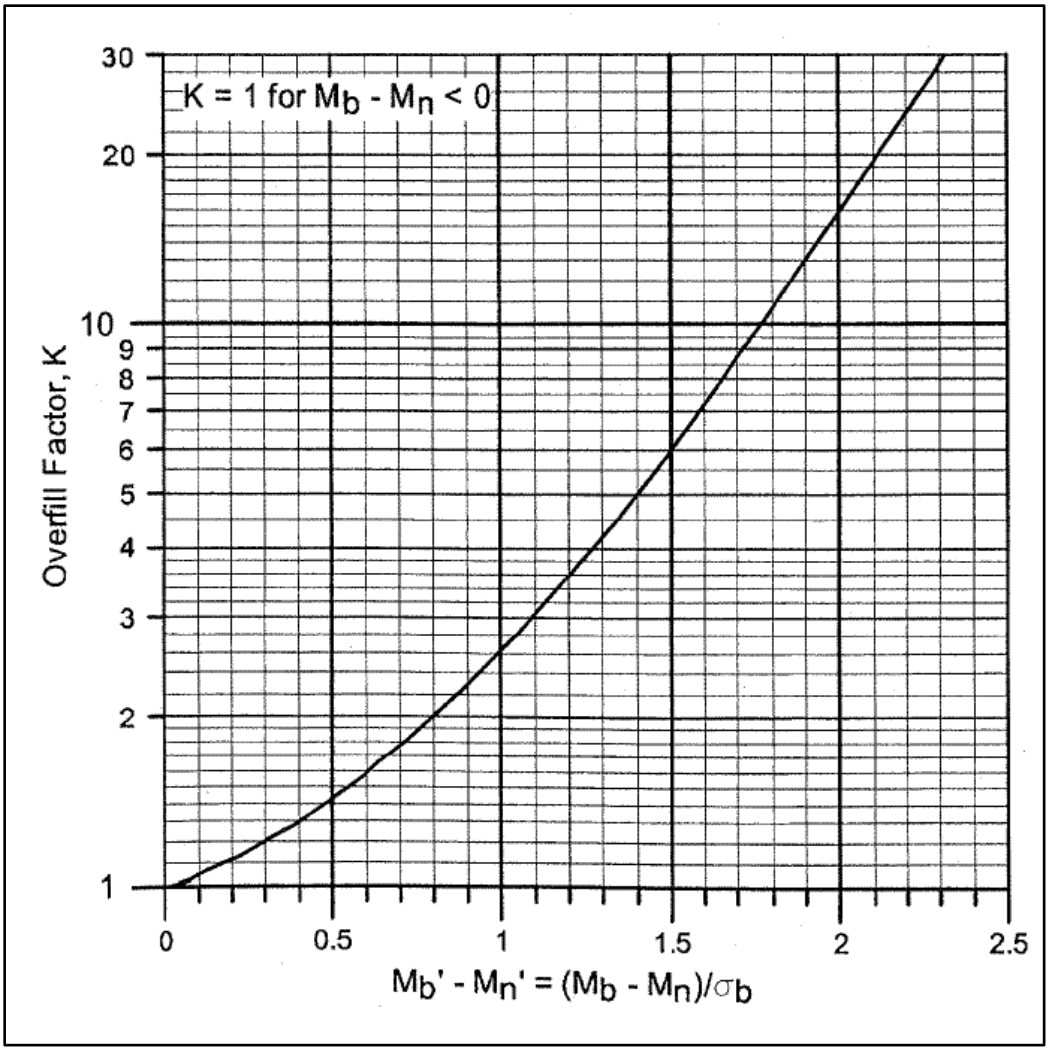


Figure 3-7 Dean's overfill ratio expressed as a single curve (Bodge, 2006)

Table 3-4 Overfill calculations for offshore sand samples.

Site	M_n	M_b	σ_b	M_b' - Mn'	Overfill Factor K
Existing Beach Sand	1.32	-	-	-	-
Reef Runway (1a)	-	1.55	0.81	0.29	1.18
Reef Runway (1b)	-	1.66	0.77	0.44	1.36
Napili	-	2.38	0.57	2.23	24.00
North Kahana	-	2.38	0.54	2.36	28.00
South Kahana	-	1.92	0.58	1.39	5.00
North Honokōwai	-	2.86	0.86	2.04	16.00
North Honokōwai	-	2.52	0.60	2.36	28.00
Sand Wave	-	0.83	1.54	-0.18	1.00

3.2 Results

3.2.1 *Reef Runway (O'ahu)*

SE previously investigated offshore sand resources surrounding the Reef Runway at the Daniel K. Inouye International Airport (HNL) on O'ahu.

SE (1994) performed geophysical testing on a 100-acre site off the west end of the Reef Runway near the Pearl Harbor entrance channel. The project was funded by CEROS for the development of a sub-bottom imaging instrument. Penetration of more than 150 ft into the sand deposit was achieved, along with 12 inches of vertical resolution of geological features. Nine (9) sand samples were obtained along a north-south transect through the middle of the survey area. Two samples toward the north boundary of the study site showed median grain sizes of 0.44 mm and 0.55 mm, while the other samples were in the range of 0.15 mm to 0.31 mm. All samples were moderately to poorly sorted.

SE (2001) performed single-beam and multi-beam bathymetric surveys and sub-bottom profiling offshore of the Reef Runway in support of the recovery of the sunken vessel *Ehime Maru*. The survey area covered about 500 acres seaward of the west end of the runway. The sub-bottom profiling showed that sand thickness within much of the survey area was up to about 20 ft thick, while two areas that overlapped the CEROS survey area were found to exceed 30 ft in thickness.

SE (2017) identified several patch reefs within the larger survey area. Divers and underwater video cameras were deployed to ground-truth the sub-bottom data and identify larger patches of sand for additional geophysical investigations. Vibracoring targeted a patch of sand identified from the sub-bottom profiling as being as much as 40 ft thick. This deposit was referred to as *Reef Runway Outer*. Five (5) vibracore samples were obtained at this location.

SE (2017) identified several patch reefs within the larger survey area, so divers and underwater video cameras were deployed to ground-truth the sub-bottom data and identify larger patches of sand for additional geophysical investigations. Vibracoring targeted a patch of sand identified from the sub-bottom profiling as being up to 40 ft thick (Figure 3-8). This deposit was referred to as *Reef Runway Outer*. Five (5) vibracore samples were obtained at this location. A comparison of the grain size distribution of the Reef Runway Outer sand and the existing beach sand is shown in Figure 3-9.

The grain size analysis found that the median grain size D_{50} is 0.18 mm, which is significantly smaller than the D_{50} for the existing beach sand (0.41 mm). The sample contained an average of 4% fines. The disparity in the grain size between the beach sand and the Reef Runway Outer deposit sand results in a calculated overfill ratio of 3.8. This suggests that nearly 4 times the design fill volume would be needed to produce the post-equilibration design beach planform and profile if sand from the Reef Runway Outer deposit were used. The overfill ratio for the Reef Runway Outer deposit does not comply with the DLNR guidelines for beach nourishment, therefore the sand is not considered suitable for beach restoration at Honokōwai Beach.

SE (2018) investigated two smaller sand deposits in closer proximity to the west end of the Reef Runway. The deposit located further offshore is referred to as *Reef Runway Inner 1a* and is located in about 60 ft of water approximately 1,500 to 3,000 ft from the runway (Figure 3-10). The deposit was initially investigated with a sub-bottom profiler to determine deposit thickness. Divers later investigated the site with an air jet probe to verify sand thickness, and a vessel-mounted vibracore to collect core samples. Jet probes penetrated 2 to 4 ft into the sand. The deposit contains an estimated 200,000 cy of sand based on the sub-bottom profiling data.

The deposit located further inshore is referred to as *Reef Runway Inner 1b* and is located in about 30 ft of water approximately 800 to 1,600 ft from the runway (Figure 3-10). Divers performed jet probing to measure sand thickness at ten (10) locations and utilized a push corer to obtain sand samples at two (2) locations. Jet probes penetrated 2.5 ft to 5 ft with an average penetration of 3.8 ft. The deposit contains an estimated 60,000 cy of sand based on probe measurements.

A comparison of the grain size distributions of the Reef Runway Inner 1a and Inner 1b sand and the existing beach sand is shown in Figure 3-11. The grain size analysis found that the median grain size D_{50} is 0.31 mm to 0.34 mm, which is slightly smaller than the D_{50} for the existing beach sand (0.41 mm). The samples contained an average of 1.4 % to 2.9% fines; however, several samples contained over 6% fines. The deposits have a calculated overfill ratio of 1.18 to 1.36, meaning that an additional 18% to 36% of the design fill volume would be needed to produce the post-equilibration design beach planform and profile.

While the grain size and overfill ratio for the Reef Runway Inner 1a and Inner 1b deposits are potentially within the limits of the DLNR guidelines for beach nourishment, the sand is not considered well-suited for beach restoration at Honokōwai Beach. The deposits are quite thin with jet probes penetrating an average depth of 3.8 ft. Sand is much less efficiently dredged from thin deposits. A dredging operation would recover only a small amount of sand each cycle and would be required to move frequently. This is expected to extend the duration and cost of dredging significantly. Thinner deposits also increase the likelihood of recovering larger diameter material (e.g., cobble), so the sand would likely need to be screened prior to placement. Washing may also be required to reduce the percentage of fine material prior to placement. The additional time and costs associated with washing and screening the sand prior to placement could be substantial.

The Reef Runway Inner 1a and Inner 1b deposits are located in close proximity to both the Reef Runway and the Pearl Harbor entrance channel. The Hawaii Department of Transportation Airports Division previously expressed concerns regarding the operation of cranes near the airport runway. The U.S. Navy has also previously expressed concerns about marine operations in close proximity to the Pearl Harbor entrance channels. Additional consultations would be required to confirm if dredging would be permissible at this location. Given the technical and logistical constraints, and the marginal sand quality, these deposits are not considered an ideal sand source for beach restoration at Honokōwai Beach.

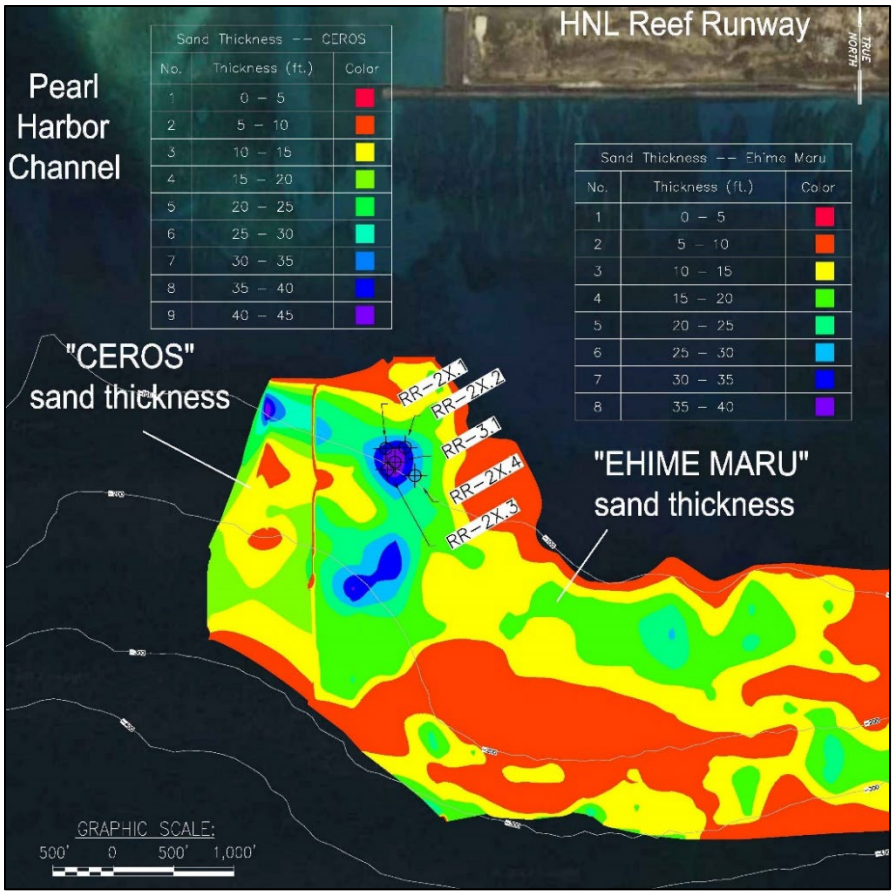


Figure 3-8 Reef Runway Outer sand deposit and vibracore locations.

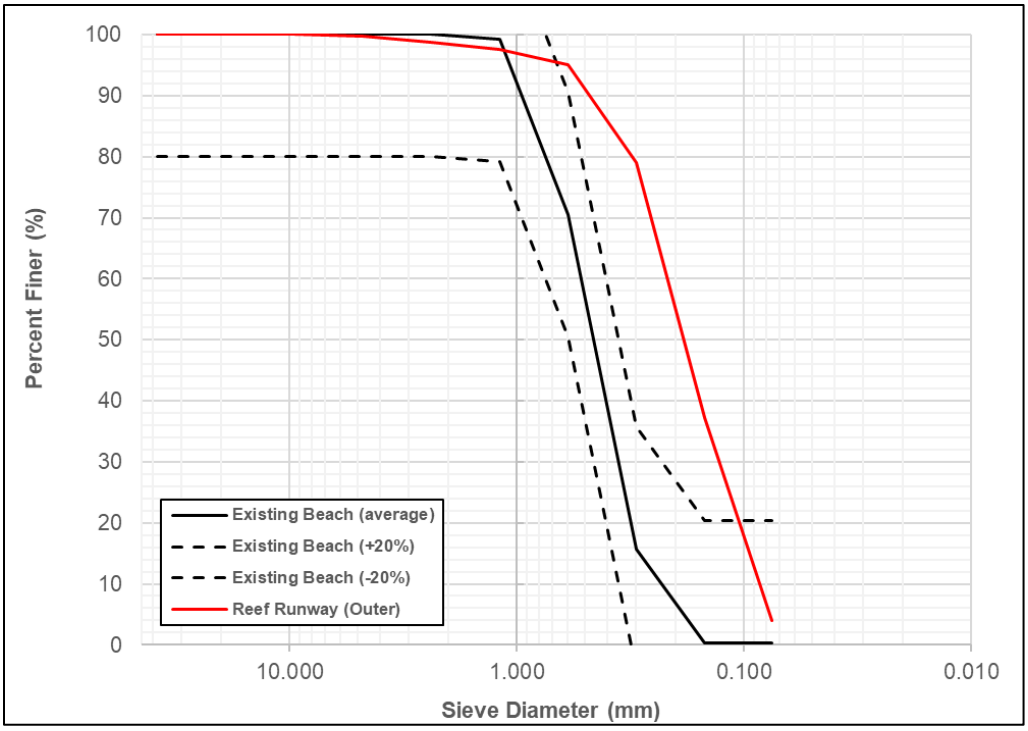


Figure 3-9 Grain size comparison of Reef Runway Outer and existing beach sand.

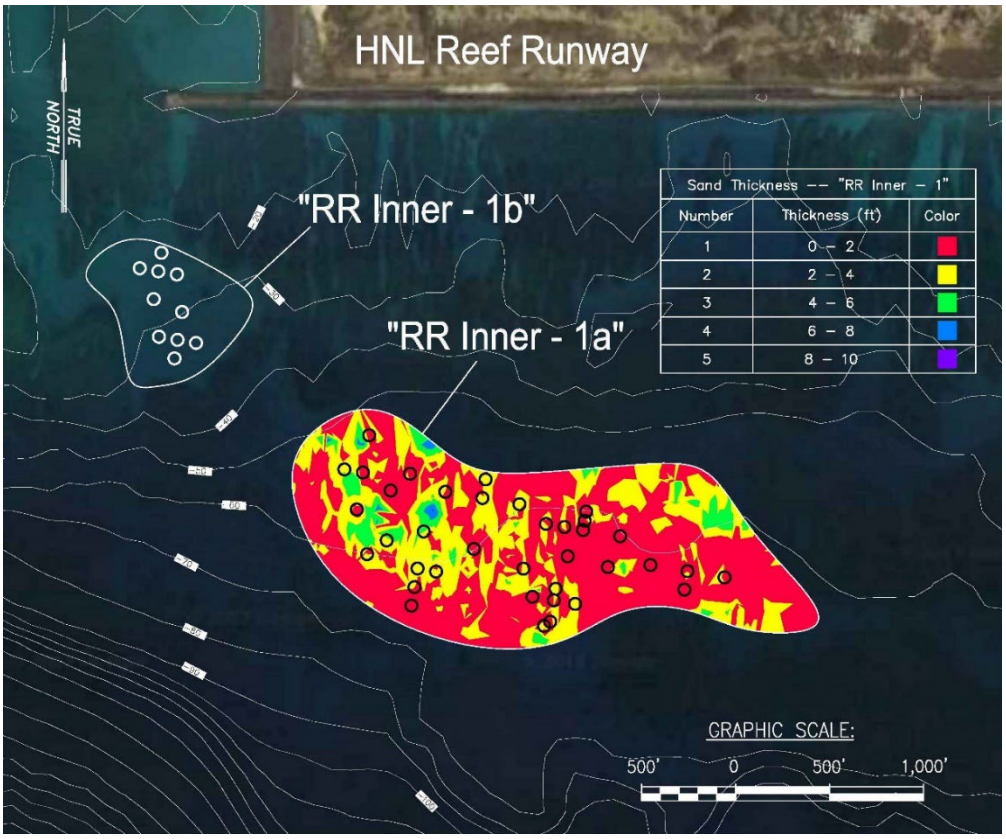


Figure 3-10 Overview map of Reef Runway Inner offshore sand deposits.

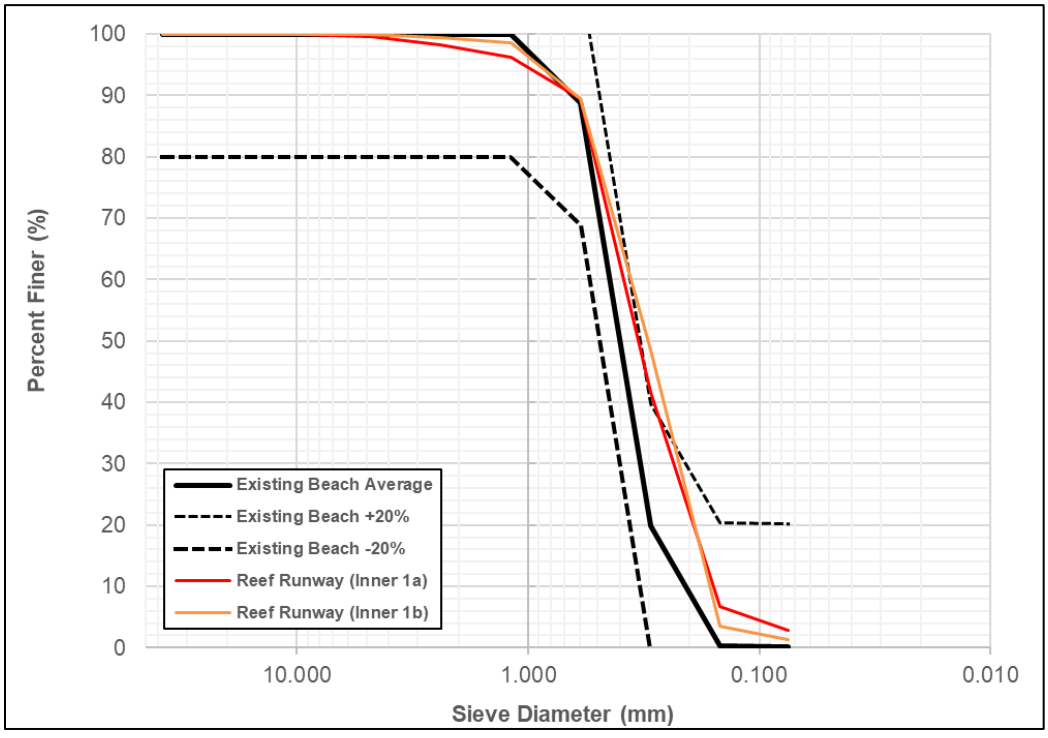


Figure 3-11 Grain size comparison of Reef Runway Inner 1a and Inner 1b and existing beach sand.

3.2.2 *Napili*

The Napili deposit is located offshore of Alaeloa Point, approximately 3 miles north of the project site (Figure 3-12). The deposit is approximately 2,000 feet from the shoreline in water depths ranging from 40 to 55 feet and has an estimated area of 7.5 acres. A representative photograph of the seafloor conditions at the Napili deposit is shown in Figure 3-13.

The Napili deposit investigation included one (1) sample location. Probe penetration was 7.0 feet and push core length was 1.1 feet. A dry photo comparison of representative samples of the existing beach sand and offshore sand at the Napili deposit is shown in Figure 3-14. A visual analysis of the core samples found that the sand is finer and darker than the existing beach sand.

The grain size analysis (Figure 3-15) found that the median grain size D_{50} is 0.16 mm, which is much less than the D_{50} for the existing beach sand (0.46 mm). The sorting value is 0.57, which categorizes the sand as moderately well sorted, and the sample contained 2.8% fines. The large disparity in the grain size between the beach sand and the Napili deposit sand results in a calculated overfill ratio of 24. This suggests that 24 times the design fill volume would be needed to produce the post-equilibration design beach planform and profile if sand from the Napili deposit were used. The overfill ratio for the Napili deposit does not comply with the DLNR requirements for beach nourishment, therefore the sand in the Napili deposit is considered unsuitable for beach restoration at Honokōwai Beach.

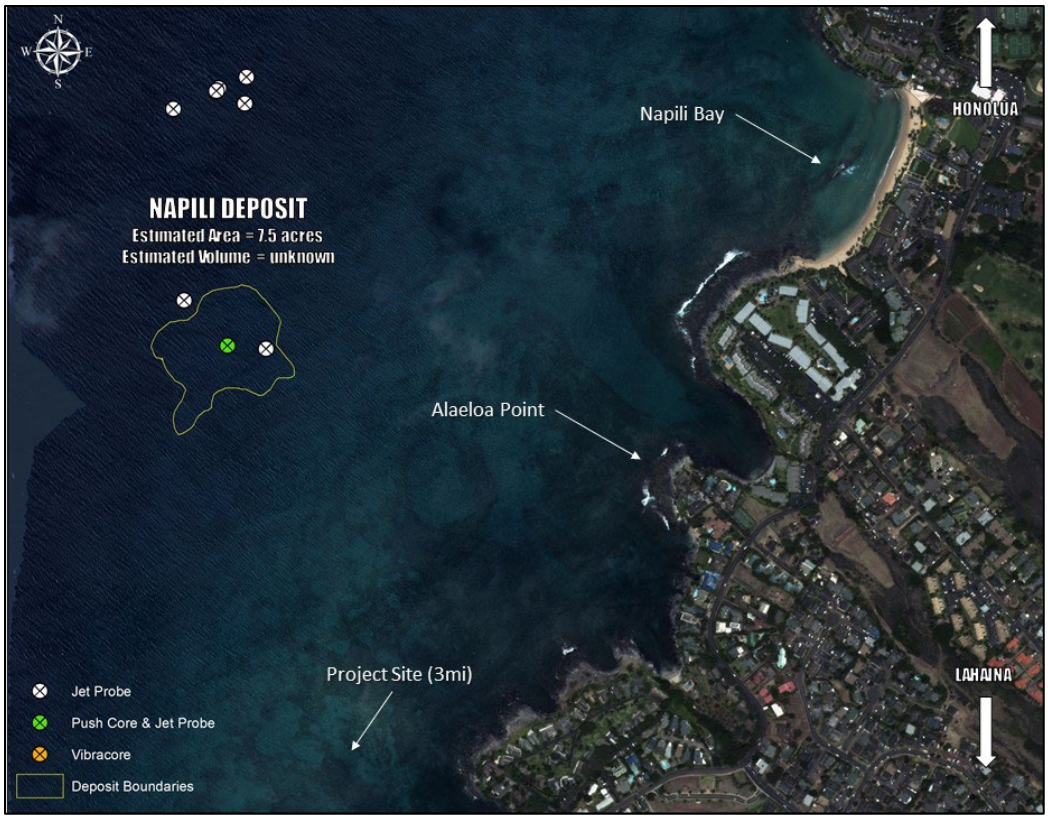


Figure 3-12 Overview map of the Napili offshore sand deposit.

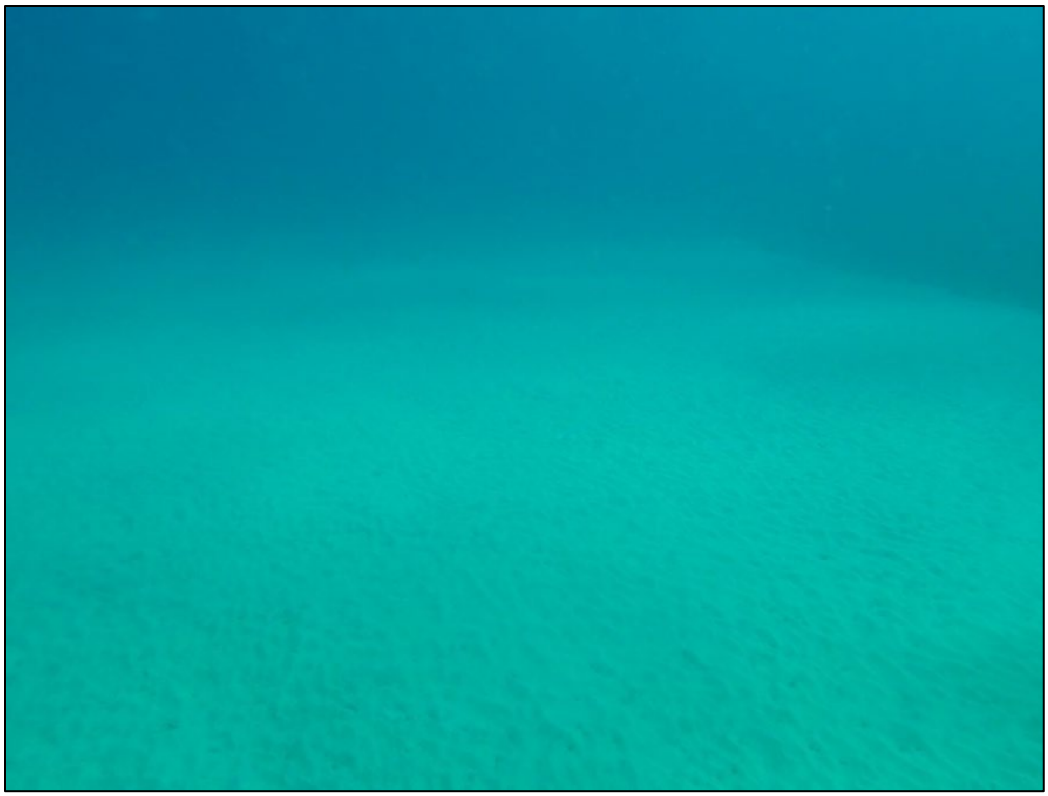


Figure 3-13 Representative photograph of the Napili offshore sand deposit.



Figure 3-14 Dry photo comparison of Napili sand and existing beach sand.

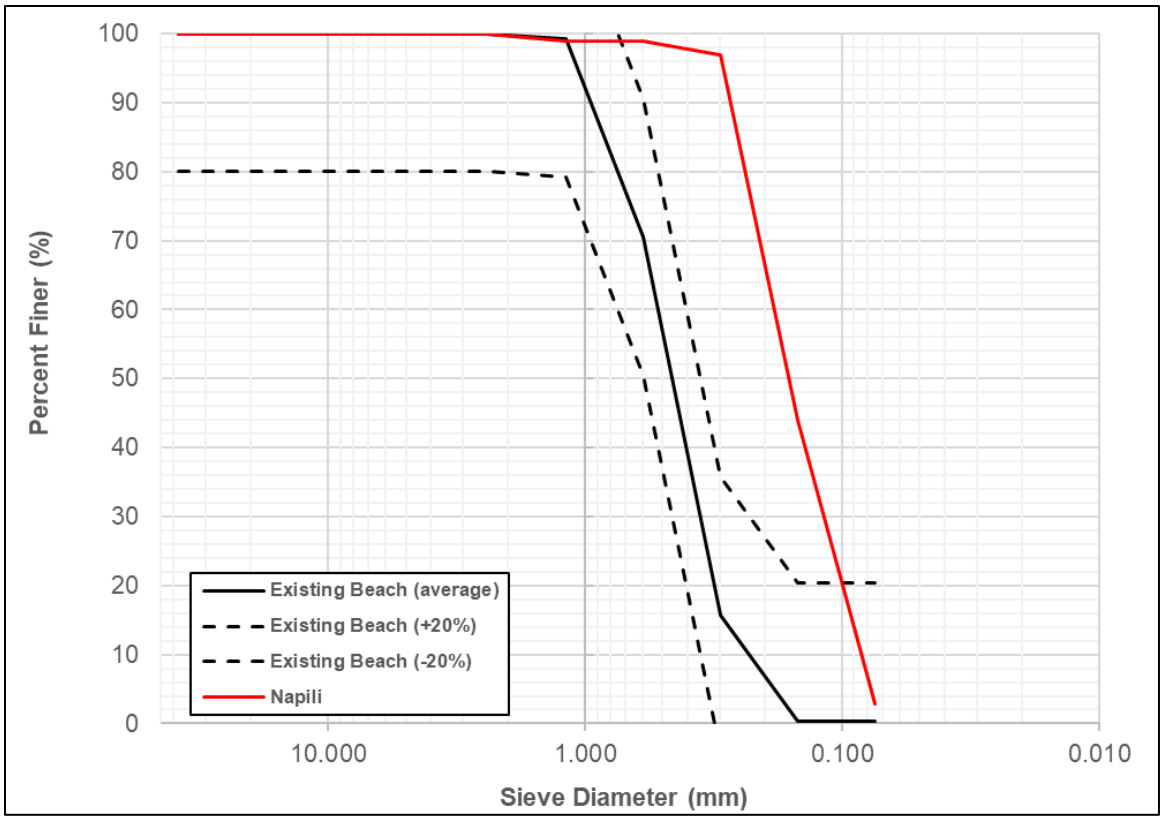


Figure 3-15 Grain size comparison of Napili sand and existing beach sand.

3.2.3 *North Kahana*

The North Kahana deposit is located offshore of Ka'opala Beach, approximately 2.5 miles north of the project site (Figure 3-16). The deposit is approximately 1,200 feet from the shoreline in water depths ranging from 20 to 60 feet and has an estimated area of 7.9 acres. A representative photograph of the seafloor conditions at the North Kahana deposit is shown in Figure 3-17.

The North Kahana deposit investigation included two (2) sample locations. Probes penetrated 6.5 and 7.5 feet. One (1) push core sample was collected with a recovered core length of 1 foot. A dry photo comparison of representative samples of the existing beach sand and offshore sand at the North Kahana deposit is shown in Figure 3-18. A visual analysis of the core sample found that the sand is finer and darker than the existing beach sand.

The grain size analysis (Figure 3-19) found that the median grain size D_{50} is 0.20 mm, which is significantly less than the D_{50} for the existing beach sand (0.46 mm). The sorting value is 0.54, which categorizes the sand as moderately well sorted, and the percentage of fines is 1.6%. The difference in grain sizes between the two samples results in an overfill ratio of 28. This means that 28 times the design fill volume would be needed to produce the post-equilibration design beach planform and profile if sand from the North Kahana deposit were used. The overfill ratio for the North Kahana deposit does not comply with the DLNR requirements for beach nourishment, therefore the sand in the North Kahana deposit is considered unsuitable for beach restoration at Honokōwai Beach.



Figure 3-16 Overview map of the North Kahana offshore sand deposit.



Figure 3-17 Representative photograph of the North Kahana offshore sand deposit.

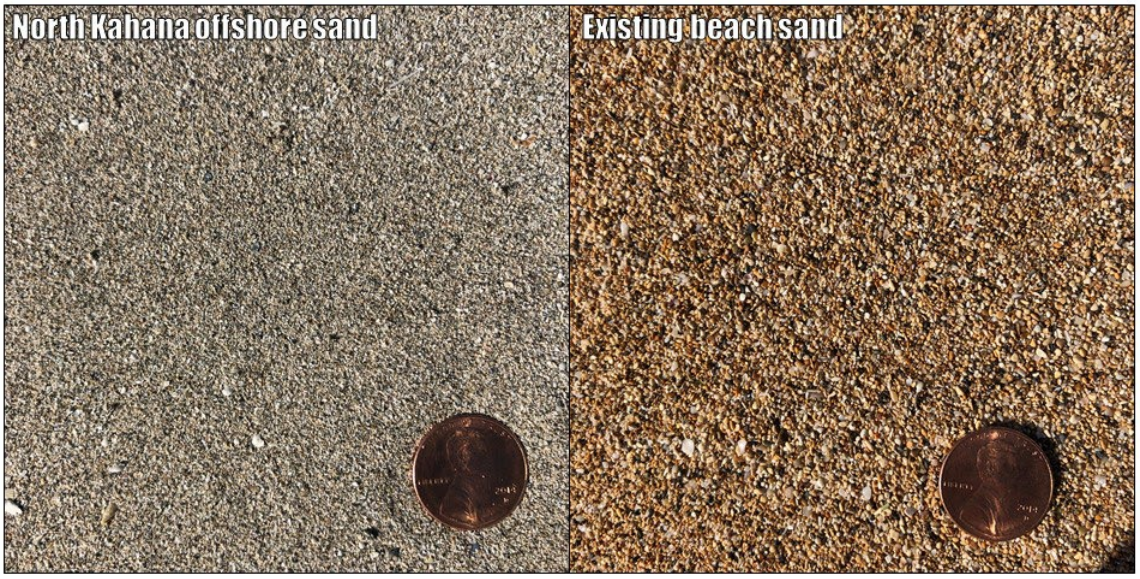


Figure 3-18 Dry photo comparison of North Kahana sand and existing beach sand.

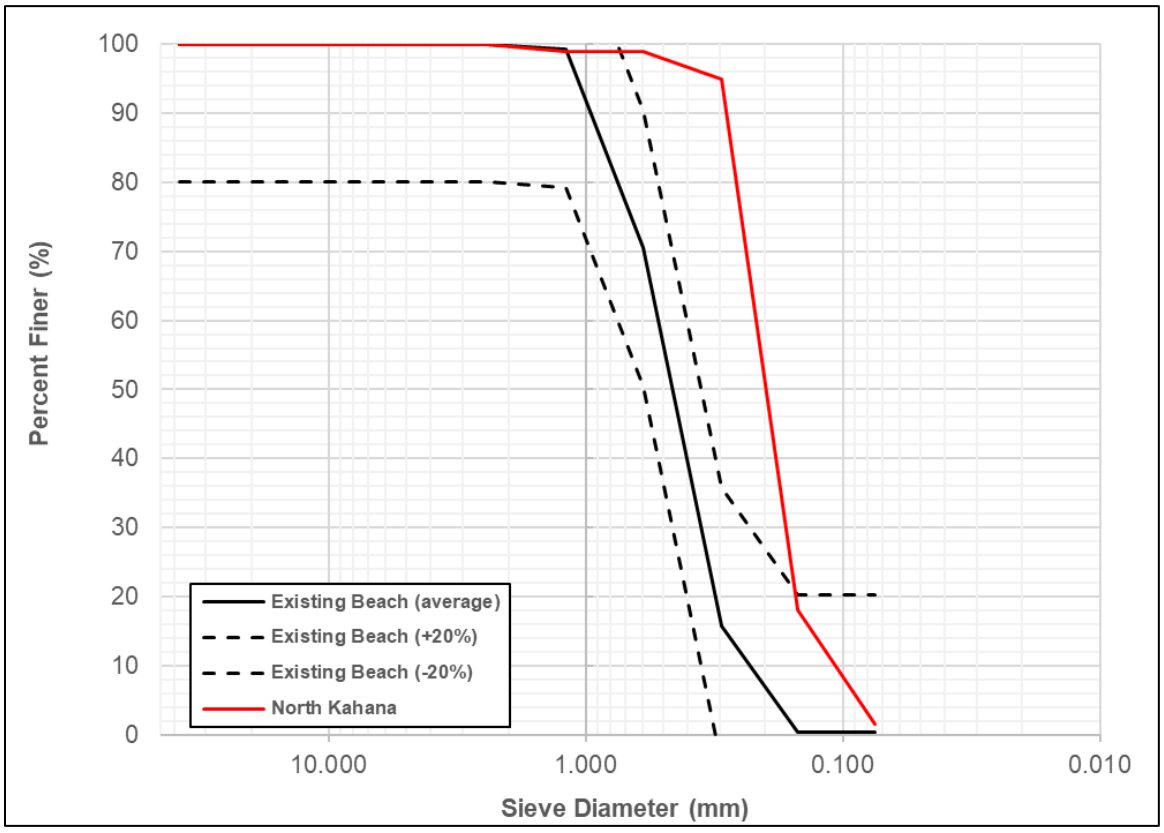


Figure 3-19 Grain size comparison of North Kahana sand and existing beach sand.

3.2.4 *South Kahana*

The South Kahana deposit is located south of Kahana Bay, approximately 1 mile north of the project site (Figure 3-20). The deposit consists of four (4) large sand fields within 1,800 feet of the shoreline in water depths ranging from 7 to 38 feet. The deposits have a combined estimated area of 71 acres and a total estimated volume of 405,000 cubic yards. The data presented in this report for the South Kahana deposit are the result of previous investigations that were conducted by Moffatt & Nichol (2016). No additional field investigations were conducted at this site as a part of the present study.

The Moffatt & Nichol (2016) study consisted of side-scan sonar and sub-bottom profiler transects, vibracore samples, and jet probes. Grain size analysis was conducted for two (2) sample locations. In those two locations, probe penetration was 1.4 and 4.7 feet. The study determined that approximately half of the total estimated volume of sand is recoverable. The sand is currently being considered as a candidate to support a large-scale beach stabilization project at Kahana Bay, north of the project site.

The grain size analysis (Figure 3-23) found that the median grain size D_{50} is 0.25 mm, which is close to half the D_{50} for the existing beach sand (0.46 mm). The sorting value is 0.58, which categorizes the sand as moderately well sorted and the percentage of fines was measured to be quite low at 0.6%. The calculated overfill ratio for the South Kahana deposit is 5, which does not comply with the DLNR requirements for beach nourishment, therefore the sand in the South Kahana deposit is considered unsuitable for beach restoration at Honokōwai Beach.

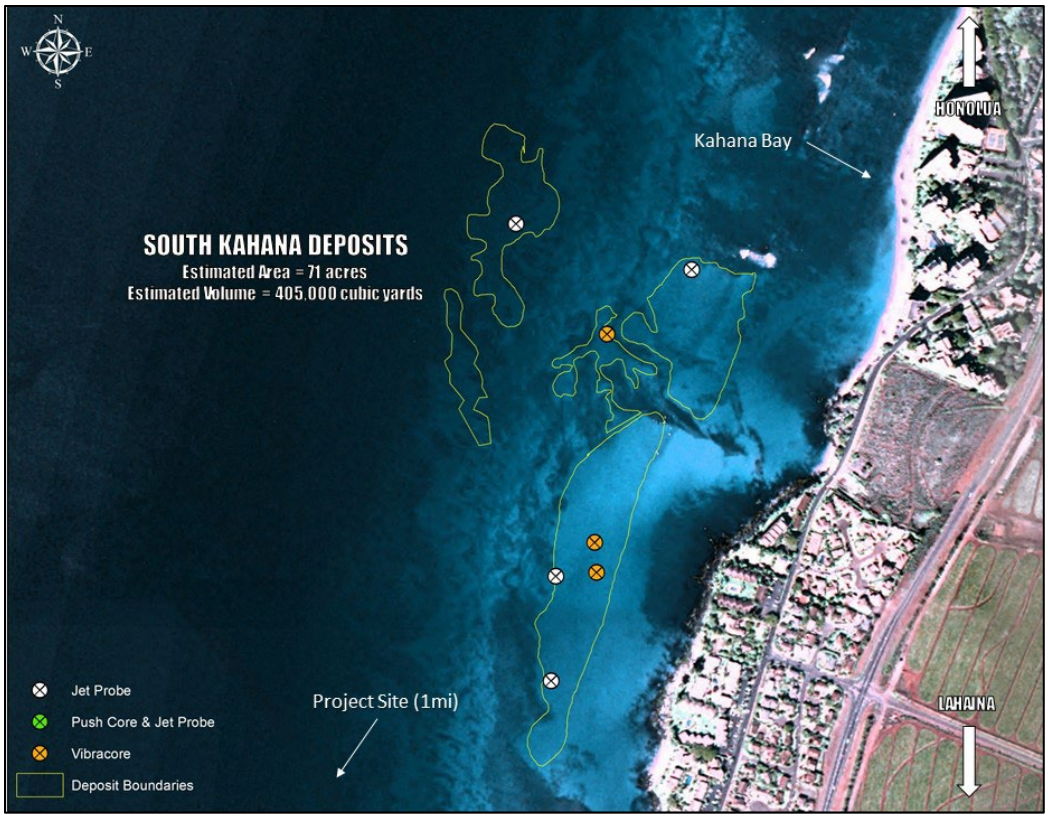


Figure 3-20 Overview map of the South Kahana offshore sand deposit.



Figure 3-21 Representative photograph of the South Kahana offshore sand deposit.



Figure 3-22 Dry photo comparison of South Kahana sand and existing beach sand.

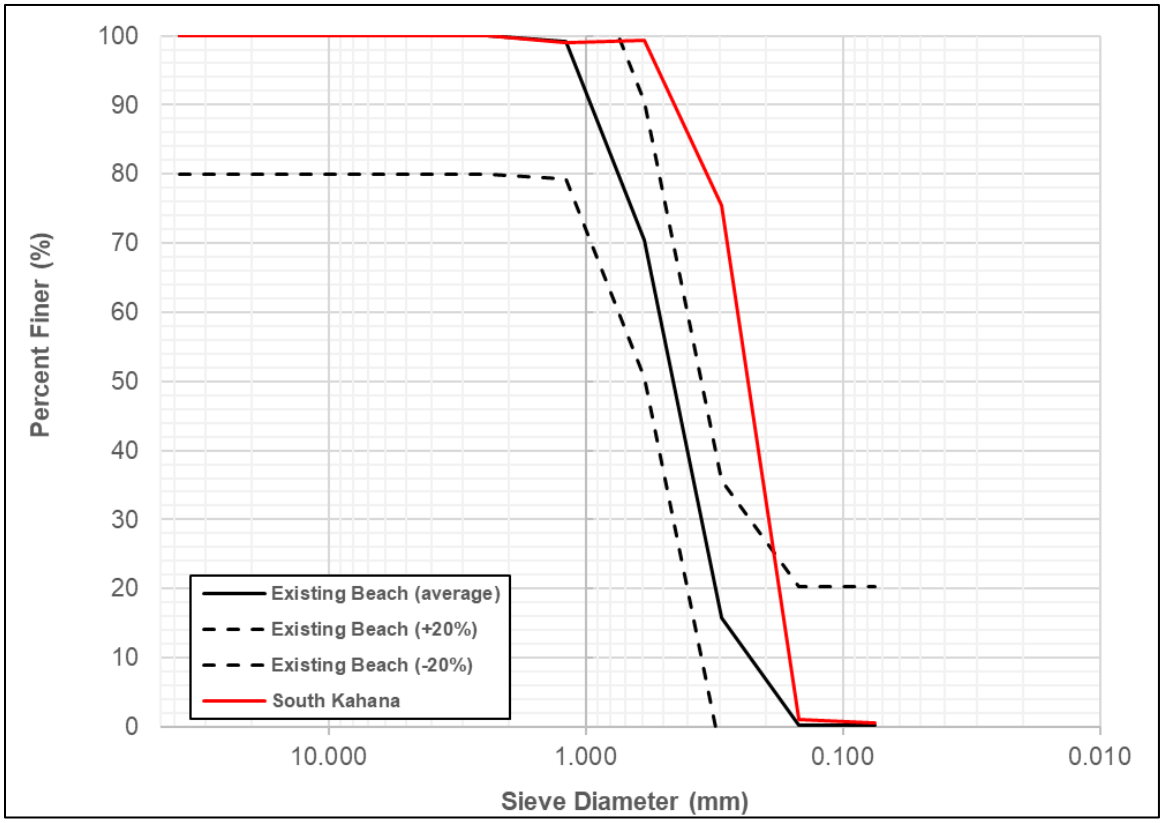


Figure 3-23 Grain size comparison of South Kahana sand and existing beach sand.

3.2.5 *North Honokōwai*

The North Honokōwai deposit is located offshore of Honokōwai Beach Park, approximately 0.5 mile north of the project site (Figure 3-24). The deposit is approximately 1,500 feet from the shoreline in water depths ranging from 35 to 60 feet and has an estimated area of 12.5 acres. A representative photograph of the seafloor conditions at the North Honokowai deposit is shown in Figure 3-25.

The North Honokōwai deposit investigation included seven (7) sample locations. Probe penetration ranged from 0.5 to 8 feet with an average of 4.6 feet. Cores ranged in length from 1.2 to 4.0 feet with an average length of 1.6 feet. A dry photo comparison of representative samples of the existing beach sand and offshore sand at the North Honokowai deposit is shown in Figure 3-26. A visual analysis of the core samples found that the sand is noticeably finer but closer in color to the existing beach sand compared to most other samples.

The grain size analysis (Figure 3-27) found a median grain size D_{50} of 0.15 mm, which is significantly less than the D_{50} for the existing beach sand (0.46 mm). The sorting value is 0.86, which categorizes the sand as moderately sorted, and the percentage of fines is 5.3%. The overfill ratio is 16, indicating that 16 times the design fill volume would be needed to produce the post-equilibration design beach planform and profile if sand from the North Honokowai deposit were used. The overfill ratio for the North Honokōwai deposit does not comply with the DLNR requirements for beach nourishment, therefore the sand in the North Honokōwai deposit is considered unsuitable for beach restoration at Honokōwai Beach.

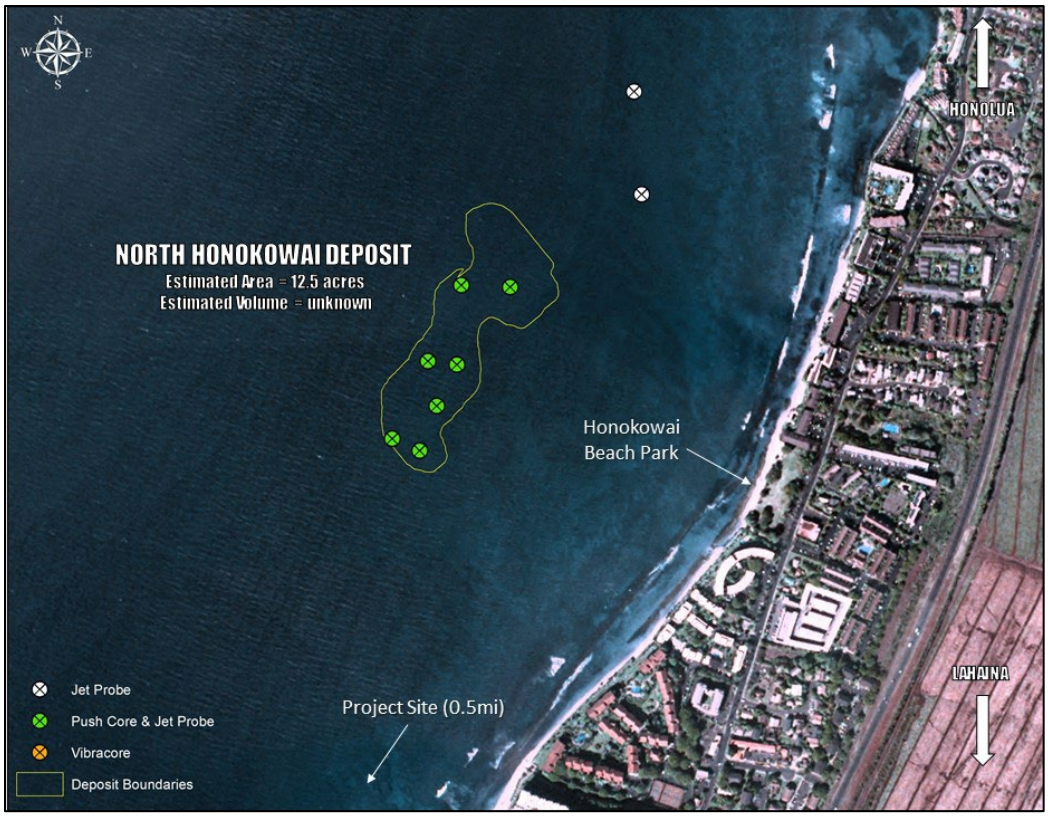


Figure 3-24 Overview map of the North Honokōwai offshore sand deposit.



Figure 3-25 Representative photograph of North Honokōwai offshore sand deposit.



Figure 3-26 Dry photo comparison of North Honokōwai sand and existing beach sand.

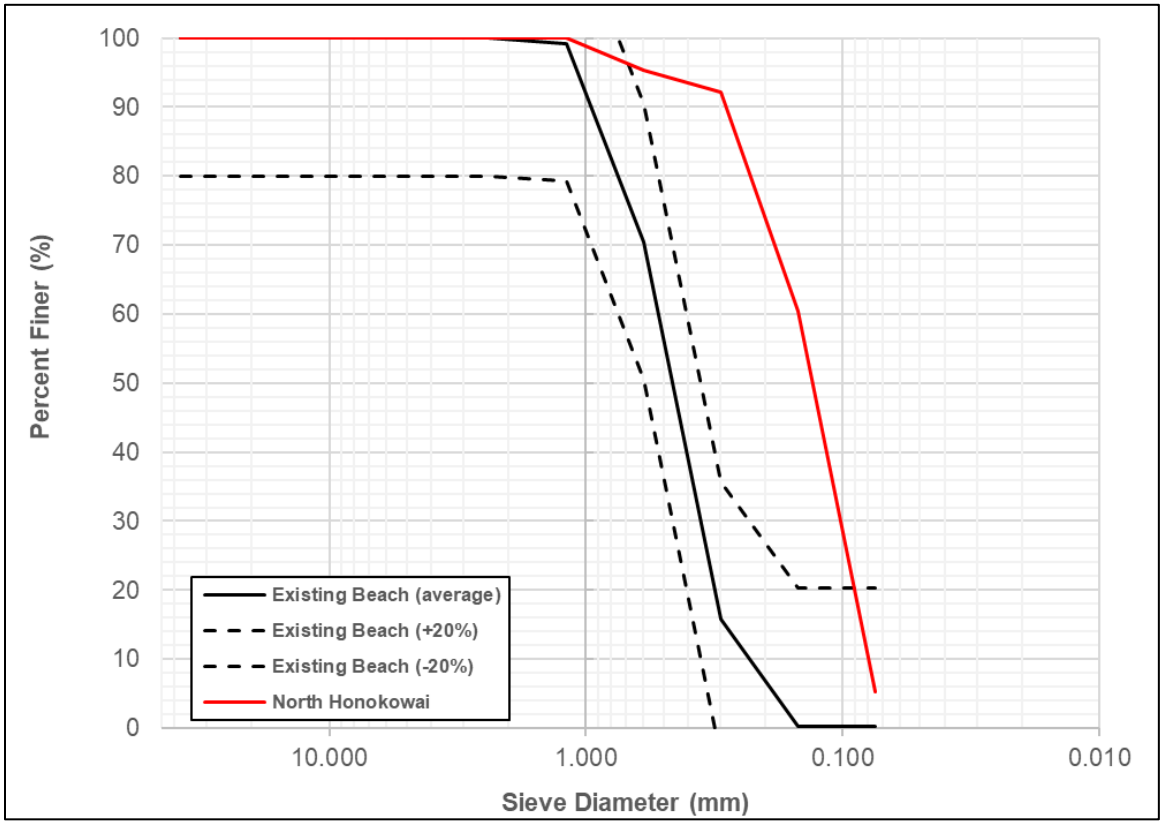


Figure 3-27 Grain size comparison of North Honokōwai sand and existing beach sand.

3.2.6 *South Honokōwai*

The South Honokōwai deposit is located offshore of the Mahana Condominiums, approximately 0.2 miles south of the project site (Figure 3-28). The deposit is approximately 650 feet from the shoreline in water depths ranging from 20 to 60 feet with an estimated area of 3.5 acres. A representative photograph of the seafloor conditions at the South Honokōwai deposit is shown in Figure 3-29.

The South Honokōwai deposit investigation included five (5) sample locations. Probe penetration in each location was 8 feet, penetrating the full length of the probe without refusal. Core lengths ranged from 1.3 to 1.9 feet with an average length of 1.6 feet. A dry photo comparison of representative samples of the existing beach sand and offshore sand at the South Honokowai deposit is shown in Figure 3-30. A visual analysis of the core samples found that the sand is finer but comparable in color to the existing beach sand.

The grain size analysis (Figure 3-31) found that the median grain size D_{50} is 0.18 mm, which is less than half the D_{50} for the existing beach sand (0.46 mm). The sorting value is 0.6, which categorizes the sand as moderately well sorted, and the percentage of fines is 3.5%. The overfill ratio is 28, indicating that 28 times the design fill volume would be needed to produce the post-equilibration design beach planform and profile if sand from the South Honokōwai deposit were used. The overfill ratio for the South Honokōwai deposit does not comply with the DLNR requirements for beach nourishment, therefore the sand in the South Honokōwai deposit is considered unsuitable for beach restoration at Honokōwai Beach.

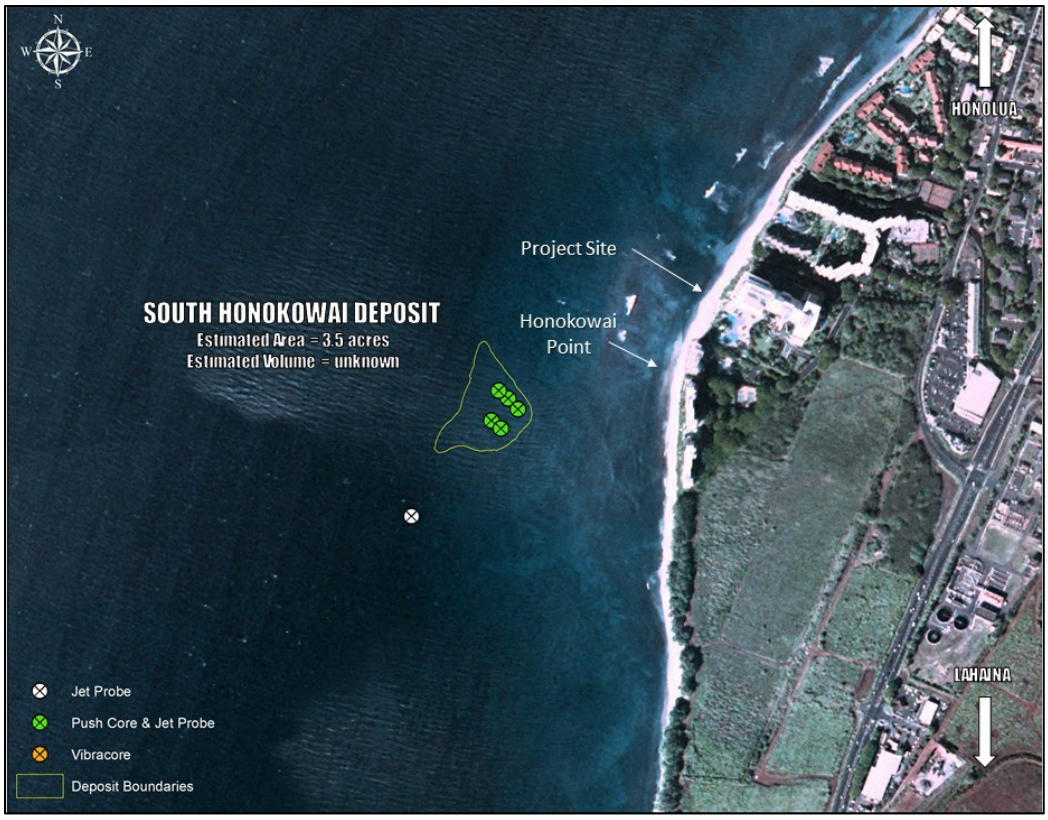


Figure 3-28 Overview map of the South Honokōwai offshore sand deposit.



Figure 3-29 Representative photograph of the South Honokōwai offshore sand deposit.



Figure 3-30 Dry photo comparison of South Honokōwai sand and existing beach sand.

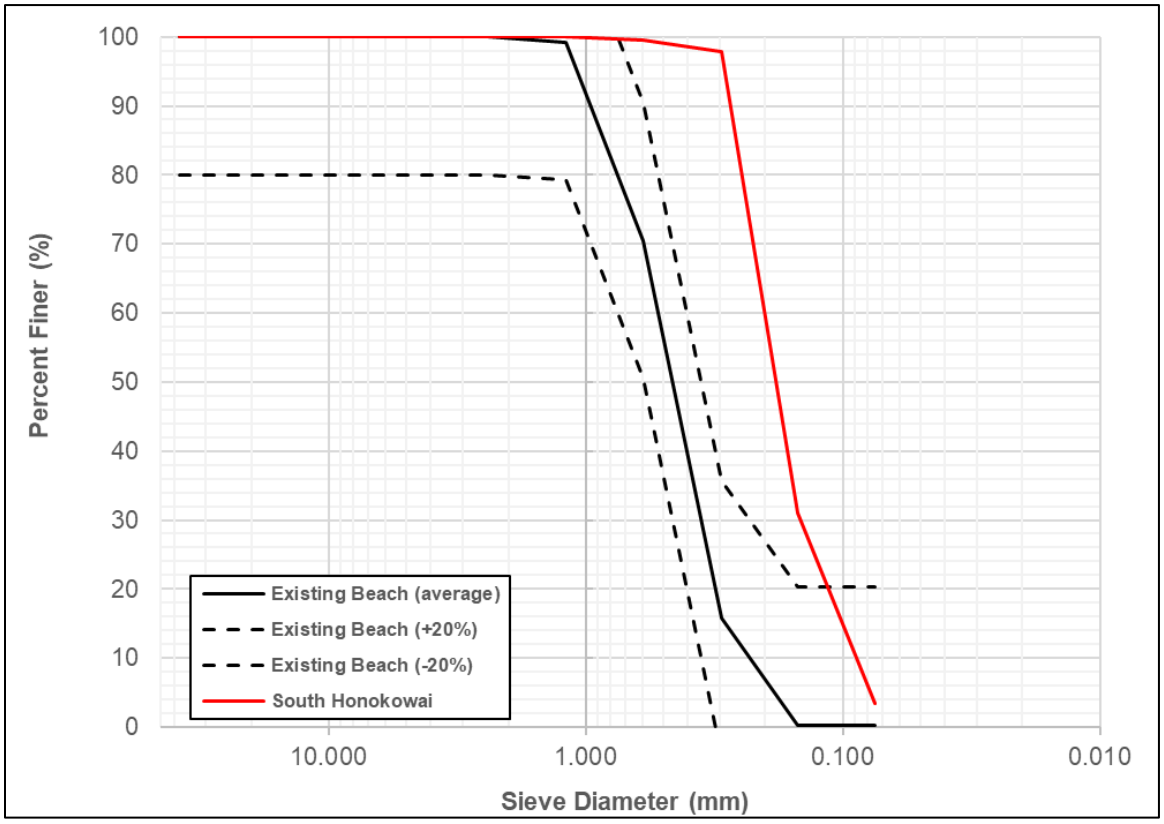


Figure 3-31 Grain size comparison of South Honokōwai sand and existing beach sand.

3.2.7 *Sand Wave*

The Sand Wave deposit is located offshore of Pu'u Keka'a, approximately 1.5 miles south of the project site (Figure 3-32). The deposit is approximately 1,450 to 2,200 feet from the shoreline in water depths ranging from 120 to 160 feet. The data presented in this report for the Sand Wave deposit incorporate the findings from previous investigations conducted by SE in 2008.

A 2008 sub-bottom profile survey showed an offshore morphology consisting of a series of terraces, or shelves formed during ancient low sea level stands by wave-induced erosion of the reef limestone. The terraces have a stair-step appearance, with the horizontal surfaces buried by thick wedge-like deposits of sand. This morphology is common in the Hawaiian Islands. Two primary terraces were found, one at approximately 175 feet water depth, and another starting at approximately 100 to 115 feet water depth. The lower terrace extends out into the 'Au'au Channel and terminates approximately 1,400 feet offshore of Pu'u Keka'a. This terrace is overlain by deposits of sand up to 60 feet in thickness and is the location of the observed large bedforms known as "sand waves".

The Sand Wave deposit investigation included ten (10) vibracore samples that were collected in May 2008 (Figure 3-33). Core lengths ranged from 2.0 to 8.5 feet. The presence of "sand waves" and the coarseness of the sediment are indications of movement caused by strong tidal currents. The boundaries of the Sand Wave deposit were not well established at the time of the 2008 survey. A dry photo comparison of representative samples of the existing beach sand and offshore sand at the Sand Wave deposit is shown in Figure 3-34.

Sand grain size in the Sand Wave deposit was variable with median grain sizes varying from 0.28 to 0.88 mm. Sand samples were obtained and analyzed from only the upper 8 feet of the deposit as limited by the vibracore penetration. Sand characteristics from deeper within the deposits are different from the overlying sand. The grain size analysis (Figure 3-35) found that the median grain size D_{50} was 0.47 mm, which was essentially the same as the D_{50} for the existing beach sand (0.46 mm). The sorting value was 1.5, which categorizes the sand as poorly sorted. The percentage of grains 0.15 mm and below was 0.38%, which means that the sand samples contained essentially no fine material. The overfill ratio was 1, indicating that the offshore sand is a match for the existing beach sand and no additional sand would be needed to achieve the design profile. The sand contained in the Sand Wave deposit complies with the DLNR requirements for beach nourishment, therefore the sand in the Sand Wave deposit is considered suitable for beach restoration at Honokōwai Beach.



Figure 3-32 Overview map of the Sand Wave offshore sand deposit.

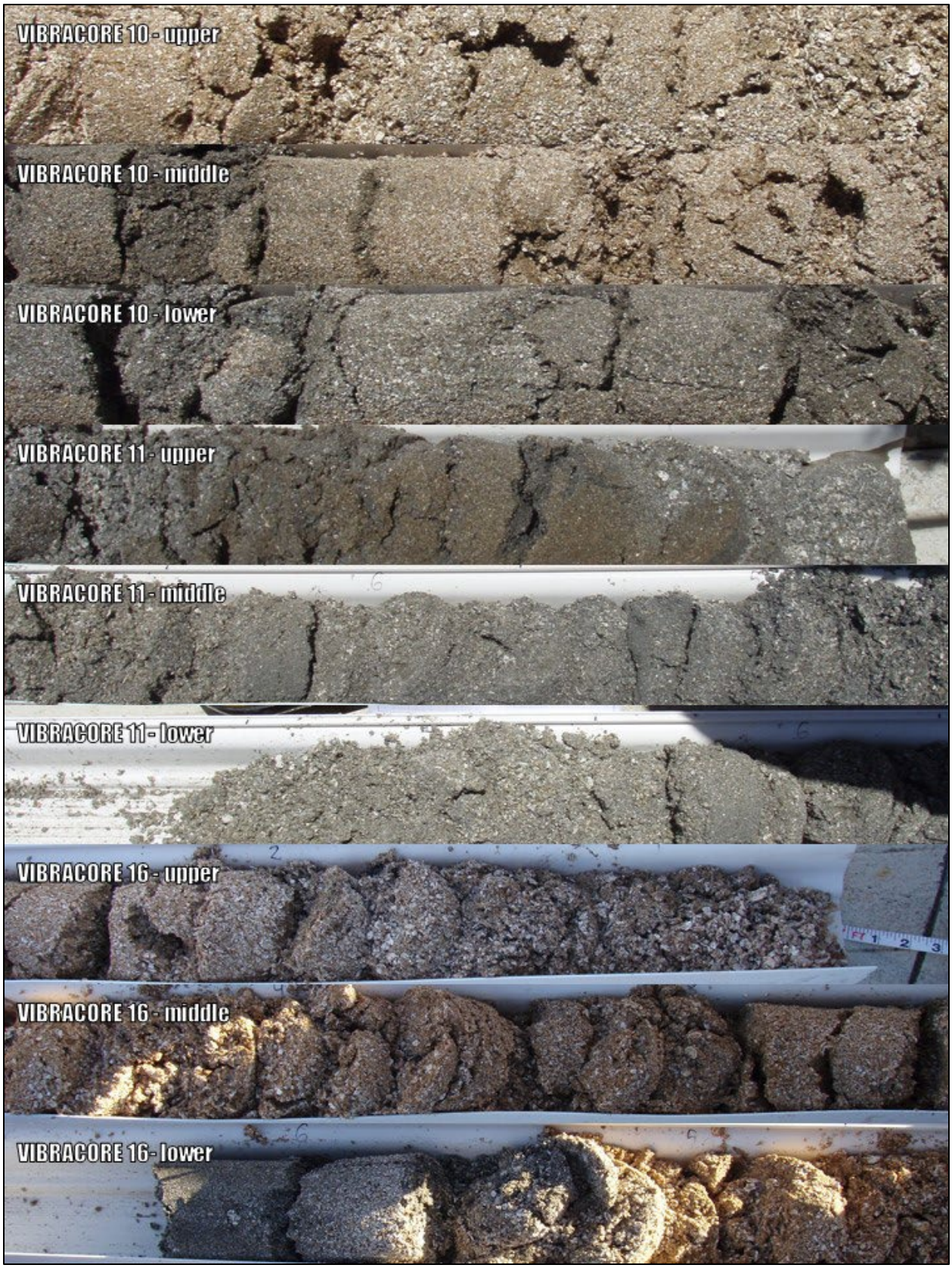


Figure 3-33 Photographs of Sand Wave vibracores (10, 11, 16)

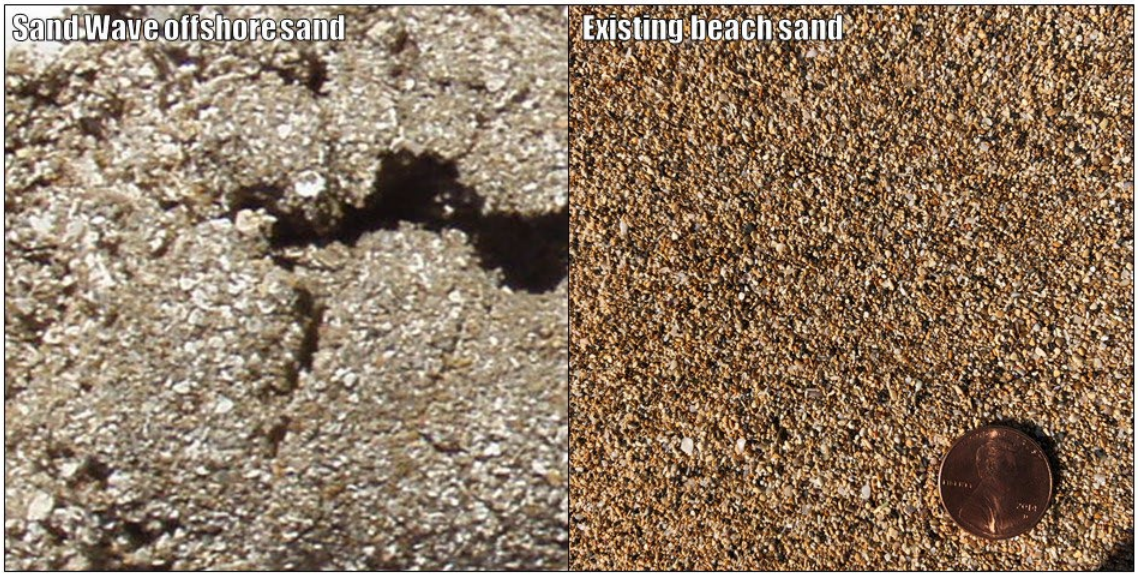


Figure 3-34 Dry photo comparison of Sand Wave sand and existing beach sand.

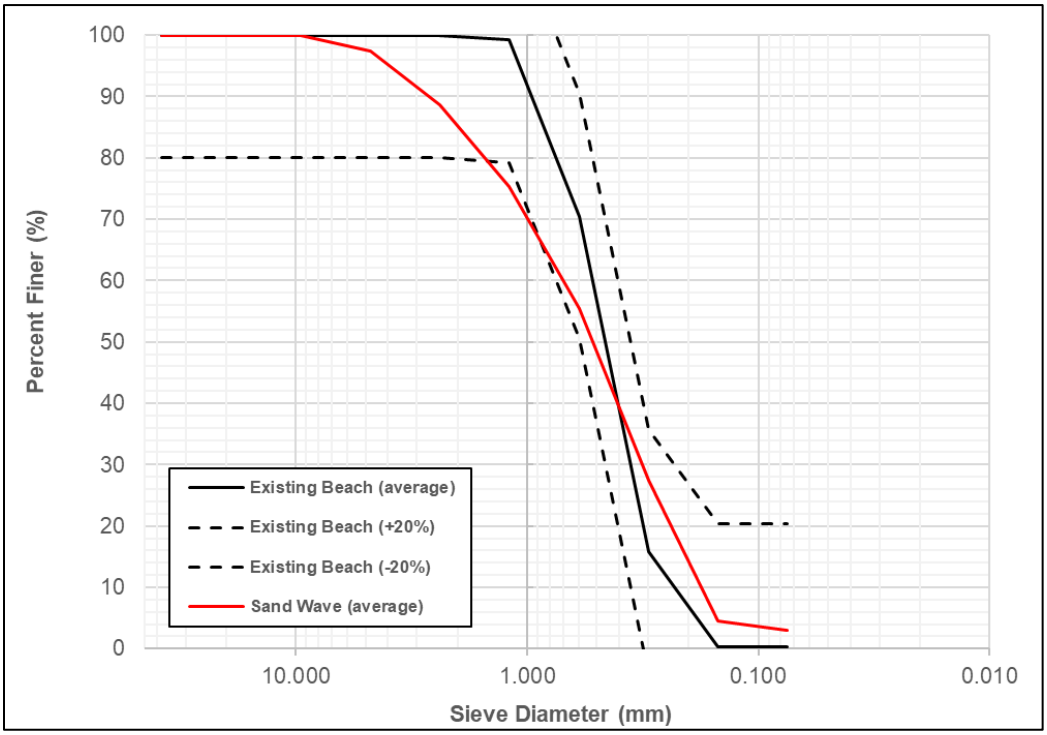


Figure 3-35 Grain size comparison of Sand Wave sand and existing beach sand.

4. DETAILED SAND INVESTIGATIONS

Based on the results of the previous offshore sand investigations, it was determined that the Sand Wave deposit was the only sand source that is compatible with the existing beach sand at Honokōwai Beach (Figure 4-1). In April 2021, SE conducted detailed offshore sand investigations at the Sand Wave deposit, which included:

- Tow camera survey to evaluate seafloor conditions and the boundaries of the deposit.
- Vibracore sampling to collect composite sand samples at selected locations.
- Grain size analysis and photographic analysis of composite sand samples.
- Calculation of overfill ratios based on grain size distributions.

Based on previous sub-bottom and side scan sonar investigations, the Sand Wave deposit is estimated to encompass approximately 12.5 acres with sand thickness ranging from 13 and 59 ft. This corresponds to a total estimated volume of 975,000 cy of sand within the boundaries of the survey area. The Sand Wave deposit is part of a larger sand field that begins near the shoreline and continues offshore to depths greater than 200 ft. The sand field continues parallel to shore north and south of Puʻu Kekaʻa. The presence of sand waves within the deposit indicates that this area is subject to strong tidal currents. Sediment in this area is likely to be dynamic and mobile, so sand volume and thickness could fluctuate as a result of seasonal or event-driven currents.

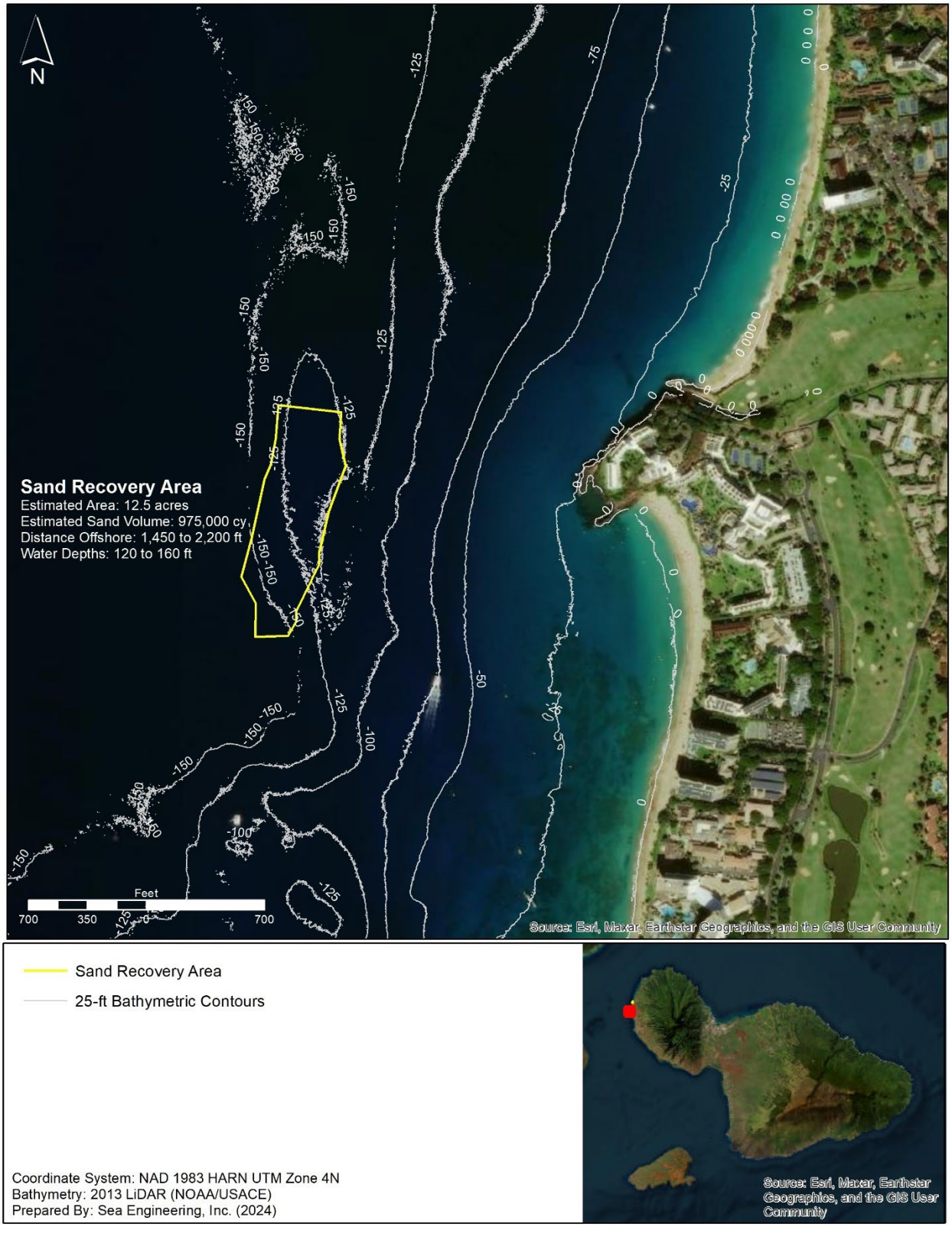


Figure 4-1. Overview map of the Sand Wave deposit.

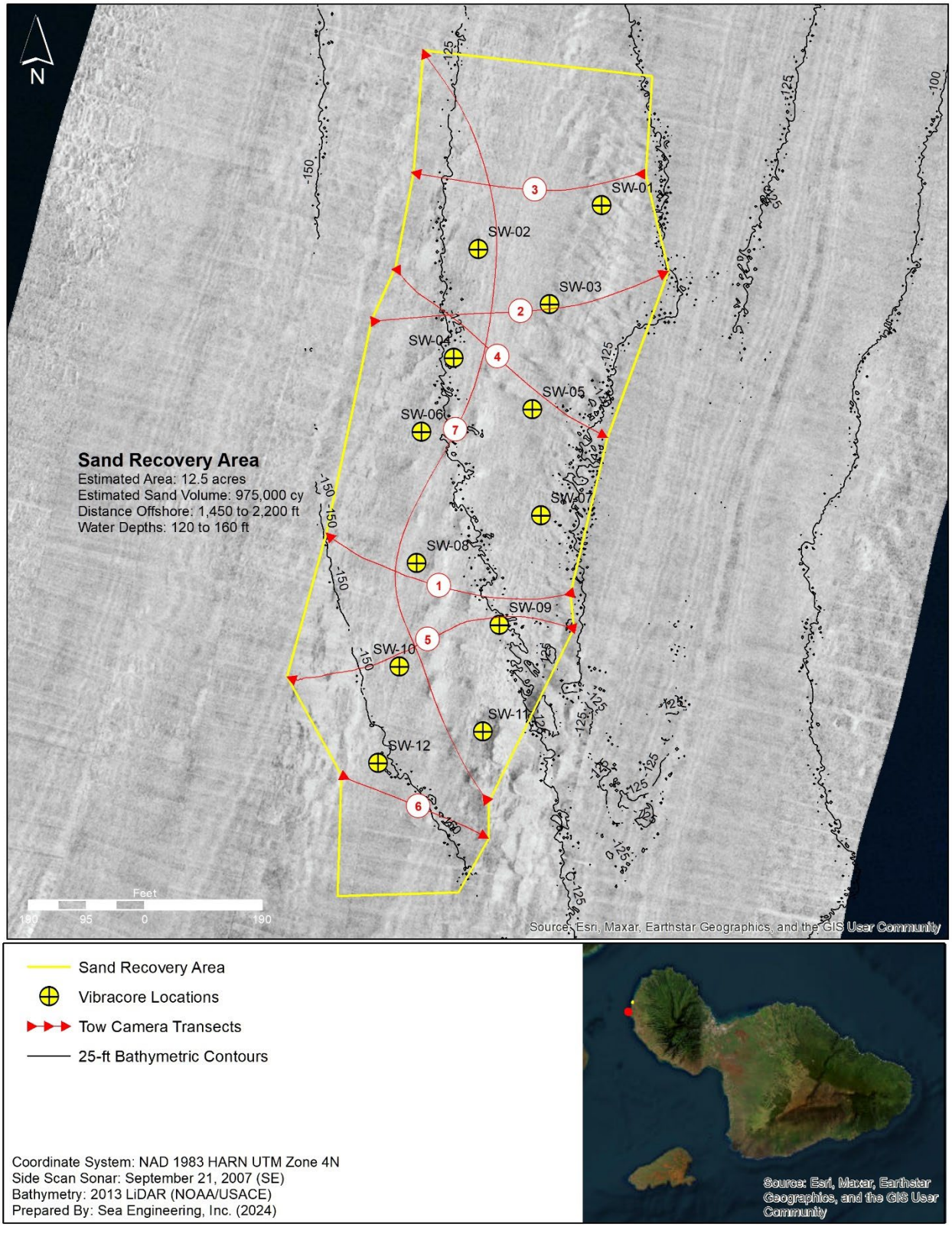


Figure 4-2. Detailed sand investigations at the Sand Wave deposit

4.1 Side Scan Sonar

Side scan sonar is used to create a plan view acoustic image of seafloor characteristics. Side scan sonar works by transmitting acoustic signals with wide vertical beam widths out to either side of the sonar towfish. A receiver then records the signals that are reflected back from the seafloor to the towfish. Hard bottom areas and features (e.g., coral reefs) produce more intense reflections than soft sediments. The result is a plan view acoustic image of seafloor characteristics, allowing mapping of bottom type across a swath of seafloor.

On September 17, 2008, SE performed a side scan sonar survey of the Sand Wave deposit. A side scan sonar transmits acoustic signals with wide vertical beam widths out to either side of the sonar towfish. A receiver then records the signals that are reflected back from the seafloor to the towfish. Hard bottom areas and features produce more intense reflections than sediments. The result is a plan view acoustic image of seafloor characteristics. This can allow mapping of bottom type across a swath of seafloor. The sonar results combined with an aerial view of the site are shown in Figure 3.1. The sidescan images indicated the presence of sand waves and other features that indicate a movable bed. Figure 4-3 shows the results of the side scan survey for the Sand Wave deposit along with the original mapped extents of the sand field. Based on the side scan survey results, it appears the extents of the deposit could be expanded to encompass where sand is evident (movable bed).

4.2 Tow Camera Survey

A tow camera survey was performed to collect video footage of the seafloor within and surrounding the Sand Wave area to better define the deposit boundaries and visually characterize the seafloor within the deposit. The footage was also used to better define the boundary of the sand deposit along with the side scan imagery (Figure 4-4). Tow camera images at selected locations along the boundaries and interior of the deposit are shown in Figure 4-5 and Figure 4-6, respectively.

The only prominent biotic colonizer observed was *Halimeda kanaloana*, a common macroalgae in West Maui. The density of the algae varied throughout the deposit. Several small, isolated patches of sea grass were observed. No coral or hard bottom was observed during the tow camera survey, or in either side scan sonar or sub-bottom surveys of the site. It is expected that the benthic infaunal community structure of the Sand Wave deposit is similar to other locations in sandy coastal areas of Hawai'i. The typical community in these environments consists of nematodes, (roundworms, phylum Nematoda), oligochaete worms (earthworm relatives, phylum Annelida, subclass Oligochaeta), copepods (tiny crustaceans, phylum Arthropoda), echinoderms (phylum Echinodermata), and mollusks (phylum Mollusca) (Bailey-Brock and Krause, 2008).

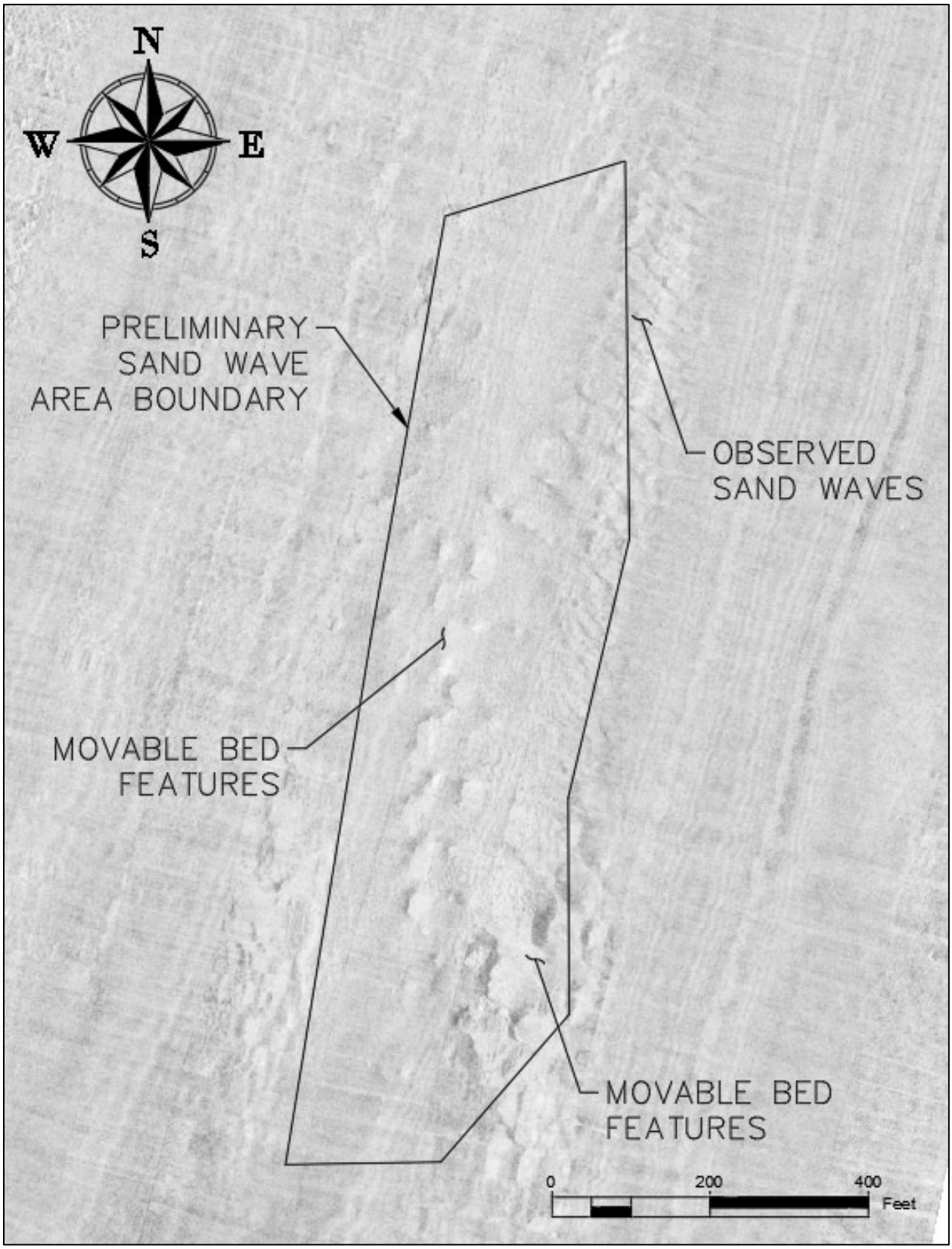


Figure 4-3 Side scan survey mosaic of the Sand Wave deposit.

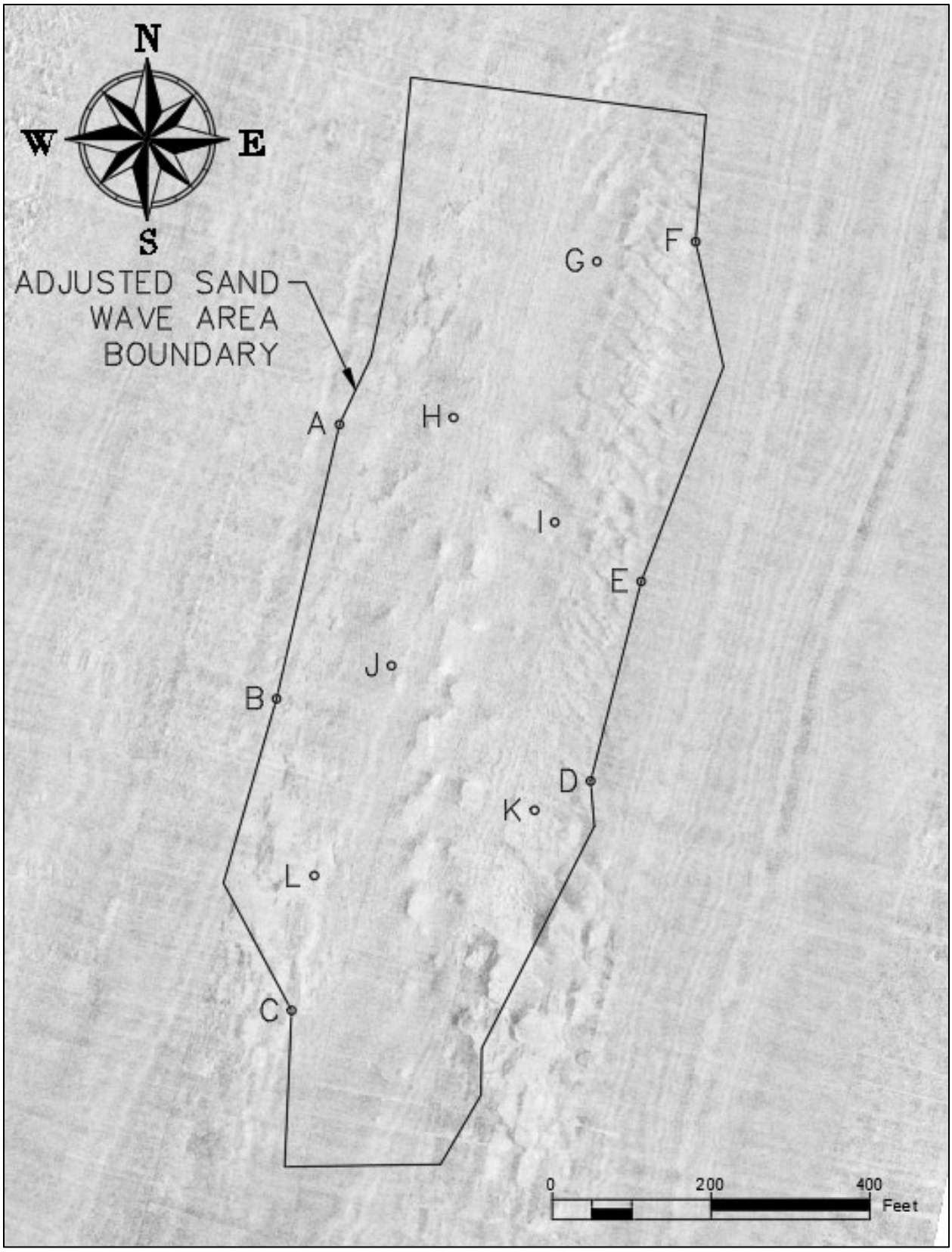


Figure 4-4 Confirmed boundary of Sand Wave deposit and locations of tow camera images.

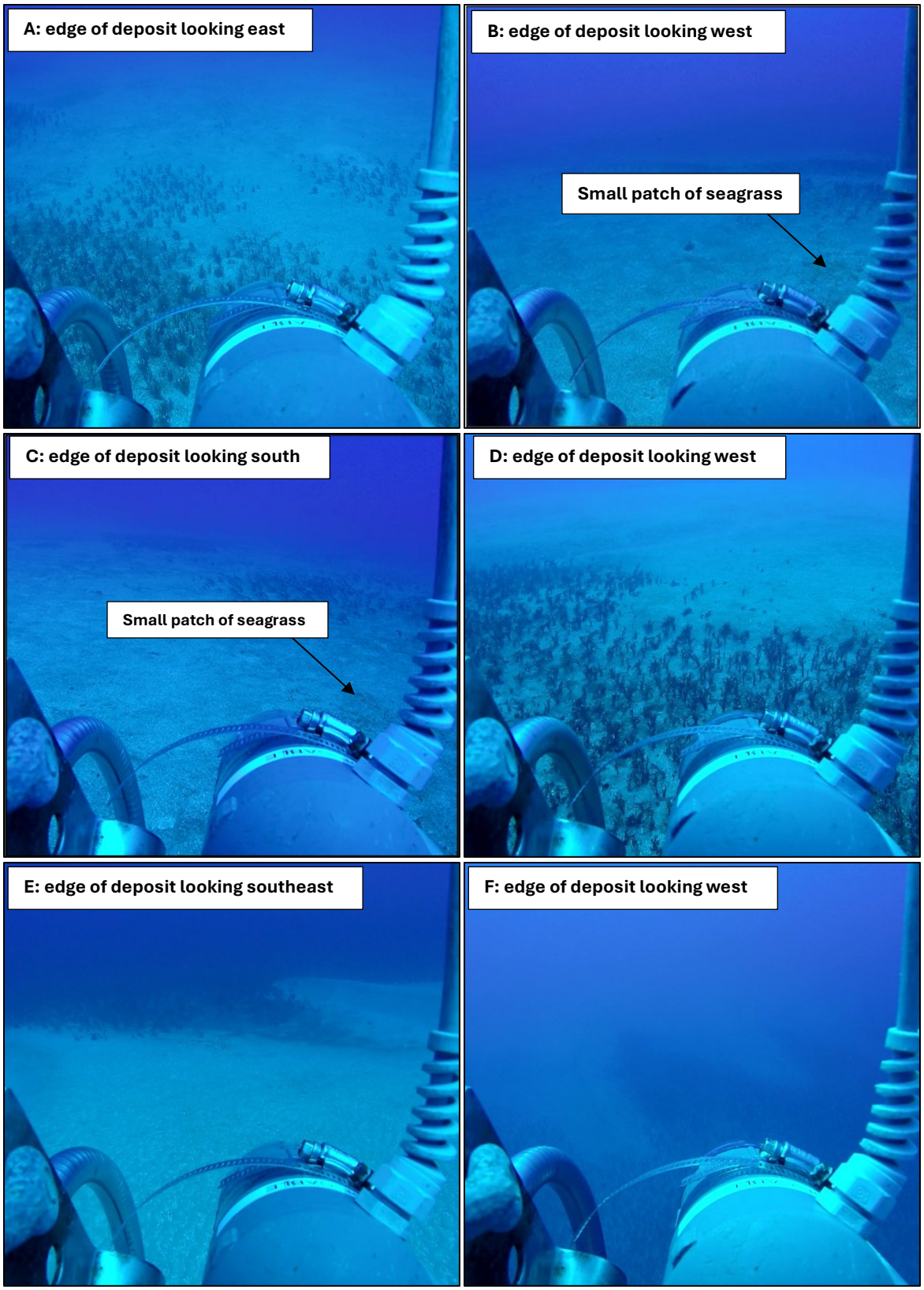


Figure 4-5 Tow camera images (A-F) along the outer boundary of the Sand Wave deposit.

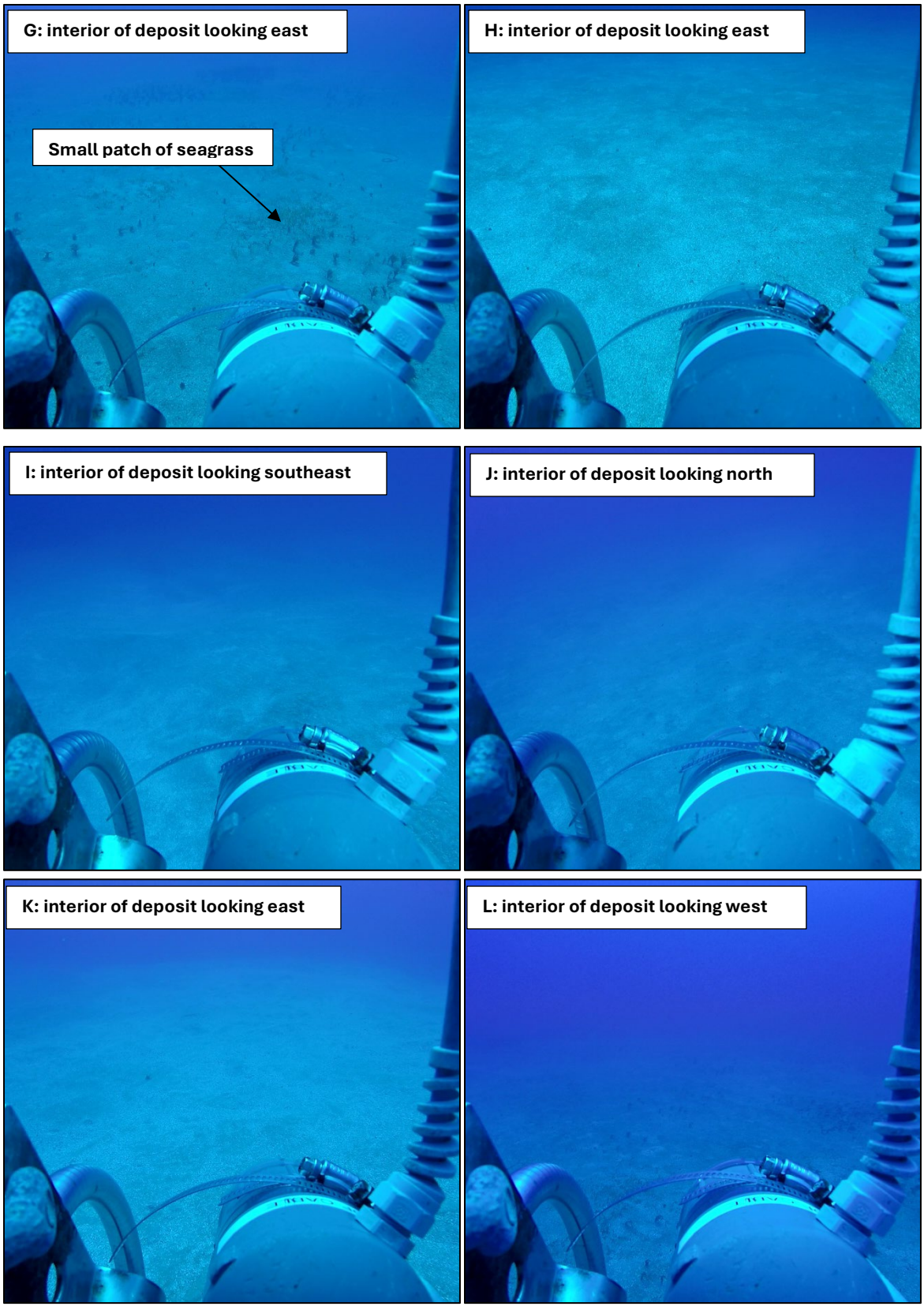


Figure 4-6 Tow camera images (G-L) in the interior of the Sand Wave deposit.

4.3 Vibracoring

Vibracoring is a method of pushing a thin-walled tube into the sand deposit and extracting a core of sediment up to about 8 ft long. The sand characteristics over the full core can be analyzed and the results interpolated to better characterize the deposit as a whole. Based on the findings, certain areas within the deposit can then be targeted or avoided, as necessary. SE's vibracore system is shown in Figure 4-7.

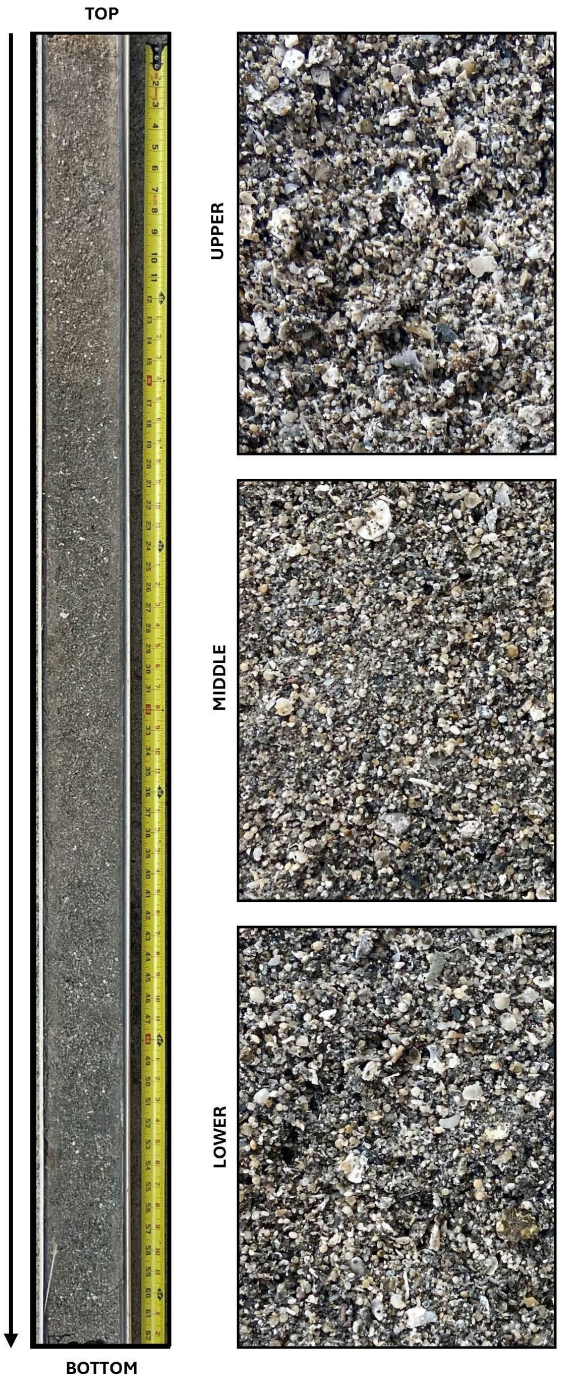
The vibracore was used to obtain twelve (12) composite sand samples from the Sand Wave deposit. Core samples were collected and analyzed by coastal geologists by dividing the cores into representative layers and assessing overall appearance, including grain type, shell fragments, color, grain size, angularity, sphericity, and sorting. The vibracore logs are shown in Figure 4-8 through Figure 4-19. Sand samples were obtained from the cores and processed for grain size distribution. A turbidity analysis was also performed for each sample.



Figure 4-7. Vibracore system and stern-mounted A-frame

VIBRACORE LOG SW-01

PHOTOGRAPHS



CORE ID:	SW-01
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215934.74 N
EASTING:	1628520.05 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	30-May-21
CORE LENGTH:	62 in (5.2 ft)
WATER DEPTH:	119 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium
Color:	Gray
Angularity:	Sub-rounded to Rounded
Sphericity:	Medium to High
Sorting:	Well Sorted

COMMENTS

- Generally uniform grayish color.
- No visible stratigraphy.
- Slightly finer gradation with depth.
- No coral cobble or large-diameter material.

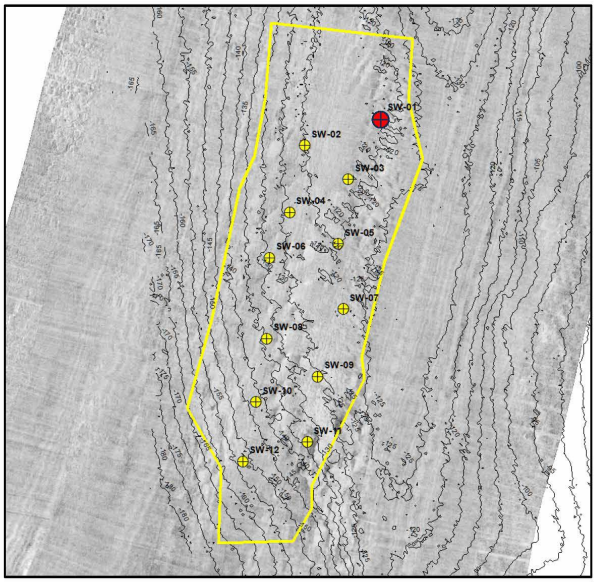


Figure 4-8 Vibracore Log SW-01

VIBRACORE LOG SW-02

PHOTOGRAPHS



CORE ID:	SW-02
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215866.42° N
EASTING:	1628318.53 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	30-May-21
CORE LENGTH:	37 in (3.1 ft)
WATER DEPTH:	119 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Tan
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Variable
Sorting:	Moderately Sorted

COMMENTS

- Generally uniform tan color.
- No visible stratigraphy.
- No anoxic layers or organic content.
- No gradation with depth.
- No coral cobble or large-diameter material.

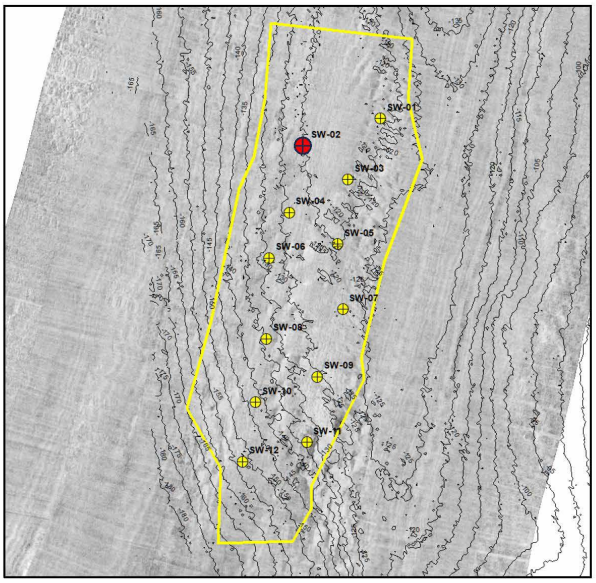


Figure 4-9 Vibracore Log SW-02

VIBRACORE LOG SW-03

PHOTOGRAPHS



CORE ID:	SW-03
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215774.98 N
EASTING:	1628432.82 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	30-May-21
CORE LENGTH:	49 in (4.1 ft)
WATER DEPTH:	117 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Variable
Angularity:	Angular to Sub-angular
Sphericity:	Low
Sorting:	Poorly Sorted

COMMENTS

- Visible stratigraphy.
- Two dark-gray contacts (anoxic).
- Two light-gray contacts (dense Halimeda flakes)
- Coarser gradation with depth.
- No coral cobble or large-diameter material.

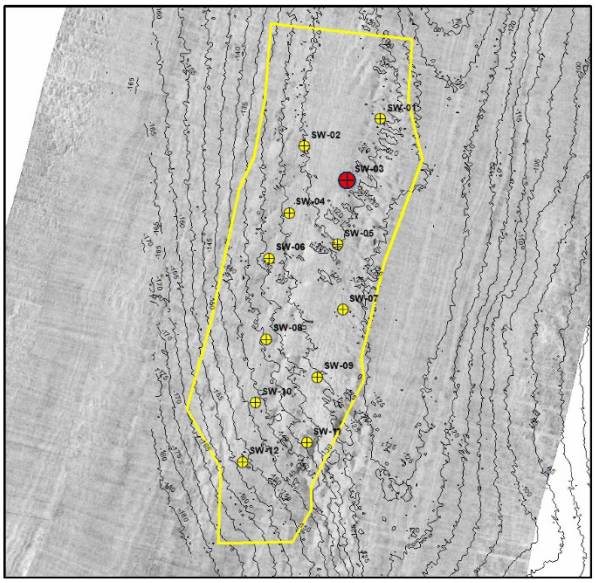
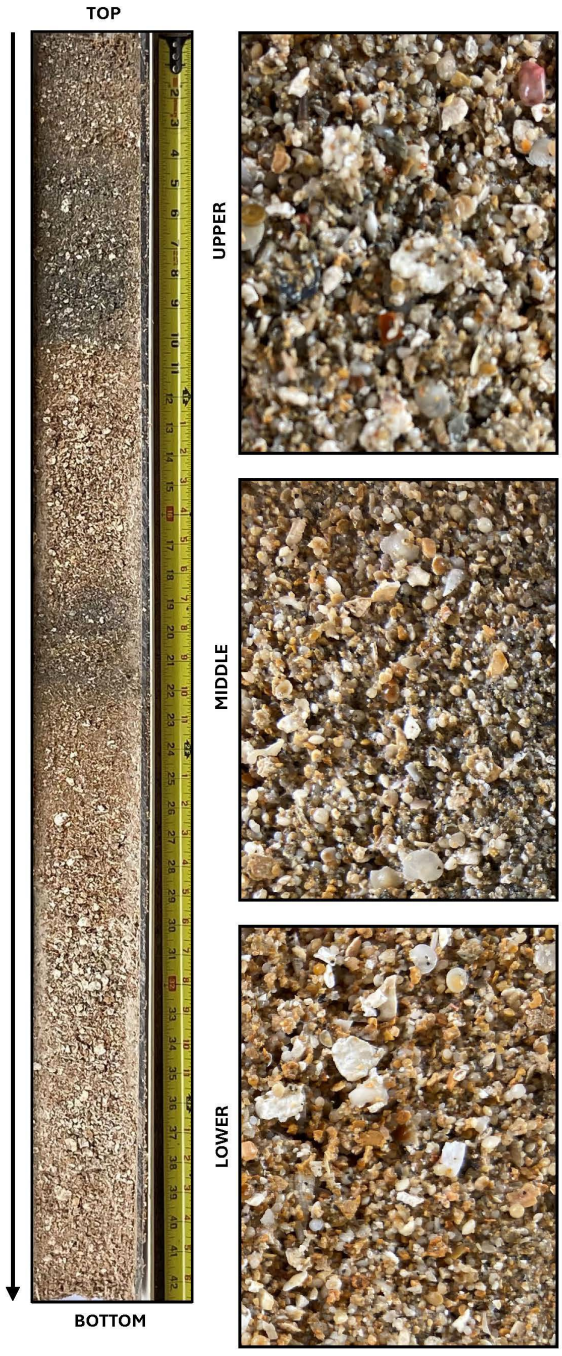


Figure 4-10 Vibracore Log SW-03

VIBRACORE LOG SW-04

PHOTOGRAPHS



CORE ID:	SW-04
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215690.07 N
EASTING:	1628275.9 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	30-May-21
CORE LENGTH:	42 in (3.5 ft)
WATER DEPTH:	124 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Variable
Angularity:	Angular to Sub-angular
Sphericity:	Low
Sorting:	Poorly Sorted

COMMENTS

- Visible stratigraphy.
- Two dark-gray contacts (anoxic).
- One light-gray contact (dense Halimeda flakes)
- Coarser gradation with depth.
- No coral cobble or large-diameter material.

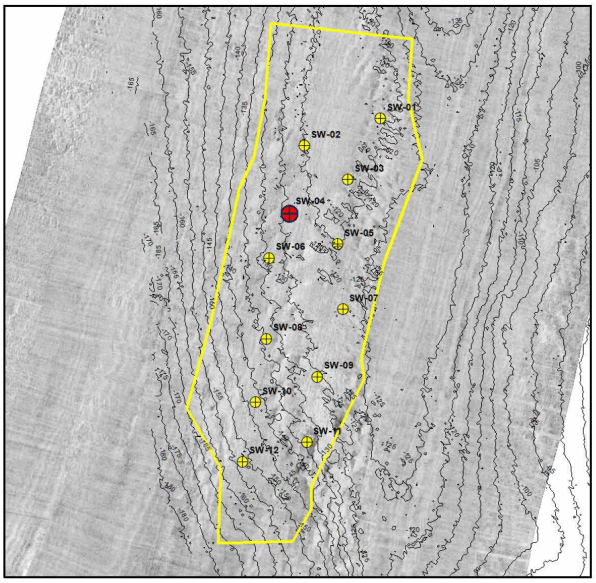
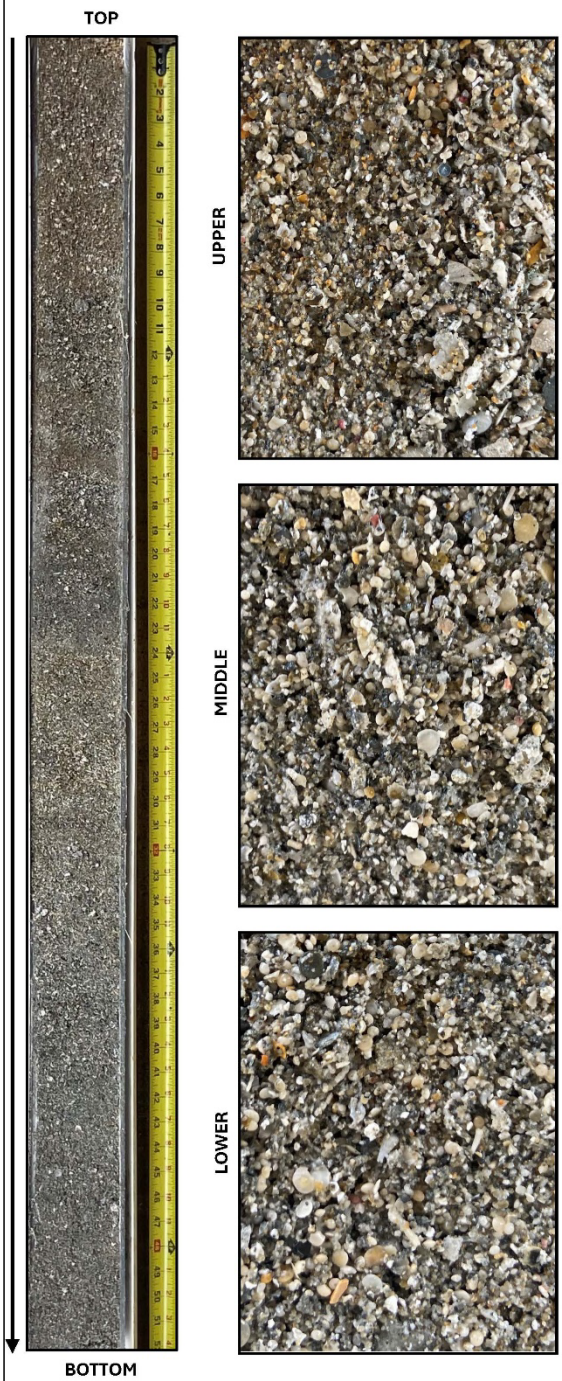


Figure 4-11 Vibracore Log SW-04

VIBRACORE LOG SW-05

PHOTOGRAPHS



CORE ID:	SW-05
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215571.21 N
EASTING:	1628221.82 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	30-May-21
CORE LENGTH:	52 in (4.3 ft)
WATER DEPTH:	121 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Tan
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Moderately Sorted

COMMENTS

- Generally uniform grayish color.
- Poorly-defined stratigraphy.
- No gradation with depth.
- No coral cobble or large-diameter material.

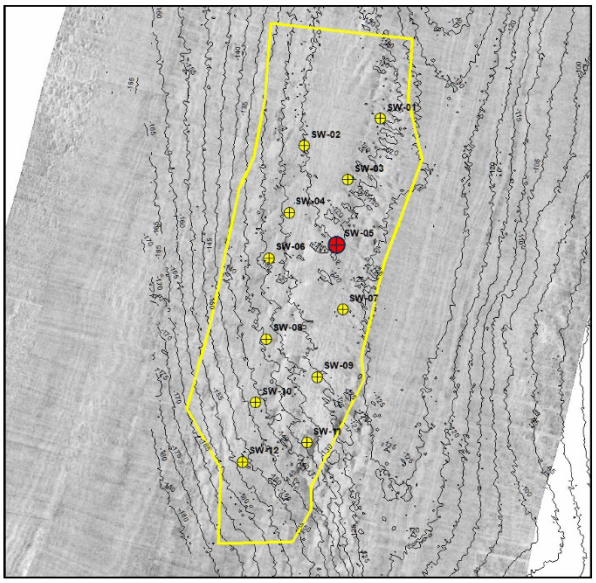
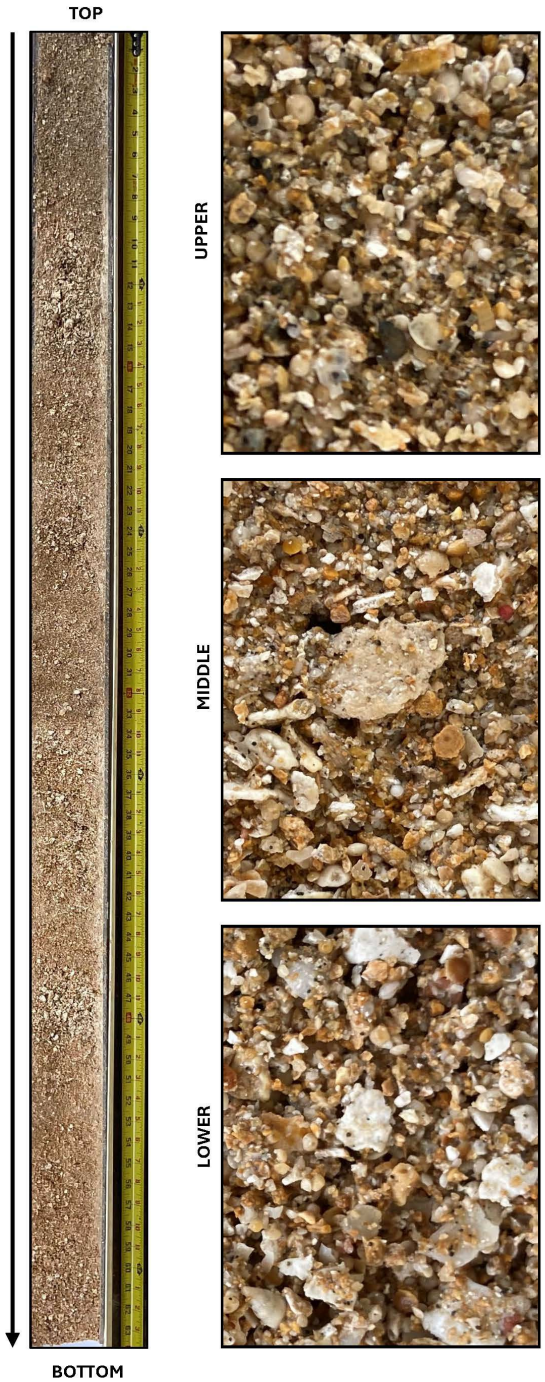


Figure 4-12 Vibracore Log SW-05

VIBRACORE LOG SW-06

PHOTOGRAPHS



CORE ID:	SW-06
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215605.08 N
EASTING:	1628402.7 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	30-May-21
CORE LENGTH:	63 in (5.25 ft)
WATER DEPTH:	127 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Tan
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Poorly Sorted

COMMENTS

- Visible stratigraphy.
- Four light-gray contacts (dense Halimeda flakes)
- No gradation with depth.
- No coral cobble or large-diameter material.

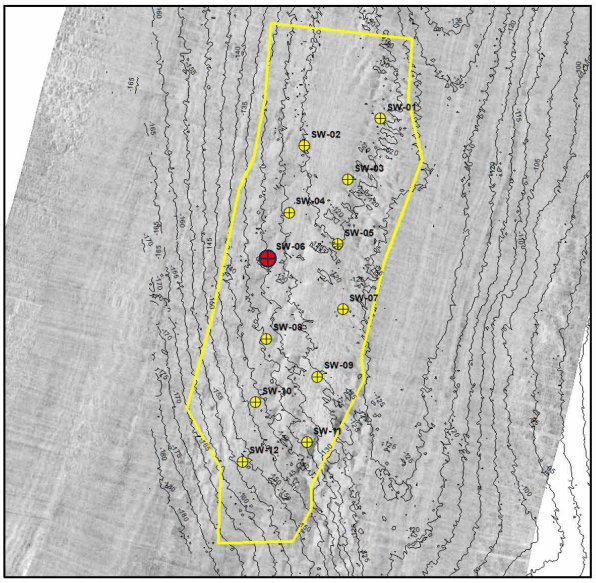
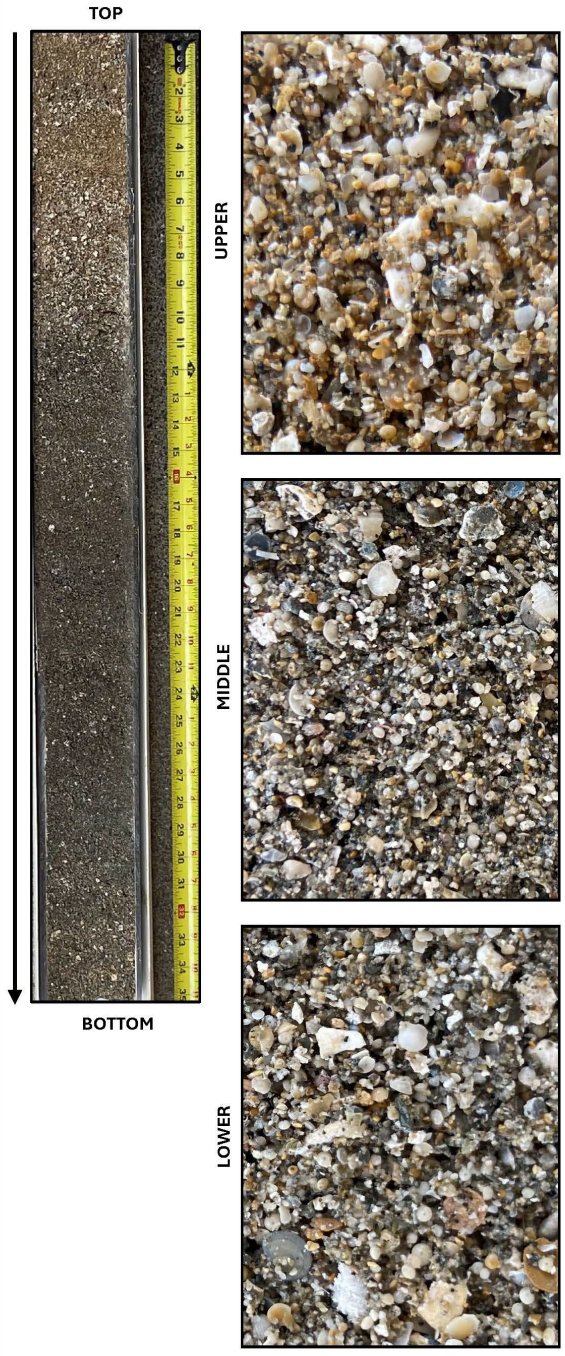


Figure 4-13 Vibracore Log SW-06

VIBRACORE LOG SW-07

PHOTOGRAPHS



CORE ID:	SW-07
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215432.57 N
EASTING:	1628413.74 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	31-May-21
CORE LENGTH:	35 in (2.9 ft)
WATER DEPTH:	121 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Variable
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Moderately Sorted

COMMENTS

- Visible stratigraphy.
- Darker color with depth.
- Finer gradation with depth.
- No coral cobble or large-diameter material.

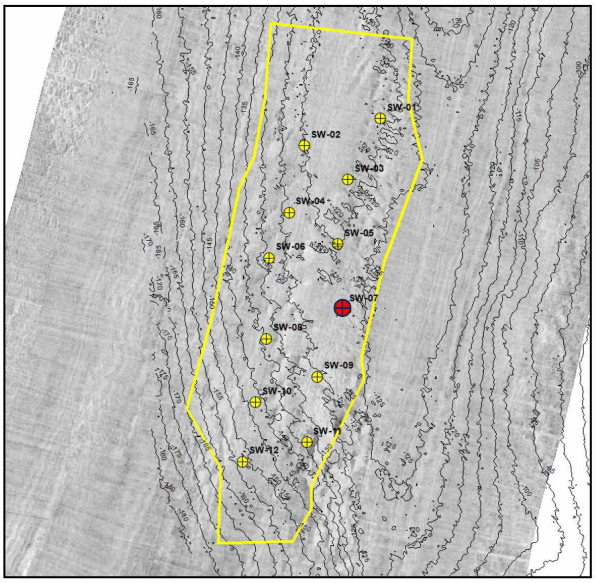
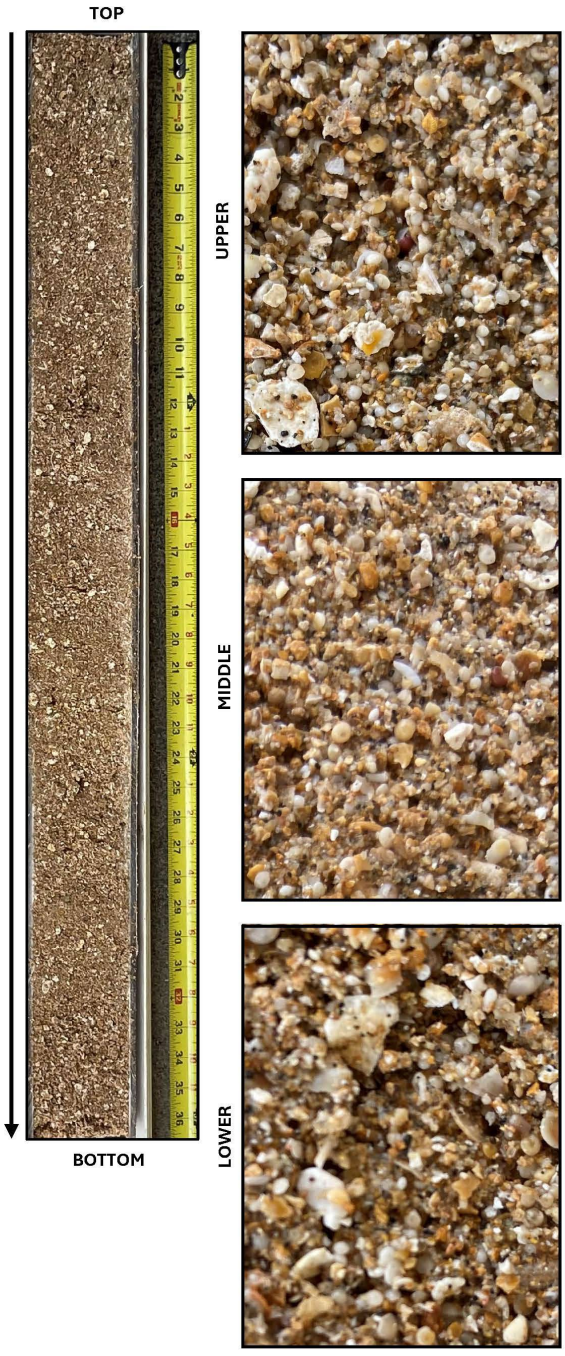


Figure 4-14 Vibracore Log SW-07

VIBRACORE LOG SW-08

PHOTOGRAPHS



CORE ID:	SW-08
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215357.9 N
EASTING:	1628210.96 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	31-May-21
CORE LENGTH:	36 in (3 ft)
WATER DEPTH:	133 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Tan
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Moderately Sorted

COMMENTS

- Generally uniform tan color.
- No visible stratigraphy.
- Slightly coarser gradation with depth.
- No coral cobble or large-diameter material.

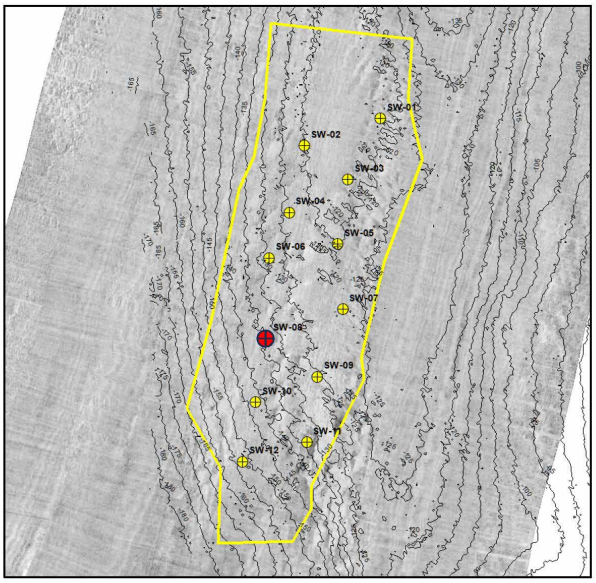
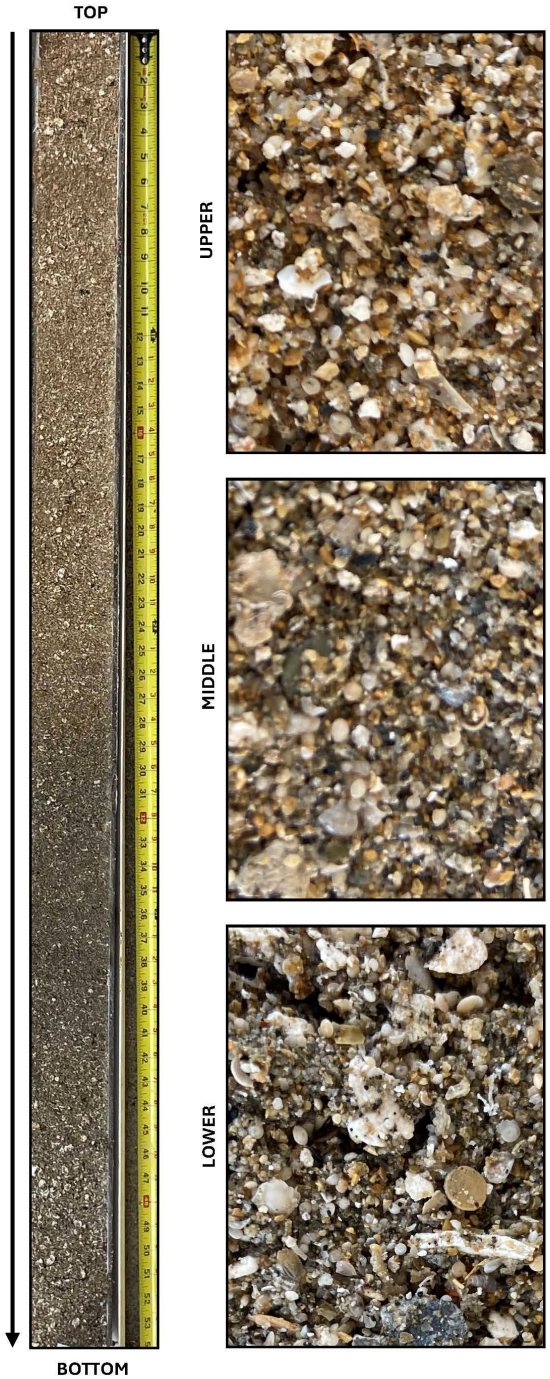


Figure 4-15 Vibracore Log SW-08

VIBRACORE LOG SW-09

PHOTOGRAPHS



CORE ID:	SW-09
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215255.7 N
EASTING:	1628343.87 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	31-May-21
CORE LENGTH:	54 in (4.5 ft)
WATER DEPTH:	127 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Variable
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Moderately Sorted

COMMENTS

- Visible stratigraphy.
- Darker color with depth.
- Coarser gradation with depth.
- No coral cobble or large-diameter material.

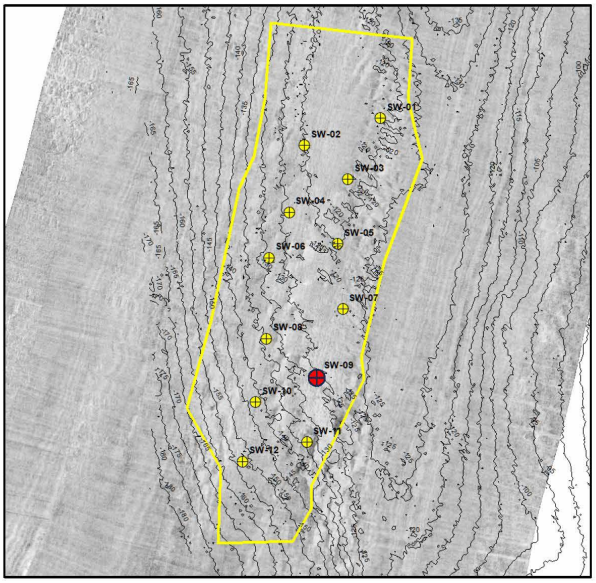
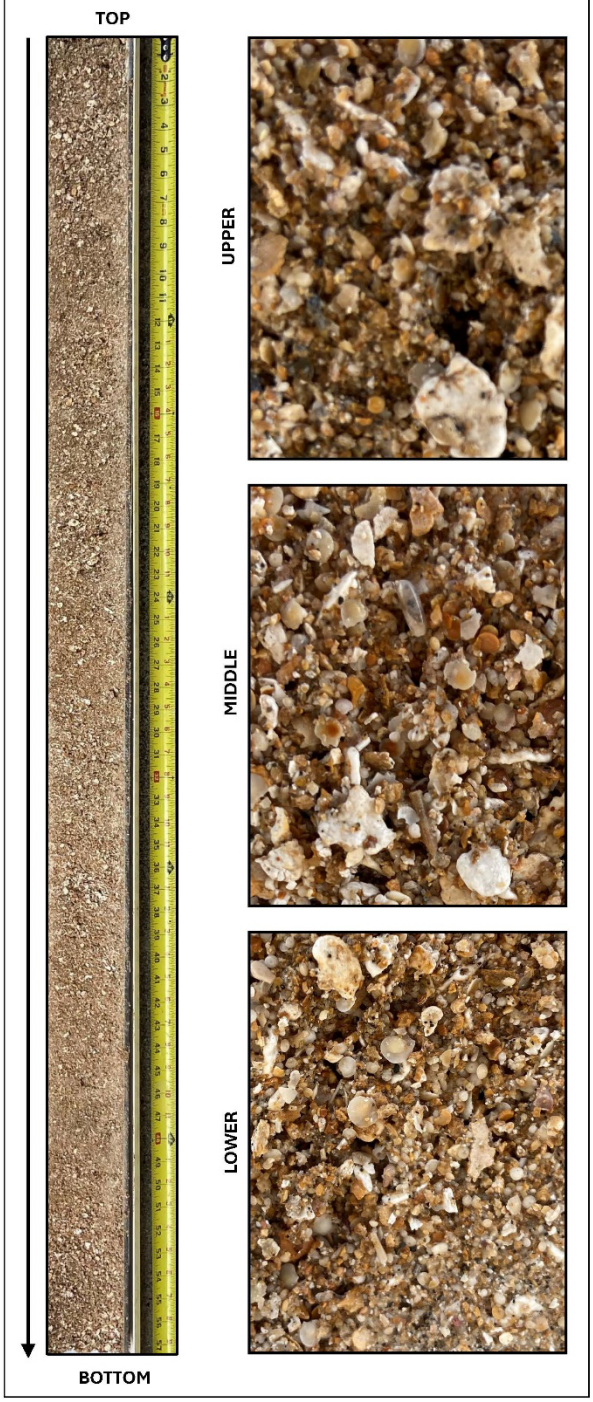


Figure 4-16 Vibracore Log SW-09

VIBRACORE LOG SW-10

PHOTOGRAPHS



CORE ID:	SW-10
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215190.14 N
EASTING:	1628180.16 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	31-May-21
CORE LENGTH:	58 in (4.8 ft)
WATER DEPTH:	143 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Coarse to Medium
Color:	Tan
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Poorly Sorted

COMMENTS

- Generally uniform tan color.
- No stratigraphy.
- No gradation with depth.
- No coral cobble or large-diameter material.

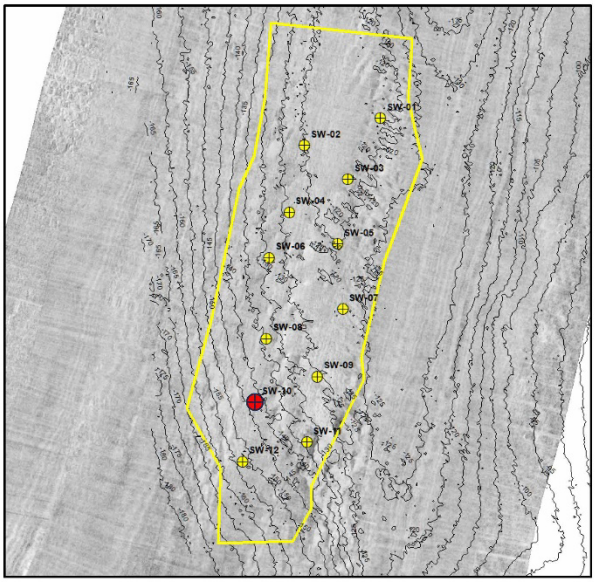
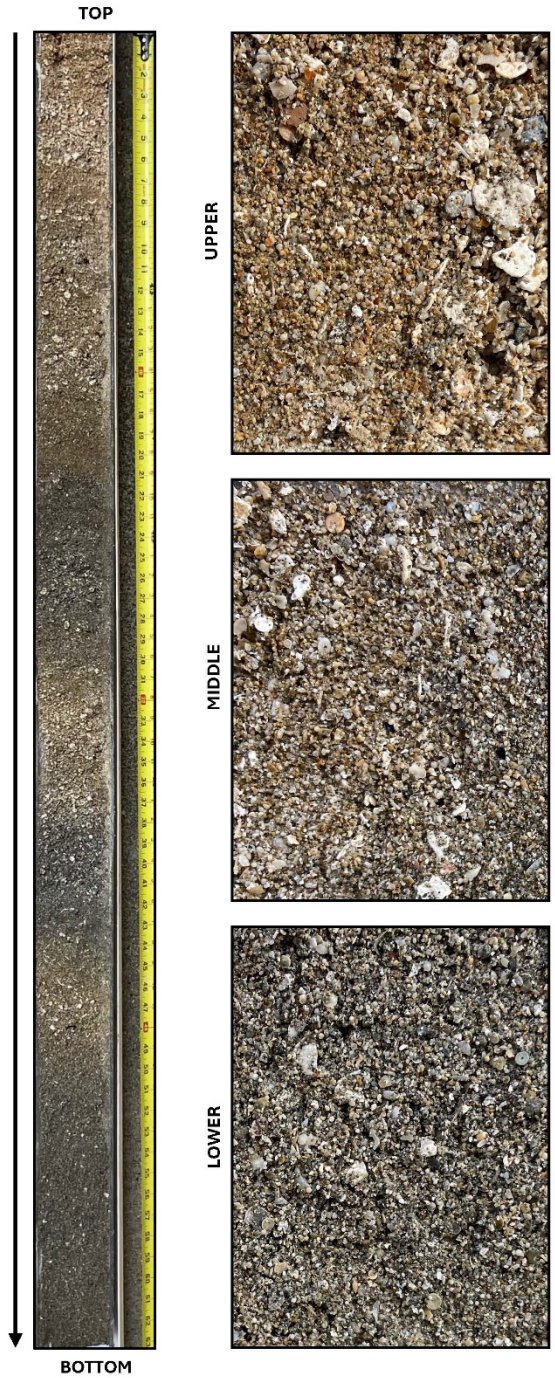


Figure 4-17 Vibracore Log SW-10

VIBRACORE LOG SW-11

PHOTOGRAPHS



CORE ID:	SW-11
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215082.68 N
EASTING:	1628314.32 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	31-May-21
CORE LENGTH:	63 in (5.25 ft)
WATER DEPTH:	132 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Variable
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Moderately Sorted

COMMENTS

- Visible stratigraphy.
- Three dark-gray contacts (anoxic).
- Slightly finer gradation with depth.
- No coral cobble or large-diameter material.

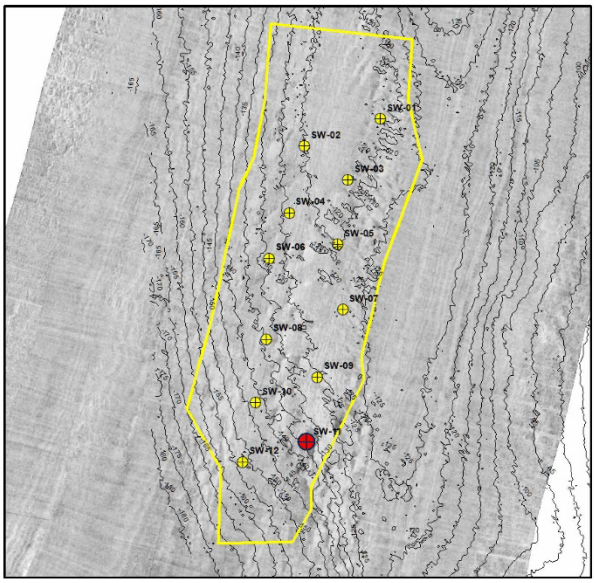


Figure 4-18 Vibracore Log SW-11

VIBRACORE LOG SW-12

PHOTOGRAPHS



CORE ID:	SW-12
LOCATION:	Sand Wave (Kaanapali, Maui)
NORTHING:	215034.31 N
EASTING:	1628143.35 E

COLLECTED BY:	Sea Engineering, Inc.
DATE COLLECTED:	31-May-21
CORE LENGTH:	50 in (4.2 ft)
WATER DEPTH:	152 ft

LITHOLOGIC DESCRIPTION	
Sediment Type:	Sand
Origin:	Marine
Composition:	Calcareous
Grain Size:	Medium to Coarse
Color:	Variable
Angularity:	Sub-angular to Sub-rounded
Sphericity:	Low
Sorting:	Moderately Sorted

COMMENTS

- No visible stratigraphy.
- Upper dark-gray contact (anoxic).
- Slightly coarser gradation with depth.
- No coral cobble or large-diameter material.

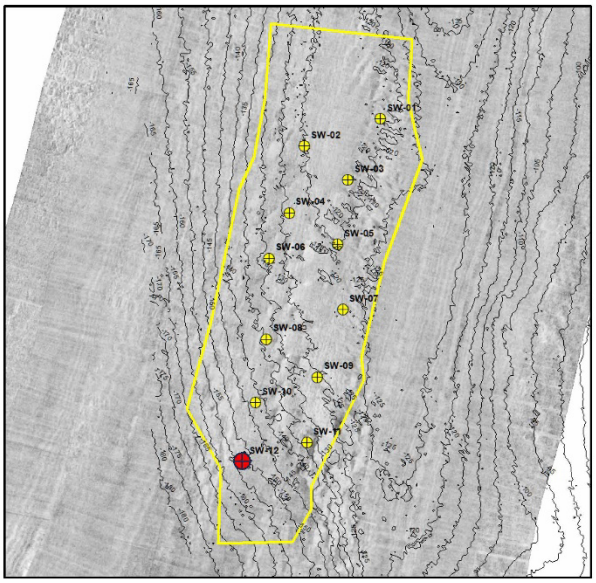


Figure 4-19 Vibracore Log SW-12

4.4 Photographic Analysis

Carbonate sands range in color from pure white to yellow, brown, and dark grey. Sand color has an important aesthetic value to beachgoers and should not be ignored when selecting an appropriate sand source for beach nourishment. Beyond the aesthetic value, color also affects temperature, as darker sands achieve higher temperatures under intense tropical sunlight than sands of lighter color. A suitable offshore sand source would preferably closely match the color of the existing beach sand. Composite samples were collected from the vibracores and dried over the course of several days under direct sunlight. The photographs are representative of the typical color and composition of the sand where each vibracore sample was collected. After offshore sand is placed on the beach, the sand color typically lightens with sustained UV exposure. Figure 4-20 shows a dry color comparison of the offshore sand samples and the existing beach sand at the Project Site. Figure 4-21 and Figure 4-22 show a dry color comparison of the existing beach sand with the offshore sand samples from the inner and outer portions of the sand deposit, respectively.

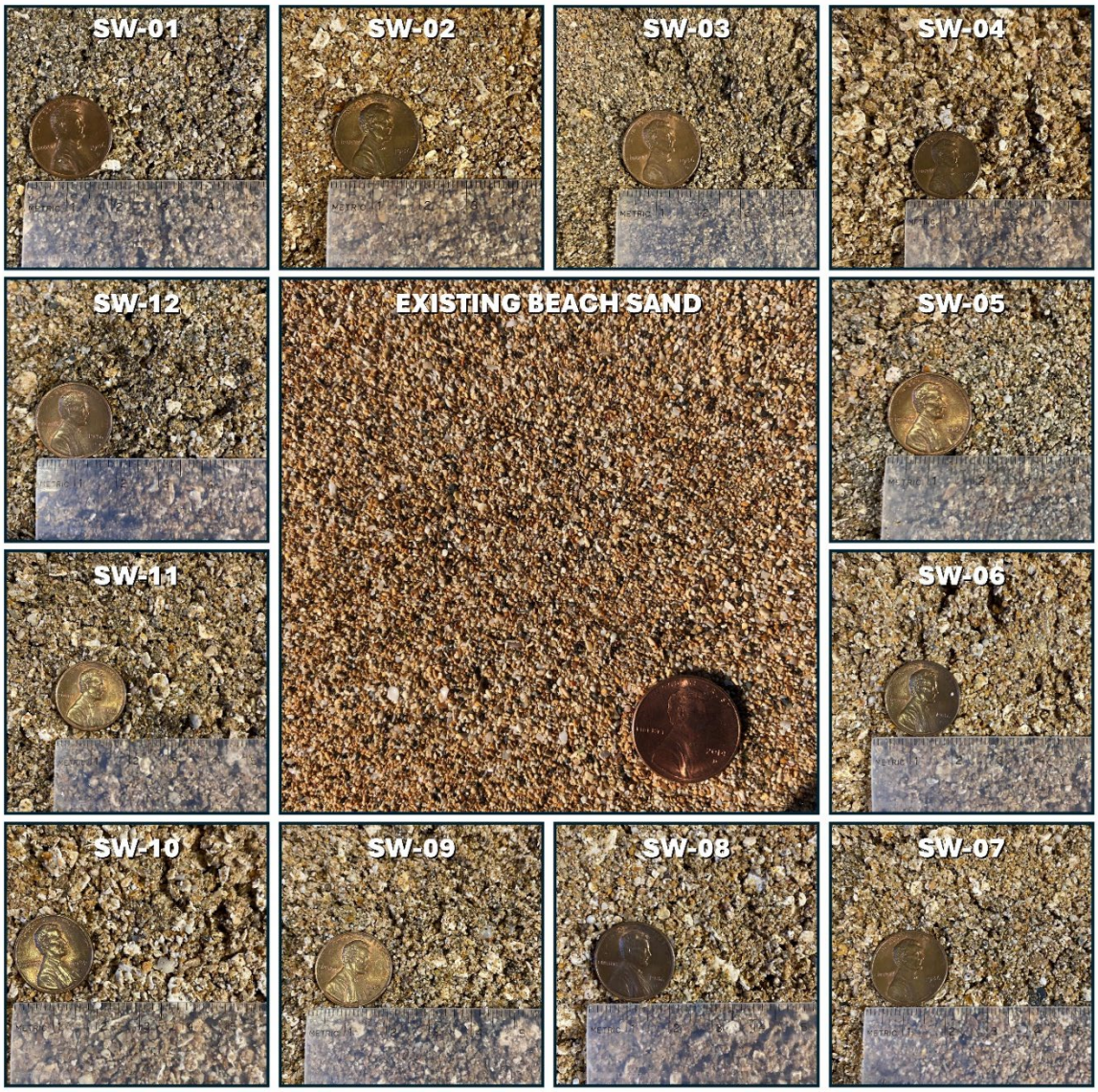


Figure 4-20. Photographic comparison of existing beach and Sand Wave sand samples

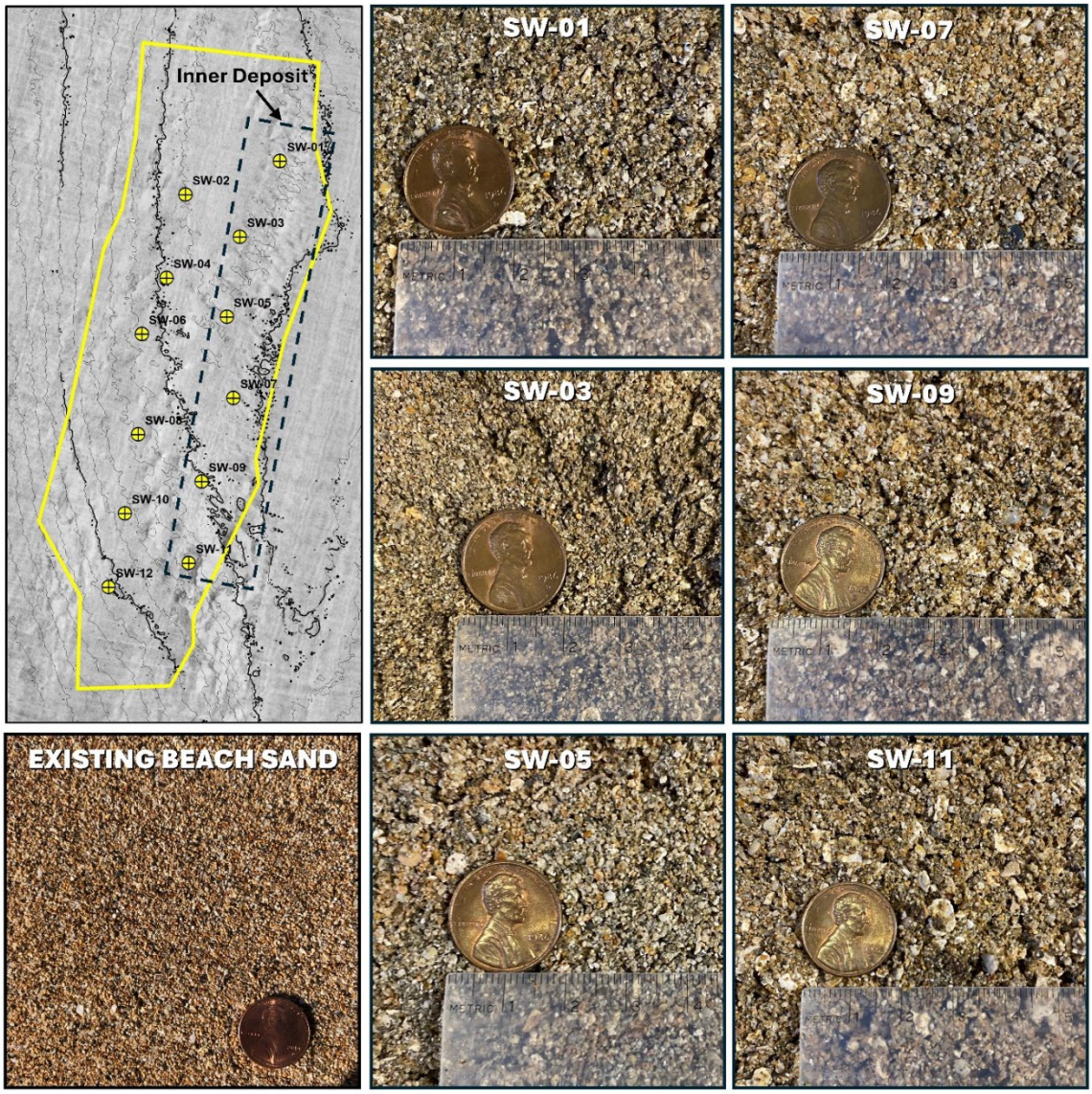


Figure 4-21. Photographic comparison of existing beach and inner Sand Wave sand samples

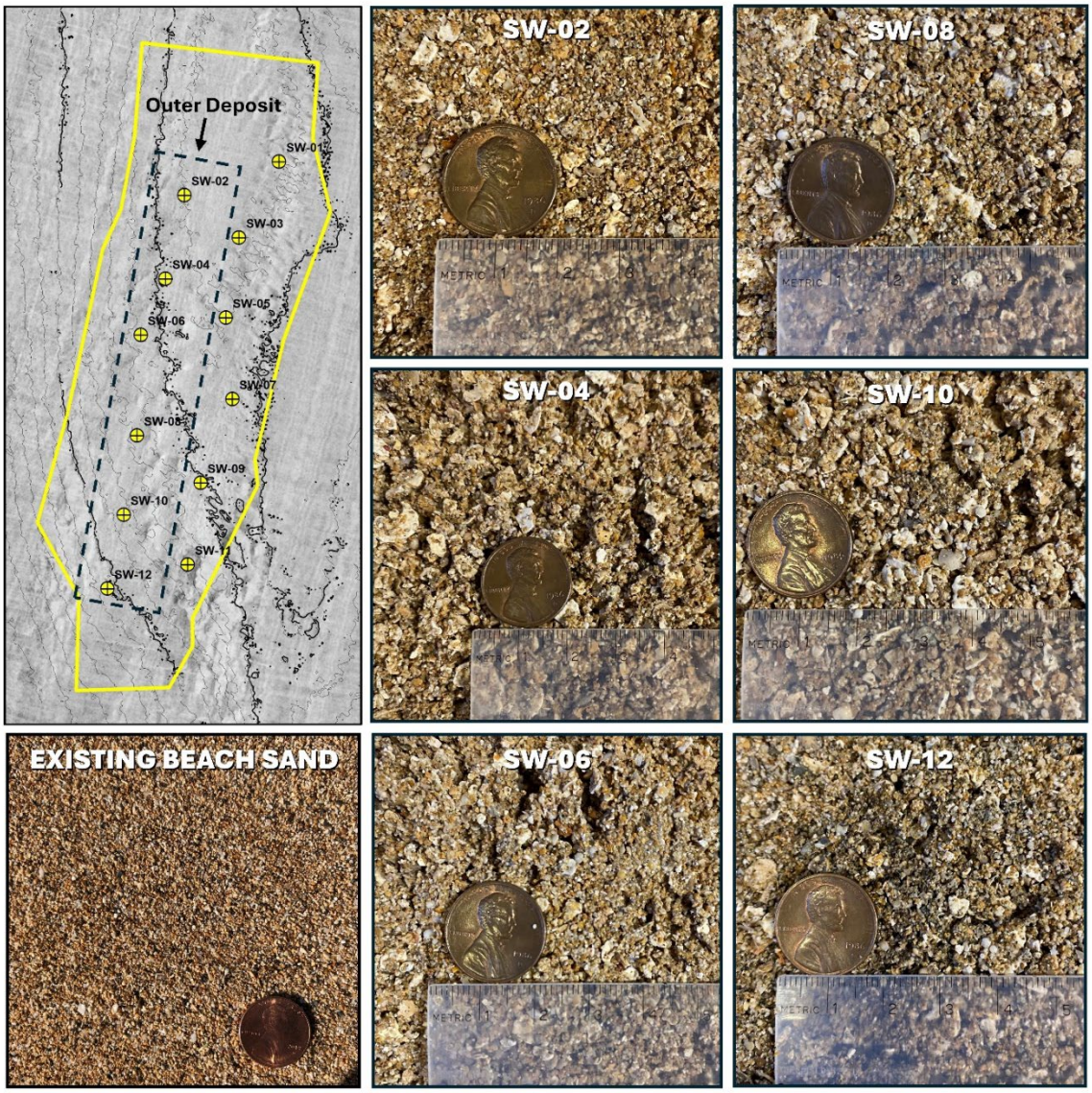


Figure 4-22. Photographic comparison of existing beach and outer Sand Wave sand samples

4.5 Grain Size Analysis

The Hawai'i Department of Land and Natural Resources (DLNR) has established the following guidelines for fill sand used for beach nourishment projects:

- Sand shall not contain more than 6% silt material (grain size smaller than 0.074 mm).
- Sand shall not contain more than 10% coarse material (grain size greater than 4.76 mm).
- Grain size distribution will fall within 20% of the existing beach grain size distribution.
- Overfill ratio of fill sand to existing sand shall not exceed 1.5.
- Sand will be primarily composed of naturally occurring carbonate beach or dune sand.
- Sand shall be free of contaminants.

The representative sand samples collected from the vibracores were analyzed using a standard laboratory sieve technique to determine grain size distribution. For any sediment sample, the percentages of grains that fall within different size classes are determined and used to create a grain size distribution curve. The grain size distributions of the offshore sand samples were compared with the existing beach. The results of the grain size analysis are shown in Figure 4-23. In the figure, the results of the grain size analysis use a Log Base 10 scale on the X axis for grain size. The cumulative percentage of grain sizes for each sample is presented on the Y axis. Shown in black in the figure is the average grain size distribution for the existing beach sand at the project site. Also shown in black dashed lines are the ±20% bounds specified in the DLNR beach nourishment guidelines.

The average grain size of the sand from the Sand Wave deposit (dashed red line) is shown to be only slightly coarser than the existing beach sand (solid black line). The median grain size (D_{50}) at the Sand Wave deposit is 0.55 mm, which is slightly coarser than the D_{50} for the existing beach sand (0.44 mm). The sorting value is 1.02, which categorizes the sand as poorly sorted. The percentage of the sand fill with grain size smaller than 0.074 mm (#200 sieve) is 3%, which means that the sand fill contains a minimal amount of fine material. Sand samples collected from the inner portion of the sand deposit (solid red line) closer to shore are less coarse and within the ±20% DLNR guidelines for coarse material. The Sand Wave deposit is large (estimated 12.5 acres) and contains a substantial volume of sand (estimated 975,000 cy), so dredging can be strategically focused on the inner portion of the deposit to maximize compatibility with the existing beach sand.

Based on the grain size distribution, natural marine carbonate grains, percentage of fine and coarse material, and overfill ratio (see Section 4.6), the sand from the Sand Wave deposit is compatible with the existing beach sand and complies with the DLNR guidelines for beach nourishment:

- Sand contains less than 3% material smaller than 0.074mm.
- Sand contains no coarse material greater than 4.76 mm.
- Grain size distribution of inner sand deposit is within ±20% of the existing beach sand.
- Overfill ratio of the fill sand to existing beach sand is 1.0 (no overfill required).
- No physical evidence or events to indicate that the sand contains any contaminants.
- Sand is composed of naturally occurring carbonate sand.

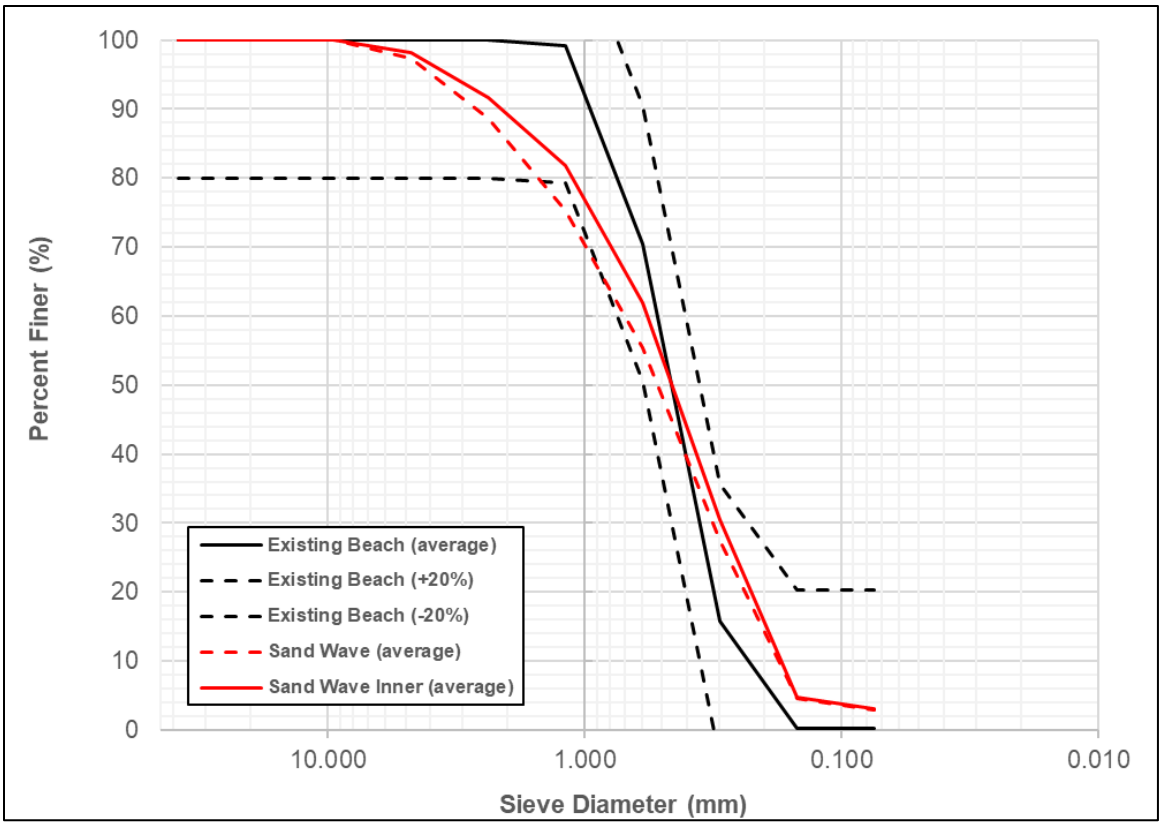


Figure 4-23. Grain size distributions for the Sand Wave deposit and the Project Site

4.6 Overfill Factor

A beach undergoes an adjustment period following nourishment. The beach equilibrium profile is achieved as sand moves cross-shore and alongshore and there may be an accompanying decrease in beach volume. This loss of sand is compensated for through an overfill ratio, which describes the compatibility of the existing beach and fill sands in terms of their respective grain size distributions. The overfill ratio is determined based on the grain size characteristics of the two sands and represents the volume of fill necessary to yield the desired beach volumes. An overfill ratio >1.0 means that the volume of sand required exceeds the design beach volume, meaning that additional sand beyond the design volume is required. An overfill calculation was performed for the sand from the Sand Wave deposit using the average grain size distributions of the existing beach sand for comparison (Table 4-1). The overfill ratio for the Sand Wave deposit is 1.0. This means that no sand in addition to the design volume needs to be placed during construction.

Table 4-1. Overfill calculation for beach fill sand from the Sand Wave deposit.

M_n	M_b	σ_b	$M_b' - Mn'$	Overfill Factor (K)
1.18	0.74	1.54	-0.29	1.0

4.7 Turbidity Analysis

Sand recovered from offshore deposits is often compatible with existing beach sand but, in some cases, may contain higher percentages of fine material that can increase turbidity during sand recovery and placement operations. Turbidity refers to a reduction in water transparency that occurs when fine sediment particles are suspended in the water column. Recovery, transport, and placement of marine carbonate sand can also increase the percentage of fines through mechanical abrasion of the friable sand grains, which can increase turbidity. Fine material is typically winnowed from the beach system by tidal and wave action during the initial equilibration process. Turbidity is a complex phenomenon that is dependent on both the optical and physical properties of suspended particles and is difficult to model or predict. To help evaluate potential impacts, laboratory turbidity analyses were conducted to compare the borrow sand and existing beach sand.

Turbidity During Sand Recovery

Offshore turbidity is typically expected during sand recovery operations. Turbidity during dredging operations may be reduced by using an environmental clamshell bucket, which is an industry best practice and has been used to minimize turbidity during dredging of harbor channels in Hawaii. Environmental clamshell buckets typically have tighter seals and overlapping sides. These buckets are designed to minimize sediment loss from within the bucket, resuspension at the dredge site, and water entrainment with each grab. A conservative estimate of the amount of material that leaks from an environmental bucket is only 0.5% (Palermo et al. 2008). This material is expected to fall out of suspension rapidly near the dredge location.

Turbidity generated from dredging operations is expected to be transported with the currents moving parallel to shore. Wave action has the potential to transport turbidity inshore. These water quality impacts are expected to be temporary, lasting only during the actual dredging operations, and are expected to be localized to the immediate vicinity of the dredging. Best Management Practices (BMPs) should be followed throughout the sand recovery work, consistent with Section 404 and Section 401 of the Clean Water Act.

Turbidity During Sand Placement

Beach restoration projects can generate turbidity plumes that can be unsightly and affect water clarity for days. Although sand fill placed on a beach must closely match the existing beach sand with respect to grain size, offshore sand will typically have a higher percentage of fines than native beach sand. Additionally, fines may be generated during dredging and placement of offshore sand onto the beach. After placement, wave action can suspend the fines creating turbidity plumes immediately offshore of the nourished beach.

Silt curtains and containment barriers should be deployed along the shoreline where sand placement is occurring. Following placement of sand on the beach, there will likely be periodic turbidity associated with equilibration of the beach profile and planform and during large wave events, as sand moves along the beach and cross-shore. Larger sand size grains are currently stable along the coastline and make up the existing beach face; however, finer material will likely move in the offshore direction through the channels.

Laboratory Turbidity Analysis

Laboratory turbidity tests were performed on numerous sand samples from the potential borrow areas. Turbidity was determined by measuring the scattering of the light through sample cells that contained distilled water and sand in suspension. A total of twelve (12) composite sand samples were obtained from the Sand Wave deposit and analyzed for turbidity.

Turbidity was measured using a Hach 2100Q Portable Turbidimeter (Figure 4-24). The instrument has an optical laser configuration that measures the scattering of the light passing through the sample cell (Figure 4-25). Turbidity is measured in Nephelometric Turbidity Units (NTUs), a standard turbidity unit for environmental monitoring in the United States. The instrument was calibrated once before the first experiment using the manufacturer's 20, 100, and 800 NTU StablCal primary calibration standards and the 10 NTU primary verification standard. The cells used for the turbidity readings were glass Hach Lab Turbidimeter Sample Cells.

All sample bottles and sample cells were meticulously cleaned prior to use. The sample bottles were vigorously cleaned with tap water. The sample cells were cleaned with tap water and filled with distilled water, then left filled for a minimum of 24 hours. The sample cells remained filled with distilled water until use to avoid oxygen contamination. Before each turbidity test, the cells were emptied, cleaned with tap water, and refilled with distilled water until overflowing. The outside walls were treated with a thin coating of Hach silicone oil to cover imperfections and scratches and to minimize stray light.

Test samples were prepared with one tablespoon of dry sand placed in a 120 mL Polystyrene sample bottle. The bottle was then filled with 100 mL of distilled water. Preceding each turbidity test run, the sample bottle was shaken vigorously to emulate turbulence. The suspension was immediately poured into a cleaned Hach cell, which was then inverted three times following the manufacturer's guidelines and placed in the machine. The turbidity runs began immediately upon cell insertion within the analyzer. A reading was taken for each sample at the following time intervals:

- 30 seconds
- 1 minute
- 2 minutes
- 5 minutes
- 10 minutes
- 15 minutes
- 20 minutes
- 30 minutes
- 1 hour
- 2 hours
- 4 hours
- 6 hours
- 24 hours



Figure 4-24. 2100Q Portable Turbidimeter

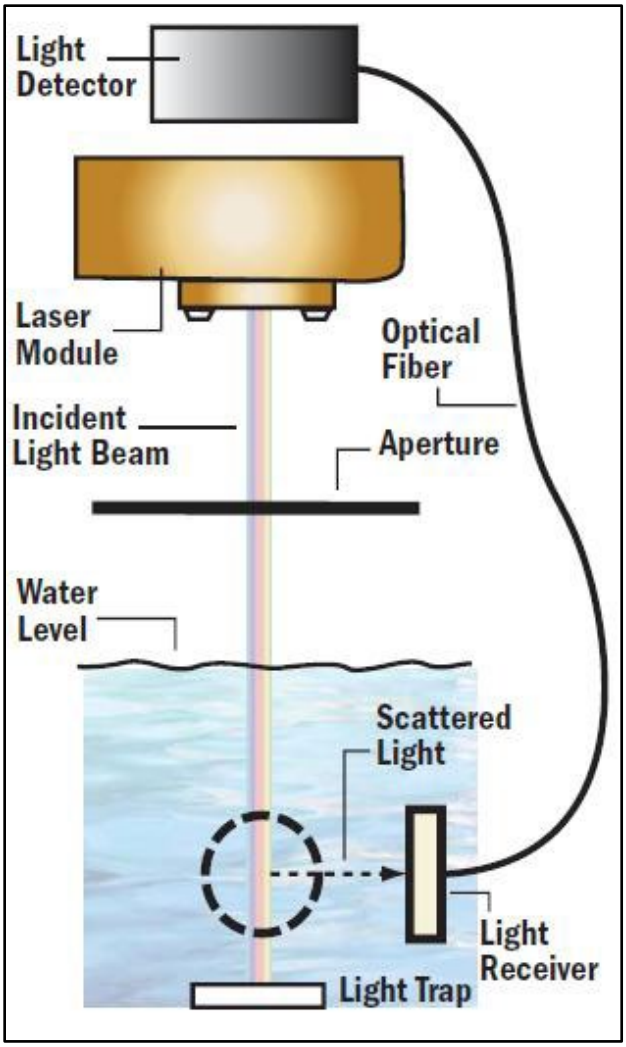


Figure 4-25. Laser Nephelometer Optical Configuration (Sadar, Cason, and Engelhardt; 2009)

Laboratory Turbidity Analysis Results

Results were stored on the device's internal memory and uploaded to a computer for further analysis. Data are plotted as turbidity versus time. The turbidity results should not be considered indicative of turbidity levels that are to be expected during beach restoration because they result from artificial experiments in a small sample bottle. This controlled environment does not simulate the energetic conditions in the marine environment. The turbidity results are, however, useful for evaluating differences between the existing beach sand and the potential sand fill.

The turbidity readings as a function of time for all 12 samples are presented in Figure 4-26, where turbidity levels are presented on the Y axis and time on the X axis. All samples tested showed an initial increase in turbidity that decreased exponentially over time. Initial readings showed turbidity values up to 1,000 NTU; however, the turbidity values decreased over 50% within 30 minutes and over 90% within 2 hours. Within 24 hours, the NTU readings decreased by over 99% with an average of 10 NTU (Figure 4-26, Table 4-2).

A turbidity analysis was also performed for a sample of the existing beach sand at the Project Site. While the beach sand sample had a significantly lower initial turbidity reading (101 NTU), the turbidity reading after 24 hours was 14 NTU, which was 4 NTU higher than the offshore sand samples at that time interval.

Marine Research Consultants, Inc. (MRC, 2021; 2024) conducted water chemistry analysis for water samples collected offshore of the Project Site and found that turbidity values near the shoreline ranged from 0.15 to 1.75 NTU and exceeded DOH criteria at several locations. Hui O Kai Ola (2024) has conducted independent water quality monitoring at a location fronting the Project Site. From 2016 to 2024, turbidity values at this location ranged from 1.6 to 10.1 NTU with an average turbidity value of 4.1 NTU, which is nearly four times the DOH criteria (Table 4-3). It is likely that the elevated values of turbidity in the nearshore zone are a result of resuspension of organic particulate material by wave action.

The results of the turbidity analysis indicate that the offshore sand from the Sand Wave deposit is expected to generate increased turbidity that would temporarily exceed the DOH criteria. However, the increase in turbidity would be expected to decrease exponentially and return to normal background levels within a relatively short period of time. These impacts are anticipated to be minor and temporary in nature and no long-term increase in turbidity is expected.

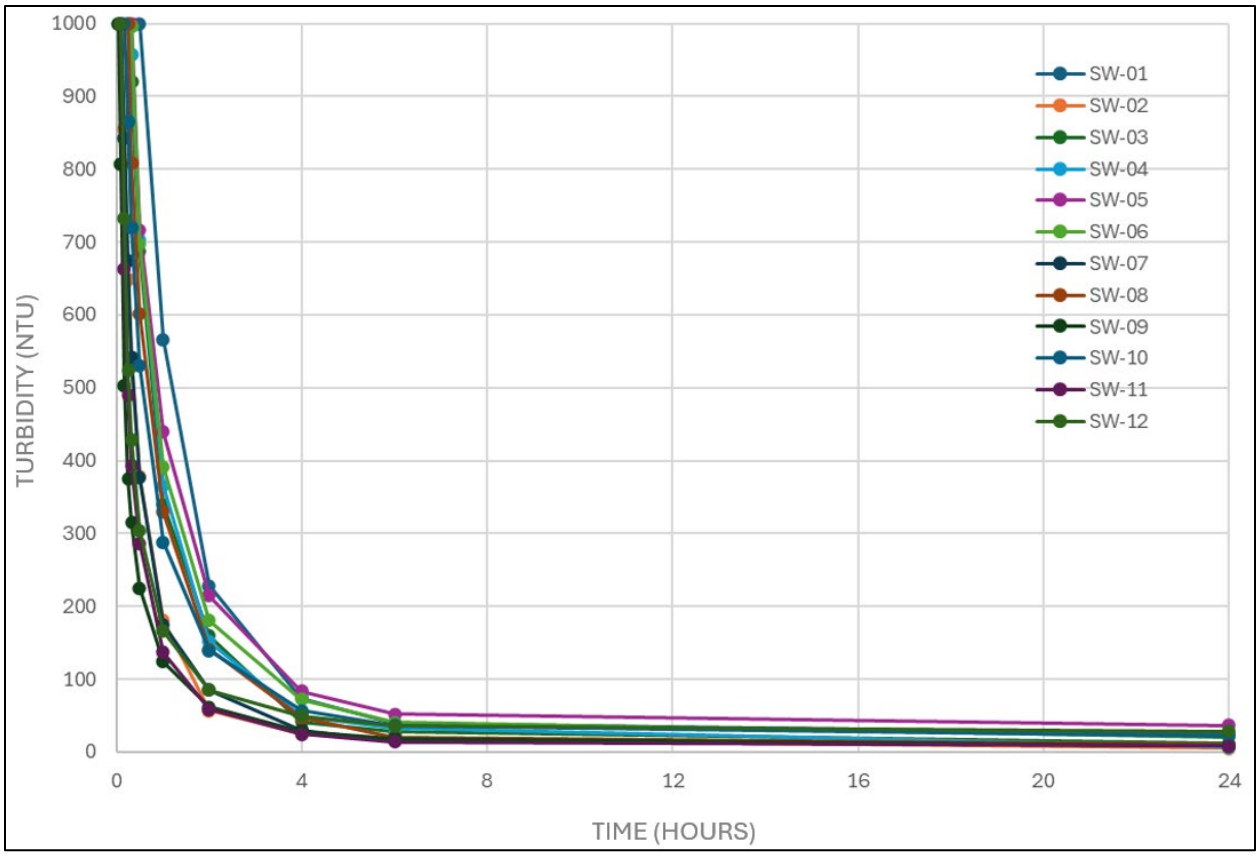


Figure 4-26. Turbidity analysis for offshore sand samples (24 hours)

Table 4-2. Turbidity values (NTU) for offshore sand samples (24 hours)

TIME (H:M:S)	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07	SW-08	SW-09	SW-10	SW-11	SW-12	AVG	% DECREASE
00:00:00	999	999	999	999	999	999	999	999	999	999	999	999	999	0%
00:00:30	999	999	999	999	999	999	999	999	999	999	999	999	999	0%
00:01:00	999	999	999	999	999	999	999	999	999	999	999	999	999	0%
00:02:00	999	999	999	999	999	999	999	999	999	999	999	982	998	0%
00:05:00	999	999	999	999	969	999	999	999	733	999	999	589	940	6%
00:10:00	999	999	999	999	736	999	975	946	415	920	933	409	861	14%
00:15:00	999	969	966	999	598	967	748	749	284	710	741	294	752	25%
00:20:00	999	781	777	999	504	809	600	637	215	566	596	225	642	36%
00:30:00	746	574	554	797	383	597	431	470	141	402	448	147	474	53%
01:00:00	383	298	252	376	207	308	209	255	61	197	231	50	236	76%
02:00:00	159	135	88	153	103	124	48	83	35	66	99	26	93	91%
04:00:00	54	46	35	34	53	47	32	34	23	35	34	17	37	96%
06:00:00	34	39	24	23	39	33	20	24	18	23	29	13	27	97%
24:00:00	9	17	6	5	18	14	6	7	10	8	13	7	10	99%

Table 4-3. Turbidity values (NTU) at Kaanapali Shores site – 2016-2024[3] (Hui O Ka Wai Ola, 2024)

	2016	2017	2018	2019	2020	2021	2022	2023	2024
	16.80	3.78	12.40	3.35	3.01	2.97	1.41	2.31	2.02
	9.79	6.31	6.56	5.44	3.36	2.72	1.83	1.38	1.51
	3.90	6.60	2.94	5.02	1.88	1.60	1.66	5.84	1.89
	6.16	8.40	7.93	5.35	2.75	3.77	1.82	2.75	3.29
	5.81	5.24	8.37	2.98	1.53	5.07	2.49	3.12	1.89
	10.63	2.59	2.36	2.86	4.32	1.37	1.80	1.58	1.20
	6.16	2.59	9.42	5.18	2.08	2.14	1.90	1.34	2.80
	12.07	2.80	7.97	1.29	2.51	1.34	0.80	1.19	1.86
	7.76	5.17	4.62	7.81	1.33	7.32	1.79	1.65	0.91
	5.78	1.99	5.53	3.71	2.80	3.32	2.05	4.06	4.50
	3.08	3.17	7.92	5.86	3.02	3.69	2.40	1.67	3.57
	5.67	2.93	15.27	1.99	4.05	1.61	2.39	1.87	3.51
	6.36	6.49	7.39	2.40	1.81	3.18	1.02	1.65	1.63
	5.80	3.22	3.20	5.72	3.24	4.17	1.32	2.05	
	3.78	5.46	3.89	3.44	2.83	3.48	1.78	4.96	
	6.31	2.79	2.95	3.43		1.77	3.19	2.01	
	6.60	10.11	8.71	3.19		3.81	1.98		
	8.40	25.53							
MINIMUM	3.08	1.99	2.36	1.29	1.33	1.34	0.80	1.19	0.91
AVERAGE	7.27	5.84	6.91	4.06	2.70	3.14	1.86	2.46	2.35
MAXIMUM	16.80	25.53	15.27	7.81	4.32	7.32	3.19	5.84	4.50

[3] 2024 monitoring data extends through 9/17/2024.

5. REFERENCES

Bodge, K.R. 2006. "Alternative Computation of Dean's Overfill Ratio." Journal of Waterway, Port, Coastal, and Ocean Engineering, Vol. 132, No. 2, p. 133-138.

Hanzawa, H. 2006. Maui Inland Sand Resource Quantification Study. Prepared for County of Maui Department of Public Works & Environmental Management. Prepared by SSFM International.

Moffatt & Nichol. 2011. Hawaii Regional Sediment Management, Kahului and Kihei Regions, Final Report: Geomorphology, Coastal Processes, Shoreline Change & Potential RSM Projects. Prepared for U.S. Army Corps of Engineers.

Moffatt & Nichol. 2016. Kahana Beach Regional Beach Nourishment Feasibility Study, County of Maui. File Number 9245.

OCM Partners. 2020. 2007 JALBTCX Hawaii Lidar: North Coasts of Hawaii (Big Island), Kauai, Maui, Molokai, Oahu, https://inport.nmfs.noaa.gov/inport/item/50066.

Sea Engineering, Inc. 2007. Kaanapali and Kahekili Beach Offshore Sand Reconnaissance Survey. Prepared for Kaanapali Operations Association, Inc. November 2007. SE Job No. 07-53.

Sea Engineering, Inc. 2008. Kaanapali Sand Survey – Phase 3. Prepared for Kaanapali Operations Association, Inc. September 2008. SE Job No. 25101.

Sea Engineering. 2012. Kaanapali Beach Needs and Management Alternatives Study. Prepared for Kaanapali Operations Association, Inc. May 2012. SE Job No. 25236.

Sea Engineering. 2018. Kaanapali Beach Restoration and Berm Enhancement Project – Environmental Impact Statement Preparation Notice (EISPN). Prepared for Hawaii Department of Land and Natural Resources. July 2018. SE Job No. 25457.

Swarzenski, P.W., Storlazzi, C.D., Presto, M.K., Gibbs, A.E., Smith, C.G., Dimova, N.T., Dailer, M.L., and Logan, J.B. 2012. Nearshore morphology, benthic structure, hydrodynamics, and coastal groundwater discharge near Kahekili Beach Park, Maui, Hawaii. U.S. Geological Survey Open-File Report 2012–1166, 34 pp. (Available at http://pubs.usgs.gov/of/2012/1166/.).

U.S. Army Corps of Engineers. 2015. Regional Sediment Management Program – Benthic Mapping Demonstration for West Maui, Hawaii. February 2015.

U.S. Army Corps of Engineers. 2006. Coastal Engineering Manual. Washington, D.C. EC 1110-2-1100, June 2006.

U.S. Geological Survey. 2012. Nearshore Morphology, Benthic Structure, Hydrodynamics, and Coastal Groundwater Discharge near Kahekili Beach Park, Maui, Hawaii. Open File Report 2012-1166.

APPENDIX E

Assessment of the Marine Environment

Hoʻāla Honokōwai
Lahaina, Maui, Hawaiʻi
Tax Map Key Nos. (2) 4-4-001:097, 098, and 100

Prepared By: Marine Research Consultants, Inc.

MARINE RESEARCH CONSULTANTS, INC.

BASELINE ASSESSMENT OF MARINE WATER CHEMISTRY AND MARINE BIOTIC COMMUNITIES

Hoʻala Honokōwai, West Maui, Hawaiʻi



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1 INTRODUCTION

Kā‘anapali Beach Club is located at 104 Kā‘anapali Shores Place, Lahaina, Maui, Hawai‘i; Tax Map Key (2) 4-4-001:098 (Figure 1). The project site consists of 1000 feet (ft) (305 meters [m]) of shoreline that is fronted by a sandy beach, referred to as Honokōwai Beach. The beach provides a natural buffer that protects the backshore area from wave action. The beach is dynamic and subject to seasonal and episodic variations in beach width and volume. In 2016 a combination of persistent North Pacific swell and elevated water levels produced high waves, strong currents, and abnormally high tides resulting in significant erosion and rapid beach loss. A vertical escarpment formed along the shoreline fronting the project site. Approximately 5,700 square ft (163 square m) of land area was lost to erosion and 1,050 cubic yards of terrestrial sediment (primarily clay and silt) was discharged into the ocean. The erosion exposed and damaged infrastructure including a concrete walkway, shower pads, irrigation lines, electrical wiring, and propane gas lines that heat the existing pool. The shoreline migrated 6 to 12 ft (2 to 4 m) inland over several months' time, due to the loss of a stable beach profile.

In May 2018, an emergency erosion protection skirt was installed along approximately 500 ft (152 m) of shoreline fronting Kaanapali Beach Club. The skirt was constructed from geotextile fabric, sand-filled geotextile mattresses, and polypropylene sandbags. The structure is authorized for a period of three (3) years to allow Kā‘anapali Beach Club time to develop a long-term solution to address the erosion problem. Sea Engineering, Inc. (SE) has been retained to assist West Maui Resort Partners L.P. in evaluating possible long-term solutions.

The objectives of the Ho‘ala Honokōwai project are to:

- Restore beach width and improve beach stability.
- Preserve and enhance cultural and shoreline access.
- Increase resilience to coastal hazards and sea level rise; and
- Enable planning for long-term adaptation to sea level rise.

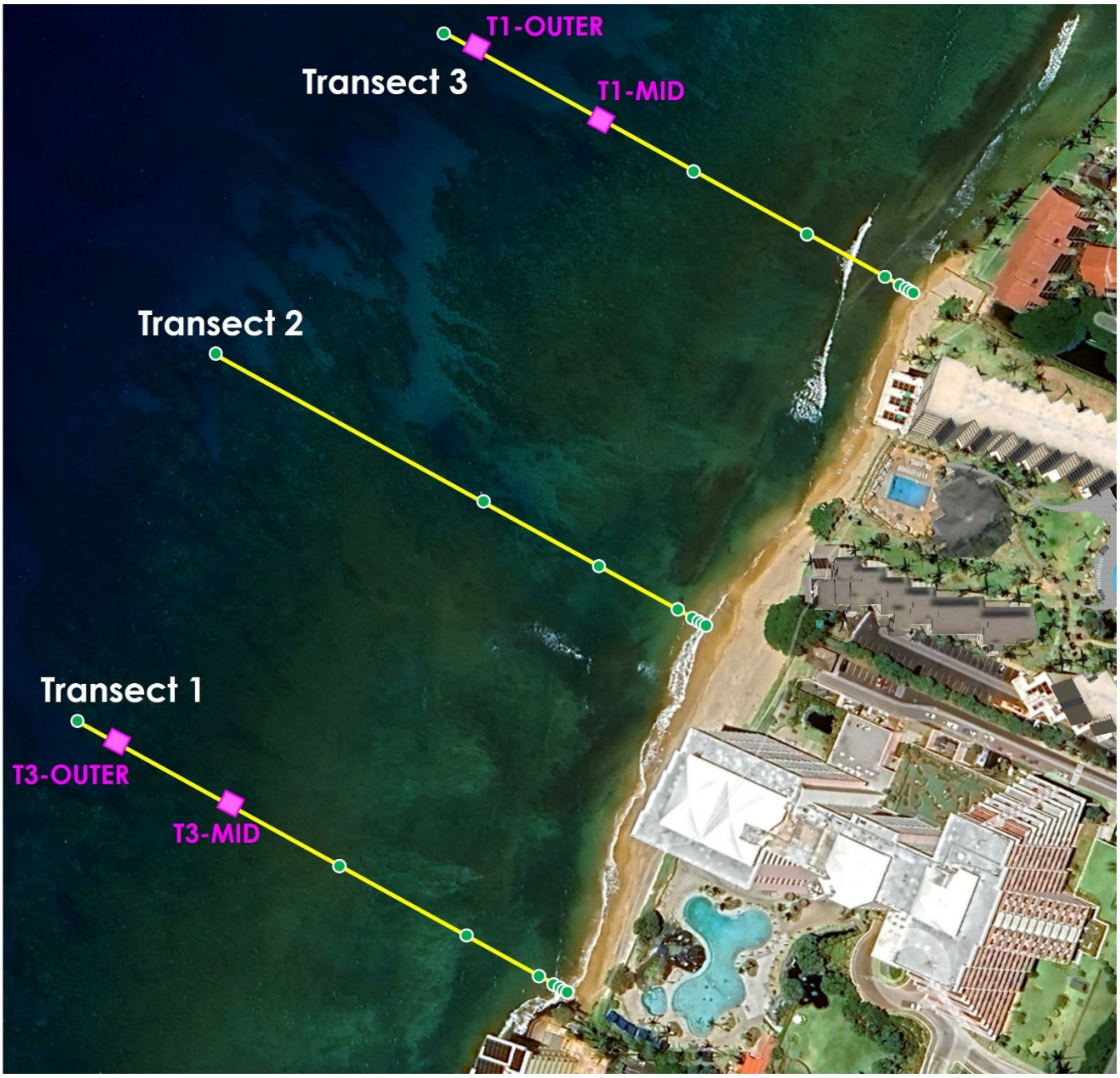
To achieve these objectives, the following alternatives are being evaluated:

Beach Stabilization refers to an individual action (Project) that involves placement of sand to nourish the beach and either (i) modifying existing structures, and/or (ii) installing new structures (e.g., groins) to stabilize the sand. Beach stabilization projects are typically designed to be implemented as a single, discrete Project with a specified design life. Beach Stabilization would consist of 3 T-head groins and 1 L-head groin spanning the entire length of Honokōwai Beach. Sand fill would be placed between the groins to create a beach with a minimum 40-foot width, +8.5-foot MSL elevation, and a 1V:8H slope from the crest to the sea bottom. An estimated 33,000 cubic yards of sand would be required for the alternative.

Beach Nourishment refers to an individual action (Project) that involves placement of additional sand to increase beach width and sand volume to offset the effects of erosion without modifying existing structures or installing any new structures. The Beach Nourishment alternative would consist of placing sand at the south end of the Honokōwai littoral cell without any structures to stabilize the sand. The sand would be placed along approximately 1,000 feet of shoreline between Honokōwai Stream and Honokōwai Point. The beach would have a crest elevation of +8.5 feet MSL and a beach slope of 1V:8H. This concept would require 27,000 cy of sand and would provide a minimum beach width of 40 feet.

Beach Maintenance refers to a series of actions (Program) that consist of periodic beach nourishment combined with sand pushing and/or sand back passing, without modifying existing structures or installing any new structures. Beach maintenance actions are typically intended to be conducted on a recurring, periodic basis over a specified period of time and are therefore considered to be programmatic in nature. The Beach Maintenance alternative would consist of an initial beach nourishment project with periodic renourishment at specified intervals. The initial nourishment effort would be identical to the beach nourishment alternative described above. Periodic beach maintenance would be performed after the initial nourishment and throughout the 50-year design life to maintain the desired beach width. Over a period of 50 years, four (4) renourishment efforts would be required to maintain the desired beach width of 40 feet. Each renourishment would require approximately 5,000 cy of sand, resulting in a total volume of 47,000 cy of sand to restore the beach and provide a minimum beach width of 40 feet.

The purpose of this document is to provide the results of ecological assessments of two aspects of the marine ecosystem fronting the Honokōwai Beach Project Area. Water chemistry was assessed by collection of two sets of samples along three transects extending from the shoreline to the open coastal ocean directly fronting the project area. The physical composition of marine habitats as well as biotic community structure were also documented. The assessment of biotic communities focused on coral reef community structure. As reef corals are both long-lived and attached to the bottom, they serve as the best indicators of the time-integrated forces that affect nearshore reef areas that can be affected by activities on land. Evaluation of the existing condition of water chemistry and marine communities provides insight into the physical and chemical factors that influence the marine setting. Understanding the existing physical, chemical, and biological conditions of the marine environment provides a basis for predicting potential effects that might occur as a result of the proposed shoreline restoration.



NOTES: Background imagery is from August 2023; Transects 1-3 are 200 m in length.

Figure 1. Map of Honokōwai Beach and Three Transects (Yellow Lines) with Water Chemistry Sampling Locations (Green Circles) and Orthomosaic Locations (Magenta Squares)

2 METHODS

2.1 Water Chemistry

Water chemistry field sampling was conducted on April 21, 2021, and May 28, 2024, by swimmers working from a small boat. Water chemistry was assessed along three survey transects that extended perpendicular to the shoreline originating at the sand-water interface of the beach and extended approximately 200 m offshore. During each sampling event water samples were collected at eight locations along each of three transects at distances of approximately 0.1, 1, 5, 10, 20, 50, 100, and 200 m from the shoreline (Figure 1). Such a sampling scheme is designed to span the greatest range of variability with respect to material input at the shoreline. Sampling was more concentrated in the nearshore zone because this area receives the most terrestrial input, and hence is most important with respect to identifying the effects of shoreline modification. Owing to the shallow depth of the nearshore shelf, only surface samples (within 20 centimeters [cm] of the surface) were collected.

Water quality constituents evaluated included all specific criteria designated for open coastal waters in Hawai'i Administrative Rules (HAR) Chapter 11-54, Section 6(b) (Open coastal waters) of the State of Hawai'i 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 constituents are sensitive indicators of biological activity and the degree of groundwater mixing.

Laboratory analyses were conducted by Marine Consulting and Analytical Resources LLC (MCAR) (Lab number HI 00928). Analyses for Si, NH_4^+, PO_4^{-3}, and NO_3^- were performed with a Seal Analytical AutoAnalyzer 3 HR (AA3HR) using standard methods for seawater analysis. TN and TP were analyzed in a similar fashion following digestion. Salinity was determined using a Mettler Toledo Seven Excellence Multi-parameter meter with an InLab 731-ISM conductivity probe.

Chl *a* was measured by filtering 150 ml through a GFF/F glass-fiber filter; pigments on filters were extracted in 90% acetone in the dark at -20 °C for 24 hours. The fluorescence of the extract was measured with a Turner Designs Trilogy Fluorometer model 7200-000 equipped with an extracted chlorophyll non-acidification module. Salinity was determined using a Mettler Toledo Seven Excellence Multi-parameter meter with an InLab 731-ISM conductivity probe, calibrated to a Hach Instruments traceable salinity standard of 35.00 parts per thousand (‰ or ppt), 53.0 mS/cm, with a readability of 0.01 ppt. Turbidity was determined using a Hanna Instruments Model #HI88703 Turbidimeter and reported in nephelometric turbidity units (NTU) (precision of 0.01 NTU).

In situ field measurements of water temperature, pH, dissolved oxygen, and salinity were acquired using RBR Concerto CTDs calibrated to factory specifications. The CTD has a readability of 0.001°C, 0.001pH units, 0.001% saturation, and 0.001 ppt (salinity).

EPA and Standard Methods (SM) methods that were employed for chemical analyses, as well as detection limits, are listed in the Code of Federal Regulations (CFR) Title 40, Chapter 1, Part 136, are as follows:

NH_4^+: EPA 350.1, Rev. 2.0 or SM4500-NH3 G, detection limit 0.042 µg/L.

NO_3^- + NO2-: EPA 353.2, Rev. 2.0 or SM4500-NO3F, detection limit 0.084 µg/L

PO_4^{3-}: EPA 365.5 or SM4500-P F, detection limit 0.28 µg/L.

Total P: EPA 365.1, Rev. 2.0 or SM4500-P E J, detection limit 0.93 µg/L.

Total N: SM 4500-N C., detection limit 1.96 µg/L.

Si: EPA 370.1 or SM 4500 SiO2 E, detection limit 0.45 µg/L.

Chlorophyll *a*: SM 10200, detection limit 0.006 µg/L.

pH: EPA 150.1 or SM4500H+B, detection limit 0.002 pH units

Turbidity: EPA 180.1, Rev. 2.0 or SM2130 B, detection limit 0.008 NTU.

Temperature: SM 2550 B, detection limit 0.01 degrees centigrade.

Salinity: SM 2520, detection limit 0.003 ppt.

Dissolved Oxygen: SM4500 O G, and detection limit 0.01% sat.

All fieldwork for the water chemistry survey was conducted by Dr. Steven Dollar and Ms. Andrea Millan.

2.2 Marine Biotic Community Structure

Marine biotic community structure surveys were conducted on April 21, 2021, and May 28, 2024. The overall physical and biotic composition of the survey area was evaluated by divers using snorkel and SCUBA working from a small boat. Dive surveys were conducted by swimming in a zigzag pattern along the three transect lines used for water chemistry sampling that fronted Honokōwai Beach (Figure 1). These surveys covered a corridor approximately 100 m wide centered on the transect line and extended to water depths of approximately 8 m. During these underwater investigations, notes on species composition were recorded, and numerous digital photographs documented the existing conditions of the area. Biologists developed a presence/absence list of all fish observed in 2021 and 2024. In addition, a list of all macroalgae observed during the 2024 surveys was tabulated. Observed macroalgae species were classified as "rare," "common," or "abundant" based on the presence of the species within the survey area. The marine biotic community structure assessment was conducted by Dr. Steven Dollar and Ms. Andrea Millan.

In addition to the swim surveys, four orthomosaic images were acquired within the survey area (see Figure 1). Each orthomosaic consisted of a rectangular section of the reef surface with areas ranging from 24-68 m^2 (Table 1). Scale bars placed at the four corners of each site aided

the diver in recognizing the boundaries of the site and provide scale to the final orthomosaic. An additional scale bar was placed near the center and oriented north. Each of the demarcated areas was then photographically recorded by a diver swimming parallel horizontal overlapping lines in a boustrophedonic ("lawn mower") pattern above the site. Between 311 and 552 photographs were collected from each site for the construction of orthomosaics.

Following fieldwork, raw photographs were processed using Adobe Bridge and Adobe Photoshop software. Agisoft Metashape software was then used to produce seamless high-resolution orthomosaic scaled images of each survey site. These orthomosaics can serve as a baseline for any future time-course monitoring that may be required. All orthomosaics are shown in Appendix A.

All corals in each orthomosaic were assigned a unique sequential numerical name and identified to the most specific level possible. The longest diameter of each colony was measured, then colonies were binned into one of the following size classes (cm): >0-10, >10-20, >20-40, >40-80, and >80-160. All coral data were sorted by species and size class.

To determine the percent cover at all quantitative survey sites, 100 points were gridded on each orthomosaic using a MatLab program developed for large images (20 to 300 megabytes). The surface type underlying each point was identified to the most specific level possible and then categorized into the broader classifications of stony corals, soft corals, non-coral invertebrates, sponges, algae, and abiotic. The surface type underlying each gridded point was tabulated for each orthomosaic site. Data was exported from MatLab to Microsoft Excel where the resulting data set provides percent cover of all surface types.

Table 1. Metadata for Four Orthomosaics on Transects off Honokōwai Beach.

SITE	PHOTOS (#)	WIDTH (m)	LENGTH (m)	AREA (m^2)
T1-MID	342	5.26	5.06	26.65
T1-OUTER	403	7.80	7.99	62.35
T3-MID	311	4.90	4.95	24.25
T3-OUTER	552	8.90	7.72	68.68

3 RESULTS

3.1 Water Chemistry

3.1.1 Distribution of Chemical Constituents

Table 2 and Table 3 show results of all water chemistry analyses for samples collected off Honokōwai Beach on April 21, 2021 and May 28, 2024, respectively. The concentrations of 12 constituents are plotted as functions of distance from shore in Figure 2-Figure 4.

Several patterns of distribution are evident for both surveys. It can be seen that the dissolved nutrients Si, TN, NO_3^- and NH_4^+ display elevated concentrations in the samples collected within 10-20 m from the shoreline. Salinity displays the opposite trend, with lower concentrations in the nearshore samples. These patterns were strongest during the May 2024 survey, particularly on Transect 3. Beyond 5-10 m from the shoreline, concentrations of nutrients and salinity are essentially constant.

As there were no streams discharging to the ocean at the time of the sampling, the horizontal gradients of nutrients and salinity likely represent 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. The gradients in the nearshore zone off Honokōwai Beach, however, are comparatively small, indicating only low volume groundwater discharge.

PO_4^{3-} is also generally elevated in groundwater relative to ocean water. In the data sets collected off Honokōwai Beach, with the exception of a single sample at the shoreline during the May 2024 survey, there is no consistent pattern of decreasing concentrations in concentration of PO_4^{3-} with respect to distance from the shoreline. Horizontal gradients of TN/TON and TP/TOP mirror the patterns of NO_3^- and PO_4^{3-}, respectively.

As the sampling area off Honokōwai Beach is an open coastal area exposed to wind and waves, 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.

Ammonium nitrogen (NH_4^+) is usually not elevated in groundwater relative to ocean water. However, with a single exception (April 2021, Transect 2) the concentrations of NH_4^+ on all transects during both surveys show peak values in the samples collected at the shoreline (Table 2 and Table 3). The values of NH_4^+ near the shoreline of Transect 3 during the 2024 survey were over an order of magnitude higher than at any other location. Such anomalous values suggest that there is an input of NH_4^+ in the nearshore region of Transect

3 from either a source on land, or a marine biotic process that is restricted to the shoreline. Transect 3 is located directly off the mouth of Honokōwai Stream. While there was no direct surface connection of the stream to the ocean at the time of sampling, it is possible that subsurface discharge of stagnated stream water to the nearshore ocean resulted in the elevated concentrations of NH_4^+.

Similar to the patterns of dissolved inorganic nutrients, the distributions of Chl *a* and turbidity also display peak values near the shoreline, with diminishing values moving seaward (Table 2 and Table 3). During the April 2021 surveys all values of Chl *a* were below 0.54 µg/L, while during the May 2024 survey, values of Chl *a* peaked at 1.30 µg/L. The highest value of turbidity in 2021 was 1.59 NTU compared to a peak value of 1.75 NTU in 2024. The progressive decrease in values of turbidity and Chl *a* with distance from shore is likely a response to resuspension of fine-grained particulate material, including plant fragments, stirred by breaking waves in the shallow nearshore zone. With decreasing wave energy and increasing water depth, turbidity in the water column decreases. Temperature and dissolved oxygen displayed no gradient of consistent change across the transects during both surveys, although the slightly elevated values in May 2024 reflect the higher degree of wave intensity during that survey (Table 2 and Table 3).

Table 2. Results of Water Chemistry Analyses from Samples Collected along Three Transects in April 2021.

SITE	DFS	PO_4^{3-}	$NO_3^-+NO_2^-$	NH_4^+	Si	TP	TN	TOP	TON	TURB	SALT	pH	Chl-a	TEMP	Diss. O_2
	(m)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(NTU)	(o/oo)	(std. units)	(µg/L)	deg. C	% sat.
TRANSECT 1	0.1	4.90	3.81	5.21	181.98	12.32	99.23	7.42	90.22	0.44	34.07	8.14	0.23	25.37	97.9
	1	4.77	3.30	2.65	144.72	11.80	88.37	7.03	82.42	0.83	34.18	8.14	0.22	25.52	103.8
	5	4.06	1.45	2.52	88.93	11.37	80.95	7.31	76.98	0.49	34.32	8.14	0.23	25.46	101.9
	10	4.06	0.92	2.87	56.27	11.30	68.21	7.24	64.42	0.34	34.32	8.16	0.21	25.65	107.1
	20	3.75	1.48	3.07	53.32	11.28	72.87	7.53	68.32	0.41	34.36	8.17	0.19	25.52	106.4
	50	3.32	1.78	2.80	57.21	11.43	88.61	8.12	84.02	0.43	34.40	8.16	0.18	25.63	110.6
	100	3.78	2.98	2.81	54.41	11.23	91.76	7.45	85.96	0.35	34.40	8.17	0.18	25.55	109.1
	200	4.31	3.36	4.76	54.25	11.14	90.37	6.83	82.25	0.30	34.40	8.16	0.15	25.68	105.7
TRANSECT 2	0.1	4.62	5.09	3.25	113.15	11.24	118.33	6.62	109.99	1.31	34.22	8.15	0.26	26.22	98.2
	1	4.53	4.08	3.15	111.68	11.55	108.68	7.02	101.45	1.06	34.29	8.16	0.28	26.24	106.9
	5	4.00	1.70	3.16	84.66	11.54	91.62	7.55	86.75	1.03	34.37	8.18	0.23	26.01	111.1
	10	4.03	1.28	3.95	74.41	11.36	94.95	7.33	89.72	0.57	34.37	8.17	0.18	25.80	107.6
	20	3.29	2.39	4.37	64.93	11.56	92.05	8.27	85.29	0.49	34.36	8.15	0.16	25.60	107.0
	50	4.22	3.33	5.32	55.01	12.77	181.23	8.56	172.58	0.26	34.36	8.04	0.18	25.38	101.4
	100	3.63	2.97	4.44	42.90	12.29	98.98	8.67	91.57	0.24	34.47	8.13	0.19	25.21	98.6
	200	3.44	1.81	5.17	52.28	12.19	91.64	8.75	84.67	0.28	34.36	8.13	0.18	25.15	95.9
TRANSECT 3	0.1	3.63	6.28	7.43	173.87	12.01	115.65	8.38	101.94	0.72	34.33	8.19	0.34	25.64	95.1
	1	3.10	0.58	3.39	71.95	11.86	91.45	8.76	87.48	1.59	34.37	8.19	0.54	25.43	96.7
	5	3.50	2.00	3.95	75.12	11.32	80.30	7.81	74.36	0.73	34.37	8.17	0.19	25.50	98.9
	10	3.66	2.73	3.44	72.44	11.11	89.74	7.45	83.56	0.43	34.37	8.15	0.16	25.62	94.7
	20	3.60	3.22	3.67	72.06	10.69	110.26	7.09	103.38	0.40	34.32	8.12	0.17	25.61	103.5
	50	3.60	2.32	5.43	52.11	11.19	106.97	7.59	99.22	0.37	34.36	8.13	0.17	25.80	109.0
	100	3.35	1.96	2.44	54.63	11.05	116.63	7.70	112.24	0.21	34.36	8.13	0.21	26.16	113.5
	200	4.25	3.90	4.03	104.82	11.56	127.44	7.31	119.51	0.28	34.29	8.12	0.28	27.34	101.4
DOH WQS		NTE 10%	10.00	5.00	-	30.00	180.00			0.50	*	**	0.50	***	****
OCW DRY		NTE 2%	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 not less than 75% saturation

Samples were collected on April 21, 2021. See Figure 1 for locations of sampling stations. Also shown are DOH WQS for "open coastal waters" under "dry" conditions, not to exceed more than 10% and 2% of the time" criteria. Green shaded values are greater than the "not to exceed more than 10% of the time limits, and yellow shaded values are greater than the not to exceed more than 2% of the time limits.

Table 3. Results of Water Chemistry Analyses from Samples Collected along Three Transects in May 2024.

SITE	DFS	PO_4^{3-}	NO_3^-+NO_2^-	NH_4^+	Si	TP	TN	TOP	TON	TURB	SALT	pH	Chl-a	TEMP	Diss. O_2
	(m)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(NTU)	(o/oo)	(std. units)	(µg/L)	deg. C	% sat.
TRANSECT 1	0.1	3.01	1.58	1.74	134.40	6.54	89.99	3.54	86.68	0.45	34.53	8.15	0.33	26.50	101.3
	1	1.92	1.30	0.34	117.90	6.14	100.10	4.22	98.46	0.36	34.54	8.15	0.30	26.28	100.0
	5	1.83	0.43	0.67	89.43	5.62	85.55	3.79	84.45	0.43	34.58	8.14	0.29	26.44	100.1
	10	1.71	0.35	0.69	88.52	5.04	85.95	3.34	84.91	0.41	34.58	8.13	0.32	26.43	99.6
	20	2.20	0.01	0.36	82.93	5.69	85.89	3.48	85.51	0.40	34.58	8.12	0.30	26.43	99.3
	50	1.43	2.79	0.59	91.18	5.22	87.85	3.79	84.48	0.55	34.61	8.10	0.20	26.09	101.1
	100	1.33	1.20	0.64	68.64	5.42	87.42	4.08	85.57	0.15	34.69	8.07	0.24	26.00	99.2
	200	1.30	bdl	0.46	36.67	6.19	90.34	4.89	89.88	0.38	34.69	8.07	0.22	25.98	101.6
TRANSECT 2	0.1	1.05	9.64	3.05	191.23	5.33	119.24	4.28	106.54	1.75	34.62	8.00	0.43	25.93	99.5
	1	0.90	8.75	3.16	173.44	4.67	111.62	3.77	99.71	1.54	34.58	8.00	0.38	25.67	101.2
	5	1.05	1.97	1.68	106.04	6.12	95.75	5.06	92.09	0.75	34.62	8.03	0.45	25.62	102.3
	10	1.55	2.03	1.86	113.55	6.26	99.09	4.71	95.20	1.12	34.62	8.01	0.41	25.61	100.5
	20	1.05	1.04	2.90	100.39	8.29	96.15	7.24	92.21	0.77	34.62	8.03	0.40	25.00	100.2
	50	4.03	3.89	2.00	65.59	10.00	101.53	5.97	95.64	0.62	34.65	8.14	0.21	26.61	102.3
	100	2.20	3.64	1.48	75.48	9.96	101.28	7.76	96.15	0.30	34.65	8.09	0.20	26.38	100.1
	200	2.67	2.47	1.33	59.66	10.71	99.26	8.05	95.46	0.42	34.69	8.08	0.24	26.12	99.1
TRANSECT 3	0.1	6.45	5.43	88.76	577.14	13.63	255.40	7.18	161.21	0.40	33.44	8.09	0.67	27.55	105.8
	1	1.83	2.03	44.23	338.00	8.69	223.59	6.86	177.34	0.78	33.91	8.17	0.98	27.01	106.0
	5	1.71	1.06	18.61	268.29	10.08	162.13	8.38	142.47	0.32	34.09	8.17	1.30	26.41	101.2
	10	1.52	0.24	1.85	82.14	9.28	107.67	7.76	105.59	0.38	34.69	8.12	0.50	25.97	99.1
	20	2.79	0.78	1.55	51.81	10.71	107.97	7.92	105.63	0.33	34.73	8.12	0.42	25.63	100.5
	50	3.53	4.67	2.51	54.63	11.19	111.89	7.66	104.71	0.33	34.73	8.08	0.21	26.40	99.7
	100	2.91	1.86	1.68	61.01	10.83	111.90	7.91	108.36	0.23	34.69	8.08	0.31	26.10	100.3
	200	2.85	2.25	1.78	53.10	10.84	102.06	7.99	98.03	0.19	34.72	8.07	0.27	26.06	100.2
DOH WQS		NTE 10%	10.00	5.00	-	30.00	180.00			0.50	*	**	0.50	***	****
OCW DRY		NTE 2%	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 not less than 75% saturation

Samples were collected on May 28, 2024. See Figure 1 for locations of sampling stations. Also shown are DOH WQS for "open coastal waters" under "dry" conditions, not to exceed more than 10% and 2% of the time" criteria. Green shaded values are greater than the "not to exceed more than 10% of the time limits, and yellow shaded values are greater than the not to exceed more than 2% of the time limits.

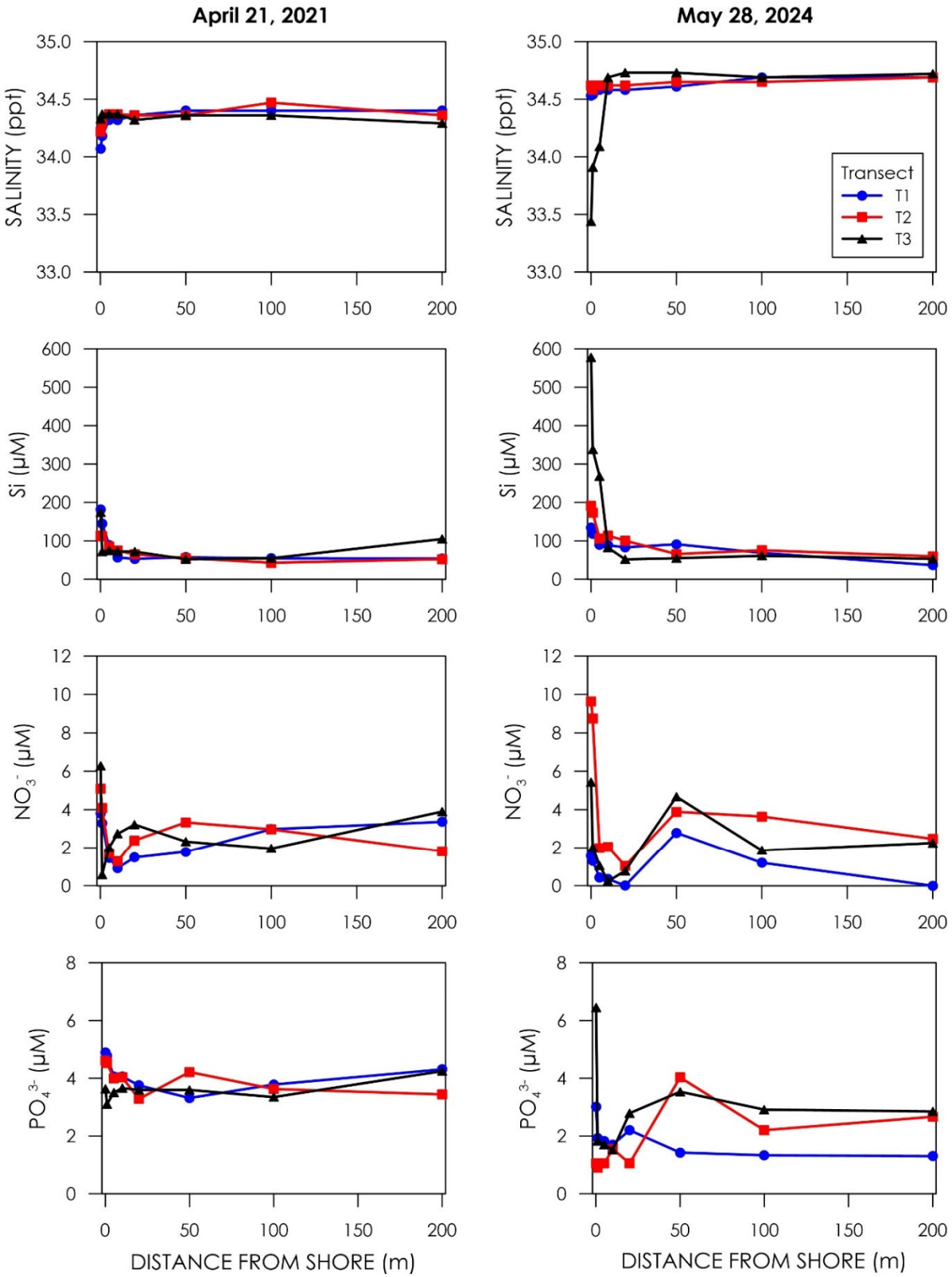


Figure 2. Plots of Salinity, Silica (Si), Nitrate (NO_3^-), and Phosphate (PO_4^{3-}) as Functions of Distance from Shore along Three Transects

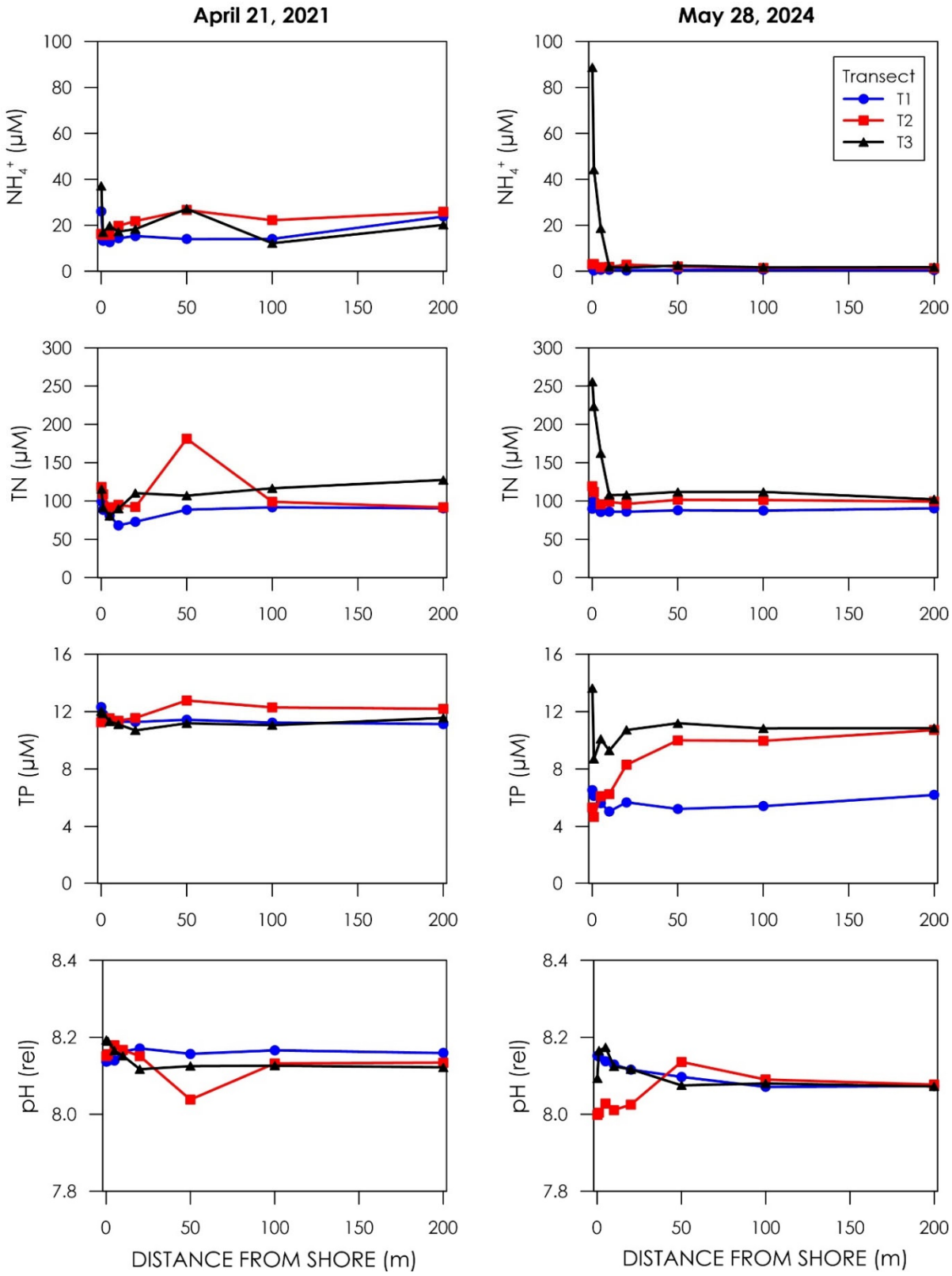


Figure 3. Plots of Ammonia (NH_4^+), Total Nitrogen (TN), Total Phosphorous (TP), and pH as Functions of Distance from Shore along Three Transects

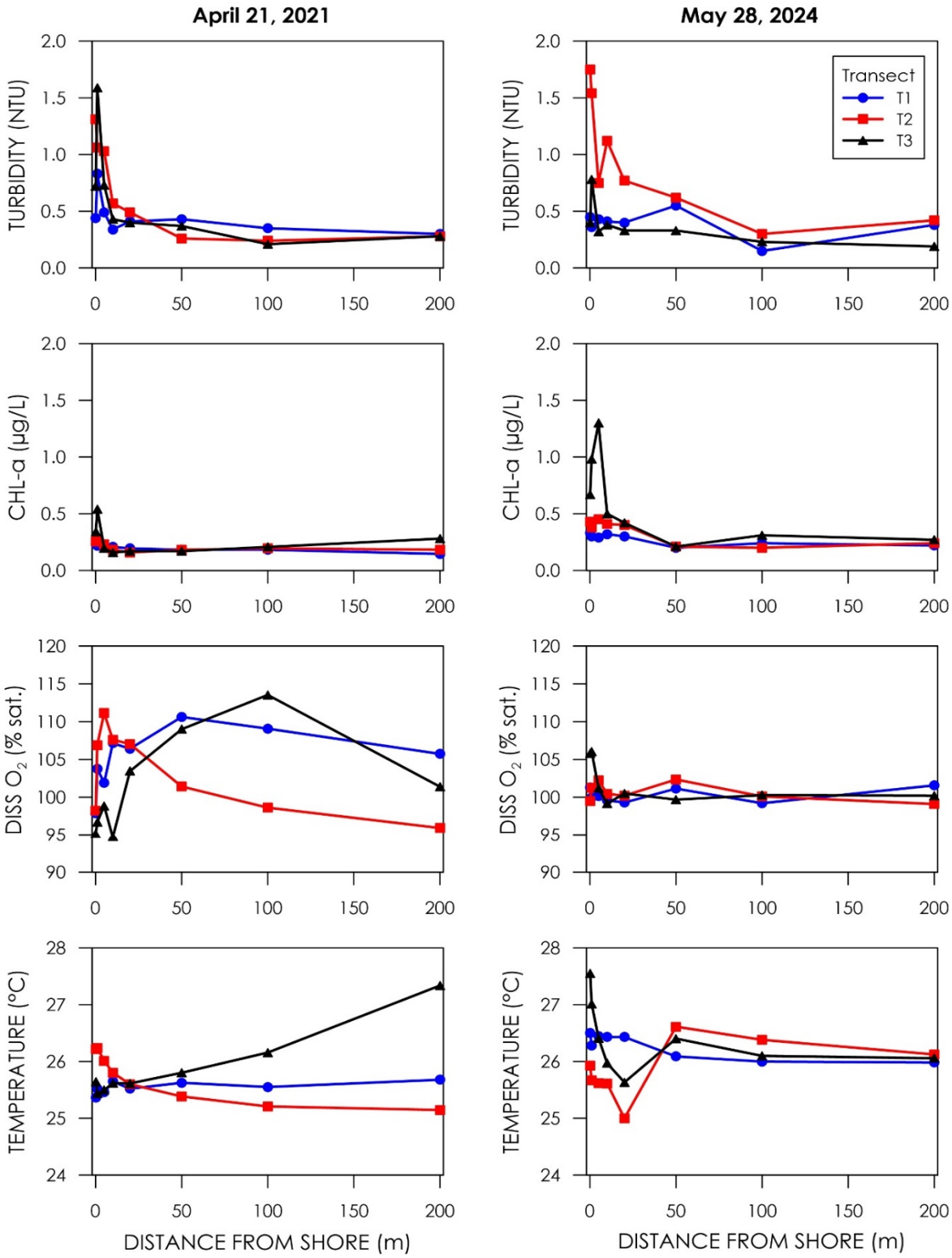


Figure 4. Plots of Turbidity, Chlorophyll a (CHL-*a*), Dissolved Oxygen (DISS O_2), and Temperature as Functions of Distance from Shore along Three Transects

3.1.2 Compliance with DOH Criteria

State of Hawai'i Department of Health Water Quality Standards (HDOH-WQS) that apply to the areas offshore of Honokōwai Beach are listed as "open coastal water" in HAR § 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"). Based on results of water sampling analysis described above, the Kā'anapali and Honokōwai shoreline area receives very little freshwater input from groundwater discharge. It is assumed that this input is less than 3 mgd per mile, and as a result dry criteria were used for this evaluation. As dry criteria present a more stringent set of standards, they can be more conservative than "wet" standards.

The HDOH-WQS are also separated into three standards: geometric means, "not to exceed more than 10% of the time," and "not to exceed more than 2% of the time." As these classifications require multiple samplings, they cannot be used for a strict evaluation of whether waters at the sampling site were within compliance standards. However, these values provide a guideline to evaluate the overall status of sampled waters in terms of the relation with State standards.

It can be seen in Table 2 that during the April 2021 survey the only nutrient constituent to exceed State of Hawai'i water quality standards for the "not to exceed more than 10% of the time" criteria under dry conditions was ammonium nitrogen (NH_4^+). When considering all three transects, values of NH_4^+ exceeded the standard five times. Note that these five values were randomly distributed. The nearshore values of turbidity also exceeded the 10% criterion on all three transects. 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 10 m from shore, all values of turbidity were below the State standards.

During the May 2024 survey three values of NH_4^+ from samples nearest the shoreline on Transect 3 exceeded DOH standards (Table 3). These elevated values of NH_4^+ also caused concentrations of TN at the shoreline of Transect 3 to exceed DOH limits (Table 2). Values of turbidity at sampling sites near the shoreline on Transects 2 and 3 exceeded DOH criteria. Values of Chl *a* near the shoreline on Transect 3 were also elevated above specific criteria (Table 2). As described for the 2021 survey, it is likely that the elevated values of turbidity and Chl *a* in the nearshore zone are a result of resuspension of organic particulate material by wave action.

3.2 Biotic Community Structure – Reef Zonation

Composition of the reef communities fronting Honokōwai Beach are in direct response to several physical factors. The physical setting is on a protruding point that focuses breaking waves, resulting in concussive forces that prevent settlement and growth of most reef organisms (primarily corals) in the nearshore regions. In addition, resuspension of sand from wave action also prevents settlement and causes destructive abrasion of corals.

For the purposes of this report, coral reef community structure is divided into three zones: the "nearshore scour" zone, "mid-reef platform" zone, and "outer reef coral" zone (Figure 5). 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 field of sand.

3.2.1 Nearshore Scour Zone

The nearshore scour zone extends approximately 100 m seaward of Honokōwai Beach with water depths ranging from 0 to 1 m. The physical composition of the nearshore scour zone consists of either sand and rocks or a bed of rocks and cobble (Figure 6-Figure 10). Corals were essentially absent from the nearshore scour zone. While many of the rock surfaces were covered with a thin veneer of algal turf, filamentous and frondose macroalgae was rare when considering the whole of the survey area. Overall, 22 species of macroalgae were identified in the nearshore scour zone with 18 of these classified as rare and 4 classified as common (Table 4). The dearth of filamentous algae and corals in the nearshore scour zone are likely due to intense concussive forces from breaking waves, which limit colonization and growth of benthic organisms. The exception to this was a small area near the shoreline along Transect 1 during the 2024 survey, which contained a community of macroalgae comprised primarily of *Dictyota* sp., *Turbinaria ornata*, and *Halimeda* sp. (Figure 10, bottom). The occurrence of macroalgae in this area is likely the result of a localized area that is sheltered from direct wave impacts.

3.2.2 Mid-Reef Platform Zone

With slightly increasing water depth and distance from shore, the scour zone transitions to the mid-reef platform zone (Figure 11-Figure 13). The mid-reef platform begins approximately 100 m seaward of Honokōwai Beach and is approximately 40 m wide with water depths ranging from 1 to 2 m. Isolated coral colonies were present, consisting predominantly of *Pocillopora meandrina*, *Porites lobata*, and *Montipora* spp.

Overall, 29 species of macroalgae were identified in the mid-reef platform zone with 14 of these classified as rare, 12 classified as common, and 3 classified as abundant (Table 4). The most conspicuous species of macroalgae was the green calcareous alga *Halimeda kanaloa*, which was present as small fields scattered across the mid-reef platform zone (Figure 13). *Dictyota acutiloba* and *Padina sanctae-crucis* were also classified as abundant as they were commonly observed in tufts and patches scattered across the zone. Other than these three species, no other macroalgae were observed in dense aggregations within the mid-reef platform.

Motile macrobenthos were rare, owing to the force of breaking waves sufficient to prevent these unattached organisms from remaining stable on the reef surface. The exception was *Echinometra mathaei*, the rock boring sea urchin, which can withstand wave forces by excavating cavities in the limestone reef surface.

3.2.3 Outer Reef Coral Zone

The seaward boundary of the mid-reef platform zone grades into the outer reef coral zone. The outer reef zone begins approximately 140 m seaward of Honokōwai Beach with water depths ranging from 2 to 8 m. This transition is mainly in the change in water depth associated with a substantial increase in abundance of live coral colonies (Figure 14-Figure 15). The predominant species in the outer reef zone are mound-shaped colonies of *Porites lobata*, interconnected mats of *Porites compressa*, and encrusting colonies of *Montipora patula* and *M. capitata*. Many of the coral colonies were up to one meter 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 corals with massive or encrusting growth forms. Hence, *P. compressa* is not found in areas that are routinely subjected to wave energy. The occurrence of expanses of interconnected colonies of *P. compressa* in the outer reef zone indicates that the area has not sustained wave stress substantial enough to destroy these coral colonies over a decadal time interval.

Overall, 8 species of macroalgae were identified in the outer reef coral zone with 5 of these classified as rare and 3 classified as common (Table 4). All three species classified as rare were crustose coralline algae (CCA). No species of frondose macroalgae were classified as common or abundant within the outer reef coral zone.

The outer reef zone terminates at a depth of approximately 7 m in a margin between the limestone platform and sand plain (Figure 15). Seaward of the outer reef margin, bottom composition consists of a flat, gently sloping sand plain devoid of macrobenthos. In many areas of West Maui, the sand plains beyond the reef platform are colonized with vast fields of the calcareous green alga *Halimeda* spp. No such areas of *Halimeda* spp. were observed to the outer limits of the present study off Honokōwai Beach.

Other macro-invertebrates that were observed on the benthic surface of the outer reef were several species of sea urchins (*Echinometra mathaei*, *Echinothrix diadema*, *Tripneustes gratilla*, and *Heterocentrotus mamillatus*). None of these urchins were particularly abundant but were found most commonly on the bare limestone reef platform rather than on living corals.

Green sea turtles (*Chelonia mydas*) are commonly found within the nearshore areas of West Maui. A single female green turtle was observed during the May 2024 survey. The turtle was resting in a carved-out pocket at the base of the limestone fossil reef (Figure 16).

3.3 Biotic Community Structure – Orthomosaic Analyses

On each of Transects 1 and 3, a typical representative region within the mid-reef and outer reef zones were selected for acquisition of an orthomosaic image. The nearshore scour zone was too shallow, and water motion too extreme, for carrying out the procedures to collect photographs necessary to develop an orthomosaic. The four orthomosaic images are shown in Appendix A.

Percentage cover of the reef surface of biotic and abiotic categories attained by point counts of orthomosaic images are shown in Table 5. The highest category of benthic cover within the mid-reef zone consists of hard substrate, primarily comprised of limestone fossil reef. Hard substrate accounted for 56% of bottom cover of the mid-reef on Transect 1 and 76% on Transect 3. Hard substrate was also a major component of bottom cover on the outer reef orthomosaics (33% Transect 1, 57% Transect 3), but less than on the mid-reef. Unconsolidated abiotic material (sand, cobbles, rubble) comprised small percentages of bottom cover within all orthomosaics (0-6%) (Table 5).

The opposite pattern occurred for coverage of live coral. Percent coverage of the bottom of all corals was 6% and 7% on the mid-reef transects, and 51% and 33% on the outer reef on Transects 1 and 3, respectively (Table 5). When coral cover is considered by species, *Porites lobata* was the most abundant on both mid-reef transects (5% and 4%). On the outer reef transects, *P. lobata* was the most abundant coral on Transect 3 (28%), while *Porites compressa* was most abundant on Transect 1 (37%). Other corals that occurred in point-count analysis of orthomosaics included *Montipora capitata*, *M. patula* (maximum of 1% for each species), and *Pocillopora meandrina* (2% on mid-reef transects).

Other components of benthic cover included crustose coralline algae, turf algae, and the brown alga *Turbinaria ornata* (Table 5). These algae were more abundant on the mid-reef than the outer reef on both transects owing to their ability to successfully occupy higher energy areas.

Table 6 shows results of size-frequency analysis of coral colonies within orthomosaic images. In total, 760 colonies were present, with 247 on the mid-reef transects and 513 on the outer reef transects. When considering size class on the mid-reef, corals were most abundant in the 5-10 cm and 10-20 cm bins, each with 71 colonies (29% each). On the mid-reef no corals were greater in longest diameter than 80 cm. On the outer reef, the size classes with the highest number of colonies were also 10-20 cm (30%) followed by 5-10 cm (25%). On the outer reef, 18% of corals were larger than 40 cm, while less than 1% were of this size on the mid-reef.

Porites lobata colonies were the most abundant coral species on both mid-reef (66%) and outer reef (46%). *Porites lobata* and *P. compressa* were the only species with colonies on the outer reef greater than 160 cm in size (Table 6).

Table 4. All Species of Macroalgae Observed within the Nearshore Scour Zone (SCOUR), Mid-Reef Platform Zone (MID), and Outer Reef Coral Zone (OUTER)

TYPE	SPECIES	SCOUR	MID	OUTER
Blue-Green	*Leptolyngbya crosbyana*	-	R	R
	Lyngbya majuscula	-	R	-
Brown	*Chrysocystis fragilis*	-	-	R
	Dictyota acutiloba	C	A	-
	Dictyota sandvicensis	R	R	-
	Padina sanctae-crucis	R	A	-
	Sphacelaria spp.	R	C	-
	Turbinaria ornata	C	C	R
CCA	*Hydrolithon* spp.	R	C	C
	Lithophyllum kotschyanum	R	R	C
	Peysonnelia rubra	R	R	-
	Pneophyllum conicum	R	R	C
	Sporolithon erythraeum	R	C	-
Green	*Cladophora catenata*	-	R	-
	Codium arabicum	R	-	-
	Derbesia spp.	R	C	-
	Dictyosphaeria spp.	-	R	-
	Halimeda discoidea	-	R	-
	Halimeda kanaloa	R	A	-
	Neomeris spp.	R	R	-
	Ulva compressa	C	C	-
	Ulva fasciata	R	R	-
	Ulva flexuosa	C	C	-
Red	*Acanthophora spicifera*	-	C	-
	Asparagopsis taxiformis	-	R	R
	Gelidiella acerosa	R	C	-
	Gracilaria salicornia	-	R	-
	Halymenia sp.	R	-	-
	Hypnea cervicornis	R	C	-
	Laurencia spp.	R	C	-
	Liagora spp.	R	C	-
	Tolypiocladia glomerulata	-	-	R
	Wrangelia elegantissima	-	R	-
TOTAL # of SPECIES per ZONE		**22**	**29**	**8**
TOTAL # of SPECIES OVERALL			**33**	

NOTES: "CCA" = Crustose Coralline Algae, "A" = Abundant, "C" = Common, "R" = Rare, and "-" Not Observed.

Table 5. Percent Cover of all Bottom Types in Four Orthomosaics (Two in the Mid-Reef Platform Zone and Two in the Outer Reef Platform Zone) Constructed along Transect 1 and Transect 3

CATEGORY	SPECIES	PERCENT (%) COVER			
		T1-MID	T3-MID	T1-OUTER	T3-OUTER
ALGAE	Crustose Coralline Algae	15	6	8	5
	Turf Algae	11	8	2	0
	Turbinaria ornata	3	2	0	0
	TOTAL ALGAE	**29**	**16**	**10**	**5**
CORAL	*Montipora capitata*	0	0	1	0
	Montipora patula	0	0	0	1
	Pocillopora meandrina	2	2	0	1
	Porites compressa	0	0	37	3
	Porites lobata	5	4	13	28
	TOTAL CORAL	**7**	**6**	**51**	**33**
NON-CORAL INVERTEBRATES	*Echinometra mathaei*	6	1	0	0
	Palythoa tuberculosa	0	1	0	0
	Tubeworm	1	0	0	0
	Tunicate	1	0	0	0
	TOTAL NON-CORAL INVERTS	**8**	**2**	**0**	**0**
HARD SUBSTRATE	Dead Coral	1	2	0	0
	Limestone Fossil Reef	55	74	33	57
	TOTAL HARD SUBSTRATE	**56**	**76**	**33**	**57**
UNCONSOLIDATED SUBSTRATE	Cobbles	0	0	0	1
	Rubble	0	0	3	1
	Sand	0	0	3	3
	TOTAL UNCON. SUBSTRATE	**0**	**0**	**6**	**5**

Table 6. Size Class Frequency of corals in Four Orthomosaics (Two in the Mid-Reef Platform Zone and Two in the Outer reef Platform Zone) Constructed along Transect 1 and Transect 3

SPECIES	SIZE (cm)	T1-MID	T3-MID	TOTAL MID	T1-OUTER	T3-OUTER	TOTAL OUTER	TOTAL
Montipora capitata	>0 - 5	-	-	**-**	1	2	**3**	3
	>5 - 10	-	-	**-**	3	6	**9**	9
	>10 - 20	-	-	**-**	7	4	**11**	11
	>20 - 40	-	-	**-**	7	-	**7**	7
	>40 - 80	-	-	**-**	2	-	**2**	2
	TOTAL	**-**	**-**	**-**	**20**	**12**	**32**	**32**
Montipora patula	>0 - 5	-	-	**-**	3	-	**3**	3
	>5 - 10	2	-	**2**	8	14	**22**	24
	>10 - 20	-	1	**1**	13	12	**25**	26
	>20 - 40	-	-	**-**	3	1	**4**	4
	TOTAL	**2**	**1**	**3**	**27**	**27**	**54**	**57**
Pavona duerdeni	>0 - 5	8	-	**8**	-	1	**1**	9
	>5 - 10	13	-	**13**	-	1	**1**	14
	>10 - 20	10	-	**10**	-	1	**1**	11
	>20 - 40	3	-	**3**	-	1	**1**	4
	TOTAL	**34**	**-**	**34**	**-**	**4**	**4**	**38**
Pavona varians	>5 - 10	-	-	**-**	1	3	**4**	4
	>10 - 20	-	-	**-**	-	1	**1**	1
	>20 - 40	-	-	**-**	-	2	**2**	2
	>40 - 80	-	-	**-**	1	-	**1**	1
	TOTAL	**-**	**-**	**-**	**2**	**6**	**8**	**8**
Pocillopora meandrina	>0 - 5	-	10	**10**	-	-	**-**	10
	>5 - 10	6	2	**8**	-	8	**8**	16
	>10 - 20	4	5	**9**	-	8	**8**	17
	>20 - 40	9	8	**17**	-	13	**13**	30
	>40 - 80	1	-	**1**	-	-	**-**	1
	TOTAL	**20**	**25**	**45**	**-**	**29**	**29**	**74**
Porites compressa	>0 - 5	-	-	**-**	-	3	**3**	3
	>5 - 10	1	1	**2**	6	27	**33**	35
	>10 - 20	-	-	**-**	26	19	**45**	45
	>20 - 40	-	-	**-**	25	4	**29**	29
	>40 - 80	-	-	**-**	18	-	**18**	18
	>80 - 160	-	-	**-**	8	-	**8**	8
	>160	-	-	**-**	6	-	**6**	6
	TOTAL	**1**	**1**	**2**	**89**	**53**	**142**	**144**
Porites evermanni	>5 - 10	-	-	**-**	-	1	**1**	1
	>10 - 20	-	-	**-**	-	3	**3**	3
	>20 - 40	-	-	**-**	-	4	**4**	4
	TOTAL	**-**	**-**	**-**	**-**	**8**	**8**	**8**
Porites lobata	>0 - 5	11	16	**27**	12	3	**15**	42
	>5 - 10	26	20	**46**	29	22	**51**	97
	>10 - 20	31	20	**51**	31	29	**60**	111
	>20 - 40	16	16	**32**	28	23	**51**	83
	>40 - 80	2	5	**7**	17	17	**34**	41
	>80 - 160	-	-	**-**	6	14	**20**	20
	>160	-	-	**-**	-	5	**5**	5
	TOTAL	**86**	**77**	**163**	**123**	**113**	**236**	**399**
TOTAL CORALS	**>0 - 5**	19	26	**45**	16	9	**25**	**70**
	>5 - 10	48	23	**71**	47	82	**129**	**200**
	>10 - 20	45	26	**71**	77	77	**154**	**225**
	>20 - 40	28	24	**52**	63	48	**111**	**163**
	>40 - 80	3	5	**8**	38	17	**55**	**63**
	>80 - 160	-	-	**-**	14	14	**28**	**28**
	>160	-	-	**-**	6	5	**11**	**11**
	TOTAL	**143**	**104**	**247**	**261**	**252**	**513**	**760**

3.4 Fish Community Structure

3.4.1 Nearshore Scour Zone

Fish were rare in the nearshore scour zone habitat. When considering both the 2021 and 2024 surveys, eight species of fish were observed in the nearshore scour zone (Table 7). Picasso's triggerfish (*Rhinecanthus rectangulus*), the yellowstripe goatfish (*Mulloidichthys flavolineatus*), and the Hawaiian sergeant (*Abudefduf abdominalis*) were observed during both the 2021 and 2024 surveys, while all other species were observed during only a single survey.

3.4.2 Mid-Reef Platform Zone

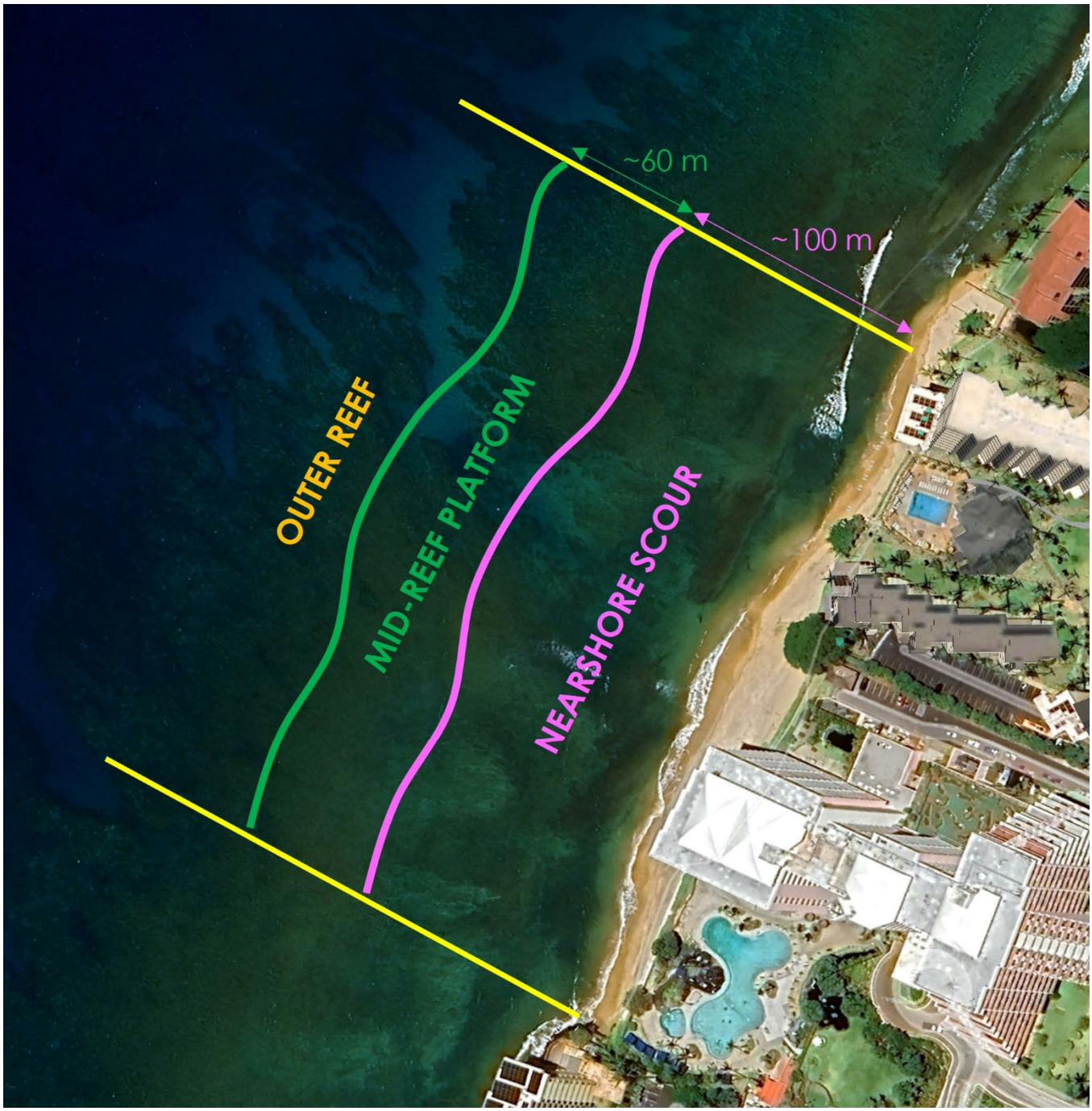
When considering both the 2021 and 2024 surveys, 36 species of fish were observed in the mid-reef platform zone (Table 7). Fifteen species of reef fish were observed on the mid-reef platform during the 2021 survey and 29 were observed during the 2024 survey. The most commonly observed fish included schools of the black triggerfish (*Melichthys niger*) and roving schools of mixed surgeonfishes (Acanthurids) and wrasses (Labrids). Fish biomass and diversity is higher in the mid reef zone when compared to the nearshore zone owing to more complex bottom structure, greater availability of shelter for fishes, and less wave stress.

3.4.3 Outer reef Coral Zone

Fish were common on the outer reef with 38 species observed between the two survey years (Table 7). When considering individual surveys, 21 species were observed in 2021 and 30 in 2024. The most common and conspicuous fish were mixed schools (eight species) of Acanthurids (surgeonfish) transiting the reef surface and mid-water near the outer margin of the reef. Other commonly observed fish were 7 species of Chaetodontidae (butterflyfishes), 4 species of Labridae (wrasses), and 7 species of Pomacentridae (damselfishes). Fish observed in the outer reef coral zone represent typical assemblages found on Hawaiian reefs of similar physical and biotic structure.

Table 7 Fish Observed within Three Zones during Surveys Conducted in 2021 and 2024

Fish Family	ZONE/SURVEY YEAR					
Fish species	Nearshore Scour		Mid-Reef Platform		Outer Reef	
	2021	2024	2021	2024	2021	2024
Acanthuridae (Surgeonfishes)						
Acanthurus blochii				X		
A. leucopareus						X
A. nigrofuscus		X	X	X	X	X
A. triostegus	X		X	X	X	X
A. xanthopterus				X		
Ctenochaetus strigosus					X	X
Naso lituratus					X	X
N. unicornis			X	X	X	
Zebrasoma flavescens			X		X	X
Z. velifer				X	X	X
Aulostomidae (Trumpetfishes)						
Aulostomus chinensis					X	
Ballistidae (Triggerfishes)						
Cantherines dumerilii				X		
Melichthys niger			X	X	X	X
M. vidua			X			
Rhinecanthus rectangulus	X	X	X	X		X
Sufflamen bursa				X	X	
Carcharhinidae (Sharks)						
Triaenodon obesus						X
Chaetodontidea (Butterflyfishes)						
Chaetodon auriga					X	
C. lunulatus					X	
C. miliaris				X		
C. multicinctus						X
C. ornatissimus					X	X
C. quadrimaculatus						X
C. unimaculatus					X	
Forcipiger sp.					X	X
Cirrhitidae (Hawkfishes)						
Cirrhitus pinnulatus			X			X
Paracirrhites arcatus					X	
P. forsteri						X
Fistularidae (Cornetfishes)						
Fistularia comersonii				X		
Labridae (Wrasses)						
Gomphosus varius			X			X
Stethojulis balteata				X		
Thalassoma duperrey		X	X	X	X	X
T. ballieui			X		X	
Lutjanidae (Snappers)						
Lutjanus fulvus				X		
Monocanthidae (Filefishes)						
Pervagor aspricaudus				X		
Mullidae (Goatfishes)						
Mulloidichthys flavolineatus	X	X		X		
M. vanicolensis						X
Parupeneus multifasciatus		X		X		X
P. porphyreus				X		X
Muraenidae (Eels)						
Echidna nebulosa	X			X		
Gymnothorax steindachneri				X		
Ostracidae (Boxfishes)						
Ostracion meleagris				X		
Pomocentridae (Damselfishes)						
Abudefduf abdominalis	X	X	X	X	X	X
A. sordidus			X			X
A. vaigiensis				X	X	X
Pycnochromis hanui						X
Plectroglyphidodon imparipennis			X			X
P. johnstonianus						X
Pycnochromis vanderbilti						X
Scaridae (Parrotfishes)						
Chlorurus perspicillatus				X		
C. spilurus			X	X	X	X
Scarus psittacus						X
Scorpionidae (Scorpionfishes)						
Sebastapistes ballieui				X		
Syngnathidae (Seahorses)						
Hippocampus kuda				X		
Zanclidae (Moorish Idol)						
Zanclus cornutus				X		
TOTAL BY YEAR	**5**	**6**	**15**	**29**	**21**	**30**
TOTAL SPECIES	**8**		**36**		**38**	



NOTE: Yellow lines indicate boundary of survey area.

Figure 5. Aerial Photograph and Diagram Showing Reef Zonation Offshore of Honokōwai Beach, West Maui, Hawai'i



Figure 6. Shoreline at Transect 1 (top) and Transect 3 (bottom) in 2021



Figure 7. Beach (top) and Nearshore Rocky Bottom on Transect 3 in the Nearshore Scour Zone

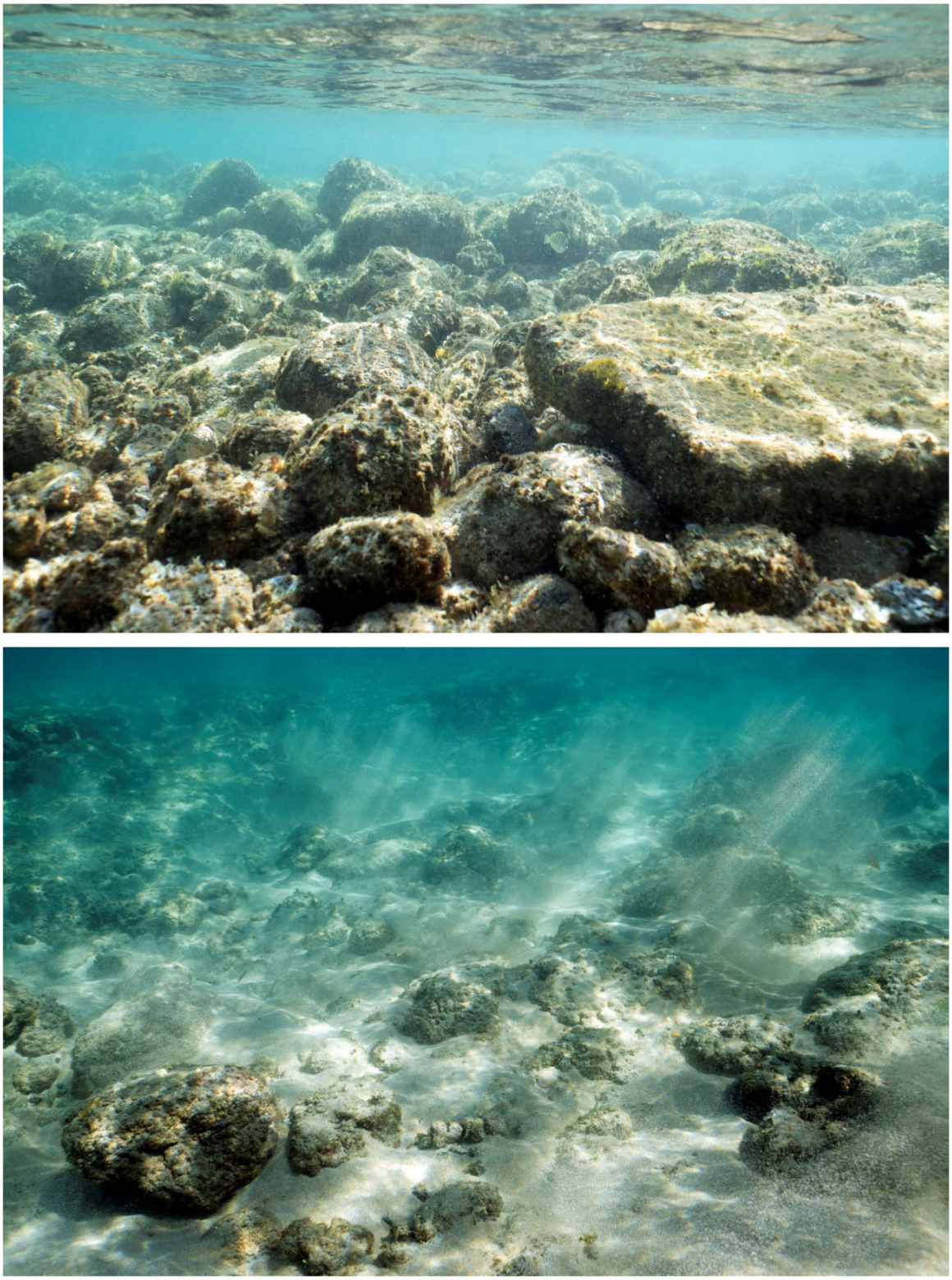


Figure 8. Nearshore Rocky Bottom on Transect 3 approximately 50 m Offshore in the Nearshore Scour Zone

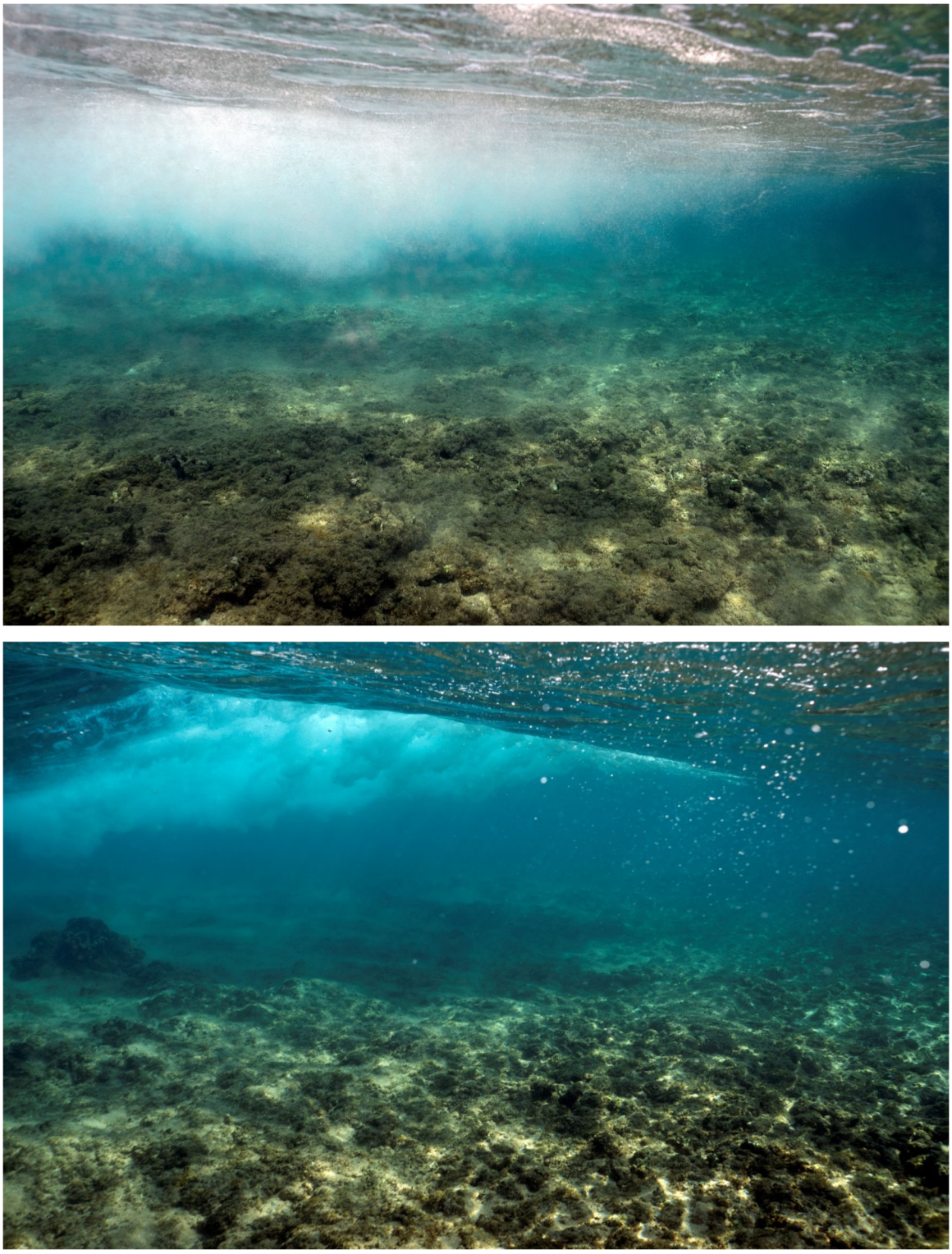


Figure 9. Two Views of Waves Breaking over the Reef Platform in the Nearshore Scour Zone approximately 80 m Offshore; Intense Scour from Breaking Waves Limits Colonization and Growth of Benthic Organisms



Figure 10. Sand/Rock Bottom at Transect 2 (top) and Macroalgae (primarily *Dictyota acutiloba* and *Halimeda kanaloa*) near the Shoreline (2024) at Transect 1 in the Scour Zone

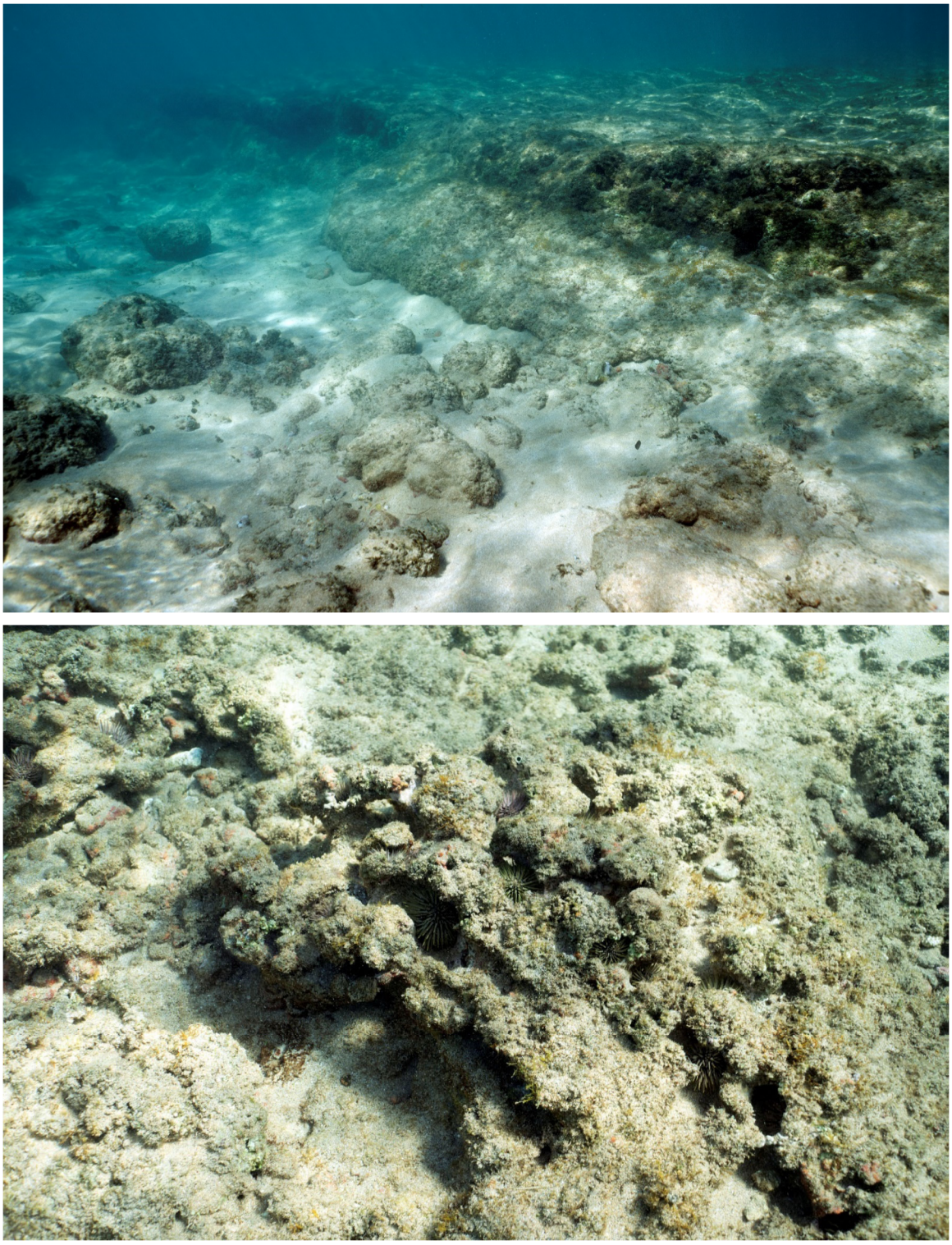


Figure 11. Boundary of Nearshore Scour Zone and Mid-Reef Platform Zone (top); Closeup of Limestone of the Platform Surface (bottom) approximately 100 m Offshore

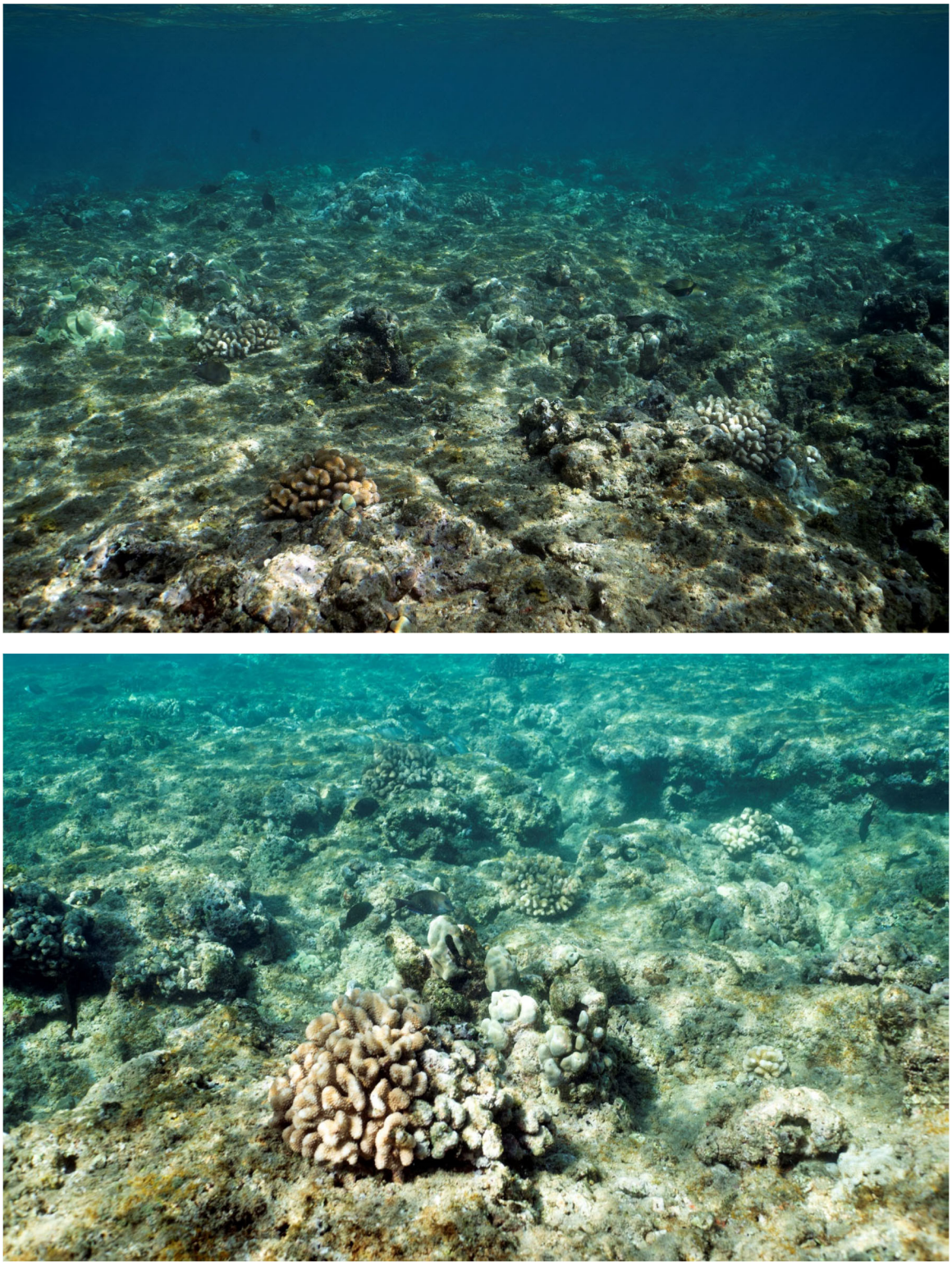


Figure 12. Fossil Reef in the Mid-Reef Platform Zone approximately 150 m Offshore; Most Common Coral is *Pocillopora meandrina*

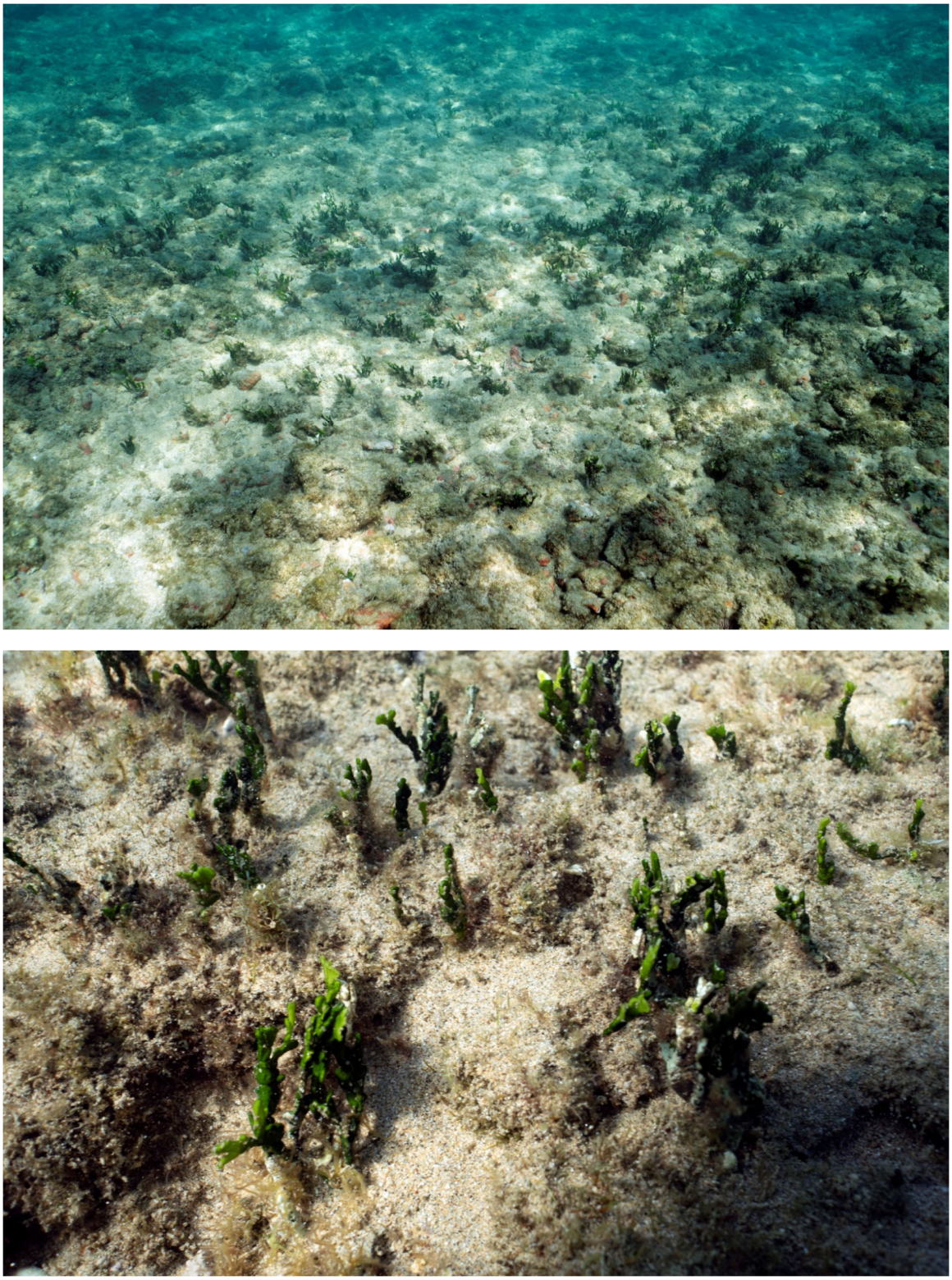


Figure 13. ***Halimeda*** **spp. Fields on Sand/Rubble Bottom approximately 120 m Offshore in the Mid-Reef Platform Zone**

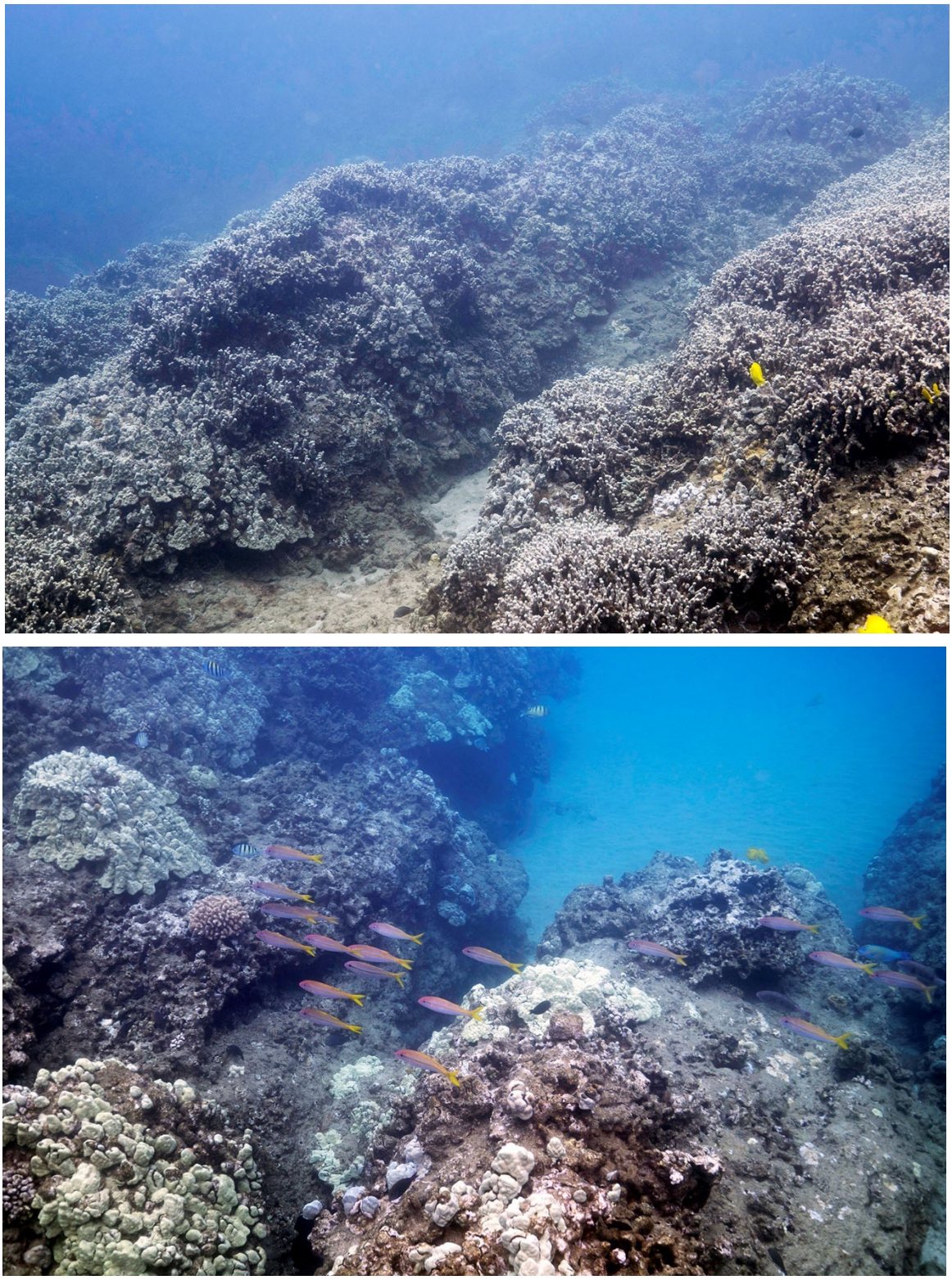


Figure 14. Outer Coral Reef Edge, ~200 m Offshore in the Outer reef Coral Zone

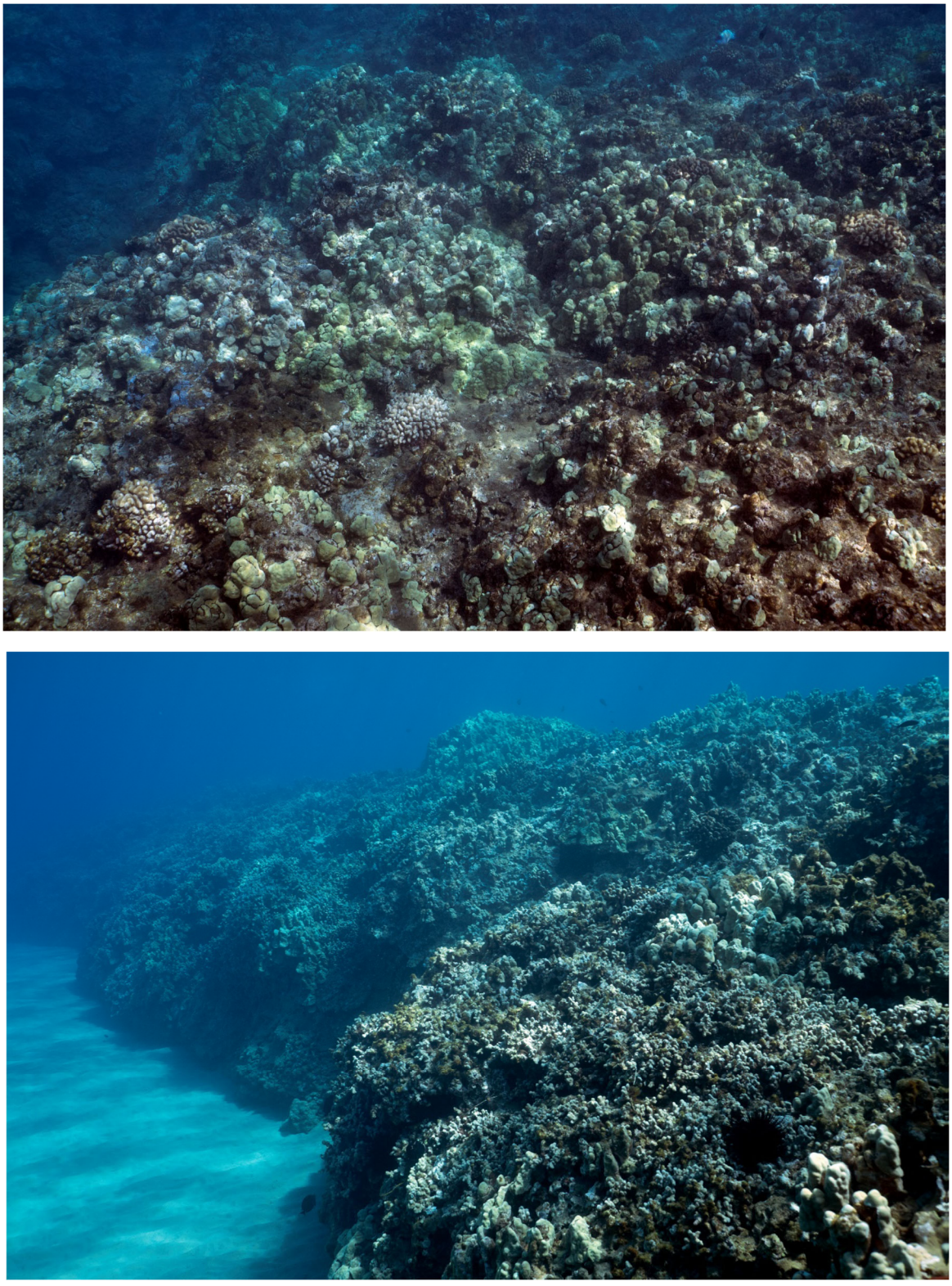


Figure 15. Coral Reef, approximately 200 m Offshore in the Outer reef Coral Zone



Figure 16. Adult Female Green Turtle (*Chelonia mydas*) Resting at the Base of a Fossil Reef Outcrop in approximately 5 m of water at the Offshore End of Transect 3

4 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 restoration fronting Honokōwai Beach in West Maui, Hawai'i. Beach restoration will prevent future erosion damage. The information collected in this study provides the basis to understand some of the important processes that are operating in the nearshore ocean environment and to be able to address any concerns that might be raised in the planning process for the proposed beach restoration. In addition, the establishment of orthomosaic sites will provide the baseline for future investigations to evaluate changes to marine biotic community structure that may be a result of beach restoration.

Results of this baseline study reveal that the major factor shaping the composition of the marine communities off Honokōwai Beach is the concussive forces associated with breaking surf. The project site is located on a protruding point of land which focuses long-period wave energy, resulting in a particularly unsuitable habitat for most reef organisms. The nearshore physical composition of the marine environment consists of wide, shallow reef flat, composed predominantly of rocks, sand, and fossil limestone. Nearshore biotic community structure is in response to the combination of shallow unstable substrate and degree of wave energy.

The documented physical structure and the nearshore biotic communities directly off Honokōwai Beach can best be described as a scour zone with essentially no corals present. At distances of about 100 m from shore, corals begin to occur in the mid-reef zone as isolated colonies. On the order of 160 m from shore, where water depth increases to levels below destructive wave forces, well-developed coral reefs proliferate. The outer reef zone off Honokōwai Beach is considered to represent a similar condition relative to other similar Hawaiian ecosystems with typical coral abundance and diversity and no outward appearance of significant stress. The proposed groins would extend between 60-75 m from the existing backshore. Thus, the seaward terminus of the groins would be within the area where corals only rarely occur, and approximately 75-90 m from where the outer well-developed high coral cover reefs occur.

Results of the water quality 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 does not extend the zone composed of rocks and sand. Turbidity of the water column peaks at the shoreline as a result of wave resuspension of naturally occurring bottom sediments and decreases steadily with distance from shore. While the proposed groins would likely reduce to some extent the effects of wave energy in the area landward of the groins, such a reduction may result in a more favorable habitat for macrobenthos including corals, algae, and motile invertebrates. The reduction in wave energy landward of the T-head groins will likely reduce slightly the mixing between groundwater and ocean water resulting in a more notable stratified water

column. However, the documented input of groundwater in this area is relatively small and limited in spatial extent compared to other coastal areas. In these areas with higher detectable groundwater input, no noticeable effects to the marine habitat have been observed. Therefore, any changes to the nutrient dynamics at the Project Site caused by the proposed beach restoration should not affect biotic resource beyond a perceptible extent that would be within the range of natural variability.

Several alternatives have been considered with respect to the proposed beach restoration at Honokōwai Beach. Beach Stabilization is one alternative which is a method of mitigating beach loss by placing engineered structures, such as groins, that mimic natural features. T-head and L-head groins decrease and reorient the amount of wave energy reaching the beach and create artificial littoral cells to stabilize the sand. The advantages of Beach Stabilization are that it increases beach stability and mitigates erosion, mitigates the need for periodic renourishment, meets the project objective to maintain a beach for a period of 50 years, and requires recovery of less than 5% of the sand available at the Sand Recovery Area.

The Beach Stabilization alternative has the potential to cause both short-term and long-term impacts to the marine environment:

Short-term

- Temporary disruption to marine species in the vicinity of active work areas during construction.
- Temporary increase in nearshore turbidity in the vicinity of active work areas during construction.
- Temporary increase in nearshore turbidity post-construction as the beach equilibrates, and any remaining fine material is winnowed out by wave action.
- The short-term impacts of the Beach Stabilization alternative will be confined to the nearshore scour zone, which consists of either sand and rocks or a bed of rocks and cobble with essentially no corals present.

Long-Term

- Permanent coverage of existing marine habitat within the footprint of the proposed groins and sand fill. However, the proposed groins will create new marine habitat by providing a substratum and protection from high wave energy for sessile organisms, such as corals and macroalgae, and providing increased habitat complexity for motile fauna. The proposed groins would be located in the nearshore scour zone, which is primarily composed of loose rocks and sand, so any loss of existing benthic habitat within the groin footprints is likely to be offset by the new habitat created by the groins.
- Permanent displacement of fish populations within the footprint of the proposed groins and sand fill. However, the proposed groins would be located in the nearshore scour zone, where fish biomass and biodiversity are currently very low, so any impact to fish populations or migration patterns is expected to be negligible.

The proposed groins will create new marine habitat, which could potentially increase fish biomass and biodiversity in the vicinity of the groins.

- The proposed groins and beach fill would provide a natural buffer that would mitigate erosion of the backshore area and the release of terrigenous sediment into the nearshore waters. Based on current projections for sea level rise and coastal erosion, the Beach Stabilization alternative has the potential to result in a long-term positive impact by reducing the potential impacts of erosion and sedimentation to water quality and benthic habitat.

A second alternative is "Beach Nourishment." This alternative would consist of placing sand at the south end of the Honokōwai littoral cell without placement of any structures to stabilize the sand. The sand would be placed along approximately 1,000 feet of shoreline between Honokōwai Stream and Honokōwai Point. The Beach Nourishment alternative has the potential to cause short-term impacts to the marine environment. Short-term impacts include a potential temporary increase in turbidity in nearshore waters during construction and immediately post-construction as the restored beach profile equilibrates. The seaward extension of more sand into the intertidal and subtidal areas is expected to be minor and would decrease over time due to natural erosion and beach narrowing. No significant impacts to water quality, biotic community structure, and fish community structure are anticipated. The Beach Nourishment alternative has an estimated design life of 10 years and would likely delay the potential negative impacts of No Action.

The third alternative consists of "Beach Maintenance." This alternative would consist of an initial beach nourishment project with periodic renourishment at specified intervals. The initial nourishment effort would be identical to the beach nourishment alternative described above. The initial nourishment effort would be identical to the beach nourishment alternative described above. Periodic beach maintenance would be performed after the initial nourishment and throughout the 50-year design life to maintain the desired beach width. Over a period of 50 years, four (4) renourishment efforts would be required to maintain the desired beach width of 40 feet. Each renourishment would require approximately 5,000 cy of sand, resulting in a total volume of 47,000 cy of sand to restore the beach and provide a minimum beach width of 40 feet.

The Beach Maintenance alternative would have similar potential impacts to the Beach Nourishment alternative; however, the impacts would occur more frequently and over a longer period of time due to the need for periodic renourishment. Repeated restoration of the beach profile would involve placing sand into the intertidal and subtidal areas multiple times. However, this area is primarily composed of loose rocks and sand, and corals do not occur in this region, so long-term impacts to water quality and corals are not anticipated.

The "No Action" alternative would consist of not implementing any of the beach restoration alternatives described above and allowing Honokōwai Beach to continue to erode naturally. For the purposes of the EIS analysis, it is assumed that the No Action alternative would involve removal of the existing temporary erosion control structure. The

No Action alternative has the potential to temporarily increase turbidity in nearshore waters during removal of the existing erosion protection skirt. However, these impacts would be limited to the immediate area of removal work and could be contained with the implementation of proper Best Management Practices (e.g., biosocks, silt curtains).

The No Action alternative would initially have less potential to impact the marine environment as it would eliminate the need for construction-related activities associated with beach restoration. However, based on current projections for sea level rise and coastal erosion, the No Action alternative has the potential to result in long-term impacts to water quality and benthic habitat.

The cumulative impacts of No Action would be broad-ranging and substantial. Honokōwai Beach is subject to chronic, seasonal, and episodic erosion. Chronic erosion refers to the gradual process of beach narrowing that occurs incrementally over time. Seasonal erosion refers to changes in beach configuration (e.g., volume, width, elevation) that typically occur in cycles based on seasonal ocean conditions. Episodic erosion refers to individual events that occur rapidly and unexpectedly, such as large swells, storms, or tsunamis. Beach loss and shoreline recession may occur as a result of chronic, seasonal, or episodic erosion, or a combination thereof. Without implementation of beach restoration, erosion and beach loss would result in significant shoreline recession that will substantially alter the configuration of the shoreline at Honokōwai Beach. While the precise timing of coastal erosion and sea level rise are not certain, current projections indicate that, if no action is taken to mitigate the erosion and restore Honokōwai Beach, total beach loss can be expected before the end of the century.

No Action would result in a range of potential environmental impacts including but not limited to beach narrowing, negative impacts to water quality and benthic habitat, loss of ecosystem services and critical natural habitat, and progressive degradation of the shoreline area. In Hawai'i, beaches are designated as critical habitat for protected and endangered species including green sea turtles and Hawaiian monk seals. Under the No Action alternative, erosion and beach loss would continue to degrade the natural environment at Honokōwai Beach, resulting in the inevitable loss of ecosystem services and critical natural habitat.

Sandy beaches provide a natural buffer that helps to prevent erosion and discharge of materials and pollutants that can negatively impact water quality and benthic habitat. Under the No Action alternative, continued erosion of the backshore area (landward of the shoreline) would result in the discharge of substantial volumes of terrigenous sediment (i.e., clay, silt, fill material) into the ocean. This erosion can be chronic (incremental) or episodic (event-driven), so the frequency and volume of discharge will likely vary over time.

Hui O Ka Wai Ola, a community group consisting of volunteers, scientists, supporters, and partner groups, has been conducting water quality monitoring at Honokōwai Beach since 2016. Their monitoring results have confirmed that high levels of turbidity and nitrates are

prevalent along the leeward coast of Maui. Their most recent report (2022) found that turbidity and nitrate levels at Honokōwai Beach far exceed Hawai'i Department of Health (DOH) water quality standards and that turbidity is expected to increase over time in northern West Maui, as coastal erosion worsens with sea level rise. The report notes, however, that the existing temporary erosion control structure at Kā'anapali Beach Club has helped to reduce turbidity levels at Honokōwai Beach. Removal of these structures would eliminate this reduction in turbidity.

A viable comparison of the effects of construction of T-groins at the Honokōwai Beach site is a series of similar T-groins that were constructed in 2013 at Iroquois Point on the south shore of Oahu, Hawaii adjacent to the entrance of Pearl Harbor (AECOS, 2020). Similar to the nearshore zone at Honokōwai Beach, the shallow subtidal zone at Iroquois Point is marginal fish and coral habitat, due primarily to low habitat complexity and sand scour. While the groin stone buried a portion of the existing subtidal environment, the area consisted of low relief habitat composed of sand, rubble and consolidated limestone reef.

Results of monitoring the 2013 beach stabilization project at Iroquois Point show what can be expected with the proposed project at Honokōwai Beach. The boulder groins provide bare, stable surfaces for recruitment of corals, non-coral invertebrates, and macroalgae. The interstitial spaces between boulders provide additional habitat for cryptic benthic organisms (crabs, shrimps, worms, etc.) and sessile organisms (sponges and tunicates), which would provide additional foraging resources for fishes. Adult and juvenile fishes are mobile and likely avoided the area during construction activities. However, following completion, the beach stabilization project created new reef fish habitat in the form of a boulder groin and sand fill.

The post-construction marine ecosystem monitoring shows that the project resulted in a significant change in marine species diversity and density (AECOS 2020). In the general project area (groins and beach cells combined), there was a 25-fold increase in fish abundance, not counting small baitfish, and a doubling of species richness (number of species). Fish biomass was more than six times greater than prior to construction. The greatest change occurred in the vicinity of the new habitat created by the rock groin structures. Other changes in the vicinity of the groins include an increase in crustose coralline algae cover from 1% to 60%, an increase of coral cover from 0 to 0.6%, and an increase in macroinvertebrate cover from 1.4% to 6.3%. Coral abundance in the groin vicinity increased from 0 to 16 colonies per 10 m^2, with the most common coral species being *Pocillopora damicornis*. These changes are attributable to the creation of hard, stable habitat for colonization. A similar long-term increase in biotic abundance and diversity would be expected at the Honokōwai Beach site as the location of the groins would be within the nearshore scour zone. It would not be expected that the groins would have any effect on the outer reef zones.

In summary, it is not likely that the proposed beach stabilization would have a negative effect on existing biotic communities that would exceed the alternative of taking no action. The nearshore scour zone extends seaward to a distance that is likely beyond the

influence of any remediation activities. The only foreseeable change may be if erosion control results in a seaward extension of more sand into the intertidal and subtidal areas. As this area is composed of sand, cobbles and bare rock, it is not a suitable habitat for corals. Thus, the addition of more sand would not result in any significant habitat shift relative to the existing condition.

APPENDIX A

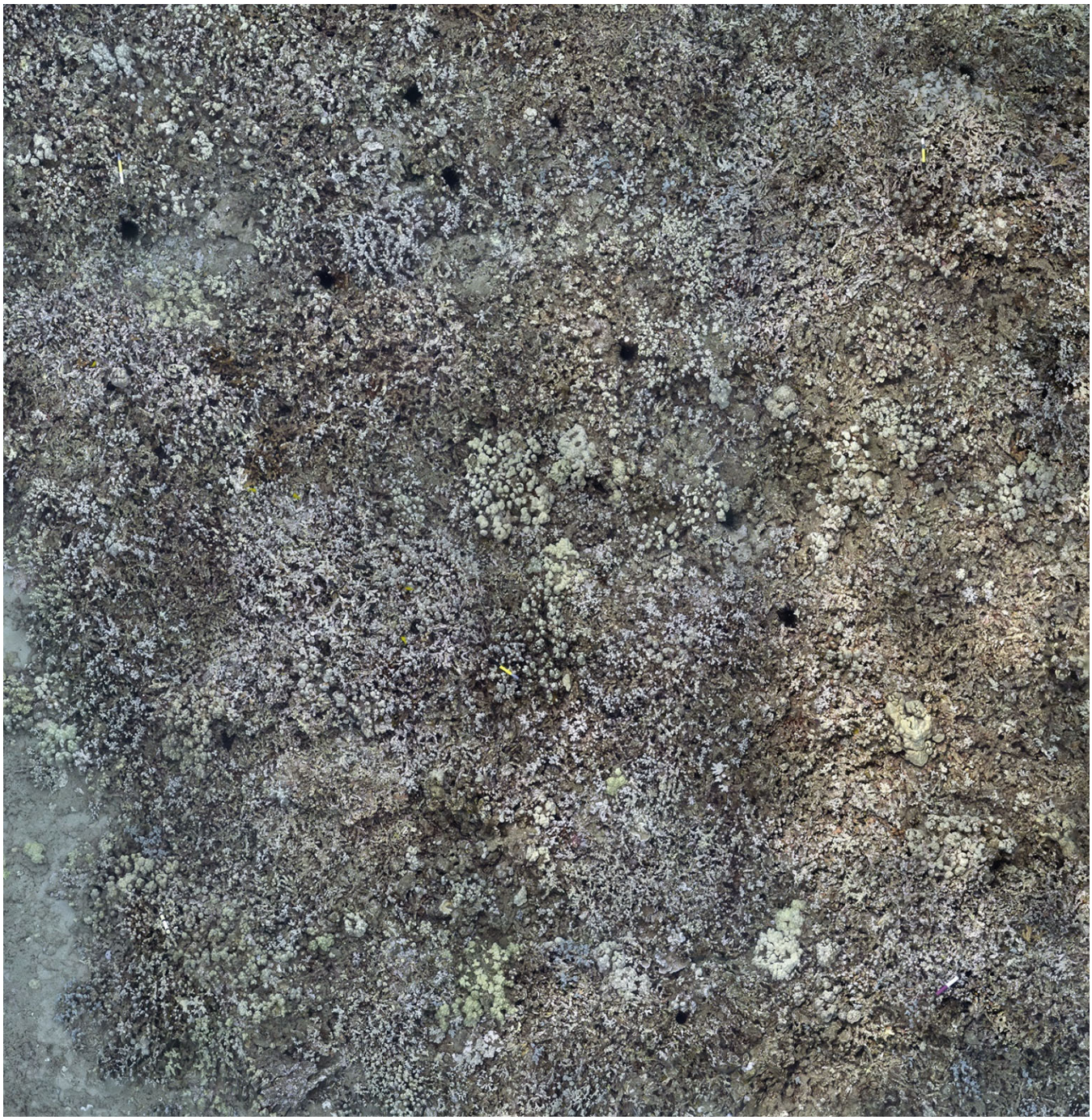
ORTHOMOSAICS

HONOKŌWAI BEACH – WEST MAUI, HAWAII

May 29, 2024



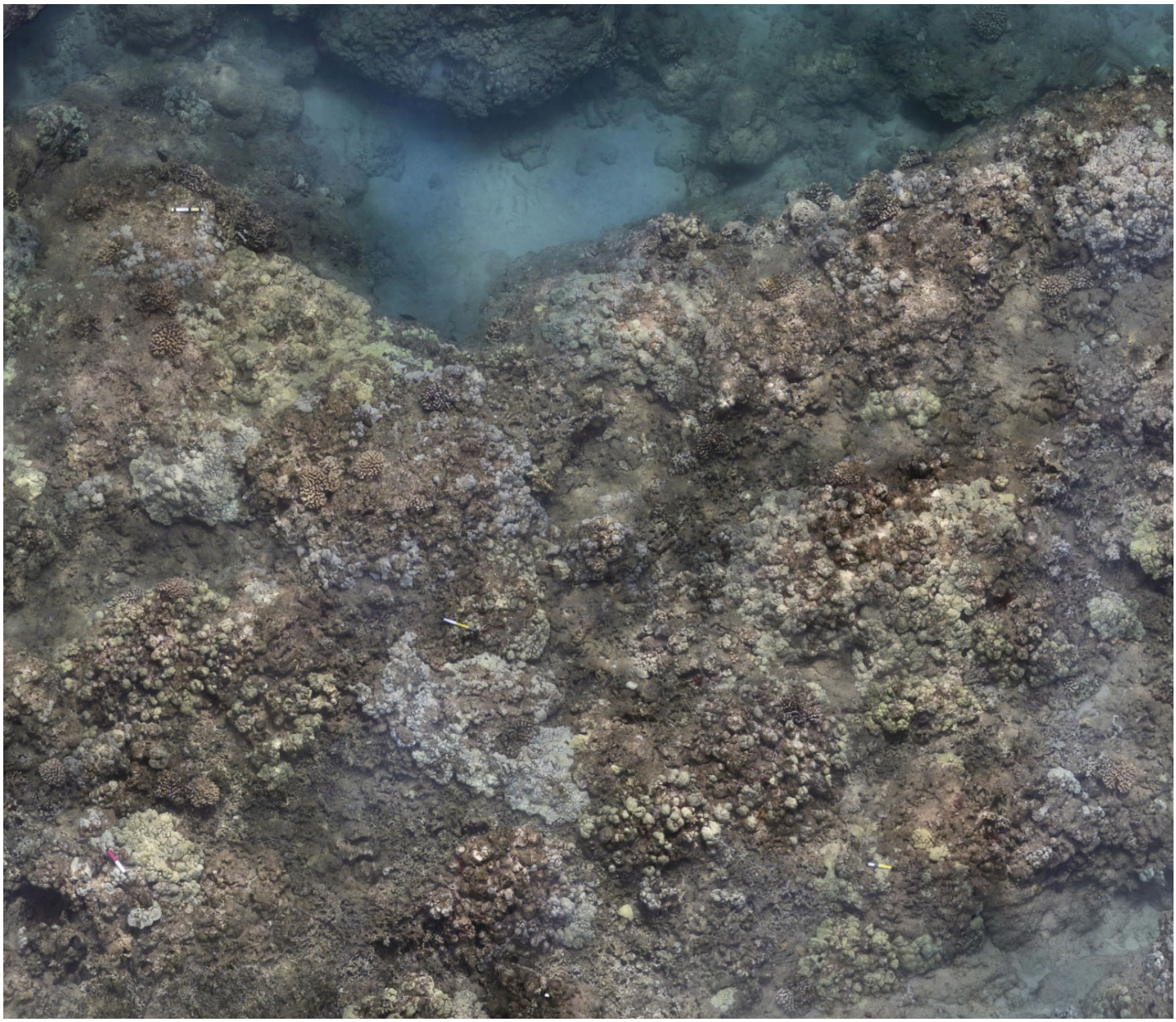
Orthomosaic of T1-Mid.



Orthomosaic of T1-Outer



Orthomosaic of T3-Mid



Orthomosaic of T3-Outer

APPENDIX F

Applicable Monitoring and Assessment Program

Hoʻāla Honokōwai
Lahaina, Maui, Hawaiʻi
Tax Map Key Nos. (2) 4-4-001:097, 098, and 100

Prepared By: Marine Research Consultants, Inc.

HO‘ALA HONOKŌWAI BEACH RESTORATION

APPLICABLE MONITORING AND ASSESSMENT PROGRAM FOR CLEAN WATER ACT (CWA) SECTION 401 WATER QUALITY CERTIFICATION

December 2024

SUBMITTED TO: Sea Engineering Inc.
Makai Research Pier
41-305 Kalanianaole Hwy
Waimanalo, Hawaii 96795, US

SUBMITTED BY: Marine Research Consultants, Inc
46-312C Haiku Rd.
Kaneohe, HI 96744

CONSTRUCTION AREA: Offshore Honokowai, Maui, Hawaii

I. DESCRIPTION of PROPOSED ACTION:

PROJECT DESCRIPTION

The proposed project is to restore Honokōwai Beach, which is located north of Kā‘anapali and south of Kahana Bay on the west coast of the island of Maui. The proposed restoration method is Beach Stabilization, which will consist of beach nourishment and construction of three T-head groins and one L-head groin. The project spans approximately 1,000 ft of shoreline. The groins will be spaced between 330 and 340 ft apart from southwest to northeast. The groins will extend between 220 and 250 ft from the existing backshore. Sand fill will be placed between the groins to create a beach with a minimum 40-ft width, +8.5-ft MSL elevation, and a 1V:8H slope from the crest to the sea bottom. An estimated 33,000 yd3 of sand will be required to restore the beach. The sand will be recovered from a marine sand deposit located offshore of Pu‘u Keka‘a (Black Rock), barged to Kahului where it will be offloaded and temporarily stockpiled prior to being trucked to the project site for placement. An estimated 22,442 tons of stone will be required to construct the groins. The stone is expected to be sourced from HC&D in Pu‘unēnē and trucked to the project site.



Figure 1. Project Area

WORK PLAN

The following in-water work will be performed:

• Clamshell dredging and barging (33,000 yd3 of sand)

• Groin construction (22,442 tons of stone; Total groin area = 53,900 ft2) a. Note: Impacts would be limited to the 46,145 sf area within the footprint of the groins that extend seaward of the beach toe.

• Sand placement (33,000 cy of sand; Total beach area = 159,400 ft2) a. Note: Impacts would be limited to the 43,395 sf area of beach fill that would be placed seaward of the beach toe.

SCHEDULE

Construction will consist of the following tasks:

1. Mobilization (10 workdays)
2. Sand Recovery and Transport (54 workdays)
3. Groin Construction and Sand Placement (270 workdays)
4. Demobilization (10 workdays)

Estimated construction duration is 344 workdays (480 calendar days), depending on ocean and weather condition.

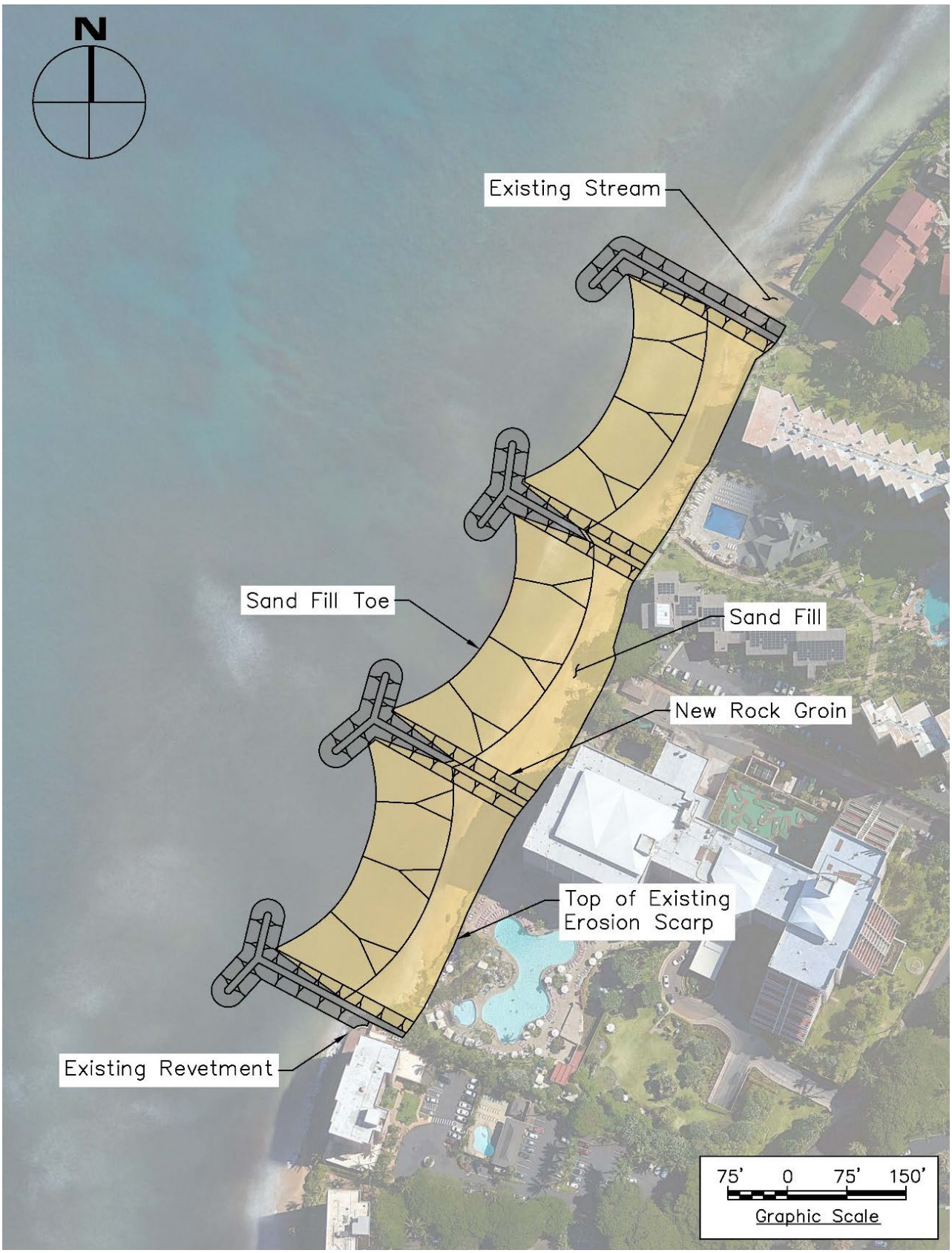


Figure 2. Concept plan view for Beach Stabilization

II. METHODS

A. Contractor Visual Inspection Monitoring

During construction, the Contractor will designate a person to perform twice daily visual inspections of the construction site to ensure that the construction activities do not result in adverse impacts. Photos will be taken by the Contractor daily with date/time stamp and will include a narrative describing photo-documentation. Observations recorded in a field notebook will include (but not be limited to): date, time, weather conditions, the description of the construction activity, and any other observed activities not related to the construction activities that may affect water quality. Any photographs that have been taken will be kept on file at the contactor's office. A hard or electronic copy of these observations and any photographs will be provided for use in preparing the final assessment report. This field notebook will be available for inspection by HDOH-CWB authorized personnel during normal business hours.

B. Water Quality Monitoring Sampling

1. Sampling Sites

Six sampling stations have been established. See Figure 3 for locations of sampling stations:

Station SR-1: Sand Recovery Site. marine sand deposit located offshore of Puʻu Kekaʻa (Black Rock).

Stations G-1, G-2 and G-3: Groin nearshore work activity stations; Each of the three G stations will be located between adjacent groins. If silt containment devices are employed during groin construction and sand placement, water sampling stations will be located 1 m (~3 ft) from the outer face of the containment device.

Station C-1 and C-2: Control stations; One control station will be located approximately 200 ft to the north of the northernmost groin, and one control station will be located approximately 200 feet to the south of the southernmost groin.

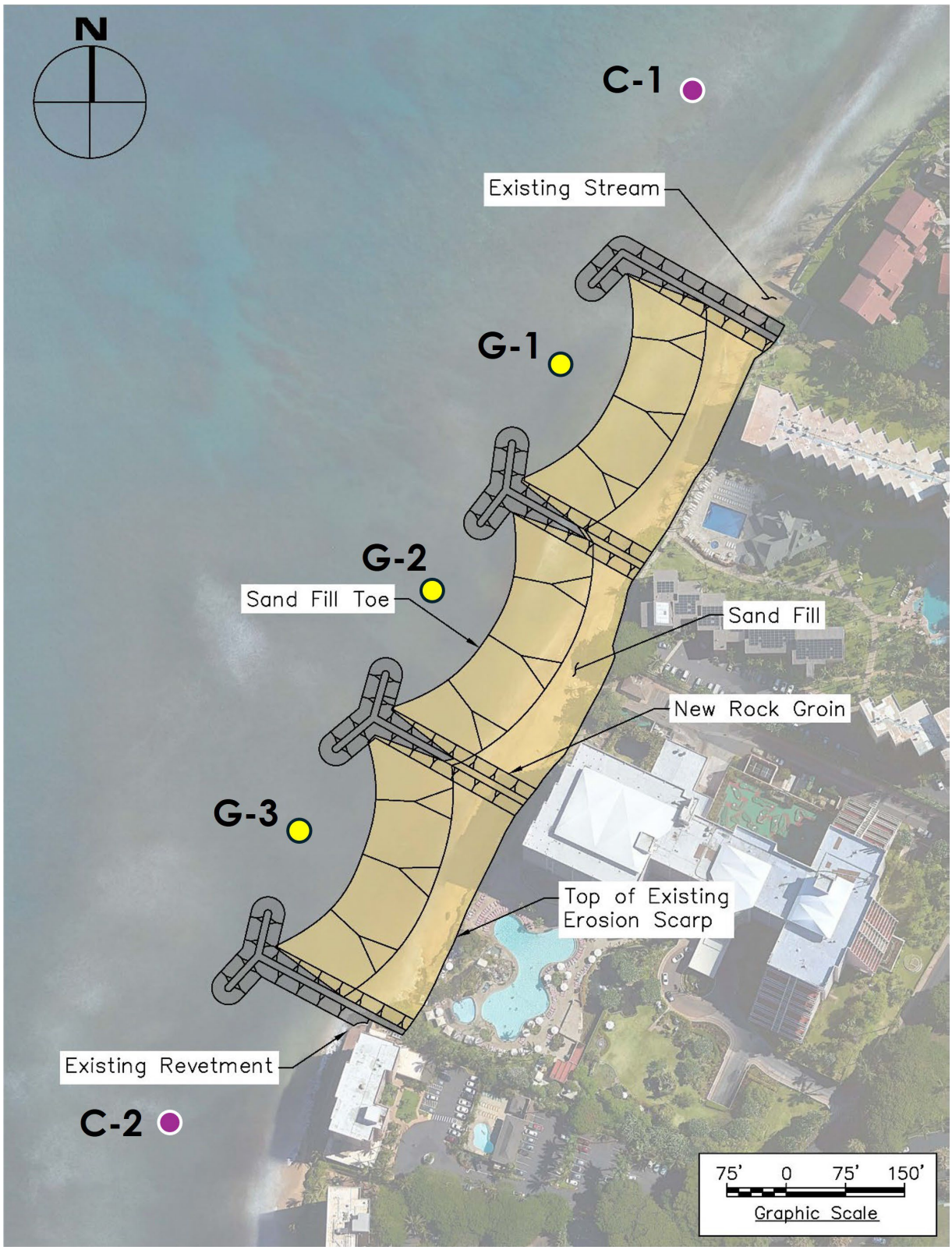


Figure 3. AMAP sampling stations off Honokawai Beach. Station SR-1 (Sand Recovery site) is not shown.

2. Sampling Constituents

Water quality monitoring will include analysis of pH, turbidity (reported in nephelometric turbidity units [NTU]), salinity (reported as parts per thousand) temperature (degrees Celsius) and dissolved oxygen (% saturation).

3. Sampling Frequency

In-water work is expected to span 480 calendar days. Prior to the commencement of construction, samples from SR-1, the center groin station and both Control stations will analyzed for all constituents listed above ten times in order to develop a baseline set of conditions that will be utilized to evaluate the effects of construction activities on water quality. During the entire period of construction, water samples will be collected twice a month from each of the six monitoring stations. Following the completion of construction, three increments of sampling will be conducted on a weekly basis commencing at least one week after completion of in-water work.

4. Field Sampling Protocol

All field sampling will be conducted by Marine Research Consultants, Inc. or another qualified contractor, with at least 5 year's experience in conducting similar AMAP monitoring plans. All technicians participating in field collections will be professionally trained in all aspects of required sampling protocols.

At the time of water sampling, field notes will be recorded that include: time of sampling; weather and ocean conditions; name of individuals conducting the sampling; construction activities and any other in-water activity.

Water will be collected working from the shoreline and/or from a small boat or floatation device. Discrete surface samples will be collected at a constant depth at all stations (~1 ft below the surface) directly into clean, pre-rinsed1-liter polyethylene bottles. Mid-water and bottom samples will be collected using a Niskin oceanographic sampling bottle or similar device. This device consists of an open-ended tube fitted with spring-loaded endcaps that are triggered shut by a messenger weight dropped from the surface. A weight suspended one foot below the bottle ensures that sampling occurs at a uniform depth above the ocean floor. Alternatively, data can be collected using a data logger that records continuously as

it is dropped through the water column creating a vertical profile of water chemistry constituents. Collection of discrete samples or continuous profiles provides important information on stratification of the water column, which is not possible with an integrated sample that mixes water from all depths.

All methods, instruments, and limits of detection for sampling and analysis are shown in Table 1. Immediately after sample collection, field measurements of pH will be collected and recorded using a portable pH meter (ex. Accumet Model AP63) with a readability of 0.01 pH units (EPA Method 150.1). The pH meter will be calibrated each day before use with commercially available 4, 7 and 10 buffers. Samples for turbidity will also be measured in the field immediately after collection using a Hach P2100 field meter and reported in nephelometric turbidity units (ntu) with a readability of 0.01 ntu. The turbidity meter will be calibrated each day using a standard solution supplied by the manufacturer. The Hach meter meets or exceeds EPA requirements for Method 180.1. Dissolved oxygen (SM2550O-G), salinity (SM2520) and temperature (SM2550B) will be measured *in-situ* using an instrument such as a YSI Pro2030 field instrument calibrated before each sampling event using manufacturers standards.

Table 1. Analytical constituents, method, method references, instruments, and minimum sensitivity for sampling of Honokōwai Beach Replenishment Project.

Analysis	Method	Reference	Instrument (minimum sensitivity)
Salinity* (practical salinity units [psu])	SM 2520 (EPA 120.1)	Standard Methods, 23rd Edition (2018)	YSI Pro2030 (0.1 psu); RBR Concerto (<0.001 psu) (0.0001‰)
Dissolved Oxygen* (% saturation, mg/L)	SM 4500-O G (EPA 360.1)	Standard Methods, 23rd Edition (2018)	YSI Pro2030 (0.01 %sat.); RBR Concerto (<0.001 %sat)
pH* (standard units)	SM 4500 H+ (EPA 150.1)	Standard Methods, 23rd Edition (2018)	Thermo Scientific Orion Star, 8107UWMMD electrode (0.01 pH units); RBR Concerto (<0.001 pH units)
Temperature* (degrees C)	SM 2550 B (EPA 170.1)	Standard Methods, 23rd Edition (2018)	YSI Pro2030 (0.1°C); RBR Concerto (<0.001 °C)
Turbidity** (nephelometric turbidity units [NTU])	EPA 180.1 Rev 2.0	EPA (1993)	Hach 2100Q (0.01, 0.1 NTU dependent on range); RBR Duo3 (<0.001 NTU)

*Analyses conducted within 15 minutes of collection, no field preservation.
**hold time <2 hours, no field preservation.

C. Monitoring Assessment and Decision System

The methodological approach for implementation of the decision process relating to water quality parameters during the construction activities for beach replenishment is presented in detail in the "Project Data Quality Objectives (DQO)." In brief, the "Problem" defined in this process is to determine whether construction activities are affecting waters of the Pacific Ocean fronting Honokōwai Beach above what can be considered natural variability. The primary potential sources of such negative effects are sand acquisition, groin construction and sand replenishment operations. The "Decision" is to determine if such differences occur, based on comparison of data collected during construction to pre-construction baseline data and State Water Quality Standards. A "Decision rule" will be developed if results of construction sampling fall outside the limits developed by pre-construction sampling. These decisions will involve either additional BMP's that may be implemented or revisions to the construction plan to reduce factors responsible for exceedances. Decision rules will be based on *t*-tests (p=0.05) [1-tailed for all constituents except pH, 2-tailed for pH] to determine if during construction sampling results are significantly higher (or lower) than pre-construction baseline values or water quality standards.

D. Reporting

Data reporting will be conducted in several formats.

1. Pre-construction Report. The 10-day pre-construction baseline data will be reported in total in a single report following completion of the sampling. The report will include all data collected, along with statistical treatment of each constituent in terms of geometric mean values, standard deviation, maxima and minima. These values will be compared to State Water Quality Standards for open coastal waters (HR 11-54-6(b) to determine pre-construction compliance.

2. During Construction Daily Reports – Sampler and Contractor will independently inspect BMP's daily documenting findings in an official logbook (including non-project related activities that may impact water quality). Photos will be taken by the Contractor daily with date/time stamp and will include a narrative describing photo-documentation. The DOH Clean Water Branch (CWB) will be notified by the Contractor or any modifications of the work plan, BMP's and/or AMAP.

Water quality data measured in the field (DO, temperature, salinity, turbidity, pH) will be incorporated into daily reports prepared by the sampler and submitted to the Contractor within 48 hours of sampling. These daily reports will include results of field testing, along with descriptive information regarding conditions of the construction operation (i.e., date, time, weather, construction activity, appearance of waters, names of sampler). Contractor will attach daily photo-documentation to daily report and submitted via email to cleanwaterbranch@doh.hawaii.gov in portable document format (pdf) by close of the business day following the sample day. As a method of determining compliance of water quality, it will be noted on the daily reports whether turbidity measurements exceed either Water Quality Standard values, and if pH falls outside the envelope of acceptability. It will also be noted if pH, turbidity and TSS fall outside the envelope of values determined during the 10-day pre-construction period. Consideration of the comparative values between the control and "work" stations will indicate if construction activities can be the cause of any elevated or anomalous measurements.

3. Post-Construction Report. Following completion of the three post-construction sampling events, a final report will be prepared including all pre-construction, during construction and post-construction data. These data will be interpreted to determine if any changes detected during the construction phase returned to pre-construction levels.

APPENDIX G

Best Management Practices Plan

Hoʻāla Honokōwai
Lahaina, Maui, Hawaiʻi
Tax Map Key Nos. (2) 4-4-001:097, 098, and 100

Prepared By: Sea Engineering, Inc.

Best Management Practices Plan

Hoʻala Honokōwai

Honokōwai, Maui, Hawai'i

August 2025



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1. INTRODUCTION

1.1 Purpose

The purpose of this Best Management Practices Plan (BMPP) is to ensure that adequate protective measures are in place during implementation of the Hoʻāla Honokōwai beach restoration project in Honokōwai, Maui, Hawaiʻi. This plan is designed to prevent, if possible, or minimize adverse impacts on the environment. The project specifications will require the contractor to adhere to environmental protection measures, including, but not limited to, those included in this BMPP. This BMPP is inclusive of the appropriate measures identified in the Standard Local Operating Procedures for Endangered Species in the Central and Pacific Region (Pac-SLOPES).

1.2 Project Site Description

The Project Site (Honokōwai Beach) is located north of Kāʻanapali and south of Kahana Bay on the west coast of the island of Maui (Figure 1-1 and Figure 1-2). The Project Site is located in the Kāʻanapali District and the Honokōwai Ahupuaʻa. The area between Honoapiʻilani Highway and the shoreline is located in the Special Management Area (SMA) and Urban State Land Use District. The area makai (seaward) of the shoreline consists of submerged lands that are located in the Resource Subzone of the Conservation District. The area mauka (landward) of the shoreline is densely developed with resort infrastructure. There are three (3) privately owned parcels near the Project Site, all of which are zoned (H) Hotel.

Honokōwai Beach is an important natural, cultural, and aesthetic resource that supports a wide variety of cultural, recreational, and economic uses. The beach also acts as a natural buffer that absorbs wave energy and reduces exposure of the backshore land and infrastructure to erosion and flooding. Nearshore hydrodynamics (i.e. waves, currents, and water circulation) along the Honokōwai shoreline are complex. At Honokōwai Beach, sediment (e.g., sand) is transported in multiple directions due to a complex combination of wave exposure, bathymetry, water depths, nearshore currents, and sediment availability. As a result, beach width and sand volume at Honokōwai Beach are constantly changing due to seasonal and episodic variations.

In 2016, a combination of persistent North Pacific swell and elevated water levels produced high waves, strong currents, and abnormally high tides that caused significant erosion and beach loss at Honokōwai Beach. The erosion exposed and damaged infrastructure including a concrete walkway, shower pads, irrigation lines, electrical wiring and propane gas lines. The erosion also threatened the northern flank of the Maui Kai Condominiums. The shoreline retreated 6 to 12 ft in just a few months, approximately 5,600 square feet (sf) of fast land was lost to erosion, and over 1,000 cubic yards (cy) of alluvial sediment (i.e., clay, silt, boulders) was discharged into the ocean. The erosion dramatically altered the configuration and appearance of Honokōwai Beach.

In 2018, a temporary erosion control structure was installed along the shoreline fronting Kāʻanapali Beach Club. The structure was authorized by the Hawaiʻi Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL) and the County of Maui, Department of Planning through the emergency permitting process.



Figure 1-1. Aerial photograph of the Project Site



Figure 1-2. Oblique aerial photographs of the Project Site (06/07/2024)

2. PROJECT DESCRIPTION

The erosion and beach loss that occurred in 2016 caused extensive environmental damage and negatively impacted the range of beneficial uses of Honokōwai Beach. The erosion caused substantial beach loss, structural damage, and created risks to public health, safety, and welfare, and impeded access to and along the shoreline. The erosion and discharge of alluvial material (i.e., clay, dirt, and boulders) from the backshore caused the formation of large turbidity plumes that negatively impacted water quality.

West Maui Resort Partners, LP (WMRP) is proposing to restore and preserve Honokōwai Beach. The objectives of the Ho‘āla Honokōwai project are to:

- Restore beach width and improve beach stability;
- Preserve and enhance cultural and shoreline access;
- Increase resilience to coastal hazards and sea level rise; and
- Enable planning for long-term adaptation to sea level rise.

It is anticipated that restoring Honokōwai Beach and preventing further erosion of the backshore will have a positive net beneficial impact on the environment, including preserving the beach and improving water quality. It is also anticipated that beach restoration will help to preserve and enhance the fundamental character of Honokōwai Beach by maintaining shoreline access and supporting existing uses along the shoreline.

The Proposed Action is the restoration and preservation of Honokōwai Beach. WMRP is considering three potential methods of implementing the Proposed Action as follows:

> ***Beach Nourishment*** – a one-time, single action involving the placement of additional sand to increase beach width and sand volume to offset the effects of erosion without modifying existing structures or installing any new structures.
>
> ***Beach Maintenance*** – a series of recurring actions over time involving the placement of additional sand, combined with sand pushing and/or sand backpassing, without modifying existing structures or installing any new structures. Beach maintenance would be conducted on a recurring, periodic basis and is therefore considered to be “programmatic” in nature.
>
> ***Beach Stabilization*** – a one-time, single action involving both (i) the placement of sand to increase beach width, and (ii) the modification of existing structures and/or installation of new structures (e.g., groins) to stabilize the sand (i.e., mitigate erosion and beach loss).

Beach Stabilization is the proposed methodology for this BMPP. Unless otherwise specified, all the BMPs included in this BMPP would apply to the Beach Nourishment and Beach Maintenance alternatives.

2.1 Beach Stabilization

Beach Stabilization will consist of beach nourishment and construction of three T-head groins and one L-head groin. The project spans approximately 1,000 ft of shoreline. The beach and groin layout is shown in Figure 2-1. The groins will be spaced between 330 and 340 ft apart from southwest to northeast. The groins will extend between 220 and 250 ft from the existing backshore. The heads will extend between 72 and 84 ft to either side of the stem, at angles ranging from 90º to 120º in order to best orient the gaps between heads parallel to the typical wave approach.

The groin crests and elevations are designed with the capability of adapting to sea level rise. The groin heads are designed with a crest elevation of +6 ft MSL. That elevation will allow some overtopping during high wave events without sacrificing beach stability. The groins are designed to be capable of being modified as sea level rises. The groin crests will have cast-in-place concrete crest caps as shown in Figure 2-2. This concrete core will serve as a base for potential groin modification as sea level rises. When sea level has risen and vertical extension is needed, a crown wall can be constructed on top of the concrete core to effectively raise the height of the groin, likely by about 1.5 ft. Design of the groin heads in this manner keeps the heights lower and the view plane more open initially, as opposed to designing the elevations for 3.3 ft of sea level rise now and having groin heads with elevation likely exceeding +9 ft MSL now.

The heads will have crest widths of 11.4 ft and side slopes of 1V:1.5H. The crest elevation is +6 ft MSL and the groin stem elevations will increase from +6 ft MSL at the heads to +7.5 ft MSL at the inshore ends on the inner groins Figure 2-3 and +8.5 ft MSL on the terminal groins (Figure 2-4). The stems will not require modification for sea level rise, so they are constructed with a three-stone crest width of 11.4 ft. Approximately 22,442 tons of stone will be required to construct the groins.

The southwest and northeast groins are considered terminal groins, meaning that they are at the ends of the beach system. All the other groins will have sand on either side, so they can be lower to allow for a continuous sand beach. As terminal groins, the stem elevations will have to be higher than the other stems to prevent sand from washing over them. The terminal groin stem elevations are set to +8.5 ft MSL as shown in Figure 2-4.

Sand fill will be placed between the groins to create a beach with a minimum 40-ft width, +8.5-ft MSL elevation, and a 1V:8H slope from the crest to the sea bottom. The inner groin stems are lower than the beach crest elevation, thus approximately half of the groin stem will be covered by sand, with the groins gradually emerging from the beach slope. An estimated 33,000 cy of sand will be required.

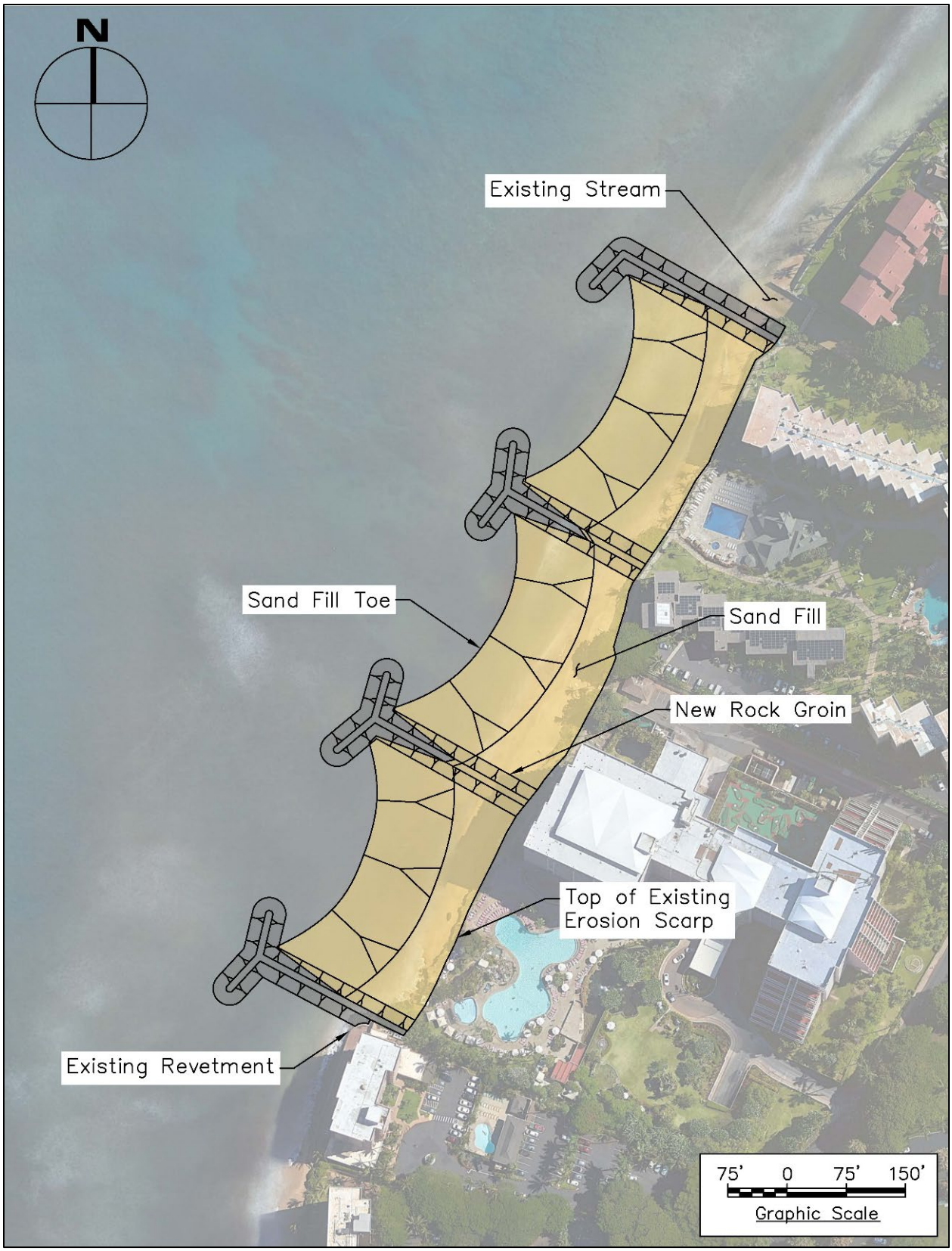


Figure 2-1. Concept plan view for Beach Stabilization

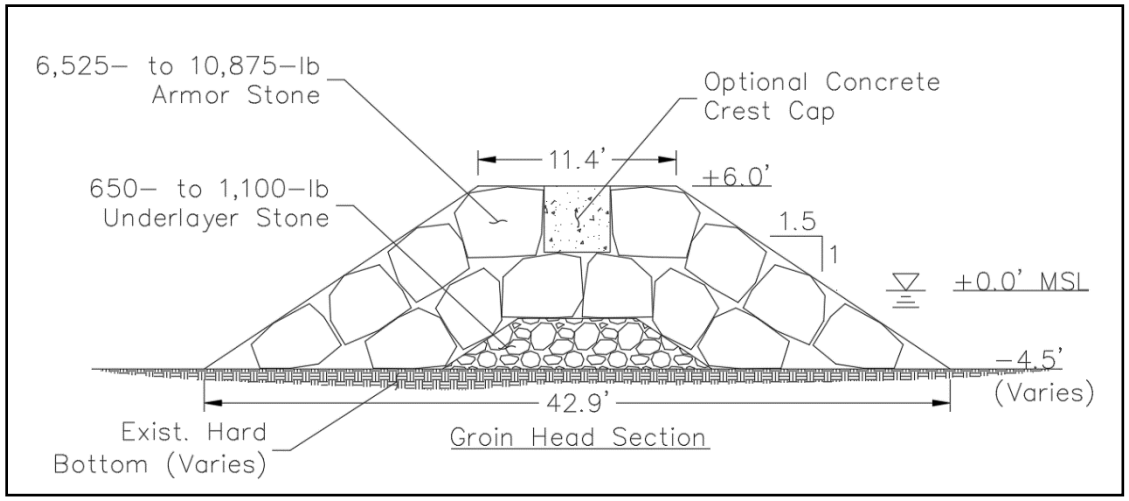


Figure 2-2. Typical groin head cross section for Beach Stabilization

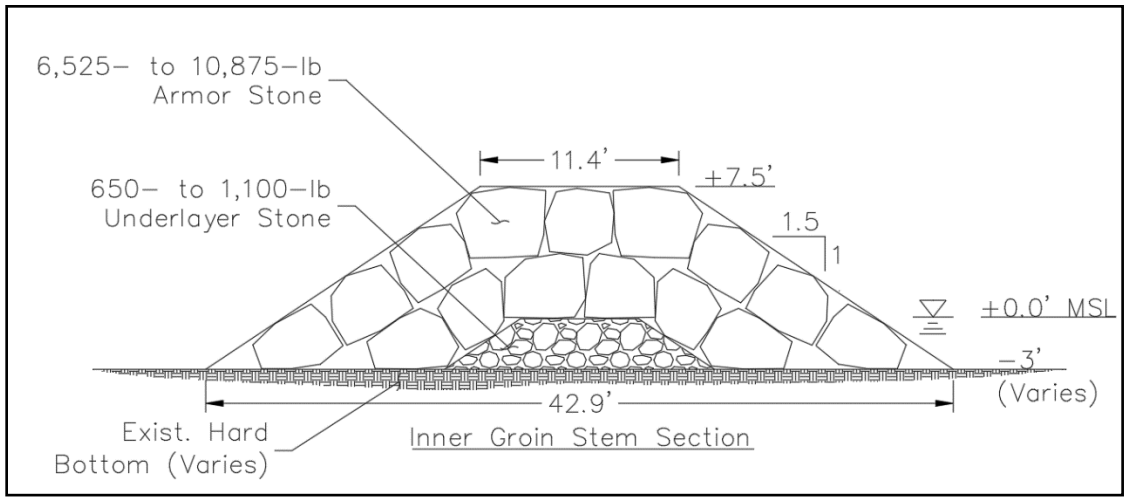


Figure 2-3. Typical inner groin stem cross section for Beach Stabilization

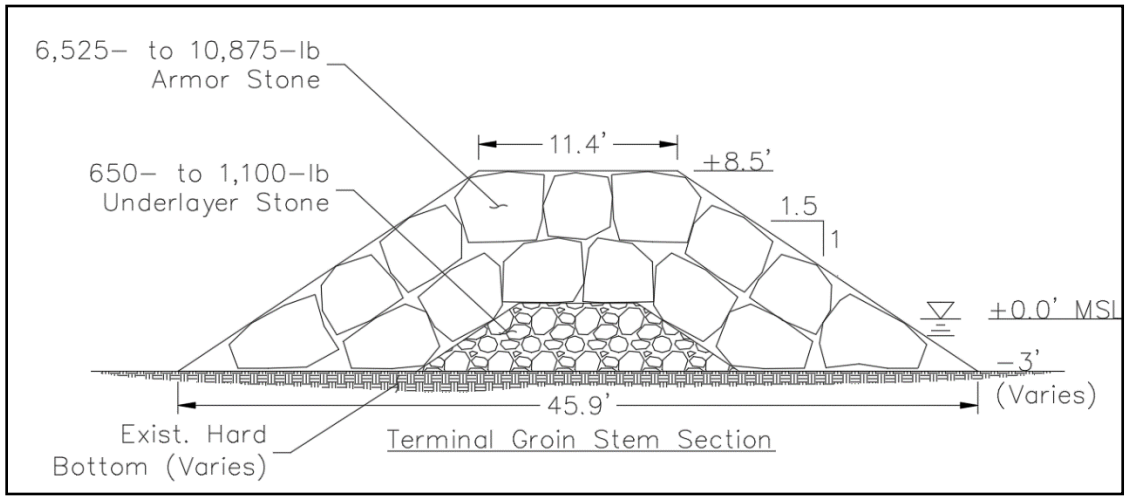


Figure 2-4. Typical terminal groin cross section for Beach Stabilization

2.2 Beach Nourishment

The beach nourishment alternative would consist of placing sand at the south end of the Honokōwai littoral cell without any structures to stabilize the sand. The sand would be placed along approximately 1,000 ft of shoreline between Honokōwai Stream and Honokōwai Point. The beach would have a crest elevation of +8.5 ft MSL and a beach slope of 1V:8H. This concept would require 27,000 cy of sand and would provide a minimum beach width of 40 ft. The concept plan for this alternative is shown in Figure 2-5.

2.3 Beach Maintenance

The beach maintenance alternative would consist of an initial beach nourishment project with periodic renourishment at specified intervals. The initial nourishment effort would be identical to the beach nourishment alternative described in Section 3.2. Approximately 27,000 cy of sand would be placed at the south end of the Honokōwai littoral cell without any structures to stabilize the sand. The sand would be placed along approximately 1,000 ft of shoreline between Honokōwai Stream and Honokōwai Point. The beach would have a crest elevation of +8.5 ft MSL and a beach slope of 1V:8H. This concept would provide a minimum beach width of 40 ft. The concept plan for this alternative is the same as the plan for Beach Nourishment (Figure 2-5).

For beach nourishment without stabilizing structures, it is recommended that periodic beach maintenance be performed after the initial nourishment and throughout the 50-year design life to maintain a stable beach. This would require additional sand added at time intervals corresponding to when the beach erodes landward a certain distance.

To maintain a minimum beach berm width of 25 to 30 ft, renourishment would be required when the initial beach shape (40-ft beach berm width) migrates landward approximately 10 to 15 ft. Based on the future shoreline change rates outlined in Section 7.5.3.2, Honokōwai Beach is projected to erode at an average rate of -1.27 ft/yr, which corresponds to 12.7 ft of shoreline recession over approximately 10 years. Over a period of 50 years, approximately four (4) renourishment efforts would be required to maintain the desired beach width of 40 ft. Each renourishment would require approximately 5,000 cy of sand, resulting in a total volume of 47,000 cy of sand to restore the beach and maintain a beach berm width of 40 ft. The renourishment interval is based on the projected average annual shoreline change rates. Depending on the actual rate of sea level rise, and how the shoreline responds, renourishment could potentially be required more or less frequently.



Figure 2-5. Concept plan view for Beach Nourishment or Beach Maintenance

3. SAND SOURCE

This section details the proposed sand source including a description of the Sand Recovery Area, physical characteristics of the existing sand at the Sand Recovery Area and the Project Site, and sand fill requirements for the Project.

3.1 General Description

Offshore investigations identified a suitable sand source located approximately 1.5 mi south of the Project Site (Figure 3-1). The offshore sand deposit (referred to herein as the Sand Recovery Area) is located in 120 to 170 ft of water depth and approximately 1,450 to 2,200 ft offshore of Puʻu Kekaʻa (Black Rock) in West Maui. Offshore reconnaissance of the sand deposit included side-scan sonar imaging, towed video transects, vibracoring, and sub-bottom profiling. Laboratory tests on the vibracore samples included graded sieve analysis, fine content analysis, and wet/dry color comparison. Sand sample analysis confirmed that the sand in the Sand Recovery Area is suitable for placement on Honokōwai Beach.

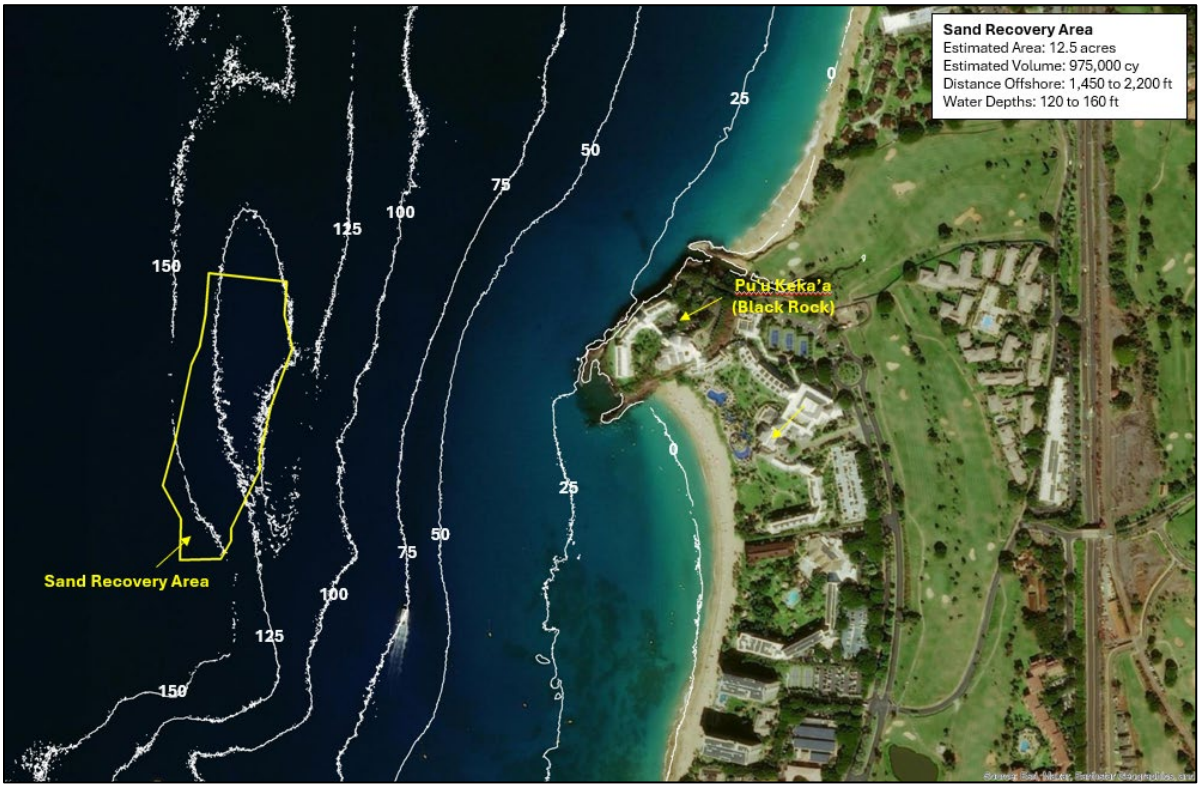


Figure 3-1. Overview map of Sand Recovery Area

Based on the sub-bottom and side-scan sonar investigations, the Sand Recovery Area is estimated to encompass approximately 12.5 acres with sand thickness ranging from 13 ft to 59 ft. This corresponds to a total estimated volume of 975,000 cy of sand. The Sand Recovery Area is part of a larger sand field that begins near the shoreline and continues offshore to depths greater than 200 ft. The sand field continues parallel to shore north and south of Puʻu Kekaʻa. The variability of sand color across the deposit indicates that this area represents the zone of mixing between the

nearshore and offshore waters. Sediment in this area is likely to be dynamic and mobile as it is exposed to both cross shore and longshore sediment transport. Sand volume and thickness could fluctuate significantly as a result of seasonal or event-driven sediment transport.

A tow camera survey was performed to document existing seafloor conditions at the Sand Recovery Area. The only prominent biotic colonizer observed was *Halimeda kanaloana*, a common macroalgae in West Maui. The density of the algae varied throughout the deposit. Several small, isolated patches of sea grass were observed. No coral or hard bottom was observed during tow camera investigations, or in either side scan sonar or sub-bottom surveys of the site.

It is expected that the benthic infaunal community structure of the Sand Recovery Area is similar to other locations in sandy coastal areas of Hawaiʻi. The typical community in these environments consists of nematodes, (roundworms, phylum Nematoda), oligochaete worms (earthworm relatives, phylum Annelida, subclass Oligochaeta), copepods (tiny crustaceans, phylum Arthropoda), echinoderms (phylum Echinodermata), and mollusks (phylum Mollusca) (Bailey-Brock and Krause, 2008).

The Project includes recovering 33,000 cy of sand from the 12.5-acre site Sand Recovery Area for use in restoring Honokōwai Beach. This sand recovery effort represents approximately 3% of the estimated available sand volume in the Sand Recovery Area, leaving 97% of the sand resource in place.

3.2 Grain Size Analysis

The Hawaiʻi Department of Land and Natural Resources (DLNR) guidelines specify requirements for fill sand used for beach nourishment projects including:

- Sand shall not contain more than 6% silt material (sand grain size smaller than 0.074 mm).
- Sand shall not contain more than 10% coarse material (sand grain size greater than 4.76 mm).
- Grain size distribution will fall within 20% of the existing beach grain size distribution.
- Overfill ratio of fill sand to existing sand shall not exceed 1.5.
- Sand will be primarily composed of naturally occurring carbonate beach or dune sand.
- Sand shall be free of contaminants.

Twelve (12) composite sand samples were obtained from the Sand Recovery Area and analyzed using a standard laboratory sieve technique to determine particle size distribution. For any sediment sample, the percentages of grains that fall within different size classes are determined and used to create a grain size distribution curve. The grain size distributions of the offshore sand samples were compared with the existing beach. The results of the grain size analysis are shown in Figure 3-1. In the figure, the results of the grain size analysis use a Log Base 10 scale on the X axis for grain size. The cumulative percentage of grain sizes for each sample is presented on the Y axis. Shown in black in the figure is the average grain size distribution for the existing beach sand at the project site. Also shown in black dashed lines are the ±20% bounds specified in the DLNR beach nourishment guidelines.

The average grain size of the sand from the Sand Recovery Area (dashed red line) is shown to be only slightly coarser than the existing beach sand (solid black line). The median grain size (D_{50}) at the Sand Recovery Area is 0.55 mm, which is slightly coarser than the D_{50} for the existing beach sand (0.44 mm). The sorting value is 1.02, which categorizes the sand as poorly sorted. The percentage of the sand fill with grain size smaller than 0.074 mm (#200 sieve) is 3%, which means that the sand fill contains a minimal amount of fine material. Sand samples collected from the inner portion of the sand deposit (solid red line) closer to shore are less coarse and within the ±20% DLNR guidelines for coarse material. The Sand Recovery Area is large (12.5 acres) and contains a substantial volume of sand (estimated 975,000 cy), so dredging can be strategically focused on the inner portion of the deposit to maximize compatibility with the existing beach sand.

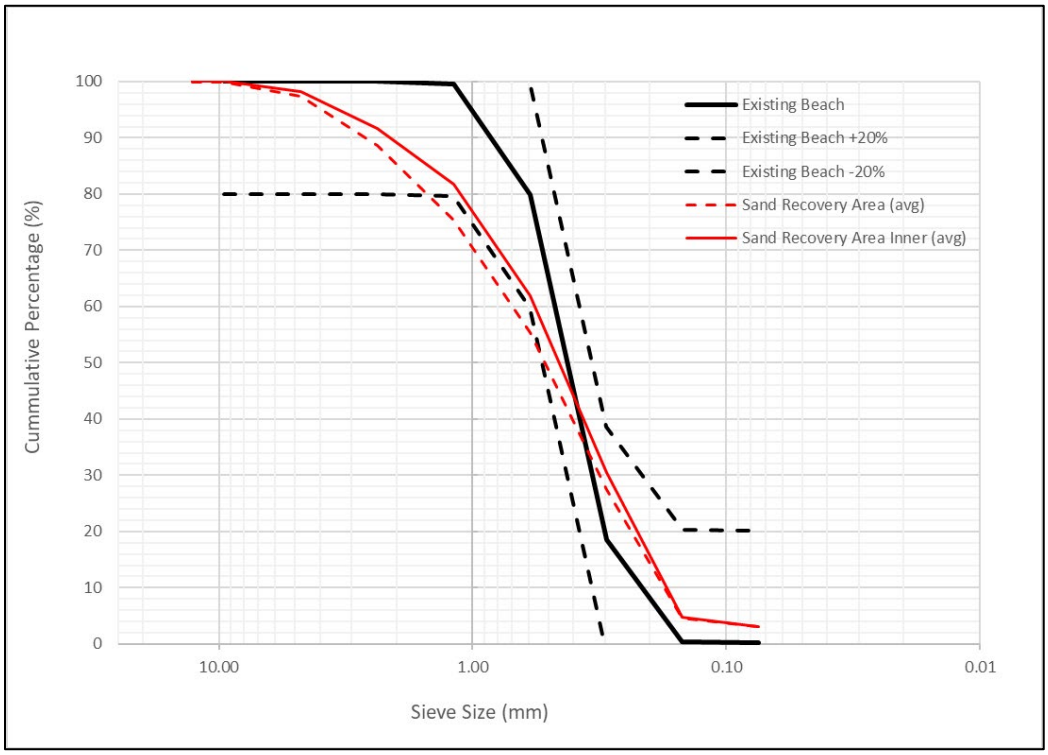


Figure 3-2. Grain size distributions for proposed fill sand and existing beach sand

3.3 Overfill Factor

A beach undergoes an adjustment period following nourishment. The beach equilibrium profile is achieved as sand moves cross-shore and alongshore and there may be an accompanying decrease in beach volume. This loss of sand is compensated for through an overfill ratio, which describes the compatibility of the native beach and nourishment (borrow) sands and is dependent on the size distributions of the native and nourishment (borrow) sand. The overfill ratio is determined based on the grain size characteristics of the two sands and represents the volume of fill necessary to yield the desired beach volumes. An overfill calculation was performed for the sand from the Sand Recovery Area using the average grain size distributions of the existing beach sand for comparison (Table 3-1). The overfill ratio for the Sand Recovery Area is 1. This means that no sand in addition to the design volume needs to be placed during construction.

Table 3-1. Overfill calculation for proposed fill sand from the Sand Recovery Area

M_n	M_b	σ_b	$M_b' - Mn'$	Overfill Factor K
1.18	0.74	1.54	-0.29	1.0

The grain size distribution, natural marine carbonate grains, percentage of fine and coarse material, and overfill ratio indicate that the sand from the Sand Recovery Area is compatible with the existing beach sand and complies with the DLNR guidelines for beach nourishment as follows:

- Sand contains less than 3% material smaller than 0.074mm
- Sand contains no coarse material greater than 4.76 mm
- Grain size distribution of inner sand deposit is within ±20% of the existing beach sand.
- Overfill ratio of the fill sand to existing beach sand is 1.0 (no overfill required).
- No physical evidence or events to indicate that the sand contains any contaminants.
- Sand is composed of naturally occurring carbonate sand

4. EQUIPMENT AND MATERIALS

This section details the anticipated equipment and materials that will be required for sand recovery, sand transport, groin construction (only applicable for Beach Stabilization), and sand placement.

4.1 Equipment

The following equipment will be used for general construction-related activities:

- ¾-ton pickup trucks (3)
- Flatbed truck
- Conex storage containers (2)
- 5kw generators (2)
- Service air compressors (2)
- Gas detector
- Fire extinguishers
- Chemical toilets
- Rollaway dumpsters
- Signage
- Rope, weights, accessories
- Safety equipment

The following equipment will be used for sand recovery and transport:

- Crane barge
- Environmental clamshell bucket
- Tugboat
- Deck barges (2)
- Support vessel (17-ft Boston Whaler)
- 10 to 16-cy dump trucks (4)
- Note: May also require long-reach excavators or a power conveyor system

The following equipment will be used for sand placement and groin construction:

- PC-400 excavators (3) (only applicable to Beach Stabilization)
- WA-380 wheeled loaders (3)
- HM-300 articulating dump truck
- D-65 bulldozers (2)
- ¾-ton pickup trucks (3)
- Flatbed truck

4.2 Materials

The following general materials will be used for general construction-related activities:

- Type 3 marine silt curtains
- Silt fencing
- 9-inch Biosock filter socks
- Security fencing
- Non-woven geotextile fabric

The following quantity of sand will be used for sand placement:

- Sand fill: 33,000 cy

The following quantities of stone will be used for groin construction (only applicable to Beach Stabilization):

- Armor stone: 3.75 to 6.25-ton (14,250 tons)
- Underlayer stone: 750 to 1,250-lb (7,282 tons)
- Core stone: 75 to 125-lb (910 tons)

5. WORK PLAN

This section details the anticipated construction process and sequencing for the recommended alternative including sand recovery, sand transport, stone transport (only applicable for Beach Stabilization), groin construction (only applicable for Beach Stabilization), and sand placement.

5.1 Sand Recovery and Material Transport

Beach stabilization will involve recovery of 33,000 cy of sand from the Sand Recovery Area and barging the sand to Kahului Harbor to be offloaded and temporarily stockpiled prior to being transported to the Sand Placement Site. Clamshell dredging is the preferred method of sand recovery for the subject project. A crane barge equipped with an environmental clamshell bucket will be used to mechanically scoop and lift sand from the seafloor and dispense the material onto a deck barge. Once the sand is loaded onto the barge, a tugboat will be used to tow the deck barge to Kahului Harbor. The anticipated barge route is shown in Figure 5-1 and Figure 5-2.

The sand will be offloaded at Kahului Harbor and stored at a temporary Stockpile Site adjacent to the offload site (Figure 5-2). This method will require approval from the Hawaiʻi Department of Transportation, Harbors Division to offload the sand at a designated location within Kahului Harbor and a designated area to serve as a temporary stockpile location. The anticipated offload site will be along the interior side of the west breakwater at Kahului Harbor. The contractor will determine the preferred method to offload the sand from the deck barge to shore. Offloading could potentially be accomplished using long-reach excavators or a power conveyor system.

Dump trucks will be used to transport the sand from the Stockpile Site to the Sand Placement Site. Dump trucks are assumed to have a capacity of 10-16 cy with an estimated volume of 12 cy of sand per truckload. Approximately 2,750 truckloads will be required to transport 33,000 cy of sand from the Stockpile Site to the Sand Placement Site. An additional 1,135 truckloads will be required to transport 22,442 tons of stone to the Project Site (only applicable to Beach Stabilization). It is assumed that stone will be sourced from the HC&D base yard at Puʻunēnē. The anticipated truck haul route is shown in Figure 5-3 (only applicable for Beach Stabilization).

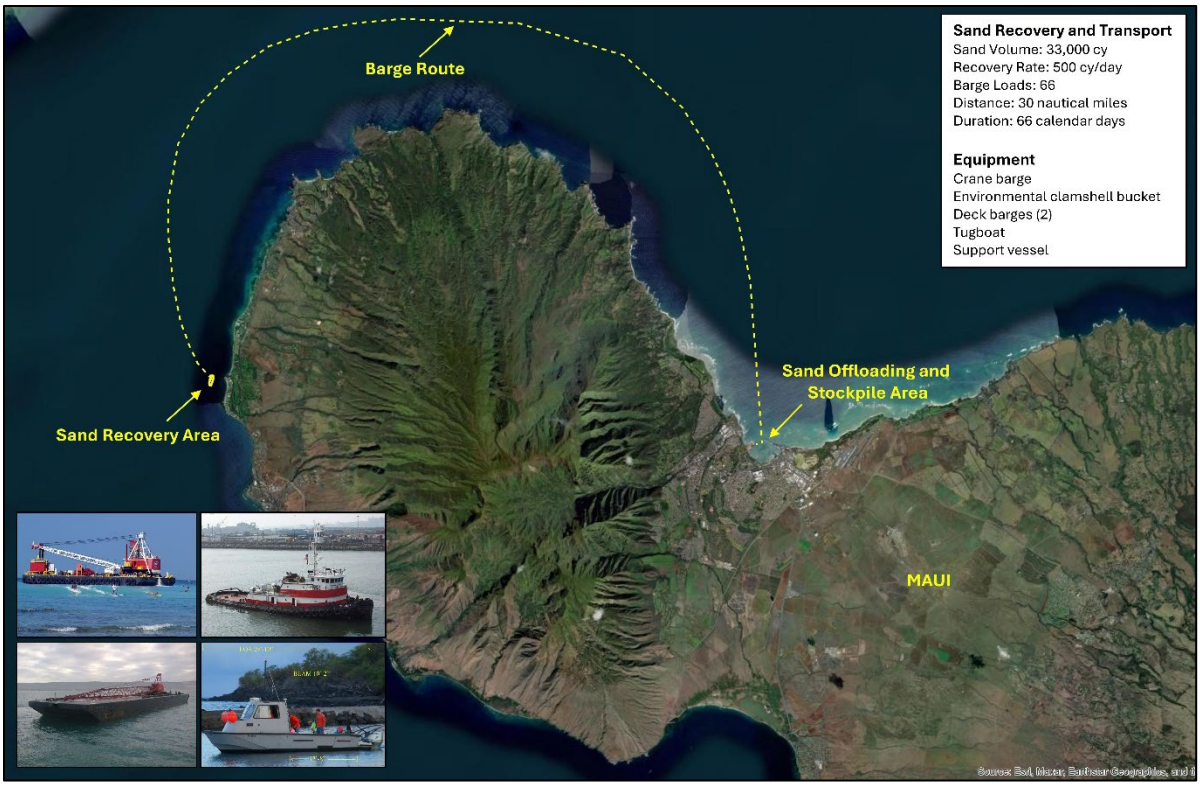


Figure 5-1. Overview of sand recovery and transport methodology

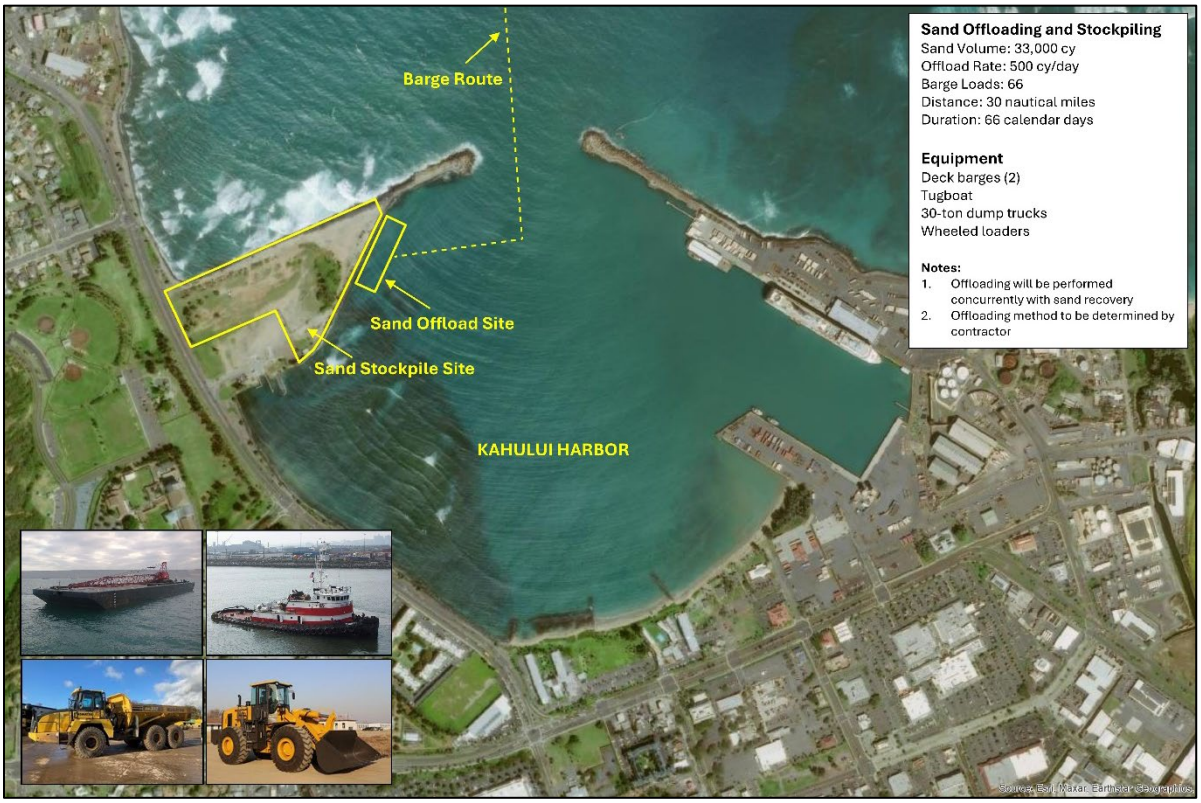


Figure 5-2. Overview of sand offloading and stockpiling methodology

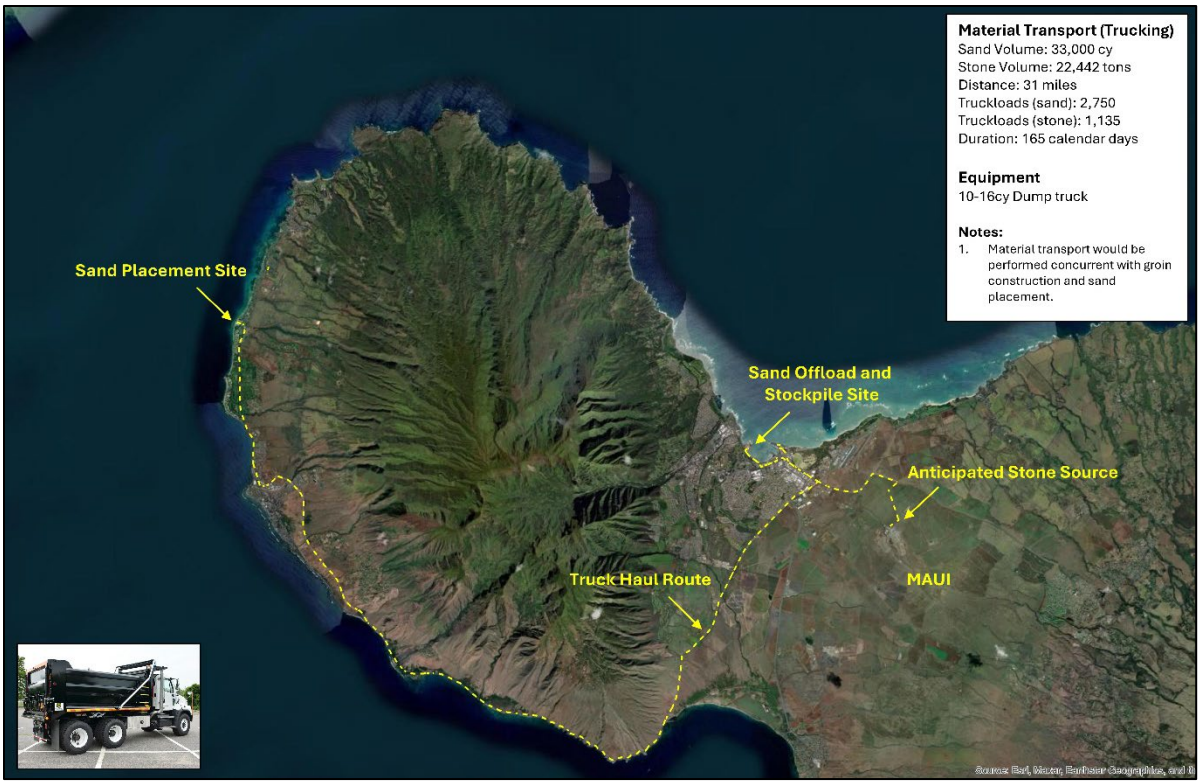


Figure 5-3. Overview of material transport methodology

5.2 Groin Construction (only applicable to Beach Stabilization)

The construction of rock rubblemound groins is a relatively straightforward marine project. The primary challenges are related to access – both to get equipment and materials to the site and to establish a work platform to construct from. The shallow reef flat and wave action prohibit access to the Project Site from the ocean. The stone will have to be transported by truck to the Project Site, and then moved to the shoreline via available accessways between the existing buildings. Direct access to the shoreline is available via a paved road between Kāʻanapali Beach Club and Kāʻanapali Shores. Access to the shoreline could also be achieved through the Maui Kai Condominium property to the south. This access point has been previously used for shoreline work at the Project Site; however, access will require approval from the Maui Kai Condominium prior to construction. An overview of the groin construction and sand placement methodology is shown in Figure 5-4. Photographs of similar groin construction projects at Iroquois Point, Oʻahu (2013) and Waikīkī, Oʻahu (2020) are shown in Figure 5-5 and Figure 5-6, respectively.

Approximately 1,135 truckloads will be required to transport the 22,442 tons of stone required to construct the groins. Materials may be temporarily stockpiled at designated laydown and staging areas, the location of which will be determined by the contractor. Prior to the start of groin construction, a survey will be performed to determine the layout of the groins and establish survey controls to ensure quality of construction. Surveyors will follow the construction of the groins and confirm construction measurements to ensure quality control.

The groin stem and head sections will be temporarily overbuilt to approximately 15 ft in width to provide equipment access, and the groins will be completed working from the heads to shore, removing excess stone as the work proceeds landward. Loose material (sand, stone, rubble) at the landward ends of the groins will be removed to place the groin stones upon hard stable substrate. Armor stones will be utilized within the allowable size range as necessary to meet the lines and grades of the groins as shown in project drawings. Groin construction will proceed one at a time and sand will be placed as each beach cell is completed. The existing temporary erosion control structure will be removed during groin construction operations. When construction is complete, groins will be surveyed to determine as-built conditions and documented.

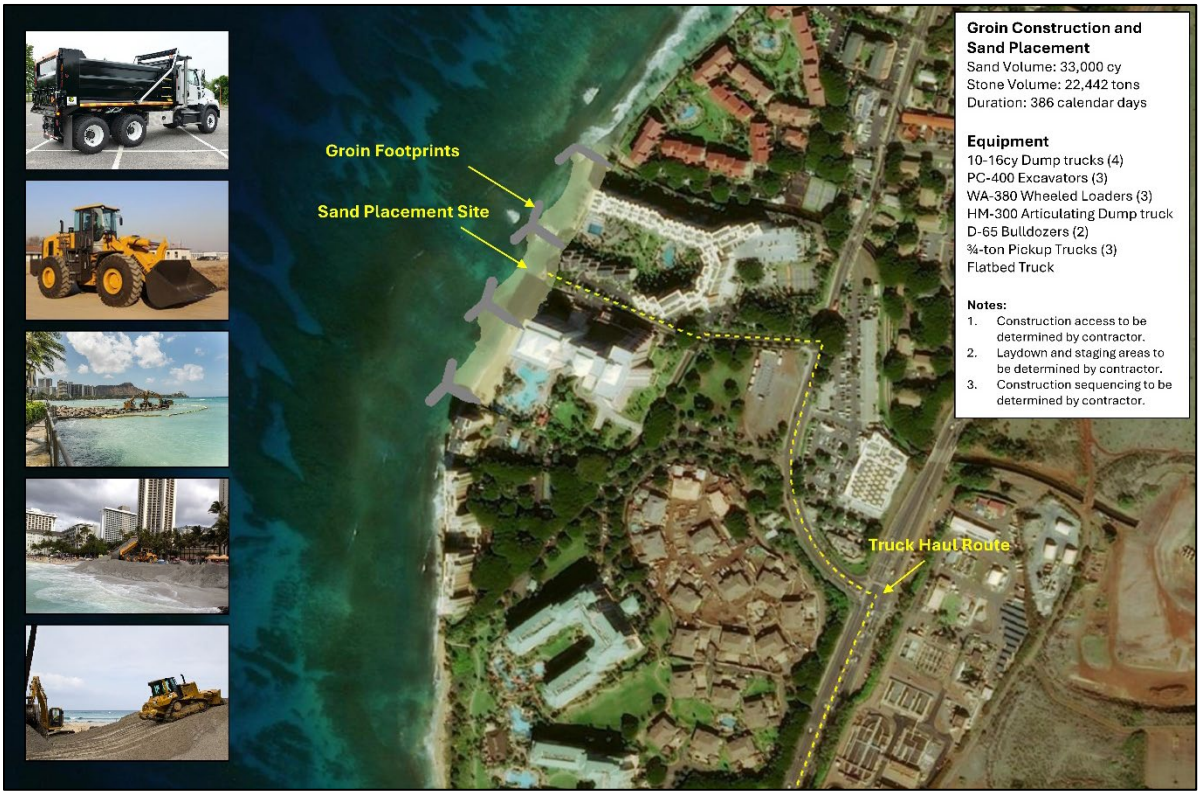


Figure 5-4. Overview of groin construction and sand placement methodology



Figure 5-5. Example of groin construction at Iroquois Point, Oʻahu (2013)



Figure 5-6. Example of groin construction at Waikīkī, Oʻahu (2020)

5.3 Sand Placement

As sand is trucked to the Project Site, the sand will be transported directly to the beach and placed to the design lines and grades. There is no dewatering associated with the truck hauling method. Sand movement and placement will be accomplished using standard mechanical equipment, including a wheeled loader, dump trucks, and bulldozers (Figure 5-7). Beach width will be increased from onshore to offshore, thus building dry substrate for machinery to operate on as the beach is extended seaward. Proper beach shape will be verified during construction with surveys and by placing survey stakes with final beach height markings as references. Design beach profiles and volume calculations will be part of the construction drawings.

A containment system will be required in the area of active sand placement to reduce the potential for turbidity impacts to coastal waters during sand placement in the water (Figure 5-8). Silt curtains and fences will be required, consistent with previous requirements of the Clean Water Act. Schematics of these containment devices are shown as Figure 5-9 through Figure 5-11. Phasing of the sand placement is not necessary. It is recommended, however, that once placement begins in an area, it continues until it is completed in that area. Working in one area at a time will limit the extent of beach closures during sand placement operations, thereby reducing impacts on beach users.



Figure 5-7. Example of sand placement at Waikīkī, Oʻahu (2012)



Figure 5-8. Examples of floating silt curtain at Waikīkī, Oʻahu (2012)

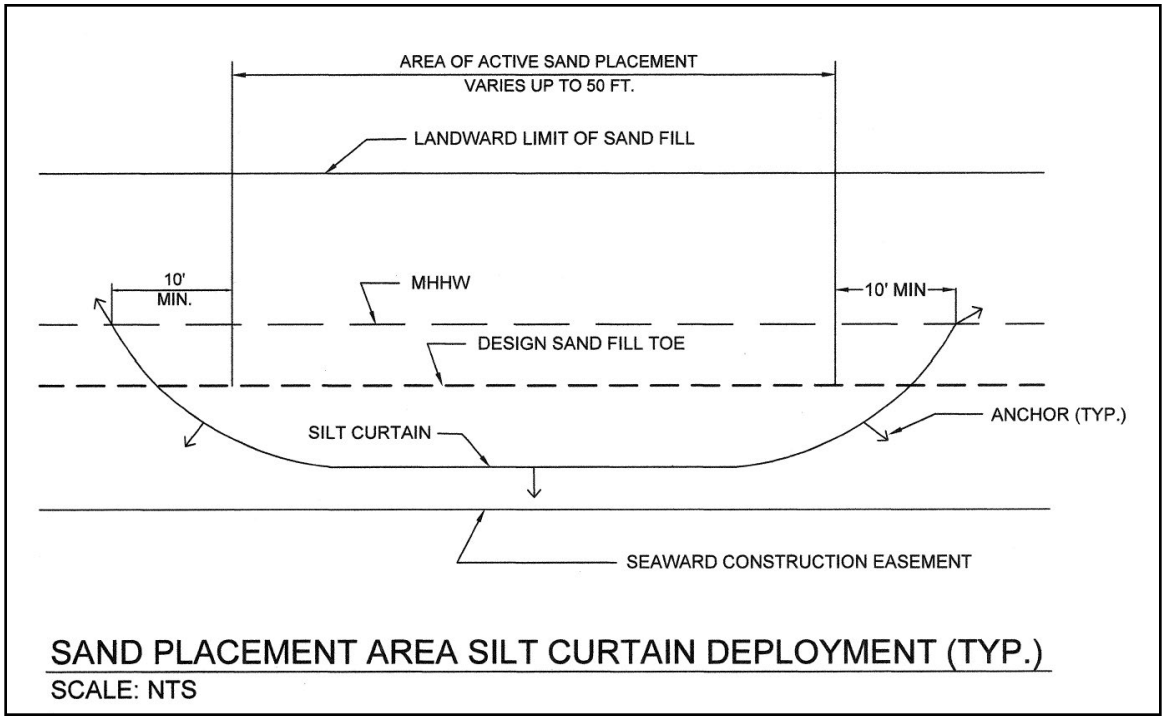


Figure 5-9. Example of silt curtain layout for sand placement

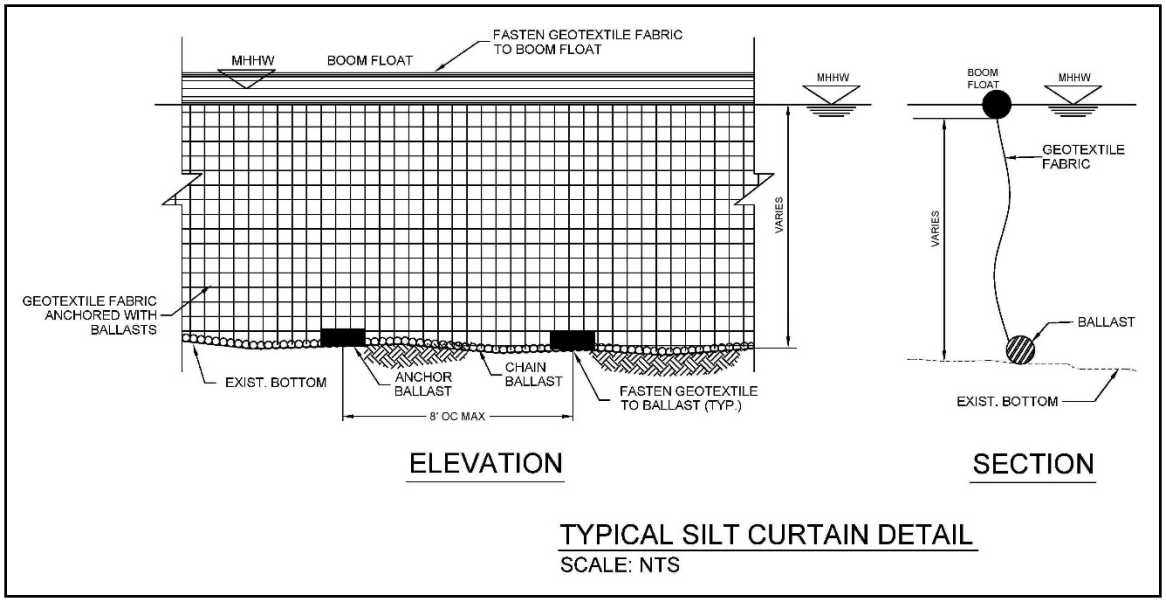


Figure 5-10. Typical silt curtain detail

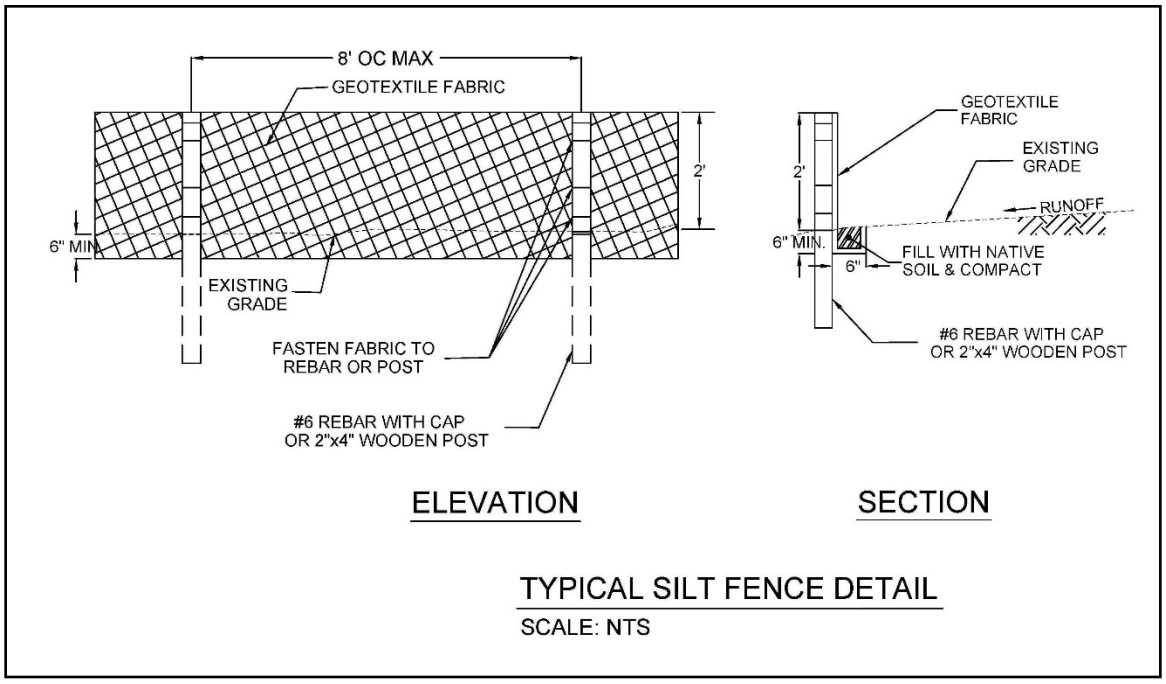


Figure 5-11. Typical silt fence detail

6. STANDARD BEST MANAGEMENT PRACTICES

This section details the anticipated Best Management Practices (BMPs) that will be utilized during sand recovery, sand transport, sand placement, and groin construction (only applicable for Beach Stabilization).

6.1 General Requirements

This section covers the requirements of environmental and pollution control during construction activities. The contractor will be responsible for conformance to all appropriate State of Hawaii Statutes.

1. With the exception of those measures set forth elsewhere in this plan, environmental protection will consist of the prevention of environmental pollution as the result of construction operations under this project. For the purpose of this plan, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare, unfavorably alter ecological balances of importance to human life, affect other species of importance to man, or degrade the utilization of the environment for aesthetic and recreational purposes. This includes Water Pollution, as defined by State of Hawaii Revised Statutes (HRS) Title 19, Chapter 342D.1,.

2. The work will include the following:

    A. Confirm that all permits required for this plan have been obtained and are valid for the construction period.

    B. Provide all facilities, equipment and structural controls for minimizing adverse impacts upon the environment during the construction period.

3. Applicable Regulations: In order to provide for abatement and control of environmental pollution arising from the construction activities, the contractor and their subcontractors in the performance of the work will comply with the intent of the applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement, including, but not limited to the following regulations:

    A. State of Hawaii Administrative Rules (HAR) Chapter 55. WATER POLLUTION CONTROL: Chapter 54, WATER QUALITY STANDARDS.

    B. State of Hawaii Administrative Rules (HAR) Chapter 59, AMBIENT AIR QUALITY: Chapter 60, AIR POLLUTION CONTROL LAW.

    C. State of Hawaii Administrative Rules (HAR) Title 12, Department of Labor and Industrial Relations, Subtitle 8, Division of Occupational Safety and Health, Subparagraph 12-202-13, ASBESTOS DUST: Environmental Protection Agency, Code of Federal Regulations Title 40, Part 61 Subpart A, NATIONAL EMISSION STANDARDS FOR AIR POLLUTANTS and Subpart B, NATIONAL EMISSION STANDARDS FOR ASBESTOS; and U.S. Department of Labor Occupational Safety and Health Administration (OSHA) Asbestos Regulations, Title 29 Code of Federal

Regulations (CFR) Part 1910.

6.2 Department of the Army Regional Conditions – NWP Requirements

1. Pre-construction BMPs:

a. Prior to commencement of the authorized work in wetlands, other special aquatic sites and other waters, the geographic limits of such waters (i.e., High Tide Line, Mean High Water Mark, Ordinary High-Water Mark, approved wetland boundary) affected by the authorized work and as approved by the Corps and demarcated on your drawings must be clearly identified in the field. The delineation of these geographic bounds may be accomplished by staking, flagging, painting, silt fencing, signage, buoys, etc. and in all cases must be maintained and remain observable throughout the construction period. The project limits of the Corps-authorized fill footprint must also be demarcated in the field to ensure that dredged or fill material is not discharged beyond the authorized limits. No activity will be conducted in or such that it affects wetlands, other special aquatic sites and other waters that require prior authorization from the Corps, outside of the permitted limits of disturbance (as shown on the permit drawings).

2. During Construction BMPs:

a. Turbidity and the suspension or re-suspension of sediment from project-related work will be minimized and contained to the immediate vicinity of the authorized activity through the appropriate use of effective containment devices or measures and based on project-specific conditions. Silt fences, silt curtains, or other diversion or containment devices will be installed to contain sediment and turbidity at the work site (a) parallel to, and along the toe of any fill or exposed soil which may introduce sediment to an adjacent aquatic site; and (b) adjacent to any fill placed or soil exposed within an aquatic site. All silt curtains, and other devices will be installed according to the manufacturer's guidelines and properly maintained throughout the construction period and until the impact area is stabilized and/or elevated turbidity levels have returned to ambient levels.

b. All project-related materials (e.g., fill, rocks, landscaping, structures, etc.) and equipment (e.g., dredges, barges, backhoes, etc.) authorized to be used or placed in wetlands, other special aquatic sites and other waters, will be free of pollutants and invasive plant and animal species.

c. Any temporary tethering, anchoring, mooring or similar in-water structural components will be placed in a manner to avoid direct physical impact to coral and seagrass beds during installation and throughout the duration of its use in wetlands, other special aquatic sites and other waters.

d. Any temporary in-water structures will be removed in their entirety upon completion of the authorized work in or affecting wetlands, other special aquatic sites and other waters. The authorized work is not complete until these temporary structures are removed.

e. Unless specifically authorized, stockpiling of project-related materials (e.g., fill, dredged material, revetment rock, pipe, etc.) or unsuitable materials (e.g., trash, debris, car bodies, asphalt, etc.) in or in close proximity to wetlands, other special aquatic sites and other waters such that the stockpiled materials could be carried into such waters by wind, rain, or high surf is prohibited.

f. Upland containment areas, if sited in uplands near wetlands, other special aquatic sites and other waters for the purpose of stockpiling, dewatering, etc. will be bounded by impermeable material to prevent return flows of dewatered effluent into such waters. The runoff or overflow from a contained disposal area into such waters requires separate authorization. There is no anticipated return flow for the proposed project.

3. Post-Construction BMPs:

a. Native plants appropriate for current site conditions will be used for re-vegetation for the purposes of restoring areas temporarily disturbed by the authorized work.

7. PROJECT-SPECIFIC BEST MANAGEMENT PRACTICES

7.1 Material Management

1. All equipment and material will be free of contaminants of any kind including: excessive silt, sludge, anoxic or decaying organic matter, clay, dirt, oil, floating debris, grease or foam or any other pollutant that would produce an undesirable condition to the shoreline or water quality. The equipment will be brought to the site in clean condition.

2. All materials will be free from any objectionable sludge, oil, grease, scum, excessive silt, organic material or other floating material.

3. Only a minimum quantity of materials necessary for the work will be stored on site.

4. Mean higher high water (mhhw), also representing mean high water mark, will be marked along the shoreline prior to conducting operations to ensure that no unauthorized fill is placed, nor unauthorized equipment operated below mhhw. For groin construction, loose material (sand, stone, and rubble) at the landward end of the groins will be removed to place the groin stone upon stable fossil reef substrate (only applicable for Beach Stabilization). Armor stones will be within the allowable size range as necessary to meet the lines and grades of the groins as shown in project drawings (only applicable for Beach Stabilization).

5. All flammable and reactive liquids will be kept in sealed and clearly labeled original or compatible containers and stored under cover more than fifty (50) feet from the edge of the property and away from the nearest drain and receiving waters.

6. Storage and stockpiling areas on land or onboard boats will be kept clean and well organized to prevent spills or run out. Excavated material from groin construction that is of beach quality will be placed adjacent to the groin, landward of the mhhw line (only applicable for Beach

Stabilization). Excavated material that is not of beach quality will be disposed of by the contractor. Trucks with waterproof lining will be used for transportation of wet material.

7. The contractor will confine all project activities to areas defined by the drawings and specifications. No materials will be stockpiled in the marine environment.

8. Materials will be used in strict accordance with the manufacturer's instructions.

9. Submit Material Safety Data Sheets (MSDS) for all hazardous materials to be brought to the work site to the construction Project Manager who will keep a copy of them on site. This includes, but is not limited to, paints, solvents, welding rods and fluxes, petroleum products, caulking, and sealant. This submittal will also include a list showing the quantities of any hazardous materials to be stored on-site.

7.2 Waste Management

Note: No hazardous waste is anticipated for this project.

1. The project staging area will be used as the primary point of collection for all waste derived from project construction. Rubbish and construction debris will be collected and confined to waste bins. The containers will be serviced as needed to prevent the build-up of large amounts of waste stored on-site.

2. Portable chemical toilets will be located on-site and will be serviced weekly, at a minimum.

3. All waste will be collected and placed daily in the container located in the upland area inshore of the project area and then disposed of off-site.

4. The contractor will arrange for pick up and disposal of the filled container as necessary.

5. Cleanup of waste will be conducted through sweeping, shoveling, or vacuuming operations only.

6. Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food in the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged.

7. Manage spent hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, as per environmental law.

8. Non-hazardous or less hazardous materials should be used whenever possible.

9. Hazardous waste will be placed in secondary containment.

10. Hazardous waste will not be mixed with other waste and repair debris placed in the dumpster.

11. Flammable or reactive waste will be placed in a separate area more than 50 feet from the edge of the property, nearest drain inlet, and the shoreline.

12. The Owner and the contractor are responsible for the proper handling, storage and/or disposal of all waste generated by project activities.

13. Any construction related debris that may pose an entanglement hazard to marine protected species must be removed from the project site if not actively being used and/or at the conclusion of the activity.

14. The contractor will not dispose of any concrete, steel, wood, and any other debris into State or Federal waters. Any debris that falls into the State and Federal water will be removed at the contractor's own expense.

15. No contamination (trash or debris disposal, alien species introductions, etc.) of marine (reef flats, streams, open oceans, etc.) environments adjacent to the project site will result from project related activities.

16. The contractor will remove all floating or submerged materials and/or debris at the end of each day, with the exception of any silt or debris containment devices.

17. In the event that floating hydrocarbon (oil, gas) products are observed, the contractor or his designated individual(s) will be responsible for directing that in-water work be halted so that appropriate corrective measures are taken in accordance with the Emergency Spill Response Plan. The Department of Land and Natural Resources will be notified as soon as practicable, and the activity causing the plume will be modified by containment. The responsible individual(s) will document the event and the measures taken to correct the issue and will report the incident (with photographs) to the Office of Conservation and Coastal Lands and the Department of the Army Regulatory Office as soon as is practicable. Work may continue only after the issue is no longer visible.

18. Particular care must be taken to ensure that no petroleum products, trash or other debris enter near-shore and open ocean waters. When such material is found within the project area, the contractor, or his designated construction agent, will collect and dispose of this material at an approved upland disposal site.

19. Waste materials and waste waters directly derived from construction activities will not be allowed to enter marine waters.

20. One or more job site dumpsters will remain on site throughout the duration of the project to collect any construction-related waste or debris.

21. Construction operations will be conducted so as to prevent the discharge or accidental spillage of pollutants, solid waste, debris, and other objectionable wastes in surface waters and underground water sources.

22. Care will be exercised in the removal and transporting of debris and rubbish for disposal.

23. Any spillage on the work surfaces will be cleaned up immediately.

24. Loads will be covered when transported.

25. Project site inspection and debris sweeps will be completed at the end of each work day. A full inspection of the project site will be conducted at the end of the project to ensure that no visible debris or project waste is present at the site upon completion of the project.

26. Any project activity related debris that is not a part of the design must be removed from the project site if not actively being used and/or at the conclusion of the project.

27. Project operations will be conducted to prevent discharge or accidental spillage of pollutants, solid waste, debris, and other objectionable wastes in surface waters and underground water sources.

7.3 Vehicle and Equipment Management

1. Fueling operations will be monitored to prevent spills, leaks, and overflows. Equipment will be fueled away from any drain or shoreline. A spill pan will be used to catch spill/leaks. Equipment will not be "topped off." Spill cleanup materials will be readily accessible.

2. Construction equipment (except small tools, generators, etc.) will be maintained off-site. If emergency repairs or maintenance on large equipment must be performed, drip pans or drop cloth will be placed under the vehicle or equipment to catch any spills/leaks.

3. Conduct the fueling and lubricating of equipment and motor vehicles in a manner that protects against spills and evaporation. Manage all used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while on-site exhibits a characteristic of hazardous waste. Used oil containing 1000 parts per million of solvents will be considered a hazardous waste and disposed of at contractor's expense. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

4. Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the contractor will prevent any material from being carried onto the pavement. Wastewater will not be discharged into existing streams, waterways, or drainage systems such as gutters and catch basin unless treated to comply with the State Department of Health water pollution regulations.

7.4 Marine Vessel Operations

1. The contractor will notify the United States Coast Guard of planned vessel movements and operations at least fourteen (14) days prior to departure from the point of origin.

2. All marine vessels must have a copy of the emergency action plan and this best management practices plan onboard.

3. A first aid kit must be onboard all vessels.

4. All employees onboard the vessels must wear applicable personal protection equipment (steel toe boots, hard hats, lifejackets) during operations.

5. A Project Manager onboard each vessel must conduct daily visual inspections of the equipment, best management practices, personal protection equipment, and correct any deficiencies before resuming work.

6. All vessels must not contain bilge or ballast waters from locations outside of the Hawaiian Islands.

7. Before any equipment, anchors(s), or material enters the water, a responsible party will verify that no ESA-listed species are in the area where the equipment, anchor(s), or materials are expected to contact the substrate. If practicable, the use of divers to visually confirm that the area is clear is preferred.

8. Equipment operators will employ "soft starts" when initiating work that directly impacts the bottom. Buckets and other equipment will be sent to the bottom in a slow and controlled manner for the first several cycles before achieving full operational impact strength or tempo.

9. All objects lowered to the bottom will be lowered in a controlled manner. This can be achieved through the use of buoyancy controls such as lift bags, or the use of cranes, winches, or other equipment that affect positive control over the rate of decent.

10. Equipment, anchor(s), or material will not be deployed in areas containing live corals, seagrass beds, or other significant resources.

11. In-water tethers and mooring lines for vessels and marker buoys will be kept to the minimum lengths necessary and will remain deployed only as long as needed to properly accomplish the required task.

12. Vessel operators will alter course to remain at least 100 yards from whales, and least 50 yards from other marine mammals and sea turtles.

13. Vessel operators will reduce vessel speed to 10 knots or less when piloting vessels in the proximity of marine mammals, and to 5 knots or less when piloting vessels in areas of known or suspected turtle activity.

14. If approached by a marine mammal or turtle, the vessel operator will put the engine in neutral and allow the animal to pass.

15. Vessel operators will not encircle or trap marine mammals or sea turtles between multiple vessels or between vessels and the shore.

16. Unless specifically covered by a separate permit that allows activity in proximity to protected species, all in-water work will be postponed when whales are within 100 yards or other protected species are within 50 yards. Activity will commence only after the animal(s) depart the area.

7.5 Historic or Cultural Features

1. No adverse impacts to any historical or cultural features are expected since the project is the restoration of a sandy beach.

2. Should any unanticipated archaeological site(s), such as walls, platforms, pavements and mounds, or remains such as artifacts, burials, concentrations of charcoal or shells be uncovered by the work activity, all work will cease in the immediate area and the contractor will notify the State Historic Preservation Office at 808.692.8015. No work will resume until the Owner and/or contractor obtains clearance from the State Historic Preservation Office.

7.6 Environmental Protection

1. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of the project. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

2. All permits and clearances will be obtained prior to the start of any project activities. The contractor and subcontractors will ensure that all restoration work complies with all permit conditions and commitments made with environmental agencies.

3. Any project related debris that may pose an entanglement hazard to protected species must be removed from the project site if not actively being used and/or at the conclusion of the proposed project.

4. All project activities will be confined to areas defined by the drawings and specifications. No project materials will be stockpiled in the marine environment outside of the immediate project area.

5. Visual inspections will be documented with photographs and written descriptions, if necessary.

6. The contractor will perform the work in a manner that minimizes environmental pollution and damage as a result of construction operations. The environmental resources within the project

boundaries and those affected outside the limits of permanent work will be protected during the entire duration of the project activities.

7. The contractor will complete daily inspection of equipment for conditions that could cause spills or leaks; clean equipment prior to operation near the water; properly site storage, refueling, and servicing sites; and implement spill response procedures and stormy weather preparation plans.

8. The project will be completed in accordance with all applicable State and County health and safety regulations.

9. The contractor will provide notifications to the National Marine Fisheries Services, efhesaconsult@noaa.gov, at least 72 hours prior to the scheduled start of project activities.

10. Project operations must cease if unusual conditions, such as large tidal events and high surf conditions affect the project site, except for efforts to avoid or minimize resource damage.

11. All vessels must be locally owned and operated vessels and do not contain bilge or ballast waters from locations outside of the Hawaiian Islands.

12. Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. Conform to the national permitting requirements of the Clean Water Act.

13. Do not intentionally disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

14. Provide and maintain, during the life of the contract, environmental protection measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

7.7 Erosion and Sediment Control

1. Silt curtains will be installed during sand placement and groin construction (only applicable for Beach Stabilization).

2. For sand placement, silt curtains will be individually anchored between 5 feet and 10 feet from the sand placement area.

3. For groin construction, silt curtains will be anchored 10 feet from the designed groin toe. The length of the silt curtains will be adequate to completely contain the area where work is taking

place. On the ends of the project site, sand bags may be used to help anchor the silt curtains above the mhhw line. (only applicable for Beach Stabilization)

4. Silt curtains, biosocks, booms, and/or silt fences will be individually anchored and regularly inspected during project operations.

5. Silt curtains, biosocks, booms, and/or silt fences will be left in place each night. All anchors will be inspected prior to sunset.

6. The contractor will keep project activities under surveillance, management and control to avoid pollution of surface or marine waters. Daily visual inspection of the project site and its environs will be conducted by a designated individual, or his representative, to verify that the permitted activities do not result in uncontrolled adverse environmental impacts.

7. Visual inspections will include monitoring of the effectiveness of the silt curtains to ensure proper function.

8. Visual inspections will be documented with photographs, a photo-orientation map, and written descriptions.

9. Sand placement and groin construction (only applicable for Beach Stabilization)will not be performed during storms or periods of high surf.

10. Visual monitoring will include ongoing inspections for turbidity outside of the confines of the silt curtain(s). In the event that turbidity is observed outside of the silt curtains, work will stop, and the silt curtains will remain in place until the turbidity dissipates. Silt curtains will be inspected after dissipation and prior to returning to project operations.

11. Wherever equipment and/or vehicles leave the site and enter surrounding paved streets, the contractor will prevent any material from being carried onto the pavement. There will be no washing of equipment on the beach or near the shoreline.

12. Should excessive siltation or turbidity, as defined in HAR Title 11 Chapter 54.4 and HAR Title 11 Chapter 54.6, result from the contractor's method of operation, the contractor will install additional silt curtains or other silt contaminant devices as required to correct the problem.

7.8 Public Health and Safety

1. The contractor is responsible for safety at the job site and will comply with all Federal, State of Hawaii, and County of Maui safety and health regulations.

2. Areas of operation upon the shoreline will be clearly marked with fencing, barricades, caution tape, or other approved devices, to protect the public from potential hazards related to construction.

3. All work areas will have posted signs advising the public of current construction activities and related hazard warnings and be patrolled by project staff as needed to ensure that members of the public do not enter the project area.

4. Crossing guards will be provided by the contractor to assist the public with transiting safely to and along the shoreline.

5. Project implementation will not interfere with the public's right to reasonable navigation.

6. Public access along the shoreline during construction will be maintained so far as practicable and within the limitations necessary to ensure safety.

7. Fire department fire lanes, access to all laydown areas and construction areas will be maintained at all times. Emergency vehicles will always have access. Do not block egress.

7.9 Noise Control

1. Best Management Practices will be utilized to minimize adverse effects to air quality and noise levels, including the use of emission control devices and noise attenuating devices.

2. Noise will be kept within acceptable levels at all times in conformance with HAR Title 11 § 46 Community Noise Control, State Department of Health, Public Health Regulations. The contractor will obtain and pay for a community noise permit from the State Department of Health when equipment or other devices emit noise at levels exceeding the allowable limits.

3. Equipment will be equipped with suitable mufflers to maintain noise within levels complying with applicable regulations.

4. The contractor must make the maximum use of low-noise-emission products, as certified by the EPA.

5. Starting of equipment meeting allowable noise limits will not be done prior to 7:00 a.m. without prior approval. Equipment exceeding allowable noise limits will not be started up prior to 7:30 a.m. Equipment meeting allowable noise limits will not be used after 9:00 p.m. without prior approval.

6. Equipment located offshore of the coastline may utilize nighttime hours as determined through coordination with regulatory agencies and surrounding landowners.

7.10 Dust Control

1. Dust, which could damage property, or cause nuisance to people, will be abated and control measures will be performed. If there is dust, standard dust mitigation procedures will be used.

2. The contractor, for the duration of the contract, will maintain all excavations, embankments, paved roads, permanent access roads, plant sites, waste disposal areas, and all other work areas within or without the project limits free from dust which would cause a hazard to the work, or the operations of other contractors, or to persons or property. Industry accepted methods of stabilization suitable for the area involved, such as sprinkling or similar methods will be permitted. Chemicals or oil treatment will not be used.

3. The contractor will prevent dust from becoming airborne at all times including non-working hours, weekends and holidays in conformance with the State of Hawaii Administrative Rules (HAR), Title 11, Chapter 60 Air Pollution Control.

4. Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, flooding, or pollution. Vacuum or sweep the work area daily.

7.11 Air Pollution Control

1. Emission: The contractor will not be allowed to operate equipment and vehicles that show excessive emissions of exhaust gases until corrective repairs or adjustments are made.

7.12 Oil and Spill Containment

1. The contractor will ensure that the Emergency Spill Response Plan, detailed in this document, is in place which will detail procedures for managing the accidental release of petroleum products to the aquatic environment during construction. Fueling of project related vehicles and equipment should take place away from the water. Absorbent pads, containment booms, and skimmers will be stored on site to facilitate the cleanup of petroleum spills.

2. Any spills or other contaminations will be immediately reported to the DOH Clean Water Branch (808.586.4309) and through email: cleanwaterbranch@doh.hawaii.gov.

3. Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated by environmental law. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. The responsible individual(s) will document the event and the measures taken to correct the issue, and will report the incident (with photographs) as soon as is practicable. Work may continue only after the issue is no longer visible.

4. Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous waste spills.

7.13 Monitoring/Measures for Visually Detected Containment

1. All work operations will be performed in conformance with the applicable provisions of the Hawaii Administrative Rules (HAR), Title 11 Chapter 55 Water Pollution Control and Title 11, Chapter 54 Water Quality Standards, and the Erosion and Sedimentation Control Standards and Guidelines of the Department of Public Works, State of Hawaii.

2. The contractor will keep construction activities under surveillance, management and control to avoid pollution of surface or marine waters. Daily visual inspection of the construction site and its environments will be conducted by a designated individual, or his representative, to verify that the permitted activities do not result in uncontrolled adverse environmental impacts. Visual inspections will be documented with photographs and written descriptions, if necessary.

    a. Daily Inspection: The project site will be inspected daily to ensure BMP's are maintained to confine and isolate potential pollutants from being discharged into surrounding areas. The site will be inspected to ensure that materials are properly stored, rubbish is being collected and disposed of properly, and all BMPs are functioning properly.

    b. Deficiencies identified by daily inspections will be corrected immediately. Work activities will stop and remain stopped until the deficiencies have been corrected.

3. Prior to delivery to the site, all construction material will be inspected to ensure they are 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.

4. Erosion control measures will be in place before any work is started. Erosion control measures will include silt fencing and biosock containment devices, as needed, around laydown and staging areas and active work areas.

5. The contractor will maintain and clear blockage and debris from the erosion control measures as necessary every day and after heavy rain events.

6. No contamination of the marine environment will result from the permitted activities. Particular care must be taken to ensure that no petroleum products, trash or other debris enter nearshore and open ocean waters. When such material is found within the project area, the contractor, or his designated construction agent, will collect and dispose of this material at an approved upland disposal site.

7. Waste materials and waste waters directly derived from construction activities will not be allowed to leak, leach or otherwise enter marine waters.

7.14 Water Quality Monitoring

1. The contractor will visually monitor the nearshore for turbidity or other water quality issues that may be associated with the project operations. Turbidity and sediment from project-related activities must be minimized and contained to the immediate vicinity of the authorized activity through the appropriate use of effective turbidity containment devices.

2. The contractor will incorporate all erosion control measures shown in the drawings and the BMPP for this project. The plans may be modified as necessary to adjust to conditions that develop during construction. Any changes to the BMPP must immediately be submitted to the DA for review.

3. The water quality will be quantitatively measured following the plan set forth by the approved Applicable Monitoring and Assessment Plan by a qualified individual.

4. All silt fences, silt curtains, and other control measures will be installed properly and stabilized, be self-sustaining, and remain in place until any turbidity levels elevated due to construction related activities have returned to ambient levels. For groin construction, silt fences, silt curtains, or other appropriate containment measures will be installed to contain sediment and turbidity at the work site (a) parallel to, and within 10 feet of, the toe of any fill or exposed soil which may introduce sediment to an adjacent aquatic site; and (b) adjacent to any fill placed or soil exposed within an aquatic site (only applicable for Beach Stabilization).

5. Erosion control measures must be properly installed before any alteration of the area may take place.

6. All disturbed areas must be immediately stabilized following cessation of activities for any break in work longer than 4 days

7.15 Wildlife and Protected Species

1. The Project Manager will designate a competent observer to survey the areas adjacent to the proposed action for ESA-listed species, including but not limited to the green sea turtle, hawksbill sea turtle, and Hawaiian monk seal.

2. Constant vigilance will be kept for the presence of Federally Listed Species.

3. Visual surveys for ESA-listed species will be made prior to the start of work each day, and prior to resumption of work following any break of more than one half hour, to ensure that no protected species are in the area (typically within 50 yards of the proposed work).

4. If the State endangered Hawaiian Monk Seal (*Monachus schauinslandi*) or threatened Green Sea Turtle (*Chelonia mydas*) are detected within 100 meters of the project area, all nearby construction operations shall cease and not continue until the focal animal has departed the area on its own accord.

5. If ESA-listed species are noticed after work has already begun, that work may continue only if there is no way for the activity to adversely affect the animal(s). The use of heavy machinery is not permitted until the creature has departed the area.

6. For groin construction, if any federally protected waterbird species appear within 100 feet of ongoing, in-water work, work activity will be temporarily suspended until the bird voluntarily leaves the area (only applicable for Beach Stabilization).

7. Do not attempt to feed, touch, ride, or otherwise intentionally interact with any ESA listed species.

8. All on-site project personnel must 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. A brochure explaining the laws and guidelines for listed species in Hawaii, American Samoa, and Guam may be downloaded from: http:www.nmfs.noaa.gov/prot_res/MMWatch/Hawaii.htm. A list of protected species in Hawaii can be found at http://www.wpcouncil.org/managed-fishery-ecosystems/hawaii-archipelago/protected-species-hawaii/

9. The contractor will keep a record of all protected species sightings, incidents of disturbance, or injury, and will provide a report to the State and the National Marine Fisheries Service (NMFS), and will be the contact person for any issues involving green sea turtles during project activities.

10. Upon sighting of a monk seal or turtle within the safety zone during project activity, immediately halt the activity until the animal has left the zone. In the event that a protected species enters the safety zone and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals contact the Marine Mammal Response Coordinator at 808.944.2269, as well as the monk seal hotline at 1.888.256.9840. For turtles, contact the turtle hotline at 808.983.5730.

11. The contractor will immediately report any incidental take of marine mammals. The incident must be reported immediately to NOAA Fisheries' 24-hour hotline at 1.888.256.9840, and the Regulatory Branch of the USACE at 808.438.9258. In Hawaii, any injuries incidents of disturbance or injury to sea turtles must be immediately reported and must include the name and phone number of a point of contact, the location of the incident, and the nature of the take and/or injury. The incident should also be reported to the Pacific Island Protected Species Program Manager, Southwest Region (Tel: 808.973.2987, fax: 808.973.2941).

12. Before any equipment, anchors(s), or material enters the water, a responsible party will verify that no ESA-listed species are in the area where the equipment, anchor(s), or materials are expected to contact the substrate. If practicable, the use of divers to visually confirm that the area is clear is preferred.

13. Equipment operators will employ "soft starts" when initiating work that directly impacts the bottom. Buckets and other equipment will be sent to the bottom in a slow and controlled manner for the first several cycles before achieving full operational impact strength or tempo.

14. All objects lowered to the bottom will be lowered in a controlled manner. This can be achieved through the use of buoyancy controls such as lift bags, or the use of cranes, winches, or other equipment that affect positive control over the rate of decent.

15. Equipment, anchor(s), or material will not be deployed in areas containing live corals, seagrass beds, or other significant resources.

16. For any equipment used in undertaking the authorized work, the 160 dB and 120 dB isopleths will not exceed the 50-yard shut-down range for impulsive and continuous sounds sources, respectively.

17. Vessel operators will alter course to remain at least 100 yards from whales, and least 50 yards form other marine mammals and sea turtles.

18. Vessel operators will reduce vessel speed to 10 knots or less when piloting vessels in the proximity of marine mammals, and to 5 knots or less when piloting vessels in areas of known or suspected turtle activity.

19. If approached by a marine mammal or turtle, the vessel operator will put the engine in neutral and allow the animal to pass.

20. Vessel operators will not encircle or trap marine mammals or sea turtles between multiple vessels or between vessels and the shore.

21. Unless specifically covered by a separate permit that allows activity in proximity to protected species, all in-water work will be postponed when whales are within 100 yards or other protected species are within 50 yards. Activity will commence only after the animal(s) depart the area.

22. Should protected species enter the area while in-water work is already in progress, the activity may continue only when that activity has no reasonable expectation to adversely affect the animal(s).

23. Any required site clearing should be timed to avoid disturbance to the State listed Hawaiian Hoary Bat or ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*) during their birthing and pup rearing season (June 1 through September 15). During this period woody plants greater than 15 feet (4.6 meters) tall shall not be disturbed, removed, or trimmed. Barbed wire shall not be used for any construction because bats can become ensnared and killed by such fencing material during flight.

24. For nighttime work that might be required, all lights used shall be fully shielded to minimize the attraction of seabirds. Nighttime work that requires outdoor lighting shall be avoided during the seabird fledging season, from September 15 through December 15, when young seabirds

make their maiden voyage to sea. If nighttime construction is required during the seabird fledgling season, a qualified biologist shall be present at the project site to monitor and assess the risk of seabirds being attracted or grounded due to the lighting. If seabirds are seen circling around the area, lights shall then be turned off. If a downed seabird is detected, the contractor shall follow DOFAW's recommended response protocol: https://dlnr.hawaii.gov/wildlife/seabird-fallout-season/#response

25. Permanent lighting shall be minimized or eliminated to protect seabird flyways and preserve the night sky.

26. If the work requires the removal of any tree tobacco over one meter in height or the disturbance of the ground around or within several meters of these plants, they shall be thoroughly inspected by a qualified entomologist for the presence of BSM eggs and larvae of the State listed Blackburn's Sphinx Moth (*Manduca blackburni*).

27. If landscaping is required, the contractor shall refer to www.plantpono.org for guidance on the selection and evaluation of landscaping plants and to determine the potential invasiveness of plants proposed for use in the project. Any landscaping shall be limited to native plant species that are appropriate for the area. No planting of invasive species will occur.

28. The movement of plant or soil material between worksites shall be minimized.

7.16 Operational Controls

1. This plan will be reviewed with the project field staff prior to the start of work.

2. All activities significantly impacting the environment will not begin until appropriate BMP's are properly installed.

3. Construction will be immediately stopped, reduced or modified; and/or new or revised BMP's will be immediately implemented as needed to stop or prevent polluted discharges to receiving waters. New or revised BMP's will be approved by appropriate regulatory agencies prior to re-commencing work.

4. The contractor is responsible for all regulatory notification requirements in accordance with Federal, State and local regulations. Submit copies of all regulatory notifications to the Contracting Officer prior to the commencement of work activities.

5. The contractor is responsible for complying with all permit conditions and requirements, including how they will be addressed in the work plans.

6. The contractor will provide the personnel, materials, and equipment necessary to comply with all permit conditions and requirements for the project.

7. All existing utilities, concrete walkways, steps, and walls, whether or not shown on the

drawings, will be protected from damage at all times during construction and grading work. Any damage will be repaired by the contractor at their expense.

8. The contractor will provide for access to and from all existing driveways and walkways at all times.

9. The contractor will take extreme care in performing work near existing concrete electrical/communication ducts and overhead wires. Appropriate protection will be implemented as required to prevent damage to those lines.

7.17 Structure, Authority, and Responsibility

1. The Project Manager/Superintendent/Project Engineer will ensure compliance with this plan.

2. The Project Manager/Superintendent/Project Engineer will appoint and train one additional individual to properly install all BMP's and to comply with all aspects of this plan.

3. The Owner(s) is also responsible for compliance with the BMPP.

7.18 Training

1. Employees will be instructed in the proper installation of the BMPP materials. Documentation of this training and personnel who were present will go in an Environmental Records binder that will be kept on site.

2. Employees will be instructed on the contents of the Emergency Action Plan. Documentation of this training and personnel who were present will go in the Environmental Records binder.

3. Employees will be instructed on Marine Protected Species BMPs. Documentation of this training and personnel who were present will go in the Environmental Records binder.

4. BMP's will be discussed, as applicable, for each new phase of work. Documentation of these meetings will go in the Environmental Records binder.

7.19 Inspection and Monitoring

1. The Project Manager/Superintendent/Project Engineer or the assigned trained individual will conduct a visual inspection of all BMPs daily.

2. All minor repairs and maintenance of the BMPs will be completed within 48 hours of detection. Major repairs of BMPs will be completed as soon as practical, and in-water work will be stopped until repairs are complete.

3. If any BMP is damaged, work will immediately be stopped and will not resume until repairs to the BMP have been completed.

7.20 Emergency Procedures

1. Natural disaster related pollutant discharge: See Contingency Plan.

2. Spill prevention and control: See Emergency Spill Response Plan.

3. An Emergency Action Plan will be kept on site and updated for use in other types of emergencies. The Emergency Action Plan should be given to all project managers during the kickoff meeting.

7.21 Record Keeping and Documentation

1. An Environmental Records binder will be stored on site. This binder will contain a copy of this plan, BMP inspection reports, all project-related permits and approvals, water quality monitoring records, training records, design drawings, a marked up version of the design drawings showing any deviations from the plan, and a contact information list. The Environmental Records binder should be updated daily and the contents should be scanned and stored digitally offsite as a backup whenever possible.

2. The Environmental Records binder will be maintained by the Environmental Manager.

3. The Environmental Records binder and Emergency Action Plan will be made available to any inspector who visits the site.

4. Records of inspection and repair of control measures will be retained in the project files for a minimum of 5 years.

5. In addition to other records required under the contract, the contractor will maintain at the job site two sets of full-size drawings, marking them in red to show all variations between the construction actually provided and that indicated or specified in the contract documents, including buried or concealed construction. Where a choice of materials or methods is permitted herein, or where variations in scope or character of work differ from that of the original contract are authorized, mark the drawings to define the construction actually provided. Show on the drawings the size, manufacturer's name, model number, and power input or output characteristics of the equipment installed. The representations of such changes will conform to standard drafting practice and will include such supplementary notes, legends, and details as necessary to clearly portray the as-built construction. Update drawings on a daily basis.

6. Submit a copy of the designated personnel and their contact information to all permitting agencies after the kickoff meeting. If any changes are made to the personnel list, submit an addendum to the agencies.

7. Topographic surveys should be performed before and after sand placement and groin construction (only applicable for Beach Stabilization) to document the material that was added to the beach.

7.22 Suspension of Work

1. Violations of any of the above requirements or any other pollution control requirements which may be specified in the Technical Specifications herein will be cause for suspension of the work creating such violation. No additional compensation will be due to the contractor for remedial measures to correct the offense. Also, no extension of time will be granted for delays caused by such suspensions.

2. If no corrective action is taken by the contractor within 72 hours after a suspension is ordered by the Owner, the Owner reserves the right to take whatever action is necessary to correct the situation and to deduct all cost incurred by the Owner in taking such action from monies due to the contractor.

3. The Owner may also suspend any operations which he feels are creating pollution problems although they may not be in violation of the above-mentioned requirements. In this instance, the work will be done by force account.

8. CONTINGENCY PLAN

The following plan will be implemented by the contractor to prevent/respond to polluted discharges resulting from a severe storm or natural disaster. It is the contractor's responsibility to abide by the following plan as well as any other binding plan, agreement, regulation, rule, law, or ordinance applicable. All contractors associated with the Hoʻāla Honokōwai beach restoration project will follow this plan when a severe storm is either forecast or anticipated. contractors must:

1. Regularly monitor local weather reports for forecasted and/or anticipated severe storm events, advisories, watches, warnings or alerts. The contractor will inspect and document the condition of all erosion control measures on that day prior, during, and after the event. The contractor will prepare for forecasted and/or anticipated severe weather events to minimize the potential for polluted discharges.

2. Secure the construction site. Securing the site should generally include:

    a. Removing or securing equipment, machinery, and maintenance materials.

    b. Cleaning up all maintenance debris.

    c. Implementing all Best Management Practices detailed in the BMPP. This includes BMPs for materials management, spill prevention, and erosion and sediment control.

3. In the event of a severe weather advisory (hurricanes, tropical storms, natural disasters) or when deemed necessary, cease regular construction operations. Work crews must finalize securing the project site and evacuate until the severe weather condition has passed.

4. Upon return to the site, all BMPs will be inspected, repaired and/or reinstalled as needed. If repair is necessary, it will be initiated immediately after the inspection and repairs or replacement will be complete within 24 hours. To facilitate repair or replacement, the contractor will be required to store surplus material on the project site if the site is located where replacement materials will not be readily available.

5. When there has been a discharge which violates Hawaii Water Pollution rules and regulations OR there is an imminent threat of a discharge which violates Hawaii Water Pollution rules and regulations and/or endangers human and/or environmental health, the permittee will at a minimum execute the following steps:

    a. Assess whether construction needs to stop or if additional BMPs are needed to stop or prevent a violation.

    b. Take all reasonable measures to protect human and environmental health.

    c. Notify the designated responsible parties and immediately notify the DOH of the incident. The notification will also include the identity of the pollutant sources and the implemented control or mitigation measures.

    d. Document corrective actions, take photographs of discharge and receiving waters.

    e. Take representative samples of the affected water, as resulted from the discharge(s), and submit analytical reports to the Department of Health Clean Water Branch.

    f. Revise BMPP to prevent future discharges of a similar nature.

9. EMERGENCY SPILL RESPONSE PLAN

9.1 Pre-Emergency Planning

1. An initial and periodic assessment will be made of the project site and potential hazardous spills that may be encountered during the normal course of work. This plan is not intended to address issues relating to materials such as PCB, Lead, Asbestos, etc. since these types of materials would have specific work plans already developed. This plan should be revised as necessary to correspond to the assessment and resubmitted to the appropriate regulatory agencies.

2. A Hazardous Materials inventory list and MSDS sheets, to include subcontractors' materials, will be filed in a binder and located in the Project Office. The inventory list and MSDS sheets will be updated and maintained by the Project Manager and Site Safety Officer as new materials are added.

3. Personnel will consult the applicable MSDS sheet prior to its use.

4. Personnel will handle hazardous materials safely and use personal protective equipment (PPE), recommended/required by the MSDS when handling hazardous materials.

5. Personnel will receive "Hazard Communication" training within three (3) working days of arrival and "product specific" training prior to the initial use/exposure of a product. This training will be conducted by the Project Manager/Superintendent or Site Safety Officer.

6. All personnel will be trained on the contents of this plan within the first month of construction and at least annually thereafter. The training should include a rehearsal of this plan. An attendance sheet will be kept on file at the Project Office.

7. Only approved containers and portable tanks will be used for storage and handling flammable and combustible liquids. Approved safety cans or DOT approved containers will be used the handling and use of flammable liquids in quantities of five (5) gallons or less. For quantities of one (1) gallon or less, only the original container or approved metal safety can will be used, for storage, use and handling of flammable liquids.

8. Flammable or combustible liquids will not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

9.2 Personal Protective and Emergency Spill Response Equipment

1. ABC fire extinguishers will be located in the project field office and in each of the company vehicles. There will be at least one fire extinguisher, rated at not less than 10B, within 50 feet of any stockpile of 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas storage. Fire extinguishers should not be located "directly" with hazardous materials, so as to endanger first responders.

2. Spill kits will be located at the project field office and/or within 50 feet of the hazardous material storage area. The spill kit contents will be determined by the Project Manager/Superintendent based on the anticipated hazardous materials to be stored and/or used on the project. The spill kits will be inventoried quarterly, and appropriate logbook entries made.

3. Emergency response personal protective equipment (PPE) consisting of:

    a. Face shield

    b. Tyvex coveralls

    c. Rubber gloves

    d. Air-purifying respirators with HEPA and organic vapor combination cartridges will be issued to the Emergency Response Team members and maintained in the project office. Separate Respiratory Protection Equipment will be designated and labeled as such; this

equipment will be inspected at least every 30 calendar days and appropriate logbook entries made.

9.3 Personnel Roles, Lines of Authority and Communication

1. Emergency Response Coordinator (ERC)

    a. The Project Superintendent is the designated ERC. If the Project Superintendent is not available, the Site Safety Officer is the designated ERC.

    b. The ERC will be in charge of and will coordinate the appropriate emergency response procedures in this plan.

2. Emergency Response Team (ERT)

    a. The ERT consists of Construction General Foreman, Labor Foreman, and a Laborer designated by the Project Superintendent.

    b. The ERT will appropriately respond to the emergency in accordance with this plan at the direction of the ERC.

9.4 Emergency Alerting and Response Procedures

1. Any person causing or discovering a known hazardous or unknown release or spill will:

    a. Immediately alert nearby personnel who may be exposed to the effects of the release or spill.

    b. Report the release or spill immediately to the ERC and the ERT. All pertinent information regarding the release should be provided to the ERC, such as the amount and type of material released, location of the release, and other factors, which may affect the response operation.

    c. If the spill or release if a petroleum product or known non-toxic chemical, the person will take immediate and appropriate measures to stop or limit the rate of release, (i.e. close the spigot to the drum or form oil or curing compound) and or contain or stop the migration of the release (i.e. create a berm of dirt around the release) until the ERC and ERT arrive.

    d. If the spill release is a toxic, highly flammable, or unknown chemical, the person will first notify the ERC before approaching the spill area from upwind to determine the source, type, and quantity of the release. The person should monitor the spill until the ERC and ERT arrive.

    e. The ERC will assess possible hazards to human health or the environment that may result from the release, fire, or explosion.

f. If the spill or release is less than 25 gallons of a known petroleum product or non-toxic chemical, the ERC will direct the ERT to contain and cleanup the spill or release.

g. If the spill or release is toxic or unknown, the ERC will immediately notify the County of Maui Fire Department and ask for assistance from the HAZMAT Response Team.

h. Immediately after the emergency, the ERC will arrange for disposing of the recovered waste, contaminated soil or any other material that results from the release, fire, or explosion at the project site in accordance with the County of Maui and State regulations and manufacturer's instructions (if source of spill or release is known).

9.5 Emergency Notification and Reporting Procedures

1. In the event that a release enters the storm or sewer system, the ERC will immediately notify the Nation Response Center (NRC) at 1.800.424.8802, the Hawaii Department of Health, Hazard Evaluation and Emergency Response Office (HEER) at 808.586.4249 and LRPC at 808.935.2785.

2. The ERC will immediately notify appropriate agencies and submit written follow-up notification in accordance with the Hazardous Substance Release Notification Guideline.

9.6 Safe Distance Staging Area

1. A staging area at safe distance upwind and higher than the location of the spill or release and its source will be immediately established.

2. Access to the spill or release location will be cleared for emergency vehicles and equipment to be used to contain and clean up the spill or release.

9.7 Site Security and Control

1. If the spill or release is located on or near the roadway, stop all traffic until the release is cleaned up.

2. If the spill or release is located away from vehicle or pedestrian traffic, install barricades/safety fencing around the affected area.

3. If the spill or release occurs during night operations, provide adequate light and use ground guides to escort emergency vehicles to the affected area.

9.8 Evacuation Routes and Procedures

1. Persons injured during the emergency condition will be evacuated to the staging area where they will be treated and or further evacuated to the nearest medical facility. The appropriate MSDS(s) will be provided to emergency service personnel and are intended to be delivered to the emergency room physicians.

2. Persons working at the affected area and who are not needed in the response effort; will report the staging areas for accountability.

9.9 Decontamination and Disposal Procedures

1. Individuals involved in the spill clean-up are required to perform personal hygiene, utilizing soap and fresh water prior to eating, drinking, or smoking.

2. Contaminated PPE will be appropriately cleaned and disinfected if possible. If this is not possible it will be disposed of per the same requirements of the contaminated substance.

3. Sorbent pads/materials and the spilled substance will be placed in appropriate containers and disposed of as specified by the appropriate MSDS.

4. Contaminated soil will be placed in an appropriate container(s) or on plastic sheeting. The ERC will arrange with an environmental services company to properly characterize, prepare the manifest, label the containers, transport, and dispose of the contaminated soil. The generator's copy of the manifest will be kept in the project files for a minimum of three (3) years.

5. In the event of a substantial release (25 gallons or more) of a suspected or known toxic chemical, the Fire Department HAZMAT Response Team will be called to control/cleanup the release. They will establish and provide the decontamination operations as required.

9.10 Emergency Medical Treatment and First Aid

1. First aid kits will be maintained at the project field office, all company vehicles, and gang boxes.

2. Injured person(s) will be treated at the staging area by a certified first aid trained individual at the project site until the ambulance arrives or they are evacuated to the nearest medical facility.

3. The appropriate MSDS(s) will be provided to emergency service personnel and are intended to be delivered to the emergency room physicians.

9.11 After the Spill Procedures

1. The ERC will review what happened and implement changes and/or corrections to prevent spill from occurring and to improve the spill response and clean-up procedures. This Plan will be revised to reflect those changes, corrections, and/or improvements implemented.

2. The ERC will prepare a record of the spill response and keep it in the project files for a minimum of 3 years.

3. The ERC will submit Follow-up Notification to HEER when required.

4. Spill response kits will be replenished directly after the emergency.

9.12 Emergency Contacts

National Response Center (NRC)		*1.800.424.8802*
Coast Guard Operations Center, Honolulu	(working hours) (after hours)	*1.808.522.8264* *1.808.927.0830*
Hawaii State Department of Health Hawaii Evaluation and Emergency Response (HEER)		*1.808.586.4249*
County of Maui Fire Department		*911*
In the event that a release enters the storm or sewer system, the ERC will immediately notify NRC, HEER, and LEPC		*1.808.935.2785*
State Historic Preservation Division		*1.808.692.8015*
(*name*), Project Manager, (*company*)		*Tel. No. – TBD*
(*name*), Contractor Project Manager, (*company*)		*Tel. No. – TBD*

APPENDIX A: PAC-SLOPES GENERAL CONDITIONS

Best Management Practices Plan
Hoʻāla Honokōwai | Honokōwai, Maui, Hawaiʻi

Pac-SLOPES General Conditions

GENERAL CONDITIONS: The following general conditions apply to each action authorized under Pac-SLOPES. Additionally, activity-specific Best Management Practices (BMPs), which are included in this verification, apply as appropriate.

1. The permittee shall grant the U.S. Army Corps of Engineers (the Corps) a right of reasonable access to monitor compliance with and the effectiveness of permit conditions.

2. The permittee shall inform the Corps and NOAA National Marine Fisheries Service, Pacific Islands Regional Office, Protected Resource Division (NMFS PRD) each interaction with a species listed under the Endangered Species Act (ESA) (ESA-listed species) and shall include information on the disposition of any ESA-listed species that is injured or killed.

3. In the event that work authorized under Pac-SLOPES results in a "take" of an ESA-listed species, as defined by the Endangered Species Act, that "take" must be reported to the Corps, and all work shall stop until the Corps, after consultation with NMFS PRD, notifies the permittee that the authorized work may resume. (The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct).

4. Constant vigilance shall be kept for the presence of ESA-listed species during all phases of the authorized work.

a) A responsible party, i.e., permittee/site manager/project supervisor, shall designate a competent observer to survey work sites and the areas adjacent to the authorized work area for ESA-listed species;

b) Surveys shall be made prior to the start of work each day, including prior to resumption of work following any break of more than one half hour. Periodic additional surveys throughout the work day are strongly recommended;

c) All in-water work will be postponed or halted when ESA-listed species are within 50 yards of the authorized work and will only begin/resume after the animals have voluntarily departed the area, with the following exception: if ESA-listed species are noticed within 50 yards of the authorized work after work has already begun, that work may continue only if, in the best judgment of the responsible party, the activity is unlikely disturb or harm the animal(s), for example, divers performing surveys or underwater work (excluding the use of toxic chemicals) is likely safe, the use of heavy machinery is not; and

d) No one shall attempt to feed, touch, ride, or otherwise intentionally interact with any ESA-listed species.

5. Project footprints shall be limited to the minimum area necessary to complete the authorized work.

6. The project area shall be flagged to identify sensitive resource areas, such as seagrass beds, ESA-listed terrestrial plants, and turtle nests.

7. The authorized work shall be timed to minimize effects on ESA-listed species and their habitats.

8. The authorized work shall cease under unusual conditions, such as large tidal events and high surf conditions, except for efforts to avoid or minimize damage to aquatic resources.

9. To ensure that effects to water quality and hydrology are minimized, a stormwater management plan, commensurate with the size of the authorized work, shall be prepared and carried out for any authorized work that will produce any new impervious surface or a land cover conversion that will slow the entry of water into the soil.

10. A pollution and erosion control plan for the authorized work site and adjacent areas shall be prepared and carried out. At a minimum, this plan shall include and require:

a.) Proper installation and maintenance of silt fences, sausages, equipment diapers, and/or drippans;

b.) A contingency plan to control and clean spilled petroleum products and other toxic materials;

c.) Appropriate materials to contain and clean potential spills will be stored at the work site, and be readily available;

d.) All project-related materials and equipment placed in the water will be free of pollutants;

e.) Daily pre-work inspections of heavy equipment for cleanliness and leaks, with all heavy equipment operations postponed or halted until leaks are repaired and equipment is cleaned;

f.) Fueling of project-related vehicles and equipment will take place at least 50 feet away from the water, preferably over an impervious surface;

g.) A plan to prevent trash and debris from entering the marine environment during the project; and

h.) All construction discharge water (e.g., concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids) must be treated before discharge.

11. Any necessary and appropriate erosion controls shall be properly installed before undertaking the authorized work.

12. Temporary access roads and drilling pads shall avoid steep slopes, where grade, soil types, or other features suggest a likelihood of excessive erosion or failure; existing access routes shall be utilized or improved whenever possible, in lieu of construction of new access routes.

13. All disturbed areas must be immediately stabilized following cessation of activities for any break in work longer than 4 days.

14. Drilling and sampling are restricted to uncontaminated areas, and any associated waste or spoils must be completely isolated and disposed of in an upland location.

15. The authorized work shall comply with all applicable NWP General and Regional Conditions.

APPENDIX B: PAC-SLOPES SPECIAL CONDITIONS

Best Management Practices Plan
Hoʻāla Honokōwai | Honokōwai, Maui, Hawaiʻi

Pac-SLOPES SPECIAL CONDITIONS

In addition to the general conditions listed the following special conditions are required under Pac-SLOPES for each activity:

2.2.3 Marina or Harbor Repair & Improvement

1) Repair and replacement of over- and in-water structures (such as piers, docks, and launch ramps) under Pac-SLOPES is expressly limited to their existing footprints.
2) No piling installation or piling replacement will be authorized;
3) Repair and removal work will be accomplished in a manner that minimizes the potential spread of invasive species that may reside on the pilings; and
4) Removed materials must be disposed of at an approved upland disposal site.

2.2.4 Piling Repair & Removal

1. Repair and removal work will be accomplished in a manner that minimizes the potential spread of invasive species that may reside on the pilings;
2. Removed pilings must be disposed of at an approved upland disposal site; and
3. Installation of new or replacement pilings of any type is not authorized

2.2.5 Buoy Installation & Repair

1. Anchoring locations and moorings must be designed to avoid, to the greatest extent practicable, impacts to live corals and other benthic organisms.
2. The following buoy deployments are expressly excluded from coverage under Pac-SLOPES:

a.) Deployment of mooring buoys in or adjacent to seagrass beds;

b.) Any new deployments or installations within the Hawaiian Islands Humpback Whale National Marine Sanctuary; and

c) With the exception of certain wave and current monitoring systems that operate in frequency bands well outside the hearing ranges of ESA-listed marine life, the deployment of moored active acoustic devices.

2.2.6 Maintenance Dredging

1. With the exception of the actual dredging apparatus (e.g. clamshell buckets, or the scoop and articulated arm of a backhoe, etc.), heavy equipment will be operated from above and out of the water;
2. The portions of the equipment that enter the water will be clean and free of pollutants;
3. Appropriate silt containment devices must be used and properly installed to avoid degradation of adjacent coral reefs, and aquatic vegetation; and
4. Dredged material must be deposited at upland sites, or at EPA designated ocean disposal sites provided sediment standards are met.
5. Dredging of coral reefs, sites that support submerged aquatic vegetation (including sites where submerged aquatic vegetation is documented to exist but may not be present in a given year), and wetlands, is not authorized;
6. Use of hydraulic dredging (aka vacuum, suction, hopper) is not authorized;
7. Any form of blasting is not authorized; and
8. Any dredging for the purpose of connecting canals or other artificial waterways to navigable waters is not authorized.

2.2.7 Minor Discharges and Excavations

NWP # 18 authorizes minor discharges of dredged or fill material into all waters of the United States, provided the activity meets all of the following criteria:

1. The quantity of discharged material and the volume of area excavated do not exceed 25 cubic yards below the plane of the ordinary high water mark or the high tide line;
2. The discharge will not cause the loss of more than 1/10 acre of waters of the United States; and
3. The discharge is not placed for the purpose of a stream diversion.

NWP # 19 authorizes minor dredging below OHW or the high tide line from navigable waters of the United States, provided the activity meets all of the following criteria:

1. The dredging involves no more than 25 cubic yards below the plane of OHW or the mean high water mark;
2. The dredging will result in no degradation of coral reefs, submerged aquatic vegetation, or wetlands; and
3. The dredging involves no connection of canals or other artificial waterways to navigable waters.

Additionally, the following conditions apply to minor discharges and excavations (dredging) covered under Pac-SLOPES:

1. The dredged or discharged material will be free of contamination; and
2. The site of excavation or discharge will contain no known forage or resting habitat for ESA-listed marine species.

2.2.8 Utility Line Installation & Repair

1. Utility line placement location and method must be designed to avoid to the greatest extent practicable, impacts to live corals, submerged aquatic or marine vegetation and other benthic organisms, and wetlands.
2. The following actions are expressly excluded from coverage under Pac-SLOPES:
   a) New installations within the Hawaiian Islands Humpback Whale National Marine Sanctuary;
   b) New installations in or adjacent to seagrass beds;
   c) Installation of new or expanded outfall and/or intake structures;
   d) Installation, removal, or abandonment of any pipeline used to convey toxic substances (e.g. crude oil or its derivatives, known toxic chemicals, etc.);
   e) Any project that involves the installation of new power lines or other conveyances that may radiate or otherwise exude substances or energies into the marine environment;
   f) Any projects that involve in-water trenching in the marine environment or in the lower reaches of freshwater streams and rivers where ESA-listed marine species may occur, or where downstream impacts of the trenching may impact those species or their habitats;
   g) Any projects that require new hydrographic surveys that employ acoustic devices such as sonars and seismic profilers.

2.2.9 Outfall Structure Repair & Replacement

1. The following actions are expressly excluded from coverage under Pac-SLOPES:
   a.) Installation of new or expanded outfall structures; and
   b.) Relocation of existing outfall structures.

2.2.10 Bank Stabilization

1. No material will be discharged into special aquatic sites;
2. An activity will involve no more than 500 feet in total length along the bank;
3. The maximum amount of material placed shall not exceed the minimum needed for erosion protection;

4. No more than one cubic yard, per running foot, of new fill will be placed below ordinary high water (OHW) or the high tide line; and
5. All material will be placed in a manner that will avoid erosion by normal or expected high flows.

2.2.12 Road Construction, Repair, and Improvement

1. Maximum road width shall be limited to the minimum width necessary;
2. Roads shall be designed and constructed in a manner that minimizes adverse impacts on surface and marine waters due to runoff and erosion;
3. Roads shall be constructed as near as possible to pre-construction contours and elevations; and
4. Roads must be bridged or culverted in a manner that maintains surface flows with minimal modification to flow direction or velocity.

2.2.13 Bridge Repair & Replacement

1. Temporary fills must consist of stable materials, and be placed in a manner, that will not be eroded by expected high flows;

2. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations within 30 days of project completion; and

3. Installation of pilings, including steel sheetpile cofferdams, is expressly excluded from coverage under Pac-SLOPES, as is any in-water drilling.

APPENDIX C: PAC-SLOPES ACTIVITY-SPECIFIC CONDITIONS

Best Management Practices Plan
Hoʻāla Honokōwai | Honokōwai, Maui, Hawaiʻi

Pac-SLOPES Activity Specific BMPs

The following Best Management Practices (BMPs) apply to each action authorized under Pac-SLOPES.

5.1 Collision with vessels:

1. Vessel operators shall alter course to remain at least 100 yards from whales, and at least 50 yards from other marine mammals and sea turtles.
2. Vessel operators shall reduce vessel speed to 10 knots or less when piloting vessels in the proximity of marine mammals, and to 5 knots or less when piloting vessels in areas of known or suspected turtle activity.
3. If approached by a marine mammal or turtle, the vessel operator shall put the engine in neutral and allow the animal to pass.
4. Vessel operators shall not encircle or trap marine mammals or sea turtles between multiple vessels or between vessels and the shore.

5.2. Direct physical impact:

1. Before any equipment, anchor(s), or material enters the water, a responsible party, i.e., permittee/site manager/project supervisor, shall verify that no ESA-listed species are in the area where the equipment, anchor(s), or materials are expected to contact the substrate. If practicable, the use of divers to visually confirm that the area is clear is preferred.
2. Equipment operators shall employ “soft starts” when initiating work that directly impacts the bottom. Buckets and other equipment shall be sent to the bottom in a slow and controlled manner for the first several cycles before achieving full operational impact strength or tempo.
3. All objects lowered to the bottom shall be lowered in a controlled manner. This can be achieved by the use of buoyancy controls such as lift bags, or the use of cranes, winches, or other equipment that affect positive control over the rate of descent.
4. Equipment, anchor(s), or materials shall not be deployed in areas containing live corals, sea grass beds, or other significant resources.

5.3 Entanglement:

1. Mooring systems shall employ the minimum line length necessary to account for expected fluctuations in water depth due to tides and waves.
2. Mooring systems shall be designed to keep the line as tight as possible, with the intent to eliminate the potential for loops to form.
3. Mooring lines shall consist of a single line. No additional lines or material capable of entangling marine life may be attached to the mooring line or to any other part of the deployed system.
4. Mooring systems shall be designed to keep the gear off the bottom, by use of a mid-line float when appropriate, with the intent to eliminate scouring of corals or entanglement of the line on the substrate.
5. Any permanent or long-term deployments shall include an inspection and maintenance program to reduce the likelihood of failures that may result in loose mooring lines lying on the substrate or hanging below a drifting buoy.

6. Mooring systems, including those used for temporary markers, scientific sensor buoys, or vessel moorings, shall be completely removed from the marine environment immediately at the completion of the authorized work or the end of the mooring's service life. The only exceptions to this rule shall be mooring anchors such as eyebolts that are epoxied into the substrate and which pose little or no risk to marine life.

5.5 Exposure to elevated noise levels:

1. For any equipment used in undertaking the authorized work, the 160 dB and 120 dB isopleths shall not exceed the 50 yard shut-down range for impulsive and continuous sound sources, respectively.
2. Maintenance dredging, in-water excavation, movement of large armor stones, and benthic core sampling shall not be undertaken if any ESA-listed species is within 50 yards of the authorized work, and those operations shall immediately shut-down if an ESA-listed species enters within 50 yards of the authorized work.

APPENDIX

B

STRUCTURAL ASSESSMENT

KAI HAWAII STRUCTURAL & FORENSIC ENGINEERS

Ken Hayashida, P.E. | President
Ryan Tanaka | Chief Executive Officer
Michael Hunnemann, P.E. | Vice President

November 7, 2024

Mr. Duane Fisher
Starn O'Toole Marcus & Fisher
104 Kaanapali Shores Place
Lahaina, Hawaii 96761

Subject: Structural Assessment of Building Foundation
Kaanapali Beach Club, Makai Building

Dear Mr. Fisher:

On Thursday, May 24, 2024, I visited the Kaanapali Beach Club to observe the shoreline and its relative position to the Makai Building. Honokowai Beach is subjected to cyclical aggradation (buildup of sand) and degradation (erosion of sand) of the beach material, with the degradation occurring in the winter months due to the northern swells. Honokowai Beach is also vulnerable to episodic events that can cause rapid erosion and beach loss over relatively short periods of time. The purpose of the visit was to assess how this cyclical erosion of the beach, along with a sea level rise of approximately 3 ft. may affect the stability of the Makai Building foundation. The Beach Club property is currently protected by a temporary erosion control structure.

The Makai Building is supported on concrete piles that are driven deep into the substrate. The substrate consists of sandy gravel down to a depth of approximately 92 ft. below grade, at which point hard basalt is found. See the enclosed Site Plan. Each building column is supported on a cluster of four piles. For the purposes of this report, the western face of the building is called the makai face. There are a total of six building columns along the makai face, each column is set back 3 ft. from each other, as illustrated in the Site Plan.

We understand that last year the winter tidal runup extended near the toe of the temporary erosion control structure. At the time of our assessment, the distance from this maximum Mean Higher High Water (MHHW) line to the northwest corner of the Makai Building was approximately 30 ft. We also understand that the erosion cycles have been occurring for several years, but that the severity of the erosion is steadily getting worse, presumably because of sea level rise.

Although no intensive analysis of the building itself is included herein, we can provide the following summary of our findings:

- The MHHW elevation after the sea level has risen approximately 3 ft. will remain well below the existing floor elevation of the Makai Building. However, with the anticipated large storms in the future, the chance of the storm surge reaching the building façade increases as the sea level rises. Eventually, the surge in the wave action may begin undermining the first-floor slab of the Makai Building if adequate countermeasures are not in place. This scenario will not have an immediate impact on the structural integrity of the building primary framing system. Only the utilities and slab-on-grade will be immediately affected.

As sea level rise reaches the projected 3' (approximate) in elevation, the ground water elevation will rise as well. The additional height in saturated soil was initially thought to reduce the skin friction of the soil around the concrete piles. A reduction in skin friction can reduce the vertical load carrying capacity of a pile. Therefore, Geolabs, Inc. was contracted for this project to provide an opinion of the rise in sea level and what effect, if any, will have on the ability of the piles to support vertical load. Geolabs has provided a memorandum, see Appendix. Generally, Geolabs' report can be summarized as follows:

- The majority of the existing concrete piles were installed below the groundwater level (typically fluctuated between +2 and -1 feet MSL).

- The sea level rise, assuming from +0.0 to +/-3.0 feet, may have insignificant impact on the driven concrete pile vertical load capacity.

- The proper design of the shoreline erosion protection will be critical to protect the pile foundation system from undermining risk, potentially affecting the performance of the existing building foundation system from excessive lateral forces.

- As the property is subjected to more large storms over time, the surging waves may continue to erode the shoreline and eventually expose the concrete piles that support the building. Once the piles and pilecaps are exposed, the lateral load capacity of the piles will begin to be reduced as the loss of soil that confines the piles is washed away. Strong earthquakes and hurricanes will produce large lateral forces. The earthquake lateral force will be in the form of ground motion, both sideways and vertical. The piles will transfer the lateral forces up into the building structural system, causing the building to sway. Strong hurricanes will exert large forces on the faces of the building, which will transfer down into the piles.

- If the rise in sea level and subsequent erosion of the soil begins to expose the concrete piles, the lateral capacity of those piles will begin to be affected. It is the lateral capacity of the piles that supports the building when large ground motion occurs, such as during an earthquake. If all the piles along the makai end of the building were to become undermined (6 columns x 4 piles per column = 24 piles), there would still be over 150 other piles supporting the building that would contribute toward resisting the lateral seismic forces. If the erosion continues and additional piles begin to be exposed, then the lateral capacity of the building will begin to be affected. An in-depth structural analysis will be required to determine how much the building stability is affected and at what level of earthquake.

- If the Coastal Study by Sea Engineering, Inc. finds that properly designed and maintained erosion countermeasures can contain the storm surges and protect the building from direct erosion of the soil substrate, then the building foundation will continue to properly support both large lateral and vertical forces. The piles will continue to be properly confined by the surrounding soil and will provide adequate lateral support for the building.

Please note that our findings and conclusions above are based on the assumption that the building and support piles were adequately designed in 1986, Project No. 85140.

Should you have any questions or comments please do not hesitate to contact me.

Sincerely,

Michael Hunnemann

Digitally signed by Michael Hunnemann
DN: C=US, E=mike@kaihwaii.com, O=KAI Hawaii Inc., CN=Michael Hunnemann
Reason: I am approving this document
Date: 2024.11.07 08:29:45-10'00'

Michael Hunnemann
KAI Hawaii, Inc.



Makai Face of Building, looking North



Beach with a Temporary Erosion Control Structure Protecting the Northwest Corner of the Building

APPENDIX

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

June 29, 2024
PR5201-2024

Mr. Mike Hunnemann
Kai Hawaii, Inc.
50 South Beretania Street, #C-119C
Honolulu, HI 96813

GEOTECHNICAL ENGINEERING CONSULTATION
KAANAPALI BEACH CLUB BUILDING FOUNDATION ASSESSMENT
KAANAPALI, MAUI, HAWAII

Dear **Mr. Hunnemann:**

Based on the information provided, we understand that a beach restoration plan is under development, involving groins and offshore sand adjacent to the existing Kaanapali Beach Club Makai Tower. There are concerns about the building foundation due to on-going erosion and expected sea level rise. We understand that the existing Makai Tower building footprint is near the shoreline, as close as about 30 feet. The shoreline is currently protected by a temporary erosion control structure.

Based on the as-built drawings provided (referencing Sheet A3.1 and A3-2 Building Sections, dated December 19, 1986), the building is supported on driven concrete pile foundations, with bottom of the pile cap elevations ranging between about +7 feet and -3 feet Mean Sea Level (MSL). Detailed structural design drawings were not available at the time this letter was prepared.

Considering majority of the existing concrete piles were installed below the groundwater level (typically fluctuated between +2 and -1 feet MSL), it is our opinion that the sea level rise, assuming from +0.0 to +3.0 feet, may have insignificant impact on the driven concrete pile compressive load capacity. However, it will have significant impact on the lateral load capacity while erosion process undermining the subsurface soil stiffness around the existing pile caps and upper 5 to 10 feet of the pile foundations. Therefore, the proper design of the shoreline erosion protection will be critical to protect the pile foundation system from undermining risk, potentially affecting the performance of the existing building foundation system.

The discussions submitted herein are based, in part, upon information obtained from the limited boring data and drawings provided. Variations of actual as-built foundations from those described in this letter report may occur. Our services on this project were performed in accordance with generally accepted standards of geotechnical engineering practice; no warranty is expressed or implied.

This letter report has been prepared for the exclusive use of Kai Hawaii, Inc. and their client for specific application to the *Kaanapali Beach Club Building Foundation Assessment* project in accordance with generally accepted geotechnical engineering principles and practices. This report may not contain sufficient data, or the proper information, to serve as the basis for detailed design and preparation of construction drawings.

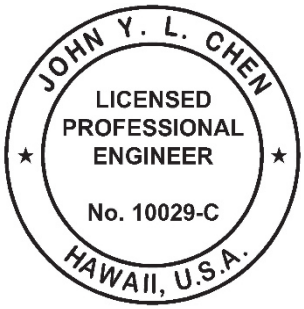
CLOSURE

We appreciate the opportunity to provide our services to you on this project. If you have questions or need additional information, please contact our office.

Respectfully submitted,

GEOLABS, INC.

By _____
John Y.L. Chen, P.E.
Vice President

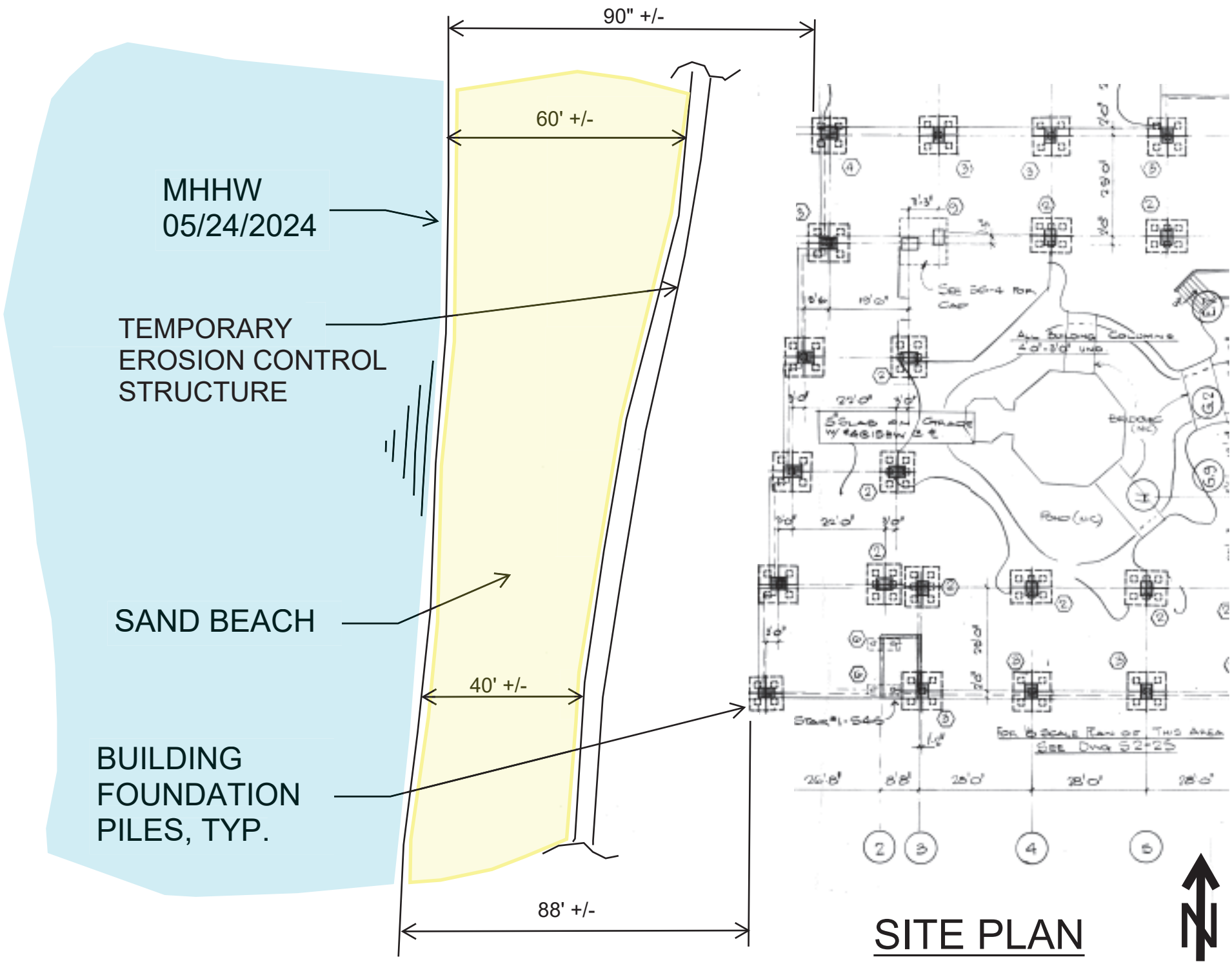


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90" +/-
60' +/-
MHHW
05/24/2024
TEMPORARY
EROSION CONTROL
STRUCTURE
SAND BEACH
40' +/-
BUILDING
FOUNDATION
PILES, TYP.
88' +/-
SITE PLAN
N

APPENDIX

C

TERRESTRIAL BIOLOGICAL SURVEY

AECOS No. 1837

Terrestrial biological surveys for Hoʻāla Honokōwai at Honokōwai Beach, West Maui



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February 7, 2025

Terrestrial biological surveys for Hoʻāla Honokōwai at Honokōwai Beach, West Maui

February 7, 2025 *AECOS* No. 1837

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Introduction

The Hoʻāla Honokōwai Project aims to restore and preserve Honokōwai Beach against erosion and beach retreat (hereafter, the "Project"). West Maui Resort Partners, L.P. (WMRP) is considering one of four options to accomplish this aim: 1) beach nourishment, 2) beach maintenance, 3) beach stabilization, and 4) no action (SEI, 2022). Beach nourishment is a one-time action involving the addition of sand to increase beach width without modifying existing or installing new structures. Beach maintenance is an action consisting of an initial nourishment project with periodic renourishment at specified intervals. A third option, beach stabilization is a one-time action involving both the addition of sand with modification of existing structures and/or the installation of new structures (e.g., groins) to minimize sand loss through erosion.

In support of an Environmental Impact Statement (EIS) for the Project[1], a length of 350 m (1,150 ft) of Honokōwai Beach and upper shore was surveyed for terrestrial flora and fauna (Figure 2). Aquatic biota surveys were also conducted at the mouth of Honokōwai Stream.

Site Description

The Project is located within the Honokōwai watershed on the island of Maui (Figure 1). The Honokōwai watershed occupies 22,655 ac (9,168 ha) and extends from approximately 1,734 m (5,689 ft) above sea level (ASL) to the ocean shore.

[1] Prepared for Munekiyo Hiraga, this document is produced for inclusion in an EIS for the Project and will become part of the public record.

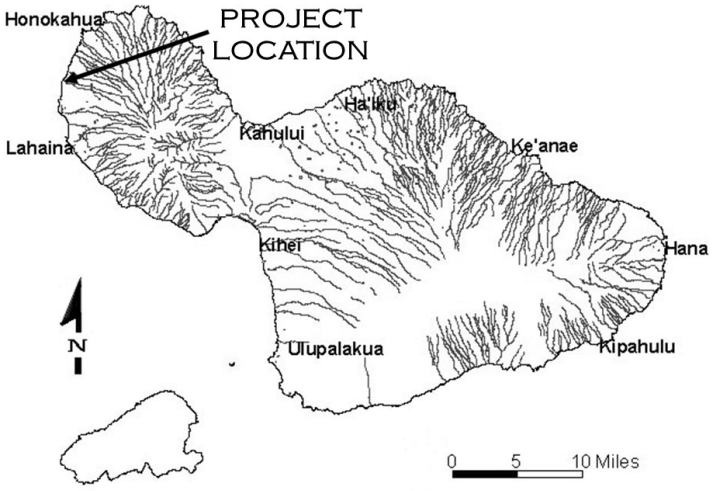


Figure 1. Project location on the Island of Maui.

The Honokōwai littoral extends 1.15 mi (6,070 ft) north from Honokōwai Point to near Kahana Bay on West Maui. The survey area is a section of shoreline referred to as Honokōwai Beach, which spans approximately 1,000 ft of shoreline fronting the Kāʻanapali Beach Club and Kāʻanapali Shores Condominium (Figure 2). At the Project site, the shore transitions from predominantly sand beach and unarmored shore (south of Honokōwai Point) to predominantly rocky or armored shore north of Honokōwai Point. Shoreline armoring begins approximately 244 m (800 ft) south of the survey area (Figure 3) and extends north to Kahana Bay. The shore at the Project Site is unarmored but has in place a temporary erosion control structure.

Honokōwai Beach is a popular destination for beach goers, shoreline fisherman, spear fishers, divers, snorkelers, swimmers, surfers, and paddlers. The area between Honoapiʻilani Highway and the shore is part of the Special Management Area (SMA) and State Urban Land Use District. The area off of the shore are submerged lands that are part of the Resource Subzone of the Conservation District. Access to the shore is provided via a paved road between Kāʻanapali Beach Club and Kāʻanapali Shores Condominium. The public access area features parking stalls, restrooms, shower facilities, and an ADA-compliant coastal walkway that provides lateral access along the shoreline.

Honokōwai Stream is located within the Honokōwai watershed (DAR watershed code: 61007). The stream originates near the peak of Puʻu Kukui in the West Maui Mountains at 1,682 m (5,520 ft) ASL, and discharges into the Pacific Ocean at Honokōwai Beach (USGS, nd). Honokōwai Stream is a perennial stream, with a length of 16.9 mi (27.2 km). The stream serves as the north end of the survey area.



Figure 2. Project area at Honokōwai Beach.



Figure 3. Survey area at Honokōwai Beach (outlined in red).

Methods

Botanical Survey

AECOS biologist G. López conducted a wandering pedestrian survey of the survey area. Plant species were identified as they were encountered. Any plant not immediately recognized during the survey was photographed and/or a representative feature (fruit, flower, leaf, branch) collected for later identification at the laboratory. Species names follow *Manual of the Flowering plants of Hawai'i* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999) for native and naturalized flowering plants, *Hawai'i's Ferns and Fern Allies* (Palmer, 2003) and *Taxonomic and Nomenclatural Updates to the Fern and Lycophyte Flora of the Hawaiian Islands* (Ranker et al, 2019) for ferns and fern allies, and A Tropical Garden Flora (Staples & Herbst, 2005) for ornamental and agricultural plants. More recent name changes for naturalized plant species follow Imada (2019).

Fauna Survey

Aquatic Fauna

On August 8, 2024, *AECOS* biologist G. López made visual observations from the right bank of Honokōwai Stream, noting species as they were encountered. Species identifications follow *Hawai'i's Native and Exotic Freshwater Animals* (Yamamoto and Tagawa, 2000) and nomenclature follows the *Integrated Taxonomic Information System* (ITIS, 2022). A photograph representative of the portion of the stream visually observed during the survey on Augusts 8, 2024 is provided in Figure 4.

Avian Survey

A survey of birds in the Project area was conducted by *AECOS* biologist K. Yoneshige in the late morning hours of August 15, 2024. The 8-minute point-count survey was done in the middle of the survey area, *makai* of the public parking area. Birds were identified to species by visual observation, aided by Leica 8 X 42 binoculars, and by listening for vocalizations. Any species observed in the area outside of the timed count at the point-count station were recorded as incidental observations. Weather conditions were ideal for avian detection during our survey, with unlimited visibility, no precipitation, and gusty winds (10 to 15 mph). An additional 30-minute time-dependent waterbird count was made at the mouth of Honokōwai Stream. The avian phylogenetic order and nomenclature used in this report follows the AOU *Checklist of North and Middle*

American Birds 2022 (Chesser et al., 2022) and the 64th supplement to the checklist (Chesser et al., 2023).

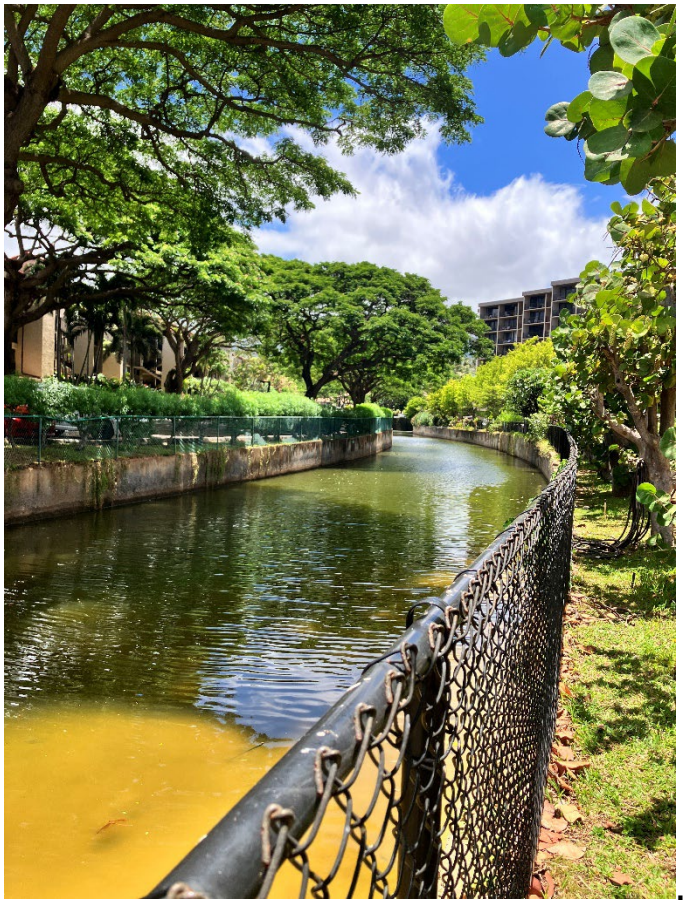


Figure 4. Stretch of Honokōwai Stream visually observed during August 8, 2024

Terrestrial Mammalian Survey

AECOS biologist K. Yoneshige made a list of all mammals encountered during the survey. Indicators of mammalian presence, such as tracks, scat, and other sign were noted. Mammalian phylogenetic order and nomenclature follow *Mammal Species of the World* (Third Edition; Wilson and Reeder, 2005).

Marine Resources

A marine resources survey was not part of our scope-of-work. However, both biologists noted any turtles and monk seals observed during the survey.

Results

Vegetation

The survey area consists of a beach, a sidewalk, and several beachfront properties with landscaping (Figure 5). On the ocean side of the sidewalk, we observed naupaka (*Scaevola taccada*), pohuehue (*Ipomoea pes-caprae*), as well as some trees. The *mauka* side vegetation mostly consists of lawns of common grass including carpet grass (*Axonopus fissifolius*), St. Augustine (*Stenotaphrum secundatum*), and zoysia grass (*Zoysia matrella*), interspersed with ornamental plants. The survey area is maintained as a landscape, with no leaf litter or plant debris present.



Figure 5. Typical vegetation present in the survey area.

Flora

A botanical (flora) listing with approximate relative abundance for all plant taxa recorded during the August 2024 survey is presented in Table 1. Entries are arranged alphabetically under family names and include scientific name, common name, status (i.e., native or non-native; see key at end of table), and a relative abundance value in survey area. "Status" reflects the state-wide distribution of the species.

In all, we recorded a total of 70 species of vascular plants: three ferns, and 67 species of angiosperms (flowering plants). Native taxa comprise seven species: one endemic (just found on the Hawaiian Islands) and six indigenous (native, but also distributed elsewhere in the Pacific), and represent 10% of the total species

observed. Three species (4%) are early Polynesian introductions (so-called "canoe plant"). The remaining 60 species (86%) are plants introduced to the Hawaiian Islands after 1778, including 38 naturalized species (i.e., grow naturally in the wild), and 22 ornamentals.

The endemic species recorded (*ʻākia* or *Wikstroemia uva-ursi*) and three indigenous species (*hala* [*Pandanus tectorius*], *hau* [*Talipariti tiliaceum*], *ʻilima* [*Sida fallax*]) are all planted as part of the landscaped vegetation. The other three indigenous species (n*aupaka*, *pohuehue,* and *milo* [*Thespesia populnea*]) appear to grow naturally on the beach side of the sidewalk, but are as well more likely plantings. Early Polynesian introductions recorded include coconut or *niu* (*Cocos nucifera*), *ti* (*Cordyline fruticosa*), and *ʻihiʻai* (*Oxalis corniculata*). All of the native plants are common across the Hawaiian Islands.

Table 1. Plants observed in the survey area at Honokōwai Beach, West Maui.

Species listed by family	Common name	Status	Abundance	Notes
PTERIDOPHYTES - FERNS & FERN ALLIES				
NEPHROLEPIDACEAE				
Nephrolepis brownii (Desv.) Hovenkamp & Miyam.	sword fern	Nat	U	
POLYPODIACEAE				
Microsorum grossum (Langsd. & Fisch.) S.B.Andrews	*laua'e*	Nat	U	
PTERIDACEAE				
Pteris vittata L.	ladder brake	Nat	U	
FLOWERING PLANTS MONOCOTS				
ARACEAE				
Epipremnum pinnatum (L.) Engl.	pothos	Nat	U	
ARECACEAE				
Cocos nucifera L.	coconut palm, *niu*	**Pol**	O	
Dypsis lutescens (H. Wendl.) Beentje & J. Dransfield	areca palm	Orn	R	
Adonidia merrillii (Becc.) Becc.	Manila palm	Orn	U	
ASPARAGACEAE				
Dracaena marginata Lam.	money tree	Orn	R	
Dracaena reflexa Lam.	---	Orn	R	

Table 1 (continued).

Cordyline fruticosa (L.) A. Chev.	ti; *kī*	**Pol**	U
Cordyline fruticosa cult.	ti	Orn	R
COMMELINACEAE			
Tradescantia spathacea Sw.	oyster plant	Orn	R
CYPERACEAE			
Cyperus gracilis R. Br.	McCoy grass	Nat	C
Cyperus mindorensis (Steud.) Huygh	kyllinga; *kili'o'opu*	Nat	U
Eleocharis radicans (Poir.) Kunth	spikerush	Nat	U
LILIACEAE			
Crinum asiaticum L.	giant lily	Nat	U
Ophiopogon japonicus (L. f.) Ker Gawl.	mondo grass	Orn	U
PANDANACEAE			
Pandanus tectorius S. Parkinson ex Z	*hala*	**Ind**	U
POACEAE (GRAMINEAE)			
Axonopus fissifolius (Raddi) Kuhlm.	nrw-lf carpetgrass	Nat	A
Eleusine indica (L.) Gaertn.	wiregrass	Nat	U
Paspalum conjugatum Bergius	Hilo grass	Nat	C
Stenotaphrum secundatum (Walter) Kuntze	St. Augustine grass	Nat	A
Eragrostis amabilis (L.) Wight & Arnott	Japanese lovegrass	Nat	U
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	Nat	U
Zoysia matrella var. *pacifica* Goudswaard	zoysia grass	Orn	A
STRELITZIACEAE			
Ravenala madagascariensis Sonn.	traveler's palm	Orn	R
Strelitzia reginae Drylander	bird-of-paradise	Orn	U
ZINGIBERACEAE			
Alpinia zerumbet (Pers.) B.L. Burtt & R.M. Smith	shell ginger	Orn	R
	FLOWERING PLANTS		
	EUDICOTS		
APOCYNACEAE			
Nerium oleander L.	oleander	Orn	U
Plumeria obtusa L.	Singapore plumeria	Orn	O
Plumeria pudica Jacq.	---	Orn	U
ARALIACEAE			
Hydrocotyle bowlesioides Mathias & Constance	marsh pennywort	Nat	R

Table 1 (continued).

ASTERACEAE (COMPOSITAE)				
Cyanthillium cinereum (L.) H. Rob.	little ironweed	Nat	U	
Eclipta prostrata (L.) L.	false daisy	Nat	R	
Emilia sonchifolia (L.) DC.	Flora's paintbrush	Nat	U	
Pluchea carolinensis (Jacq.) G. Don	sourbush	Nat	U	
Sphagneticola trilobata L.	wedelia	Nat	U	
Sonchus oleraceus L.	sow thistle	Nat	R	
Synedrella nodiflora (L.) Gaertn.	nodeweed	Nat	U	
Youngia japonica (L.) DC.	Oriental hawksbeard	Nat	R	
BALSAMINACEAE				
Impatiens walleriana Hook .f.	snapweed	Nat	R	
CARYOPHYLLACEAE				
Drymaria cordata (L.) Willd. ex Roem.	*pipili*	Nat	R	<1>
COMBRETACEAE				
Terminalia catappa L.	tropical almond	Nat	U	
Clusia rosea N. Jacq.	autograph tree	Nat	R	
CONVOLVULACEAE				
Ipomoea pes-caprae (L.) R.Br.	*pohuehue*, beach morning glory	**Ind**	U	
EUPHORBIACEAE				
Codiaeum variegatum (L.) Blume	croton	Orn	O	
Euphorbia hirta L.	garden spurge	Nat	U	
Euphorbia prostrata Aiton	prostrate spurge	Nat	U	
FABACEAE				
Desmodium incanum DC.	Spanish clover	Nat	R	
Indigofera hendicaphyla Jacq.	creeping indigo	Nat	U	
Albizia saman (Jacq.) F. Muell.	monkeypod	Nat	R	
GOODENIACEAE				
Scaevola taccada (Gaertn.) Roxb.	*naupaka kahakai*	**Ind**	A	
MALVACEAE				
Hibiscus rosa-sinensis L.	Chinese hibiscus cult.	Orn	C	
Talipariti tiliaceum (L.) Fryxell	*hau*	**Ind**	A	
Sida fallax Walp.	*'ilima*	**Ind**	U	
Thespesia populnea (L.) Sol. ex Corrêa	*milo*	**Ind**	O	
MORACEAE				
Ficus microcarpa var. *crassifolia* (W.C.Shieh) J.C.Liao	wax ficus	Orn	O	
NYCTAGINACEAE				
Boerhavia coccinea Mill.	false *alena*	Nat	R	
Bougainvillea sp.	bougainvillea	Orn	R	<1>
OXALIDACEAE				
Oxalis corniculata L.	*'ihi'ai*	**Pol**	U	
PASSIFLORACEAE				
Passiflora edulis Sims	passion fruit	Nat	R	

Table 1 (continued).

PHYLLANTHACEAE			
Phyllanthus debilis Klein ex Willd.	*niruri*	Nat	U
POLYGONACEAE			
Coccoloba uvifera (L.) L.	sea grape	Orn	O
PORTULACACEAE			
Portulaca oleracea L.	pigweed	Nat	U
ROSACEAE			
Rhaphiolepis indica (L.) Lindl.	Indian hawthorn	Orn	U
URTICACEAE			
Pilea microphylla (L.) Lieb.	artillery plant	Nat	U
RUBIACEAE			
Ixora coccinea L.	ixora	Orn	R
Ixora sp.	ixora	Orn	R
THYMELAEACEAE			
Wikstroemia uva-ursi A.Gray	*ʻākia*	**End**	R
VERBENACEAE			
Duranta erecta L.	golden dewdrop	Orn	U

Legend to Table 1.

STATUS = distributional status for the Hawaiian Islands:

End - endemic; native uniquely to the Hawaiian Islands.

Ind - indigenous; native to Hawai'i, but not unique to the Hawaiian Islands.

Nat - naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of the Cook Expedition in 1778, and well-established outside of cultivation.

Orn - exotic, ornamental or cultivated; plant not naturalized (not well established outside of cultivation).

Table 1 (continued).

Pol - Polynesian introduction before 1778.

ABUNDANCE = occurrence ratings for plants by area:

R – Rare	seen in only one or perhaps two locations.
U - Uncommon	seen at most in several locations
O - Occasional	seen with some regularity
C - Common	observed numerous times during the survey
A - Abundant	found in large numbers; may be locally dominant.

NOTES:

<1> - Plant observed lacking fruit or flowers; identification uncertain.

Fauna

Aquatic Fauna

Table 2 is a listing of aquatic species identified in Honokōwai Stream. The table includes observations of species in the stream made by *AECOS* biologist G. López on August 6, 2024. Fishes observed include mosquitofish (*Gambusia affinis*), mullet (*Mugil cephalus*), tilapia (*Oreochromis mossambicus* and *Sarotherodon melanotheron*), *and* Hawaiian flagtail or *'aholehole (Kuhlia xenura*), which are common species in this type of environment.

Table 2. Aquatic species observed in Honokōwai Stream.

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Status
	VERTEBRATES	
CHORDATA, TELEOSTEI, MUGILIFORMES, MUGILIDAE		
Mugil cephalus L.	*'ama'ama*, striped mullet	**Ind**
CICHLIFORMES, CICHLIDAE		
Oreochromis mossambicus Peters	Mozambique tilapia	Nat
Sarotherodon melanotheron Rüppell	blackchin tilapia	Nat
CENTRARCHIFORMES, KUHLIIDAE		
Kuhlia xenura Jordan and Gilbert	*aholehole*, Hawaiian flagtail	**End**
CYPRINODONTIFORMES POECILIIDAE		
Gambusia affinis Baird & Girard	mosquitofish	Nat

Legend to Table 2.

STATUS:

Nat – naturalized – a species introduced to Hawai'i intentionally or accidentally.

Ind - indigenous. A native species also found elsewhere in the Pacific

End - endemic - A native species found only in the Hawaiian Islands

Avian Fauna

The birds observed during the survey are listed in Table 3. Three species were recorded from a single point-count station within the survey area. During the 30-minute waterbird count at the *muliwai* of Honokōwai Stream, one waterbird species was recorded. Including four species not counted at the 8-minute point-count station. Of the species observed, only the Black-crowned Night-Heron or *ʻaukuʻu* (*Nycticorax nycticorax*) is indigenous. The remainder are common, alien species introduced to the Hawaiian Islands.

Table 3. Avian species detected within the survey area at Honokōwai Beach.

Common Name	ORDER FAMILY *Species*	Status
	COLUMBIFORMES	
	COLUMBIDAE - Pigeons & Doves	
Rock Pigeon	*Columba livia*	A †
Zebra Dove	*Geopelia striata*	A †
	PELECANIFORMES	
	ARDEIDAE - Herons, Bitterns & Allies	
Black-crowned Night Heron	*Nycticorax nycticorax hoactli*	**I**
	PASSERIFORMES	
	ESTRILDIDAE	
African Silverbill	*Lonchura cantans*	A †
	PASSERIDAE	
House Sparrow	*Passer domesticus*	A †
	STURNIDAE - Starlings	
Common Myna	*Acridotheres tristis*	A
	FRINGILLIDAE - Fringilline and Cardueline Finches & Allies	
House Finch	*Haemorhous mexicanus*	A
	THRAUPIDAE - Tanagers	
Red-crested Cardinal	*Paroaria coronata*	A

† = Incidental observation, observed outside of the timed count.

Table 3(continued).

Legend to Table 3.

Status		
	A	Alien – introduced by humans, naturalized.
	I	Indigenous - native but not unique to the Hawaiian Islands; nests in the Hawaiian Islands and elsewhere.



Figure 6. Monk seal (*Neomonachus schauinslandi*) resting on Honokōwai Beach (circled in red).

Discussion and Recommendations

Recommendations included below are partly based on U.S. Fish and Wildlife Service, "Avoidance and Minimization Measures" (USFWS-PIFWO, 2022). Implementation of the recommendations (provided below as bulleted items) by the Project contractor will minimize impacts to listed species to the maximum extent practicable.

Floral Resources

Although scattered and sparse, occurrences of native flora are present within the survey area. These plants are all common species, and their respective populations are more abundant outside of the survey area. Indeed, moist are planted into the landscaping. No plant proposed or listed as a threatened or endangered species as set forth in the Endangered Species Act of 1973 as amended (USFWS, n.d.-b) were seen in the survey area. For plants, state listing follows the federal listing (HDLNR, 1998).

Fauna Resources

Aquatic Fauna

Within the Project area, Honokōwai Stream may not provide ideal habitat for native amphidromous animals because of the beach berm that prevents continuous stream flow from reaching the ocean. However, this stream reach may serve as a passageway to more suitable stream environments upstream. Additionally, the presence of the mullet and ʻ*aholehole* indicate that a surface connection from the stream to the ocean exists on occasion. Juveniles of these species reside in estuaries and adults can be found in nearshore waters. Project work should be planned to protect the existing water quality.

- Construction BMPs for work in/near aquatic environments should be incorporated into the Project plan to minimize the degradation of water quality and impacts to fish and wildlife resources.

Waterbirds

Protected Hawaiian waterbirds on Maui include the endemic Hawaiian Duck, endemic Hawaiian Coot, the Hawaiian endemic subspecies of Common Gallinule, and the Hawaiian endemic subspecies of Black-necked Stilt. These waterbird species are protected under both state and federal endangered species statutes (HDLNR, 2015; USFWS, nd-a). Black-crowned Night Heron is an indigenous water-obligate species with healthy populations on most Hawaiian Islands and protected under the federal Migratory Bird Treaty Act. Although technically not a waterbird, Hawaiian Goose or *nēnē* (*Branta sandwichensis*) is a federally-listed threatened and state-listed endangered species on Maui.

The lack of vegetation within Honokōwai Stream does not provide adequate nesting or forage habitat for Hawaiian waterbird species. Therefore, protected Hawaiian waterbirds are unlikely to occur in the Project area. If any endangered

waterbirds are observed within the work area, the following BMPs are recommended to minimize or avoid impacts to Hawaiian waterbird species:

- Post and implement reduced speed limits and inform project personnel and contractors about the presence of endangered species on-site or nearby.

- If an endangered waterbird enters an active construction area, cease all construction activity. Work may resume after the individual leaves the area on its own volition.

- Avoid creating surface water features (puddles, etc.) after grading and grubbing. Surface water should be removed to avoid creating a nuisance attractant.

- A qualified biologist should conduct a preconstruction survey for endangered waterbird nests immediately prior to construction activity near the water feature. If a nest is found, contact USFWS immediately. Establish and maintain a 100-foot buffer around all active nests and/or broods until the chicks/ducklings have fledged. Do not conduct potentially disruptive activities or habitat alteration within this buffer.

Seabirds

Given the Project location in a coastal environment, protected night-flying Hawaiian seabirds are likely to overfly or otherwise utilize the parcel. Protected seabirds in Hawai‘i include: Wedge-tailed Shearwater (*Ardenna pacifica*), Hawaiian Petrel (*Pterodroma sandwichensis*), Newell's Shearwater (*Puffinus newelli*), and Band-rumped Storm-Petrel (*Hydrobates castro*). Three of the species (Hawaiian Petrel, Newell's Shearwater, and Band-rumped Storm-petrel) nest at high elevations in the mountains, precluding nesting disturbance by the Project. However, in the summer and fall, nocturnally flying seabirds (especially fledglings) transiting to the sea from inland locations can become disoriented by exterior lighting. When disoriented, a seabird can collide with man-made structures or the ground. If not killed outright, a dazed or injured bird is an easy target of opportunity for feral mammals (Podolsky et al., 1998; Ainley et al., 2001; Day et al., 2003). The primary cause of mortality in nesting seabirds in Hawai‘i is predation by alien mammalian species at the nesting colonies (Ainley et al., 2001). Collision with man-made structures is considered the second most significant cause of mortality of these seabirds in Hawai‘i.

- The Project can minimize or avoid risks to protected night-flying seabirds by not conducting night-time construction and ensuring that all outdoor lighting is fully shielded (dark sky compliant; see HDLNR-DOFAW, 2016).

No nests, burrows, or other sign (feathers, eggs, scat) of Wedge-tailed Shearwater were observed at the parcel, and it appears that no seabirds have recruited to the site (the *naupaka* along the back of the beach would be typical habitat). Project construction activities at the parcel should not adversely affect Wedge-tailed Shearwater nests, as none is present on-site. As Wedge-tailed Shearwater typically return to their natal colonies, recruitment away from such locations is limited. Despite a low probability, if a nest is found during construction, work in the vicinity should be suspended and USFWS notified. USFWS provides the following recommendations:

- If Wedge-tailed Shearwater nest within a Project area and construction would cause ground disturbance, time project construction to occur outside of the breeding season (March through November; USFWS-PIFWO, 2023).

- Use opaque shields on outdoor lighting, positioned so that the bulb is only visible from below and the light source cannot be seen from the beach. In addition, use motion sensor controls so that lights are off when the area is not in use (USFWS-PIFWO, 2023).

Terrestrial Mammalian Resources

Hawaiian Hoary Bat

It is possible that the native Hawaiian hoary bat uses resources within the Project vicinity. The principal potential impact of the Project on bats would occur if trees are removed. This species of bat uses multiple roosts within a home territory (Bonaccorso, 2015), so the disturbance associated with removal of any particular tree would be minimal. However, an exception occurs during the bat pupping season, when a female bat carrying a pup may be unable to rapidly vacate a roost tree that is being felled; or an unattended pup is unable to flee a tree that is being felled.

- Potential adverse impacts to Hawaiian hoary bat can be avoided or minimized by not clearing woody vegetation taller than 4.6 m (15 ft) between June 1 and September 15, the bat pupping season, and by avoiding the use of barbed wire for fencing (USFWS-PIFWO, 2023).

Marine Resources

Hawaiian Monk Seal

The Hawaiian monk seal (*Monachus schauinslandi*) was first listed as an endangered species pursuant to the Endangered Species Act (ESA) on November 23, 1976 (41 FR 51612) and remains listed as endangered. In that same year, the Hawaiian monk seal population was designated as "depleted" under the Marine Mammal Protection Act (MMPA).

Critical habitat for Hawaiian monk seals has been designated (NOAA-NMFS, 2015) and includes the seafloor and marine habitat to 10 m above the seafloor from the 200 m depth contour through the shoreline and extending into terrestrial habitat 5 m inland from the shoreline between identified boundary points. These terrestrial boundary points define preferred pupping areas and significant haul-out areas. (NOAA-NMFS, 2015). The shoreline off the Project site falls within assigned boundary points MA61 and MA62: Punalau Beach through to Mala Wharf, and therefore is designated monk seal terrestrial critical habitat. The waters offshore of the Project area are designated monk seal marine critical habitat.

The majority of Hawaiian monk seal sighting information collected in the main Hawaiian Islands is reported by the general public and, therefore, highly biased by location and reporting effort. The only truly systematic monk seal count data available for the main Hawaiian Islands are from aerial surveys conducted by the Pacific Islands Fisheries Science Center (PIFSC) in 2000, 2001, and 2008 (Baker and Johanos 2004, PIFSC unpublished data). No Hawaiian monk seals were sighted in the area covered by this report during these aerial surveys.

Reports by the general public, which are non-systematic and not representative of overall seal use of main Hawaiian Island shorelines, have been collected in the main Hawaiian Islands since the early 1980s. For the purposes of this report, a sighting is defined as a calendar day during which an individual seal is documented as present at a specific location. There have been 159 reports of monk seals at Honokōwai Beach from 2014 to 2023 (Table 4). Of the total sightings, 115 reports can be attributed to four uniquely identifiable seals (Table 5). No monk seal births have been documented at Honokōwai Beach.

Table 4. Reported Hawaiian monk seal sightings at Honokōwai Beach, Maui (2014 to 2023).

Location	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Honokōwai Beach	0	1	0	2	2	13	11	9	0	0	**3**

Table 5. Number of sightings of uniquely identified Hawaiian monk seals reported at Honokōwai Beach, on the island of Maui (2014 to 2023).

Seal ID	Seal Sex	Sightings	Status
R308	Female	75	Alive 2024
R404	Male	36	Alive 2024
RP26	Male	1	Alive 2024
RS06	Male	3	Alive 2024
Total		**115**	

Sea turtles

The distinct population segment (DPS) of green sea turtle that occurs in Hawai'i is federally-listed as a threatened species (USFWS and NOAA-NMFS, 2016; USFWS, 2018) and as a threatened subspecies (*Chelonia mydas agassizi*) under Hawai'i regulations (DLNR, 2014).

Threats to the green sea turtle in Hawai'i include: disease and parasites, accidental fishing take, boat collisions, entanglement in marine debris, loss of foraging habitat to development, and ingestion of marine debris. Throughout the global range of green sea turtle, nesting and foraging habitats are being altered and destroyed by coastal development, beach armoring, beachfront lighting, vehicular/pedestrian traffic, invasive species, and pollution from discharges and

runoff (NOAA & USFWS, 2007a, 2007b). Adult green sea turtles forage in shallow nearshore areas and coral reefs. Contamination from effluent discharges and runoff has degraded these environments, and invasive species may reduce native algae species preferred by green sea turtles or could exacerbate susceptibility to, or development of disease (NOAA-NMFS and USFWS, 2007a). Fibropapillomatosis, a disease characterized by the presence of internal and/or external tumors that may grow large enough to hamper swimming, vision, feeding, and potential escape from predators continues to be a major threat to green sea turtles. Extremely high incidence has been reported in Hawai'i, where affliction rates peaked at 47-69% in some turtle foraging areas (Murakawa et al., 2000).

Hawksbill sea turtle is distributed across the Pacific, Indian, and Atlantic oceans. Hawksbill sea turtle is much less common in the Hawaiian Islands than green sea turtle and is known to nest only in the southern reaches of the state (NOAA-PIFSC, 2010). Hawksbill sea turtle is federally-listed as endangered (USFWS, nd) and is also listed as an endangered subspecies (*Eretmochelys imbricata bissa*) under Hawai'i state regulations (HDLNR, 2014). Hawksbill sea turtle faces many of the same threats affecting green sea turtle (see above section; NOAA & USFWS, 2007b).

Impacts Assessment

The alternatives considered for the proposed restoration and preservation of Honokōwai Beach are: 1) beach nourishment, 2) beach maintenance, 3) beach stablization, and 4) no action (SEI, 2022).

Beach Nourishment: Beach nourishment is a one-time action that involves the addition of sand to increase beach width without placement of any structures to stabilize the sand. The sand would be placed along approximately 1,000 ft of shoreline between Honokōwai Stream mouth and Honokōwai Point. The beach nourishment alternative has the potential to cause local, short-term impacts. Because the source of this sand has not been determined, impacts on sourcing cannot be assessed.

- ***Impacts to Vegetation***

The presence or use of machinery on the beach and in the backshore area has the potential to result in damage to the existing vegetation. Transportation of construction equipment and construction activities could result in temporary direct physical disturbance to vegetation by trampling plant species. To minimize this impact, we recommend avoiding vegetated areas as much as possible. In the event that damage to the indigenous flora occurs, we suggest replanting with

species that naturally grow in this coastal area, such as *naupaka*, *pohuehue,* and *milo.*

- ***Impacts to Aquatic Fauna***

No impacts to aquatic fauna are anticipated with the beach nourishment alternative if the stream area is avoided.

- ***Impacts to Waterbirds and Seabirds***

There may be minor and temporary adverse effects to waterbirds and seabirds present in the Project area during construction. Effects to waterbird and seabird species during construction include potential disturbance from noise and human activity, as well as risk of direct mortality from ground disturbance and vehicle/construction equipment strikes. Night work, if necessary, could have an adverse effect on seabirds in the Project area. Illumination in the Project area would cause seabird behavior modification, such as altering their patterns of feeding, migrating, and predator avoidance. Visual inspections for nesting birds in the Project back shore should be conducted prior to construction. If found, appropriate buffers must be implemented.

- ***Impacts to Terrestrial Mammals***

Impacts of the Project on bats could occur only if trees are cleared. Potential adverse impacts to Hawaiian hoary bat can be avoided or minimized by not clearing woody vegetation taller than 4.6 m (15 ft) between June 1 and September 15, the bat pupping season, and by avoiding the use of barbed wire for fencing (USFWS-PIFWO, 2023).

- ***Impacts to Threatened/Endangered Species/Critical Habitat***

With the beach nourishment alternative, there could be minor, localized and short-term adverse impacts to ESA-listed marine species and associated (monk seal) critical habitat present in the Project area. Potential effects during the construction include potential disturbance from noise and human activity, and an increase in nearshore turbidity. Night work, if necessary, would illuminate the beach. This could result in localized adverse impacts to listed sea turtles by modifying behavior, such as nesting.

The beach nourishment alternative would result in temporary beneficial impacts to monk seal and sea turtle haul out with the availability of an increased beach area.

Beach Maintenance: Beach maintenance is an action consisting of an initial beach nourishment project with periodic renourishment at specified intervals. Impacts of the initial nourishment effort would be identical to the beach

nourishment alternative described above. The beach maintenance alternative would be expected to result in similar potential impacts to the beach nourishment alternative; however, the impacts would be repeated. Repeated restoration of the beach profile would involve placing sand into the intertidal and subtidal areas multiple times over a period of 50 years. The amount of beach area available for monk seals and sea turtles would fluctuate between each renourishment interval. This could result in adverse long-term impacts to behavior since the amount of beach area available for haul-out would fluctuate over the 50-year design life of the Project. On the other hand, a one-time nourishment without maintenance could result in an improved beach environment for a period of 10 years, or less.

Beach Stablization: Beach Stabilization is a single action involving the addition of sand with modification of existing structures or the installation of new structures (e.g., groins) to reduce beach loss. Groins are engineered structures that are constructed perpendicular to the shoreline to block the longshore transport of sediment (i.e., sand). Beach stabilization would utilize a combination of T-head groins and L-head groins to decrease and reorient the amount of wave energy reaching the beach and create artificial littoral cells to stabilize the sand along the shore.

This alternative would result in similar potential impacts to the beach nourishment alternative; with additional impacts related to in-water work of the groins. The localized impacts from construction activity of the groins could potentially cause in-water disturbance to monk seals and sea turtles. With the installation of groins, the amount of beach area is anticipated to increase and stabilize. This could result in a beneficial long-term effect to monk seals and sea turtles since the amount of area available for haul-out would not fluctuate over the 50-year design life of the Project.

No Action: Under the No Action Alternative, the Project would not be implemented. There would be no change related to vegetation or fauna (including endangered avian and marine species) from the current condition under the No Action Alternative.

References Cited

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, in: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna. Studies in Avian Biology No. 22*. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. Pp. 108-123.

Baker JD, and Johanos TC. 2004. Abundance of the Hawaiian monk seal in the main Hawaiian Islands. Biological Conservation 116:103-110.

Chesser, R. T., S. M. Billerman, K. J. Burns, C. Cicero, J. L. Dunn, B.E. Hernández-Baños, R. A. Jiménez, A. W. Kratter, N. A. Mason, P. C. Rassmusen, J. V. Remsen Jr., D. F. Stotz, and K. Winker. 2022. *Check-list of North American Birds*. American Ornithological Society. Available online at URL: http://checklist.aou.org/taxa. last retrieved August 26, 2024.

Chesser, R. T., S. M. Billerman, K. J. Burns, C. Cicero, J. L. Dunn, B.E. Hernández-Baños, R. A. Jiménez, A. W. Kratter, N. A. Mason, P. C. Rassmusen, J. V. Remsen Jr., D. and K. Winker. 2023. Sixty-fourth supplement to the American Ornithological Society's Check-list of North American Birds. *Ornithology*, 140: 1-11.

Day, R. H., B. Cooper, and T. C. Telfer. 2003. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. *The Auk,* 120: 669-679.

Hawai'i Department of Land and Natural Resources (HDLNR). 1998. Indigenous Wildlife, Endangered And Threatened Wildlife And Plants, And Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

Hawai'i Department of Land and Natural Resources (HDLNR). 2014. Hawai'i Administrative Rules, Title 13, Department of Land and Natural Resources, Subtitle 4 Fisheries, Part V Protected Marine Fisheries Resources, Chapter 95, Rules Regulating the Taking and Selling of Certain Marine Resources. May 1, 2014. 16 pp.

Hawai'i Department of Land and Natural Resources (HDLNR). 2015. Hawai'i Administrative Rules, Title 13, Department of Land and Natural Resources, Subtitle 5 Forestry and Wildlife, Part 2 Wildlife, Chapter 124,

Indigenous Wildlife, Endangered and Threatened Wildlife, Injurious Wildlife, Introduced Wild Birds, and Introduced Wildlife. February 27, 2015. 16 pp.

Hawai'i Department of Land and Natural Resources-Division of Forestry and Wildlife (HDLNR-DOFAW). 2016. Wildlife Lighting. PDF available at URL: http://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf; last retrieved August 26, 2024.

Imada, C. T. 2019. Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). *Bishop Museum Tech. Rept. 69*. 209 pp.

Integrated Taxonomic Information System (ITIS). 2022. ITIS. Available online at URL: https://www.itis.gov/; last visited on August 26, 2024.

Johanos TC. 2023a. Hawaiian Monk Seal Research Program Hawaiian monk seal survey data collected in the main Hawaiian Islands, 1983–2023. U.S. National Oceanographic Data Center. https://www.fisheries.noaa.gov/inport/item/5676

Johanos TC. 2023b. Hawaiian Monk Seal Research Program Hawaiian monk seal master identification records (annual) collected in the Hawaiian Archipelago, 1962–2023. U.S. National Oceanographic Data Center. https://www.fisheries.noaa.gov/inport/item/12939.

Johanos TC. 2023c. Hawaiian Monk Seal Research Program Hawaiian monk seal master identification records (seal) collected in the Hawaiian Archipelago, 1962–2023. U.S. National Oceanographic Data Center. https://www.fisheries.noaa.gov/inport/item/5677.

National Oceanic and Atmospheric Administration–National Marine Fisheries Service (NOAA-NMFS). 2015. Endangered and Threatened Species: Final Rulemaking To Revise Critical Habitat for Hawaiian Monk Seals. *Federal Register*, 80 (162; August 21, 2015), pp. 50925-50988. Available online at URL: https://www.federalregister.gov/documents/2015/08/21/2015-20617/endangered-and-threatened-species-final-rulemaking-to-revise-critical-habitat-for-hawaiian-monk; last retrieved September 17, 2024.

National Oceanic and Atmospheric Administration–National Marine Fisheries Service (NOAA-NMFS). 2023. Draft Biological Report for the Designation of Marine Critical Habitat for Six Distinct Population Segments of the Green Turtle, *Chelonia mydas*, pp. 156-157. Available online at URL: https://www.fisheries.noaa.gov/s3/2023-07/DraftGreenTurtleCH-BiologicalReport-June2023.pdf; last retrieved September 6, 2024.

National Oceanic and Atmospheric Administration–Pacific Islands Fisheries Science Center (NOAA-PIFSC). 2010. Draft map guide to marine turtle nesting and basking in the Hawaiian Islands, p. 29.

National Oceanic and Atmospheric Administration and U.S. Fish and Wildlife Service (NOAA & USFWS). 2007a. Green Sea Turtle (*Chelonia mydas*). 5-Year Review: Summary and Evaluation. Available online at URL: https://repository.library.noaa.gov/view/noaa/17044; last retrieved September 6, 2024.

National Oceanic and Atmospheric Administration and U.S. Fish and Wildlife Service (NOAA & USFWS). 2007b. Hawksbill Sea Turtle (Eretmochelys imbricata). 5-Year Review. Available online at URL: https://repository.library.noaa.gov/view/noaa/17041; last retrieved January 9, 2024.

Parham, J. E., G. R. Higashi, E. K. Lapp, D. G. K. Kuamoʻo, R. T. Nishimoto, S. Hau, J. M. Fitzsimmons, D. A. Polhemus and W. S. Devick. 2008. Atlas of Hawaiian Watersheds and their Aquatic Resources. Island of Maui. Bishop Museum and Division of Aquatic Resources. 8 pp.

Podolsky, R., D. G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kauaʻi. *Colonial Waterbirds*, 21: 20-34.

Sea Engineering, Inc. 2022. Environmental Impact Statement Preparation Notice (EISPN): Hoʻāla Honokōwai. Prep. for West Maui Resort Partners, L.P. 74 pp.

Smith, T. D. no date (nd). Fort Derussy sand backpassing. U.S. Army Corps of Engineers, Honolulu District and State of Hawaii Department of Land and Natural Resources. https://rsm.usace.army.mil/hawaii/documents/d2p/workshop/4c_Fort_DeRussy_Backpass02.pdf. Last retrieved October 16, 2024.

U.S. Fish & Wildlife Service (USFWS). 2012. Department of the Interior, Fish and Wildlife Service, 50 CFR Part 17, endangered and threatened wildlife and plants; endangered status for 23 species on Oahu and designation of critical habitat for 124 species. *Federal Register*, 77 (181; Tuesday, September 18, 2012): 57648-57862.

U.S. Fish & Wildlife Service (USFWS). 2022. Endangered Species. List of species available online at URL: https://www.fws.gov/endangered/index.html; last accessed on August 26, 2024.

U.S. Fish & Wildlife Service (USFWS). Undated website (nd). Critical Habitat Portal. Available online at URL: https://ecos.fws.gov/ecp/report/table/critical-habitat.html. Last accessed on September 17, 2024.

U.S. Fish & Wildlife Service-Pacific Islands Fish and Wildlife Office (USFWS-PIFWO). 2022. FINAL Avoidance and Minimization Measures (AMMs). Revised April 2022. Available online at URL: fws.gov/sites/default/files/documents/Animal%20Avoidance%20and%20Minimization%20Measures-April%202022.pdf; last retrieved August 26, 2024.

U.S. Geological Survey (USGS). Undated website (nd). National Hydrography Dataset (NHD). Available online at URL: https://apps.nationalmap.gov/; last retrieved September 3, 2024.

Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai'i: Volume I and II*. Bishop Museum Special Publication 83. University of Hawai'i Press. 1853 pp.

Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1999. *Supplement to the Manual of the flowering plants of Hawai'i*, pp. 1855-1918. *In:* Wagner, W. L., D. R. Herbst, and S. H. Sohmer, Manual of the flowering plants of Hawai'i. Revised edition. 2 vols. University of Hawaii Press and B.P. Bishop Museum.

Wilson, D. E., and D. M. Reeder (editors), 2005. *Mammal species of the world: a taxonomic and geographic reference.* 3rd edition. 2 vols. John Hopkins University Press. Baltimore, Maryland. 2142 pp.

Yamamoto, M. N. and A. W. Tagawa. 2000. *Hawai'i's Native and Exotic Freshwater Animals*. Mutual Publishing, Honolulu. 200 pp