Final ~~Draft~~ Environmental Impact Statement

Kā'anapali Beach Restoration and Berm Enhancement

December 2021 ~~June 2020~~

Prepared for:
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KĀ‘ANAPALI BEACH RESTORATION
and
BERM ENHANCEMENT

Final Environmental Impact Statement

Proposing Agency:

DEPARTMENT OF LAND AND NATURAL RESOURCES

This document and all ancillary documents were prepared under the signatory’s direction or supervision, and the information submitted, to the best of the signatory’s knowledge, fully addresses document content requirements as set forth in Chapter 343, Hawai‘i Revised Statutes, and Title 11, Chapter 200, Hawai‘i Administrative Rules, as applicable.

_______________________________ October 27, 2021____________

Suzanne D. Case, Chairperson **Date**
Board of Land and Natural Resources

Accepting Authority:

GOVERNOR, STATE OF HAWAI‘I

Prepared by:

SEA ENGINEERING, Inc.

October 2021

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LIST OF ACRONYMS AND ABREVIATIONS

AMAP	Applicable Monitoring and Assessment Plan
BMP	Best Management Practices
BMPP	Best Management Practices Plan
CGG	(University of Hawaiʻi) Coastal Geology Group
cf	cubic feet
cy	cubic yard
CWA	Clean Water Act
CZM	Coastal Zone Management
DA	Department of the Army
DAR	Department of Aquatic Resources
DEIS	Draft Environmental Impact Statement
DLNR	Department of Land and Natural Resources
DOBOR	Department of Boating and Ocean Recreation
DOH-CWB	Department of Health – Clean Water Branch
EISPN	Environmental Impact Statement Preparation Notice
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FIRM	Flood Insurance Rate Map
ft	foot/feet
HAR	Hawaiʻi Administrative Rules
HDPE	High Density Polyethylen
HLC	Hanakaʻōʻō Littoral Cell
HRS	Hawaiʻi Revised Statutes
in	inch
KLC	Kāʻanapali Littoral Cell
KOA	Kāʻanapali Operations Association, Inc.
mgd	Million Gallons Per Day
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
MSL	Mean Sea Level
NPDES	National Pollutant Discharge Elimination System
OCCL	Office of Conservation and Coastal Lands
OEQC	Office of Environmental Quality Control
SEI	Sea Engineering, Inc.
SLR	Sea-level rise
SMA	Special Management Area
TMK	Tax Map Key
UHMWPE	Ultra-High-Molecular-Weight Polyethylene
USACE	United States Army Corps of Engineers

EXECUTIVE SUMMARY

Project:
Kāʻanapali Beach Restoration and Berm Enhancement

Approving Authority:
Governor, State of Hawaiʻi ~~Department of Land and Natural Resources~~

Proposing Organization:
Department of Land and Natural Resources
State of Hawaiʻi
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E-mail: cconger@seaengineering.com

Location
Kāʻanapali Beach, Maui, Hawaiʻi

Tax Map Keys:
Seaward of ~~Fronting~~ (2) 4-4-013:007, (2) 4-4-013:006, (2) 4-4-013:008, (2) 4-4-013:013, (2) 4-4-013:002, (2) 4-4-013:001, (2) 4-4-008:022, (2) 4-4-008:019, (2) 4-4-008:001, (2) 4-4-008:002, (2) 4-4-008:003, (2) 4-4-008:005

State Land Use District:
Conservation (Resource Subzone) – Sand Recovery and Beach Restoration

Maui County Zoning:
H-2 (Hotel) – Some Staging and Access to the Beach

Project Summary:
Kāʻanapali Beach has been negatively impacted by chronic erosion and extreme seasonal erosion over the previous four decades. The rate and severity of damage has accelerated likely due to sea level rise and recent record high water levels. Sand loss from the natural beach systems, or littoral

cells,~~Sand loss~~ is expected to continue and likely~~even~~ accelerate with sea level rise. The~~As an adaptation measure, the~~ beach may be conserved~~maintained~~ with ~~either~~ sand nourishment~~restoration,~~ or managed retreat or a combination of approaches, but managed retreat is a long-term action that does not address chronic beach loss happing now. ~~, or both.~~ Managed retreat is a multidecadal process, requiring years of planning, funding, and implementation. As a synergistic mid-term step in a much longer adaptation process~~. In the meantime~~, the beach can be restored~~maintained~~ through sand nourishment utilizing sound engineering design and best practices to ensure protection of the nearshore marine environment.

Beach restoration is a specific type of environmental restoration, focused on restoring coastal sandy habitat that extends across the terrestrial/marine boundary. In broad terms, environmental restoration is focused on the renewal of a damaged resource, typically after the resource has been damaged due to human interactions. Modern sea level rise is a result of human-induced global atmospheric and ocean warming. Changes in storm severity have also been attributed to climate change. Moreover, these phenomena are identified as key drivers in accelerating erosion rates in Hawaiʻi and globally. As such, beach restoration is an important and viable environmental restoration technique to be deployed as part of the suite options needed to adapt to long-term changes in climate, the ocean, and our shorelines.

The State of Hawaiʻi and the Kāʻanapali Operations Association, Inc. have developed a plan to ensure the~~ long-term~~ viability of this sandy coastal resource, which includes both beach restoration and berm enhancement. 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") (Figure 1). The proposed project is intended to mitigate the impacts of ~~coastal erosion and~~ rising water levels and coastal erosion, which are increasing with global sea level rise. ~~and increased storm severity in the tropics.~~

The project provides a nature-based adaptation solution that restores natural habitat and recreational resources while increasing coastal hazard mitigation and~~increases~~ protection for the Kāʻanapali Resort community as a mid-term approach while long-term adaptation options are developed.~~while restoring recreational resources and natural habitat.~~ Adding beach quality sand to the north and south littoral cells is a key action for restoring the beach back to its former width and volume~~. The project is intended to make~~making Kāʻanapali Beach more resilient to the impacts~~effects~~ of coastal~~seasonal~~ erosion and high wave overwash~~longer-term climate change~~.

The Hanakaʻōʻō Littoral Cell is suffering from a combination of chronic and episodic erosion, which has resulted in beach narrowing, shoreline recession, reductions in beach access, and damage to backshore infrastructure including the Kāʻanapali Beachwalk. The beach in this littoral cell is less seasonally dynamic than the beach in the Kāʻanapali Littoral Cell to the north; however, the long-term changes in beach location and width are ~~far~~ more per~~va~~sist~~v~~ent along this length of shoreline than in the Kāʻanapali Littoral Cell.~~.~~ The presently narrow beach, chronic erosion, and limited seasonal sand transport make this section of shoreline suitable for beach restoration. Beach restoration would include the addition of beach quality sand from the current beach face out to the former extent of the beach in the 1980s. This part of the~~The~~ proposed project would use approximately 50,000 cubic yards of highly~~beach~~ compatible marine carbonate sand to restore the beach to the approximate position shown in the 1988 aerial photograph. This would widen the dry beach by between 41 and 78 feet (Figure 2).

The Kāʻanapali Littoral Cell, between Hanakaʻōʻō Point and Puʻu Kekaʻa, experiences significant seasonal erosion with alternating predominant wave directions in summer and winter. Berm enhancement, or raising the elevation of the beach berm, would create a new reservoir of sand along the backshore (the upper, usually dry area of the beach) to augment the current sediment system with additional volume. This additional volume of highly compatible sand will ~~and~~ help offset temporary beach loss during the natural seasonal erosion cycles. Sand placed at the north end of the beach would be seasonally eroded during the winter months, while sand placed at the south end of the littoral cell, at Hanakaʻōʻō Point, would be released during summer months. Both berm enhancement areas would provide a buffer during extreme erosion events by increasing total beach sand volume within the broader littoral cell. This part of the~~The~~ proposed project would use approximately 25,000 cubic yards of sand to raise the beach berm elevation by 3.5 feet along most of~~within~~ the Kāʻanapali Littoral Cell (Figure 2). The berm enhancement area would extend from the vegetation in the backshore to the berm crest, at the mauka edge of the beach face.

A total of approximately 75,000 cubic yards of sand is needed for the proposed beach restoration and berm enhancement project, with 50,000 cubic yards and 25,000 cubic yards allocated to the Hanakaʻōʻō and Kāʻanapali littoral cells, respectively. The beach quality sand proposed for recovery~~would be recovered~~ from an 8.5-acre sand deposit is~~,~~ located from approximately 150 feet to nearly 800 feet seaward of Kāʻanapali Beach. This sand area,~~offshore of Puʻu Kekaʻa~~ in 28 to 56 feet water depth (Figure 2), is part of a much larger regional sand field fronting Kāʻanapali.

Sand compatibility between the recovery site and the active beach is one of the most important aspects of beach restoration. High compatibility helps to minimize the potential for negative water quality impacts from fine sediments associated with beach restoration, while maximizing the stability or equilibrium of the beach with typical wave conditions. Moreover, the offshore sand's similarity to the adjacent beach sand is likely a result of transport and loss from the active beach system, meaning this project is likely returning beach sand back to its beach of origin.

The proposed sand recovery method consists of a moored crane barge equipped with an environmental clamshell bucket, two sand transport barges, several tugboats, and two landing areas at opposite ends of the project area.

The crane barge would lift sand from the seafloor with the environmental clamshell bucket and place it onto two approximately 1,500 cubic yard capacity barges. Environmental clamshell buckets are designed to minimize water volume and maximize precision with each sand recovery scoop, which minimizes potential impacts to the surrounding environment. The sand transport barges would rotate between the sand recovery site and the off-loading sites. Once a sand transport barge is filled at the sand recovery site, it would be towed to the off-loading site by a tugboat, where the barge would be moored adjacent to an elevated trestle or floating bridge (Figure 3). The elevated trestle or floating bridge would extend from approximately 15 feet of water depth to shore. Sand would be transferred from the barge to shore along the bridge/trestle system using a methodology selected by the contractor. Land-based equipment would then transfer the sand from the shoreline, at the end of the elevated trestle or bridge, to the placement area. At the sand placement area, which would move each day as the project advances, bulldozers and crews would spread sand along the shore to meet the lines and grades of the design beach restoration plan and section and the berm enhancement plan and section. Sand would be placed over the existing beach and no excavation of the beach is planned with the proposed project.

During placement activities there would be heavy equipment ~~operated~~ operating on the beach at the sand transfer site and at the sand placement site. These areas would be treated as active construction sites and public access would be limited near the heavy machinery and sand loading and grading areas. The sand placement site would move progressively through the berm enhancement and beach restoration areas as sand is added to the beach. Sand would be mechanically hauled by dump trucks between the two transfer sites on the beach and the restoration areas on the berm and beach. During hauling operations, the transit corridor for the trucks would be cordoned off and assistants would be available along the full length of the haul route to facilitate public access to and from the shoreline. While~~During marine~~ sand transport barges are transiting~~delivery operations,~~ from the sand recovery barge to the off-loading sites, marine traffic and public access along the navigation route would be restricted. There would be approximately four rotations of barges between the recovery site and off-loading sites each day. There would also be restricted public access around the sand recovery barge and the offloading sites, to protect the public from potentially dangerous contact with the equipment and support materials.

Beach restoration ~~During construction, which~~ is expected to last approximately two months, including sand recovery, transfer, and placement activities, which are expected to take place at least 12 hours per day, seven days per week. The goal is to complete the project in the most efficient manner possible, thereby limiting the inconvenience to the general public and construction related impacts to the environment. The work is projected to take place during October, November, and part of December, minimizing overlap, as much as possible, with southern summer swell and northern winter swell environments.

Other forms of beach nourishment are also effective, have been utilized within the United States and on international coastlines, and may work at this location. Use of other means and methods for beach nourishment at Kā'anapali would be contingent on the feasibility of given site conditions and on receiving permits from the applicable Federal, State, and County agencies. An alternate sand recovery and transport technique is hydraulic dredging, where sand entrained in seawater as a slurry is delivered via a pipeline to the beach or the inshore waters directly adjacent to the beach. Additional methods include, but are not limited to, sand transfer in submerged pipelines to create submerged sand bars, mechanical placement on the beach through conveyor belts, and dune creation or restoration. Sand placed in nearshore~~Nearshore~~ and connected features are spread throughout the beach and inshore sand field by natural wave and current processes.

The State has developed extensive~~Extensive~~ best management practices~~ have been developed~~ through the environmental review process and consultation with natural resource management agencies to ensure that coral and other marine organisms and resources are protected throughout project construction. Identification of a beach compatible and suitable sand source is a critical element of the marine protection program. The sand selected for this project is a nearly ideal match to the native beach. The compatibility, in terms of the sand's physical characteristics and quality, between the proposed sand source and the beach exceeded all other sand sources investigated during this project. Moreover, high compatibility between restoration sand and native beach sand has been shown to result in faster equilibration and more natural response of the restored beach, as well as minimization of potential long-term negative impacts that may occur with beach restoration projects. In addition, the sand recovery site is nearby, which limits travel and sand transfer requirements.

The proposed project represents an effective and beneficial step in coastal adaptation to sea level rise. Beach restoration is a nature-based ecosystem restoration project that is designed to improve mid-term ecologic function, cultural and recreational resources, and coastal hazard mitigation. The beach may be restored in the mid-term with sand nourishment, while managed retreat is investigated as a long-term response and adaptation practice. Likely, the future of coastal management in Kāʻanapali, and Hawaiʻi as a whole, will require a combination of approaches including both of these and more. For now, managed retreat is a long-term action to be developed and implemented in the future, and beach restoration is an achievable target for early success in adaptive coastal management. Moreover, the character of the sand is very similar in nature to the native sand on Kaanapali beach, which typically results in the restored beach behaving much like the native beach.

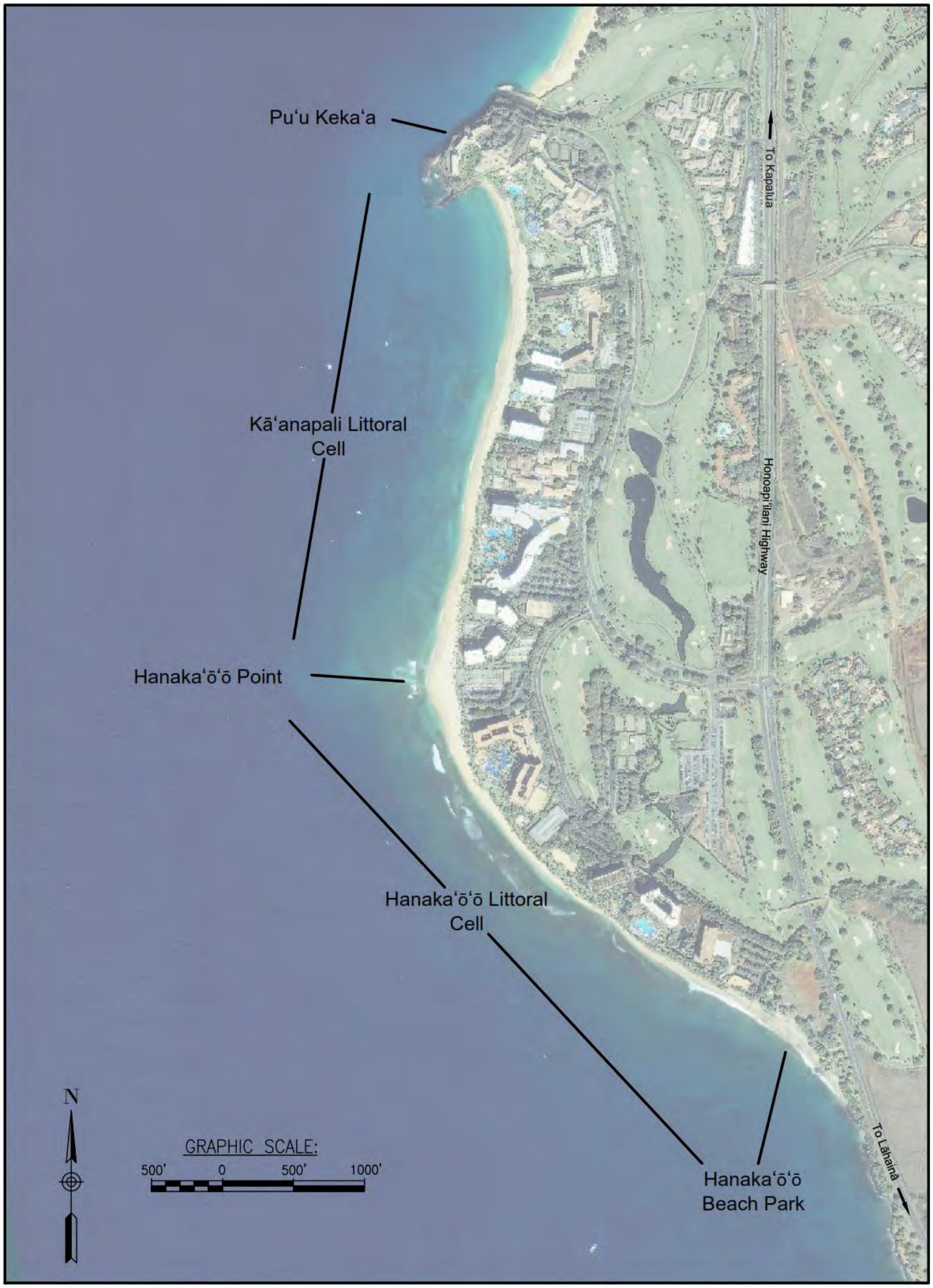


Figure 1. Project Area, Kāʻanapali Beach, Maui, Hawaiʻi

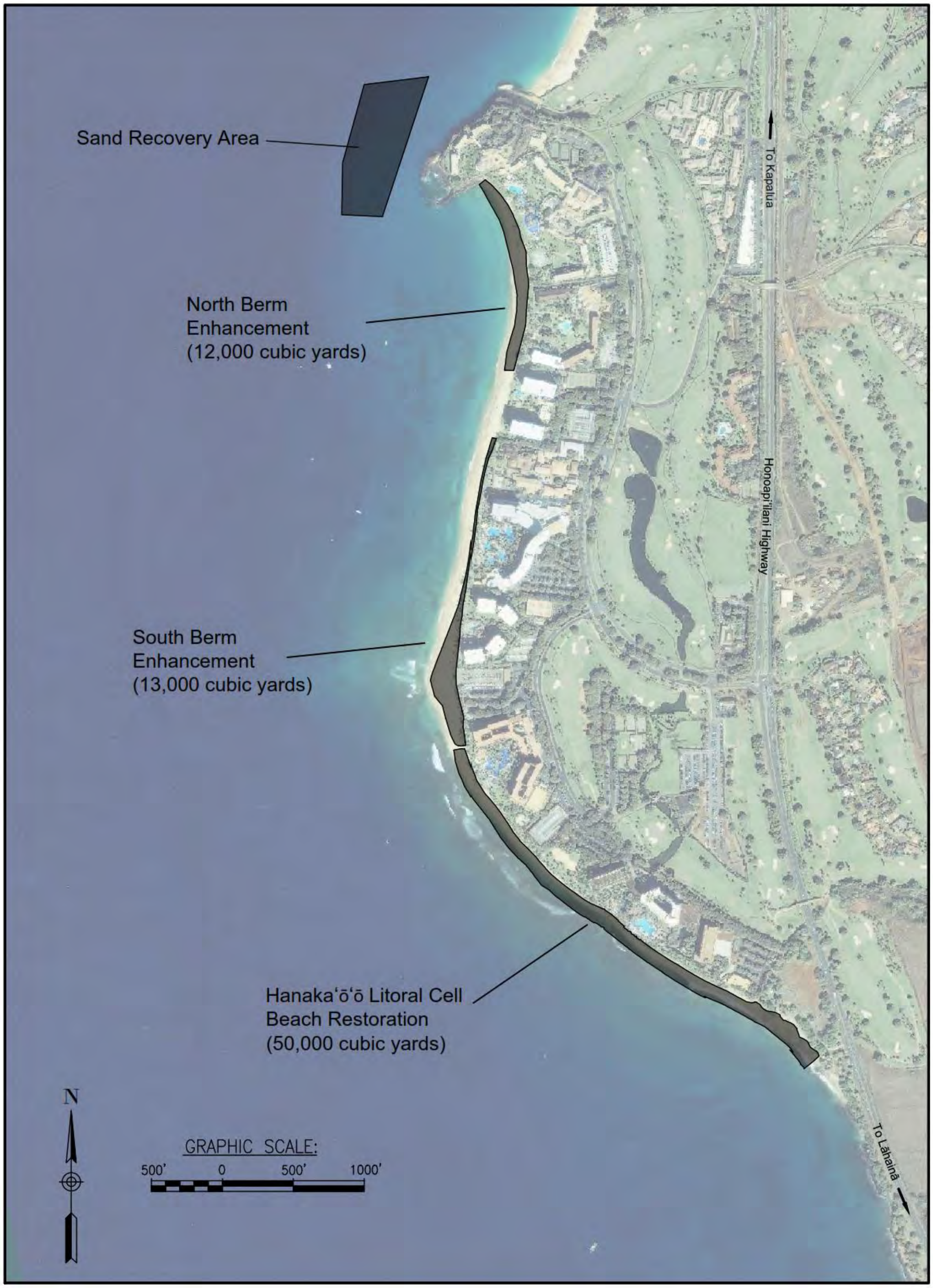


Figure 2. Proposed project elements, Kā'anapali Beach, Maui, Hawai'i

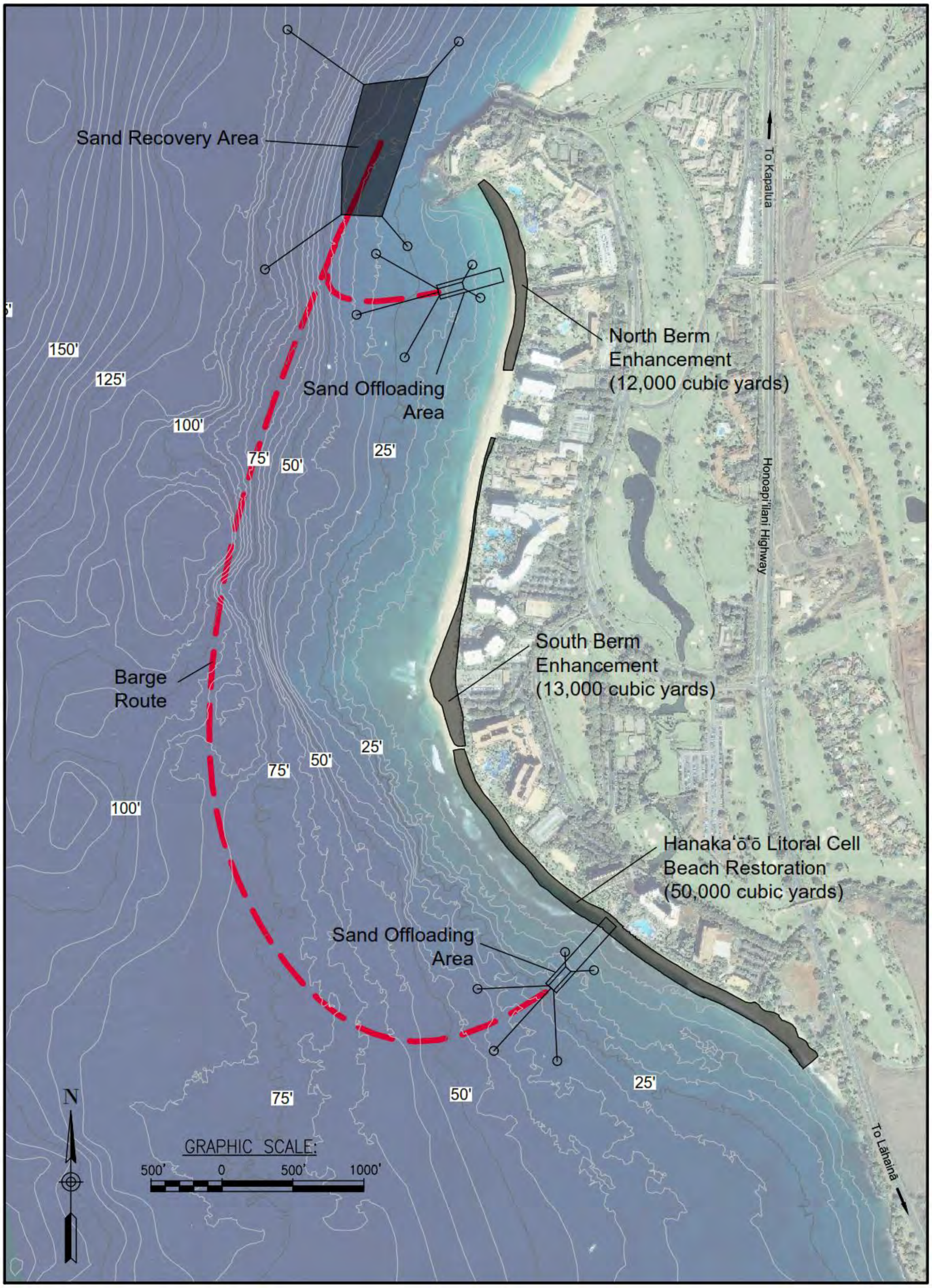


Figure 3. Proposed sand transportation routes and offloading areas, Kā'anapali Beach, Maui, Hawai'i

Required Permits & Approvals:

- Environmental Impact Statement (Chapter 343, HRS and §11-200, HAR)
- Department of the Army Permit (Section 10 and Section 404)
- Clean Water Act Section 401 Water Quality Certification
- Clean Water Act Section 402 National Pollutant Discharge Elimination System
- Coastal Zone Management Act Consistency Review
- Conservation District Use Permit
- Right of Entry Permit for Kāʻanapali Beach
- HRS, Section 6E Historic Preservation Review
- County of Maui Special Management Area Permit

Compatibility with Land Use Plans and Policies:
The proposed alternative conforms to the intent of and is compatible with the following plans:

- Maui Countywide Policy Plan
- Maui Island Plan
- West Maui Community Plan
- Hawaiʻi State Planning Act
- Conservation Lands State Functional Plan
- Recreation State Functional Plan
- Tourism State Functional Plan

Actions Requiring Environmental Impact Statement:

- Work within the State Conservation District
- Use of State Land
- Use of State Funds
- Work within the Shoreline Area

Estimated Cost:
$9,000,000 - $13,000,000

Time Frame:
Construction will begin when the necessary permits and approvals are obtained, and a construction contract is awarded, currently estimated for Fall ~~2021~~2022. The construction period is estimated to be 63 to 75 days.

Alternatives Considered:

- Alternative Sand Sources in the Region
- No-action Alternative – Unmanaged Retreat
- Temporary Shore Protection
- Permanent Buried Shore Protection
- Vertical Accommodation~~Adpatation to Sea-Level Rise and Erosion~~
- Managed Retreat

Unresolved Issues:

Unresolved Issues	**Discussion – Action to Resolve or Reason to Leave Unresolved**
Anchor system placement locations	Prior to placement of anchors, as part of each location's anchoring system, the seafloor will be inspected by diver or camera to ensure that anchors and hardware to minimize impacts to benthic communities.
Sand transfer system seafloor contact	Prior to emplacement of the sand transfer system, at the proposed locations in the nearshore, the seafloor will be inspected by diver or camera to ensure that anchors and hardware to minimize impacts to benthic communities.
Potential Seabird nesting and Nēnē in the project area	Prior to commencing construction an ornithologist will investigate the project to ensure no seabird nesting sites will be impacted by the project. The ornithologist will also look for nēnē during the investigation. Should any active nesting sites or nēnē be identified, the project team will coordinate with USFWS.
Potential Endangered Vegetation in the project area	Prior to commencing construction an arborist will investigate the project to ensure no endangered vegetation will be impacted by the project. Should any endangered vegetation be identified, the project team will coordinate with USFWS.
Potential Turtle Nests in the Beach and Dune	Consultation with the Services to obtain the latest information on sea turtle activity in the area will take place and additional BMPs shall be employed to avoid impact to sea turtle nests and hatchlings during this period, including constant monitoring of the beach and ocean during beach restoration activities.
Ocean recreation access issues	Require coordination between the contractor and the local community, via website or other digital format, to relay updated schedules for vessel movement as well as updated lists and locations that have limited or no access due to restoration activities. Ensure ocean access between the sand recovery area and Puʻu Kekaʻa, suitable for outrigger, or similar, vessel traffic for the duration of the project.
Short-term to less than one-year economic impacts on subsistence fishers and gatherers	The sand recovery area may have fisheries utilized by subsistence fishers in the region. Require coordination between the contractor and the local subsistence fishing community, via website or other digital format, to relay updated schedules and projected locations for sand recovery, transport, and placement operations. Ensure the local subsistence fishing community has the maximum access allowable, given public safety concerns, to the sand recovery site and along the shoreline. Shoreline areas closed to the public will be limited to active construction areas utilized for sand offloading, sand transfer along the shoreline, and sand placement on the beach. Crossing guards will be available to assist beach users with safe transit across the transportation lanes, to and from the waterline.
Cultural Resources	Require coordination between the contractor and local cultural practitioners, via website or other digital format, to relay updated schedules for vessel movement as well as updated lists and locations that have limited or no access due to restoration activities. Ensure maximum feasible standoff between the sand recovery area and Puʻu Kekaʻa is maintained, within the practicable limits of the scope of the project.
Public Safety Concerns - Changes to seafloor bathymetry at the sand recovery area	Educational and warning signs shall be placed along the shoreline during and after the project. These signs should include warnings for beach and ocean users to address public safety issues.

Unresolved Issues	**Discussion – Action to Resolve or Reason to Leave Unresolved**
Managed Retreat	Coastal management now and into the foreseeable future will rely on a range of design and adaptation options that are best suited to local needs, priorities, and capabilities. The suitability of the various design and adaptation options will continue to evolve based on the latest scientific projections for sea level rise, observed erosion and flooding impacts, and availability of government programs and policies to support implementation of managed retreat or other adaption measures.
Short-term impacts to Kona crab community in the sand recovery area	Previous studies indicate that Kona crab recolonize impacted regions within several months to years. Short-term impacts are anticipated to the Kona crab community at the sand recovery site; however, impacts are not anticipated in the regional sand field that represents the broader Kona crab habitat, outside of the sand recovery footprint.
Hawaiian Islands Humpback Whale National Sanctuary	Marine operations, including sand recovery in the nearshore, are scheduled to overlap with Humpback Whale season in the region. Additional coordination, through the permit process, will be completed before implementation of the project. BMPs for marine mammals are already included in Section 7.
User Conflicts – Beach and Offshore	Space on the beach and in the ocean will be restricted around the active work areas. To minimize potential user conflicts, the contractor will need to have open lines of communication with the local community, via website or other digital format. Communication should relay updated schedules for vessel movement, beach restoration, offloading scheduling, truck hauling routes, as well as updated lists and locations that have limited or no access due to restoration activities. Ensure ocean access between the sand recovery area and Puʻu Kekaʻa, suitable for outrigger, or similar, vessel traffic for the duration of the project. Ensure regularly spaced crossing guards are available to assist with beach access. Minimize restricted work areas to active work zones and upcoming work zones.
Compaction of the beach and vertical scarping during erosion events	Tilling of the placed sand will be completed at the end of each restoration activity to mitigate compaction and scarping of the beach profile.
Archaeological Monitoring Plan	No excavation of the beach profile is proposed for the preferred alternative. Ongoing coordination with SHPD will determine the need for an archaeological monitoring plan. If a plan is required, it will be submitted to, reviewed, and approved by SHPD prior to completion of permits.
Access to the Hanakaʻōʻō grinding stones	Access to and from the site will be a design requirement during the project. The site is located to the south of the beach restoration effort with existing access from the upper Hanakaʻōʻō Beach Park parking lot.

- ~~Permits and resource agency reviews have not been completed. Permit review will include regulatory compliance discussions and possible modifications to the proposed project.~~

Beneficial and Adverse Impacts, and Mitigation Measures:

Resource Area	Proposed Action Impacts – Beach Renourishment (Preferred Alternative)	Mitigation Measures
Sea-level rise	**Long-term beneficial impacts:** Mitigating impacts of increasing erosion and flooding with SLR while conserving and restoring the beach environment with a nature-based adaptation solution. Restores natural habitat and recreational resources.	**Long-term mitigation:** N/A
Flood and Tsunami Hazard	**Long-term beneficial impacts:** Reduced susceptibility to flooding from large wave events.	**Long-term mitigation:** N/A
Offshore Bathymetry	**Short-term adverse impacts:** 6' deep depression at the ~~Puʻu Kekaʻa~~ Sand Recovery Area.	**Short-term mitigation:** Design incorporates current scientific findings on optimal basin design, resulting in a shallow depression with a long-axis oriented parallel to prevailing current direction. Similar recovery basins have had minimal impact on their regional~~adjacent~~ sand fields.
Nearshore Bathymetry and Coastal Processes	**Short-term adverse impacts:** Wave reflection at Hanakaʻōʻō Point during first season post-placement. Beach profile adjustments immediately after placement. **Mid-term impacts:** Increased beach berm height in the KLC. **Long-term beneficial impacts:** Beach width increases across both littoral cells.	**Short-term mitigation:** Ensure regular notification of beach users during adjustments and first season of summer swell. Recommend signage along the beach. **Mid-term mitigation:** Ensure regular notification of beach users during adjustments and first season of winter swell. Recommend signage along the beach. **Long-term mitigation:** N/A
Sand Characteristics	**Short-term adverse impacts:** Anoxic smell; change in beach color. **Long-term adverse impacts:** Potential compaction or lithification of placed sand; potential placement of some coral cobbles.	**Short-term mitigation:** Notification to beach users during first 3 months after placement. Recommend signage along the beach. **Long-term mitigation:** Tilling the delivery paths regularly during sand placement and at the end of the project are proven methods to mitigate lithification from construction activities. Monitoring during sand recovery and placement operations will be utilized to identify and minimize larger cobble placement in the beach profile.
Water Quality	**Short-term adverse impacts:** Increase in turbidity at the placement areas and at the ~~Puʻu Kekaʻa~~ Sand Recovery Area. **Long-term adverse impacts:** Intermittent increases in turbidity as fines in placed sand particles are released during seasonal high waves and erosion (~1 year).	**Short-term mitigation:** Water quality monitoring and silt containment devices. **Long-term mitigation:** Continued monitoring of water quality and beach dynamics.
Marine Biology	**Short-term adverse impacts:** Temporary loss of infaunal organisms at the dredge and placement areas. Potential impacts from vessel movement. Potential impacts from	**Short-term mitigation:** Monitoring during and after construction. Observers during construction operations to minimize or avoid contact. Diver or camera-based investigation of the seafloor prior to placement of

Resource Area	Proposed Action Impacts – Beach Renourishment (Preferred Alternative)	Mitigation Measures
	construction and sand placement related turbidity. Temporary displacement of organisms in the location of the anchor systems at the sand recovery site and the sand transfer sites. Temporary displacement of organisms for emplacement of the sand transfer systems. **Long-term beneficial impacts:** Conservation/restoration of sandy habitat for coastal species. **Long-term impacts:** Hard marine substrate within the 1988 beach footprint covered by sand.	anchors and hardware. Diver or camera-based investigation of the seafloor prior to installation of the sand transfer systems. **Long-term mitigation:** N/A **Long-term mitigation:** N/A
Protected Species	**Short-term adverse impacts:** Potential interaction with protected species during construction efforts. Interactions will be mitigated through application of BMPs. **Long-term beneficial impacts:** Conservation/restoration of sandy coastal habitat for protected species, especially in chronically eroded areas of the coastline.	**Short-term mitigation:** Interactions will be mitigated through application of BMPs provided by NOAA National Marine Fisheries Service in the PacSLOPES guidance. **Long-term mitigation:** N/A
Flora	**Short-term impacts:** Temporary displacement of cultivated vegetation at the mauka edge of the berm enhancement area. **Long-term impacts:** Conservation of vegetation at the mauka edge of project beach.	**Short-term mitigation:** N/A **Long-term mitigation:** Recommend replanting with native and endemic species, excluding the beach, restored beach, or berm enhancement area
Air Quality	**Short-term adverse impacts:** Local degradation of air quality due to construction related equipment exhaust.	**Short-term mitigation:** Use of machinery compliant with current State emissions standards.
Noise	**Short-term adverse impacts:** Increased noise from construction equipment.	**Short-term mitigation:** Use of equipment compliant with current State noise standards.
Streams	**Long-term impacts:** Alteration of the Hāhākea Gulch stream's path to the ocean by lengthening the intermittent stream channel across the restored beach berm. Similar to stream conditions prior to1988.	**Long-term mitigation:** None, because this is the prior condition of the stream when the beach was naturally wider, prior to 1988.
Scenic and Open Space Resources	**Short-term adverse impacts:** Turbidity, unsightly construction equipment, and minor sand color change. **Long-term beneficial impacts:** Improved views with increased beach width and removal of temporary erosion protection materials.	**Short-term mitigation:** Notification to beach users during first 3 months after placement. Recommend signage along the beach. **Long-term mitigation:** N/A
Surrounding Land Use	**Long-term beneficial impacts:** Protection of backshore land uses from erosion and coastal hazards, while conserving and restoring the natural beach environment.	**Long-term mitigation:** N/A
Community Character	**Long-term beneficial impacts:** Protection of community character from erosion and coastal hazards, while conserving and restoring the natural beach environment.	**Long-term mitigation:** N/A

Resource Area	Proposed Action Impacts – Beach Renourishment (Preferred Alternative)	Mitigation Measures
Tourism	**Short-term adverse impacts:** Restricted access to portions of the beach that are undergoing nourishment efforts, and areas on the water that are being utilized for sand recovery, transport, and offloading operations. **Long-term beneficial impacts:** Improved beach resources provide long-term stability to coastal tourism.	**Short-term mitigation:** Notification to beach users during placement. Crossing guards to assist public with beach access. Notice to Mariners to inform ocean users. Recommend signage along the beach. **Long-term mitigation:** N/A
Beach Access	**Short-term adverse impacts:** Interruption during construction. **Long-term beneficial impacts:** Conservation, restoration of public beach access and protection of the Beachwalk.	**Short-term mitigation:** Notification to beach users during placement. Crossing guards to assist public with beach access. Recommend signage along the beach. **Long-term mitigation:** N/A
Coastal and Nearshore Recreation	**Short-term adverse impacts:** Closure of nearshore waters around dredge area and offloading locations; closure of portions of the beach during placement; brief disruption to canoe area at Hanakaʻōʻō Beach Park; possible undesirable wave reflection at Hanakaʻōʻō Point surf break during first season post-placement. **Long-term beneficial impacts:** Conservation and restoration of beach recreation though natural restoration of the beach resource.	**Short-term mitigation:** Notification to beach users during placement. Crossing guards to assist public with beach access. Notice to Mariners to inform ocean users. Recommend signage along the beach. Ensure regular notification of beach users during adjustments and first season of summer swell. **Long-term mitigation:** N/A
Public Health	**Mid-term adverse impacts:** Potential increase in return wave energy in the KLC due to higher berm elevation.	**Mid-term mitigation:** Ensure regular notification of beach users during adjustments and first season of winter swell. Recommend signage along the beach.
Cultural Resources	**Short-term adverse impacts:** Potential for conflict associated with interpretation of impacts in the area around Puʻu Kekaʻa as a leina a kaʻuhane~~ka uhane~~, or a leaping place for departed souls. **Long-term beneficial impacts:** Conservation of both *in situ* and previously disturbed iwi kūpuna in the coastal plain through natural restoration of the beach resource, which provides erosion mitigation for the backshore.	**Short-term mitigation:** Ensure open communication during beach renourishment operations. Have an identified point of contact during placement. If cultural practices are taking place within the project area, but have not been previously observed, then all effort will be made to minimize and mitigate any project impacts. **Long-term mitigation:** N/A
Economy and Labor Force	**Short-term beneficial impacts:** Creation of construction and construction-related jobs. **Long-term beneficial impacts:** Stability in coastal and beach related jobs at the project site.	**Short-term mitigation:** N/A **Long-term mitigation:** N/A
Recreational Facilities	**Short-term adverse impacts:** Brief disruption to canoe area at Hanakaʻōʻō Beach Park during sand placement.	**Short-term mitigation:** Notification to beach users during placement. Crossing guards to assist public with beach access. Routine coordination with the canoe clubs to provide schedule updates. Recommend signage along the beach.

Resource Area	Proposed Action Impacts – Beach Renourishment (Preferred Alternative)	Mitigation Measures
Roadways	**Short-term impacts:** Transportation of heavy machinery during mobilization and demobilization	**Short-term mitigation:** N/A
Water System	**Long-term beneficial impacts:** Reduction in potential erosion threat to water systems through conservation and restoration of the sand beach through natural beach nourishment.	**Long-term mitigation:** N/A
Wastewater System	**Long-term beneficial impacts:** Reduction in potential erosion threat to waste~~r~~water systems through conservation and restoration of the sand beach through natural beach nourishment.	**Long-term mitigation:** N/A
Electrical, Telephone, and Cable Television Services	**Long-term beneficial impacts:** Reduction in potential erosion threat to communicat~~a~~ion and electrical systems through conservation and restoration of the sand beach through natural beach nourishment.	**Long-term mitigation:** N/A

1. PROJECT OVERVIEW

1.1 Introduction

Kāʻanapali Beach is located in West Maui (Figure 1-1) within the census-designated place of Kāʻanapali. South Kāʻanapali Beach is nearly 1.5 miles of golden sand beaches, extending from Hanakaʻōʻō Beach Park at the south end to Puʻu Kekaʻa (a rocky promontory that is commonly referred to as "Black Rock") at the north end. Kāʻanapali Beach experiences both chronic and episodic erosion that has caused shoreline recession, beach narrowing, reduction in coastal access, and occasional severe damage to shoreline infrastructure and amenities. Portions of the shoreline are also seasonally dynamic, meaning the shape of the shoreline changes in response to changing swell direction from winter to summer. Erosion and beach narrowing can be exacerbated if an erosion event occurs during a seasonal extreme ocean water level or wave event.

The Kāʻanapali Beach Resort is located mauka of Kāʻanapali Beach and contains five hotels and seven condominiums and vacation clubs on 1,200 acres of land. The resort is managed by the Kāʻanapali Operations Association (KOA). The resort is located alongside both Kāʻanapali Beach and Kahekili Beach to the north. The resort has constructed and maintains for public use long spans of the Kāʻanapali Beachwalk for public use, which provides coastal lateral access for the region. Kāʻanapali Beach and Resort draw approximately 500,000 visitors annually during a typical year.

KOA, which is deeply interested in the health of Kāʻanapali Beach, has been pro-active in initiating a work program to evaluate methods to mitigate the shoreline erosion and beach narrowing problem. In 2006, Sea Engineering, Inc. (SEI) was contracted by KOA to evaluate the feasibility of restoring Kāʻanapali Beach.

The first step in designing the beach nourishmentrestoration project was finding sufficient highly compatible sand to augment the existing sand system's volume. Sand surveys offshore of Kāʻanapali began in 2007 and indicated the presence of sufficient quantities of suitable sand for potential use in restoring the beach. In March of 2010, SEI submitted a detailed proposal to use offshore sand to restore the southern portion of the beach, between Hanakaʻōʻō Point and Hanakaʻōʻō Beach Park. In 2014, the Department of Land and Natural Resources (DLNR) entered into a Memorandum of Understanding (MOU) with KOA to fund a beach nourishmentrestoration project at Kāʻanapali Beach, and in 2015 a contract was issued to SEI to conduct research, develop a concept plan, draft an Environmental Impact Statement (EIS), and pursue permits for a regional beach nourishmentrestoration effort at Kāʻanapali Beach.

1.2 Property Location, Existing Use, and Land Ownership

Kāʻanapali Beach is located on the west shore of the island of Maui, extending south from Puʻu Kekaʻa around Hanakaʻōʻō Point to Hanakaʻōʻō Beach Park, a distance of approximately 7,450 feet. Figure 1-2 shows an overview of the project shoreline. Within Kāʻanapali Beach are the Kāʻanapali Littoral Cell (KLC), located between Puʻu Kekaʻa and Hanakaʻōʻō Point, and the Hanakaʻōʻō Littoral Cell (HLC), located between Hanakaʻōʻō Point and Hanakaʻōʻō Beach Park. A littoral cell is a segment of coast that is more or less isolated sedimentologically from adjacent coastal segments. Both littoral cells include the active beach system and the nearshore sand fields.

The entire project area is located at or makai of the shoreline location, as defined in HRS Chapter 205A, and is State land that lies in the Resource Subzone of the Conservation District.

Inshore of the project area is a mixture of public and private land. Hanakaʻōʻō Beach Park is the southern boundary of the proposed beach restoration site. This public beach park includes parking and amenities such as picnic tables and restrooms. The beach park is a popular spot for visitors and local residents alike. Multiple canoe clubs maintain a canoe hale at the north end of the beach park. Landward of the beach park is the Hanakaʻōʻō Cemetery, a historic burial ground that contains graves from plantation-era West Maui. South of the beach park, the shoreline becomes rocky with intermittent sandy stretches. The town of Lāhainā begins approximately one mile to the south of Hanakaʻōʻō Beach Park.

The Kāʻanapali Beachwalk begins at the north end of Hanakaʻōʻō Beach Park. The Beachwalk is a public amenity that is privately owned and maintained. The Beachwalk extends continuously for nearly 1.2 miles from the Hyatt Regency Maui, abutting Hanakaʻōʻō Beach Park, to the north side of Puʻu Kekaʻa, continuous across eight shorefront properties. The Beachwalk is the only ADA-compliant thoroughfare along the beach.

Hanakaʻōʻō Beach Park marks the southern boundary of the HLC, which comprises approximately 3,600 feet of southwest-facing shoreline. The beach within the HLC has progressively eroded landward during the last four decades. To the south of the park, towards Lāhainā, the beach has disappeared along nearly 700 feet of coastline. To the north of the park, the backshore is densely developed with hotel and condominium buildings as well as resort amenities including the Beachwalk. The Hyatt Regency Maui Resort is located backshore of the southern half of the HLC. The shoreline fronting the Hyatt has experienced several significant erosional and beach narrowing events since 2011. Many of these events have also threatened the Beachwalk and other hotel amenities and have resulted in relocation of the Beachwalk in one portion of the shoreline. The Marriott Maui Ocean Club is located backshore of the northern half of the HLC, and previous erosion events in this area have resulted in a narrowing of the beach and relocation of the Beachwalk as well.

Hanakaʻōʻō Point is the boundary between the Hanakaʻōʻō Littoral Cell and the Kāʻanapali Littoral Cell. It is also the northern boundary of the proposed beach restoration. The proposed berm enhancement begins to the north of Hanakaʻōʻō Point. Hanakaʻōʻō Point accretes (grows) into a wide sandy beach throughout each winter swell season and erodes (shrinks) throughout each summer swell season.

The KLC is a west-facing shoreline that begins at Hanakaʻōʻō Point and extends approximately 3,850 feet north to Puʻu Kekaʻa. Similar to the HLC, the backshore of the KLC is densely developed with hotel buildings, resort amenities, and a shopping center. Puʻu Kekaʻa is a distinct rock promontory that creates a well-defined boundary between the KLC and the Honokōwai Littoral Cell to the north. Puʻu Kekaʻa is also the northern boundary of the proposed berm enhancement. The Beachwalk provides lateral access to the entire KLC.

Figure 1-1. Kāʻanapali Beach location on the west side of Maui Island

Figure 1-2. Kāʻanapali Beach overview.

The Kāʻanapali Littoral Cell (KLC) extends from Hanakaʻōʻō Point to Puʻu Kekaʻa. The Hanakaʻōʻō Littoral Cell (HLC) extends from Hanakaʻōʻō Beach Park to Hanakaʻōʻō Point.

1.3 Purpose and Need for Beach Restoration and Berm Enhancement

Kāʻanapali Beach has been negatively impacted by a combination of chronic erosion and extreme seasonal erosion over the previous four decades. Sand loss is expected to continue and even accelerate with sea level rise. As an adaptation measure, the beach may be maintained with either sand nourishment, or managed retreat, or both. Managed retreat is a multidecadal process, requiring years of planning, funding, and implementation, especially for a major resort development such as Kāʻanapali. In the meantime, the beach can be maintained as an interim measure through sand nourishment utilizing sound engineering design and best practices to ensure protection of the nearshore marine environment.

The State of Hawaiʻi and the Kāʻanapali Operations Association, Inc., have developed a plan to ensure the viability of this sandy coastal resource, which includes both beach restoration and berm enhancement. 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") (Figure 1, above). The proposed project is intended to mitigate the impacts of coastal erosion and rising water levels, which are increasing with global sea level rise and increased storm severity in the tropics. Both of these phenomena are at least partially a result of human induced climate change. The project provides a nature-based adaptation solution that restores natural habitat and recreational resources while increasing natural coastal hazard mitigation and protection for the Kāʻanapali Resort community. Adding beach quality sand to the north and south littoral cells is a key action for restoring the beach back to its former width and volume. The project is intended to make both Kāʻanapali Beach and the Kāʻanapali community more resilient to the effects of seasonal erosion and longer-term climate change.

Before Kāʻanapali became a tourist destination, the West Maui economy was largely based on agriculture, including sugar cane and pineapple. In the early 20th century, immigrant workers lived in plantation camps that dotted the landscape. Evidence of West Maui's plantation history is still visible today at the Kekaʻa Landing Pier on the north side of Puʻu Kekaʻa, the Hanakaʻōʻō Cemetery behind Hanakaʻōʻō Beach Park, and the Lāhainā, Kāʻanapali, and Pacific Railroad (the "Sugar Cane Train") located inland of the Kāʻanapali Resort.

Post-war Maui saw a sharp decline in population due to the decline of the sugar and pineapple industries and the bourgeoning Oʻahu and mainland US economies. Maui lost 24 percent of its population from 1940 to 1960 as the younger generation left in search of employment. In 1959, the *Report of Land Use for the Island of Maui*, prepared by Community Planning Inc., identified tourism as a potential solution to reversing the downward population trend on the island. Later in 1959, Amfac, Inc. (formerly American Factors) began developing the Kāʻanapali shoreline into a master-planned resort destination area, the first of its kind in Hawaiʻi. Over the next 50 years, extensive construction took place along Kāʻanapali Beach, and the backshore is now developed with resort hotels and condominiums. The Resort contributes approximately $3 billion annually to the State economy during normal operations. During typical years, Kāʻanapali employs roughly 5,000 people, provides nearly $230 million in income, pays approximately $180 million in State and County taxes, not including income tax on the $230 million, donates more than $1 million to support nonprofits, and provides more than $5 million in community service and support.

During a 2008 study of Waikīkī Beach on Oʻahu, visitors said they are less likely to return if Waikīkī Beach is eroded or unavailable. Visitors to Kāʻanapali would likely have a similar response to beach erosion.

The beach within the KLC is seasonally dynamic, meaning the seasonal swell direction determines the beach shape. During most years, a shift in beach sand between the north and south ends of the KLC results in beach narrowing at the donor end of the beach. During some particularly energetic seasons, the beach narrowing can be so severe as to cause damage to backshore infrastructure at the donor end. Periodic extreme erosion events have resulted in the loss of beach width, vegetated landscape, and damage to the Kāʻanapali Beachwalk. A list of some of the recent events that impacted the KLC is presented in Figure 1-3 and Table 1-1.

In the strong El Niño winter of 1997-1998, persistent North Pacific swell severely impacted the north end of the KLC. This event resulted in the undermining and failure of a section of Beachwalk fronting the Sheraton, as well as threatening a pool facility. On April 24, 1998, the Sheraton obtained an emergency authorization from the County of Maui to install steel road plates along 100 feet of shoreline to protect the hotel swimming pool from undermining. The road plates, which were installed immediately thereafter, were located 8 to 10 feet from the seaward edge of the pool.

An erosion event in 2003 at Hanakaʻōʻō Point, the south end of the littoral cell, resulted in the loss of up to 30 feet of vegetated land and numerous trees. Over 70,000 sandbags were emplaced and steel plates installed in efforts to protect the shoreline, at a cost of several hundred thousand dollars. Following this event, the Kāʻanapali Aliʻi condominium prepared an emergency response plan with the assistance of the State of Hawaiʻi DLNR to allow rapid deployment of temporary shore protection during future erosion events. This plan identified action triggers and outlined a 2-week implementation schedule.

The initial response to the 2003 event was a difficult lesson for all involved. Placing sandbags involved intensive labor with modest results. The sandbags broke down within a few weeks due to exposure to the sun, and many of them floated offshore and became an environmental nuisance. The best and final protective measure used by Kāʻanapali Aliʻi in desperation was the placement of steel road plates. These plates appeared to work well; however, they were not exposed to wave action for long before the anticipated seasonal reversal of the sand transport direction occurred, the beach widened, and the plates were able to be removed. Having the giant steel plates in place for an extended period of time is not desirable for the State, the public, or a beach resort, as they are unsightly and potentially dangerous.

In response to this series of erosion events, SEI was contracted by KOA in 2006 to begin evaluating the feasibility of nourishing Kāʻanapali Beach. The first phase of work, completed in August 2006, provided an overview of sand sources and costs, and permit and environmental requirements. The second phase of work, completed in November 2007, consisted of an offshore survey of potential sand sources using sidescan sonar and sediment coring. The third phase of work completed in September 2008 included a more ~~extensive~~ comprehensive sand survey conducted offshore of Kāʻanapali and Kahekili Beach. The focus of the 2008 survey was to more extensively map the sand deposits offshore of these beaches and to attempt to determine the deposit sand quality, thickness, and volume. The work included a sub-bottom profiler survey and vibracoring.

While long-term beach management plans were being developed, erosion events at Kāʻanapali continued. In December 2008, a severe Kona storm caused rapid beach loss, land erosion, and damage to the Beachwalk at Hanakaʻōʻō Point. The damage occurred quickly, with no time to implement an emergency response, further highlighting the Kāʻanapali shoreline's vulnerability to extreme wave events.

Meanwhile, the shoreline within the Hanakaʻōʻō Littoral Cell has been undergoing both chronic and episodic erosion at a rate that has accelerated over the last several decades. Southern swell during the summer of 2013 caused severe erosion that undermined the Beachwalk in the middle of the littoral cell. Vegetation that had collapsed into the ocean and several sections of the Beachwalk were removed. In response, 400 coir (natural fiber) sandbags were installed under the remaining portion of the Beachwalk to prevent further undermining and collapse. In 2015, this area once again experienced an erosion event that threatened the Beachwalk. In response, the Hyatt deployed an Emergency Erosion Protection Skirt along 200 feet of the eroded shoreline. The geotextile skirt, a cloth blanket placed atop the erosion scarp, is a temporary solution but has been effective in slowing erosion of the area. The geotextile skirt, which was not designed for long-term deployment, was removed and replaced in November of 2016. It was also extended 100 feet to the south to mitigate continuing erosion and impacts to the Beachwalk.

During the 2017-2018 winter season, large north swells arrived along West Maui causing severe erosion at multiple properties. The erosion scarp approached Kāʻanapali Beach Hotel's northwest corner prompting the installation of a sand mattress in January 2018 to maintain the existing use of the property, Beachwalk, and to preserve lateral access. A sand mattress is a geotextile drape with narrow tubes along the face, which are filled with beach compatible sand. There was a steep erosion scarp along the southern portion of the property for over six months. The height and instability of the erosion scarp required that it be fenced off to protect beach users. By the end of October 2018, the beach in front of the Kāʻanapali beach Hotel had fully recovered and the mattress was almost entirely buried under the beach berm. In January of 2019 the mattress, wooden Beachwalk extension, and supporting materials were all removed from the shoreline.

During the 2019 summer season, south swells transported sand from Hanakaʻōʻō Point to the north. A stairway leading from the Beachwalk to the beach fronting Whaler's Village, a beach safety sign fronting The Whaler at Kāʻanapali, as well as two trees in front of the Marriott, were all lost. In addition, sandbags from the 2003 erosion event were re-exposed at the Marriot and were removed from the shoreline. Sand pushing, moving sand from a wide portion of the beach to a narrow portion of the beach, was conducted at The Whaler at Kāʻanapali to enhance the berm for the remainder of the season.

Despite ongoing erosion events, beach narrowing, and threats to backshore infrastructure, it is notable that the shoreline at Kāʻanapali has undergone no previous long-term improvements to the sand beach or berm. Temporary erosion mitigation materials have been deployed, including sandbags, road plates, and erosion skirts, though none have been emplaced as permanent shoreline armoring of the Kāʻanapali shoreline.

Long-term planning is necessary to facilitate management of the beach resource and coastline. Beach restoration and berm enhancement provide natural management options that mitigate the erosion impacts and coastal hazards resulting from and exacerbated by sea level rise and increased storminess in the tropics. Projects such as the proposed can be effective interim steps in long-term planning and adaptation that restore natural resources, provide hazard mitigation benefits, and minimize the need and likelihood for shoreline structures.

Figure 1-3. Kāʻanapali Beach shoreline erosion events and protection overview

Table 1-1. Kāʻanapali Beach shoreline history

Year	Event
Early 1900s	Kekaʻa Landing Pier built to the north of Puʻu Kekaʻa as the primary loading spot for shipping processed sugar from the island and bringing in supplies for the plantation camps in West Maui
1950s	Post-war population of Maui sharply declines; plantation operations in West Maui fall from their peak
1959	*Report of Land Use for the Island of Maui* identifies tourism as a potential solution to reversing the downward population trend of the island
1959	Amfac, Inc. begins developing Kāʻanapali Beach Resort
1998	Beachwalk near Puʻu Kekaʻa, providing lateral access along the shoreline, was undermined and collapsed after a prolonged period of North Pacific swell; road plates were driven into the sand to protect a pool facility at the Sheraton
2003	Loss of vegetated landscape and damage to the Beachwalk at Hanakaʻōʻō Point, near the Kāʻanapali Aliʻi, after extended periods of high surf and water levels; road plates driven into the sand to protect the Beachwalk
2006	KOA begins looking into beach nourishment as a long-term shoreline management plan for Kāʻanapali Beach Resort
2007	Initial sand source reconnaissance offshore of Kāʻanapali Beach, including sidescan sonar surveys and sand sample collection
2008	A severe Kona storm resulted in rapid beach loss, land erosion, and damage to the Beachwalk at Hanakaʻōʻō Point
2008	Sub-bottom surveys and vibracore operations confirm the presence of suitable sand source offshore of <u>Kāʻanapali Beach</u>~~Puʻu Kekaʻa~~
2013	Severe erosion undermined the Beachwalk in the middle of HLC, makai of the Hyatt Regency Maui, requiring removal of vegetation and hardscape; 400 coir (natural fiber) sandbags installed to prevent further damage to the Beachwalk
2015	Continued erosion in the middle of the HLC requires the installation of an Emergency Erosion Protection Skirt along 200 feet of shoreline
2016	Continued erosion pressure at the Beachwalk, in the middle of the HLC, requires replacement of existing Emergency Erosion Protection Skirt and extension to the southeast by approximately 100 feet~~.~~
2018	Erosion fronting the Kāʻanapali Beach Hotel requires the installation of a "sand-filled mattress" to protect the Kāʻanapali Beachwalk~~.~~
2019	Erosion fronting The Whaler at Kāʻanapali, Whaler's Village, and the Marriott. Sand pushing at The Whaler at Kāʻanapali and removal of debris fronting Whaler's Village and the Marriott~~.~~

<u>1.4 Statement of Objectives</u>

<u>Kāʻanapali Beach has been negatively impacted by chronic erosion and extreme seasonal erosion over the previous four decades. Sand loss is expected to continue and even accelerate with sea level rise. As an adaptation measure, the beach may be maintained with either sand nourishment, or managed retreat, or both. Managed retreat is a multidecadal process. In the meantime, the beach can be maintained as an interim measure through sand nourishment utilizing best practices to ensure protection of the nearshore marine environment.</u>

Objectives for the interim resource restoration and erosion mitigation effort are below:

- Provides a nature-based solution as an interim step in sea-level rise adaptation
- Ensures the viability of this sandy coastal resource
- Restores recreational resources and natural habitat
- Mitigates the impacts of coastal erosion and rising water levels, which are increasing with global sea-level rise and increased storm severity in the tropics
- Increase the resilience of the Kāʻanapali community to the effects of seasonal erosion and longer-term climate change
- Protects backshore lands and improvements on an interim basis

Modern sea-level rise acceleration and increased storm severity in tropics are the result of long-term climate changes associated with anthropogenic (human) alterations to the planet's climate system. In essence, the purpose and objectives of the proposed project are related to mitigating human impacts to the environment with a nature-based adaptation solution.

~~1.4~~1.5 Proposed Action

Coastal management now and into the foreseeable future will rely on a range of design and adaptation options that are best suited to local needs, priorities, and capabilities. The suitability of the various design and adaptation options will continue to evolve based on the latest scientific projections for sea level rise, observed erosion and flooding impacts, and availability of government programs and policies to support implementation of managed retreat or other adaption measures. Beach restoration is an acceptable and suitable option for Kāʻanapali in the coming decades, and should not be ruled out; however, that does not negate the need for parallel investigating of and eventual adoption of other long-term management and adaptation options. Beach restoration is a short to mid-term solution, intended to restore coastal resources while long-term solutions are investigated and implemented. Beach restoration is not the answer to sea level rise adaption, but rather allows us to manage and remedy erosion effects so that we can avoid coastal armoring; protect, preserve and enhance our beaches; maintain economic viability of visitor destinations; and buy needed time to figure out what managed retreat looks like for Kāʻanapali and how to accomplish it.

Several beach management plans have been written that encompass beaches of the Hawaiian Islands in general, the island of Maui, and specifically Kāʻanapali. The plans have the same general emphasis, outlining the problems and giving overviews of possible management alternatives. These plans, and any resulting actions generated from the plans, typically address key management issues identified for the region. Input based on regulatory environment, coastal processes, shoreline history, local interests and concerns, and government agency requirements and suggestions for the area produced the following key management considerations:

- DLNR prefers beach nourishment~~restoration~~ over shoreline armoring. Coastal armoring can potentially affect the physical, biological, and ecological characteristics of a shoreline, depending on the installation and where it is located. Community considerations could also be negatively affected by coastal armoring.
- The KLC is highly dynamic and experiences large seasonal fluctuations in beach width at the ends of the cell.

- The HLC is less seasonally dynamic; however, it is experiencing chronic erosion and is also subject to severe storm damage. The beach is narrow, and dry beach may be non-existent at high tide.
- Severe storms, such as Kona storms and tropical cyclones, can cause rapid erosion damage along the entire coast.
- Inland dune sand is not available at this time and is not a good match for the beach sand in either the Hanaka'ō'ō or Kā'anapali littoral cells.
- No other sources of compatible carbonate sand are presently available on the island.

Given these considerations, SEI has developed a proposed action that satisfies the following beach management tasks:

- Recovering nearshore beach compatible sand from offshore of Kā'anapali Beach. This would provide a local sand source that is a good match for both littoral cells.
- Restoration of the HLC, through the placement of additional beach sand. This is a technique that is supported by the DLNR and County of Maui Planning Department regulatory agencies.
- Adding sand to the dry berm area ("berm enhancement") in the KLC. This would augment the existing sand volume, providing greater capacity for the littoral cell to respond to and recover from episodic events.
- Mitigate the impacts of coastal erosion and high-water levels, which are increasing with sea-level rise (SLR), by providing a nature-based adaptation solution that increases protection for the Kā'anapali Resort community while restoring recreational resources and natural habitat by bringing the beach back to its former width and volume.

Kā'anapali Beach is a valued environmental, social, cultural, and recreational area for residents and visitors. Beach restoration is a mid-term solution that is intended to preserve and enhance the beach resource and shoreline public access for visitors and local residents, alike. It is not intended to fundamentally alter the processes that cause beach erosion at Kā'anapali, rather, it is a restoration and adaptation action to effectively set the clock back by restoring the beach to a former width and volume. Beach restoration is a single step in the long road to conserving the environmental, social, recreational, aesthetic, and economic value of Kā'anapali Beach. The proposed beach restoration project, including both beach restoration and berm enhancement, does not preclude the County of Maui, the West Maui community, and private landowners from developing a long-term sea-level rise adaptation plan, which will likely consider many options, including managed retreat.

~~1.4.1~~1.5.1 *Beach Restoration of Hanaka'ō'ō Littoral Cell*

Beach restoration involves placing quantities of compatible sand on a beach to maintain or widen the beach to a previous condition. Beach restoration is an environmental restoration activity, an investment in improving the public beach resource, and an alternative to hard shore protection structures (seawalls and revetments) as a means of erosion control. The HLC, which experiences minimal seasonal transport and more severe chronic erosion, is a feasible location for a beach restoration project.

The proposed project includes restoring the HLC beach to the approximate position shown in the 1988 aerial photograph (Figure 1-4). This requires 50,000 cubic yards of sand and would widen the dry beach by between 41 and 78 feet. A plan view of the proposed beach restoration is shown in Figure 1-5. Profile views of the proposed beach restoration is shown in Figure 1-6 and Figure 1-7.

1.4.21.5.2 Beach Berm Enhancement of the Kā'anapali Littoral Cell

The proposed project includes beach berm enhancement, or raising the elevation of the beach berm, within the KLC. The purpose of berm enhancement is to create a stockpile of sand along the backshore to augment the current sediment system with additional volume. This would provide a buffer during extreme erosion events by increasing back beach sand volume. Beach berm enhancement would be accomplished by adding a layer of sand atop the existing dry beach, or the area between the beach crest and the vegetation line, at the northern and southern ends of the KLC.

Raising the elevation of the beach berm by 3.5 feet at the southern portion of the KLC, fronting Whaler's Village, the Westin, the Kā'anapali Ali'i, and the Marriott, would require approximately 13,000 cubic yards of sand. This portion of the berm enhancement is referred to herein as the Hanaka'ō'ō PointSouth Berm Enhancement. A plan view of the Hanaka'ō'ō PointSouth Berm Enhancement is shown in Figure 1-8. Profile views of the berm enhancement are shown in Figure 1-9.

Raising the elevation of the beach berm by 3.5 feet at the northern portion of the KLC, fronting the Sheraton and the Kā'anapali Beach Hotel, would require approximately 12,000 cubic yards of sand. This portion of the berm enhancement is referred to herein as the NorthPu'u Keka'a Berm Enhancement. A plan view of the NorthPu'u Keka'a Berm Enhancement is shown in Figure 1-10. Profile views of the berm enhancement are shown in Figure 1-11.

Typical seasonal sediment transport within the KLC is between 20,000 and 30,000 cubic yards. The cumulative berm enhancement volume, 25,000 cubic yards of placed sand in the KLC, is equivalent to the volume of sand moved within the littoral cell during a typical season.

1.4.31.5.3 Sand Source - Pu'u Keka'a Sand Recovery Area

Sand compatibility between A key component to the recovery site and the active beach is onesuccess of the most important aspects of proposed beach restoration. High compatibility helps to minimize potential negative impacts associated with beach restoration, while maximizing the efficacy of the and berm enhancement project andis the speedavailability of equilibration in the sandy coastal environmentsuitable sand for placement. Placed sand should closely match the grain size distribution, color, composition, and density of the native beach sand. Deviation from any of these characteristics could result in unpredictable behavior of the beach restoration project. Multiple sources of sand were carefully evaluated in terms of character, quality, quantity, recovery cost, and general feasibility. Initial investigations for this project concluded that there was no readily available terrestrial source of sand and that local offshore sand resources should be evaluated. The sand selected for this project is a nearly ideal match to the existing beach sand. Compatibility of sand character and quality between the selected sand source and the native beach was not met or exceeded by any other sand source investigated for potential use. The sand recovery site is nearby, which limits travel and sand transfer requirements. Moreover, the offshore sand's similarity to the adjacent beach sand is likely a result of transport and loss from the active beach system, meaning this project is likely returning beach sand back to its beach of origin.

Offshore investigations for this project located a suitable sand deposit relatively close to shore at the north end of the beach restoration area. near Pu'u Keka'a. The deposit (referred to herein as the Pu'u Keka'a Sand Recovery Area) is located in 28 to 56 feet of water depth and approximately 150 to 800 feet offshore of Pu'u Keka'a. Offshore reconnaissance of the sand deposit included side-scan sonar imaging, towed video transects, hand coring, compressed air probing, vibracoring, diver inspection, and subbottom profiling. Laboratory tests on the vibracore samples included graded sieve analysis, fine content analysis, calcium carbonate analysis, and wet/dry color comparison. Sand sample analysis revealed the sand in the Pu'u Keka'a Sand Recovery Area to be suitable for placement on Kā'anapali Beach. Subbottom and side-scan sonar investigations revealed the Pu'u Keka'a Sand Recovery Area to be approximately 11 acres in area with a varying thickness between 7 and 26 feet. This corresponds to a total estimated volume of 358,000 cubic yards of sand.

The proposed project includes removing 75,000 cubic yards of sand from 8.5 acres of the Pu'u Keka'a Sand Recovery Area for use in restoring the beach in the HLC and enhancing the beach berm in the KLC. This sand recovery effort represents approximately 21% of the overall sand volume in the Pu'u Keka'a Sand Recovery Area, leaving 79-80% of the sand resource in place. This recovery effort would require a submarine excavation pit that is approximately 6 feet deep and covers the dredging extents shown in Figure 1-12. The sand recovery method is discussed in Section 1.6.

1.4.4 1.5.4 Expected Project Lifespan

According to the State of Hawai'i Sea Level Rise Report (Hawai'i Climate Change Mitigation and Adaptation Commission, 2017), Kā'anapali is anticipated to undergo significant erosion as sea levels rise (see Section 5.2). Beach restoration and berm enhancement can help to extend the life of Kā'anapali Beach in its current form. The HLC beach restoration is intended to return the beach to its approximate location in 1988, reversing over 30 years of erosion. However, the project lifespan is anticipated to be less than 30 years because the rate of erosion along Kā'anapali Beach has accelerated, based on observations. This acceleration of erosion rate likely corresponds to rising regional sea-level (see Section 2.1.8).

Using recent erosion rates to extrapolate into the future can be a reasonable approach to estimate the upper limit of the project's lifespan. The University of Hawai'i Coastal Geology Group (CGG) produced erosion maps for the Kā'anapali area; however, the erosion rates are based on shorelines dating back to 1912 and likely underestimate rates of recent and future erosion under increasing SLR. To estimate a reasonable lifespan of the proposed project, the most recent statistically significant erosion rates are more appropriate for use. SEI updated the CGG study by removing chronological outliers to show that the present-day erosion rate averages 2 feet per year within the Hanaka'ō'ō Littoral Cell (Sea Engineering, 2017). The proposed beach restoration would move the beach toe 41 feet seaward on average; therefore, the upper limit on the project lifespan would be approximately 20 years.

Unpredictable extreme events such as hurricanes, Kona storms, and tsunamis could significantly affect the project's lifespan. Accelerating rates of regional sea-level rise or multi-month regional bulges in water level or both can also reduce the project's lifespan.

Structural sand retention devices have been deployed locally, domestically, and globally to increase sand beach stability and beach nourishment project lifespans; however, this project has been developed as a nature based interim step in long-term sea-level rise adaptation and coastal management. As such, structural additions in the nearshore did not meet the proposed project's purpose and objectives.

a) b)

Figure 1-4. Kāʻanapali Beach Historical Shoreline a) 1988 aerial photograph (UH Coastal Geology Group) and b) 2013 aerial photograph (Google Earth)

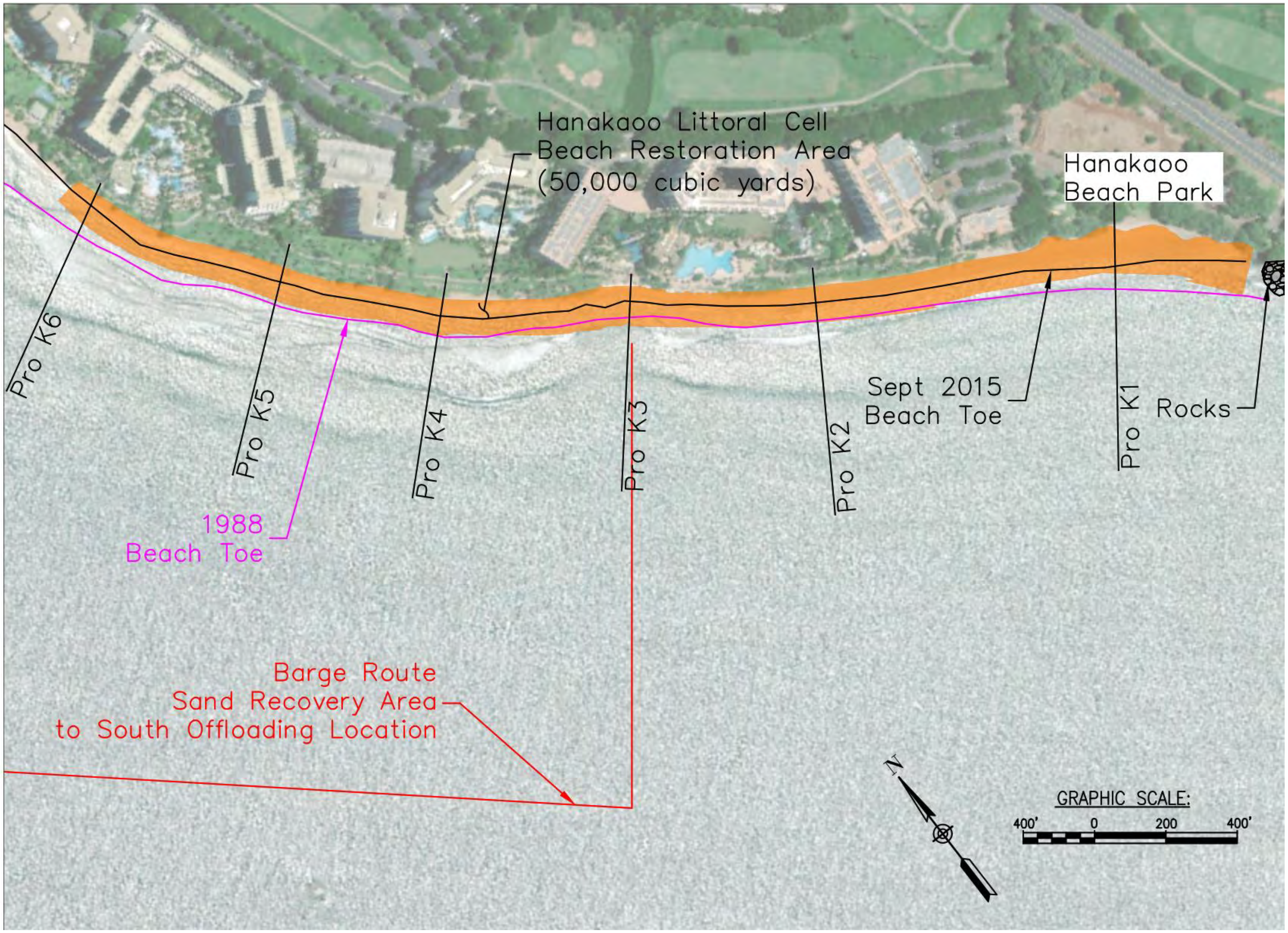


Figure 1-5. Hanaka'ō'ō Littoral Cell Beach Restoration area – Plan View

The addition of 50,000 cubic yards of sand would widen the dry beach by between 41 and 78 feet. Sand would be brought to an area offshore by barge and then through the shallower water depths by an elevated trestle or floating bridge to shore.

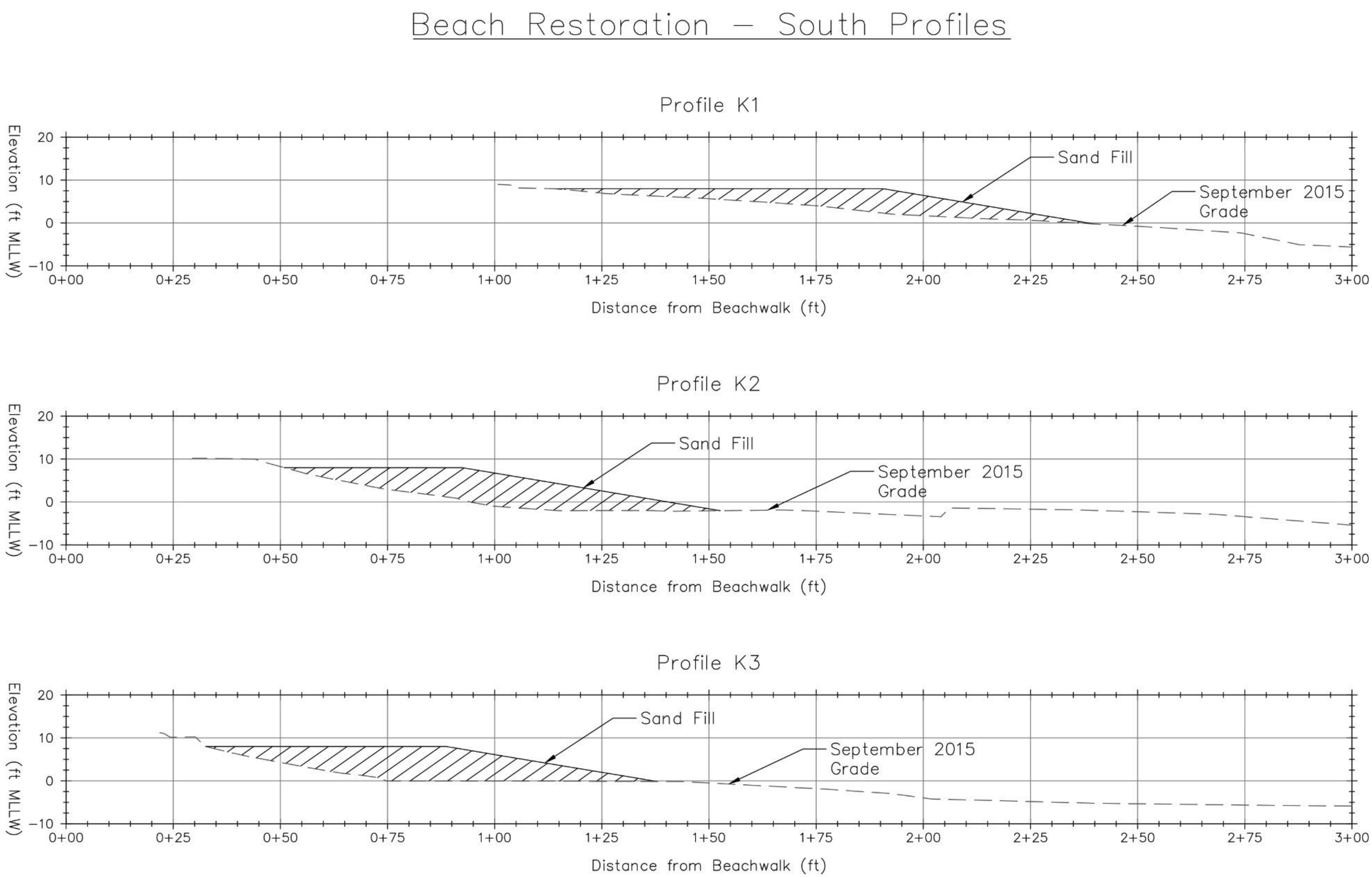


Figure 1-6. Hanaka'ō'ō Littoral Cell Beach Restoration – Profile Views (South Profiles).

The hatched area indicates the design sand fill placement that would result in widening the dry beach width by 41 to 78 feet.

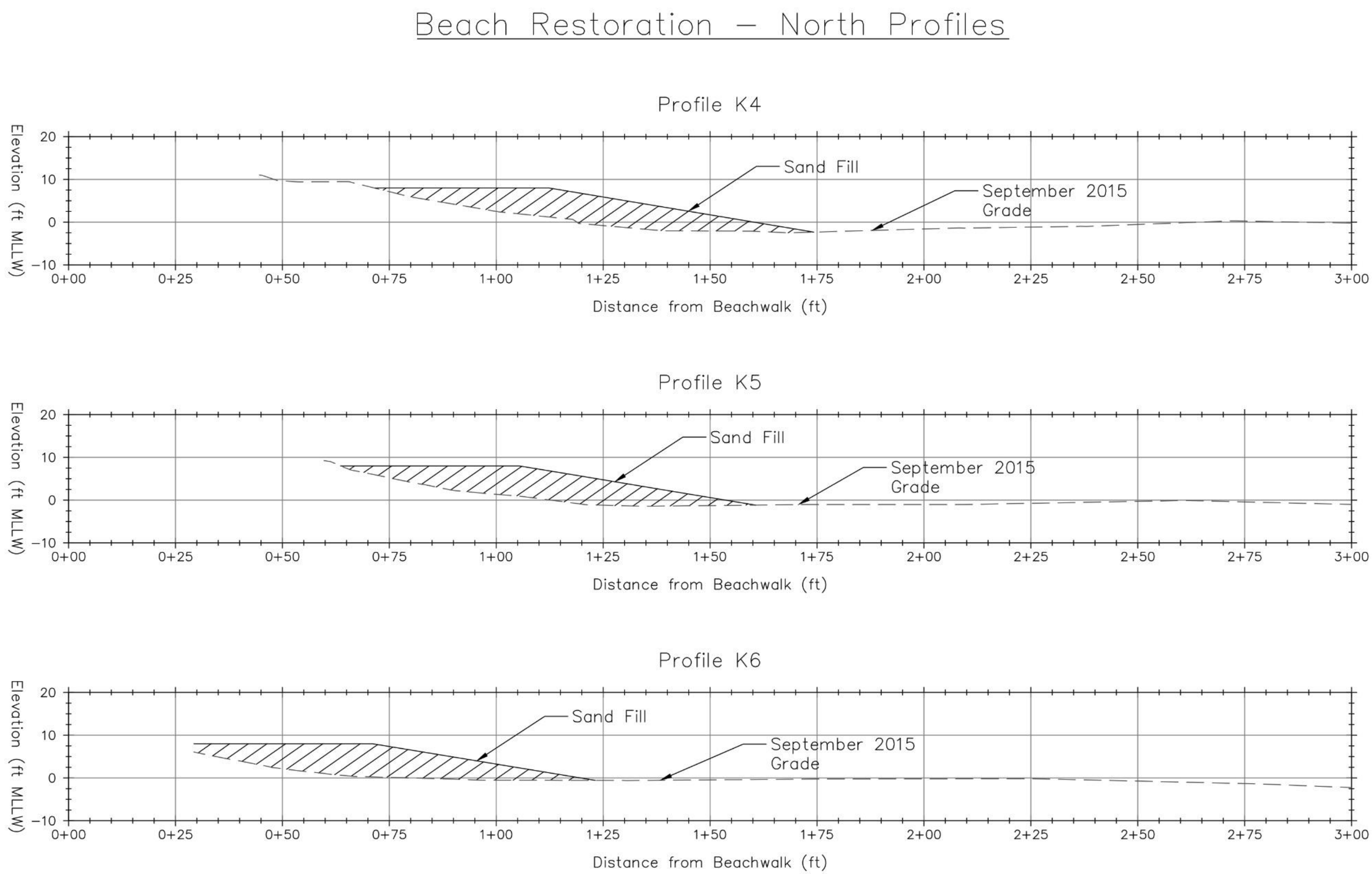


Figure 1-7. Hanakaʻōʻō Littoral Cell Beach Restoration – Profile Views (North Profiles).

The hatched area indicates the design sand fill placement that would result in widening the dry beach width by 41 to 78 feet.

Figure 1-8. SouthHanakaʻōʻō Point Berm Enhancement area – Plan View.

The berm would be raised by 3.5 feet requiring approximately 13,000 cubic yards of sand.

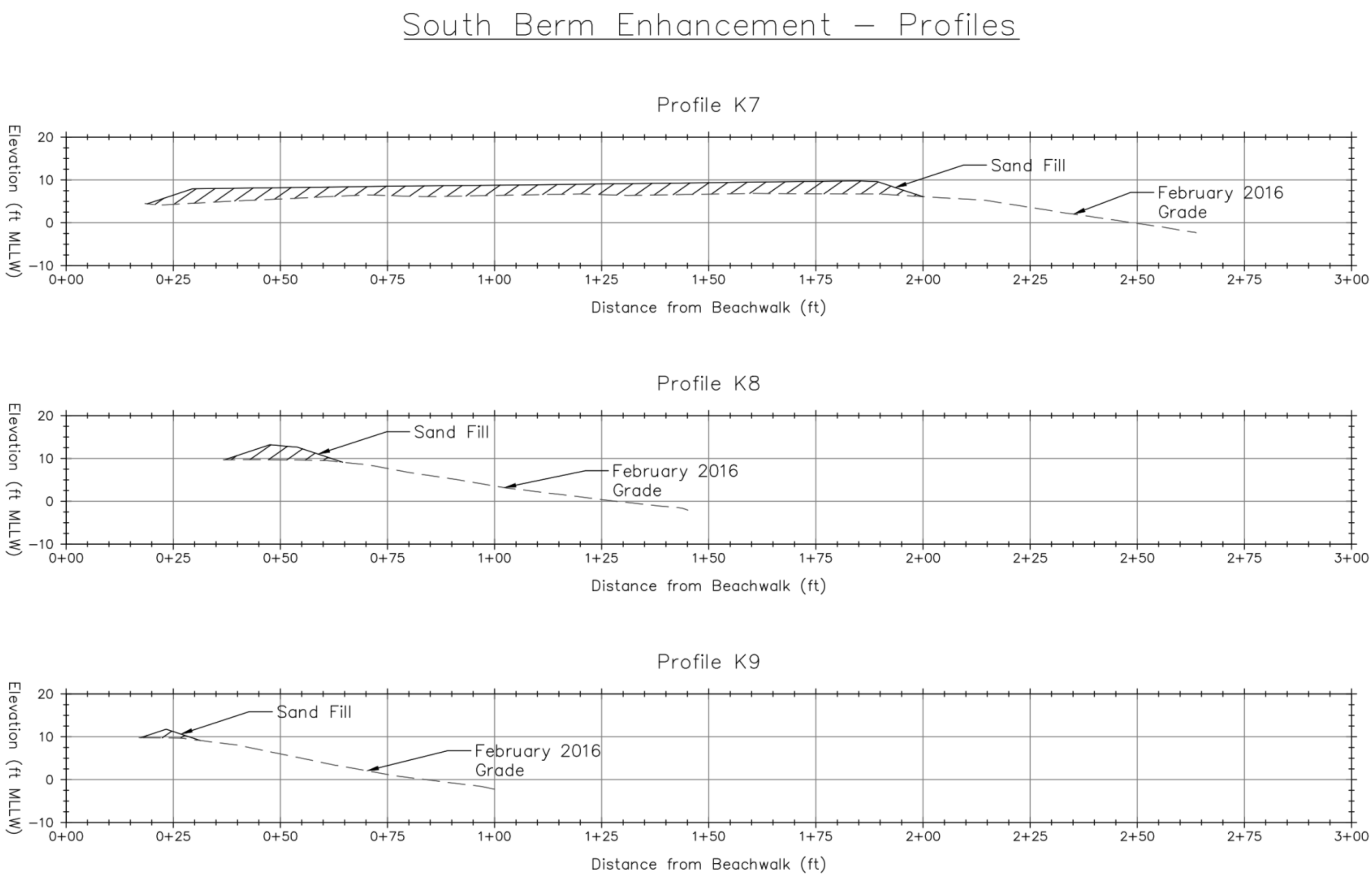


Figure 1-9. South~~Hanaka'ō'ō Point~~ Berm Enhancement – Profile Views.

The hatched area indicated the sand that would be placed to match the design berm height.

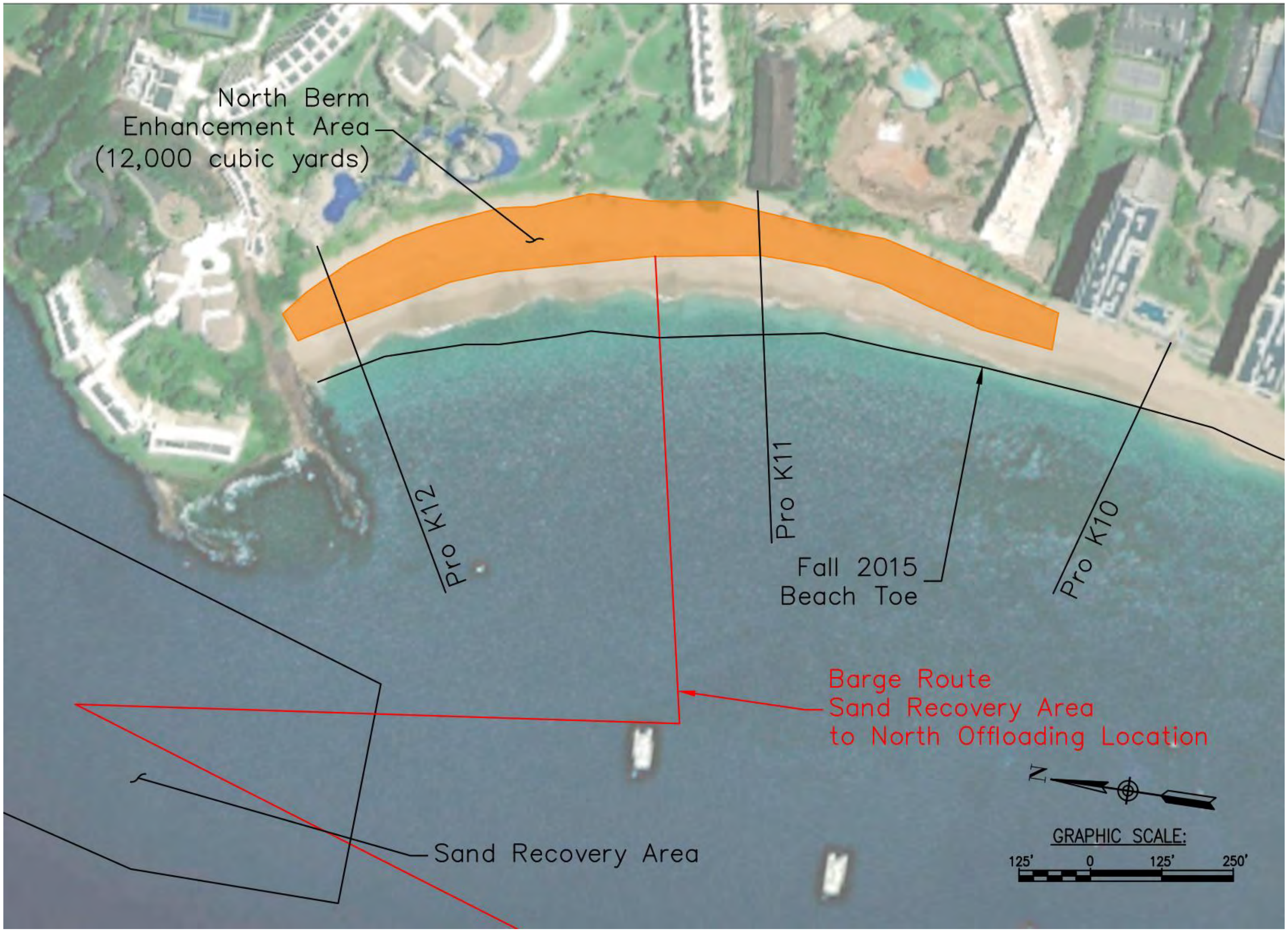


Figure 1-10. North~~Puʻu Kekaʻa~~ Berm Enhancement area – Plan View.

The berm would be raised by 3.5 feet requiring approximately 12,000 cubic yards of sand.

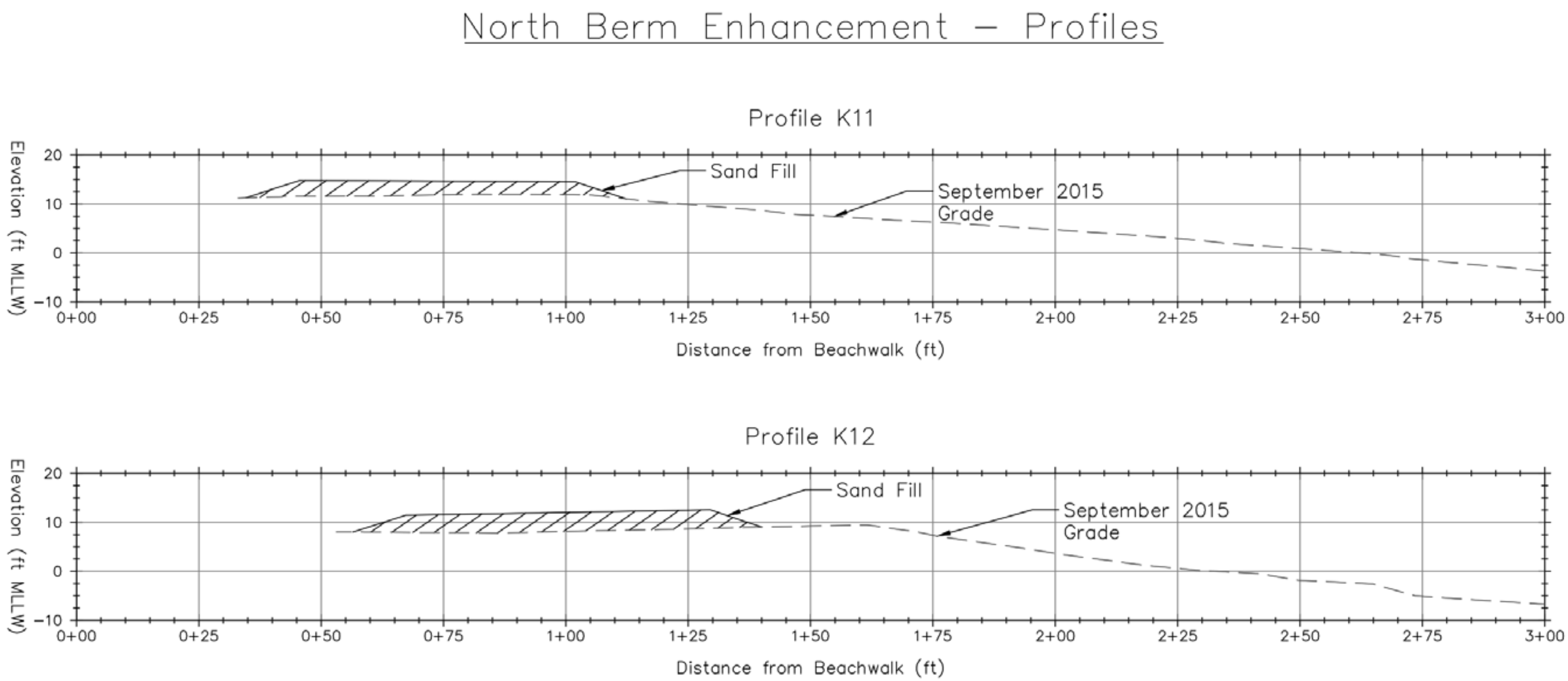


Figure 1-11. NorthPu'u Keka'a Berm Enhancement – Profile Views.

The hatched area indicated the sand that would be placed to match the design berm height.

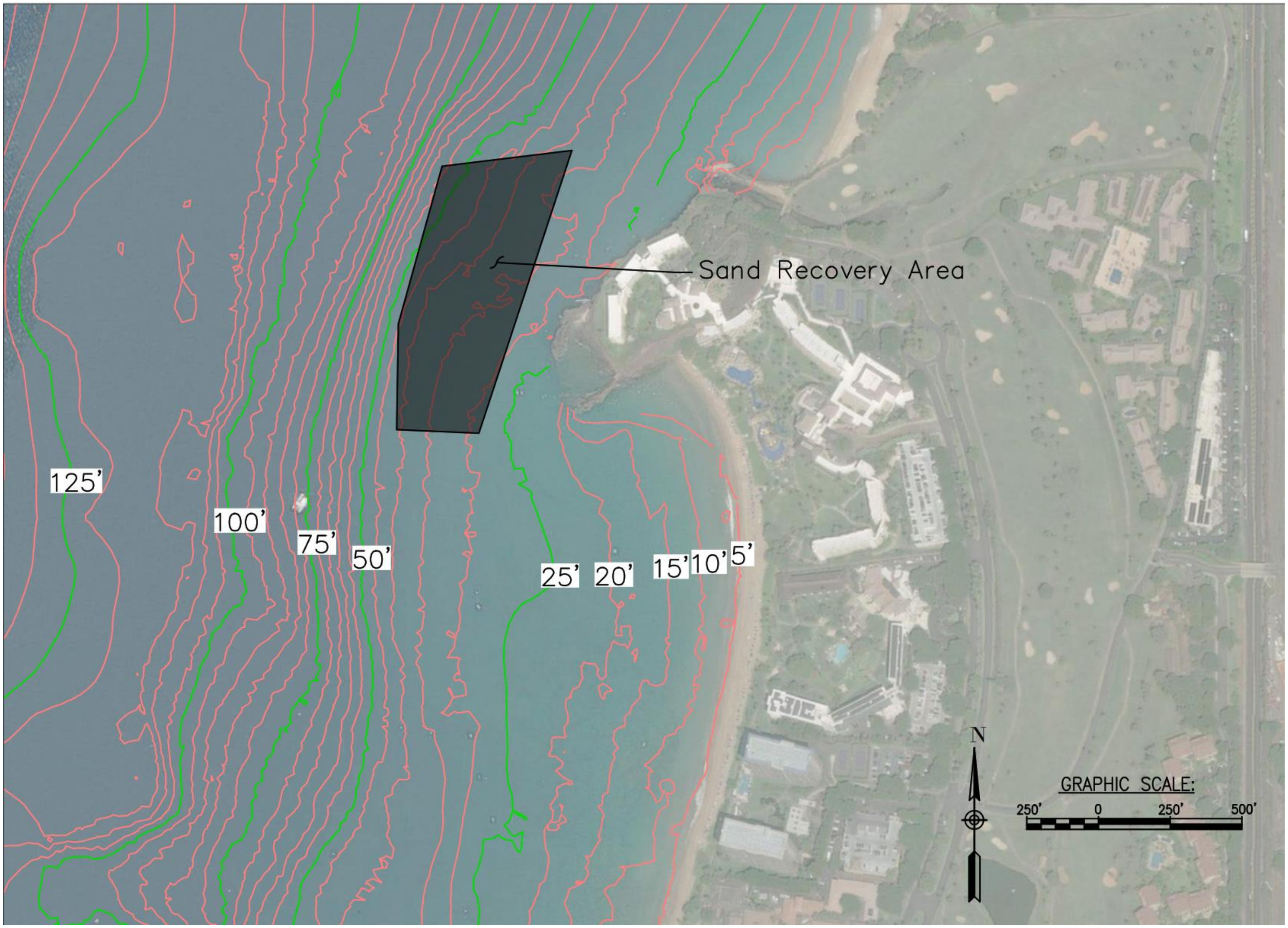


Figure 1-12. ~~Puʻu Kekaʻa~~ Sand Recovery Area.

Sand in this area is the best local source of beach quality sand that closely matches Kāʻanapali Beach color and grain size. The area is between~~approximately~~ 150 to 800 feet offshore in 28 to 56 feet of water depth.

1.51.6 Beach RestorationSand Recovery and Transfer Methodology – Schedule – Estimated Costs

1.5.11.6.1 Primary Sand Recovery and Transfer Methodology

Approximately 75,000 cubic yards of sand would be recovered from an 8.5-acre area within the Pu'u Keka'a Sand Recovery Area, located approximately 150 to 800 feet from the shoreline,offshore of Pu'u Keka'a in 28 to 56 feet water depth. The proposed sand recovery method consists of a moored crane barge equipped with an environmental clamshell bucket. An environmental clamshell bucket is a mechanical means of dredging that reduces the amount of seawater that is collected with the sediment (Figure 1-13). Once the bucket is full, the shutter (visor) is closed and only then is the bucket hauled out of the water and the sediments discharged into a barge. This visor or shutter prevents sediments from spilling back into the water.

The mooring configuration for the crane barge is shown in Figure 1-14. The crane barge would lift sand from the seafloor and place it onto two 1,500 cubic yard capacity deck barges or scows, or similar. The deck barges would be equipped with concrete wear decks and containment fences.

The deck barges would rotate between the Pu'u Keka'a Sand Recovery Area and the off-loading sites so dredging and offloading operations could be performed simultaneously. Once a deck barge was filled at the Pu'u Keka'a Sand Recovery Area, it would be towed to one of two off-loading sites, where it would be moored to an elevated trestle or floating bridge to shore. Approximate barge routes are shown in Figure 1-15. Barges would stay well offshore of surf and snorkeling sites during transit between the offshore sand deposit and the offloading locations.

The North Offloading Location would be located makai of the Sheraton (Figure 1-16) and would supply sand to the NorthPu'u Keka'a Berm Enhancement area. The South Offloading Location would be located makai of the Hyatt (Figure 1-17) and would supply sand to the Hanaka'ō'ō Littoral Cell Beach Restoration area and the Hanaka'ō'ō Point Berm Enhancement area. Offloading locations were chosen based on their proximity to the placement areas and nearshore bathymetry and geomorphology. The seafloor offshore of the KLC is sand with no coral or reef, therefore the north offloading location is simply placed in the middle of the NorthPu'u Keka'a Berm Enhancement Area. In contrast, the fringing reef in the HLC limits the potential locations for offloading. The South Offloading Location is located over a paleo stream channel that forms a gap in the reef.

Each offloading location would require an anchoring system for the barges as well as a bridge structure or floating platform, and machinery for transporting sand to shore. The deck barges would be moored in approximately 15 feet 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. Sand placement would start at the offloading locations and progress down the beach in each direction. Bulldozers and crews would spread sand along the shore to create the design beach plan and section or berm plan and section.

An alternate offloading design consideration could include positioning a jack up barge adjacent to the Kekaʻa Landing, on the north side of Puʻu Kekaʻa. A jack up barge typically utilizes piles at each corner of the vessel to lift the barge out of the water. Once out of the water, the barge can be elevated above ocean waves and currents, to provide a stable platform to work from. Scow barges could be anchored alongside the jack up barge. A crane, positioned on the jack up barge, could be used to offload the sand from the scow barges. Transfer from the jack up barge could be done by conveyor belt to a truck loading point on the shore, or by direct loading into trucks. If sand is loaded directly into trucks, then improvements will be required between the landing and the nearest roadway, Kāʻanapali Parkway.

~~1.5.2~~1.6.2 *Alternate Sand Transfer Methodology*

An alternate sand transfer methodology may be employed by the construction team. This alternate methodology would employ the same system for recovery of sand from the seafloor, using a crane barge and environmental bucket. The recovered sand would be placed within a scow, or similarly designed barge, moored alongside the sand recovery barge. This alternate methodology would employ hydraulic transfer of sand, as is commonly done in other states and other nations. Hydraulic dredging and hydraulic transport of sand are the most common methodology used in the United States, and account for more than 95% of all domestic beach nourishment projects.

For the northern KLC berm enhancement, the sand would be hydraulically transferred from the scow barge, at the sand recovery site, to an excavated dewatering pit in the berm (Figure 1-18) in the form of a slurry (mix of sand and water). This would require transferring the sand approximately 1,600 feet through a High-Density Polyethylene (HDPE) pipeline, Ultra-High-Molecular-Weight Polyethylene (UHMWPE) pipeline, or similar. The slurry would be discharged into a landlocked dewatering pit, where the slurry would dewater as the seawater percolated through the sandy beach substrate each night. During the day, the dewatered sand would be recovered and built into the berm enhancement. During the final day or days, the filled dewatering pit would be covered by previously excavated sand to achieve the grades and slopes designed for the northern KLC berm enhancement. The slurry pipeline route from the sand recovery area to the beach is entirely along sandy seafloor.

The HLC beach restoration area would have as many as three sand transfer locations, starting at the south end of the project area (Figure 1-19). The slurry transfer would begin at Hanakaʻōʻō Beach Park, where the beach is currently widest. The process would be similar to the northern KLC berm enhancement, except that the scow would transit from the sand recovery area to approximately 1,000 feet offshore of Hanakaʻōʻō Beach Park. Once the scow is on-station, it would connect to an HDPE pipeline, UHMWPE pipeline, or similar, and hydraulically transfer the sand to shore in a slurry. The slurry would discharge into a landlocked dewatering pit excavated within the beach berm. The transferred sand would dewater each night and would then be excavated from the pit for placement as beach restoration sand. The pipeline route, from the transfer station to the dewatering pit, would be across sandy substrate.

As the beach restoration moves north from the beach park, it would widen the beach between 41 ft to 78 ft. Once the restoration effort reached the paleochannel in the middle of the HLC project area, the transfer station would be moved. The middle transfer station would be located approximately 1,000 feet offshore of the beach at the paleochannel. The pipeline would be floated in deeper water, then would sit atop the sandy substrate and exposed fossil reef within the paleochannel, until reaching shore. Similar to the other sites, the sand would dewater overnight in an excavated, landlocked pit within the beach berm. The dewatering pit would likely be located within the newly placed restoration sand, as the natural beach is narrow at this location. In the morning, the excavated sand would be used to continue the restoration efforts, moving north along the project site.

The northern transfer site would be located 1,000 feet offshore of the south end of Hanakaʻōʻō Point. There is a shallow depression in the reef that extends to the beach face. The pipeline would be floated in deep water and rest atop the fossil reef and sandy substrate near shore. The beach at the south end of Hanakaʻōʻō Point is seasonally dynamic, and the width changes considerably between summer (at its narrowest) and winter (at its widest). The dewatering pit would be excavated in a mixture of restoration sand and recently accreted sand, as the point widens throughout the project's duration.

The last phase of the project would be the berm enhancement at the south section of the KLC. The dewatering pit could be moved slightly north, so that it overlapped with the southern KLC berm enhancement area. As with the northern KLC berm enhancement, the dewatered sand would be placed each day, and the final day or days would include covering the dewatering locations with excavated sand to achieve the grades and slopes designed for this berm enhancementrestoration location.

As with the primary sand transfer methodology, land-based equipment would transfer the sand from the dewatering location to the restoration area. Sand placement would start at the dewatering locations and progress along the beach, from south to north. Bulldozers and crews would spread sand along the shore to create the design beach plan and section or berm plan and section.

Another means for dewatering the slurry is direct discharge of the hydraulic slurry onto the beach, which is commonly used in other states for beach nourishment efforts. In these projects, the return water is allowed to flow directly back to the ocean, leaving the marine sand on the beach. The sand is then spread to match the design elevations. This methodology is the most efficient form of beach nourishment and could be deployed safely; however, it would require the support of the the State of Hawaiʻi Department of Health and the United States Army Corps of Engineers Regulatory Branch.

1.5.31.6.3 Alternate Sand Recovery Methodology

Previous marine sediment recovery projects in Hawaiʻi have utilized hydraulic dredging to both recover and transfer sand. Recovery actions are undertaken from a floating dredge plant, which is typically a crane barge with onboard pump and power systems to power the hydraulic dredge. The slurry is then transferred to shore, directly from the dredge, using a system similar to that described in Section 1.6.2. Once on land, the slurry would be dewatered.

The 2012 beach nourishment project in Waikīkī, Oʻahu, Hawaiʻi, utilized hydraulic sand recovery and transfer to bring over 24,000 cubic yards of sand to the coastline (Figure 1-20). This sand was dewatered onshore, then mechanically transferred to nourishment areas for placement and grading.

A similar process could be applied at Kāʻanapali. This could utilize a dewatering plan similar to that described in Section 1.6.2.

~~1.5.4~~1.6.4 Additional Beach Nourishment Methodologies

Additional beach nourishment methodologies that are employed in other states and nations, not discussed in the sections above, include, but are not limited to:

- Discharge of sand, from the hull of a hopper barge, to inshore waters. Repeated discharge in a confined area creates a sand bar near the beach. The intended purpose of the inshore sand bar is to gradually feed sand to the littoral cell, using ocean waves and nearshore currents.
- Inshore sand bars can also be created by discharge of sand slurry from a fixed pipeline. This creates a sand bar that can be recharged as needed through the fixed pipeline on the seafloor. A semi-permanent, submerged dredge site would be established in the sand recovery area.
- Dune restoration or creation, similar to berm enhancement, allows for the placement and storage of sand in the littoral cell. Dunes are accessed by waves and provide sand to the active littoral cell during high wave events and erosion events. Dune restoration and creation is actively done on Maui and other islands in Hawaiʻi. This type of project could augment the proposed beach restoration project in a meaningful and beneficial way by restoring terrestrial habitat, improving the coastal hazard mitigation capability of the shoreline, and storing beach quality sand for future erosion events. Currently, dune restoration is outside the project's scope, as it would require work mauka of the shoreline, on private property in the County Special Management Area, grubbing and excavation, and significant alterations to the existing shoreline vegetation.
- The Dutch created a large, dry sand feature that extends out from the beach, called the sand motor. This type of nourishment effort uses focused placement of sand to create a salient feature, or one that extends out from the normal beach face. Then normal waves, currents, and wind move the sand and nourish the broader littoral cell. The sand motor in the Netherlands covers approximately one square kilometer.

1.6.5 Project Sequence

Project sequence is anticipated to start with mobilization of the sand recovery effort and the north sand transfer station. Sand recovery and beach restoration activities will be contemporaneous, with the North Berm Enhancement task completed first. Sand delivery, transfer and placement will continue at the North Berm Enhancement area until the task is complete. Sand transportation from the sand offloading location will be by truck delivery along the truck haul route. The typical daily work area, shown for scale, truck haul route, and sand delivery and transfer area for the North Berm Enhancement are shown in Figure 1-21.

Following completion of the North Berm Enhancement area, sand transfer will move to the south end, at the transfer site in the Hanakaʻōʻō Littoral Cell. Beach restoration in the HLC will commence at the sand delivery and transfer location, then work south and north, out from the transfer area. Sand delivery will be by truck along the truck haul route. The typical daily work area, shown for scale, truck haul route, and sand delivery and transfer area for the HLC Beach Restoration are shown in Figure 1-22.

The South Berm Enhancement task will be completed last. Sand transportation from the HLC sand offloading location will be by truck delivery along the truck haul route, through the HLC Beach Restoration area. The typical daily work area, shown for scale, and truck haul route for the South Berm Enhancement are shown in Figure 1-23.

~~1.5.5~~1.6.6 Project Schedule, Sequence, and Duration

The proposed project would take place during the fall and winter months. The Federal resource agencies, including the National Marine Fisheries Service and the U.S. Fish and Wildlife Service both suggest that beach nourishment projects not be conducted during peak coral spawning and marine animal nesting and birthing season (spring and early summer).

The current schedule includes permitting activities from mid ~~2020~~ 2021 through early ~~2021~~ 2022 and contracting through summer ~~2021~~2022. This would allow the project to take place during the fall and early winter of ~~2021~~2022, with the possibility of individual tasks being completed in early ~~2022~~2023.

Table 1-2 shows a preliminary project construction timeline. Work is expected to proceed 7 days per week and 12 hours per day. The anticipated duration for placing 75,000 cubic yards of sand, including time for site mobilization and demobilization, is approximately 63 to 75 calendar days. This is based on an estimated rate of dredging and delivery to the beach of between 1,500 cy to 2,000 cy per day. Operational weather windows have been maximized by using multiple barges for the sand recovery and transfer system. Having one barge anchored over the recovery site, and separate barges used explicitly for sand delivery and transfer to shore allows more flexibility with both beach restoration and berm enhancement.

Table 1-2. Preliminary project timeline

Activity	Duration
Mobilization	5 days
Move and place sand	38 - 50 days
Weather delays	5 days
Safety factor	10 days
Demobilization	5 days
Total	63 - 75 days

~~1.5.6~~1.6.7 Beach Restoration~~Nourishment~~ and Berm Enhancement Costs

The cost of mobilization and demobilization for the primary sand recovery and transfer methodology is estimated to be $4,000,000. Mobilization includes transporting equipment (barges, tugs, cranes, earthmoving equipment, etc.) to the site, setting mooring anchors around the borrow area and offloading locations, and constructing floating bridges or trestles at the offloading locations. Demobilization includes removing all equipment and anchors from the site. The fixed cost of mobilization and demobilization is a significant percentage of the total project cost because dredging equipment is very specialized and is not readily available on Maui, therefore nearly all equipment must be shipped from Oʻahu or further.

The cost estimate, utilizing the primary sand recovery and transfer methodology, is based on a per cubic yard cost of $85 for dredging and placement. The estimated cost for beach berm enhancement in the KLC is $2,125,000. The estimated cost for beach restoration of the HLC is $4,250,000. The preliminary estimated cost for the Kā'anapali Beach Restoration and Berm Enhancement project including mobilization, demobilization, and best management practices is $11,125,000. The cost estimate is broken down in Table 1-3. Given potential changes in means and methods, dredging technology, and inflation, a range of costs between $9,000,000 to $13,000,000 is given for planning purposes.

Table 1-3. Kā'anapali beach restoration and berm enhancement cost estimate

Description	Amount
Mobilization/Demobilization	$4,000,000
Berm Enhancement Dredging and Placement (25,000 cubic yards at $85 per cubic yard)	$2,125,000
Beach Restoration Dredging and Placement (50,000 cubic yards at $85 per cubic yard)	$4,250,000
Best Management Practices	$750,000
Total	$11,125,000

1.6.8 Public Lands and Public Funds

The proposed project is located on State lands. The sand recovery area and all anchoring systems are entirely located within State submerged lands, in the Resource Subzone of the Conservation District. The sand transfer systems and the beach restoration work will cross the waterline, but still be located makai of the shoreline, upon State submerged lands. All sand placement for the berm enhancement will also be located makai of the shoreline location.

Funding for the project will be provided by both the State of Hawai'i Department of Land and Natural Resources (DLNR) and the Kā'anapali Operations Association (KOA), with close to an even cost share. The construction funds are currently available, with the State's portion already encumbered and KOA's portion secured and ready for use.

The State is responsible for conservation and restoration of beaches, as well as environmental stewardship of coastal ecosystems. Funding beach restoration and berm enhancement projects fits within the scope of the DLNR's management priorities and the Conservation District objectives. In addition, the nearly equal cost share by the abutting landowners creates an attractive and attainable funding opportunity to conduct restoration work on the coastline.

KOA is an active member of the community and a faithful partner to the State in this endeavor. During typical years, Kā'anapali employs roughly 5,000 people, provides nearly $230 million in income, pays approximately $180 million in State and County taxes, not including income tax on the $230 million contributed in salaries. In addition, KOA donates more than $1 million to support local nonprofit organizations and provides more than $5 million in community service and support. KOA's participation and support in this project is in keeping with their ongoing commitment to the West Maui community.

Within the United States, beach nourishment projects have been documented as providing rewarding returns on investment at the federal, state, and local levels. Projects funded and completed in Florida have been analyzed in detail to explore the relationship between funding dollars and return on investment. Figure 1-24, from Houston's 2018 paper on the value of Florida's beaches, shows the relationship between funding for nourishment projects and tax revenue generated by beach tourists in Florida. Beach restoration projects in Hawaiʻi are generally smaller scale (length of coastline and volume of sand) than in Florida and elsewhere on continental coasts and are developed and implemented specifically to suite Hawaii's unique coastal environments. However, the general finding that beach nourishment projects provide a good return on investment appears to apply to Hawaiʻi scale projects, also. The State economy of Hawaiʻi, similar to Florida, has a strong relationship with the tourism sector.

Analysis of funding sources, costs, and benefits, indicate that restoration of the beach environment is not only a worthwhile endeavor in terms of conserving the public trust beach and coastal ecosystem but is also an attractive and rewarding investment in and for the community.

Figure 1-13. Clamshell bucket sand recovery at Pearl Harbor entrance channel.

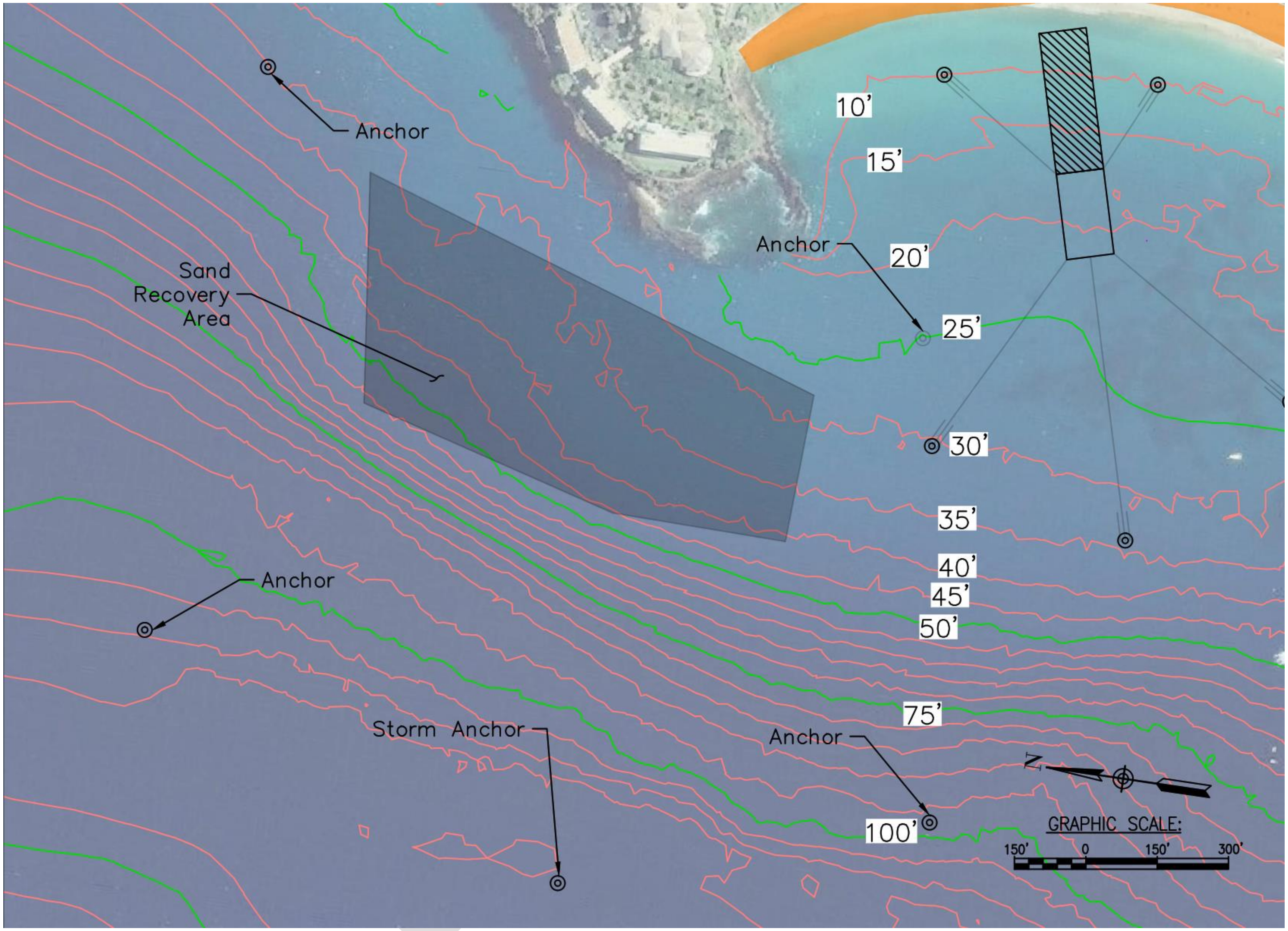


Figure 1-14. Anchor spread around the ~~Pu'u Keka'a~~ Sand Recovery Area.

The anchor locations are on sandy substrate.

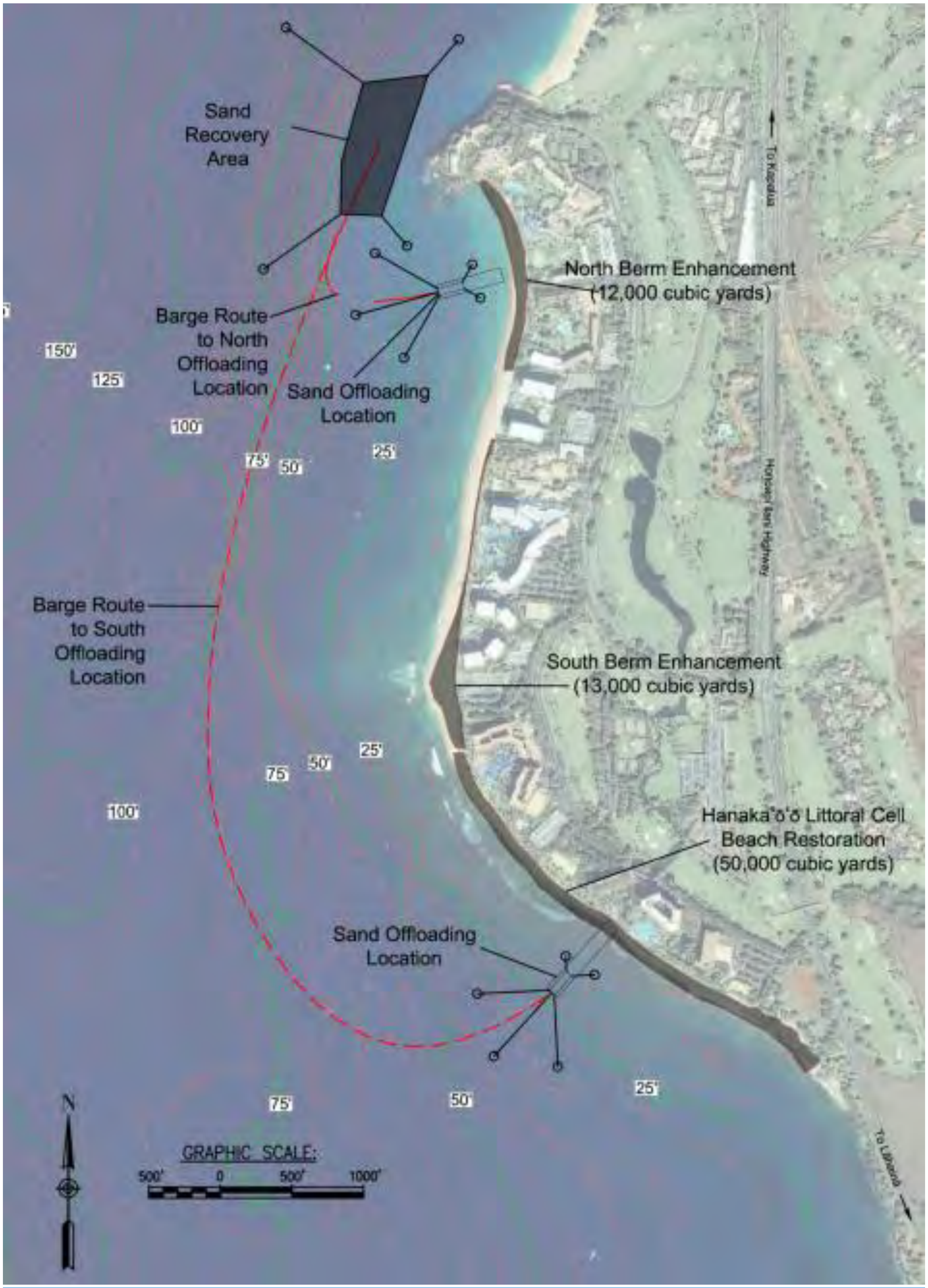


Figure 1-15. Primary sand recovery and transfer methodology: Approximate barge routes to offloading locations

A barge would take sand from the sand area to the north or south offloading location where sand would be transferred to a bridge or trestle system that would bring sand the remaining distance to the beach.

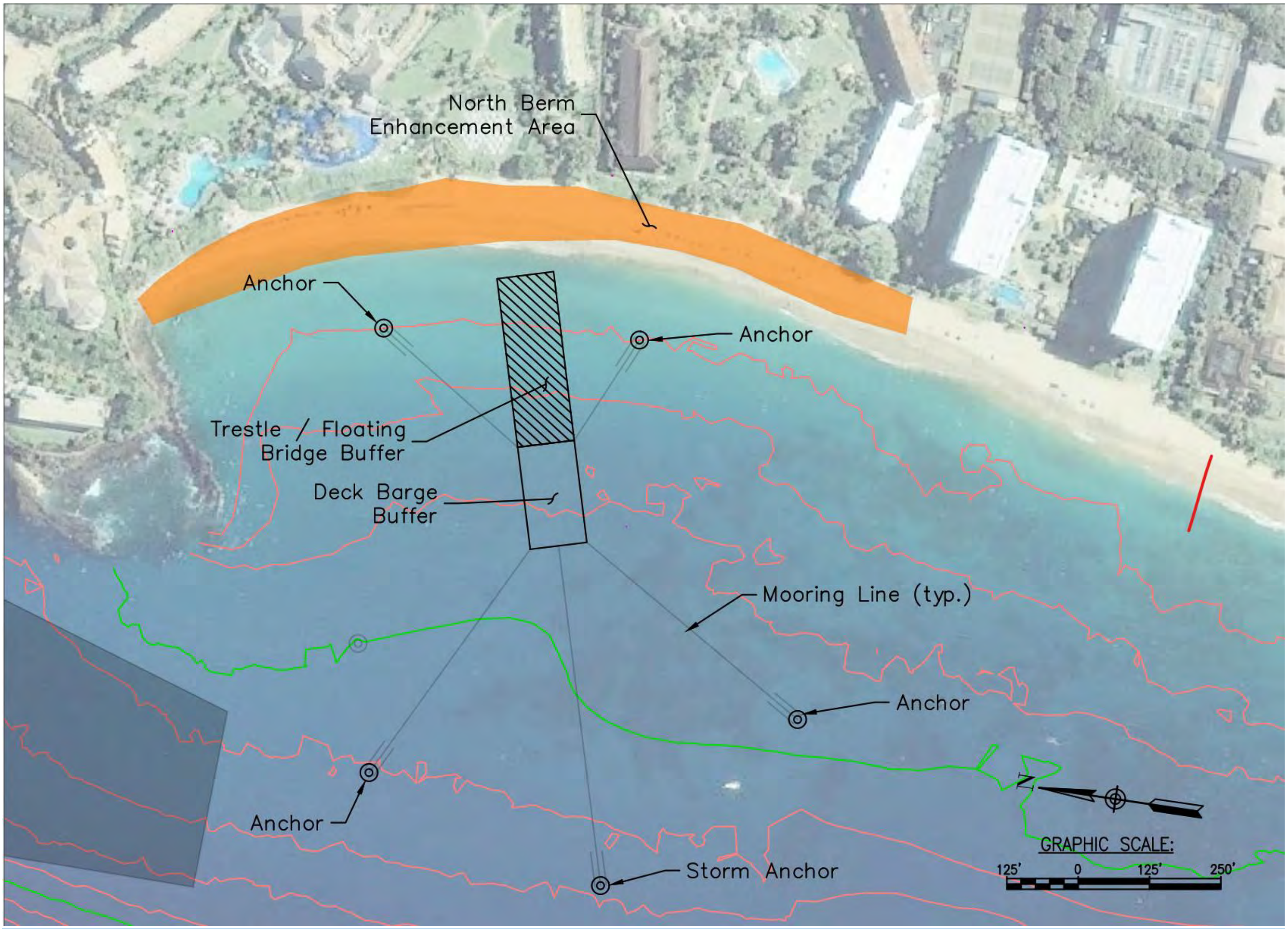


Figure 1-16. Primary sand recovery and transfer methodology: Nearshore anchor spread for the North Offloading Location

The anchor locations are on sandy substrate.

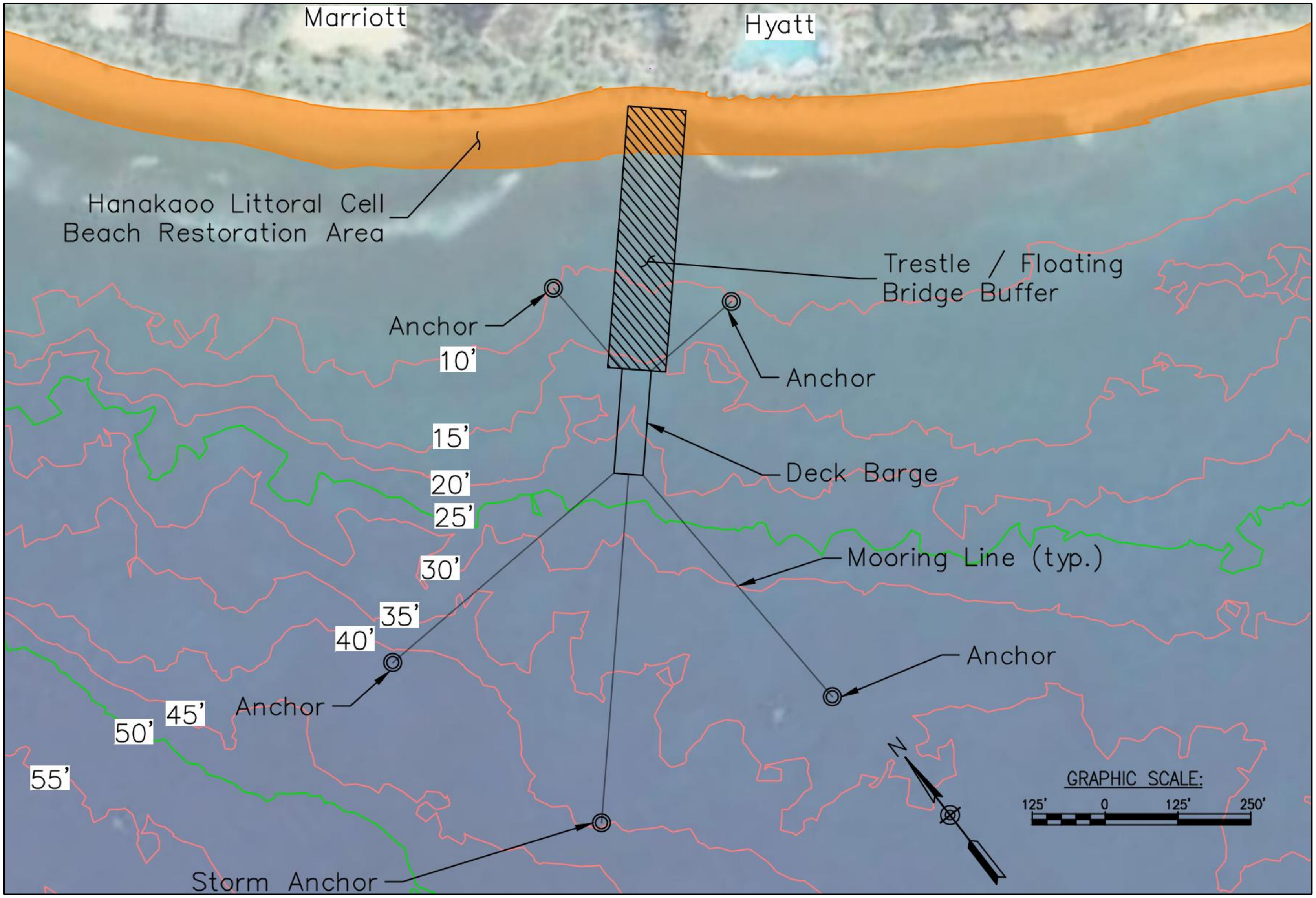


Figure 1-17. Primary sand recovery and transfer methodology: Nearshore anchor spread for the South Offloading Location.

The anchor locations are on sandy substrate over the paleochannel.

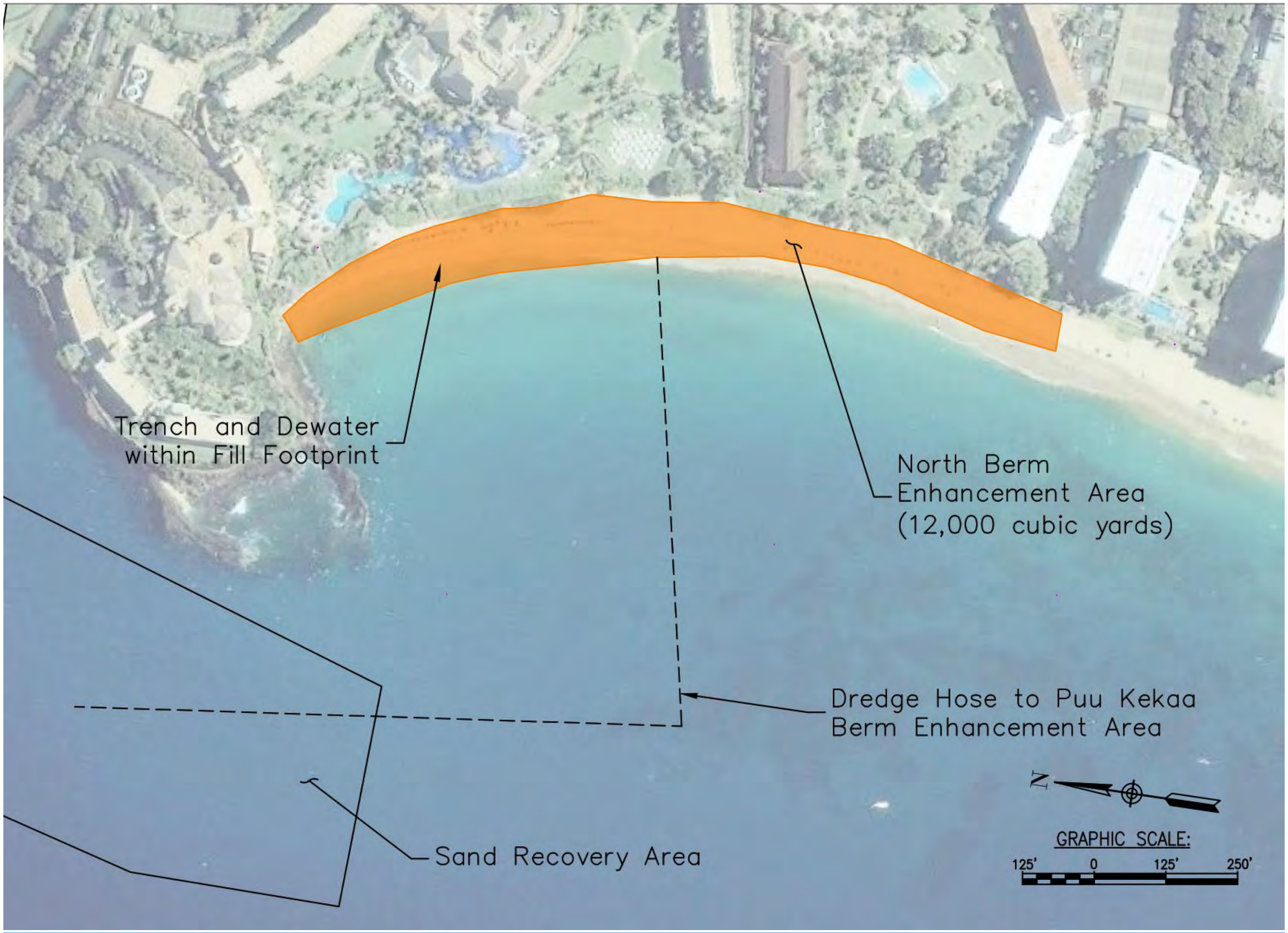


Figure 1-18. Alternate sand recovery and transfer methodology: Approximate Hydraulic Delivery Pipeline Route to NorthPu'u Keka'a Berm Enhancement Area

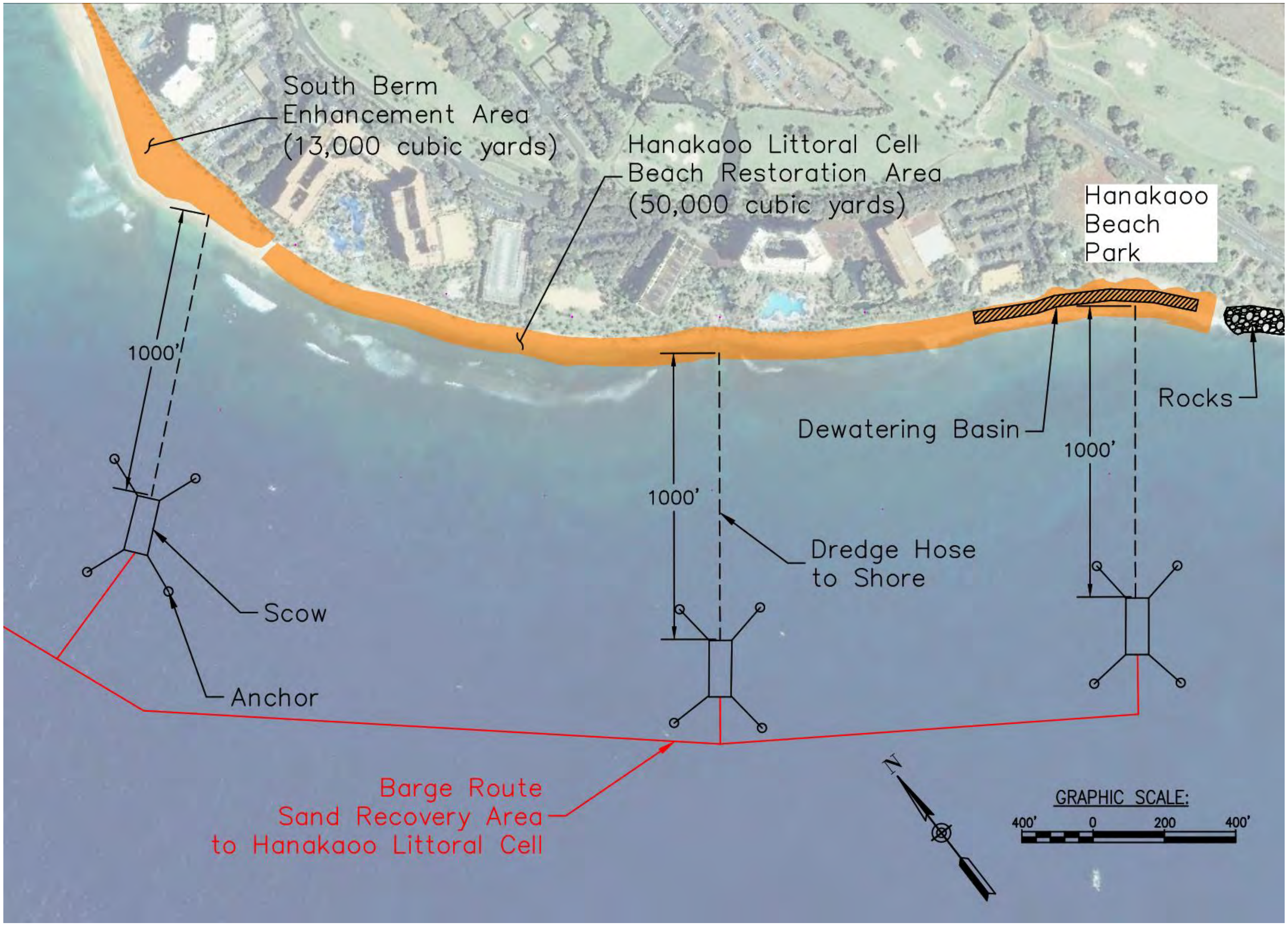


Figure 1-19. Alternate sand recovery and transfer methodology: Nearshore anchor spread for the South Offloading Locations Utilizing Hydraulic Delivery Pipeline.

Figure 1-20. Hydraulic sand recovery system used in the 2012 Waikīkī Beach Nourishment Project

Figure 1-21. North Berm Enhancement sand transfer, truck haul route, and typical daily work area.

Figure 1-22. Hanakaʻōʻō Beach Restoration sand transfer, truck haul route, and typical daily work area.

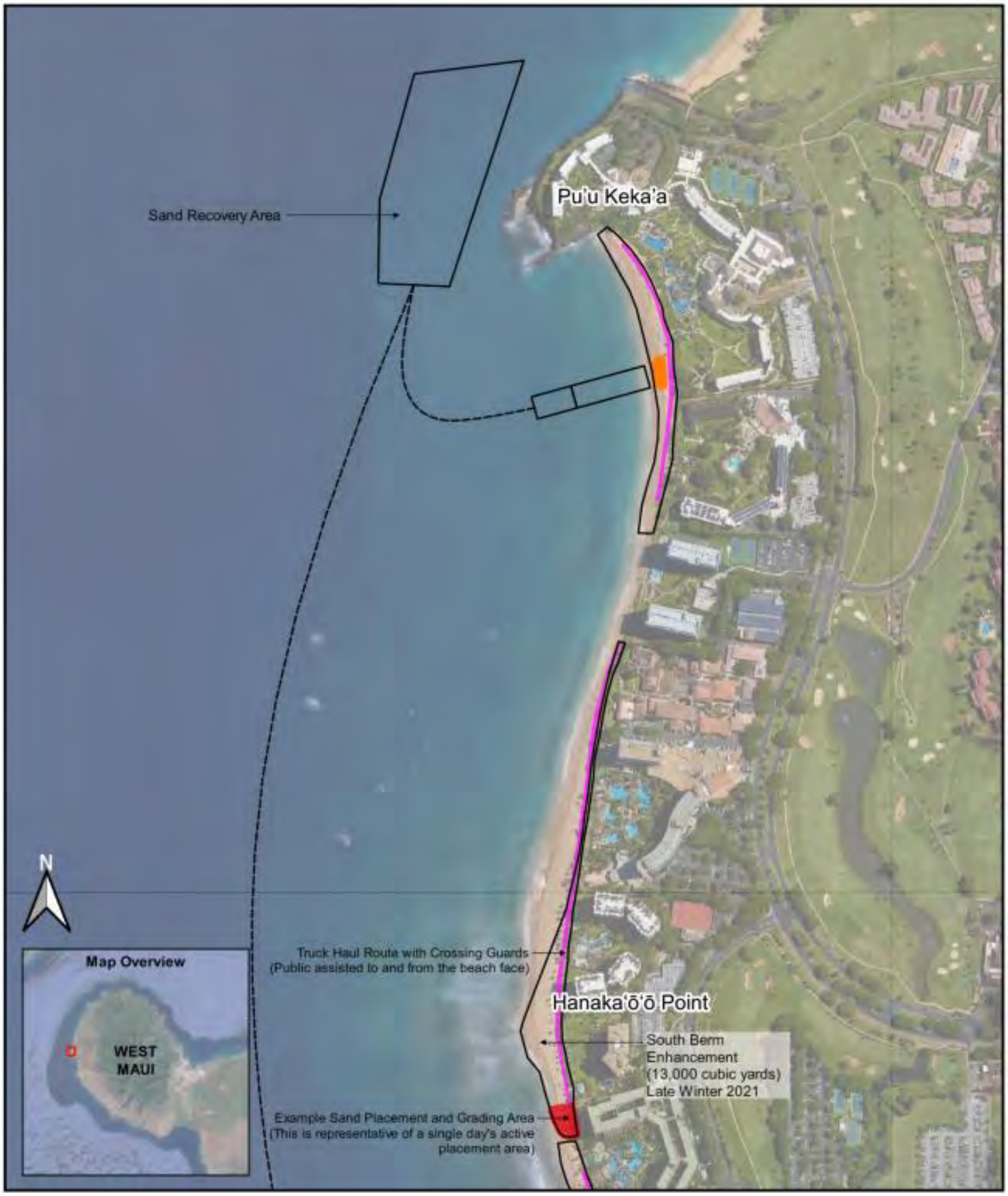


Figure 1-23. South Berm Enhancement sand transfer, truck haul route, and typical daily work area.

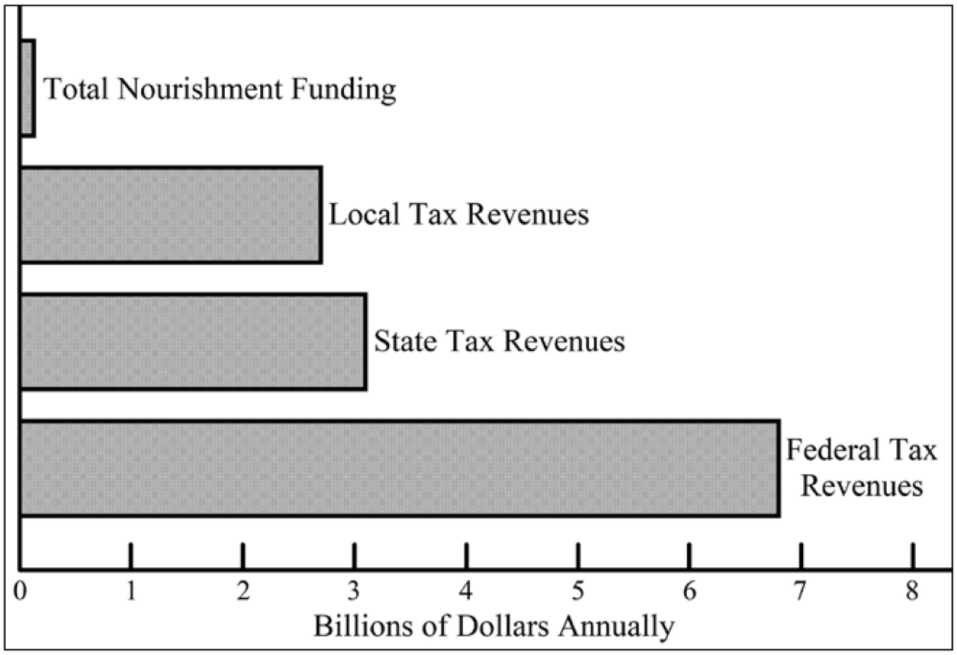


Figure 1-24. Comparison beach nourishment funding costs to beach tourist generated tax income generated annually in Florida (Houston, 2018).

2. DESCRIPTION OF THE EXISTING ENVIRONMENT, POTENTIAL IMPACTS OF THE PROPOSED ACTION, AND MITIGATION MEASURES

This chapter details the existing environment and evaluates potential environmental consequences associated with the proposed action and alternatives. In addition, the chapter ~~and~~ discusses possible management and design measures to minimize or avoid impacts. Direct impacts are analyzed under each resource section. Cumulative and secondary impacts are addressed at the end of the chapter.

2.1 Physical Environment

2.1.1 Climate

Existing Condition

The Hawaiian Island chain is situated south of the large eastern Pacific semi-permanent high-pressure cell, the dominant feature affecting air circulation and climate in the region. Over the Hawaiian Islands, this high-pressure cell produces persistent northeasterly winds called tradewinds. During the winter months, cold fronts sweep across the north-central Pacific Ocean, bringing rain to the Hawaiian Islands and intermittently modifying the tradewind regime. Thunderstorms, which are rare but most frequent in the mountains, also contribute to annual precipitation.

Due to the tempering influence of the Pacific Ocean and their low-latitude location, the Hawaiian Islands experience extremely small diurnal and seasonal variations in ambient temperature. Average temperatures in the coolest and warmest months in Lāhainā are 73˚F (January) and 79.5˚F (August). These temperature variations are quite modest compared to those that occur at inland continental locations.

Topography and the dominant northeast tradewinds are the two primary factors that influence the amount of rainfall on any given location on Maui. Near the peaks of the West Maui Mountains and the windward slope of Haleakalā, which are fully exposed to the tradewinds, rainfall averages nearly 250 inches per year. On the leeward side of the island, where the project is located, the rainfall is much lower with average annual rainfall in Kāʻanapali being less than 15 inches per year. Although the project area is on the leeward side of the island, the humidity is still moderately high, ranging from mid-60 to mid-70 percent.

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

Figure 2-1 shows a wind rose diagram for wind data recorded in 2014 at the Kapalua Airport, 3 miles to the north of the project site. The wind rose shows the frequency of occurrence based on wind speed and direction and indicates the dominance of Northeast tradewind flow in the islands.

The West Maui Mountains have a blocking effect that decreases the influence of tradewinds in the Kāʻanapali area and causes the winds to come from a more northerly direction (following the land contours). Wind speeds in the channels between Maui, Molokaʻi, and Lānaʻi can be significantly faster due to the funneling effect caused by the land masses.

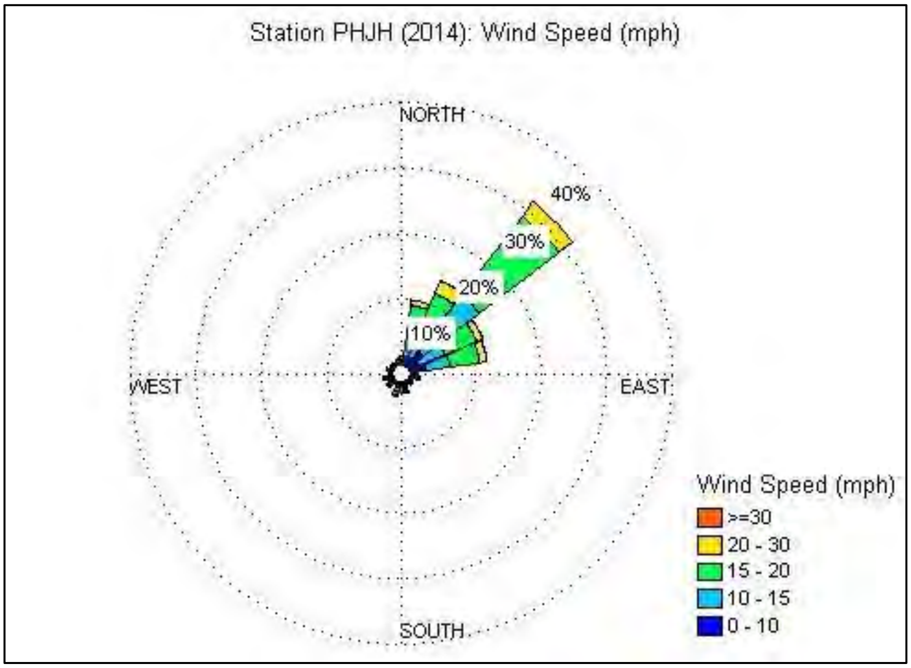


Figure 2-1. Wind rose for Kapalua Airport (Station PHJH)

<u>Potential Impacts and Proposed Mitigation Measures</u>
The proposed project is anticipated to have a negligible impact on the climate.

2.1.2 Tides

<u>Existing Condition</u>
Hawaiʻi tides are semi-diurnal with pronounced diurnal inequalities (i.e., two high and low tides each 24-hour period with different elevations). Tidal predictions and historical extreme water levels are provided by the NOAA National Ocean Service (NOS) Center for Operational Oceanographic Products and Services. The nearest official tide station to Kāʻanapali is located at Kahului Harbor, and the water level data for that station is shown in Table 2-1.

Table 2-1. Water level data for Kahului Harbor (relative to mean sea level)

Datum	Elevation (feet MLLW)	Elevation (feet MSL)
Highest Astronomical Tide	+3.1	+2.0
Mean Higher High Water	+2.2	+1.1
Mean High Water	+1.9	+0.8
Mean Tide Level	+1.1	0.0
Mean Low Water	+0.3	-0.8
Mean Lower Low Water	0.0	-1.1

Hawai'i is also subject to periodic extreme tide levels due to large-scale oceanic eddies that have recently been recognized and that sometimes propagate through the islands. These events are referred to as *mesoscale eddies* and can produce tide levels that can be on the order of 0.5 to 1 foot higher than normal for periods up to several weeks (Firing and Merrifield, 2004).

There is a consensus among Hawai'i coastal scientists and engineers that the 2003 erosion event that damaged the shoreline at Hanaka'ō'ō Point was caused by the vigorous and sustained occurrence of southern swell in combination with pronounced short-term increases in sea level due to the presence of mesoscale eddies (Sea Engineering, 2003; Vitousek et al., 2007). One of the highest sustained sea level measurements recorded at the Honolulu Harbor tide gauge occurred during September of 2003 (Firing and Merrifield, 2004). Comparative analysis of tide levels, satellite altimetry, and hydrographic measurements around the Hawaiian Islands suggest that the 2003 extreme water levels were largely due to an anti-cyclonic eddy with an offshore water level rise of about 0.5 feet and a diameter of roughly 186 miles. Figure 2-2 is a graph of predicted and verified (measured) tide levels at Honolulu Harbor during June 2003. The figure shows a sustained super-elevation of water level of at least 0.5 feet throughout the month, as is indicated by the purple 'Observed – Predicted' data on the graph.

Nearshore waves are typically depth-limited, meaning that the amount of wave energy that reaches the shoreline is directly tied to the water level at the shoreline. As wave energy increases exponentially with wave height, a water level increase of 0.5 feet can dramatically change the coastal processes at a particular shoreline. The previously existing beach profile equilibrium can be suddenly modified, and beach loss and coastal erosion can occur rapidly. This has been well documented at Hanaka'ō'ō Point and at erosion hot spots in the HLC.

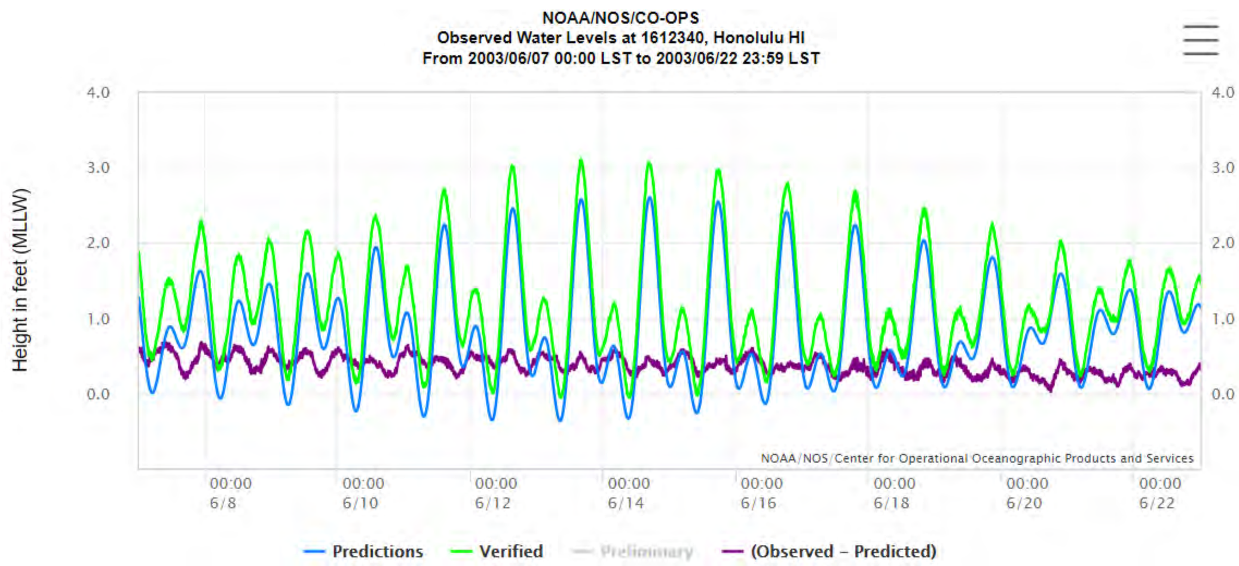


Figure 2-2. Honolulu Harbor tide record for June 2003 (NOAA NOS)

Potential Impacts and Proposed Mitigation Measures

The proposed project is anticipated to have a negligible impact on regional tides or water levels.

2.1.3 Sea-Level Rise

Existing Condition

The present rate of global mean sea-level rise (SLR) is +3.4 ± 0.4 mm/yr (NASA, 2017), where a positive number represents a rising sea level. Global mean SLR has accelerated over preceding decades compared to the mean of the 20th Century. Factors contributing to the rise in sea level include melting of land-based glaciers and ice sheets and thermal expansion of the ocean water column. NOAA recently revised their SLR projections through 2100 taking into account up-to-date scientific research and measurements. According to NOAA global SLR projections, their "*Intermediate*" scenario represents approximately 3 feet of rise by 2100 and their "*Extreme*" scenario represents more than 8 feet by 2100. The NOAA report describes the Extreme scenario as "physically plausible" and corresponds to a business-as-usual trajectory for increasing greenhouse gas emissions (i.e., no reductions in the increasing rate of emissions) and worst case for glacier and polar ice loss in this century.

Rates of SLR are variable in time throughout the oceans due to variations in temperature, atmospheric pressure, winds, currents, and vertical land motion. The sea level trend for Honolulu Harbor for the period of 1905 to 2019 is shown in Figure 2-3 (NOAA, 2017). The rate of relative sea level rise (RSLR) is shown in the figure as being +1.51 ± 0.21 mm/yr based on monthly data for the period 1905-2019. Though the Kahului Harbor's tide gauge record doesn't start until 1947, Figure 2-4, it also shows a persistent rise in sea level across the decades. The RSLR for Kahului is +2.23± 0.40 mm/yr based on monthly data for the period 1947-2019. Both Figure 2-3 and Figure 2-4 show interannual anomalies that approach 0.5 feet (15 cm) in magnitude due to natural oceanic variability from processes such as the El Niño Southern Oscillation.

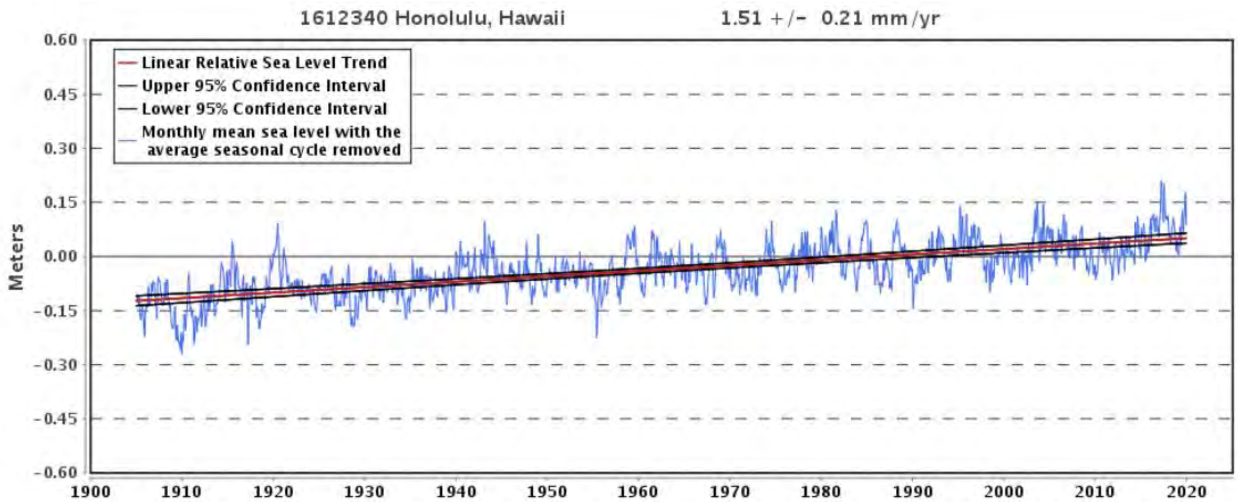


Figure 2-3. Mean sea level trend, Honolulu Harbor, 1905 to 2019 (NOAA, 2020)

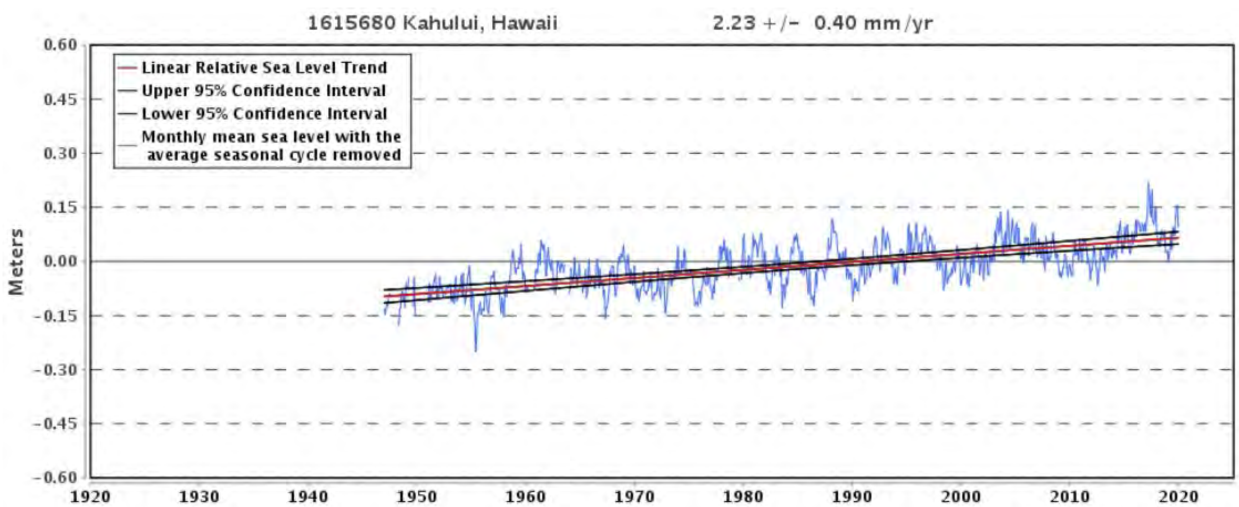


Figure 2-4. Mean sea level trend, Kahului Harbor, 1947 to 2019 (NOAA, 2020)

Hawaiʻi thus far has seen a rate of SLR lower than that of the global average due to variations in regional phenomena described above. Acceleration in global mean SLR has only recently been detected. It may be that SLR has been accelerating regionally among the Hawaiian Islands over the past decade or more; however, the acceleration is not discernable in the local tide gauge record yet due to high inter-annual variability "masking" a longer-term signal. Regional acceleration in the rate of SLR is expected to become discernable over the coming decades as ice mass (melt water) is redistributed from polar regions to the global oceans due to equilibrium changes in Earth's gravitational field and rotation. The NOAA 2017 report indicates that SLR rates around the Hawaiian Islands and other regions located far-field of ice sheet masses are expected to be as much as 1.4 times the rate of global mean SLR over this century.

Table 2-2 shows NOAA's most recent global mean SLR scenarios, while Table 2-3 and Figure 2-5 present estimations of Hawaiʻi's mean sea-level rise scenarios based on the revised NOAA projections, taking into account the far-field effects. While the projections are based on the most current scientific models and measurements, discretion is necessary in selecting the appropriate scenario. Selecting the appropriate SLR projection is a function of many parameters, including topography, coastal setting, the criticality of infrastructure, potential for resilience, budget, and function. As an example, it may be best to design a power plant or hospital based on the *High* or *Extreme* rate, since those are considered critical infrastructure that would be expensive to modify, and damage could have a long, far-reaching impact. On the other hand, light infrastructure such as a beach park restroom might be designed based on a lesser rate and could be adapted or relocated as sea level rises as part of future mitigation plans.

The regional climate assessment for Hawaiʻi and affiliated Pacific Islands was recently completed. Contributors to the assessment included NOAA, USGS, University of Hawaiʻi, and other public and private entities. These results became part of the National Climate Assessment that was released in 2018 (USGRP, 2018). An important initial conclusion of the regional assessment is that NOAA's revised *Intermediate* rate should be used for Hawaiʻi. This is shown as the black line in Figure 2-5. This results in a projected SLR of 0.6 feet by 2030 (within the design life of this project) and 2.3 feet by 2070. The magnitude and uncertainty associated with these projections necessitates a prudent approach when evaluating the feasibility and longevity of follow up nourishment actions. Each effort will require an in-depth review of SLR observations, impacts, and projections for the project region.

Table 2-2. Global Mean Sea Level (GMSL) rise scenarios

(NOAA, 2017)

Scenario (feet)	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
Low	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Intermediate-Low	0.1	0.3	0.4	0.6	0.8	1.0	1.1	1.3	1.5	1.6
Intermediate	0.1	0.3	0.5	0.8	1.1	1.5	1.9	2.3	2.8	3.3
Intermediate-High	0.2	0.3	0.6	1.0	1.4	2.0	2.6	3.3	3.9	4.9
High	0.2	0.4	0.7	1.2	1.8	2.5	3.3	4.3	5.6	6.6
Extreme	0.2	0.4	0.8	1.3	2.1	3.0	3.9	5.2	6.6	8.2

Table 2-3. Hawaiʻi Local Mean Sea Level (LMSL) rise scenarios

(Based on NOAA, 2017)

Scenario (feet)	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
Low	0.1	0.2	0.3	0.5	0.6	0.7	0.9	1.0	1.2	1.3
Intermediate-Low	0.1	0.3	0.5	0.7	0.9	1.1	1.4	1.6	1.9	2.1
Intermediate	0.1	0.4	0.6	1.0	1.3	1.8	2.3	2.9	3.5	4.2
Intermediate-High	0.2	0.4	0.7	1.1	1.7	2.4	3.2	4.1	5.0	6.3
High	0.2	0.4	0.8	1.4	2.1	3.0	4.0	5.3	7.0	8.4
Extreme	0.2	0.4	0.9	1.6	2.4	3.5	4.8	6.5	8.3	10.5

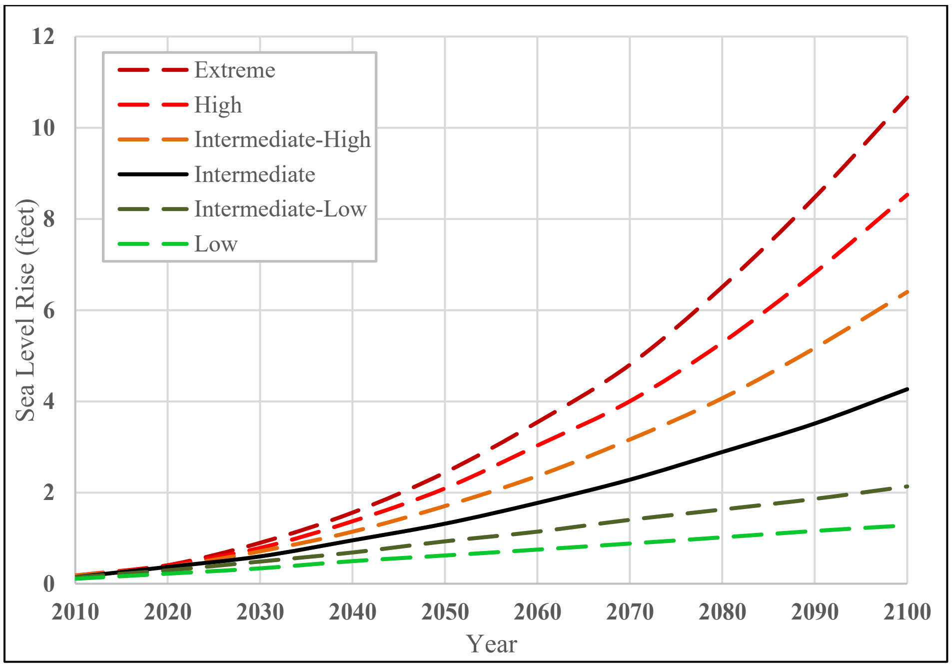


Figure 2-5. Hawaiʻi Local Mean Sea Level (LMSL) rise projections

(Based on NOAA, 2017)

Potential Impacts and Proposed Mitigation Measures

The proposed project is anticipated to have a negligible impact on the global, Pacific basin, regional, or local sea level. Rather, the proposed project is intended to mitigate the impacts of SLR by providing a nature-based adaptation solution that increases protection for Kāʻanapali Resort community while restoring recreational resources and natural habitat through restoration of the beach to its former width and volume. SLR is a product of human induced climate change, meaning the proposed project is a nature-based response to human induced environmental changes.

2.1.4 Currents

Existing Condition

Local currents in the Hawaiian Islands are generally driven by the semi-diurnal tides, wind, and breaking waves. The predominant current can differ between the nearshore (inside the wave breaker zone) and the offshore.

Wave-induced currents predominate inside the breaker zone, generating both longshore (shore parallel) and onshore/offshore (rip) currents. These nearshore, wave-induced currents drive the seasonal sediment transport in the KLC, between Hanakaʻōʻō Point and Puʻu Kekaʻa. Summer swells that reach the Kāʻanapali shoreline break at an oblique angle to the west facing KLC, creating a longshore current to the north. Winter swells from the north reverse the current.

Offshore currents are generally tidal- and wind-driven and can vary over the water column. To measure currents offshore of Kāʻanapali, two Acoustic Doppler Current Profilers (ADCPs) were deployed between October 30, 2015, and February 9, 2016. Figure 2-6 shows the ADCP locations.

The ADCPs measured and recorded current speeds and directions at numerous depths through the water column. The ADCPs were programmed to ping on a regular periodicity. The average measurement for each 1-hour sample interval was recorded in order to remove effects of local water particle velocities due to wave action. The current profile time series data were analyzed to determine primary speed and direction, averaging several depth zones each for the bottom, mid-depth, and surface layers. The bottom layer includes the bottom one-fifth of the water column. The surface layer includes the top one-fifth of the water column. The mid layer is the middle one-fifth of the water column.

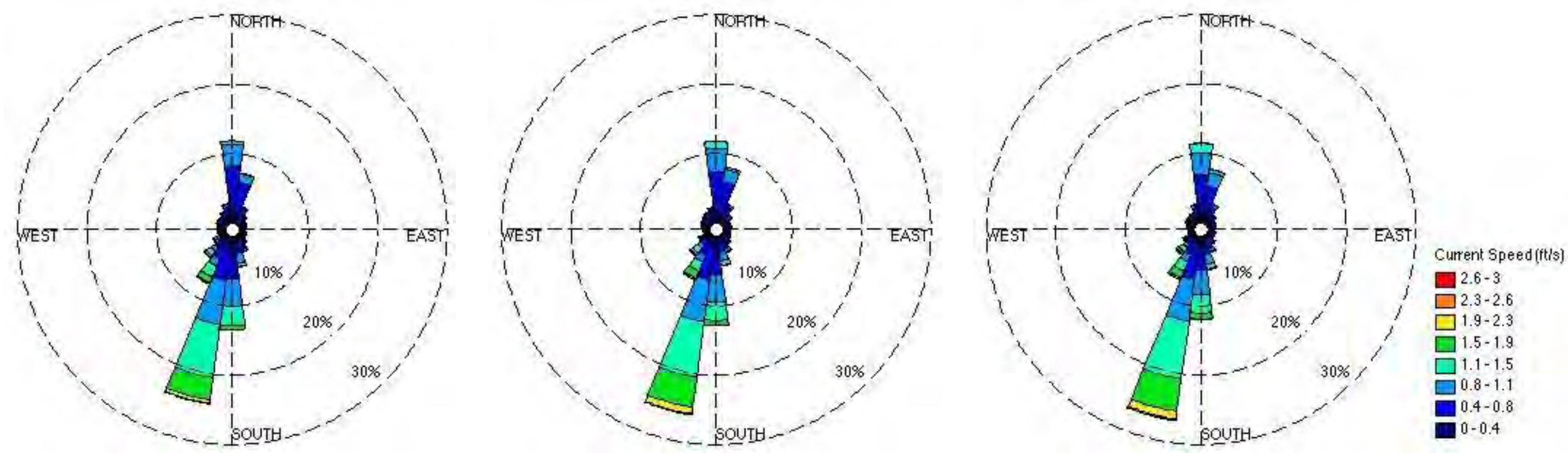
ADCP-1 was located 600 feet offshore of Puʻu Kekaʻa in a water depth of 39 feet. The measured current was semi-diurnal, i.e., two northward and two southward peaks per day. Currents at this location averaged 1.5 feet per second. Peak currents ranged from 1 to 2.3 feet per second and were generally stronger in the southward direction. The measured current had a fairly uniform flow over the bottom, middle, and surface layers.

ADCP-2 was located 750 feet off of the Paleo-stream channel in 31 feet of water. Currents measured by ADCP-2 were semi-diurnal, similar to those measured by ADCP-1 but peak directions were oriented northwest-southeast. Velocities were generally higher when the current was moving the northwest direction. The surface layer at ADCP-2 moved in a similar direction as the middle and bottom layers but had a stronger current magnitude. Peak currents ranged from 1 to 2.5 feet per second, slightly stronger than those measured by ADCP-1.

Summary current rose diagrams for bottom, mid, and surface water layers are presented for ADCP-1~~Puʻu Kekaʻa~~ and for ADCP-2~~Paleo-stream channel~~ in Figure 2-7 and Figure 2-8, respectively. The rose diagrams illustrate the percent frequency of occurrence of both current direction and speed at different depths in the water. The diagram is read like a compass, with North in the up direction. In a rose diagram, rings represent frequency of occurrence in percent intervals, bars represent current speeds, and the location of the bars represents the direction of current flow. Current direction is reported as the direction flow is going to (oceanographic convention); for example, a current flowing from due east to west would have the direction of west, or the compass direction 270° from north.

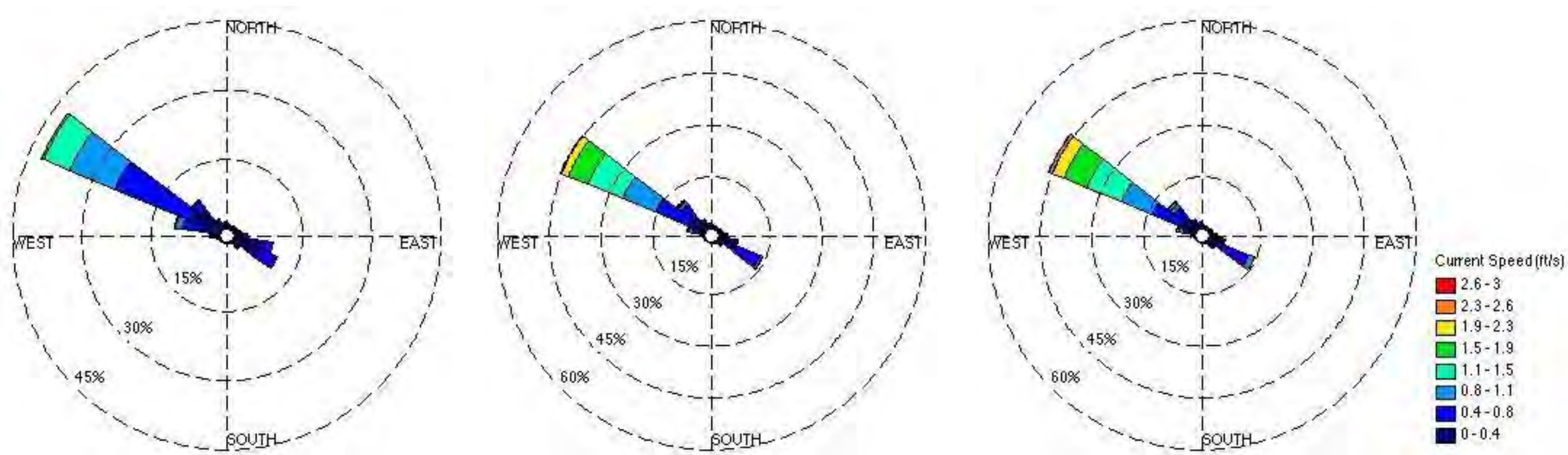
The semi-diurnal, nearly uniform flow of water indicates that currents offshore of Kāʻanapali are predominantly tidally driven. The current primarily runs parallel to shore. The strongest peak currents are observed during spring tides and the weakest peak currents are observed during neap tides. Currents are generally stronger when moving in the southward direction versus the northward direction at ADCP-1. Currents are generally stronger when moving in the northwestward direction versus the southeastward direction at ADCP-2. The peak northward current generally corresponds to high tide and the peak southward current generally corresponds to a low tide. The current slows as the tides change and then reverses direction. Representative time series of current magnitude and direction measured by ADCP-1 and ADCP-2 are shown in Figure 2-9 and Figure 2-10, respectively.

Figure 2-6. ADCP locations



a) b) c)

Figure 2-7. ADCP-1 ~~(Puʻu Kekaʻa)~~ a) bottom layer, b) middle layer, c) surface layer



a) b) c)

Figure 2-8. ADCP-2 ~~(Paleo-Stream Channel)~~ a) bottom layer b) middle layer c) surface layer

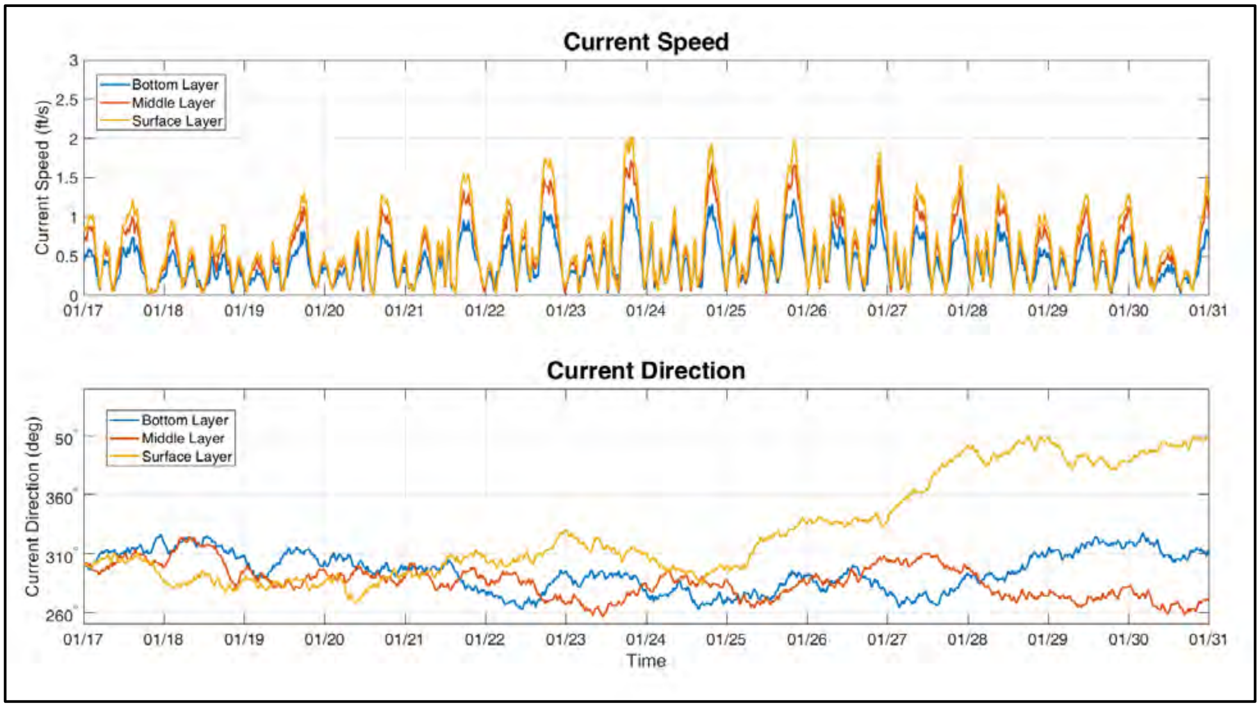


Figure 2-9. ADCP-1 ~~(Pu'u Keka'a)~~ current speed (top) and direction (bottom) for the surface, middle, and bottom of the water column.

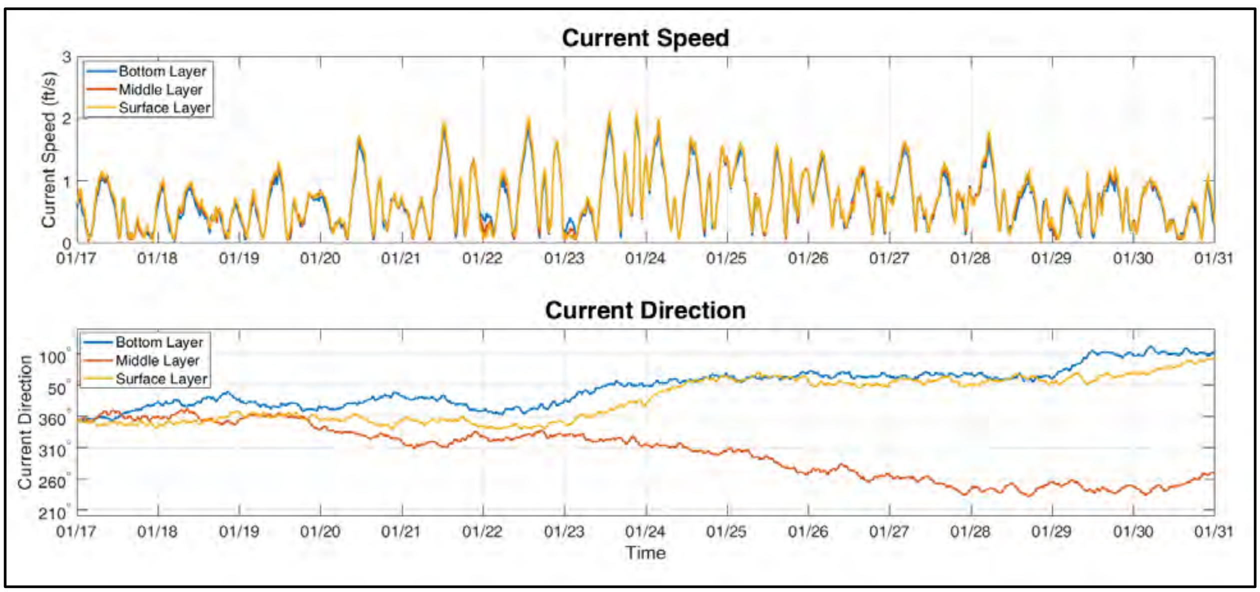


Figure 2-10. ADCP-2 ~~(Paleo-stream channel)~~ current speed (top) and direction (bottom) for the surface, middle, and bottom of the water column.

<u>Potential Impacts and Proposed Mitigation Measures</u>

The proposed project is anticipated to have a negligible impact on regional or local ocean currents.

2.1.5 Offshore Waves

The wave climate in Hawaiʻi is characterized by four general wave types including northeast tradewind waves, southern swell, North Pacific swell, and Kona wind waves. Tropical storms and hurricanes also generate waves that can approach the islands from virtually any direction. Unlike winds, any and all of these wave conditions may occur at the same time.

Tradewind waves occur throughout the year and are most persistent April through September when they usually dominate the local wave climate. These waves result from the strong and steady tradewinds blowing from the northeast quadrant over long fetches of the open ocean. Tradewind deepwater waves are typically between 3 to 8 feet 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 tradewinds 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 tradewind waves by the island of Maui itself.

Southern 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 feet and periods of 14 to 20 seconds. Depending on the positions and tracks of the southern hemisphere storms, southern swell approaches from the southeasterly to southwesterly directions. The project site is directly exposed to swell from the southerly direction and these waves represent the greatest source of wave energy reaching the project site.

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 Hawaiian shores with little attenuation of wave energy. These are the waves that have made surfing beaches on the north shores of Oʻahu and Maui famous. Deepwater wave heights often reach 15 feet and in extreme cases can reach 30 feet. 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 Molokaʻi for swell approach from the northwest.

Kona storm waves also directly approach the project site; however, these waves are fairly infrequent, occurring only about 10 percent of the time during a typical year. Kona waves typically range in period from 6 to 10 seconds with heights of 5 to 10 feet and approach from the southwest. Deepwater wave heights during the severe Kona storm of January 1980 were about 17 feet. Kāʻanapali is directly exposed to Kona storms waves that approach from the west between Lānaʻi and Molokaʻi or approach from the southwest between 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 shores of all the Hawaiian Islands. Damage from these hurricanes was extensive.

Kāʻanapali is at the center of the Maui Nui complex, which consists of the islands of Maui, Lānaʻi, Molokaʻi, and Kahoʻolawe. These islands shelter the Kāʻanapali area from direct exposure to northeast trade wind-generated waves and North Pacific swell from the northwest. However, the area is exposed to southern swell, North Pacific swell, and occasional swell from the west. Figure 2-11 shows the direct wave exposure at Kāʻanapali. Waves diffract and refract around the islands to reach the project, 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 the source is located. More powerful waves have been observed at a global scale in the tropics in recent decades, likely as a result of ongoing climate impacts.

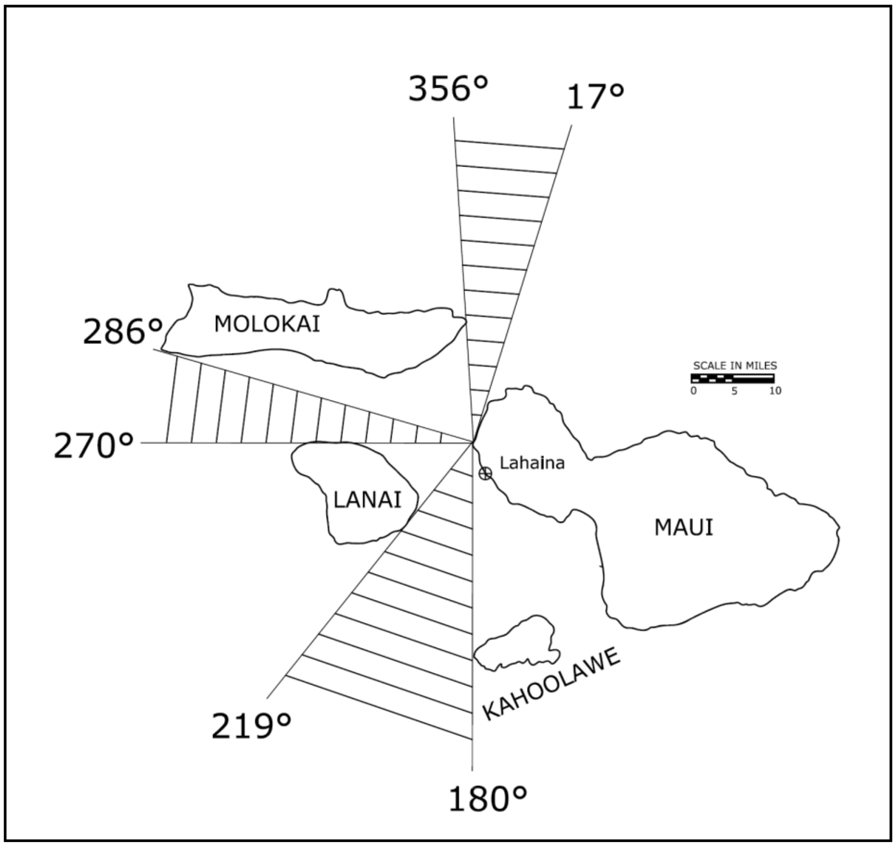


Figure 2-11. Wave exposure at Kāʻanapali

The two ADCPs were also programmed to record hourly surface wave height and direction. The ADCP data were analyzed to calculate the significant wave height H_s, peak period T_p, and peak direction from the hourly wave spectrum recorded at each station.

Summary wave height and period roses are presented in Figure 2-12 for ADCP-1 and Figure 2-13 for ADCP-2. The wave height rose diagrams illustrate the percent frequency of occurrence of both wave direction and height. The wave period rose diagrams illustrate the percent frequency of occurrence of both wave direction and period. Wave direction is given as the direction waves are coming from (meteorological convention); for example, waves coming from due east to west would have the direction of east, or the compass direction 90° from north.

ADCP-1 was located 600 feet off of Puʻu Kekaʻa in 39 feet of water and measured long period north and south swell and short period wind waves generated by the prevailing northeast wind. Wave direction at ADCP-1 was predominantly from the northwest due to refraction of north swell around West Maui, with a widespread from north to west-southwest. Waves approaching from the south and north refract and bend towards the west-facing shoreline as the waves reach shallow water. The largest waves recorded were 4.9 feet during a large north swell in late-January. The average wave height was 1.6 feet during the deployment. No Kona storms occurred during the ADCP deployment which could have also generated waves from the west. A time series of wave height, period, and direction is shown in Figure 2-14.

ADCP-2 was located 750 feet off of the Paleo-stream channel in 31 feet of water and was exposed to south swell. The data shows that minimal north swell and wind wave energy reached ADCP-2 because of shadowing from Hanakaʻōʻō Point. Though wave heights increased slightly during the north swell events observed at ADCP-1, the Hanakaʻōʻō Cell of Kāʻanapali Beach is much more sheltered from swell from this direction. The waves recorded at ADCP-2 were consistently from the southwest. The maximum wave height during the measurement period was 3.3 feet during an out of season south swell in mid-January, and the average wave height was 1.2 feet during the 3-month deployment. Regardless of the deepwater wave direction, wave crests were nearly shore-parallel when they reached ADCP-2 due to refraction. A time series of wave height, period, and direction is shown in Figure 2-15.

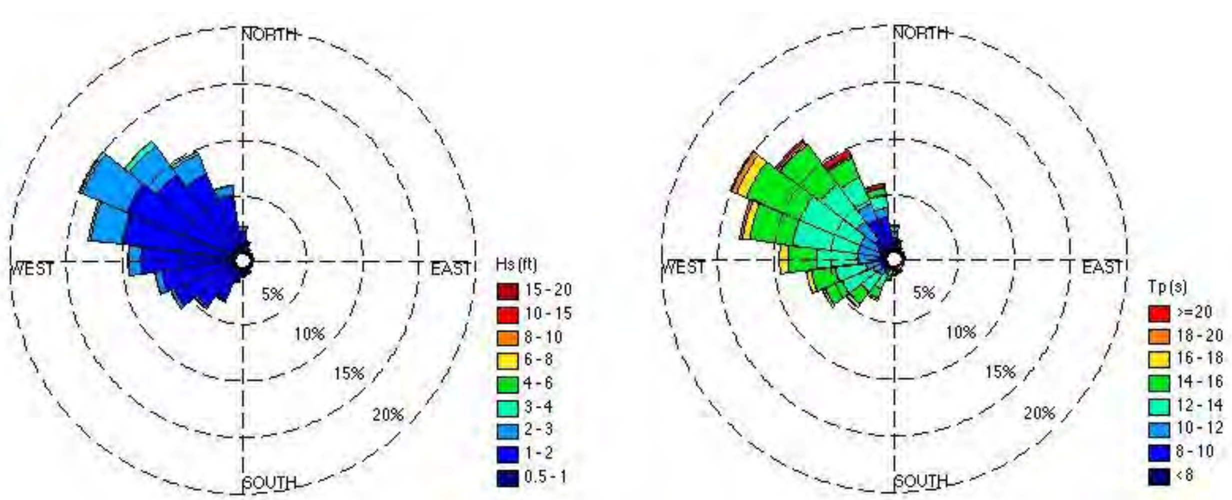


Figure 2-12. a) Wave height rose and b) wave period rose for ADCP-1 ~~(Puʻu Kekaʻa)~~

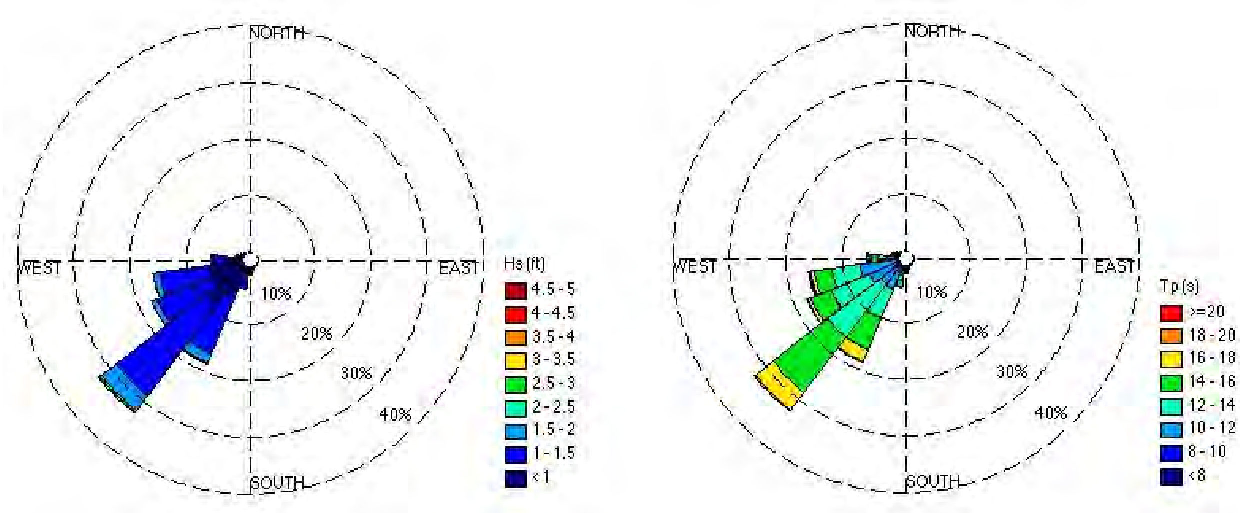


Figure 2-13. a) Wave height rose and b) wave period rose for ADCP-2 ~~(Channel)~~

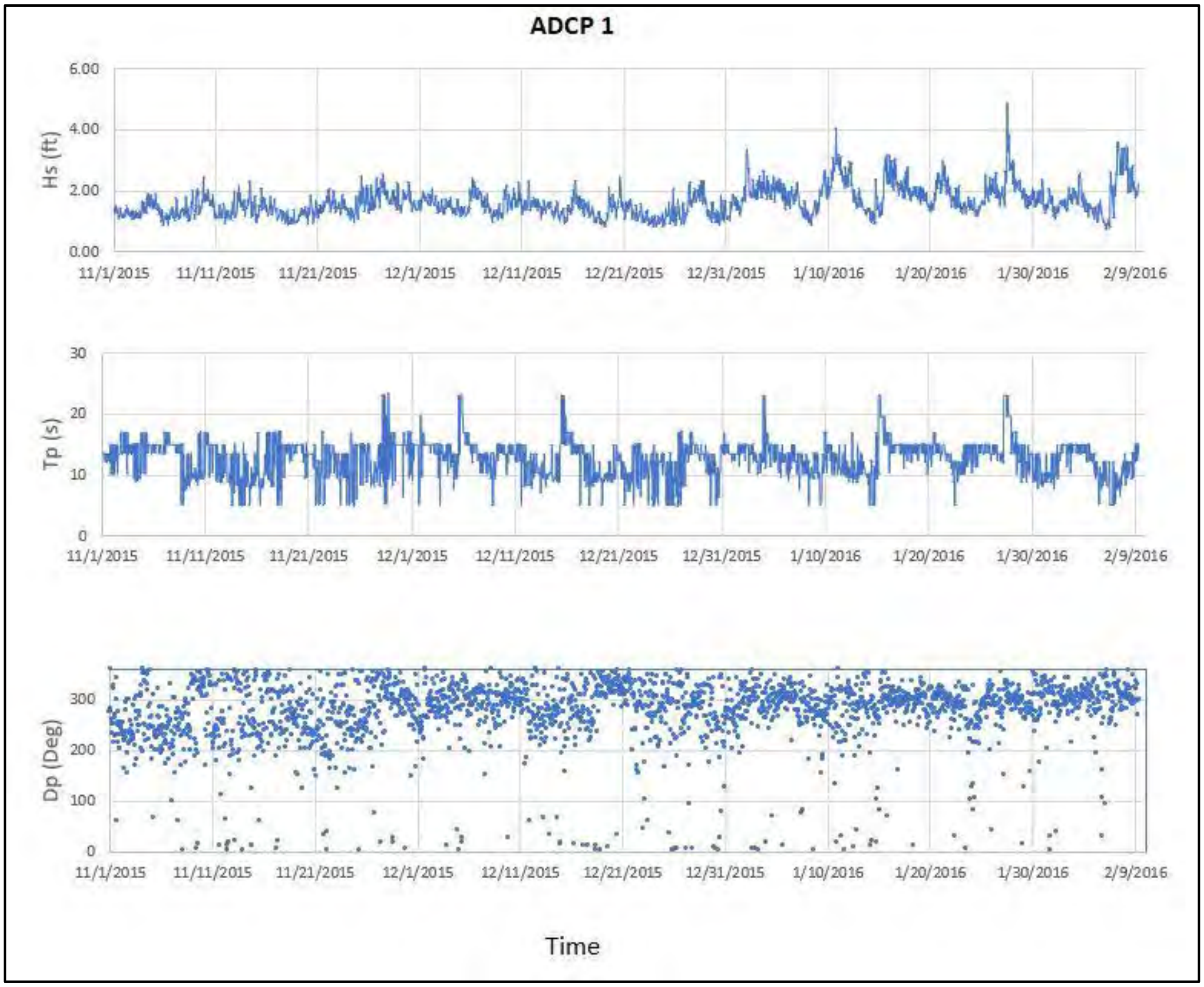


Figure 2-14. ADCP-1 ~~(Pu'u Keka'a)~~ time series of significant wave height (top), period (middle), and direction (bottom).

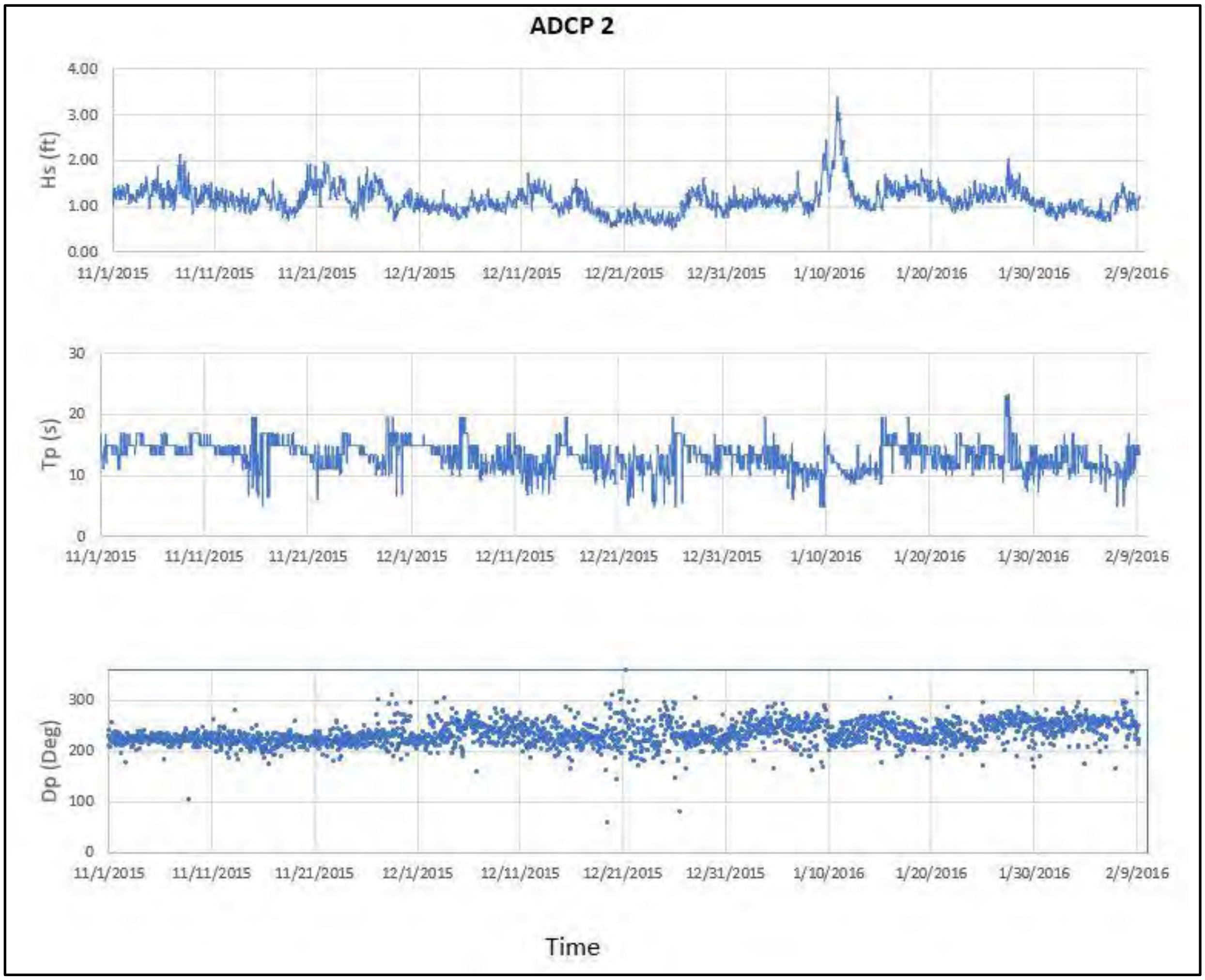


Figure 2-15. ADCP-2 ~~(Paleo-stream channel)~~ time series of significant wave height (top), period (middle), and direction (bottom).

<u>Potential Impacts and Proposed Mitigation Measures</u>
The proposed project is anticipated to have a negligible impact on the offshore wave environment. Anticipated impacts to the nearshore environment can be found in Section 2.1.8.

2.1.6 Flood and Tsunami Hazard

<u>Existing Condition</u>
Flood hazards for the portion of Kā'anapali in which the project is located are depicted on Flood Insurance Rate Map (FIRM) Flood Sheets 1500030351F and 1500030353F. The proposed project is in Zone VE with a base flood elevation that varies between 9 and 11 feet above mean sea level (MSL). The maps indicate that the shoreline is exposed to flooding caused by storm waves and tsunami.

Tsunamis are sea waves that result from large-scale seafloor displacements. They are most commonly caused by an earthquake of magnitude 7.0 or greater adjacent to or under the ocean. If the earthquake involves a large segment of land that displaces a large volume of water, the water will travel outwards in a series of waves, each of which extends from the ocean surface to the sea floor where the earthquake originated. Tsunami waves may only be a foot or so in height in mid-ocean, but they can have wave lengths of hundreds of miles and travel at 500 miles per hour. As they approach shore, they interact with the seafloor by slowing in speed and increasing in height. Tsunami waves can both wash inland and recede at considerable speed.

Most tsunamis in Hawaiʻi originate from the tectonically active areas located around the Pacific Rim (i.e., Alaska, Chile, Japan). Waves originating with earthquakes in these areas take hours to reach Hawaiʻi, and the network of sensors that is part of the Pacific tsunami warning system can give Hawaiʻi several hours advance warning of tsunami from these locations. Less commonly, tsunamis originate from seismic activity in the Hawaiian Islands, and there is much less advance warning for these. For example, the 1975 Halape earthquake (magnitude 7.2) produced a wave that reached Oʻahu in less than 30 minutes.

Walker (2013) reports one historical tsunami with runup data at Kāʻanapali Beach. The 1946 tsunami originated in the Aleutian Islands, Alaska and had a runup elevation of 10 to 12 feet at the KLC. Fletcher et al (2002) classifies the area as a "high" tsunami hazard area.

Potential Impacts and Proposed Mitigation Measures

The proposed project is intended to mitigate the impacts of wave overwash and flooding by providing a nature-based adaptation solution that restores the beach to its former width and volume, increasing the space between the ocean and the existing backshore infrastructure. This will increase the wave energy dissipating properties of the beach and decrease the landward extent of wave runup reducing the susceptibility to backshore flooding from large swell events.

The proposed beach restoration effort is anticipated to have a negligible impact on the existing tsunami hazard for the area. This is because the proposed project does not include changing the elevation of the backshore. Damage from tsunamis depends on the height of the water level rise relative to the backshore elevation, neither of which will be affected by the proposed project.

2.1.7 Offshore Bathymetry

A comprehensive topographic and bathymetric data set of the surrounding area was generated from a combination of surveys. A 50-m resolution multibeam bathymetry and backscatter synthesis data set (Hawaiʻi Mapping Research Group, 2016) was used for deepwater bathymetry. The 2013 USACE MCAP Topographic Lidar was used for nearshore bathymetry. The combined data set reveals offshore bathymetric features that play a fundamental role in the location and shape of Kāʻanapali Beach.

Kāʻanapali Beach and the ~~Puʻu Kekaʻa~~ Sand Recovery Area are located on the western coastline of Maui, inshore of the ʻAuʻau channel and south of the Pailolo channel (Figure

2-16). The 'Au'au channel is a relatively shallow interisland channel that reaches depths up to 200 feet. It connected West Maui and Lāna'i as a land bridge during past periods of glacial maxima and resulting low stand in sea level. The northern slope of the 'Au'au Channel drops into the deeper Pailolo Channel, which separates West Maui from Moloka'i and is around 800 feet at its deepest. There are several rises and terraces between the deeper portions of the 'Au'au Channel and the project area.

The seafloor steeply rises to a depth of around 50 feet in the area offshore of the KLC and the ~~Pu'u Keka'a~~ Sand Recovery Area (Figure 2-17). The sand recovery area is in a broad, sand-covered terrace that gently slopes upward toward the basaltic cliff face of Pu'u Keka'a.

Figure 2-17 shows offshore bathymetry contours in the KLC. The KLC is a west-facing shoreline and is not protected by a well-defined fringing reef as is found offshore of the HLC. In sharp contrast to the HLC, the 5-foot depth contour is located only 10 to 20 feet seaward of the mean lower low water line. As a result, significantly more wave energy reaches shore in the KLC littoral cell compared to the HLC. Additionally, less refraction takes place as the waves approach KLC shore, resulting in waves that break at an oblique angle to the shoreline.

The HLC is a southwest-facing shoreline with a shallow fringing reef that extends 400 feet offshore (Figure 2-18). This shallow fringing reef causes waves to break offshore, and much of the wave energy is dissipated over the reef. Additionally, the waves refract across the reef, so the wave crests are approximately shore parallel by the time they reach shore regardless of the deepwater swell direction.

One notable exception to this is the area around a paleo-stream channel in the middle of the Hanaka'ō'ō Littoral Cell. There is a gap in the offshore reef fronting this area that was formed by a relic stream channel that existed at a lower sea level stand. The gap, which is visible in the 5-foot and 10-foot depth contours in Figure 2-18, has water depths that are approximately 5 feet deeper than the adjacent reef flats to the north and south. As a result, less wave energy is dissipated offshore. Accelerating erosion inshore of this paleo-stream channel over the last decade has been threatening backshore infrastructure such as the Beachwalk.

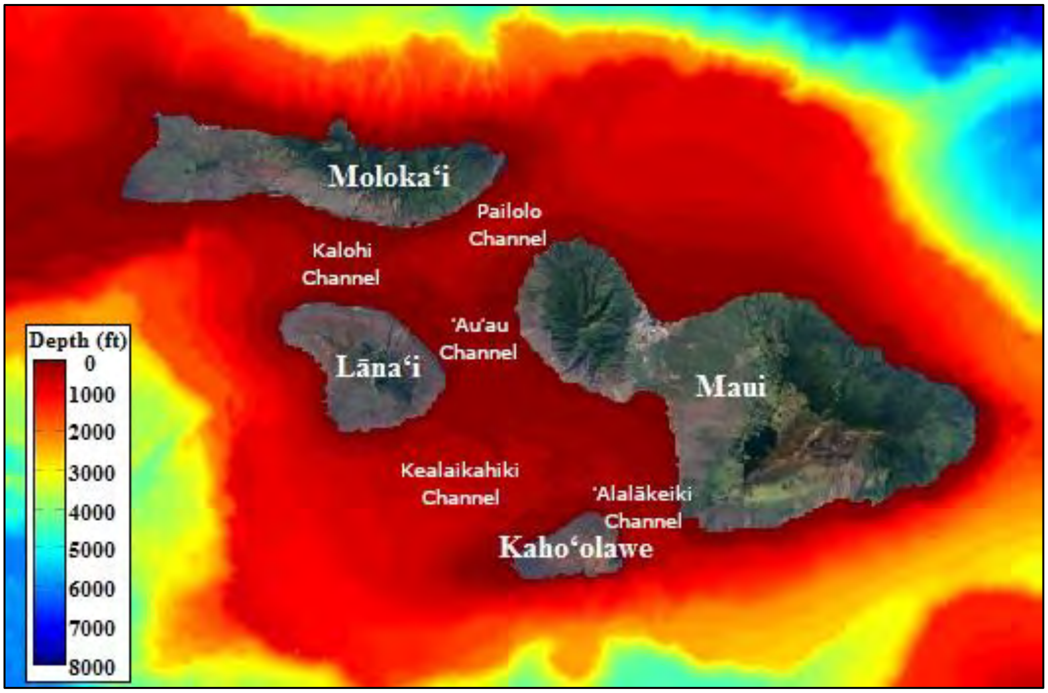


Figure 2-16. Maui Nui Island Complex. Project Site Inshore of ʻAuʻau Channel and South of Pailolo Channel

Figure 2-17. Nearshore Bathymetry in the KLC and the Sand Recovery Area

Figure 2-18. Nearshore bathymetry in the HLC

Potential Impacts and Proposed Mitigation Measures

The proposed project is anticipated to have an impact on the seafloor bathymetry at the sand recovery site. The ~~Pu'u Keka'a~~ Sand Recovery Area is located offshore of the boundary between the Honokōwai and Kā'anapali Littoral Cells. The proposed project includes excavation of 75,000 cubic yards of sand from an approximately 8.5-acre area within the sand deposit. This would create a depression in the seafloor that is approximately 6 feet deep with a side slope of 1V:3H. There is the potential for sand from the regional seafloor to naturally fill in the pit. Natural tidal current and wave action would smooth the angle of the side slope with time. Regional sediment transport through the sand recovery site would also bring additional sand volume to fill into the depression.

The Delft3D modeling suite was used to assess how the proposed sand recovery depression would change over time due to the local hydrodynamics. Delft3D is a world-leading 3D modeling suite to investigate hydrodynamics, sediment transport, morphology, and water quality for fluvial, estuarine and coastal environments. The Delft3D-FLOW module was utilized for this study and is a multi-dimensional (2D or 3D) hydrodynamic and transport simulation model which calculates non-steady flow and transport phenomena that result from tidal and meteorological forcing (Deltares, 2017).

A 5-meter resolution Delft3D-FLOW grid was developed to encompass the proposed sand recovery area. Current and water level data from ADCP-1 (see Section 2.1.4) was used as input at the open boundaries of the Delft3D-FLOW model. The ADCP data provided current and water level data to force the flow model over the simulation period. The flow model was validated by comparing the model output to the measured flow and water level data from ADCP-1. Model results of flow compared to the measured values are shown in Figure 2-19.

The validated flow model was used to model the sediment transport around the proposed sand recovery area. Model input for sediment grain size was taken from vibracore sand sample data in the area of the proposed sand recovery (see Section 2.1.9). Morphological changes in the recovery area were modeled over a 1-year period. The morphological model in Delft3D was strictly used to provide insight into the sediment transport pattern and potential changes related to the depression created in the seafloor by sand recovery efforts.

Figure 2-20 shows the modeled morphological changes around the proposed dredge pit over a typical year. Blue shading shows areas of erosion and red shading shows areas of deposition. Figure 2-21 shows the bed level change along two transect sections directed north-south and east-west through the proposed dredge pit. The output shows sand moving from the top of the side slope of the recovery area walls down to the base of the depression. This behavior is expected with the mobilized sediment being transported down the slope due to gravity.

The model shows that the depression would likely take much longer than one year to fill in with marine sediment. Thus, the proposed project is not anticipated to be a significant "sink" for sand from the restored beach nor have an effect on erosion rates of adjacent shorelines.

The sand deposit is well offshore of the "depth of closure" of the beach toe, which has been measured to be near the 12-foot depth contour. It is not anticipated that changes in and around the sand recovery site would result in erosion of the adjacent shorelines. The depth of closure is typically the deepest depth at which sediment transport connected to the beach system occurs.

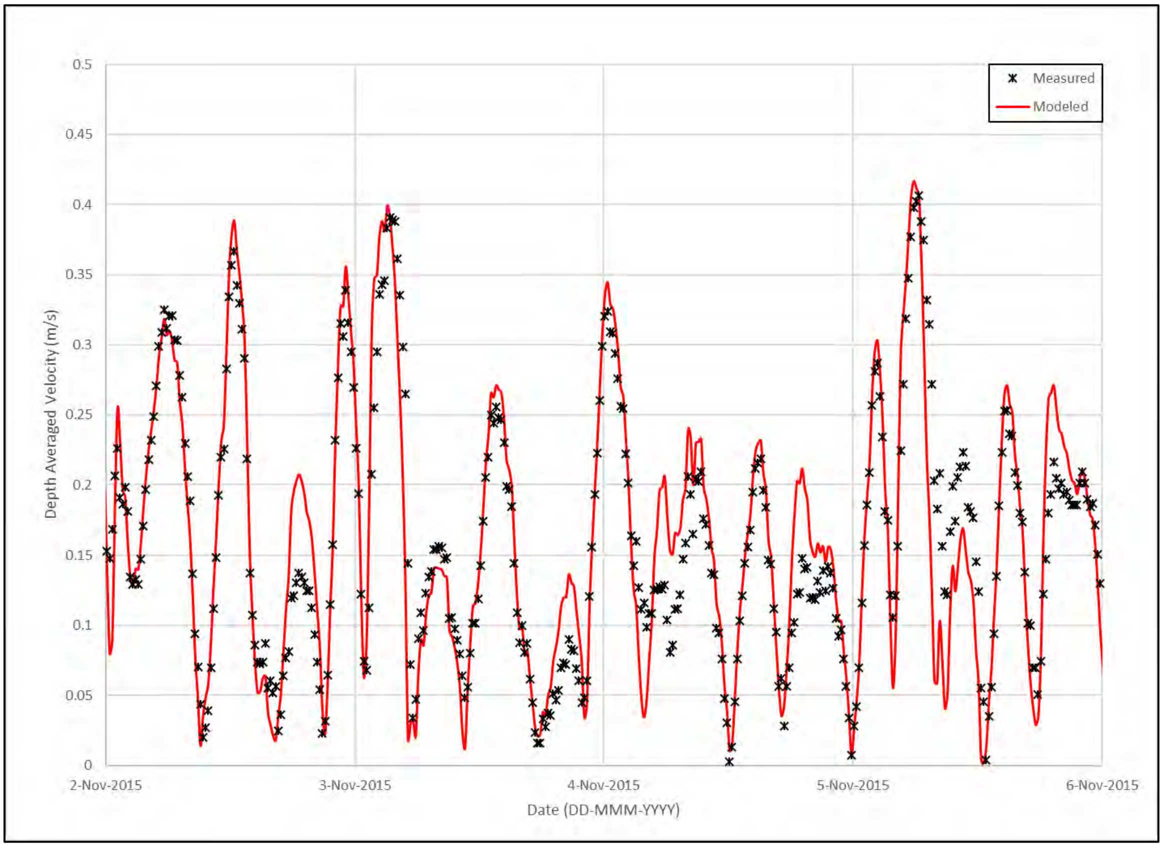


Figure 2-19. Delft3D-FLOW model output (red) compared to measured flow (black) at ADCP-1 between Nov. 2 to Nov. 6, 2017.

The comparison shows good agreement between modeled and measured data.

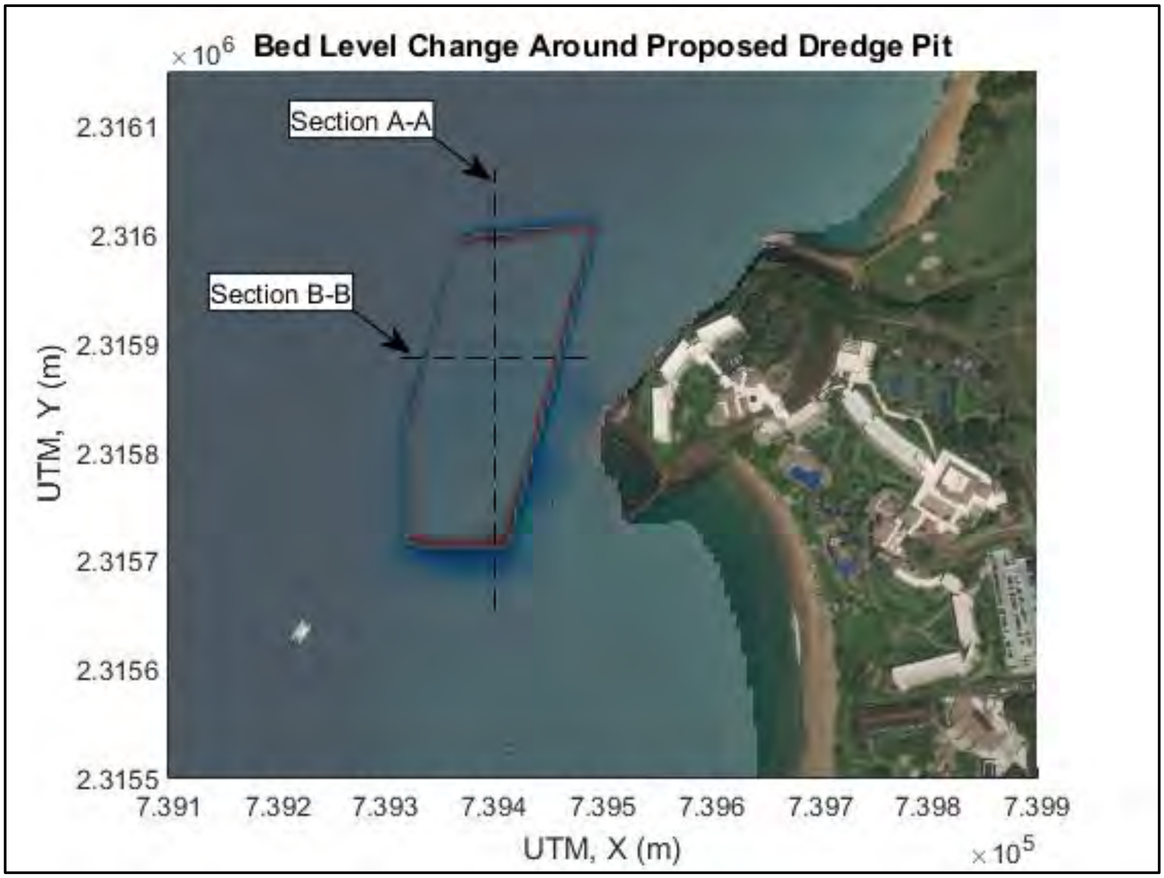


Figure 2-20. Delft3D-FLOW model output of bed level change in the sand recovery area after one year (blue areas indicate erosion; red areas indicate deposition)

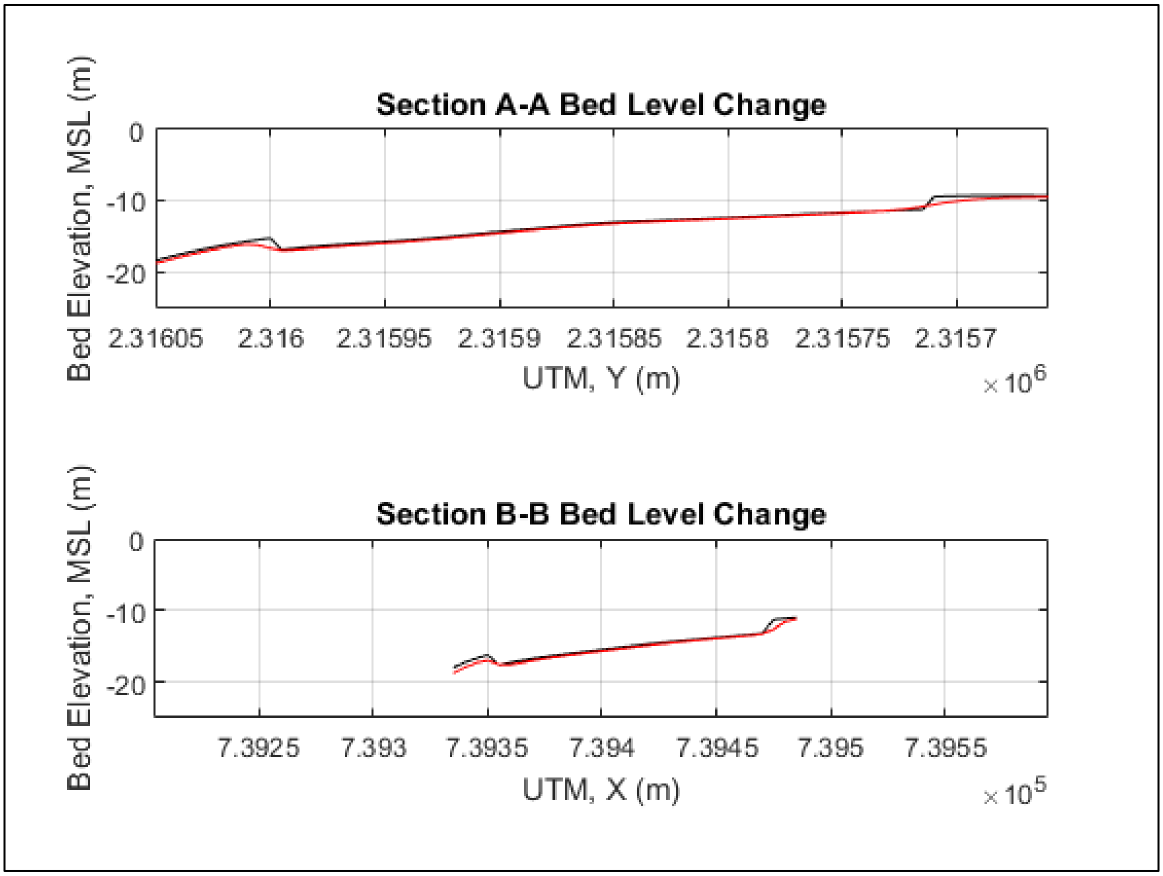


Figure 2-21. Sand recovery area bed level change along section A-A and section B-B (black line indicates initial bed level; red line indicates bed level after one year)

2.1.8 Nearshore Bathymetry and Coastal Processes

Existing Condition

Beach profiles were surveyed on September 9, 2015, at the conclusion of the summer swell season, and on March 16, 2016, at the conclusion of the winter swell season. These dates were chosen to capture the seasonal extreme positions of the shoreline along Kāʻanapali Beach. Data were collected using a Leica Builder R200M Total Station. Beach profile locations are shown in Figure 2-22. Profiles are assumed to represent typical post-summer and post-winter shoreline locations; however, the actual shoreline position varies from year to year.

The beach profile shape varies along Kāʻanapali Beach throughout the year. The average beach crest elevation is +10 feet MLLW. The average beach face slope is 1 vertical unit to 7 horizontal units. The dry beach width (the distance between the beach crest and vegetation line) varies from 0 feet fronting the Hyatt and the Marriott to up to 220 feet at Hanakaʻōʻō Point. The dry beach is narrower on average within the HLC compared to the dry beach within the KLC.

The HLC is approximately 3,600 feet of shoreline that encompasses Hanaka'ō'ō Beach Park and the beach fronting the Hyatt and the Marriott resorts. The southwest-facing beach in this cell is primarily affected by southern hemisphere swell, Kona storms, and higher water levels that allow more wave energy across the shallow fringing reef.

The shoreline in the HLC has been steadily moving landward as a result of chronic erosion. Much of this erosion trend has been the result of a stepwise recession resulting from episodic erosion events. These extreme erosion events, which create significant landward jumps in the vegetation line, are more likely to occur during the summer when the coastline is directly exposed to southern swells. Observations by SEI staff and anecdotal accounts from personnel at the resort properties confirm that south swell and high tides are the primary cause of erosion events.

Profile K1, shown in Figure 2-23, crosses through the beach park. The profile shows variation between the post-summer (red) and post-winter (blue) surveys. At the conclusion of the summer swell season, the beach park was depleted of sand, and an erosion scarp had formed fronting the grassy backshore. During the winter season, the beach accreted sand, and the beach crest moved seaward by approximately 66 feet. This change was likely due to the north swell pushing sand to the south. South swell breaking at an oblique angle to the shore transports sand north, as well as cross-shore to form sand bars in the nearshore waters. In contrast, north swell breaking at a mild oblique angle to the shore transports the sand to the south, back towards the beach park, and the smaller, refracted north swells also moves sand back onshore.

Moving north, there is a wide and shallow fringing reef directly offshore. The reef is incised near the middle of the littoral cell by a paleo-stream channel. The channel is sand filled and creates a shore-perpendicular depression in the reef extending from the beach to outside the reef crest on the reef slope.

Higher tides and higher water levels, combined with wave energy, affect the beach dynamics in this region. Typically, higher water levels and wave energy result in beach narrowing along this length.

The paleo-stream channel's depression in the offshore reef causes wave energy to break at an oblique angle to shore, pushing sand away from the area, accelerating erosion impacts at this site and the adjacent beaches. This submerged and sand-filled paleo-stream channel can also cause dangerous rip current formation during high surf conditions (Figure 2-24).

Profile K2 (southeast of the paleo-stream channel) is shown in Figure 2-25, Profile K3 (located in the middle of the paleo-stream channel) is shown in Figure 2-26, and Profile K4 (northwest of the paleo-stream channel) is shown in Figure 2-27. There are only minor differences between the post-summer (red) and post-winter (blue) survey results at these locations. The beach crest moved seaward by 8 feet at Profile K2, southeast of the paleo-stream channel, and seaward 1 foot at Profile K3, in the channel, between the post-summer and post-winter surveys. This may be from a series of strong north swells that transported sand south along the shoreline within the HLC. At Profile K4, located at the north end of this area, the beach crest eroded and moved landward by 21 feet between surveys which is consistent with this transport pattern.

The narrow beach continues to the north (Figure 2-28) to Hanakaʻōʻō Point. The shallow fringing reef is continuous across this section and the long-term beach erosion trend is consistent with the areas to the south. Winter waves, which cause accretion of the point, occasionally push sand around Hanakaʻōʻō Point into the north end of HLC. Profile K5 is shown in Figure 2-29.

Hanakaʻōʻō Point is the northern boundary of the HLC and the southern boundary of KLC. This sand point is both a long-time prominent morphologic feature (shown in a 1932 T-sheet survey) and exceptionally variable on a seasonal timescale. The actual location of the point fluctuates based on recent swell direction and season. The sandy point is located at the northern end of the shallow fringing reef makai of the HLC and extends north onto the deeper reef.

The point is typically deflated during summer months with southern hemisphere swell moving sand north toward Puʻu Kekaʻa and inflated in the winter months when northern swell moves sand back. The point, as a boundary between littoral cells, can be described as "leaky". During long periods of strong south swell, sand may be transported out of the HLC and into the KLC. In contrast, during long periods of strong north swell, sand may be transported across the boundary from the KLC into the HLC. Physical conditions offshore of the point, including water depth above the reef and the orientation and extent of the reef, affect wave refraction and control the extent to which the point can accrete sand during winter months. These physical characteristics are responsible for limiting the seaward edge of the stable beach and result in sand moving offshore and south to the HLC during extreme winter sand migration seasons.

Typical summer conditions are very narrow and typical winter conditions are significantly wider. Beach profiles measured at Profile K6 (Figure 2-30) and at Profile K7 (Figure 2-31) highlight this seasonal pattern.

The KLC shoreline, spanning approximately 3,850 feet of coastline, is dynamic, and portions of it undergo pronounced seasonal changes. The west-facing beach is exposed to North Pacific swell and Kona storm waves in the winter and south swell in the summer. The waves approach the shore at an oblique angle, and the breaking waves and longshore currents they create transport sand along the shoreline. The predominant transport direction in the winter months is to the south, under the influence of the prevailing North Pacific swell. This southward transport causes the north end of the littoral cell, near Puʻu Kekaʻa, to erode while the south end, at Hanakaʻōʻō Point, accretes. Waves generated by irregularly occurring winter season Kona storms approach from the south and southwest and move sand northward along the beach, temporarily reversing the pattern. The alongshore transport direction reverses in the summertime, with the prevailing south swell moving sand to the north. This seasonally variable wave climate results in pronounced shifts in the winter/summer sandy beach widths at each end of the beach.

During most years, the seasonal movement of sand between the north and south ends of the KLC proceeds without impact on the hotels and beach users. The beach narrows, but the seasonal reversal of transport occurs before property becomes threatened. Periodically, however, the seasonal shift is extreme, and the ends of the littoral cell are depleted of sand. This is often due to a stronger or weaker than average swell season from the north or the south. These occasional extreme seasonal events can result in significant shoreline erosion and recession of the edge of vegetation.

The KLC includes Hanakaʻōʻō Point, which is a critical sand storage area for the seasonal changes within the littoral cell. Hanakaʻōʻō Point receives the sand during the winter months and supplies the sand during the summer months, growing and shrinking in volume as the sand within the littoral cell shifts south then north. Makai of the beach, the reef transitions from a shallow fringing reef outside of Hanakaʻōʻō Point to a deeper reef offshore of the middle of the KLC and finally to a sand field at the north end. Just past the north endsouth side of the beach is Puʻu Kekaʻa,. Puʻu Kekaʻa is a large basalt headland that acts as the terminal feature, separating the KLC to its south from the Honokōwai Littoral Cell to its north.

The beach returns to a narrow strip of sand fronting a naupaka hedge (Figure 2-32) as it moves north beyond Hanakaʻōʻō Point. The middle of the KLC is the inflection point for the seasonal changes in the littoral cell, meaning that typically the beach does not significantly grow as the sand is transported from the north end, nearbetween Puʻu Kekaʻa, to and Hanakaʻōʻō Point, or vice versa. Some years do result in seasonal erosion that narrows the beach and creates large scarps at the edge of the naupaka hedge. Typically, however, the minimal change between the post-summer and post-winter shorelines maintains a narrow, steep beach in this region, as is shown for Profile K8 in Figure 2-33, Profile K9 in Figure 2-34, and Profile K10 in Figure 2-35. Puʻu Kekaʻa is the northern boundary of the KLC. This area has a sand field offshore. During summer months sand accumulates alongside Puʻu Kekaʻa and to the south and is returned to Hanakaʻōʻō Point by winter swell. Sand bars form and move through the sand field regularly during periods of high sand volume movement.

Large winter swell can have a rapid and significant impact on the beach in this area. Summer and winter surveys show profound changes at Profile K11 (Figure 2-36) and Profile K12 (Figure 2-37).

The bottom composition along Profiles K11 and K12 is sand, as the profiles are located within the large sand field that extends alongside and offshore ofsurrounds Puʻu Kekaʻa. The post-summer (red) and post-winter (blue) profiles at K11 and K12 align at approximately the 12-foot depth contour. Deeper than 12 feet, the profiles were nearly unchanged between the post-summer and post-winter surveys. This would meet the US Army Corps of Engineers (CETN, 3/98) definition of Depth of Closure:

> *"The depth of closure for a given or characteristic time interval is the most landward depth seaward of which there is no significant change in*

bottom elevation and no significant net sediment transport between the nearshore and the offshore."

In other words, the 12-foot contour is the likely offshore limit of active beach processes.

Long term erosion rates were calculated by CGG and SEI using historical T-sheets from 1912 and 1932, aerial imagery from 1949 to 2007. SEI also used aerial imagery from 2010 and a surveyed MLLW line from 2016. Short term erosion rates were calculated using aerial imagery from 1963 through 2010 and a surveyed MLLW line from 2016. The 2016 shoreline, using MLLW, was interpolated from a project area topographic survey completed by Ailana Surveying and Geomatics. 1963 is the last aerial image that shows minimal backshore development on the Kāʻanapali shoreline. Erosion rates were calculated using linear regression and no shorelines are eliminated as outliers. CGG analysis considered 1992 and 1997 shorelines as outliers fronting the Hyatt, but the 2016 shoreline surveyed by Ailana Surveying and Geomatics shows that these shorelines were not outliers, rather they reflected an acceleration in shoreline recession landward.

For the historic erosion assessment, Kāʻanapali Beach was divided into 119 transects with transect 0 at Hanakaʻōʻō Beach Park and transect 118 at Puʻu Kekaʻa. Transect 67 is located at Hanakaʻōʻō Point and separates the KLC (Figure 2-38) from the HLC (Figure 2-39).

Table 2-4 provides a summary of the erosion rate analysis conducted by SEI. Short-term and long-term erosion rates in the HLC are highest at Hanakaʻōʻō Beach Park, with short term rates reaching up to 1.8 feet per year. Other erosion hotspots are on the shoreline mauka of the paleo channel, which sees a short-term shoreline recession of 1.3 feet per year. The average short-term erosion rate for the HLC is 0.66 feet per year. Erosion rates have accelerated in the HLC, and projections based on SLR scenarios predict additional erosion of the coastal plain in this region.

Short-term and long-term erosion rates in the KLC are highest on the south side of Puʻu Kekaʻa, with short-term rates reaching up to 2.3 feet per year. Analysis of short-term erosion trends in the KLC shows some accretion from transects 82 to 94 (in the middle of the littoral cell), but it is less than a tenth of a foot per year. Short-term erosion rates at specific locations in this littoral cell are likely skewed as a result of seasonal influences captured with the aerial imagery and are not likely indicative of trends for the cell. However, the average short-term erosion rate for the entire KLC is likely far more representative of the aggregate change for the beach cell. The average short-term erosion rate for the entire KLC is 0.36 feet per year, indicating a mild, but measured, overall erosion trend for the beach cell.

Figure 2-22. Beach profile locations within the Kā'anapali Littoral Cell (KLC) and the Hanaka'ō'ō Littoral Cell (HLC).

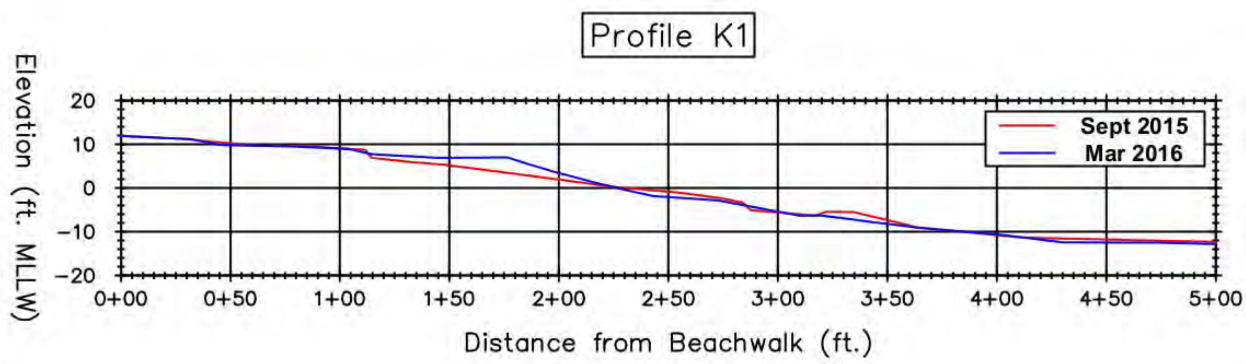


Figure 2-23. Profile K1 (Hanaka'ō'ō Beach Park)

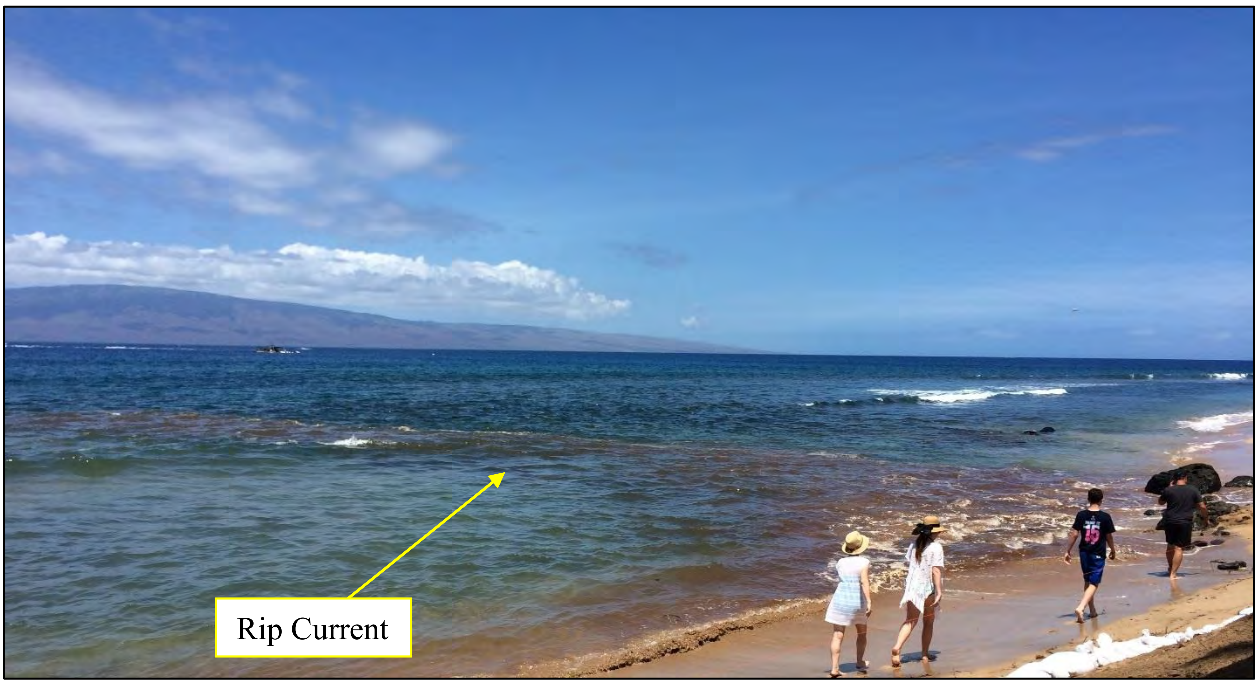


Figure 2-24. Rip current formation within the paleo-stream channel; turbidity resulting from fastland loss prior to Erosion Skirt installation (7/28/2015 photo)

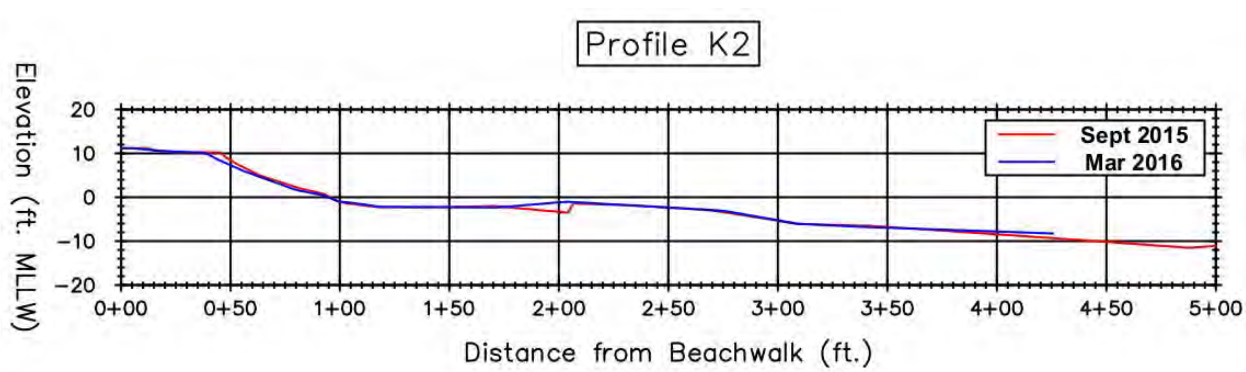


Figure 2-25. Profile K2

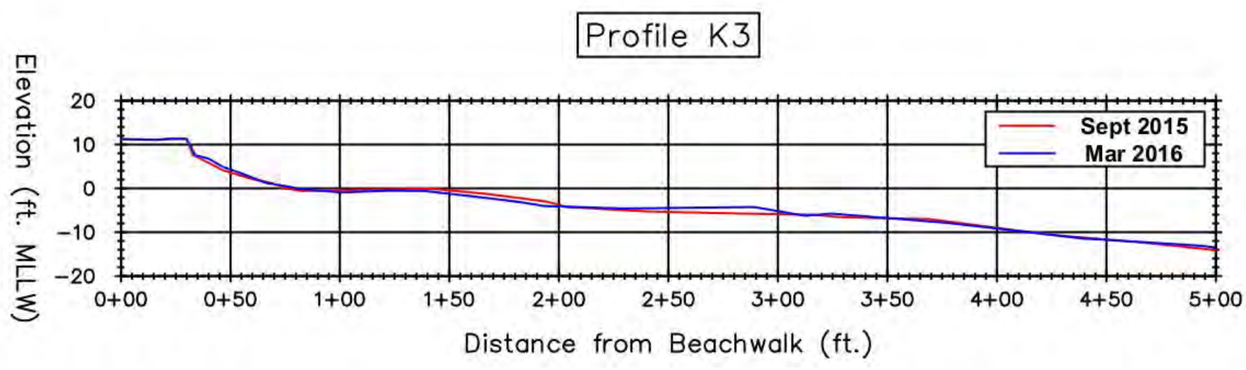


Figure 2-26. Profile K3 (paleo-stream channel)

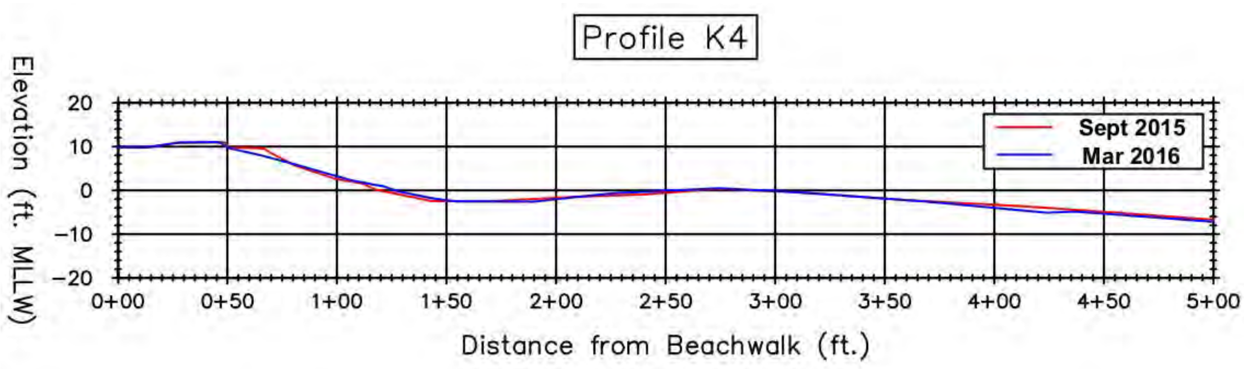


Figure 2-27. Profile K4

Figure 2-28. Narrow beach at the north end of the HLC (9/9/15 photo)

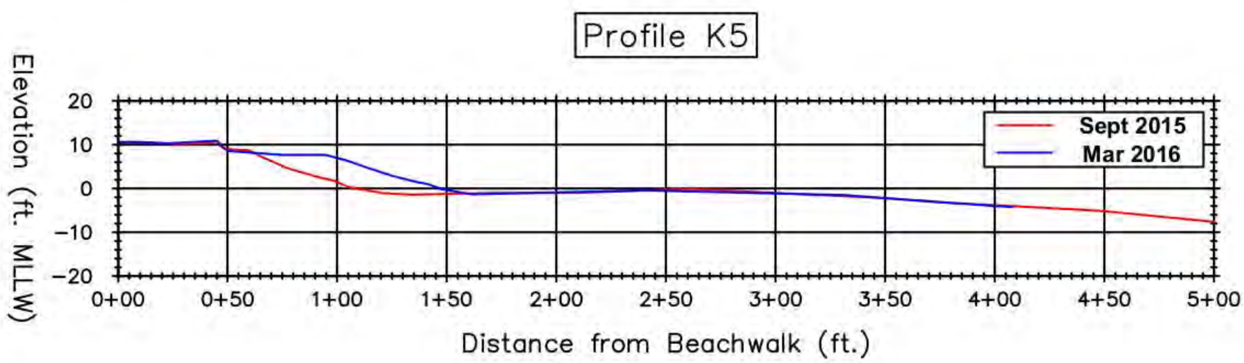


Figure 2-29. Profile K5

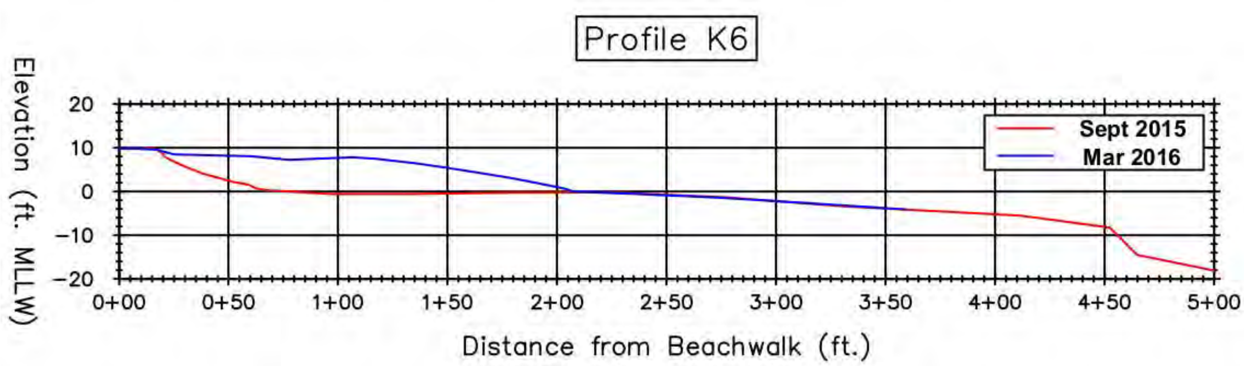


Figure 2-30. Profile K6

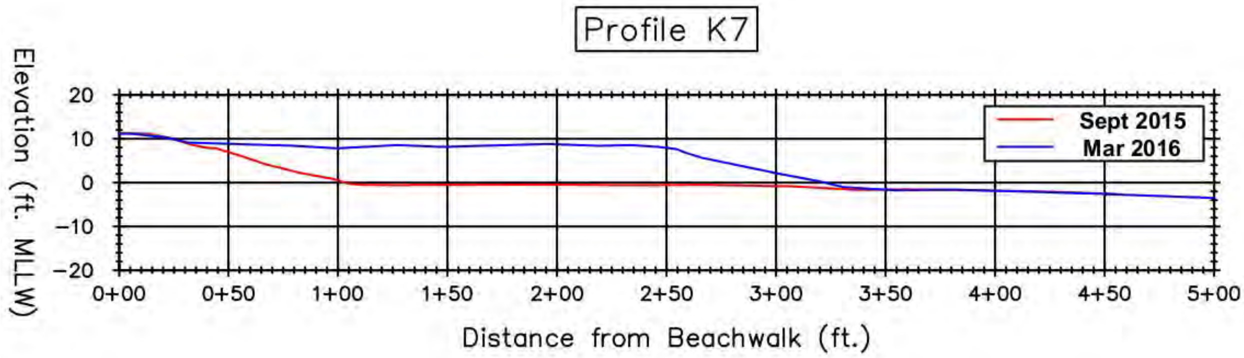


Figure 2-31. Profile K7 showing 210-foot seaward movement in MLLW line location at Hanakaʻōʻō Point

Figure 2-32. Kāʻanapali Littoral Cell near Profile K9 (9/8/2015 photo)

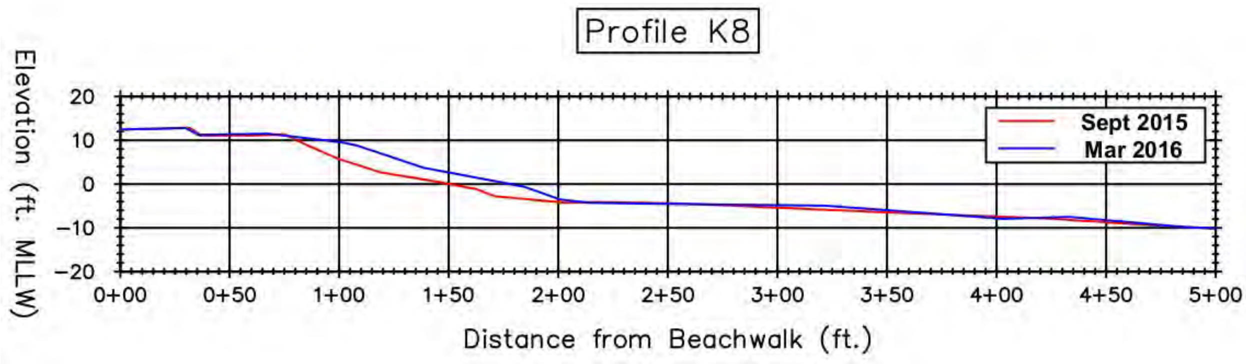


Figure 2-33. Profile K8

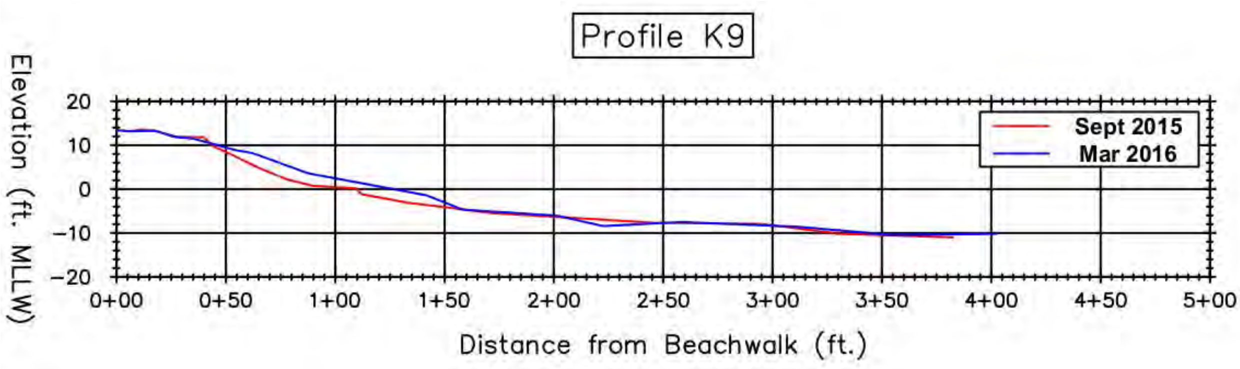


Figure 2-34. Profile K9

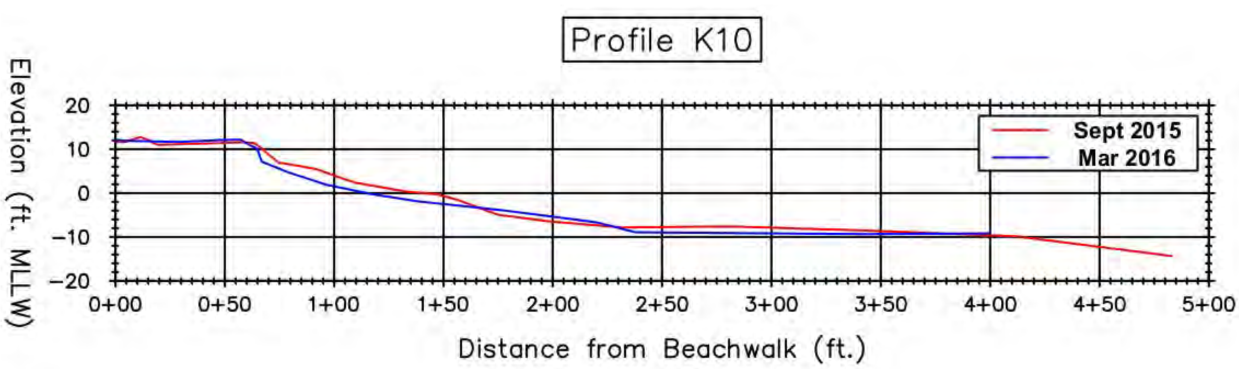


Figure 2-35. Profile K10

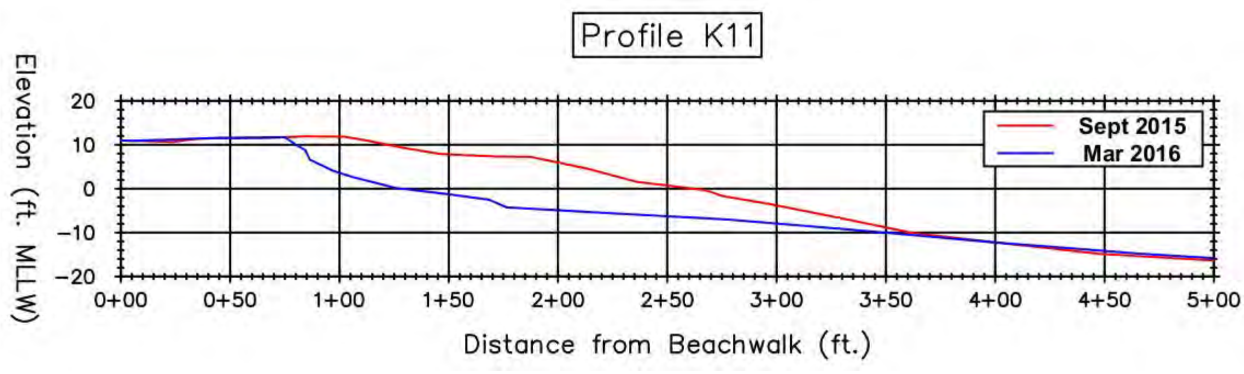


Figure 2-36. Profile K11

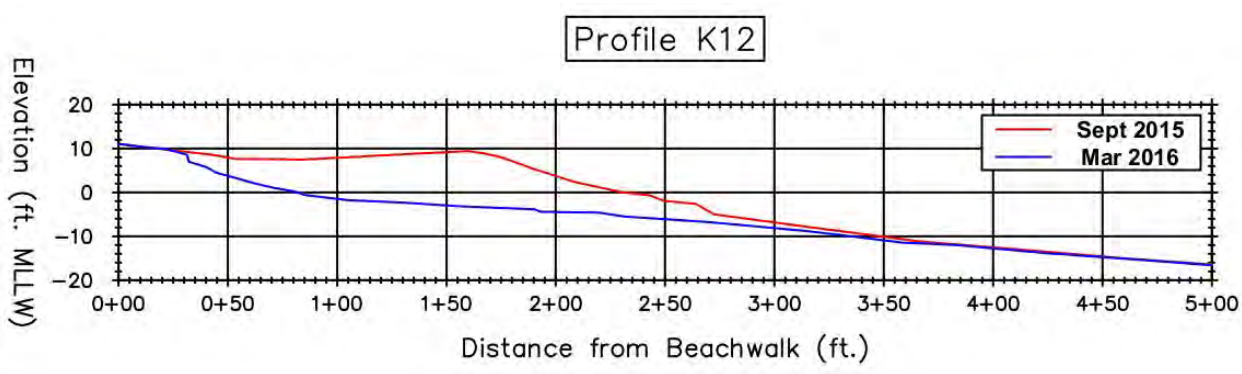


Figure 2-37. Profile K12

Figure 2-38. KLC Average Annual Erosion Rates (1912-1997) (University of Hawaiʻi Coastal Geology Group)

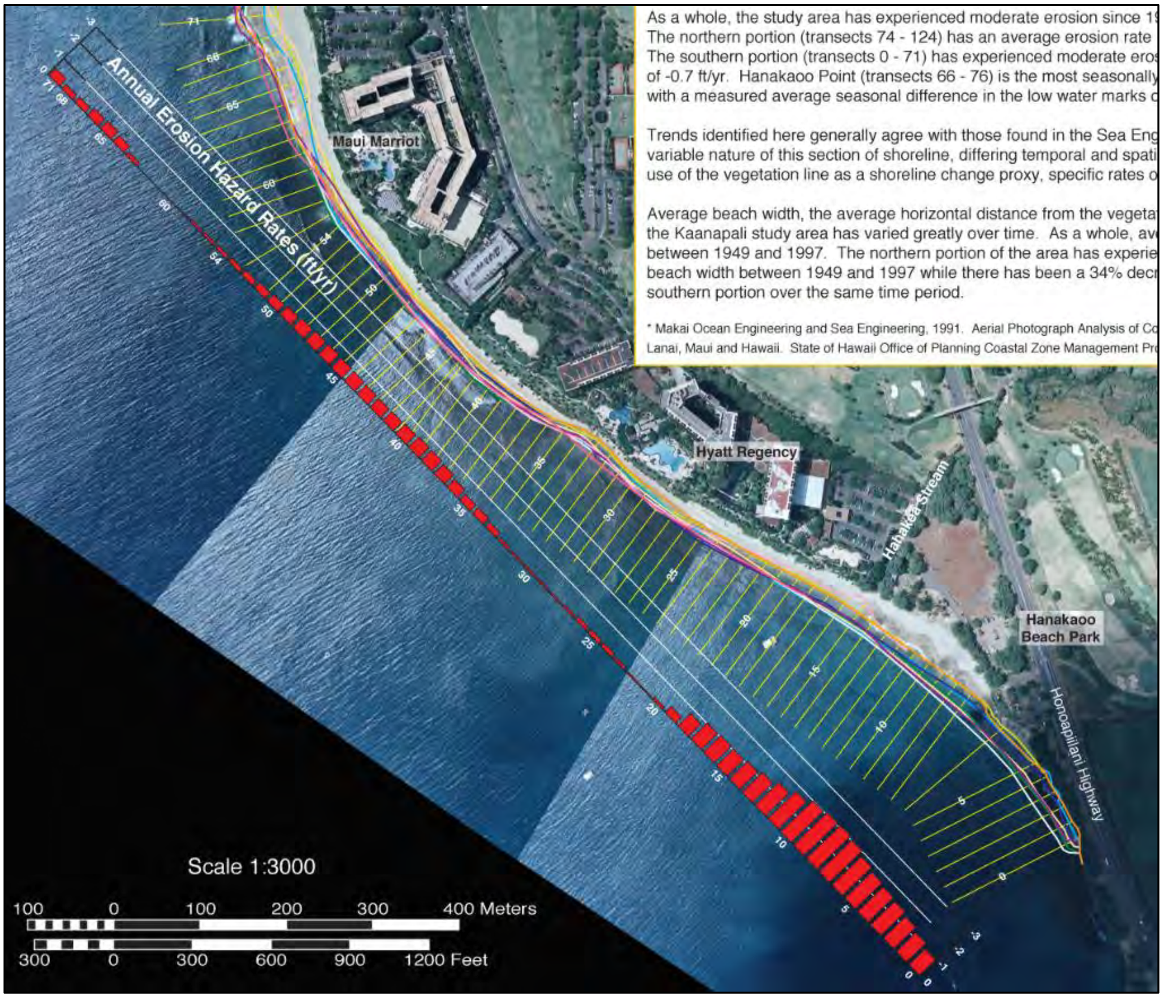


Figure 2-39. HLC Average Annual Erosion Rates (1912-1997) (University of Hawaiʻi Coastal Geology Group)

Table 2-4. Historic Shoreline Erosion Rates and Trends

Littoral Cell	HLC	KLC
Transect Start	0	67
Transect End	67	118
Long Term Erosion (1912-2007)		
Average	0.55 ft/yr	0.17 ft/yr
% of Transects Erosional	96% (65 of 68)	98% (51 of 52)
Maximum	1.61 ft/yr	0.57 ft/yr
Maximum Location	Hanakaʻōʻō Beach Park	Near Puʻu Kekaʻa
Short Term Erosion (1963-2010)		
Average	0.66 ft/yr	0.36 ft/yr
% of Transects Erosional	82% (56 of 68)	54% (28 of 52)
Maximum	1.78 ft/yr	2.30 ft/yr
Maximum Location	Hanakaʻōʻō Beach Park	Near Puʻu Kekaʻa

Potential Impacts and Proposed Mitigation Measures

The proposed project is intended to alter the topography along Kāʻanapali Beach by building the beach wider and increasing the beach berm elevation compared to its present configuration. The proposed project is intended to mitigate the impacts of seasonal and long-term beach erosion by providing a nature-based adaptation solution that restores the beach to its former width and volume. Restoring the beach in the HLC to the approximate position shown in the 1988 aerial photograph would widen the dry beach by between 41 and 78 feet. A plan view of the proposed beach restoration was shown previously in Figure 1-5. Profile views of the proposed beach restoration were shown in Figure 1-6 and Figure 1-7.

The berm enhancement portion of the project would increase the elevation of the beach berm by 3.5 feet atfronting the "SouthMarriott, Kāʻanapali Aliʻi, Westin, and Whaler's Village ("Hanakaʻōʻō Point Berm Enhancement" or southern) and atfronting the "NorthSheraton and the Kāʻanapali Beach Hotel ("Puʻu Kekaʻa Berm Enhancement"." or northern). The berm enhancement portions of the project are located in the KLC. A plan view of the SouthHanakaʻōʻō Point Berm Enhancement was shown previously in Figure 1-8. Profile views of the berm enhancement were shown in Figure 1-9 and Figure 1-11. A plan view of the NorthPuʻu Kekaʻa Berm Enhancement was shown in Figure 1-10.

Nearshore sandbars, sand waves, and sand ripples are currently present in the natural beach system and would continue to develop in both the beach restoration area and berm enhancement area. These sandy features develop, move across, and disappear on both sandy and hard seafloor substrates in the Kāʻanapali nearshore environment. Following sand placement, there will be a period of beach equilibration, during which the beach profile and offshore water depths can be expected to vary as the beach adjusts to the prevailing wave conditions and the beach assumes its stable configuration. Chronic erosion would continue to affect the shoreline along the full length of Kāʻanapali Beach, as would seasonal and episodic erosion and beach adjustment events. In addition to these natural phenomena, the littoral cells may also be impacted by large magnitude events such as strong Kona storms, hurricanes, tsunamis, extreme water level changes, and other oceanographic and atmospheric events.

Any and all of these can produce large-scale changes in the beach, as the project site is located on an open ocean coastline that is exposed to a wide range of events and hazards. As a result of one or more of the extreme natural events listed above, all placed sand and some or all of the existing sand could be temporarily or permanently lost from the beaches.

The proposed project does not include construction of any permanent structures that would alter the coastal processes along Kāʻanapali Beach. Furthermore, the volume of sand proposed for the beach restorationnourishment effort would only extend the beach seaward to its approximate position shown in the 1988 aerial photo. The berm enhancement portion of the project only includes placement of sand landward of the waterline at the time of construction, in a volume roughly equal to the sand naturally moved seasonally within the littoral cell.

No long-term adverse impacts or cumulative impacts are anticipated as a result of the beach restoration and berm enhancement projects. Short-term changes in the bathymetry and coastal processes will be observed while the nearshore sand fields, beach face, and berm equilibrate after the nourishment project. Short-term impacts may include scarping of the beach face, sand bar formation and migration, changes in shorebreak location, and other beach process related changes over the course of several seasons to a year after the nourishment project. No mitigation is proposed for nearshore bathymetry or coastal processes, as natural coastal processes will return the shoreline to normal after sand placement.

2.1.9 Sand Characteristics

Existing Condition

Kā'anapali Beach is composed primarily of carbonate sand with a small basalt component (less than 10% by mass) and 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. Native beach sand in Kā'anapali is golden 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/cm^3; 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/cm^3. This is the most relevant study on the subject in Hawai'i, with no studies being conducted for Maui sand to date.

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-axes.

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 $\varphi = -\log_2 D$. Descriptive sorting values are presented in Table 2-5.

Table 2-5. 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 were taken at locations within the Hanakaʻōʻō and Kāʻanapali Littoral Cells. Composite beach samples contain sand from the beach berm, beach crest, beach face, and beach toe. Sample locations are listed in Table 2-6. Grain size analysis of representative sand samples, presented graphically in Figure 2-40, indicate that the average median grain size is approximately 0.31 mm within the HLC and 0.36 mm within the KLC. Both of these average sizes are 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 sands within Kāʻanapali Beach have a high degree of sorting and a very low percentage of fines.

Table 2-6 shows the beach samples to be well or moderately well sorted with < 0.16% fines by mass. Figure 2-40 displays each sample's grain size distribution, for comparison to adjacent areas.

Short-term and long-term changes within the littoral cells are a function of sand movement along the coastline, from the face of the beach down through the nearshore sand fields and across submerged hard bottom features. This movement of marine sediment combines with the terrigenous sediment entering the proposed project area through streams and runoff, as evidenced by previous events (discussed below in Section 2.1.10 Water Quality). The result of marine sediment migration and terrigenous sediment input into the region can be assessed by analysis of reef top sediment samples collected at various locations along the reef.

A variety of sediment samples were collected from pockets in the reef offshore of the HLC to better understand nearshore sediment processes and for comparison with the beach sand samples (Figure 2-41). Grain size analysis indicated a wide range of stable sediment sizes in the healthy reef (Figure 2-42). The forereef sand samples had a D_{50} ranging from 0.13 to 1.2mm. The finest sand was found at Reef Sample 3, along the north side of the Hyatt paleochannel where the rip current takes beach sand offshore (Figure 2-24). The coarsest sand was at Reef Sample 2, fronting the Marriott in an area of regular surf activity. Reef samples 1 (fronting Hanakaʻōʻō Point) and 4 (southern end of the Hyatt) more closely match the native beach. Native sediment in the healthy reef has a range of sizes from fines through gravel and cobbles. Waves and nearshore currents mobilize fines from much of the exposed reef surface on a continual basis. The overall health of the forereef is a testimony to the efficacy of mobilization and transport of sediment within the existing littoral system. Though the area is naturally, routinely exposed to fines through rainfall and large wave events, active flushing of the reef surface is able to maintain a healthy ecosystem. The robust health of the nearshore reef adjacent to the proposed project area is discussed in detail in Section 2.1.11Marine Biology.

Table 2-6. Sediment size characteristics, Kāʻanapali Beach samples

Profile Name	Littoral Cell	D_{50} (mm)	Sorting (ϕ)	% Fine
K1	Hanakaʻōʻō	0.21	0.67	0.00
K2	Hanakaʻōʻō	0.36	0.70	0.11
K4	Hanakaʻōʻō	0.32	0.50	0.16
K5	Hanakaʻōʻō	0.30	0.52	0.14
K6	Hanakaʻōʻō	0.31	0.56	0.15
K7	Kāʻanapali / Hanakaʻōʻō	0.37	0.59	0.00
K11	Kāʻanapali	0.34	0.51	0.00
K12	Kāʻanapali	0.37	0.79	0.00
HLC Average	Hanakaʻōʻō	0.31	0.64	0.09
KLC Average	Kāʻanapali	0.36	0.54	0.00
Kāʻanapali Average	All	0.32	0.63	0.07

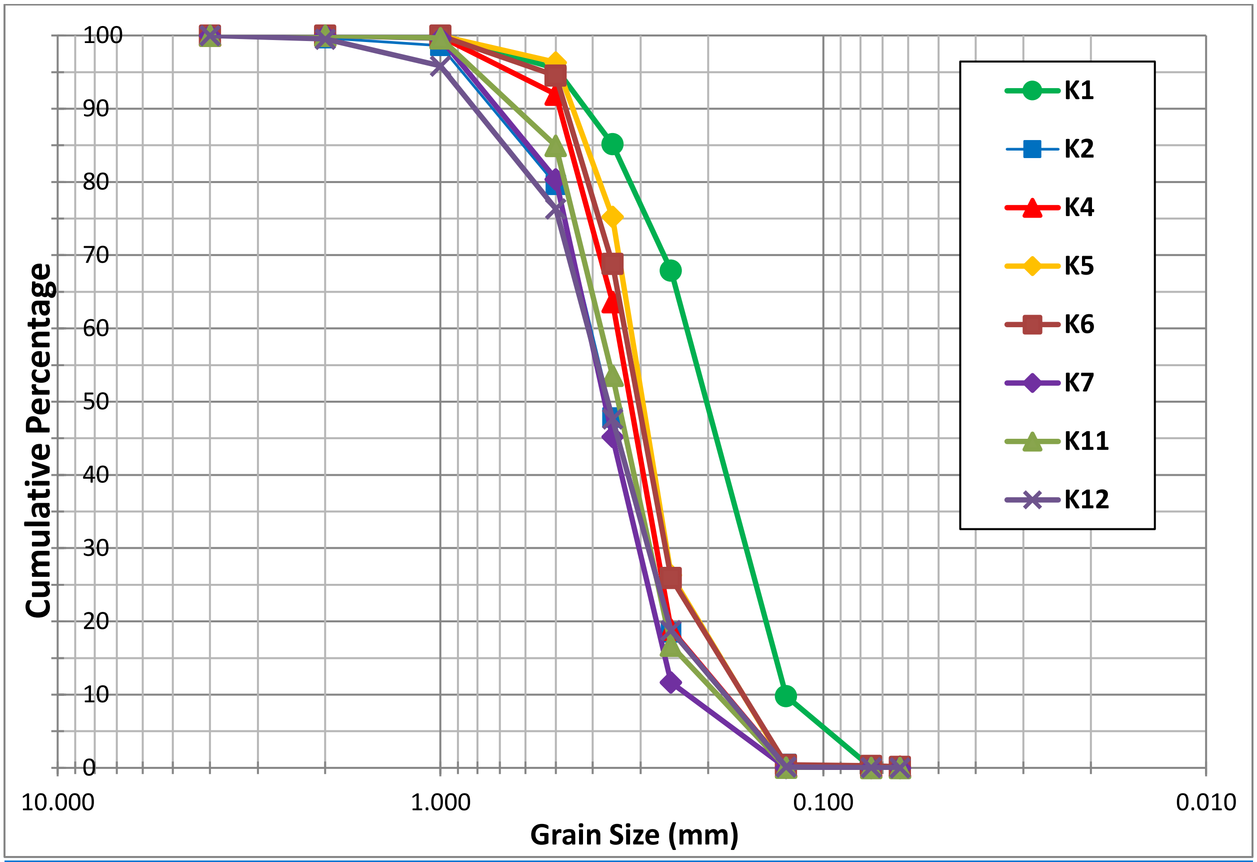


Figure 2-40. Sand grain distribution, Kāʻanapali Beach samples

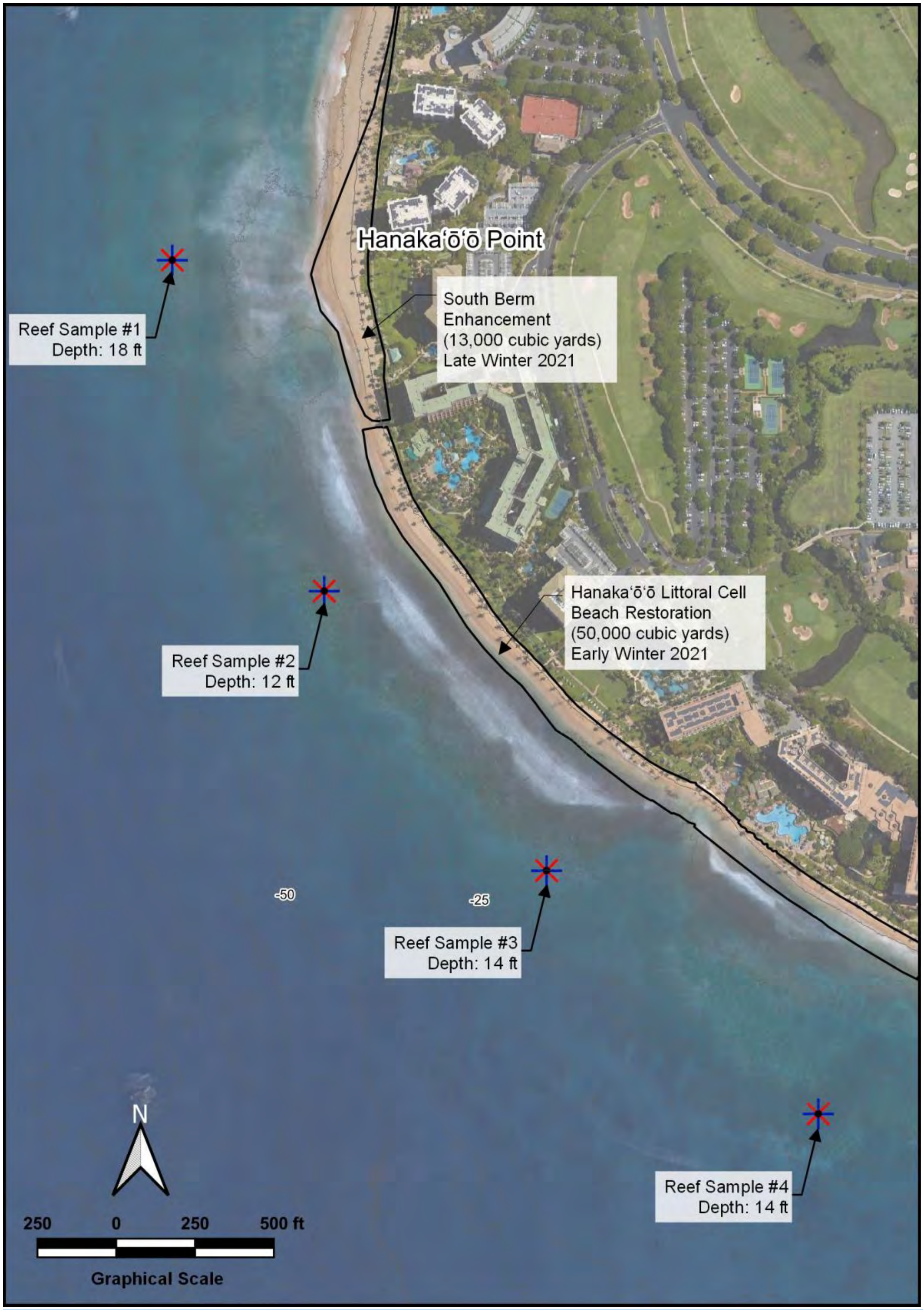


Figure 2-41. Forereef Sediment Sample Locations and Depths

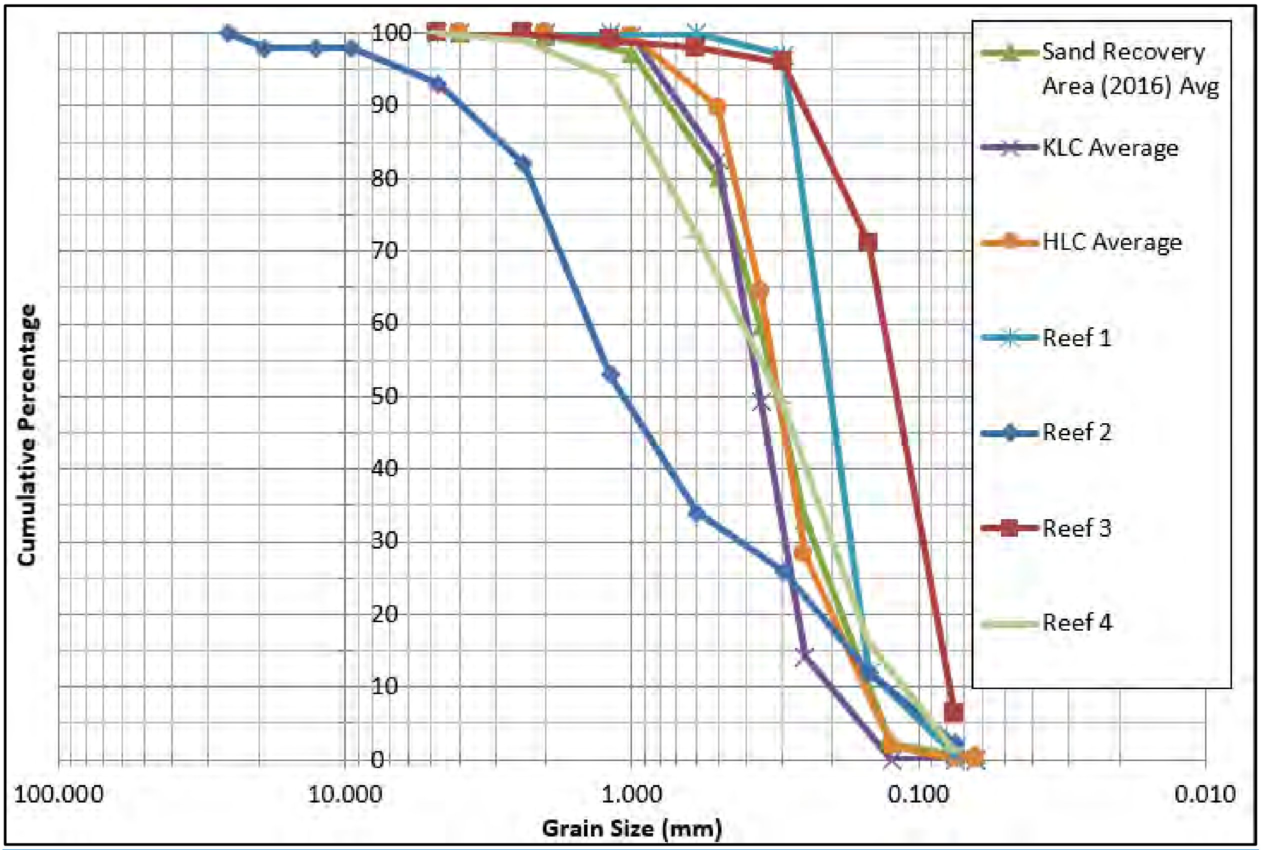


Figure 2-42. Grain Size Comparison Between Forereef Sediment Samples and Project Area Sand Samples

Potential Impacts and Proposed Mitigation Measures

A critical component for successful beach nourishment~~restoration~~ projects is the availability of suitable sand for placement. Placed sand should closely match the grain size distribution, color, composition, and density of the native beach sand. Deviation from these characteristics may result in unpredictable behavior of the beach nourishment~~restoration~~ project. In addition, the State Department of Land and Natural Resources (DLNR) Small Scale Beach Nourishment guidelines specify that sand used to nourish a beach must meet several specific requirements:

- The sand shall contain no more than six (6) percent silt material (sand grain size smaller than 0.074 mm).
- The sand shall contain no more than ten (10) percent coarse material (sand grain size greater than 4.76 mm).
- The grain size distribution would fall within 20% of the existing beach grain size distribution.
- The overfill ratio of the fill sand to existing sand shall not exceed 1.5.
- The sand would be free of contaminants such as silt, clay, sludge, organic matter, turbidity, grease, pollutants, and others.
- The sand would be primarily composed of naturally occurring carbonate beach or dune sand.

Multiple sources of marine and terrestrial sand were carefully evaluated in terms of character, quality, quantity, recovery cost, and proximity to Kāʻanapali Beach. Initial investigations for this project concluded that there was no readily available, economical terrestrial or outer-island source of sand and that local offshore sand resources should be evaluated. Offshore investigations for this project took place along the nearshore reef complex offshore to a water depth of approximately 200 feet. The search included a thorough investigation of the seafloor from just north of Mala Wharf (south of Kāʻanapali Beach) to offshore of Kahekili Beach Park (north of Puʻu Kekaʻa). Through multiple sand investigation efforts, spanning over a decade and including multiple square miles of seafloor, a suitable sand deposit was identified offshore of the north end of the project beachnear Puʻu Kekaʻa, referred to as the "Puʻu Kekaʻa Sand Recovery Area". Additional sand resource investigations have been conducted in the Nāpili-Honokōwai region, where no suitable offshore sand deposits were found for potential use in nourishment of Kāʻanapali Beach.

The proposed project includes recovering 75,000 cubic yards of sand from 8.5 acres of the Puʻu Kekaʻa Sand Recovery Area for use in restoring the beach in the HLC and enhancing the beach berm in the KLC. Seventeen vibracore samples, ranging in length from 2 to 8.5 feet, were obtained by Sea Engineering at various locations in the Puʻu Kekaʻa Sand Recovery Area during field operations in 2008 and 2016. Grain size analysis indicates that the Puʻu Kekaʻa Sand Recovery Area samples meet the grain size requirements as specified by DLNR. Figure 2-43 and Figure 2-44 show the average grain size distribution for the Puʻu Kekaʻa Sand Recovery Area compared with the average littoral cell grain size distributions and +/- 20% DLNR limits for the HLC and KLC, respectively. Table 2-7 compares the grain size distribution characteristics between Puʻu Kekaʻa Sand Recovery Area and the two littoral cells.

Even sand that is suitable for placement can have undesirable performance that is difficult to predict. Potential problems include: compaction and lithification of placed sand; coral cobbles in the placed sand; anoxic conditions in the placed 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 project along the truck haul route between the dewatering basin and the sand placement area. A 1- to 3-foot tall, hardened berm formed along the seaward edge of the haul route. SEI engineers attributed this sand compaction to heavy loaded dump trucks traveling over the beach fill. Additionally, chemical processes in the form of carbonate dissolution and precipitation likely contributed to the hardening of the beach fill.

Sand fill for the present project would be moved along the beach from the offloading locations using equipment similar to that used in the Waikīkī Beach Maintenance project. 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 will be minimized by mechanically loosening or turning the sand along the truck haul route at regular intervals. Moreover, haul routes can be monitored, mechanically turned over, and plowed after project completion, if needed.

Coral cobbles and rubble, which occur naturally in offshore sand deposits, were an issue during the 2012 Waikīkī Beach Maintenance project. These larger grains were uncomfortable for beach users, as they tended to accumulate in the nearshore at the toe of the beach. The potential for coral rubble was addressed by engineers during the design process, and efforts were made to reduce the recovery of large pieces of rubble from the offshore sand deposit. 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 at the beach toe, just offshore of the waterline. The contractor removed coral rubble by hand, and the Waikīkī Improvement Association organized volunteer rock picking efforts.

Though the grain size distribution of the sediment in the ~~Puʻu Kekaʻa~~ Sand Recovery Area has been thoroughly investigated, coral rubble, or sediment grains that are cobble-sized or larger, may exist sporadically within the sand deposit. During offshore sand sample recovery, no coral rubble larger than 1 inch in diameter was encountered at the ~~Puʻu Kekaʻa~~ sand deposit. Additionally, air-jet probing encountered no layers of coral rubble between the sand surface and 6 feet below the ocean floor. However, rubble may exist in discreet pockets within the sand deposit.

One of the disadvantages of clamshell dredging is that there is no method to screen coral rubble 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 coral rubble is encountered in an area within the offshore sand deposit, sand recovery operations will move to a different location within the deposit.

Screening the sand as it is offloaded from the barges is possible but would drastically slow production and could still allow cobbles to enter the beach system. Visual inspection of the sand as it is being recovered is the most effective way to minimize cobble content by identifying any areas that have higher volumes of large grains. Additionally, sieve testing will be performed periodically on the deck barge as sand is being recovered by the clamshell bucket. If excessive cobble is encountered, recovery operations will be relocated within the ~~Puʻu Kekaʻa~~ Sand Recovery Area.

A suitable offshore sand source would preferably match the color of the existing beach sand. While natural calcareous beaches can range in color from light brown to white, sand in offshore deposits usually turns a gray color as a result of anoxic conditions typically produced by a lack of wave action and associated mixing and aeration of the sand, or with depth within the deposit. Figure 2-45 shows a dry color comparison of offshore samples from the Puʻu Kekaʻa Sand Recovery Area with native beach sand. Offshore samples in the figure were taken from various layers in the offshore sand deposit and dried under direct sunlight. All samples pictured represent a typical color for that layer in the area where the vibracore sample was taken. The color of the offshore samples, after several days of drying, closely match the native beach sand, though some samples have a slightly greyer color. Color comparison tests and drying suggest that the grey may fade in sunlight. In addition, the mixing of offshore sand and native 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 scent. Based on previous sand recovery efforts within the Hawaiian Islands, any odor from recovered sand is anticipated to diminish with exposure to sun and air.

The sand source is not expected to have either hazardous materials or contamination within the sediment. There have not been significant environmental contamination events at the sand source or adjacent to it. There are no environmental remediation or clean up actions at or adjacent to the sand source. There are also no significant point sources of contamination adjacent to the sand recovery area. With no environmental contamination events, sources of contamination, or remediation sites adjacent to the sand recovery area, there is no reason to suspect the sand recovered from the Sand Recovery Area to have contaminants.

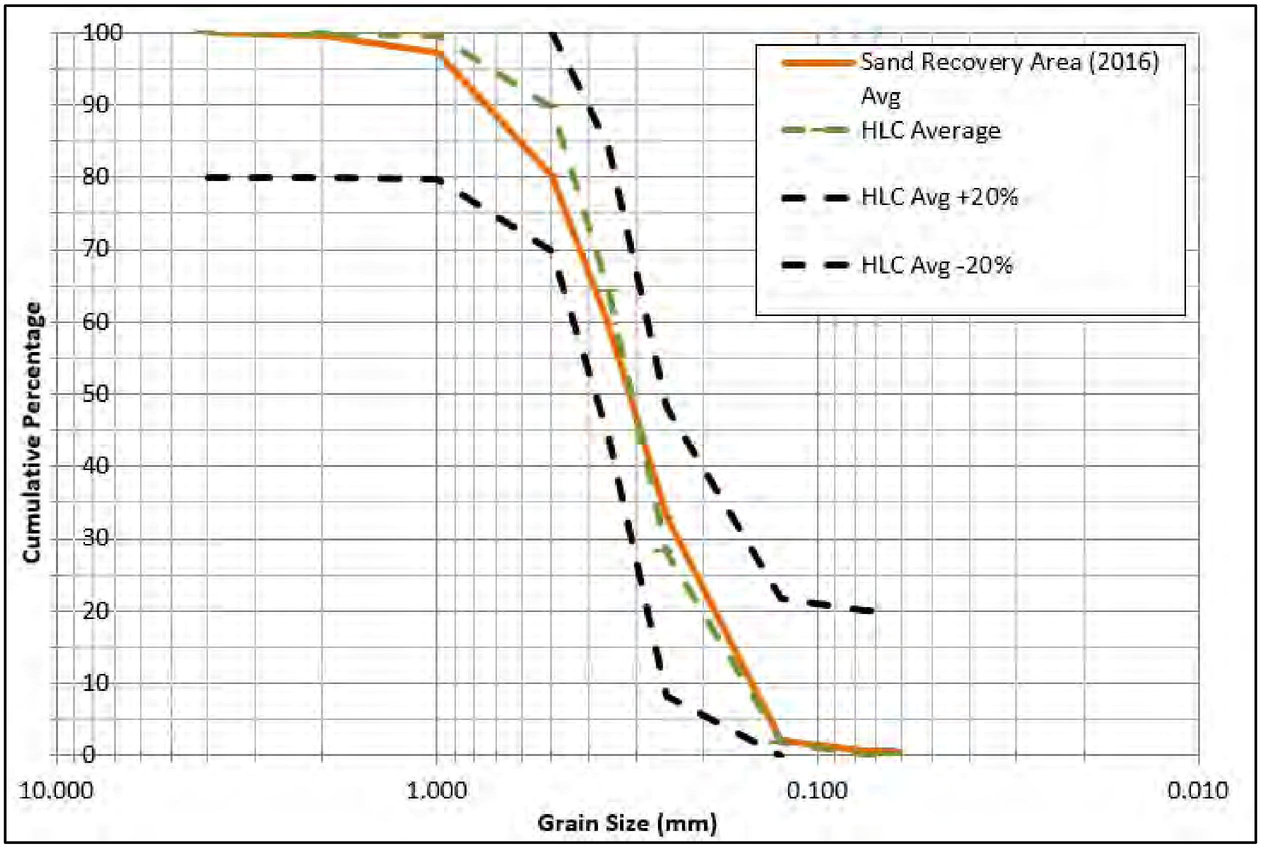


Figure 2-43. 2016 Puʻu Kekaʻa Sand Recovery Area average with HLC average and ±20% limits (dashed)

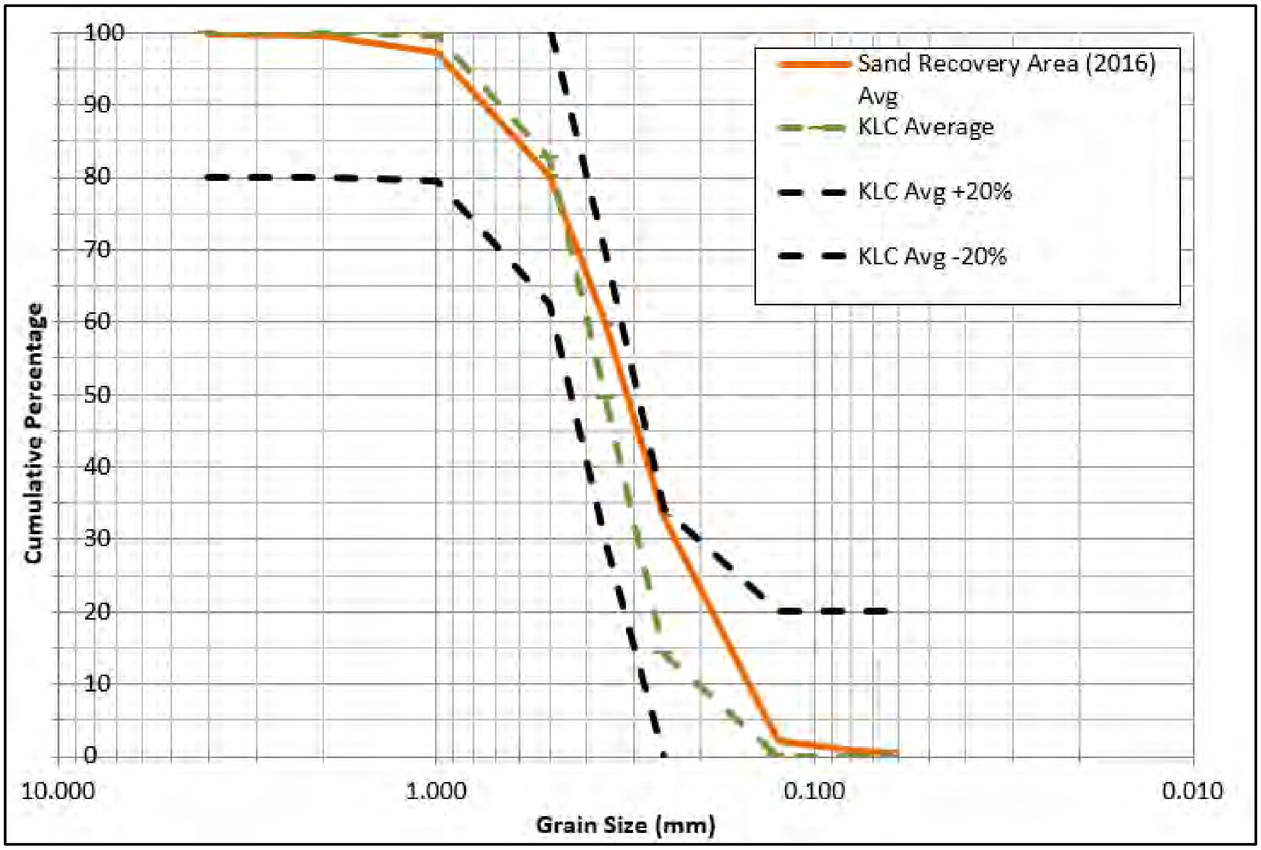


Figure 2-44. 2016 Puʻu Kekaʻa Sand Recovery Area average with KLC and ±20% limits (dashed)

Table 2-7. Sediment size characteristics, Puʻu Kekaʻa Sand Recovery Area and Kāʻanapali Beach samples

Grain Size (mm)	4.000	2.000	1.000	0.500	0.355	0.250	0.125	0.075	0.063
Puʻu Kekaʻa Sand Recovery Area 2016 Avg	99.958	99.554	97.191	80.186	59.619	33.078	2.209	0.693	0.583
HLC Average	100.00	99.947	99.662	89.723	64.317	28.212	1.852	0.132	0.093
KLC Average	100.00	100.00	99.630	82.660	49.380	14.190	0.015	0.000	0.000

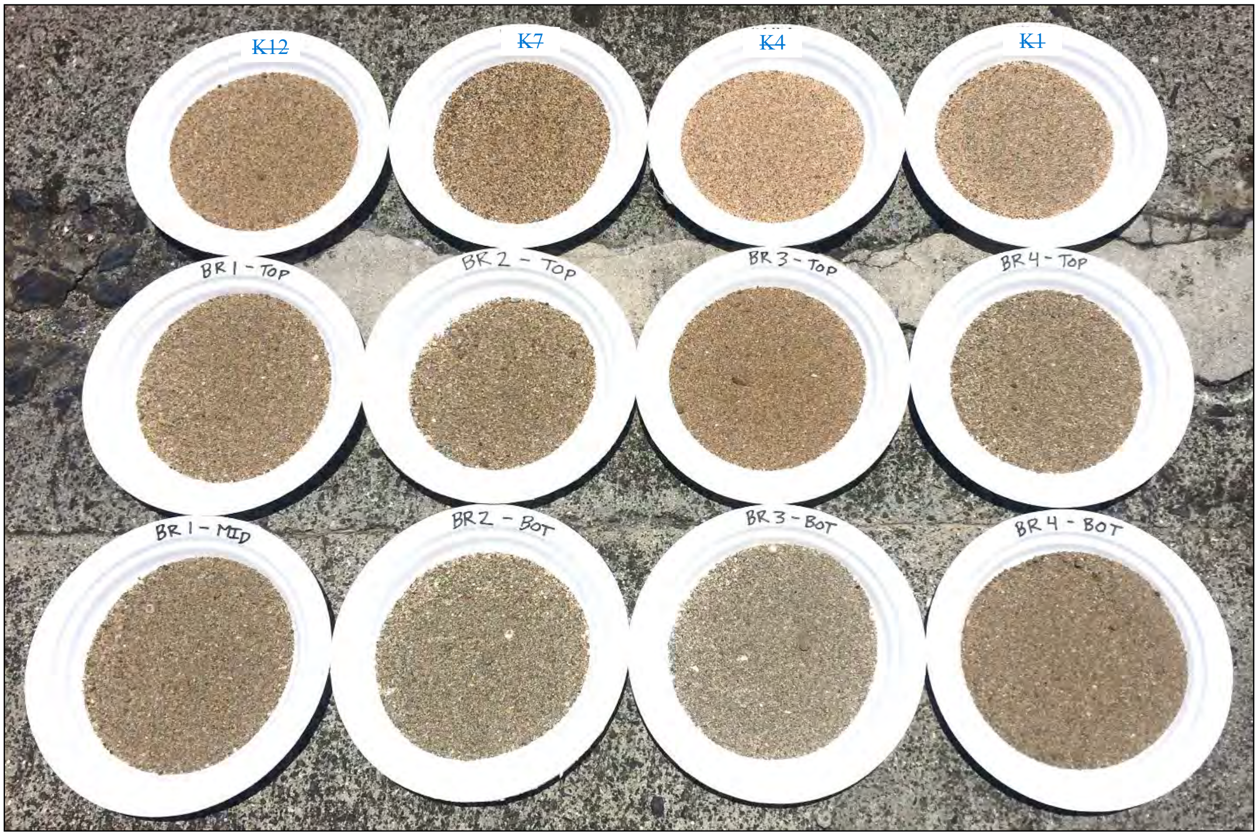


Figure 2-45. Dry color comparison between native Kāʻanapali Beach sand (top row) and offshore sand (bottom two rows)

2.1.10 Water Quality

Existing Condition

State of Hawaiʻi Department of Health Water Quality Standards (HDOH-WQS) that apply to the areas offshore of Kāʻanapali Beach Nourishment~~Restoration~~ site are classified as "open coastal water" in HRS Chapter §11-54-6(b). Two sets of standards are listed depending on whether an area receives more than 3 million gallons per day (mgd) of freshwater input per shoreline mile ("wet standards") or less than 3 mgd of freshwater input per shoreline mile ("dry"). As the Kāʻanapali project area (just under 1.5 miles in length) typically receives less than 3 mgd per mile, dry criteria are appropriate for this area.

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 relationship with State standards.

During a reconnaissance survey in 2017, the only nutrient constituents to exceed State of Hawaiʻi water quality standards for the "not to exceed more than 10% of the time" criteria under dry conditions were:

- Nitrate-nitrogen (NO_3^-) at the shoreline of the HLC and KLC
- Several values of ammonium nitrogen (NH_4^+) within 82 ft (25 m) offshore
- Turbidity at the shoreline of the KLC

The elevated concentration of NO_3^- near the shoreline is likely a result of the mixing of groundwater with ocean water. Results of the water quality reconnaissance survey indicate a small component of groundwater entering the ocean near the shoreline. The groundwater input is rapidly mixed to background coastal oceanic values through wave action, and likely only affects the very nearshore waters where macrobenthos (corals and algae) do not occur.

The turbidity of the water column peaks at the shoreline and decreases steadily with distance from shore (Figure 2-46 and Figure 2-47). 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 164 ft (50 m) from shore, all values of turbidity were well below the standards.

When the active beach is narrow, backshore bank erosion can occur during periods of high wave and water levels (Figure 2-48). Backshore fill at Kāʻanapali has been observed to be composed of sediment with a finer grain size than the native beach sand. The material can become suspended by wave action and transported offshore. This can cause elevated turbidity levels offshore that can be harmful to coral reef health.

The north end of the beach park is bounded by the Hāhākea Stream (Figure 2-49), an ephemeral stream that receives input from the Wahikuli and Hāhākea Gulches during periods of rain. It is common to see the beaches surrounding the stream mouth covered in nuts from the kukui trees that grow upstream. Streamflow events result in significantly increased nearshore turbidity, likely due to the presence of sediment and fines (fine grained sediment) entrained by the stream waters (Figure 2-50).

Laboratory turbidity tests were performed on a variety of sand samples from the ~~Puʻu Kekaʻa~~ Sand Recovery Area and Kāʻanapali Beach. Turbidity was determined by measuring the scattering of the light through sample cells that contained distilled water and sand in suspension.

Sand samples from the proposed recovery area were tested and compared with the Kāʻanapali Beach sand samples. The ~~Puʻu Kekaʻa~~ Sand Recovery Area was sampled using a diver hand core system and a ship-mounted vibracore system. Samples from this area are labeled BR. Kāʻanapali Beach was sampled in four locations between Puʻu Kekaʻa and Hanakaʻōʻō Beach Park. Two samples are from the KLC and two are from the HLC. In total, twelve sand samples were tested from the ~~Puʻu Kekaʻa~~ Sand Recovery Area and four from Kāʻanapali Beach.

The average turbidity was measured using a Hach 2100Q Portable Turbidimeter. A reading was taken for each sample at the following time intervals: 30 seconds, 1 minute, 2 minutes, 5 minutes, 10 minutes, 20 minutes, 1 hour, 2 hours, 4 hours, 6 hours and 24 hours. Data are plotted as turbidity versus time. The sample results from the ~~Puʻu Kekaʻa~~ Sand Recovery Area are plotted in Figure 2-51. Kāʻanapali Beach sample results are plotted in Figure 2-52. Figure 2-53 shows the average for each location.

All offshore samples tested showed initial turbidity that exponentially decreased with time. ~~Puʻu Kekaʻa~~ Sand Recovery Area samples had initial turbidity values ranging from 75 to 1000 NTUs, with an average value of 330 NTUs. 1000 NTUs is the maximum reading on the turbidimeter. The Kāʻanapali Beach samples had initial turbidity values ranging from 2 and 17 NTUs, with an average value of 7 NTUs.

Sand from within the offshore sand deposits will be mixed during excavation, transport, and placement on the beach. Average values for the usable area in the deposit are important, as they are representative of the material that will eventually be placed on the beach. Average turbidity results for the sand recovery area had higher initial turbidity values than the composite Kāʻanapali Beach sample.

After 6 hours, the average recovery site sand turbidity fell to 13 NTUs. After 24 hours, the average for the recovery site sand had a turbidity value of 3 NTUs, compared to the average beach sample turbidity reading of 1.3 NTUs after 24 hours of settling.

The Kāʻanapali Beach samples have low turbidity values. The samples were collected from active beach faces that are regularly washed by waves. Swash zone dynamics on higher energy beaches such as Kāʻanapali Beach, typically suspend and remove finer particles. Also, wind can blow fine grains off the active beach face, further reducing the fraction of fine sediment on the beach.

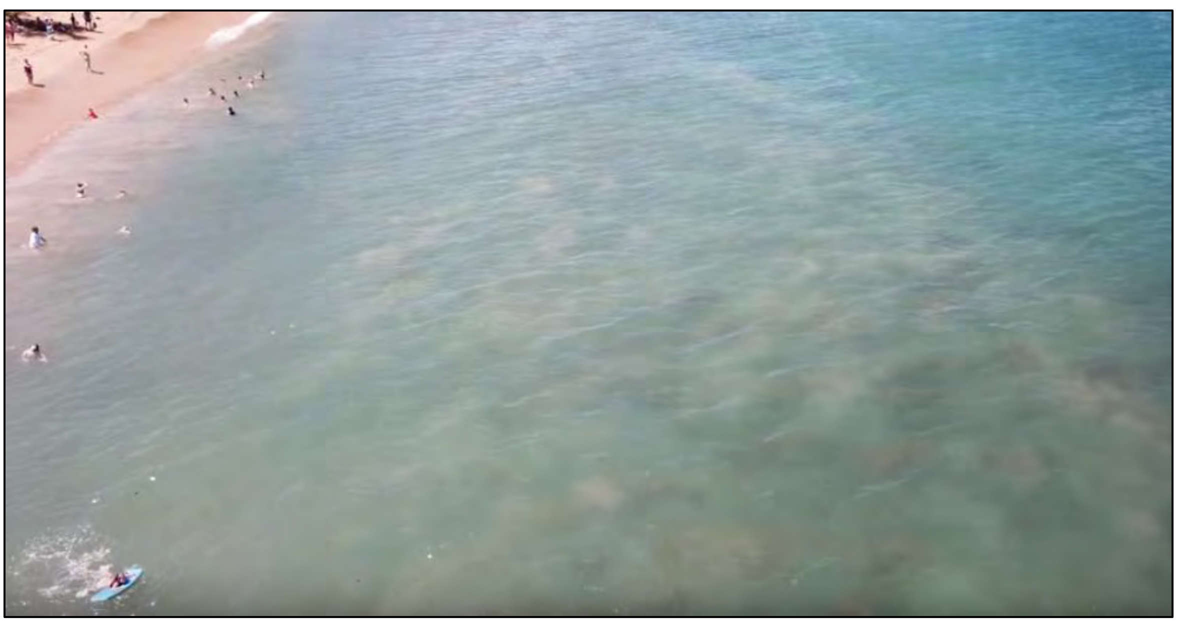


Figure 2-46. Natural Nearshore Turbidity in the KLC During Low Wave Energy Conditions (July 2018)

Figure 2-47. Natural nearshore turbidity in the KLC during typical wave energy conditions (August 2018)

Figure 2-48. Natural nearshore discoloration in the KLC During High Wave Energy Conditions (July 15, 2019)

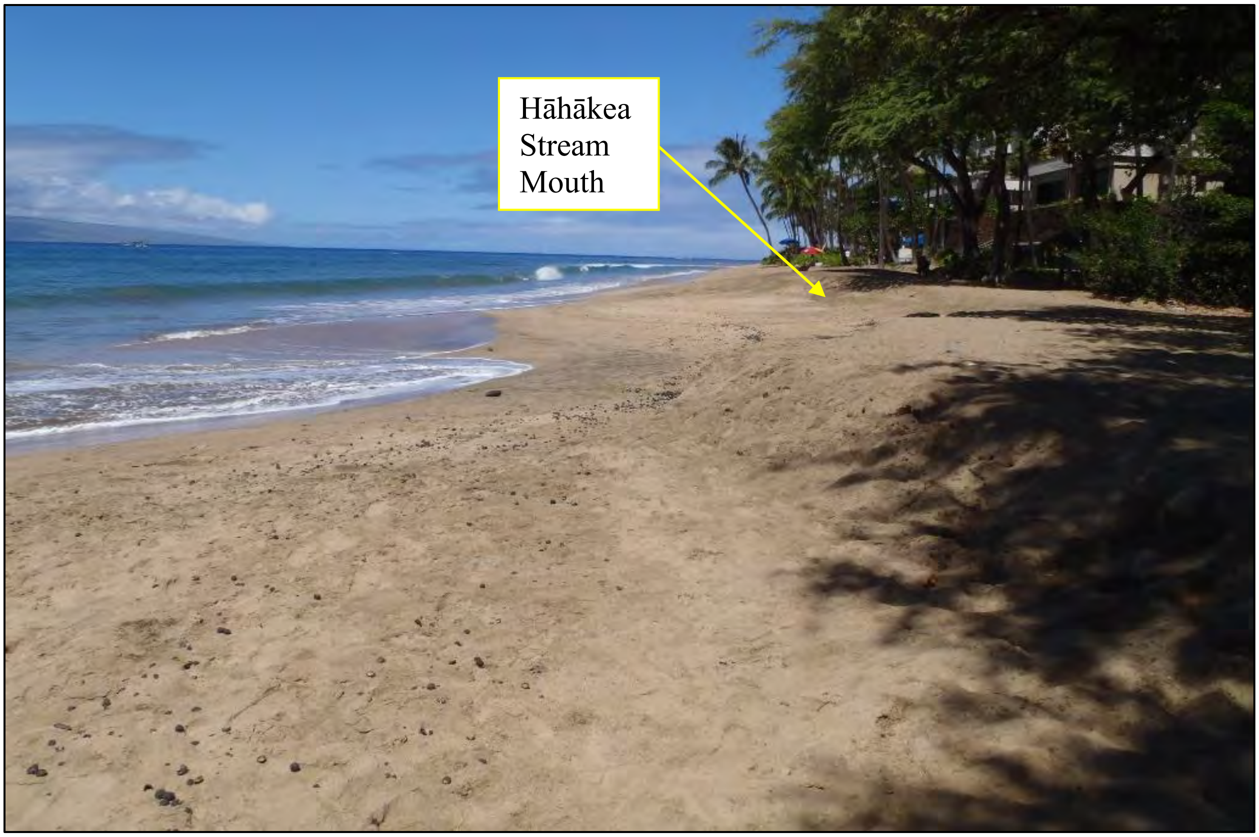


Figure 2-49. Hāhākea Stream Mouth at the north end of Hanakaʻōʻō Beach Park

Figure 2-50. Hāhākea Stream during February 2019 rain event.

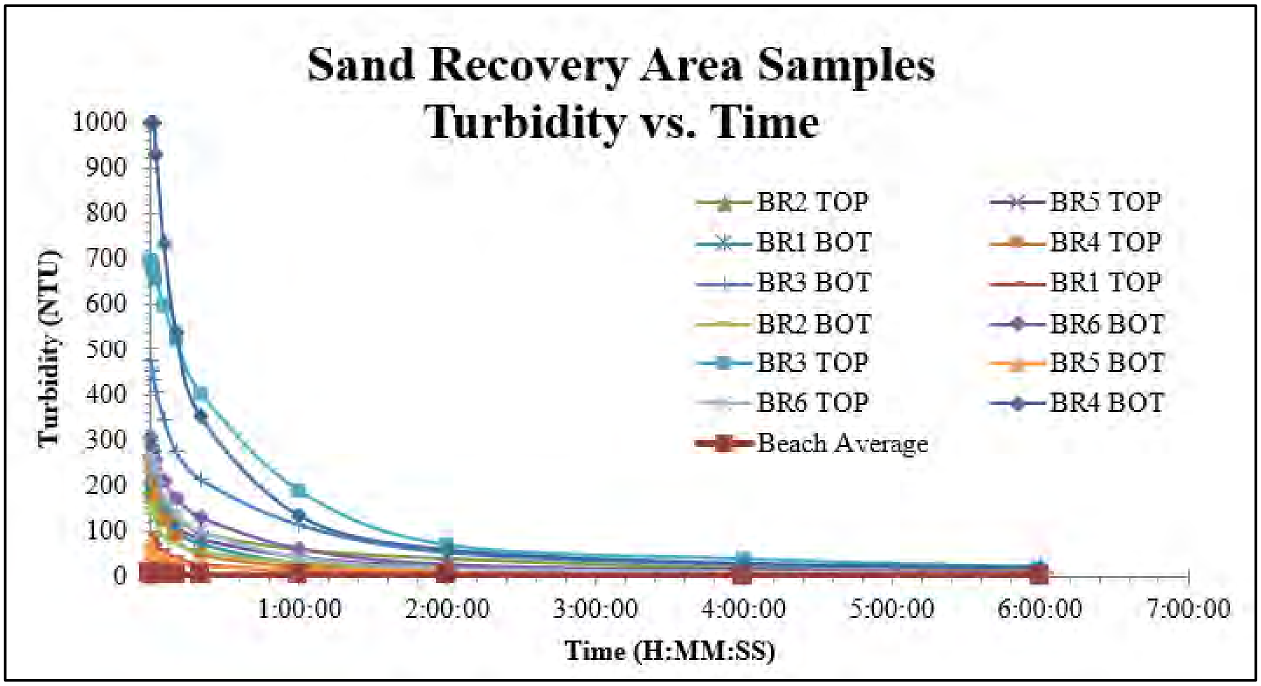


Figure 2-51. Turbidity results for Sand Recovery Area~~Puʻu Kekaʻa~~ samples and beach average

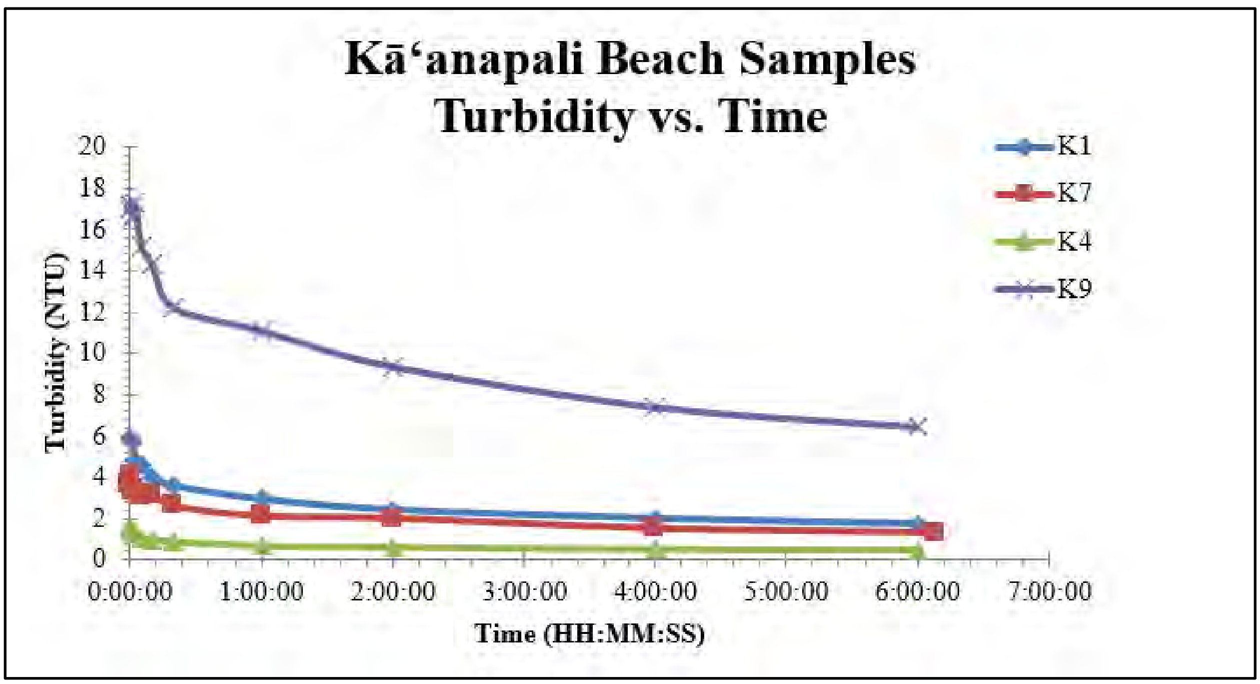


Figure 2-52. Turbidity results for Kāʻanapali beach samples

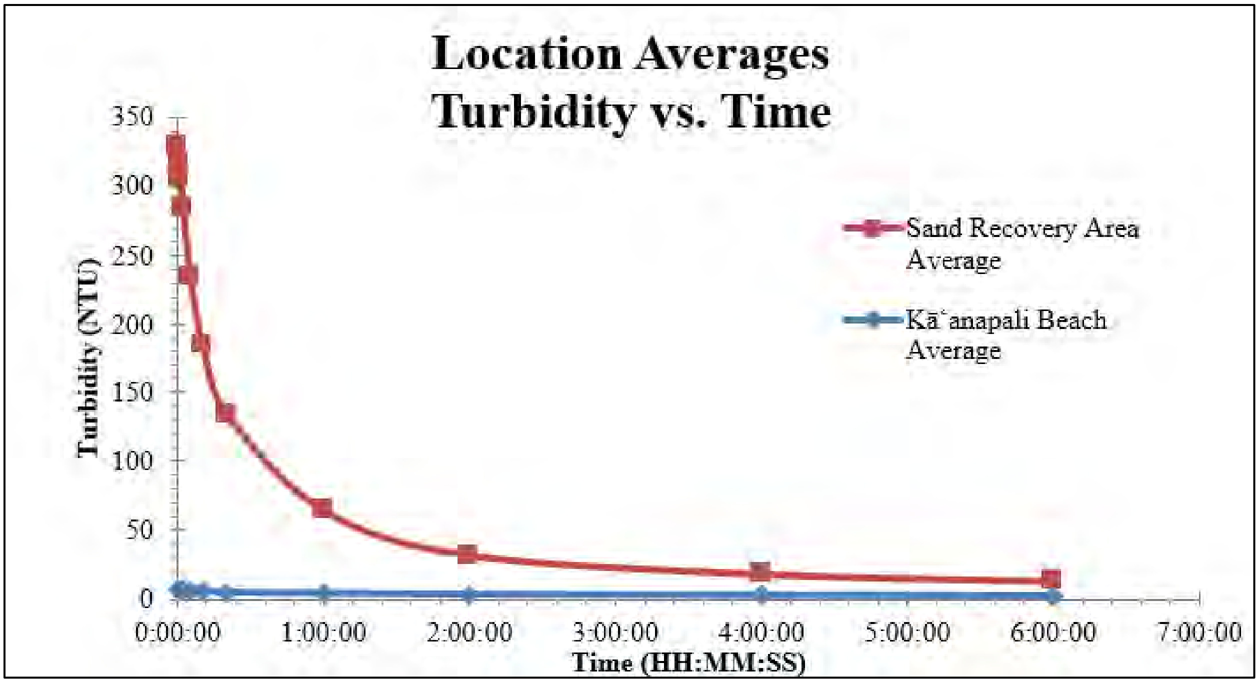


Figure 2-53. Averaged turbidity results for ~~Puʻu Kekaʻa~~ Sand Recovery Area and Kāʻanapali beach

Potential Impacts and Proposed Mitigation Measures

Beach nourishment~~restoration~~ projects, in general, can generate turbidity plumes that can be unsightly and affect water visibility for days. Though sand recovered from the ~~Puʻu Kekaʻa~~ Sand Recovery Area satisfies the DLNR requirements for beach-quality sand, it still has approximately 0.6% fine content. Though this is a low volume, it is still higher than the native beach sand. These fine grains will be winnowed from the beach system and moved offshore as the beach is reshaped by wave action. Recovery, transport, and placement of carbonate sand can also increase the percentage of fines through mechanical abrasion of the friable grains leading to more potential for turbidity due to the sand transfer process.

Nearshore turbidity is anticipated along the beach restoration shoreline during operations. Turbidity occurs when fine sediment particles are suspended in the water column. Turbidity is anticipated to be a temporary impact and would naturally dissipate as fine suspended sediment is naturally diluted and transported away in nearshore currents. Silt curtains and containment barriers would be deployed along the shoreline where sand placement is occurring to mitigate the turbidity.

Offshore turbidity is also expected at the dredge site. 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, minor volumes of sand containing fine particles would escape the bucket and be released into the water column. Turbidity at the dredge site will 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 Hawaiʻi. 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. Silt curtains are not proposed for the sand recovery effort due to greater depths and exposure to tidal currents and wave forces.

Approximately 0.5% of material grabbed by the clamshell bucket is anticipated to be released into the water column during the recovery. Turbidity generated from dredging operations at the Sand Recovery Area~~Pu'u Keka'a~~ is expected to have a net transport to the south, with the currents moving parallel to shore. The nearest live corals down current from the dredge site are located approximately 3,000 feet to the south, towards Hanaka'ō'ō Point, and the intermediate area is all part of the larger, regional sand field. While the sand-sized particles will fall out of the water column rapidly, returning to the sand field, a negligible amount of turbidity, approximately 0.03 cubic yards of fine material for each 1,000 cubic yards of recovered sand, will remain in the water column long enough to be transported to the coral reef's northern end. This small volume of material will be widely distributed across the full breadth of nearshore waters. Turbidity associated with clamshell recovery of sand is only expected to be present during recovery operations. No post-recovery turbidity is expected for the clamshell operation.

Following placement of sand on the beach within the HLC, there will likely be periodic turbidity associated with equilibration of the beach profile and platform, as sand moves along the beach and cross-shore. Any turbidity generated during beach restoration at the HLC is expected to have a net transport to the north, towards Hanaka'ō'ō Point owing to the predominant waves and currents. Larger sand size grains are currently stable along the coastline and make up the existing beach face; however, the finer material will likely remain suspended until it has moved offshore. Average fine sediment content in the proposed beach restoration~~nourishment~~ sand is 0.6%. This is equivalent to 300 cubic yards of fine sediment within the entire 50,000 cubic yards of placed sand within the HLC. Most of these fines will be located landward of the dynamic swash zone at the time of placement. Though periodic turbidity is expected during high wave and water level events following placement, the preferred alternative is anticipated to reduce the potential for turbidity as frequently occurs in the project area. At present the release of fill material and sediment into the nearshore environment occurs when a backshore scarp (steep eroded bank) is being actively eroded, such as fronting the Hyatt.

Initially, the material placed on the beach berm within the KLC will not interact with nearshore waters. During the erosive season (winter for the North~~Pu'u Keka'a~~ Berm Enhancement and summer for the Hanaka'ō'ō Point Berm Enhancement) the placed sand will gradually become incorporated into the active beach system. Similar to the existing condition, placed sand will be carried alongshore in the direction of the wave generated current. Average fine sediment content in the proposed berm enhancement~~nourishment~~ sand is 0.6%. This is equivalent to 150 cubic yards of fine sediment within the entire 25,000 cubic yards of placed sand within the KLC. Turbidity generated from these fines would move in the direction of wave propagation.

Sediment transport and initiation of motion in unidirectional flow is well-studied for sand-sized sediment. Sediment transport has not been well-established for the more complicated oscillatory wave regime in the near-offshore region, in general. Turbulent processes during breaking waves are even less well understood. To add to the complexity, sediment suspension and transport in the swash zone (area of wave run-up and run-down on the beach face) is also difficult to model. To simplify the complexity of transportation of fine sediment, the process can be broken into three steps. The first is to determine the threshold velocity to initiate motion of fine sediment. The second is to calculate the area where fine sediment could be mobilized based on prevailing wave conditions. The third is to use modeled wave driven currents to estimate where mobilized fine sediment will be transported.

To assess potential suspension and transport of project-related fine sediments, critical velocities to initiate motion were calculated using the equation from Komar and Miller (1974), where the threshold orbital wave velocity (U_{wcr}) is a function of the grain diameter (d), wave period (T), acceleration due to gravity (g), and the ratio of densities of grain and water (s):

$$U_{wcr} = [0.118g(s-1)]^{2/3} d^{1/3} T^{1/3}$$

Wave conditions and the resulting wave orbitals were calculated using the Simulating Waves Nearshore (SWAN) numerical wave model. Another numerical wave model named CMS Wave and Flow was used to model the wave-driven flow in the project area. Offshore wave inputs were obtained from the SWAN model. These modeled velocities were compared to the threshold orbital velocities to creating a mapped area of where the bottom orbital velocities from waves can mobilize fine sediment (Figure 2-54 and Figure 2-55). Four wave cases were evaluated: monthly north swell during winter season (Figure 2-56), monthly south swell during summer season (Figure 2-57), average tradewind wave conditions measured at ADCP 1 (Figure 2-58), and average tradewind wave conditions measured at ADCP 2 (Figure 2-59).

Model results highlight the interaction between waves, currents, and the movement of fine particles in the nearshore area around the project site. Though each modelled wave condition results in the mobilization and movement of fines in a different way, each wave condition does have the potential to create small turbidity plumes during and immediately after the nourishment effort. The currents moving along shore and offshore with the highest flow rates are the likely paths to mobilize finer sediment and create small plumes, respectively.

Beach nourishment~~restoration~~ projects, in general, can generate turbidity plumes that can be unsightly and affect water visibility for days. Although the proposed sand for placement on the beach and berm closely matches the existing beach sand with respect to grain size, the Sand Recovery Area~~Pu'u Keka'a~~ sand does have approximately 0.6% fines, which is higher than the native beach sand. Additional fines may be generated during sand recovery, transport, and placement activities. After placement, wave action is expected to release fine sediment over the course of the project's lifetime. This may result in suspended fines, that can create a turbidity plume offshore of the beach restoration and berm enhancement areas, as detailed above.

Following placement of nourishment~~restoration~~ sand, turbidity levels in the nearshore waters at the project site will return to natural. The limited volume of fine grains in the fill material will be suspended and transported offshore as part of the natural swash zone dynamics. The 2012 Waikīkī Beach Restoration project had diminishing nearshore turbidity for approximately 6 months, including the beach restoration effort. Though the wave exposure at Kāʻanapali Beach is greater, the fine content in the sand is lower, so there an expectation for a similar duration of diminishing turbidity signature from the beach associated with this project.

A beach restoration effort at Kanai A Nalu Project, similarly to the HLC beach restoration effort, consisted of beach nourishment on the beach face. The project scale was smaller; however, placing 1,500 cy of sand compared to 50,000 cy. The Kanai A Nalu sand was fine-grained inland dune sand with higher percentages of silt and clay size particles. This sand, though suitable for beach restoration action, is not as compatible for beach nourishment as some marine sands. The Kanai A Nalu restoration sand, with higher fine content, is more susceptible to creation of turbidity and sedimentation in the nearshore. The Kanai A Nalu project did not report use of turbidity curtains for containment, though their post-construction water quality monitoring reported an improvement in water clarity.

For the Kanai A Nalu Project, water quality monitoring was also conducted (Norcross, et. al., 2004). There were three transects with three stations along each transect: one in the swash zone, one at 25 m from the shoreline, and one at 100 m. Measurements included turbidity, salinity, dissolved oxygen content, and temperature. One transect was located at either end of the project area and the third was in the center. Sampling was conducted monthly over 12 months (Oct 2002 – Sept. 2003). The beach nourishment occurred over 5 days (June 2-6, 2003) during which samples were conducted daily and for the two days after construction.

Background turbidity was found to be 0-12 NTU with a spike to 40 NTU during a Kona storm. During construction, the swash zone turbidity increased by 2.33 NTU over pre-construction average to 11.2 NTU; the 25 m offshore site increased by 2.86 NTU to 6.47 NTU; and the 100 m offshore site increased by 1.47 NTU to 3.32 NTU.

Five days after construction had ceased, turbidity levels had returned to within 1.0 NTU of pre-construction levels at seven of the nine sampling stations, and within 3.0 NTUs of pre-construction levels at the remaining two stations (3-25 and 3-100). The highest actual increase in turbidity from pre-construction levels was 21.63 NTUs, occurring at station 3-25, which reached a level of 24.37 NTUs compared with 2.74 NTUs before construction.

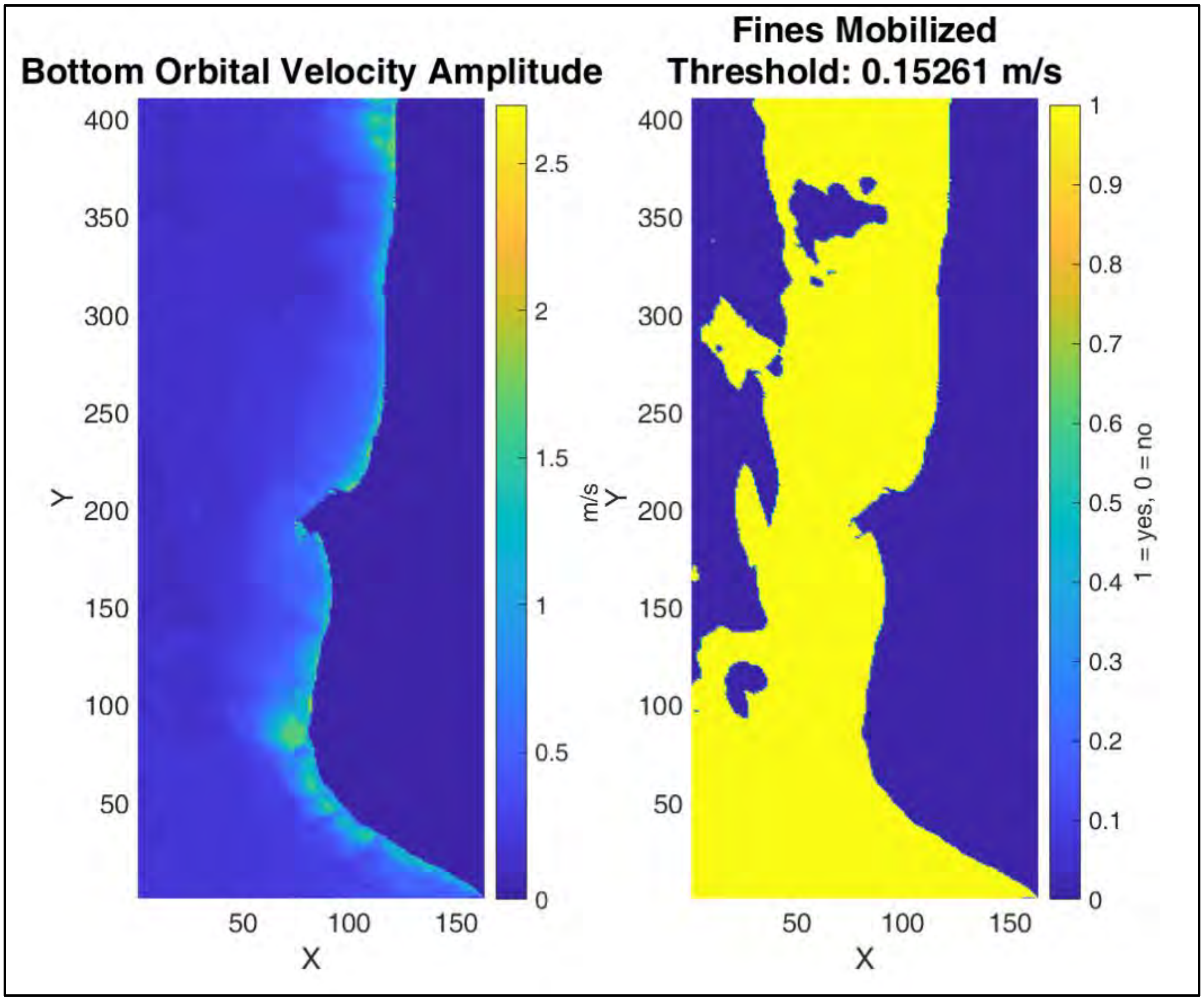


Figure 2-54. Orbital Velocities and Sediment Mobilization Surface Area for Predicted Monthly North Swell Event (Winter).

If the bottom orbital velocities are great enough, they cause fine sediment particles to become mobilized in the water column.

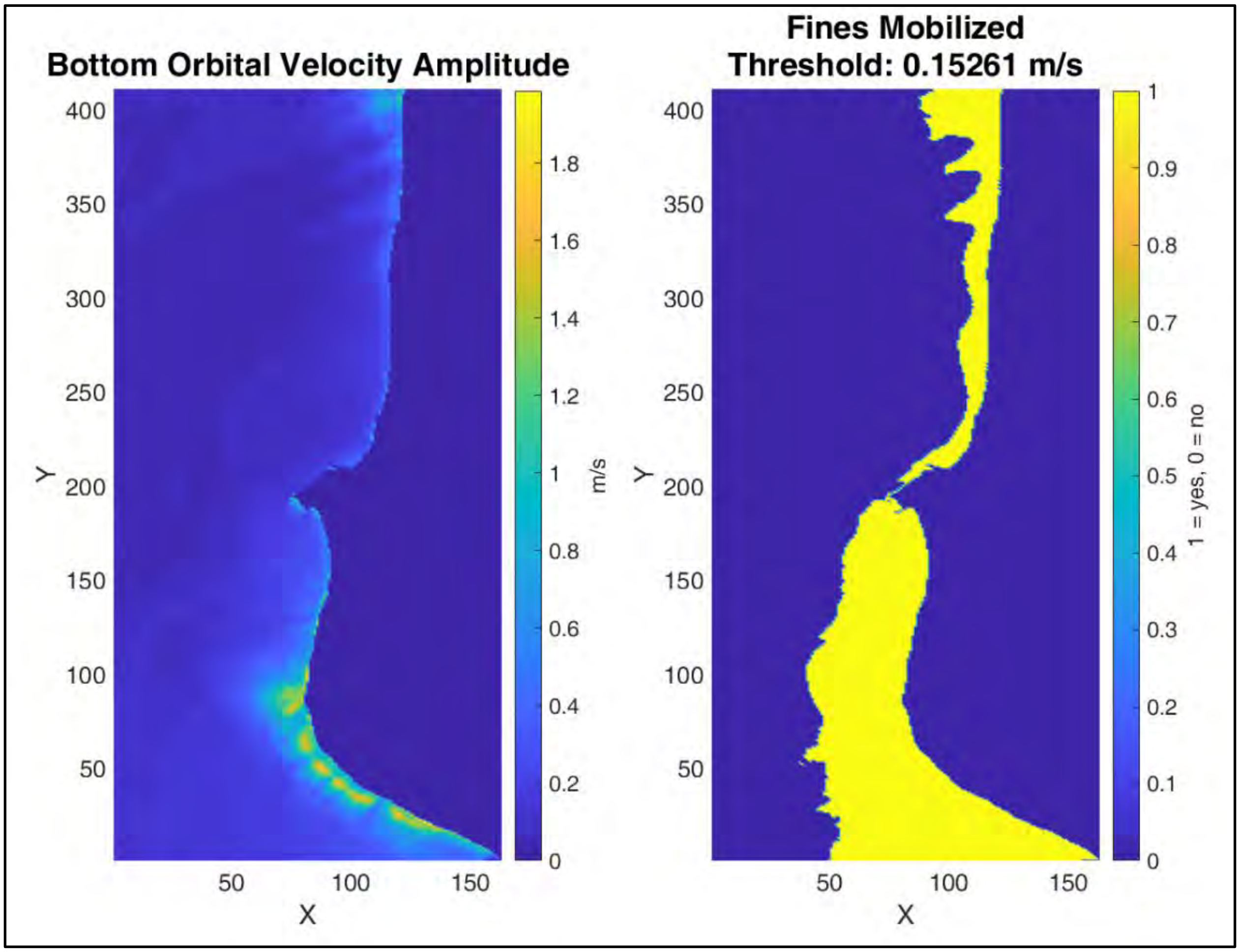


Figure 2-55. Orbital Velocities and Sediment Mobilization Surface Area for Predicted Monthly South Swell Event (Summer).

If the bottom orbital velocities are great enough, they cause fine sediment particles to become mobilized in the water column.

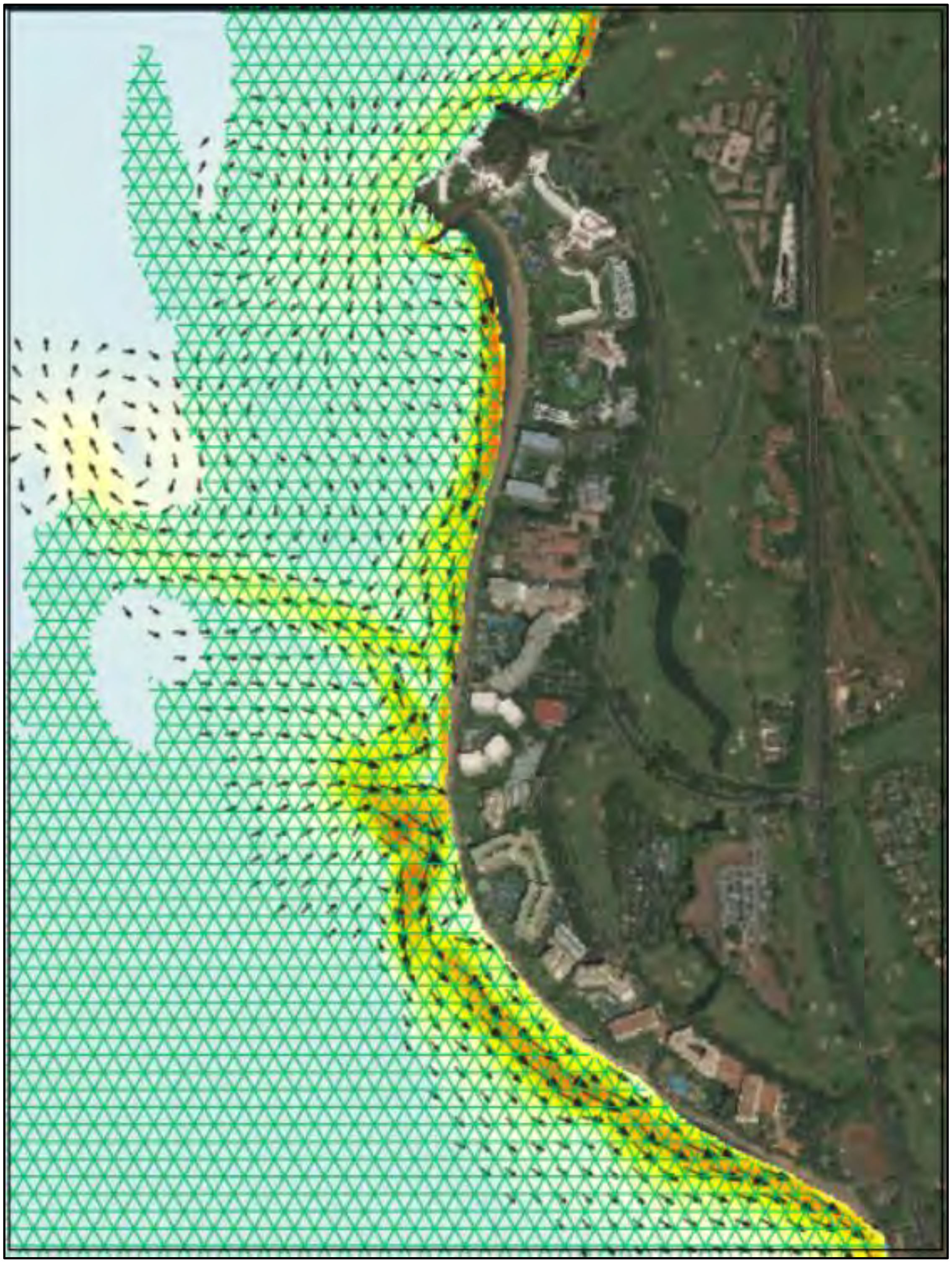


Figure 2-56. Sediment Transport Pathways During Predicted Monthly North Swell Events (Winter)

Figure 2-57. Sediment Transport Pathways During Predicted Monthly South Swell Events (Summer)

Figure 2-58. Sediment Transport Pathways During Predicted for Average Tradewind Wave Conditions (Measured at ADCP-1)

Figure 2-59. Sediment Transport Pathways During Predicted for Average Tradewind Wave Conditions (Measured at ADCP-2)

2.1.11 Marine Biology

Existing Condition

A baseline marine environmental assessment was conducted for the proposed project and is included as Appendix B in this document. Work included diver reconnaissance, drop camera video investigations, and desktop investigations. Multiple regions were assessed, including the ~~Pu'u Keka'a~~ Sand Recovery Area and surrounding sand fields, deeper anchor sites, the KLC, and the HLC.

Following outreach associated with the DEIS publication and review process, additional work was completed on the marine environmental assessment, and is included as an addendum to the baseline study in Appendix C of this document, alongside the original marine ecological assessment.

Biotic composition of the reef area was assessed by divers using SCUBA working from a small boat. Two types of benthic reef evaluations were conducted during the field surveys. Seven "verification" sites were surveyed to provide a set of quantitative ground-truth data to compare to existing mapping products. In addition, three "monitoring" sites and seven "verification" sites were established and surveyed in order to establish baseline conditions for time-course monitoring designed to quantify impacts to coral community from sand restoration activities (Figure 2-60).

Both types of sites were evaluated with a photographic "orthomosaic" technique that uses several software programs to merge multiple digital photographs into a single undistorted image. These images provide a permanent record of the reef habitat at a point in time and can be analyzed to provide quantification of various components of benthic community structure.

Prior to fieldwork, the locations of each monitoring and verification site were chosen based on a composite benthic habitat map prepared by Sea Engineering, Inc. These maps overlaid data from four mapping sources (PIFSC [2017], NOAA [2016], USGS [2014] and NCCOS [2007]). In the field, each site was identified from the surface using a handheld GPS. The exact survey locations were refined by divers to ensure representative bottom cover in each area. For the three monitoring sites, divers marked square areas 5 x 5 meters (m) (25 m2) using measuring tapes. Cable ties 24-inches long were affixed to the reef at the corners of the square areas in order to relocate the exact sites in future monitoring surveys.

For the seven verification sites, survey areas were approximately 3 m x 3 m (9 m2). Prior to data acquisition 30-centimeter (cm) long metal pipes were placed at the four corners of the survey square, while a fifth pipe was placed at the center. The pipes were marked at 10 cm intervals to serve as scale indicators. Following completion of dive operations at the survey site, the coordinates of the center pipe were recorded by GPS on the boat to ensure exact positioning.

The reef surface within the boundaries of each of the sites was photographed by divers using cameras fitted with 24-millimeter lenses in underwater housings. Photographs were acquired by divers swimming horizontal overlapping "lawnmower" lines at a constant depth of approximately 2 m above the reef surface while continually taking overlapping photographs. Approximately 400 individual images were collected for the three monitoring orthomosaics, and a range of 200-300 individual images were collected for the seven verification orthomosaics.

For analysis, grids were created that located 200 points on each of the monitoring orthomosaics, and 100 points on each of the verification orthomosaics. Corals underlying the gridded points were identified to the species level while other benthic cover types were identified to a more general level (e.g., crustose coralline algae, turf algae, dead coral, limestone fossil reef, and sand).

Sand Recovery Area

The ~~Puʻu Kekaʻa~~ Sand Recovery Area is a broad plain of white-grey sand located within a larger sand field that begins near the shoreline~~inshore at Puʻu Kekaʻa~~ and continues offshore to depths greater than 200 feet (Figure 2-61). The sand field continues parallel to shore along the length of the Kāʻanapali Littoral Cell and the Honokōwai Littoral Cell. South of Hanakaʻōʻō Point, the sand field is broken up by patches of reef and pavement. Six drop camera video transects were recorded in the ~~Puʻu Kekaʻa~~ Sand Recovery Area (Figure 2-60).

The only prominent biotic colonizer observed in the ~~Puʻu Kekaʻa~~ Sand Recovery Area~~Area~~ was *Halimeda kanaloana*, a common macroalgae in West Maui. The density of the algae varied both between and along the transects. Transect 1 had the highest density while Transect 6 had the lowest density. All six transects had patches of sand with no algae. One school of *Decapterus macarellus* (Mackerel scad, opelu) was observed at Transect 6. No coral or hard bottom was observed during reconnaissance dives or drop camera investigations in the sand borrow area, or in either side scan or sub-bottom surveys of the site.

It is expected that the benthic infaunal community structure of the ~~Puʻu Kekaʻa~~ 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).

Drop camera video was recorded at the three deep anchor points offshore of the ~~Puʻu Kekaʻa~~ Sand Recovery Area (shown previously in Figure 1-14). The deepest of the three anchor points was at a depth of 112’, while the shallowest of the three anchor points was at a depth of 80’. All three anchor points contained the common green algae, *Halimeda kanaloana*. The density of the algae was slightly greater at the deeper anchor point site than at the other two anchor points. No other species were distinguishable on drop camera footage at these three sites.

Nearshore Environment

Results of these marine environmental studiesthis baseline study (Marine Research Consultants, Inc. 2017 and 2020) reveal that the major factor shaping the composition of the marine communities offshore of the project site is the concussive forces associated with breaking surf. Nearshore reef community structure is in response to the degree of wave energy which controls community composition. The documented structure of the marine communities indicates that within the nearshore area where waves regularly break, the physical habitat is either sand or a flat barren limestone bench with essentially no benthic community, with no corals present. At intermediate distances from shore, corals begin to colonize the hard surfaces. At deeper zones wave forces and sand resuspension are reduced to a level where coral communities can settle and grow, and the deep reefs are characterized by high densities of a variety of species of Hawaiian reef corals.

The NorthPuʻu Kekaʻa Berm Enhancement area is located closest to the sand borrow site, and as a result, is more influenced by sand scour and coverage of the reef surface than the other two survey areas. The nearshore area consists of a continuous sand bottom that is in a state of near-continuous resuspension during regular wave events. Seaward of the sand flat, the bottom composition consists of irregularly spaced fossil limestone reef structure that contains only scattered coral colonies, primarily of the species *pocillopora meandrina* (cauliflower coral). The relatively barren reef platform extends approximately 150 m from the shoreline, where it abuts a sand plain. Tufts of the green calcareous alga *halimeda* occur in the sand plain.

The South Berm Enhancement area is located along Hanakaʻōʻō Point, between the beach restoration and North Berm Enhancement areas. As this area is more distant from the sand borrow area, there is less effect to reef community structure from sand scour and cover of the bottom. With less sand in the system, the nearshore area consists of a flat, pitted limestone bench that is covered with a thin veneer of turf algae. The nearshore reef bench is devoid of large sessile benthos. Within the nearshore zone motile macrobenthos, particularly sea urchins, were extremely scarce, likely as a result of the force of breaking waves which is sufficient to prevent these unattached organisms to remain stable on the reef surface.

Moving seaward, the first corals to occur are scattered heads of *Pocillopora meandrina*. With increasing distance from shore and increasing water depth, other corals gradually appear, primarily encrusting or sturdy lobate forms of *Porites* and *Montipora*. At a water depth of approximately 8 meters, the outer reef zone consists of a mixed community of most of the common Hawaiian reef corals that cover most of the surface of the limestone reef platform.

The primary coral species occurring in the outer reef zone area *Porites lobata, which occur primarily as large encrustations or hemispherical dome-shaped colonies up to two meters in diameter*. The large size, and healthy appearance of these colonies indicates that they are on the order of at least several decades old. *Porites compressa*, commonly called "finger coral" occurs as interconnected mats. The growth form of *Porites compressa* consists of elongated fingers, which are substantially more delicate and susceptible to breakage compared to the other corals. Hence, *P. compressa* is not found in areas that are routinely subjected to wave energy. The occurrence of large, intact colonies of *P. compressa* in the outer reef zone off of the Kāʻanapali Sand Restoration area indicates that the outer reef zone has not sustained wave stress substantial enough to destroy these coral colonies over at least a decadal time interval. While less abundant than species of *Porites*, other corals observed in the area were *Montipora patula, M. capitata, M. flabellata, Pavona varians, P. duedeni, Porites brighami, P. evermanni, P. brighami, Leptastrea purpurea,* and the solitary coral *Fungia scutaria.* No growth of dense stands of benthic algae were noted anywhere on the reef.

The outer reef zone terminates at a depth of approximately 10 m in a margin between the limestone platform and sand plain. Seaward of the outer reef margin bottom composition consisted of a flat, gently sloping sand plain. No pastures of *Halimeda* were observed during the present study at the junction of the reef platform and the sand plain in the area.

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

Reef fish were considered low in abundance throughout the study area. The most common, and conspicuous fish were mixed species of Acanthurids (surgeonfish) occupying mid-water near the outer margin of the reef platform.

The HLC Beach Restoration area reef zonation pattern is similar to that at Hanakaʻōʻō Point, with several exceptions. The innermost zone adjacent to the beach consists of a barren limestone platform. The beach restoration area has a zone of emergent fossil reef projections within a sand zone that lies between the inner reef bench and the outer reef. Seaward of the sand zone, the outer reef consists of a similar assemblage of lobate and encrusting corals as described for the point. However, the outer region of the reef platform consists of a sub-zone dominated by widespread monospecific stands of *Porites compressa*. As at the point, the reef platform terminates in a near vertical scarp that abuts sand plains. The monospecific stands of *P. compressa* indicate that this region has been extremely stable with respect to lack of impact from large storm waves for at least decades. In addition, throughout this study, there was no overall indication of bleaching of corals from the El Nino events of 2014-2015, which have been documented for the region.

Table 2-8 shows the results of point count analyses of the three monitoring orthomosaics. Total coral cover ranged from 45.5% to 69.5%. The lowest cover occurred at M1, which is the site of the Ridge to Reef Monitoring station. The highest coral cover occurred at M3, located in the approximate center of reef of the Hanakaʻōʻō littoral cell where sand restoration will occur. Seven coral species were encountered in the monitoring orthomosaics. M1 and M2 included four species, the most abundant of which was Porites lobata (29% and 30.5% of bottom cover, respectively). M3 included seven species of coral, the most abundant of which was Montipora patula (33.5% of bottom cover). As the number of coral species and the dominant coral differs between orthomosaic M1-M2 and M3, it is evident that these two locations represent somewhat different coral assemblages.

In addition to living corals, several other categories are classified in the point count analyses. These categories include crustose coralline algae and turf algae. Had any macroalgae been encountered, these species would be included at the lowest recognizable taxonomic level. Abiotic bottom composition is classed as sand, limestone fossil reef, and dead coral. Dead coral is differentiated from limestone fossil reef by the presence of distinct skeletal colony morphology. Conversely, limestone fossil reef is bare substrate that clearly consists of limestone deposition without any identifiable colonial structure.

Four maps (Figure 2-63, Figure 2-64, Figure 2-65) of the Kāʻanapali reef created by four federal agencies divide bottom cover of living corals into two classifications (10<50% and 50<90%). An overlay of the four map products indicates that overall, the maps created by PIFSC, NOAA, USGS, and NCOOS provide a consistent representation of the reef structure (Figure 2-66). The PIFSC map provides somewhat lower values than the other three. Seven locations on the reef were selected as ground-truth sites to provide verification of the mapping products. Orthomosaic images of nine square meter areas of the reef surface were constructed. Orthomosaic images were analyzed using point count methods to generate quantitative representations of reef community structure. While the resolution of the existing maps is very coarse, they are generally consistent with quantitative ground-truth data. One region where the ground-truth diverges from the maps is the area adjacent to the sand channel that is proposed as the site of the sand offloading platform. In this area ground-truth data indicates lower coral cover than occurs in several of the maps.

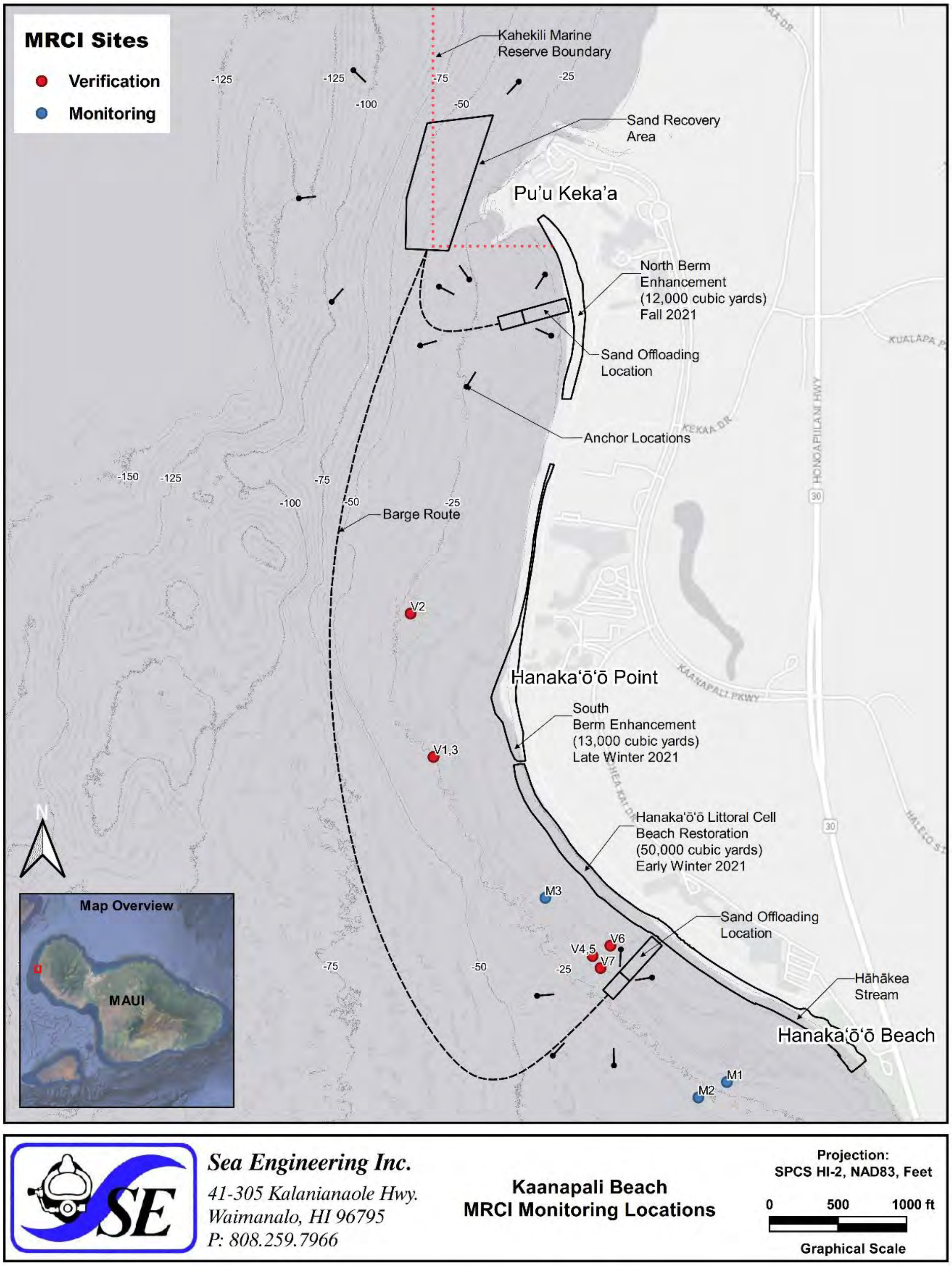


Figure 2-60. MRCI benthic biology monitoring stations

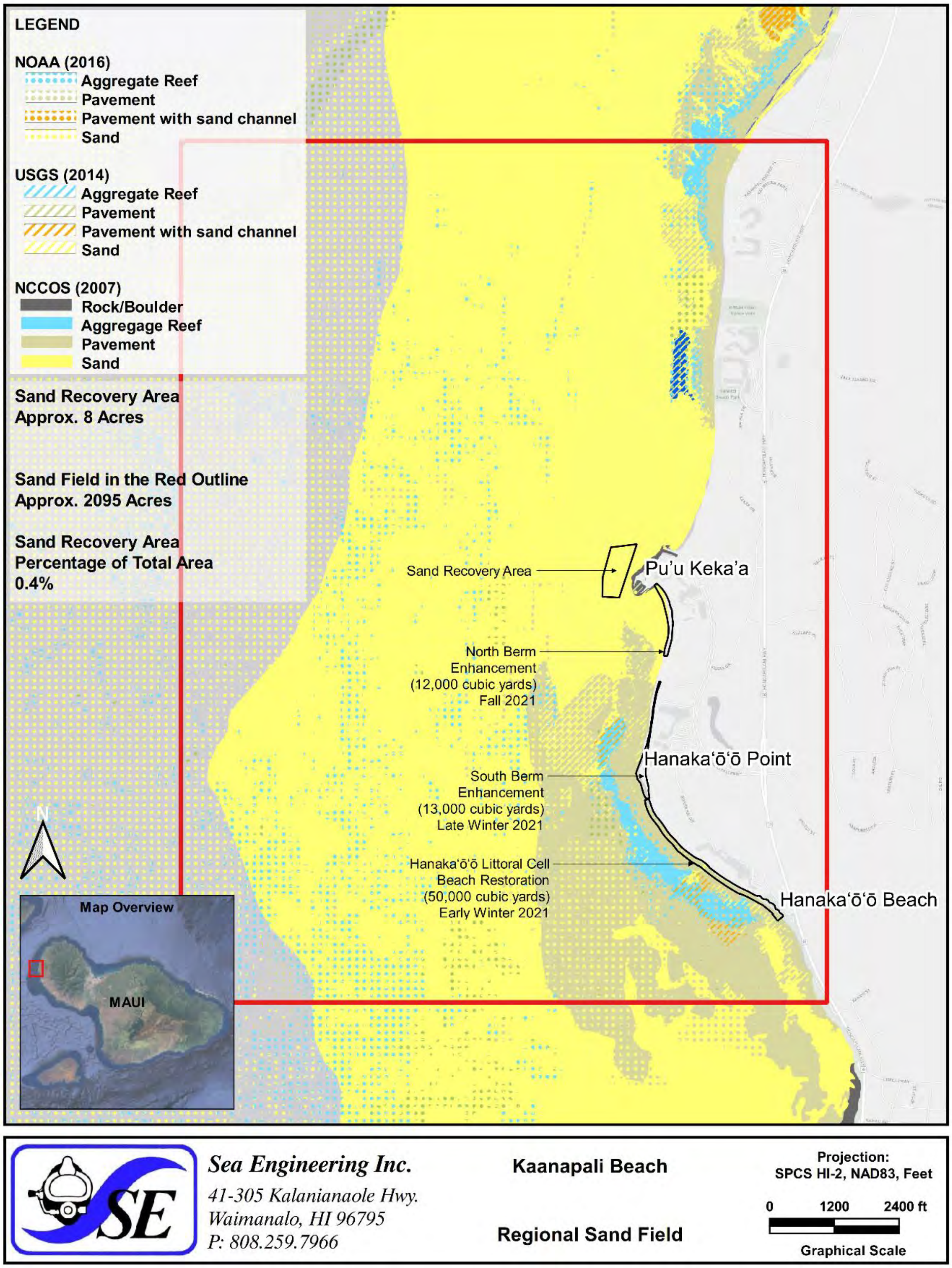


Figure 2-61. Proposed sand recovery area relative to the regional nearshore sand field

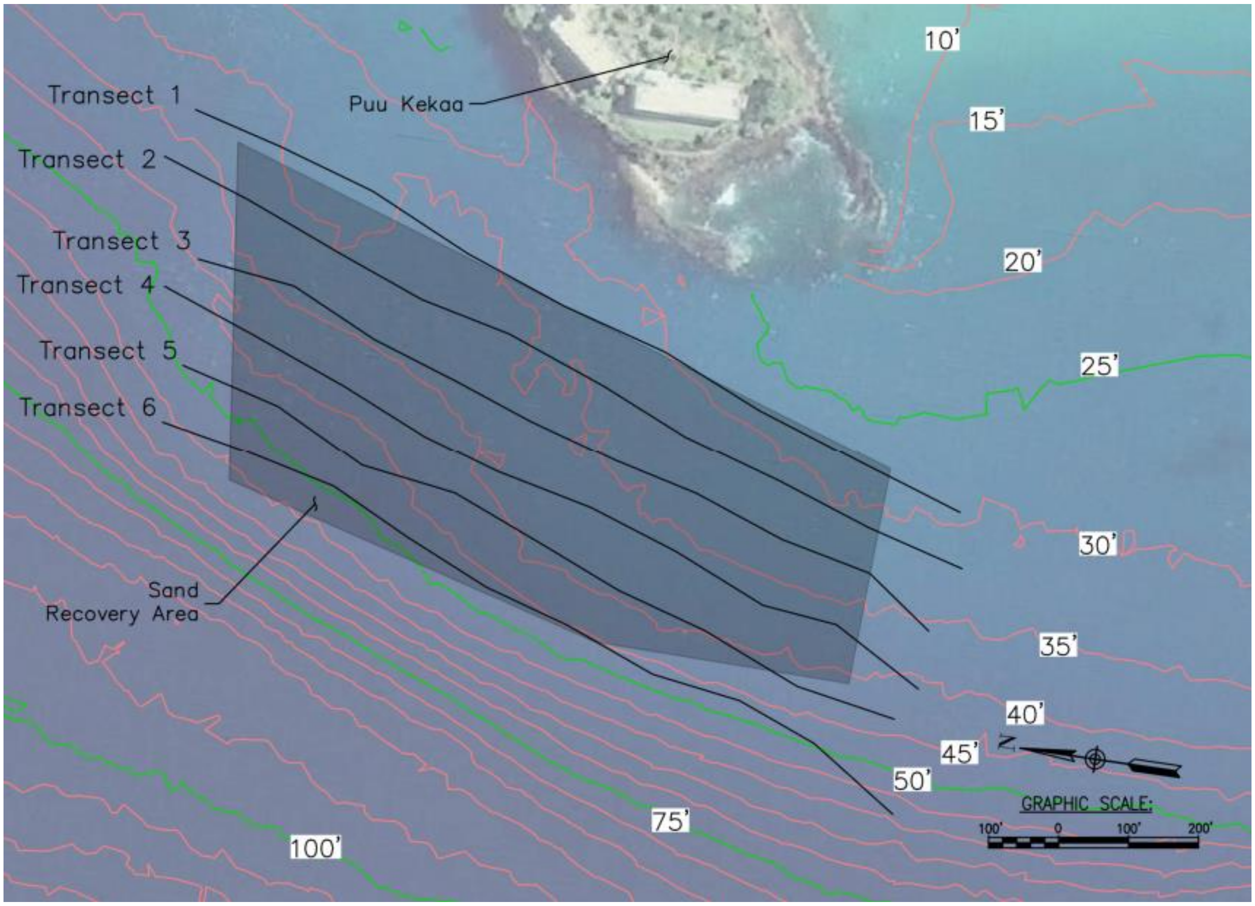


Figure 2-62. Drop Camera Transects within the Sand Recovery Area (February 4, 2019)

Table 2-8. Percent bottom cover of corals and other non-coral substratum from orthomosaics at reef locations offshore of the proposed project. M prefixes are for prospective monitoring locations and V prefixes are for verification sites.

	ORTHOMOSAIC									
CORAL SPECIES	**M1**	**M2**	**M3**	**V1**	**V2**	**V3**	**V4**	**V5**	**V6**	**V7**
Depth	**22'**	**24'**	**12'**	**17'**	**12'**	**19'**	**12'**	**13'**	**12'**	**14'**
Montipora capitata	8.5	10.0	8.0	6.0	2.0	43.0	12.0	12.0	2.0	25.0
Montipora flabellata	-	-	2.0	-	-	4.0	-	-	2.0	-
Montipora patula	-	-	33.5	18.0	2.0	15.0	11.0	19.0	9.0	20.0
Pavona duerdeni	-	-	2.0	-	-	-	-	-	-	-
Pavona varians	-	-	-	0.5	-	-	-	-	-	-
Pocillopora meandrina	-	0.5	2.0	-	-	-	-	-	-	-
Porites compressa	7.5	21.5	7.5	42.0	44.0	10.0	12.0	9.0	-	12.0
Porites evermanni	-	-	-	-	1.0	-	-	-	-	0.5
Porites lobata	29.0	30.5	14.5	16.0	19.0	5.0	34.0	34.0	25.0	11.0
Palythoa tuberculosa	0.5	-	-	-	-	-	-	-	-	-
TOTAL CORAL	**45.5**	**62.5**	**69.5**	**82.5**	**68.0**	**77.0**	**69.0**	**74.0**	**38.0**	**68.5**
Crustose Coralline Algae	2.5	11.0	0.5	2.0	4.0	1.0	-	2.0	2.0	-
Turf Algae	0.5	0.5	0.5	1.0	-	-	-	-	-	-
Dead Coral	0.5	-	0.5	-	-	-	-	1.0	4.0	1.0
Limestone Fossil Reef	30.5	25.5	29.0	14.5	27.0	22.0	31.0	17.0	55.0	30.5
Sand	20.5	0.5	-	-	1.0	-	-	6.0	1.0	-
TOTAL NON CORAL	54.5	37.5	30.5	17.5	32.0	23.0	31.0	26.0	62.0	31.5

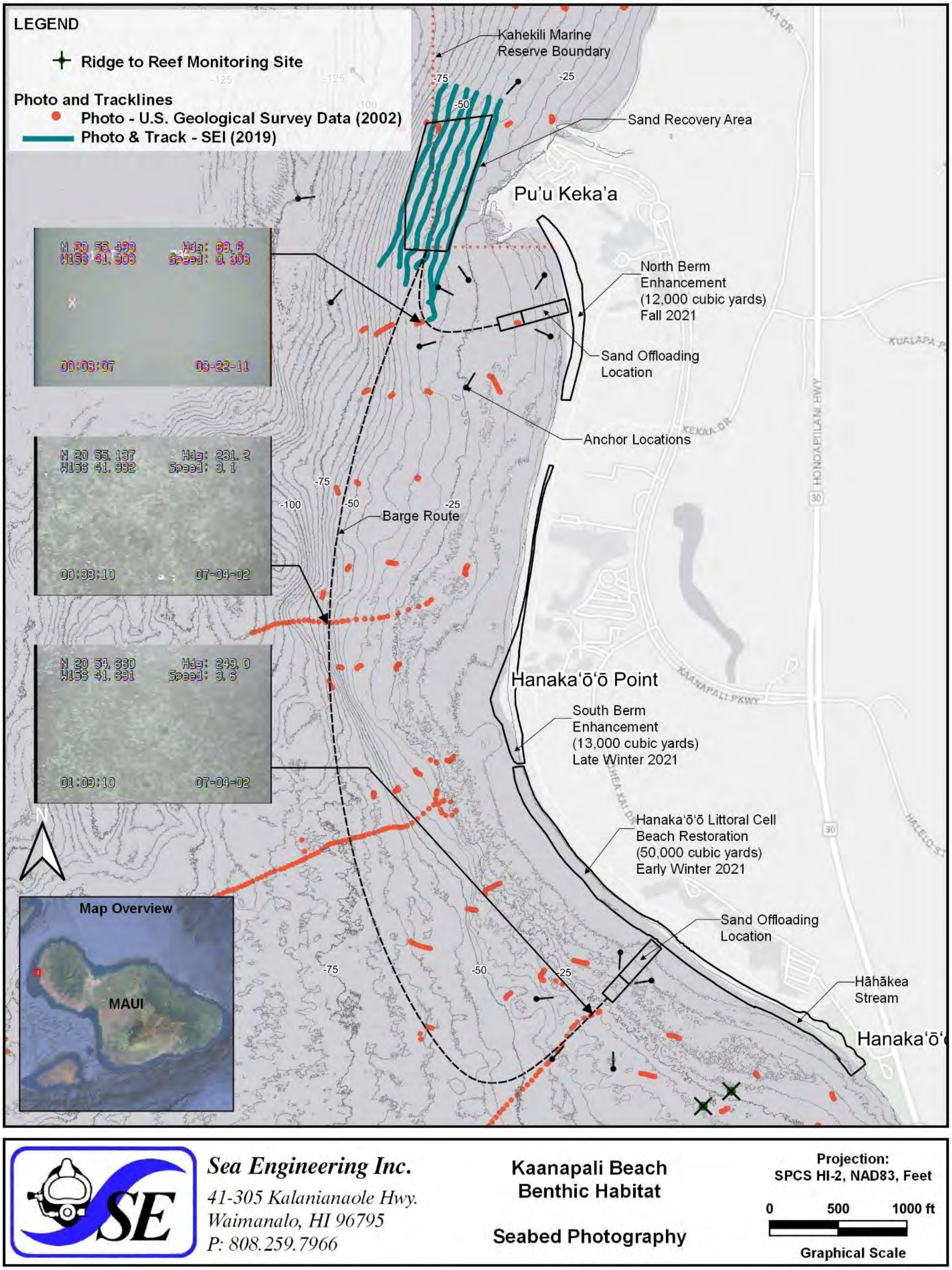


Figure 2-63. Prior research and data sets for the regional nearshore environment

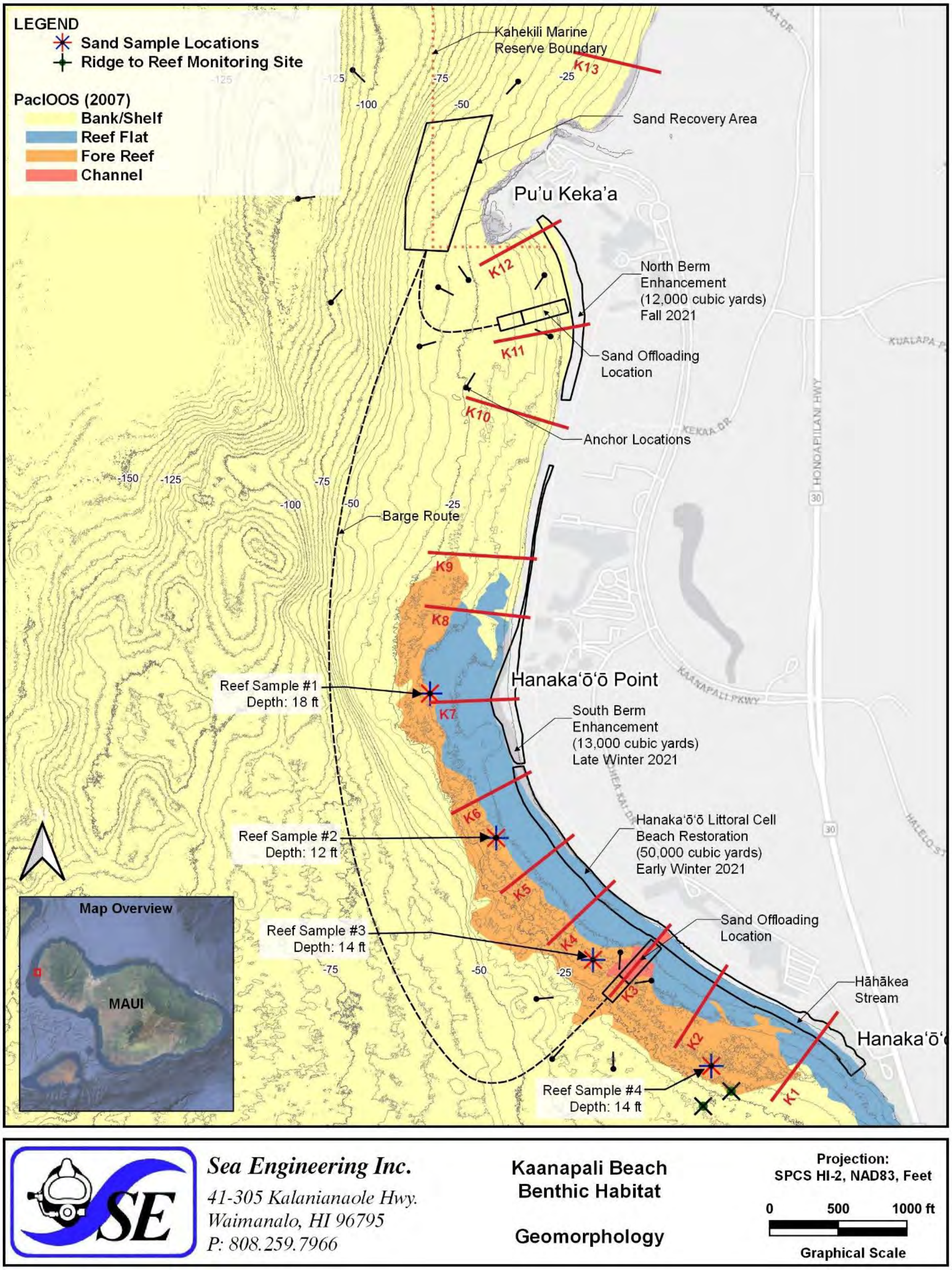


Figure 2-64. Geomorphology of the regional nearshore environment

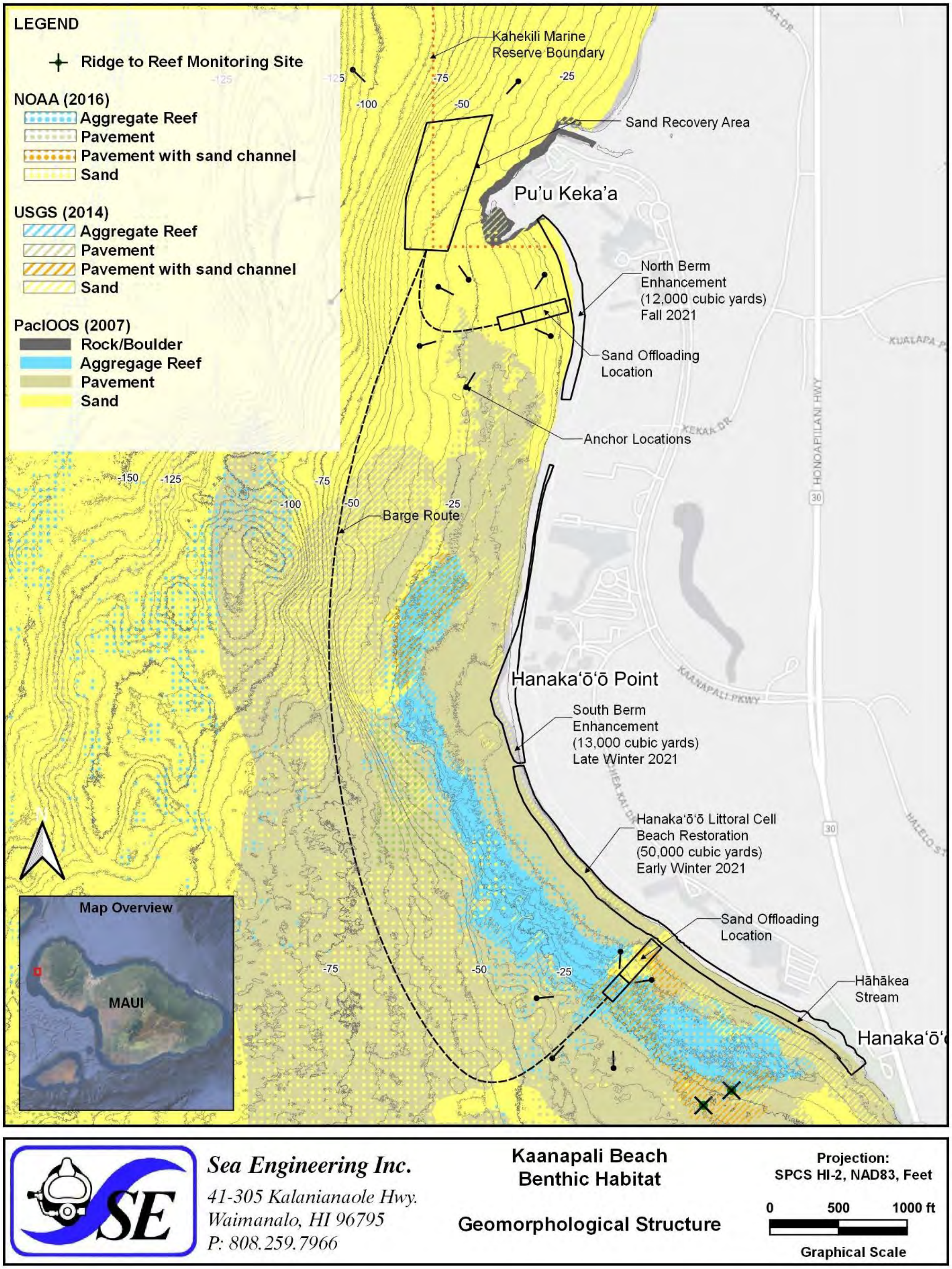


Figure 2-65. Geomorphologic Structure of the regional nearshore environment

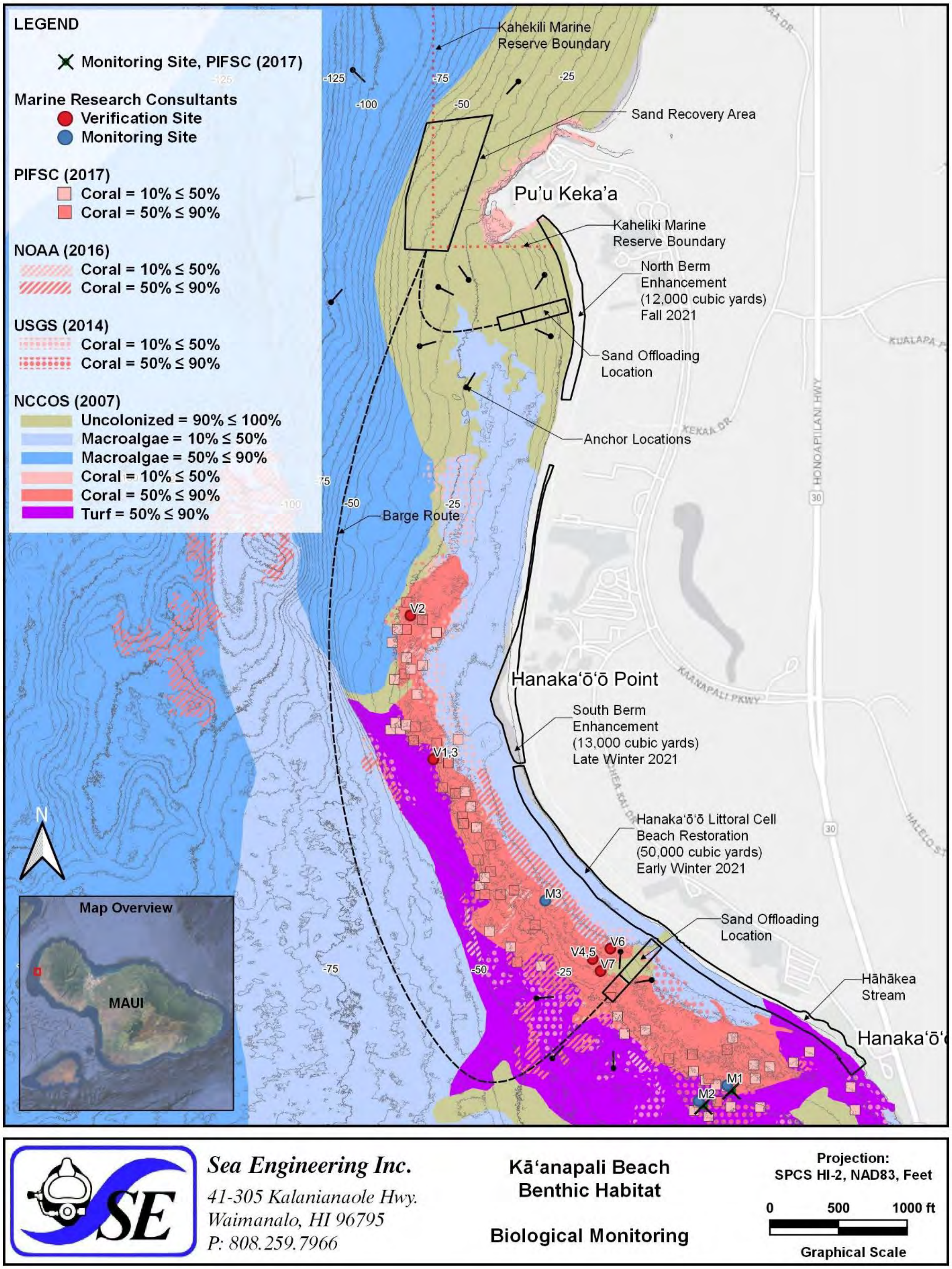


Figure 2-66. Benthic biology of the regional nearshore environment

Potential Impacts and Proposed Mitigation Measures

Sand Recovery Area

It is anticipated that the infauna organisms in the sand recovery area will be lost during dredging and subsequent relocation to Kā'anapali Beach. The time it will take for infauna to recover in the sand borrow area is unknown but is projected to be fast owing to the small size and rapid regeneration time of most infaunal animals (Bailey-Brock and Krause, 2008). Many infaunal invertebrates are reproductively active throughout the year. As a result, these organisms will likely be recruited to the borrow area from adjacent non-impacted sand deposits relatively quickly. Some species may also repopulate the borrow area through the transport of their pelagic larval phase by local currents.

A white paper (Rosov, et al, 2016) produced by the American Shore and Beach Preservation Society (ASBPA) compiles literature related to infaunal impacts from beach restoration and offshore sand recovery efforts. There were several trends to the monitoring and research documents they reviewed:

- Sand recovery areas oriented with the dominant current direction produce the smallest changes to regional sand fields and have the fastest ecological recovery rates.
- Shallow recovery areas alter the regional sand fields the least and have the fastest ecological recovery rates.

The proposed sand recovery area and depth of recovery both meet these requirements for fastest ecologic recovery rates.

Investigations ~~done~~ completed as part of the Waikīkī Sand Replenishment Project in 2012 included an evaluation of~~attempt to evaluate~~ changes in the benthic infaunal communities before and after sand removal. Results were inconclusive and showed a much larger change in the infaunal community structure through time at the control sites than at the impact sites (Forsman, et al, 2012). No mitigation is proposed for potential impacts to infauna based on the observed rapid recovery of the infaunal community as part of a similar project in Hawaiian nearshore waters.

Public comments received during the DEIS review period included discussion on the presence of nabeta (Laenihi, *Xyrichtys umbrillatus*) in the region of the sand recovery site. Their identified habitat is sandy areas at depths from 60 to 300 feet, near the shoreline. Though the recovery area is close to shore and sandy, the depths range from 28 feet to 56 feet, and trend on the shallow side of nabeta habitat. Nabeta may be displaced during the two to three month construction window for the project. As nabeta are typically solitary fish, the scale of displacement in time and number of organisms is not expected to be severe. No mitigation effort is proposed for the temporary displacement of nabeta at the sand recovery site.

Public comments received during the DEIS review period included discussion on the presence of Kona crab (*Ranina ranina*) in the region of the sand recovery site. Their reported presence in the sand field is fitting, as their habitat is sand fields, typically in water depths of 30 feet to over 300 feet. Sand recovery operations are expected to impact Kona crabs that are living in the recovery footprint. The project is scheduled for October through December, which is outside the spawning season (May to August) for the species and should limit impacts to propagation. The sand recovery area is a small portion of the much larger regional sand field shown in Figure 2-61 above. Though the impact will be present at the recovery site, the regional impact is anticipated to be negligible. Long-term, secondary, and cumulative impacts are not anticipated. No mitigation is proposed for the temporary loss of Kona crab at the sand recovery site.

Sedimentation occurs when fine sediment particles suspended in turbid water dissipate and settle on the ocean floor, so sedimentation is a normal process that follows turbidity from a high-wave or rainfall runoff event. Turbidity generated from dredging operations at the Puʻu Kekaʻa Sand Recovery Area is expected to have a net transport to the south by currents moving parallel to shore. The nearest live corals down current from the dredge site are located approximately 3,000 ft to the south off Hanakaʻōʻō Point, with most of the intermediate area covered by an expansive sand field. Sand-sized particles will fall out of the water column rapidly and return to the sand field during the sand recovery operations. Some turbidity, produced as the environmental bucket is lifted through the water column and up and over the side of the deck barge, will remain in the water column long enough to be transported to the coral reef's northern end, this material is expected to be at a volume of less than 0.03 cy per 1,000 cy of sand recovered from the area. This will likely result in approximately 0.06 cy sediment released into the water column each day during sand recovery. This small volume would be widely distributed across a vast area, and likely be quickly dispersed by nearshore wave action and longshore currents. Therefore, it is unlikely that the sand recovery operation will produce sedimentation on live coral reefs, as shown in Figure 2-67. Over the course of the full sand recovery effort, expected to last between 37 to 50 days, an estimated 60.75 cf, or 2.25 cy, of fine sediment is anticipated to be released as part of the sand recovery process. No mitigation is proposed as this is anticipated to be a negligible impact.

The anchor systems at the sand recovery site and both sand transfer sites will have contact with the seafloor. The anchors and hardware immediately adjacent to the anchors will be placed on sandy seafloor and are expected to impact organism movement and activities immediately in their placement area. To minimize potential impacts from the anchor systems, the seafloor will be investigated by divers or cameras or both to verify placement is on sand. Regular monitoring of the anchors will be conducted to ensure they are operating properly. Potential impacts to the marine community can be assessed during anchor monitoring, also. Pre-placement confirmation and during construction monitoring are proposed as engineering design mitigation efforts.

Sand Transfer Sites

The sand transfer systems, proposed at the north end of the project area and in sand channel at the middle of the HLC, will be emplaced directly above sandy substrate and may include contact with the seafloor. The south sand transfer location, centered over the paleo-channel, has the closest proximity to existing reef resources. Marine biologists identified sand pockets in the reef that will be proposed for anchoring and stabilization of the sand transfer system. For placement of materials, specific locations for offloading station anchors will be provided.

These transfer sites will be investigated by divers or camera or both prior to emplacement of the sand transfer systems to verify all contact points are located on sandy seafloor. Regular monitoring of the sand transfer system will be conducted to ensure they are operating properly. Potential impacts to the marine community can be assessed during sand transfer system monitoring, also. Pre-placement confirmation and during construction monitoring are proposed as engineering design mitigation efforts.

Berm Enhancement Areas

The berm enhancement operations are not expected to produce sedimentation during placement. The design proposes to place the berm enhancement sand atop the dry beach berm, mauka of the wash of the waves. This placement area is above the active beach face environment and mauka of the waterline and marine environment. No mitigation, outside of the proposed Best Management Practices, is proposed for sand placement on the dry berm.

Beach Restoration Area

Sand placement in the proposed beach restoration area includes placing highly compatible, beach quality sand atop and makai of the current active beach face. The placement area extends from the berm crest, or top of the active beach face, offshore to roughly the location of the beach toe in 1988. The outer margin of the proposed restoration area in the nearshore waters was previously covered by sand, either as beach or nearshore sand field, in 1988. Interior portions of the proposed beach restoration area were covered with sand as recently as the past year.

Intertidal and Beach Face Habitat

Sand crabs live in the intertidal and beach face at the proposed project site (Figure 2-68 and Figure 2-69). The beach restoration effort proposed for the HLC will cover the active beach face and coastal/nearshore habitat with beach quality sand. Sand will be placed in thicknesses ranging from 1-8 feet on the beach face.

Beach nourishment efforts at the Kanai A Nalu Condominiums, Mā'alaea, Maui, are the closest documented beach restoration project, geographically. The Kanai A Nalu Project, similarly to the HLC beach restoration effort, consisted of beach nourishment on the beach face. The project scale was smaller; however, placing 1,500 cy of sand compared to 50,000 cy proposed for this project. The Kanai A Nalu sand was fine-grained inland dune sand with higher percentages of silt and clay size particles. This sand, though suitable for beach restoration action, is not as compatible for beach nourishment as some marine sands. The Kanai A Nalu restoration sand, with higher fine content, is more susceptible to creation of turbidity and sedimentation in the nearshore. The Kanai A Nalu project did not report use of turbidity curtains for containment, though their post-construction water quality monitoring reported an improvement in water clarity. This project is a good analogue for reference, in that their sand characteristics were a good match for the native beach, though they were finer in general grain size and were sourced from an inland sand field.

In 1998, an unpublished study of the status of the reef fronting the Kanai A Nalu, was completed by Robin Neubold in an attempt to determine whether there had been any negative impacts to the reef from the previous sand replenishment efforts. Neubold's study concluded that the beach nourishment had caused no adverse effect on the offshore marine ecosystem. A 2001 permit application for further beach replenishment prompted a closer look at the environmental parameters that could be affected by additional placement of inland dune sand on the beach. This study examined water quality, beach profiles, suspended sediment characteristics, fish counts, ghost crab hole counts, and video transects analyzed with a random point-count system. These results showed positive impacts to the beach and nearshore environments, and were published in 2009 (Norcross, et. al., 2009).

The June 2003 beach nourishment project at Kanai A Nalu Condominiums in Maʻalaea (Norcross, et. al., 2004) included before, during, and after project marine monitoring. This monitoring effort included an assessment of sand crabs. From September 2002 to January 2003, sand crab holes averaged 2 to 3 per square meter. After January, the beach was in an eroded state and no sand crab holes were found. Two days after the beach nourishment project, sand crab holes began to reappear. By September (3 months after nourishment), sand crab populations had recovered to 2 to 3 per square meter.

The 2016 ASBPA white paper discussed above also addresses ecological recovery in the beach face, following beach restoration efforts. Key findings are:

- Use of compatible sand decreases recovery time in the nearshore and beach areas and promotes recovery of pre-existing communities.
- Beach restoration efforts in non-spring seasons reduces recovery time in the nearshore and beach areas.

The proposed beach restoration effort meets the suggested criteria and has many similarities to the Kanai A Nalu project. Though short-term impacts are expected to the beach face, intertidal community, no mid-term or long-term impacts are anticipated.

Nearshore Marine Habitat

The Kanai A Nale fish count surveys found an *increase* in fish from 9 to 79 fish along the transects before and after nourishment respectively.

For the Kanai A Nalu Project, water quality monitoring was also conducted. There were three transects with three stations along each transect: one in the swash zone, one at 25 m from the shoreline, and one at 100 m. Measurements included turbidity, salinity, dissolved oxygen content, and temperature. One transect was located at either end of the project area and the third was in the center. Sampling was conducted monthly over 12 months (Oct 2002 – Sept. 2003). The beach nourishment occurred over 5 days (June 2-6, 2003) during which samples were conducted daily and for the two days after construction.

Background turbidity was found to be 0-12 NTU with a spike to 40 NTU during a Kona storm. During construction, the swash zone turbidity increased by 2.33 NTU over pre-construction average to 11.2 NTU; the 25 m offshore site increased by 2.86 NTU to 6.47 NTU; and the 100 m offshore site increased by 1.47 NTU to 3.32 NTU.

Five days after construction had ceased, turbidity levels had returned to within 1.0 NTU of pre-construction levels at seven of the nine sampling stations, and within 3.0 NTUs of pre-construction levels at the remaining two stations (3-25 and 3-100). The highest actual increase in turbidity from pre-construction levels was 21.63 NTUs, occurring at station 3-25, which reached a level of 24.37 NTUs compared with 2.74 NTUs before construction.

Placement of sand in the water for the beach restoration effort at the HLC will result in the release of some fines from the seaward margin of the placed sand. The outer face of the restored beach, which is exposed to wash of the waves, will be turned over by swash dynamics. In addition, immediately following placement, the beach face and berm are expected to equilibrate, transitioning from the lines and grades determined for placement to the natural beach face and nearshore sand profile determined by the wave and water level conditions at each location. This equilibration process can take weeks to months, and even after this transition the beach will continue to adapt to the ever-changing wave conditions and water levels. Though the fine content of the recovered sand is very low, there is still 0.58%, on average, in the proposed beach restoration sand. Over the course of the projected 20-year lifespan, it is expected that approximately 290 cy of fine calcium carbonate sediment will be released through erosion and equilibration. This includes the initial placement and equilibration process. On average, 14.5 cy of fine calcium carbonate sediment is expected to be released over the course of each year. The release of fines will also occur in pulses during storms, high waves, and/or high water levels, which are already periods characterized by elevated turbidity and high nearshore energy, which typically results in transport and wide area dispersal of finer grains. ~~.~~

The existing forereef environment receives fines through the natural processes that affect the coastline. Even minor wave events suspend fine sediment in the nearshore and create turbid conditions in the water column. In addition, storm runoff events from the local natural drainage systems also produce plumes of turbid water.

As corals are long-lived and fixed to the bottom, coral community structure provides an excellent indication of the aggregate physical conditions over timescales of decades to centuries. Hence, the coral communities off Kāʻanapali have developed and grown throughout the large fluctuations of seasonal sand dynamics that have re-shaped the beach over the last several decades. As such, large fluctuations in beach structure occurring in the past have not had any apparent negative effects on the offshore coral community structure. Sediment samples taken from the forereef, of naturally occurring sediment in the nearshore, indicate a wide range of sediment sizes spanning from clay sized particles through cobble. These reef sediment samples were all collected from within healthy reef assemblages on the forereef in depths between 12 ft to 18 ft below sea level (Figure 2-64). There was no indication at these locations of reef impacts due to sedimentation.

Thus, it is not likely that the proposed action to place highly compatiblerestore sand on the beach, restoring the beach to its former width and volume, would have a significant negative effect to existing communities. The anticipated change is where the beach restoration efforts result in a seaward extension of more sand into the intertidal and subtidal areas. As corals do not occur in this region, such a situation does not appear to present any potential for concern as the nearshore is already composed of sand and rubble and was covered by sandy substrate within the past 30 years.

Similar to the anticipated flushing of sedimentation from atop live corals, the turbid waters that may result from the project during sand placement, distribution, and grading operations onshore are also expected to be carried away by nearshore wave action and currents. In general, turbid waters are produced when fine, lightweight particles are suspended.

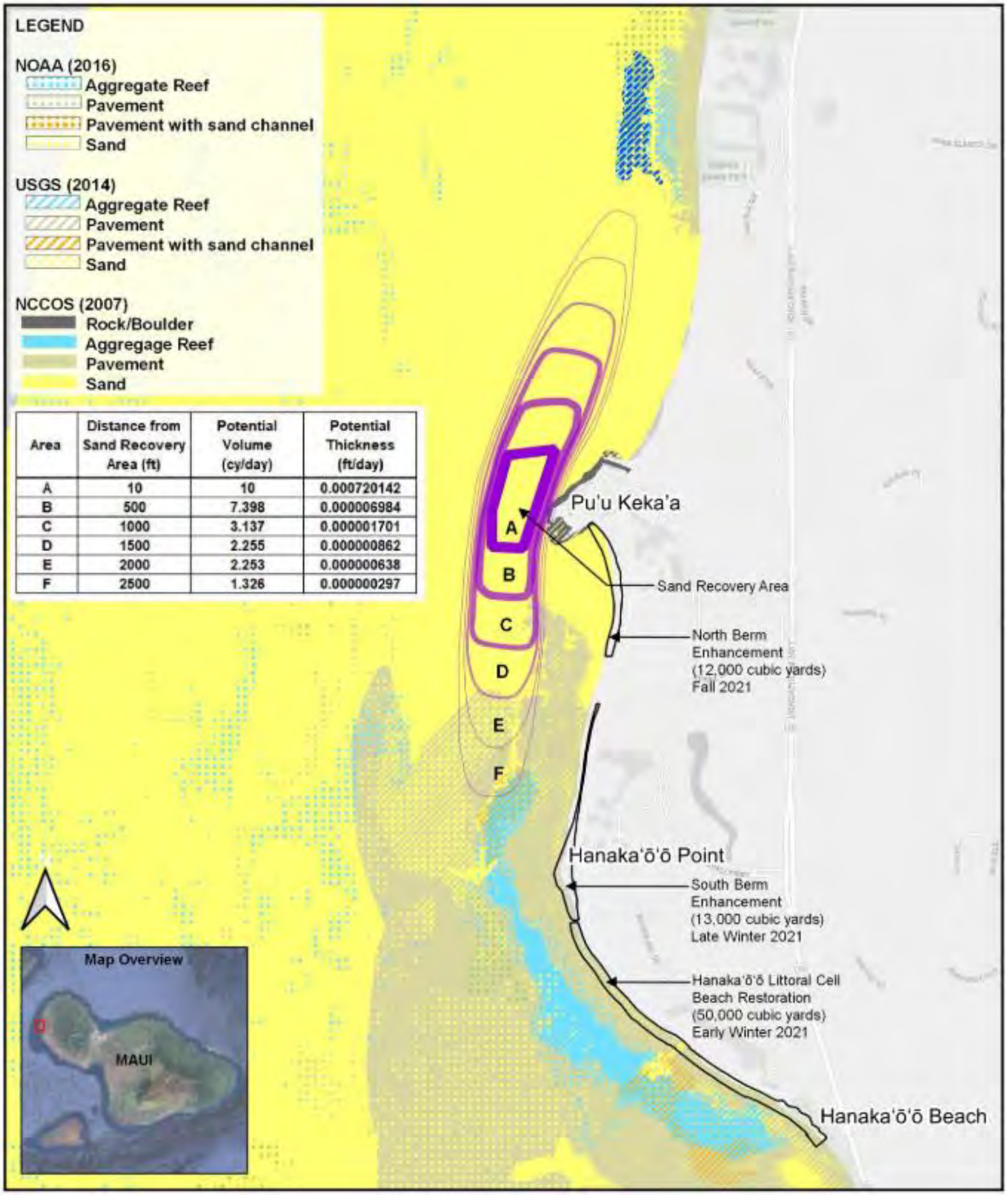
Engineering design practices are used to minimize potential impacts through:

- Selection of a highly compatible sand source
- Minimization of return water during recovery, transport, and placement operations
- Careful site selection and monitoring for anchor systems and sand transfer systems
- Employment of Best Management Practices during construction

Additional mitigation will be provided by monitoring water quality and marine biology, before, during, and after construction, to assess real time impacts. Post-construction beach dynamics, marine ecosystem, and water quality monitoring are proposed and detailed below in Section 7.1 Monitoring Programs. Post-construction monitoring will include reef monitoring offshore of the beach restoration area and at a control site north of Puʻu Kekaʻa. Beach and water quality monitoring efforts are proposed as an extension of the construction monitoring programs.

Overall, the proposed project is anticipated to have a negligible long-term impact on the marine environment at Kāʻanapali Beach. Potential short-term impacts in the sand recovery area include temporary loss of infauna and other species that live within the sand environment, where sand is recovered (sand recovery area) and placed (HLC beach restoration). Potential short-term impacts in the beach restoration and berm enhancement areas include temporary impacts to water quality and the re-occupation of the 1988 beach footprint in the nearshore..

For organisms that rely on the littoral sandy substrate as habitat, such as turtles and monk seals, the proposed project is anticipated towill maintain littoral health in both the HLC and KLC for the project lifespan.



Area	Distance from Sand Recovery Area (ft)	Potential Volume (cy/day)	Potential Thickness (ft/day)
A	10	10	0.000720142
B	500	7.398	0.000006984
C	1000	3.137	0.000001701
D	1500	2.255	0.000000862
E	2000	2.253	0.000000638
F	2500	1.326	0.000000297

Figure 2-67. Potential sedimentation areas and volumes associated with daily sand recovery efforts at the sand recovery area

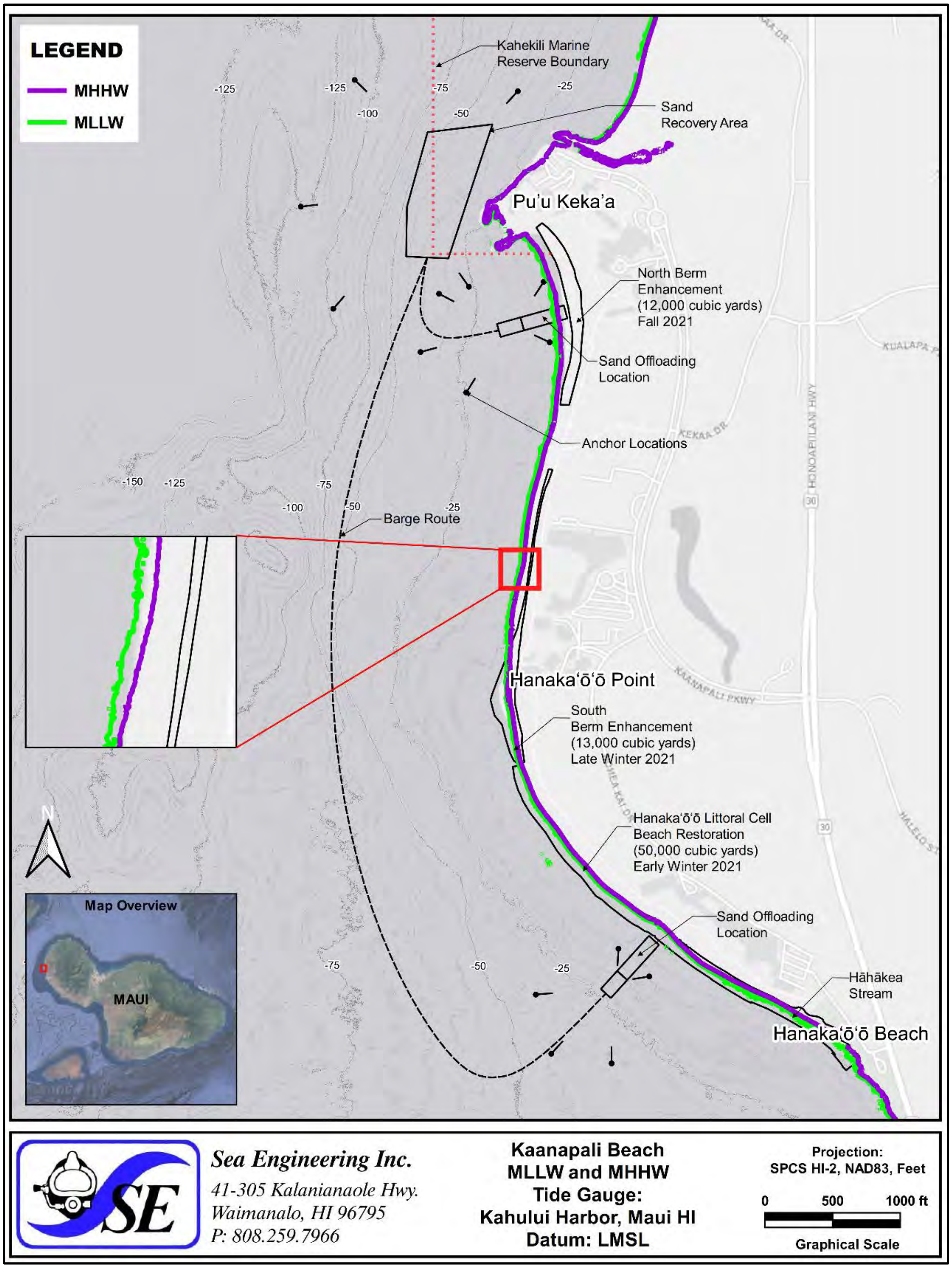


Figure 2-68. Intertidal region in the proposed project area

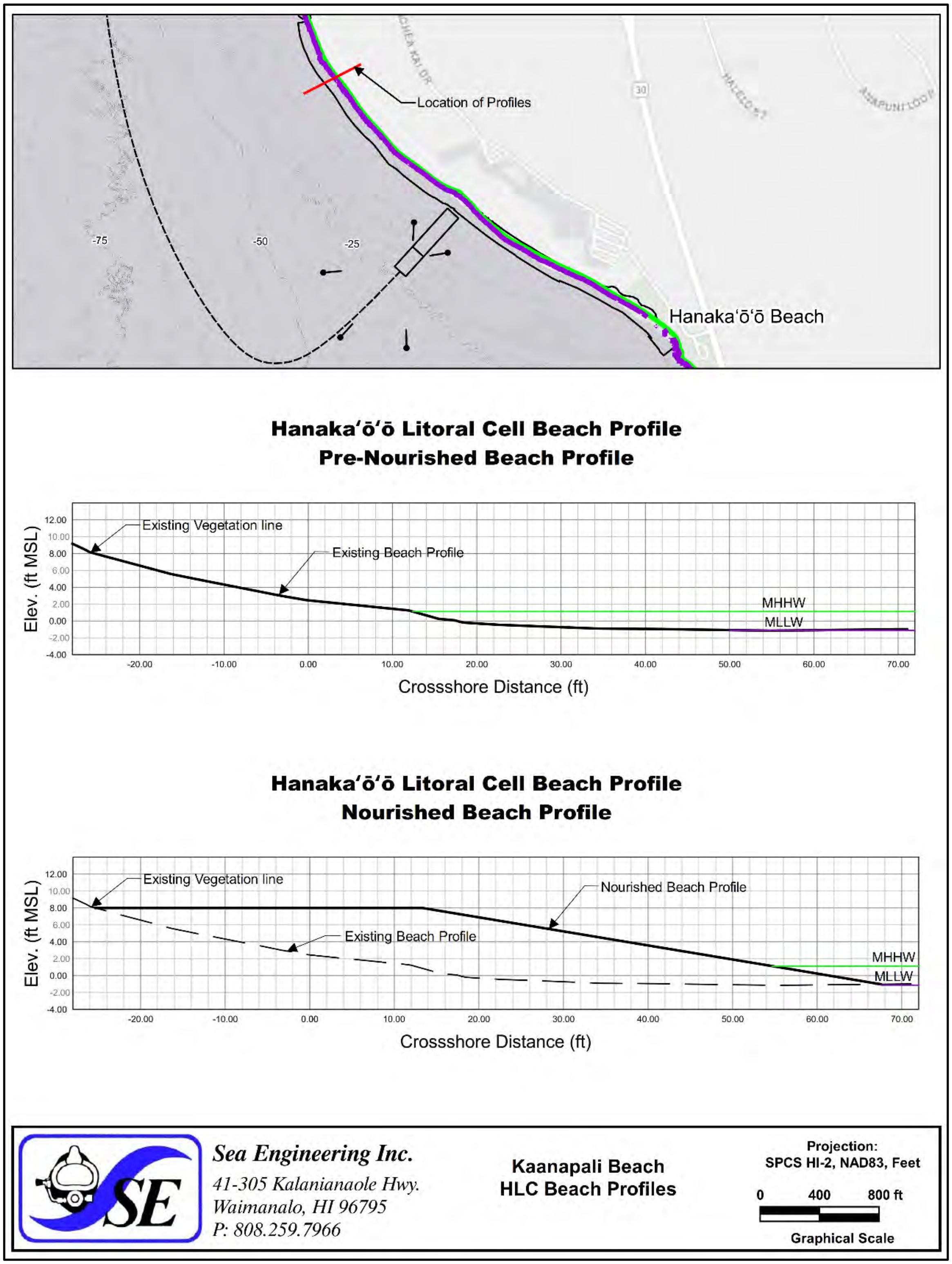


Figure 2-69. Intertidal region in the proposed project area, including elevation views of existing and proposed beach profiles

2.1.12 Protected Species

Existing Condition

The beaches and coastline of Maui are used by the endangered Hawaiian monk seal (*monachus schauinslandi*) for hauling out and for pupping and nursing. These marine mammals are frequently observed in the waters of Kāʻanapali. The majority of monk seal sighting information collected in the main Hawaiian Islands is reported by the general public and is highly biased by location and reporting effort. Systematic monk seal count data come from aerial surveys conducted by the Pacific Islands Fisheries Science Center (PIFSC). Aerial surveys of all the main Hawaiian Islands were conducted in 2000-2001 and in 2008 (Baker and Johanos, 2004, PIFSC unpublished data).

Reports by the general public, which are non-systematic and not representative of overall seal use of main Hawaiian Islands shorelines, have been collected in the main Hawaiian Islands since the early 1980s. The NOAA Monk Seal Population Assessment Program keeps records of monk seal sightings throughout the populated Hawaiian Islands. A sighting is defined as a calendar day during which an individual seal was documented as present at a given location. It should be noted that the majority of monk seal sightings are reported when seals are sighted onshore.

A NOAA report of monk seal sightings was produced for this project (Mercer, 2015). The report compiled sightings from Hanakaʻōʻō Beach Park to Kahekili Beach Park for the years 2005 through 2014. For that time period, 245 monk seals sightings were documented, with more than half occurring near Puʻu Kekaʻa. There were only 35 monk seal sightings during that time period from Hanakaʻōʻō Beach Park to Hanakaʻōʻō Point. No births have been documented for the area.

As of 2015, both the Main Hawaiian Islands and the remote Northwestern Hawaiian Islands are considered critical habitat for this species (50 CFR 226), as was published in NOAA's Final Rule (80 FR 50925). The marine environment from 200 m below sea level to the shoreline and the terrestrial environment to 5 m inland of the shoreline is considered Hawaiian monk seal critical habitat at the project site. The project area is located in the Terrestrial Critical Habitat segment between MA 61 and MA 62 on Maui's western coastline.

The humpback whale or *kohola* (*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). Humpback whales normally frequent Hawaiian waters annually from November to May with the peak between January and March (HIHWNMS, 2014).

Of the sea turtles found in the Hawaiian Islands, only the green sea turtle (*chelonia mydas)* is common in the project vicinity. The hawksbill sea turtle (*eretmochelys imbricata*) is rare in the Hawaiian Islands and is only known to nest in the southern reaches of the state (NMFS-USFWS, 1998; NOAA-NMFS, 2007). In 1978, the green sea turtle was listed as a threatened species under the Endangered Species Act (ESA; USFWS, 1978, 2001). Since protection, the green sea turtle has become the most common sea turtle in Hawaiian waters with a steadily growing population (Chaloupka et al., 2008). Green sea turtle nesting mostly occurs on beaches of the Northwestern Hawaiian Islands, with 90% occurring at French Frigate Shoals (Balazs et al., 1992). None of the Hawaiian sea turtles is known to nest in the project vicinity.

The green sea turtle diet consists primarily of benthic macroalgae (Arthur and Balazs, 2008), which the shallow reefs of the main Hawaiian Islands provide in abundance. Red macroalgae generally make up 78% of their diet, whereas green macroalgae make up 12%. Turbidity (murky water) does not appear to deter green sea turtles from foraging and resting areas and construction projects in Hawai'i have found sea turtles adaptable and tolerant of construction-related disturbances (Brock, 1998a, b). The preferred algal food species are found near the project site, and turtles are commonly observed foraging in the vicinity of Kā'anapali Beach.

Additional species reported in the region include:

- Hawaiian hoary bat (Lasiurus cinereus semotus)
- Hawaiian goose, Branta (Nesochen) sandvicensis
- Hawaiian yellow-faced bees (Hylaeus anthracinus, H. assimulans, H. facilis, H. hilaris, and H. longiceps)
- Hawaiian petrel (Pterodroma sandwichensis)
- band-rumped storm-petrel (Oceanodroma castro)
- Newell's shearwater (Puffinus auricularis newelli)
- Wedge-tailed shearwaters (Ardenna pacificus)

Potential Impacts and Proposed Mitigation Measures

The sand recovery and transport efforts are expected to be conducted in nearshore, relatively shallow waters. In addition, the recovery work will be accomplished through positioning with anchor lines, limiting the need to use vessels for repositioning. The barge transport between onloading and offloading sites will be at slow speeds. These practices minimize the risks to whales, turtles, and seals in the water. On-land work will be conducted on the beach, which is part of the natural habitat for both turtles and seals in Hawai'i. No work will be conducted within 50 yards of marine protected species that are identified in the nearshore waters or on the beach.

Consultation with the National Marine Fisheries Service and U.S. Fish and Wildlife Service to obtain the latest information on sea turtle activity in the area will take place and additional BMPs shall be employed to avoid impact to sea turtle nests and hatchlings during this period, including constant monitoring of the beach and ocean during beach restoration activities.

A shore bird survey will be completed by an ornithologist prior to commencing construction operations on the beach. The ornithologist will also investigate the site for the presence of nēnē, who have been observed in urban beach settings in Hawai'i. U.S.

Fish and Wildlife Service will be contacted in the event protected shore birds or nēnē are observed in the beach restoration area.

During operations, a suite of Best Management Practices, many adopted from the National Marine Fisheries Services' PacSLOPES program, will be adhered to for minimizing contact with marine protected species. These BMPs are presented in Section 7.2.5.

Adherence to these operational guidelines and BMPs is expected to result in no significant impact on marine protected species during construction activities.

In relation to long-term impacts, both sea turtles and seals rely on sandy littoral habitat and this project will result in improved health and longevity for the sandy coastal ecosystem.

2.1.13 Coastal Flora and Fauna

Existing Condition

The Kā'anapali Resort is professionally landscaped. The vegetation immediately mauka of the active beach is composed of typical coastal vegetation, including naupaka, beach heliotrope, and beach morning glory (Figure 2-70). This area does not currently support a coastal dune system, as is found in other locations on West Maui. Previous dune surveys, completed as part of the County permit process, indicate that the area is landscaped with topsoil and fill material commonly found mauka of the sand beach. The irrigated vegetation has the tendency to grow out onto the active beach berm when the beach is wide. Grasses, both native and introduced, and a wide variety of palms can be found in the Beachwalk area between the active beach and the hotels.

The vegetated area on the beach is also heavily trafficked. This area is typically covered in naupaka and beach heliotrope, which are extending across small areas of the berm from the mauka landscaped areas. The proposed project area does not include any mature trees. The proposed project area only overlaps the outer margin of the low-lying ground cover that is extending makai from landscaped areas.

Dune restoration or creation, similar to berm enhancement, allows for the placement and storage of sand in the littoral cell. Dunes are accessed by waves and provide sand to the active littoral cell during high wave events and erosion events. Dune restoration and creation is actively done on Maui and other islands in Hawai'i. This type of project could augment the proposed beach restoration project in a meaningful and beneficial way by restoring terrestrial habitat, improving the coastal hazard mitigation capability of the shoreline, and storing beach quality sand for future erosion events. However, dune restoration is currently outside the project's scope, as it would require work mauka of the shoreline, on private property in the County Special Management Area, grubbing and excavation, and significant alterations to the existing shoreline vegetation.

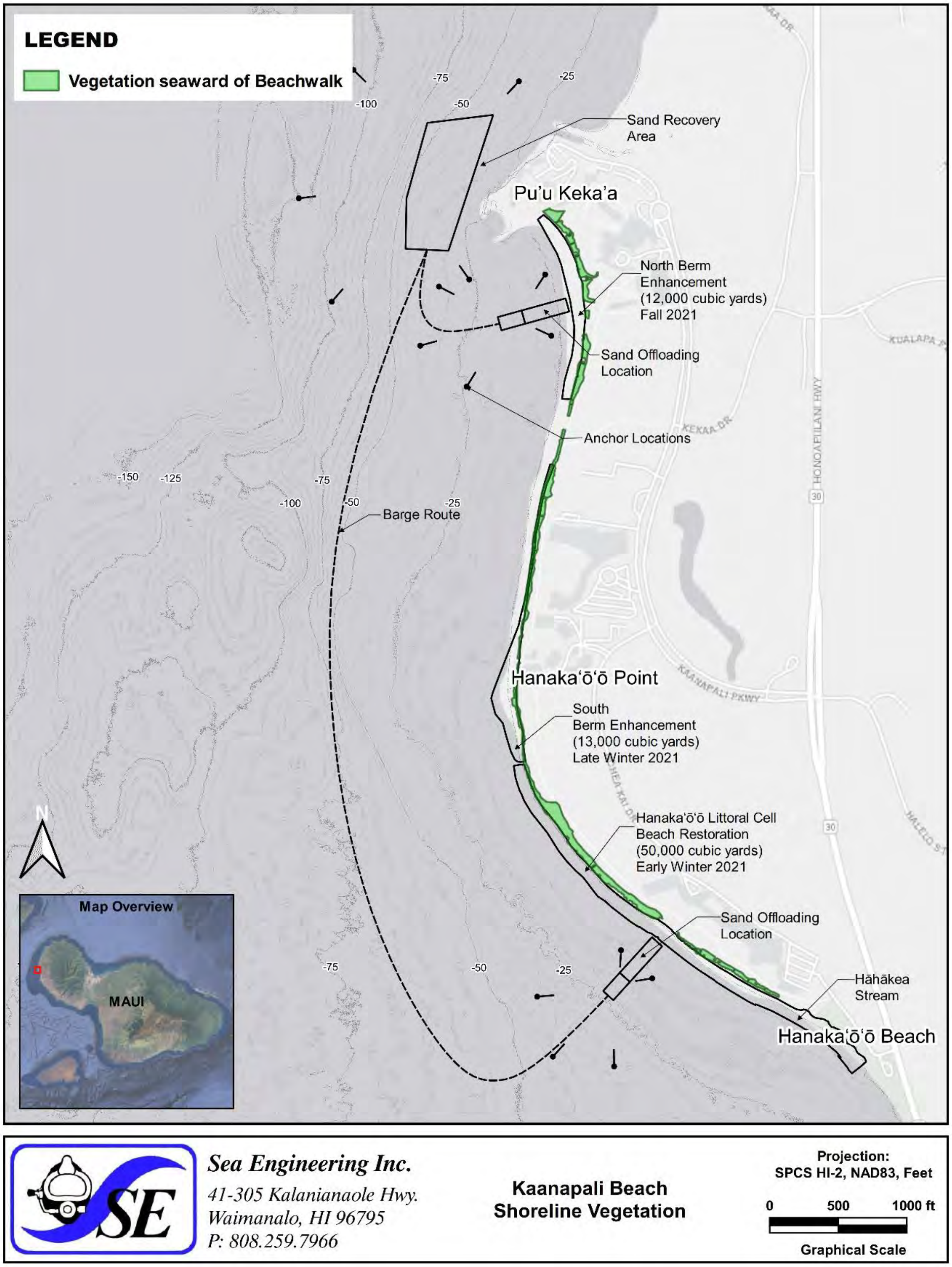


Figure 2-70. Coastal vegetation map showing existing, landscaped vegetation located between the Beachwalk and the waterline in the proposed project area.

Potential Impacts and Proposed Mitigation Measures

Berm enhancement involves placing sand on the beach between the beach crest and the stable vegetation line. Small amounts of transient vegetation such as naupaka and morning glory that has overgrown onto the active beach may be covered during the Berm Enhancement portions of the project.

The proposed project is anticipated to have a negligible impact on coastal, terrestrial flora and fauna due to its location atop the existing sand beach. Prior to beach restoration activities, a coastal bird survey and an endangered vegetation survey will both be completed along the proposed project area. This is included in Section 8 Unresolved Issues.

Currently, it is not permissible through State law to plant or cultivate vegetation makai of the certified shoreline location, as defined in HRS § 205A. Both HRS § 115 and HRS § 183C have clear language protecting beach transit corridors with respect to coastal vegetation. Since all sand placement in the proposed beach restoration project is makai of the shoreline location, no post-restoration planting is proposed.

2.1.14 Air Quality

Existing Condition

The EPA has set national ambient air quality standards (NAAQS) for ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, 2.5-micron and 10-micron particulate matter (PM2.5 and PM10), and airborne lead. The NAAQS establishes the maximum concentrations of pollution considered acceptable, with an adequate margin of safety, to protect public health and welfare. The State of Hawaiʻi has also adopted ambient air quality standards for certain pollutants, some of which are more stringent than the Federal standards. The State currently has set standards for 5 of the 6 criteria pollutants (excluding PM2.5) in addition to hydrogen sulfide (DOH, 2003).

Generally, air quality in the area is excellent. The State of Hawaiʻi DOH monitors ambient air quality on Maui using a system of 3 monitoring sites. The primary purpose of the monitoring network is to measure ambient air concentrations of the 6 criteria NAAQS pollutants. DOH monitoring data for 2008 shows that at no time did air quality exceed the short-term or long-term State or National standards for the 6 pollutants measured [particulate matter (PM2.5 and PM10), nitrogen dioxide (NO2), sulfur dioxide (SO2), carbon monoxide, and hydrogen sulfide]. The State of Hawaiʻi Department of Health's only ozone monitoring station is located at Sand Island on Oʻahu. Existing ozone concentrations at that location also meet State and Federal ambient air quality standards.

Potential Impacts and Proposed Mitigation Measures

Because most of the work will take place on the sandy shoreline, the preferred alternative differs from many construction projects in that it involves little or no on-site soil disturbance that could result in particulate emissions (i.e., dust or dirt). Potential sources of air pollution as a result of the project are related to the construction phase.

During the actual sand recovery and transfer process, construction machinery will create temporary degradation in air quality in the immediate vicinity of the project area. This negative impact on air quality will be limited to typical work hours and will end once the beach restoration~~nourishment~~ and berm enhancement sand is in place. As part of the construction process, the contractor will observe all BMPs to keep construction-related emissions to the lowest practicable levels.

Short-term declines in air quality may occur due to emissions from construction equipment and would include carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), directly emitted particulate matter (PM_{10} and $PM_{2.5}$), and toxic air contaminants such as diesel exhaust particulate matter. Sulfur dioxide (SO_2) is generated by oxidation during combustion of organic sulfur compounds contained in diesel fuel. Off-road diesel fuel meeting Federal standards can contain up to 5,000 parts per million (ppm) of sulfur, whereas on-road diesel is restricted to less than 15 ppm of sulfur.

These minor effects on air quality are short-term in duration and, therefore, will not result in adverse or long-term impacts. Implementation of the following measures will reduce any air quality impacts resulting from construction activities:

- Apply water or dust palliative to the site and equipment as frequently as necessary to control fugitive dust emissions.
- Properly tune and maintain construction equipment and vehicles.
- Locate equipment and materials storage sites as far away from hotels and commercial uses as practical. Keep construction areas clean and orderly.

Once construction is completed and construction equipment leaves the site, the project is anticipated to have negligible long-term air emissions or impact on air quality.

2.1.15 Noise

Existing Condition

Existing ambient noise levels vary considerably within the project area both spatially (i.e., from place to place) and temporally (i.e., from one time to another). In general, existing background sound levels are the result of vehicle traffic, aircraft, ongoing maintenance, construction equipment, resort activities, surf, boats, and wind. In the vicinity of significant construction activity, noise levels can intermittently reach 80 dBA.

Potential Impacts and Proposed Mitigation Measures

HAR §11-46, “Community Noise Control” establishes maximum permissible sound levels (see

Table 2-9) and provides for the prevention, control, and abatement of noise pollution in the State from stationary noise sources and from equipment related to agricultural, construction, and industrial activities. The standards are also intended to protect public health and welfare and to prevent the significant degradation of the environment and quality of life. The limits are applicable at the property line rather than at some pre-determined distance from the sound source. Because of that, the Class B limits applicable to land zoned for resort use appears the most applicable. HAR §11-46-7 grants the Director of the State of Hawaiʻi Department of Health the authority to issue permits to operate a noise source that emits sound in excess of the maximum permissible levels specified in

Table 2-9 if it is in the public interest and subject to any reasonable conditions. Those conditions can include requirements to employ the best available noise control technology.

It may not be possible to mitigate construction noise to the extent that it does not at times exceed existing background noise levels or is inaudible to beach users, hotel guests, etc. Some reduction is practical, however, and the following measures would be implemented:

- Equipment operation on the shoreline will be limited to the hours between 7:00 a.m. and 8:00 p.m.
- Broadband noise backup alarms in lieu of higher frequency beepers will be required for construction vehicles and equipment. Broadband noise alarms tend to be less audible and intrusive with distance as they blend in with other background noise sources.
- The project will specify the use of the quietest locally available equipment, e.g., high insertion loss mufflers, fully enclosed engines, and rubber-tired equipment when possible.
- The use of horns for signaling will be prohibited.
- Worker training on ways to minimize impact noise and banging will be required.

A project hotline will be provided at the job site to allow for noise feedback and other concerns from the hotel operators. The hotline could also be used to help develop modifications to construction operations whenever feasible.

Once construction is completed and construction equipment has left the site, the project is anticipated to have no long-term noise emissions.

Table 2-9. Maximum Permissible Sound Levels in dBA

Zoning Districts	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Class A	55	45
Class B	60	50
Class C	70	70

Table Notes:
(1) Class A zoning districts include all areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type.

(2) Class B zoning districts include all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.

(3) Class C zoning districts include all areas equivalent to lands zoned agriculture, country, industrial, or similar type.

(4) The maximum permissible sound levels apply to any excessive noise source emanating within the specified zoning district, and at any point at or beyond (past) the property line of the premises. Noise levels may exceed the limit up to 10% of the time within any 20-minute period. Higher noise levels are allowed only by permit or variance issued under sections 11-46-7 and 11-46-8.

(5) For mixed zoning districts, the primary land use designation is used to determine the applicable zoning district class and the maximum permissible sound level.

(6) The maximum permissible sound level for impulsive noise is 10 dBA (as measured by the "Fast" meter response) above the maximum permissible sound levels shown.

Source: Hawai'i Administrative Rules §11-46, "Community Noise Control"

2.1.16 Streams

Existing Condition

There are no perennial streams located within the Project Area. The nearest perennial stream is Kahoma Stream that drains into the ocean at Mala Wharf, 3 miles to the south of the Project Area. Hāhākea Stream is an ephemeral stream located within the Project Area between the Hyatt Regency and Hanaka'ō'ō Beach Park. This ephemeral stream originates in Hāhākea Gulch and passes under Honoapi'ilani Highway via a concrete box culvert.

Presently the stream runs in an approximate straight line between the beach park canoe hale and the Hyatt's southernmost parking lot before reaching the ocean. The stream has in the past cut a path to the south, through Hanaka'ō'ō Beach Park, makai of the canoe hale and canoe storage areas. During flood events, the stream is heavily laden with terrigenous sediment and debris (Figure 2-71).

Potential Impacts and Proposed Mitigation Measures

The additional sand from the beach restoration at the mouth of the ephemeral Hāhākea stream could alter the stream's path to the ocean, similar to past events due to natural causes. Future stream mouth migration within the sand beach is likely to continue to occur after the beach restoration~~nourishment~~. The beach crest elevation fronting the Hāhākea Gulch stream will be 1 foot lower than the adjacent beach crest to allow the stream to drain straight into the ocean.

Regardless of the path the stream takes, the proposed project will result in an elongation of the stream path for the ephemeral Hāhākea stream, as it would cross a longer beach berm. Typically, this ephemeral stream brings upland sediment to the nearshore waters, so an elongated path through the sand beach may allow for additional natural filtration of the stream discharge. These discharge events have typically been associated with plumes of upland sediment and debris released into the nearshore waters.

Since there is no stream discharge associated with the project, the proposed project is anticipated to have only a negligible impact on perennial and intermittent/ephemeral streams.

Figure 2-71. February 2019 flood event. The stream overtopped its banks and flooded the adjacent parking lot.

2.1.17 Scenic and Open Space Resources

<u>Existing Condition</u>

The Kāʻanapali shoreline is a globally recognized visitor destination. The wide expanse of water with typically calm conditions, the deep blue colors of the ocean, and an unobstructed view of the island of Lānaʻi make the seaward and alongshore views from the shoreline spectacular. At the same time, the tall buildings that have been developed relatively close to the ocean along portions of the shoreline in the project area block views of the West Maui Mountains.

The appearance of the beach is of significant interest to the Kāʻanapali Resort, as their guests represent the most numerous and closest viewers. However, it is also of considerable interest to those who own and/or use adjacent areas and the Kāʻanapali Beachwalk. This beach, like all sandy shorelines in Hawaiʻi, is available to any member of the public and can be visited and enjoyed at any time. Thus, the project area is also of equal value to members of the public who visit the area.

The ongoing erosion within the HLC is having deleterious effects on the scenic and aesthetic value of the shoreline. Emergency shore protection in the form of geotextile sandbags, geotextile fabric, road plates, and jersey barriers have been or are currently deployed to protect the Beachwalk from erosion. Emergency shore protection is typically unsightly, as are active erosion scarps, salt-damaged vegetation, collapsed trees, and turbidity from bank erosion.

Potential Impacts and Proposed Mitigation Measures

Impacts to scenic and open space resources will largely be confined to the sand recovery and transfer phase of the proposed project. Visible turbidity during construction may impact the deep-blue colors of the ocean offshore of the Kāʻanapali shoreline. Turbidity is further discussed in Section 2.1.10.

Construction equipment including barges, tugboats, cranes, temporary piers or trestles or pipelines, dump trucks, off-road capable vehicles, loaders, etc., will be present both on the beach and offshore throughout the duration of the beach restoration and berm enhancement project. The dredge barge at the ~~Puʻu Kekaʻa~~ Sand Recovery Area is expected to be particularly visible for the duration of sand recovery efforts. During sand recovery operations, the barge and crane will at times be directly offshore and within 300 feet of the Moana Hale building of the Sheraton, offshore of ~~and adjacent to~~ Puʻu Kekaʻa.

The proposed beach restoration and management~~maintenance~~ project is anticipated to have a positive long-term impact on the scenic and aesthetic resources of the area, as emergency shore protection that is currently installed may be removed and existing erosion scarps will be buried. The color of sand from the ~~Puʻu Kekaʻa~~ Sand Recovery Area is slightly greyer than the native beach sand; however, after a season of mixing and fading in the sun, the color difference is anticipated to be negligible.

No long-term negative impacts to scenic and open space resources are anticipated from this project; however, there will likely be a long-term positive impact to open space resources with the nourishment~~restoration~~ efforts on the beach.

2.2 Socio-Economic Environment

2.2.1 Surrounding Land Use

Existing Condition

According to the West Maui Community Plan land use maps, the beach area at Kāʻanapali is designated as OS (Open Space). Adjacent land use includes H (hotel), B (business/commercial), and PK (park). Hanakaʻōʻō Beach Park, the Hyatt Regency Maui

Resort & Spa, and the Marriott's Maui Ocean Club are located adjacent to the Hanakaʻōʻō Littoral Cell Beach Restoration area. The Marriott's Maui Ocean Club, the Kāʻanapali Aliʻi, the Westin Maui Resort and Spa, and Whalers Village commercial center are located adjacent to the Hanakaʻōʻō Point Berm Enhancement area. The Kāʻanapali Beach Hotel and the Sheraton Maui Resort & Spa are located adjacent to the NorthPuʻu Kekaʻa Berm Enhancement area.

Potential Impacts and Proposed Mitigation Measures

The proposed project is an environmental restoration project and does not include the construction of permanent structures or alteration of land use at Kāʻanapali Beach. The proposed project is anticipated to have a negligible impact on the surrounding land use.

The proposed project is expected to protect backshore land uses by mitigating the impacts of coastal erosion and rising water levels, which are increasing with global SLR. Use of this nature-based adaptation solution will increase protection for the Kāʻanapali Resort community while restoring recreational resources and natural habitat by bringing the beach back to its former width and volume. The project is intended to make Kāʻanapali more resilient to the effects of climate change.

2.2.2 Community Character

Existing Condition

The Kāʻanapali Resort area includes the typical features of a Hawaiian resort community: hotel and condominium buildings, restaurants, shopping, ocean and beach activities, golf, entertainment, and more. There is no residential housing within Kāʻanapali Resort and minimal housing located nearby. The nearest residential housing is mauka of Honoapiʻilani Highway. Most residential housing in West Maui is concentrated in Lāhainā, south of the project site. West Maui residents still frequent the Kāʻanapali area. Kāʻanapali Beach is accessible via multiple beach access paths and lateral access is available via the Kāʻanapali Beachwalk. Hanakaʻōʻō Beach Park is a "local's park" with plentiful parking and amenities for public use including picnic tables, benches, and barbeque pits.

Potential Impacts and Proposed Mitigation Measures

As the proposed project is a resource restoration project, it is anticipated to have a negligible impact on community character. The proposed beach restoration and berm enhancement project is necessary to restore the sandy beach on this coastline. In addition, restoration of the beach provides protection for the community character and the Kāʻanapali Beachwalk, where they are or may be threatened by coastal erosion. Protection of the Beachwalk, which allows lateral beach access for both visitors and residents, is essential for maintaining much of the community character along Kāʻanapali Beach.

2.2.3 Tourism

Existing Condition

In 2017, 204,000 jobs statewide were supported by Hawaiʻi's tourism industry. On Maui, visitor arrivals and visitor spending both set records, with more than 2.7 million arrivals and $4.76 billion spent. Beaches continue to be a draw for visitors, with millions of visitors and locals visiting Hawaiʻi beaches each year. A study in August 2016 surveyed 1,275 visitors to Oʻahu, Maui and/or Kauaʻi, and found that 98% of the visitors went to the beach on their vacation. On Maui, 96.7% of those surveyed said they visited a Maui beach and almost 50% said they visited the beach four or more times.

Potential Impacts and Proposed Mitigation Measures

The proposed project is intended to protect the beach by mitigating the impacts of coastal erosion and rising water levels, which are increasing with global SLR. This is a nature-based adaptation solution that restores recreational resources and natural habitat by bringing the beach back to its former width and volume. The proposed beach restoration and berm enhancement project will be a temporary nuisance to visitors to the Kāʻanapali area during construction. The project is not anticipated to have a long-term negative impact on tourism, as it is intended to improve the health of the existing beach resource. As such, it is anticipated that the project will have a positive impact on tourism after beach health is restored along the coastline. Since much of island's economy is based on the tourism, following the exodus of island youth during the economic decline of the 1950's and the conscious decision to focus on tourism to rebuild the economy and create stable, local jobs, improvement of tourism is likely to have a corresponding effect on the local economy.

2.2.4 Beach Access

Existing Condition

Pedestrian beach access to Kāʻanapali Beach is available through the Hanakaʻōʻō Beach Park at the south end of the beach and via six public right-of-ways that are oriented perpendicular to the shoreline. Two are located at the northern and southern boundaries of the Hyatt Regency Maui property. Two are located between the Kāʻanapali Aliʻi and the Marriott and the Kāʻanapali Aliʻi and the Westin. Another is located at Whaler's Village, and the northernmost access is located between the Sheraton and the Kāʻanapali Beach Hotel. Lateral shoreline access through the region is available via the Kāʻanapali Beachwalk that runs from Hanakaʻōʻō Beach Park to Puʻu Kekaʻa and along the beach itself.

The Beachwalk is the only ADA-compliant thoroughfare along the beach. Property managers along the coast view the Beachwalk as the main pedestrian artery that makes Kāʻanapali a community. The Beachwalk is a public amenity, available to any and all beachgoers visiting Kāʻanapali. In some locations between Hanakaʻōʻō Beach Park and Hanakaʻōʻō Point, the beach is severely narrowed due to both chronic and episodic erosion. In these locations, the beach is wet at higher tides and during swell events, and the Beachwalk is the only reliable access along the coastline. There is very little or no vegetative buffer remaining between the deflated beach face and the scarp on the seaward side of the Beachwalk in these eroded sections.

The Beachwalk is actively used from before dawn to well after sunset each day of the week. A 2016 pedestrian study (SSFM, 2016) was conducted in the vicinity of the Hyatt Regency Maui, at the south end of the beach. This study documented pedestrian flow rates of 9 to 20 people per minute at peak usage periods on the Beachwalk. Approximately 70% of the

Beachwalk travelers were from the continental U.S., while 12% were from international locations and 18% were from Hawaiʻi. Approximately 0.1% of these travelers were mobility disadvantaged. Though this number is low, relative to the full volume, it is significant in that this group can only access the coastline along the Beachwalk.

The entire Beachwalk system of walkways stretches from the Hyatt Regency Maui to the south to the Honua Kai Resort to the North and extends over 3 miles in length along the beach providing safe lateral access along the beach for residents and guests alike. Studies of the entire Beachwalk system documented 18,000 pedestrian trips per day, totaling roughly 6,570,000 pedestrian trips per year.

Potential Impacts and Proposed Mitigation Measures

Placement operations on the beach would result in short-term impacts on coastal access at the work site. These beach nourishment~~restoration~~ operations would require lengths of the coast to be cordoned off during sand movement and placement operations. Crossing guards would be placed at designated crossings along the shoreline and Beachwalk to assist the public in transiting across the access route. While operating, the heavy machinery would emit noise and exhaust. Working longer days and seven days a week will limit the overall impact by reducing overall project duration.

The project is not anticipated to have negative long-term impacts to beach access; however, it is anticipated to have positive long-term impacts to beach access by improving lateral coastal access along the currently eroded and impeded sections of coastline. Moreover, it will augment the nature based protective buffer, or sand beach, and improve mitigating for the failure of the Beachwalk from episodic erosion events.

2.2.5 Coastal and Nearshore Recreation

Existing Condition

Coastal and marine uses of Kāʻanapali Beach and its nearshore waters are regulated by the State of Hawaiʻi's Department of Land and Natural Resources administrative rules. Uncertified copies of the rules are found online through the Department's website. Certified copies may be obtained from DLNR by request.

Swimming, surfing, gathering, worship, sunbathing, beach transiting, snorkeling, scuba diving, freediving, boating, cliff jumping, standup paddleboarding, kayaking, paddling, fishing, parasailing, thrill crafts, athletic events, and other activities take place along the entire Kāʻanapali coastline. Hanakaʻōʻō Beach Park is one of only two lifeguarded beaches in West Maui, and the only one in the Kāʻanapali/Lāhainā area.

While sunbathing takes place along the entire length of Kāʻanapali Beach, swimming tends to be concentrated from Hanakaʻōʻō Point to Puʻu Kekaʻa. As an example, the 10-mile Maui Channel Swim from Lānaʻi to Maui finishes on the beach fronting the Kāʻanapali Beach Hotel. The shore south of the point is bordered by a shallow reef shelf, while the shore between Hanakaʻōʻō Point and Puʻu Kekaʻa is bordered by a mostly sandy seafloor. The sand bottom north of the point is more attractive to swimmers who wade in and out of the water with bare feet. These activities are addressed in HAR §13-251-76 as follows:

Kāʻanapali Beach shall mean the area within Kāʻanapali ocean waters that is situated between the shoreline and the mean high tide mark along the shores. Kāʻanapali Beach is designated for public use for sunbathing, foot traffic, swimming, and other activities which, when engaged in, shall not unduly disrupt others from enjoying the beach.

The ocean surrounding Puʻu Kekaʻa, or Black Rock, is one of the most popular snorkeling destinations on Maui. With excellent visibility and depths to 25 feet, there is a wide variety of sea life, including fish, turtles, and crustaceans. This location is always rated as one of the top ten snorkeling sites on Maui. Taking advantage of this site, almost every hotel on Kāʻanapali Beach has one or more beach concessions that offer snorkeling equipment rentals and sales, introductory snorkeling lessons, and introductory scuba lessons.

In addition to the beach concessions, a number of commercial catamarans and monohull boats that operate from the Kāʻanapali mooring zone off Hanakaʻōʻō Point offer snorkeling and scuba excursions to nearby destinations such as Honolua Bay and Olowalu. However, they do pick up their passengers from Kāʻanapali Beach.

The most popular surf spot on Kāʻanapali Beach is located on the reef offshore Hanakaʻōʻō Point. It is the most consistent spot and offers the longest rides, which are preferable conditions for beginners and other surfers. Although surf may be found at the point throughout the year, it breaks best during the summer months. Several other less used surf spots are located between Hanakaʻōʻō Point and Hanakaʻōʻō Beach Park near the small sand channel through the reef off the Hyatt Regency Maui Resort & Spa. During the summer months, sand normally erodes at Hanakaʻōʻō Point and accretes at the north end of Kāʻanapali Beach, where it may form a sandbar extending seaward south of~~along~~ Puʻu Kekaʻa. With the arrival of the first winter swells, a surf spot may form along the outer edge of the sandbar with waves extending as far south as the Kāʻanapali Beach Hotel. The surf spot is short-lived, disappearing as the winter waves erode the sandbar. This spot is in the project area. The north end of Kāʻanapali Beach is also used as a bodysurfing, bodyboarding, and skimming site when waves, beach, and bottom conditions are favorable. Several beach concessions along the Kāʻanapali boardwalk rent surfboards and standup paddleboards (SUPs) and offer lessons. Several concessions also rent ocean kayaks and offer kayak tours along the beach and around Puʻu Kekaʻa. Paddlers in both activities transit the nearshore waters of the project area.

Outrigger canoe paddling in the project site is concentrated at Hanakaʻōʻō Beach Park, which is also known as Canoe Beach. Three canoe clubs are based at the park: Kahana Canoe Club, Lāhainā Canoe Club, and Napili Canoe Club. All three hold practices there and store their canoes in a single canoe hale and along a grassy area behind the beach. The clubs are members of the Maui County Hawaiian Canoe Association and participate in MCHCA regattas every year in June and July. They also participate in the long-distance racing season, which follows the Hawaiian Canoe Racing Association championships in August. The full six-person outrigger paddling season runs from April until October, each year. Outrigger canoe regattas on Maui take place at various locations around the island, including at Hanakaʻōʻō Beach Park. The regatta racecourse at the beach park is situated offshore the park, which places it within the general project area. In addition, outrigger canoe training takes place year-round, including through the project area. This activity, outrigger canoe paddling, is addressed in HAR §13-251-58, which identifies restrictions for vessels in the Kāʻanapali Beach waters as follows: "This section shall not apply in the event of an emergency, to law enforcement or rescue craft, to vessels participating under a valid ocean waters permit issued by the department, or to Hawaiian design canoes engaged in crew training."

One company offers narrated outrigger canoe tours at Kāʻanapali Beach. It operates from the beach concession at the Royal Lāhainā Hotel on the north side of Puʻu Kekaʻa, where the canoes are launched and landed. The tour route circles Puʻu Kekaʻa to Kāʻanapali Beach and then returns to its point of origin. This activity, outrigger canoe tours, is addressed in HAR §13-251-66 as follows: "No person shall operate nor shall any owner authorize or permit a canoe to transport passengers for hire unless the canoe meets all the requirements of these rules and a canoe captain or second captain, each having a valid permit issued by the department, is on board. In these instances, the senior crew member aboard shall not permit the vessel to be utilized for canoe surfing unless a minimum crew as provided in subsection (a) is on board."

Shore casting and spearfishing, including night diving, by individual free divers and scuba divers, occurs primarily at the south end of Kāʻanapali Beach and outside of the project area. Divers access the area either from shore or by boat. Commercial net fishing is an infrequent activity that occurs in or near the project area in the vicinity of Puʻu Kekaʻa. The exact location depends on the movements of the target school of fish. This activity may include surrounding net operations on the surface for pelagic fish such as akule (big-eyed scad) or underwater surround net operations for bottom fish such as weke (goatfish). Fishing boat usage at Kāʻanapali is addressed in HAR §13-251-58, which identifies restrictions in the Kāʻanapali Beach waters as follows: "(2) No person shall navigate a motorboat within 200 feet of the shoreline, or designated swimming area, or within one hundred feet of a diver's flag, nor shall any person navigate a commercial motorized vessel within 500 feet of the shoreline except within a designated ingress/egress corridor. Notwithstanding this paragraph, vessels engaged in fishing outside of the designated ingress/egress corridors are exempt from the 200-foot shoreline restriction, provided that designated swimming areas are approached with caution and due care. (3) No person shall navigate a motorized vessel within 300 feet of a vessel engaged in fishing. (4) A vessel engaged in fishing shall not impede the passage of any vessel passing through a designated ingress/egress corridor."

Parasailing takes place in a designated area seaward of the project area but is not permitted during the whale season (December 15 to May 15), the time of year when whales are wintering in Hawaiʻi. It is addressed in HAR §13-256-108 Lāhainā- Kāʻanapali Offshore Restricted Area as follows: "(b) Restrictions. The Lāhainā- Kāʻanapali Offshore Restricted Area is designated as a parasailing area. Parasailing activity shall remain seaward of the described boundary when within three miles of the coastline, except when transiting to or from Lāhainā Harbor, Mala ramp or a designated mooring area. No more than five commercial operating area use permits shall be issued for this zone. Persons operating vessels shall exercise due care when transiting this area." Parasailing does not take place in the project area.

Use of jet skis or other thrill crafts takes place in two designated areas south of the project area but is not permitted during the winter and spring when whales are wintering in Hawaiʻi. It is addressed in HAR §13-256-109 Kāʻanapali Commercial Thrill Craft Areas as follows: "(b) A maximum of three commercial thrill craft operating area permits may be issued for Kāʻanapali ocean waters. Notwithstanding the contrary provisions of sections 13-256-18, a person owning one or more business entities holding valid commercial thrill craft permits may consolidate all commercial thrill craft operations within Kāʻanapali Commercial Thrill Craft Area 1; provided that no more than eighteen rental units and three safety units shall be operated at any one time. Kāʻanapali Thrill Craft Area 2 is reserved for use by a single permittee. All supporting rafts or platforms shall be located within the operating area and shall display an anchor light at night. (c) These areas shall be closed to all thrill craft operations during the whale season, from December 15 to May 15 of the following year." The use of thrill crafts does not take place in the project area.

Water sledding, which includes using a motorized vessel to tow one or more persons on a water sled, such as an inflatable raft or tube, takes place in one designated area south of the project area but is not permitted during the winter and spring when whales are wintering in Hawaiʻi. It is addressed in HAR §13-256-111 Kāʻanapali Commercial Water Sledding Zone as follows: "(1) This area is designated for commercial water sledding. No more than two commercial operating area use permits for water sledding shall be issued for this zone. (2) This area shall be closed to all commercial water sledding operations during the whale season from December 15 to May 15 of the following year." Water sledding does not take place in the project area.

Several ocean sports events have taken place on Kāʻanapali Beach, such as the Maui Jim Ocean Shootout, the Hawaiian Sailing Canoe Association's events, and the Maui Channel Swim. The Maui Jim Ocean Shootout event is one of several in the Maui Jim Ocean Racing Series and had been held at Kāʻanapali Beach. It includes competitive events for prize money in standup paddling (SUP), outrigger canoe paddling (OC-1), ocean swimming, surfski paddling, and paddleboard paddling. The event sponsor provides all racing craft free-of-charge. The racecourses are close to shore and front the Kāʻanapali Beach Hotel, the event hotel. The annual event has been held in June and includes international television coverage. The racecourses are in the project area. The Maui Channel Swim event is a 10-mile channel crossing relay that starts on Lānaʻi at the Club Lānaʻi Pier and ends at Kāʻanapali Beach at the Kāʻanapali Beach Hotel, the event hotel. Relay teams consist of six persons who swim alternate legs of the racecourse. Each swimmer swims 30 minutes once, then rotates through 10-minute swims until complete or six hours have passed. Each team is supported by an escort motorboat, which must stop 200 yards off the finish line on Kāʻanapali Beach. The race is held every year in September on the Saturday of Labor Day Weekend. The finish line for this event is in the project area. The Hawaiian Sailing Canoe Association's 2020 race schedule included the following: June 5, Kahului to Kāʻanapali (Waa Kiakahi); June 6, Community Service (Waa Kiakahi) rides at Kāʻanapali; June 7, Kāʻanapali to Kaunakakai, Molokaʻi. Each year the HSCA events take place on Kāʻanapali Beach fronting the Kāʻanapali Beach Hotel, which is in the project area. The Waa Kiakahi event introduces Hawaiian sailing canoe to members of the public, including both locals and visitors alike.

Potential Impacts and Proposed Mitigation Measures

There will be disruption to coastal and nearshore recreation during construction of the beach restoration and berm enhancement project.

Five (5) anchor lines at the ~~Puʻu Kekaʻa~~ Sand Recovery Area will be in place for the duration of sand recovery operations, and floating sections or anchor line would be marked with floats and lights as needed. The machinery operating on the barge would be run from the early morning until later in the afternoon each day. Some lighting would be needed on the barge to conduct operations during the morning hours and to mark lines and vessels at night.

Delivery of sand to shore would require the emplacement of bridge structures, floats, or pipelines from the shoreline to 15 feet of water depth. In addition, the delivery barges would utilize a four-point mooring system with a storm anchor positioned directly offshore. Any floating portions of these anchor lines would be marked. Delivery operations would require tugboats to maneuver the barges close to shore, where they can be secured in the four-point mooring system.

All of these marine construction activities would be taking place in the nearshore waters and are expected to directly impact ocean recreation and access in the area. The waters within the ~~Puʻu Kekaʻa~~ Sand Recovery Area and offloading locations would be closed to ocean recreation for the duration that construction activities are ongoing in those locations. A 100-foot-wide no-entry safety zone will be enforced around the northern and southern offloading stations and the ~~Puʻu Kekaʻa~~ Sand Recovery Area, precluding ocean recreation activities to maintain public safety during the construction window.

Careful planning has gone into minimizing the disruption to ocean recreation, resulting in a construction schedule that includes longer workdays, and working seven days a week in an effort to limit the duration of the project. This accelerated construction schedule will significantly reduce the overall duration of the project.

Public safety during the beach restoration and berm enhancement project will be of utmost importance. A Notice to Mariners detailing construction activities and locations will be publicly issued through the United States Coast Guard prior to mobilization of construction equipment on site. A public awareness campaign will be initiated through OCCL and DOBOR to help spread awareness about project activities.

Communication will be maintained with the local canoe clubs for the duration of the project. Construction teams will work with the canoe clubs to minimize interruptions and impacts to practices and water access for the duration of the project. Flag person(s) will be stationed near the canoe hale to assist with transit across the construction access route during beach restoration~~nourishment~~ efforts at Hanakaʻōʻō Beach Park.

Resort activity coordinators, beach vendors, and concessions will be coordinated with, so they may inform customers of construction activities. All onshore and offshore hazards will be clearly marked with signage and/or marker floats. Transit corridors, both on the beach and in the water, will be clearly labeled. Flag persons will be provided as needed.

Placement operations on the beach would require lengths of the coast to be cordoned off during sand transport and placement operations. Crossing guards would be placed intermittently along the shoreline to assist the public in transiting across the access route.

Nearshore bathymetry will be altered in the proposed project area as beach volume is restored. The HLC beach restoration includes placement of sand on the seafloor, where the beach was located in 1988. While the beach face is equilibrating after the restoration activity, nearshore sand bars can develop, move through the area, and disappear. The beach face slope can adjust to wave conditions and the beach orientation can rotate to accommodate the changing seasons. These changes, associated with adjustments of the restoration sand to the nearshore environment, can produce changes in wave patterns, currents, and nearshore bathymetry for one to several seasons. Utilizing highly compatible restoration sand minimizes the scale and duration of these potential impacts.

There is the potential for the proposed project to initially have some impact on surfing at Hanakaʻōʻō Point. Because the additional sand will be placed directly on the berm at Hanakaʻōʻō Point, the shoreline will not be extended further offshore than it would be naturally. However, the additional sand will cause the sand point to erode slower than it would without the berm enhancement. This could enhance undesirable wave reflection to continue past the first few swells of the summer surf season.

This delayed erosion of the point is expected to occur ~~only~~ during the first southern swell season after sand placement. Historical aerial photographs and topographic surveys show that the point has a maximum sediment volume that is reached towards the end of winter during extreme North Pacific swell seasons. This volume is independent of the volume of sand contained within the KLC because wave action at the reef crest, makai of the point prevents further seaward accretion of the beach. Since the sandy point cannot grow beyond this wave controlled seaward extent, sand begins to bypass the point and continue into the HLC. The beach restoration and berm enhancement project are not expected to have an effect on surfing after the first southern swell season.

The ephemeral surf site in the sand field south of Puʻu Kekaʻa, which forms during early winter swells, may be impacted during the first winter, as the beach and enhanced berm erode at the north end of the KLC.

The surf sites along the reef crest offshore of the HLC may have impacts during the equilibration period after beach restoration. During this period there may be additional wave reflection as the beach face equilibrates; however, the magnitude of change is anticipated to be small as the design beach slope is very close to the natural beach slope in this area.

Surf sites were evaluated based on the bathymetric features that control the waves, such as reef structure for the point and HLC waves and mobile sand features for the ephemeral wave south of Puʻu Kekaʻa, as well as the potential impacts of the beach restoration project. Additional discussion that is drawn upon for the evaluation of potential impacts to surfing is included in previous sections. These discussions include how observational and instrument data, combined with physics-based models have informed the design and evaluation of potential impacts. These discussions can be found in Section 2.1.4 Currents, Section 2.1.8 Nearshore Bathymetry and Coastal Processes, Section 2.1.9 Sand Characteristics, and Section 2.1.10 Water Quality.

There is potential for the proposed project to disrupt boating-related recreational activities during operations. Sand from the sand recovery area will be placed on a barge and towed by a tugboat to the sand offloading locations. The tugs and barges would be anchored first at the North Offloading Location and second at the South Offloading Location, under the proposed construction plan. There will be two barges alternating between the sand recovery area and the offloading location, but for the majority of the day, they will be moored at these locations. They will typically transit between the sand recovery area and the offloading location, up to four times per day, with a transit time expected to be less than 30 minutes. While the barges are in transit, other marine vessels and marine activities will need to adjust to their movements. Barge routes may change according to weather conditions, but they are expected to be approximately 2,000 feet offshore in 100 feet of water, well offshore of swimming, snorkeling, scuba, and surfing sites.

During the first phase of the project (the NorthPuʻu Kekaʻa Berm EnhancementRestoration), the beach from the Aston to the Westin will be open for vessels to pick up and drop off passengers. Once the berm enhancement is completed at the North SitePuʻu Kekaʻa, the North Offloading Location will be demobilizeddemobilized, and all in-water work between the Sand Recovery AreaPuʻu Kekaʻa and Hanakaʻōʻō Point will be complete.

The last phase of the operation will be the Hanakaʻōʻō Point Berm Enhancement, which only extends as far north as Whaler's Village. Placement of sand on the berm fronting the Westin and Whaler's Village is anticipated to take six to seven days. During that time, the beach fronting the Aston, Kāʻanapali Beach Hotel, and Sheraton will be open for dropping off and picking up passengers. In summary, there will always be an open stretch of beach within the KLC for beach loading and unloading of passengers for commercial marine tours.

Potential Impacts and Proposed Mitigation Measures

Though the project is expected to have short-term impacts, the proposed project is anticipated to have a negligible long-term impact on coastal and nearshore recreation. There are likely to be positive long-term impacts that result from an improved beach ecosystem and resources, including access to and along the beach for coastal and nearshore recreation.

2.2.6 Public Health and Safety

Existing Condition

Kāʻanapali Beach, specifically the area to the south of Puʻu Kekaʻa, is one of the deadliest stretches of coastline in the State of Hawaiʻi. Despite this reputation, the area continues to be a popular spot for snorkeling and diving for both visitors and local residents. There were 21 fatal drownings at Puʻu Kekaʻa from 2007 to 2016, with 17 of those occurring after 2011. A 2019 State trauma registry found that Kāʻanapali Beach was tied with the Big Island's Laaloa Beach and Oʻahu's Sandy Beach for the third highest in spinal injuries with 20 at each.

What appears innocuous from shore (calm, clear water full of people enjoying themselves) can quickly turn dangerous for an unsuspecting and unprepared individual. Long periods of calm ("lulls") can be followed by brief periods of large waves ("sets"). Strong alongshore tidal and wave generated currents can transform into cross-shore (or "rip") currents when they interact with the Puʻu Kekaʻa rocky headland. These currents can pull swimmers offshore. Steep drop-offs at the beach toe could cause swimmers to lose their footing. Wave events typically result in turbidity and reduced visibility that could disorient swimmers, snorkelers, and SCUBA divers. In addition, Kāʻanapali Beach experiences massive sand transport, both seasonally and in response to wave events, with up to 300 feet of beach width growing and receding at Hanakaʻōʻō Point and the beach south of Puʻu Kekaʻa. This sand transport results in dramatic changes to the nearshore conditions and depths. All of the above contribute to the dangerous environment at Kāʻanapali.

Other injuries are common along Kāʻanapali Beach as well. Because there is no offshore reef between Hanakaʻōʻō Point and Puʻu Kekaʻa, waves arriving from deep water quickly dissipate their energy all at once along the shoreline. This explosive dissipation of energy is in the form of powerful, plunging waves breaking in very shallow water ("shorebreak"). Shorebreak and wave driven sand transport can cause sand to collect in offshore sandbars and shoals, which can injure swimmers diving into what they expect to be deep water. Exacerbating the hazard is cobble that sometimes collects at the beach toe and the seafloor just offshore of the beach toe. People diving from beached vessels, thrill craft, and other nearshore recreational objects such as floating trampolines, are also at risk of impacting sandbars. Impact with the sandy bottom, whether from shorebreak or diving into the water, can cause injuries that range from non-life-threatening scrapes and bruises, broken limbs, soft tissue tears, and joint dislocations to life-threatening spinal and brain injuries. The later can cause immediate paralysis or loss of consciousness that can lead to drowning.

There is no lifeguard tower at Puʻu Kekaʻa, and the nearest lifeguard tower is nearly 1.5 miles to the south at Hanakaʻōʻō Beach Park. Though lifeguards at Hanakaʻōʻō Beach Park can respond to incidents along Kāʻanapali Beach, the HLC is out of direct line of sight from the lifeguard tower, which drastically increases response time. To reduce the frequency of drownings, the Kāʻanapali Operations Association installed 30 rescue tubes along 3 miles of Kāʻanapali shoreline. Permanent signage at beach access points warns beach users of the persistent public health hazards at Kāʻanapali Beach, such as shorebreak and currents (Figure 2-72). Additional signage is occasionally deployed to warn of less frequent hazards, such as shark sightings and exceptionally large surf (Figure 2-73).

Maui sees more shark attacks than any other Hawaiian island, likely due to the large and protected shallow ocean shelf within Maui Nui. There have been numerous shark sightings in the waters offshore of Kāʻanapali Beach. Reported attacks in the area are less frequent, with the only recent shark attack occurring in 2013 north of Kāʻanapali near Honokōwai Point.

Stinging sea life such as the Portuguese man-o-war and box jellyfish occasionally frequent the waters offshore of Kāʻanapali. While the sting of Hawaiʻi's box jellyfish is not usually lethal, it is reported to be more painful than that of the more common Portuguese man-of-war. In rare instances, stings to the mouth and throat or a severe allergic reaction (anaphylaxis) can require emergency care.

Ambulance service is operated under a state contract with American Medical Response (AMR). Two units operate in West Maui, out of the Napili Fire Station and the Lāhainā Comprehensive Health Center. Currently, these two AMR units provide emergency services for the proposed project area, responding to all of these public health and safety issues.

Figure 2-72. Permanent hazardous conditions sign at Kāʻanapali Beach

Figure 2-73. Temporary hazardous condition sign at Kā'anapali Beach

Potential Impacts and Proposed Mitigation Measures

The beach profile in the HLC, including the beach face slope and the beach toe feature, will be built to the pre-construction shape and location; the beach face will simply be translated further offshore. This may change the hazard from breaking waves on the shoreline. The beach profile in the KLC will change, with the addition of 3.5 feet of additional berm elevation. During the first erosion season at each end of the littoral cell, the erosion scarp will extend an additional 3.5 feet in elevation until the berm enhancement sand has been mobilized. During this time, return waves energy may be higher and scarp elevations may be higher. Studies on beach safety following beach restoration efforts were summarized in a letter to the editor or the Journal of Coastal Research by Fletemeyer in 2018. In this letter, they document potential changes associated with the addition of sand to the beach and nearshore environment. The author concludes that beach morphology and nearshore bathymetry will be significantly altered '…until natural processes can return the beach to its natural state." Based on anecdotal accounts and documented events, there appears to be a correlation between beach nourishment efforts and beach safety. Central to the public safety concerns are changes to local rip currents and changes in shoreline wave patterns. These changes may be affected by:

- Sand compaction from beach restoration efforts can create vertical scarps, which alter wave runup and return.
- Changes in nearshore bathymetry changing the incidence and type of waves occurring near the shoreline.

The proposed project is not anticipated to have an impact on sightings and interactions with dangerous sea life at Kāʻanapali Beach.

Public safety during the beach restoration and berm enhancement project will be of utmost importance. A Notice to Mariners detailing construction activities and locations will be publicly issued through the United States Coast Guard prior to mobilization of construction equipment on site. A public awareness campaign will be initiated through OCCL and DOBOR to help spread awareness about project activities.

KOA, DLNR, and the project team will coordinate with resort activity coordinators, beach vendors, and ~~concessions, so~~concessions, so they may inform customers of construction activities. Onshore~~All onshore~~ and offshore hazards will be clearly marked with signage and/or marker floats. Transit corridors, both on the beach and in the water, will be clearly labeled. Flag persons will be provided as needed.

An Emergency Action Plan (EAP) will be implemented for the proposed project. The EAP addresses risk assessment concerns in the project area and determines risk management recommendations to address them. The EAP, which includes a project notification list with contact information, will be distributed to everyone involved in the project, including the contractors conducting the onsite operations and their personnel. Medical emergencies may occur anywhere in the project area at any time. The EAP addresses how they would be reported and who would be notified. For emergencies that occur offshore, the EAP designates a shoreline location with good access for emergency response vehicles to receive the victim being brought ashore. In the event that high surf precludes a beach landing, an alternate site, such as Hanakaʻōʻō Beach Park, should be designated. The beach park is within the project area, has a county lifeguard on duty during the day, and can accommodate emergency response vehicles. The lifeguard is also equipped with a jet ski and could assist with an ocean emergency or extrication. For emergencies that occur onshore, the EAP identifies the nearest sites for emergency vehicle access to the north and south offloading and sand placement locations.

HAR §13-256-109 Kāʻanapali Commercial Thrill Craft Areas addresses anchored platforms as follows: "All supporting rafts or platforms shall display an anchor light at night." Many of the catamarans and monohulls that conduct commercial tours at Kāʻanapali Beach offer sunset cruises. Although most of them return to the beach before the sun sets, sometimes they return after dark, such as during the winter months. Anchor lights are for their safety and for the safety of other vessels operating at night. Anchor lines for the dredge barge will be in place for the duration of the sand recovery operation. Anchor lines for the floats or bridge will be in place for the duration of the sand offloading, first at the north site and second at the south site. Floating anchor lines at all of these sites would also be marked with floats and lights.

When the dredge barge and floats or bridge are not in use and unoccupied, swimmers and other individuals on various personal watercraft may attempt to board them, especially at night. Some type of security watch should be considered, perhaps by alerting security staff members at the various hotels when operations have ceased. The 100-foot-wide no-entry safety zone on either side of the sand offloading station should be marked by buoys.

Educational and warning signs should be placed along the shoreline during and after the project. These signs should include warnings for beach and ocean users to address public safety issues.

Implementation of proper precautions, safety notices, markings, and outreach, such as those detailed above, will help minimize public health and safety hazards along the shoreline both during and following construction. Notwithstanding such precautions, coastal processes characteristic of Kā'anapali Beach (strong currents, energetic waves, massive sand movement resulting in bottom changes and bar formation, water turbidity, etc.) will continue to pose hazards to people. Existing natural hazards in and around the project area are not anticipated to continue during and after the proposed project.

It is likely the proposed project will change these hazards at a localized scale, and potentially a regional scale, as the area equilibrates to the restoration sand. Mitigation, in the forma result of educational and warning signs, for potential changes in location, type, and severity of nearshore and beach hazards is proposed. Additional mitigation in the form of post-placement tilling of the beach is intended to mitigate the formation of vertical scarps on the beach face and the rip currents they can affect. the project.

2.2.7 *Cultural Resources*

Existing Condition

Following Hawai'i statehood in 1959, unproductive plantation lands along the Kā'anapali coast were cleared and repurposed as a vacation destination, with the first major hotel on Kā'anapali Beach, the Sheraton Maui Hotel (now the Sheraton Maui Resort & Spa), opening in 1963 adjacent to Pu'u Keka'a. Over the next 20 years, 7 additional resorts and shopping complexes were constructed immediately inland of the project area.

Kā'anapali Beach is now largely dedicated to tourism-related recreational activities, including sunbathing, snorkeling, and beach volleyball. Some of the most popular water sports among visitors, such as surfing and paddleboarding, originated in Polynesian, and particularly in Hawaiian, traditional culture. Local events are routinely held at Kā'anapali Beach in conjunction with resort activities. An example is the Hawai'i Sailing Canoe Association's annual visit to the beach, which provides a hands-on cultural learning experience. The local community continues to utilize Kā'anapali Beach for traditional cultural practices that include gathering, fishing, diving, outrigger paddling, and ocean recreational activities, which are deeply rooted in the history of the area.

While no terrestrial or marine cultural assets have currently been discovered in the project area, the project team is aware that cultural assets may be identified during public notices and community meetings. Should any Iwi or cultural assets be discovered, the proper authority shall be contacted.

Cultural Impact Assessment

The proposed project is closely associated, through its proximity, to one of Maui's most important cultural sites, Puʻu Kekaʻa. The proposed project was designed with a deep respect for the site and is intended to preserve Puʻu Kekaʻa so that no physical harm will occur based on the proposed activities. Puʻu Kekaʻa is a bold and striking geographic feature found in legend, history, and modern cultural practices. Though the name, Puʻu Kekaʻa, has been roughly translated as "hill of rumbling", its significance in cultural practices is as a leina a kaʻuhane, or a leaping place for departed souls. This large, basalt promontory erupts forcefully as a striking feature in the middle of miles of sandy shoreline, providing a unique location on the western shore where traditional Hawaiian religion believes deceased spirits may pass westward into the afterlife. Possibly due to this site's spiritual connection to the afterlife, there have historically been many burials in the region, which in some cases have left iwi kūpuna exposed above ground according to records.

The area was also the site of a famous battle, Koko O Nā Moku, or the "Bloodshed of the Islands" that took place in 1738. This battle was between Kamehamehanui, the appointed ruler of Maui, and Kauhiʻaimokuakama. This was the final battle in their war for power and raged for days on the coastal plain of Kāʻanapali, with warriors from the Island of Hawaiʻi and Oahu supporting the opposing Maui forces. So many warriors were injured or killed during the battle that their blood flowed to the ocean, turning the sea red. The remains of many fallen warriors from Koko O Nā Moku were reportedly left in Kāʻanapali, likely adding many iwi kūpuna in the area around Puʻu Kekaʻa.

The site's cultural function as a leina a kaʻuhane and the consequent density of burials are probable reasons Puʻu Kekaʻa also garnered a reputation as a haunted location. Using this reputation to his advantage, Kahekili, the great ruler of Maui who unified many of the Hawaiian Islands prior to Kamehameha, dove off the cliff face to prove he was a descendant of the gods.

Puʻu Kekaʻa is one of the most important cultural sites on Maui, and a location that many cultural practitioners hold a powerful connection to. As such, great care can and should be taken when considering projects located in the region.

The region around the proposed project at Kāʻanapali Beach, including Puʻu Kekaʻa, has a rich historical and cultural legacy. Because of this legacy, individuals and groups have expressed major concerns for the resources, fearing potential impacts from a proposed project that will be located near Puʻu Kekaʻa. Many public commentors voiced concern about or outright objection to the proposed project based on its proximity to Puʻu Kekaʻa. Further, on November 18, 2020, the proposed project was presented to the Maui Island Burial Council who voted to oppose sand recovery offshore of Puʻu Kekaʻa.

The proposed project includes the recovery of sand from a marine sand deposit and placement of the sand atop and makai of the existing dry beach. No excavation of the coastal plain is proposed. A certified shoreline will be acquired prior to beach restoration, further documenting the extent of wash of the waves. This shoreline certification will be used both for permitting and to monument the high wash of the waves prior to restoration activities. No further development of the backshore is planned as part of this proposed project or expected to occur as a result of the proposed project. Previous impacts, especially those associated with disturbances to iwi kūpuna, were associated with agricultural and development activities in the coastal plain.

Potential impacts to cultural and archaeological resources were identified as a critical design consideration for any potential beach restoration project in the area, to be avoided and minimized to the greatest extent possible. A key design parameter was avoiding contact with, and maximizing distance from, any potential or known cultural resources in the region, including Puʻu Kekaʻa. The proposed project is designed to be no closer than 150 feet to the basalt headland, with the sand recovery area located between 150 feet to more than 800 feet from the promontory.~~The Kāʻanapali area has a rich historical and cultural legacy. A Cultural Impact Assessment (CIA) for the project was completed in 2016, and is included as Appendix A – Cultural Impact Assessment (International Archaeology, LLC) within this document. Consultations were held in the winter of 2015, with comments presented in the CIA. Findings of the CIA indicate that there does not appear to be any known traditional Hawaiian cultural practices that would be adversely affected by the proposed project. Neither does it seem like the activities associated with the project will conflict with traditional cultural practices as expressed in legend. If cultural practices are taking place within the project site, but have not been observed, then all effort will be made to minimize and mitigate any project impacts.~~

~~Puʻu Kekaʻa is considered a leina a ka uhane (a place where deceased spirits pass into the afterlife), with an intangible boundary that may extend far beyond the cliff itself. The CIA concluded that though the construction work in this region is not anticipated to impact either cultural practices or artifacts, there may still be a contentious response from individuals within the Native Hawaiian community.~~

During construction, the use of some portions of the shoreline area and offshore areas may be prevented for public safety reasons. The contractor and the State will try to accommodate the needs of native Hawaiian practitioners during construction (e.g., surfing, fishing, diving, paddling, gathering, worship, and other activities not yet identified), but will not do so if it endangers public safety. Upon completion, the project would not curtail any of these important cultural activities.

Coastal and nearshore recreational and cultural activities, including but not limited to surfing, fishing, diving, paddling, and gathering, are also discussed at length in the EIS in Section 2.2.5 Coastal and Nearshore Recreation. Marine biological resources and potential impacts are discussed in Section 2.1.11 Marine Biology. Tides and Currents are discussed in Section 2.1.2 and Section 2.1.4, respectively.

A Cultural Impact Assessment (CIA) for the project was completed in 2016 by International Archaeology, LLC and is included as Appendix A – Cultural Impact Assessment (International Archaeology, LLC). International Archaeology reached out to area practitioners in November and December of 2015. A complete record of those communications and consultations is included in the CIA. In addition, a meeting was held with SHPD, International Archaeology, and the design team on November 9, 2015, where potential cultural impacts and best management practices were discussed. The CIA concluded that though the construction work in this region is not anticipated to impact either cultural practices or artifacts, there may still be a contentious response from individuals within the Native Hawaiian community due to the proximity of the project to Puʻu Kekaʻa.

This was the original review and assessment for the proposed project. Since the completion of the CIA, extensive follow up work associated with the EISPN, DEIS, and two rounds of public engagement have been completed. Community engagement has been a key element of the proposed project's investigation, design, and environmental review processes. Community and agency feedback has been incorporated, where appropriate, into the proposed project's design. These efforts built upon the foundation of the CIA, expanding its breath and depth and exploring new topics. This process has been a synergistic activity, growing with the information and insights provided through discussion with and comments from Kanaka Maoli, longtime residents, and others who are interested and engaged in the cultural resources of the region. The FEIS is the synthesis of all these activities, presenting a much richer and deeper discussion and analysis of the local cultural resources and potential impacts from the proposed project. Central to this process has been the Ka Paʻakai cultural analysis.

A Ka Paʻakai Cultural Impact Analysis was completed for the proposed project in order to more fully understand and address potential impacts to the cultural resources in the region, which might result from the proposed project. The analysis is based on existing conditions and the feedback and responses collected during the public comment and outreach process. This analysis builds upon the data, analysis, and discussions that started with the CIA and matured through the EISPN and DEIS public comment, review, and consultation processes.

Ka Paʻakai Cultural Impact Analysis

The State has a responsibility to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. This includes ensuring that legitimate customary and traditional practices of native Hawaiians be protected to the extent feasible.

The Hawai`i Supreme Court in Ka Paʻakai O Ka `Aina v. Land Use Commission (2000) suggested three tests for agencies to protect traditional and customary Hawaiian practices to the extent feasible. The tests include assessment of the following:

A) The identity and scope of valued cultural and historical or natural resources in the petition area including the extent to which traditional and customary Native Hawaiian rights are exercised in the petition area;
B) The extent to which those resources including traditional and customary Native rights will be affected or impaired by the proposed action; and
C) The feasible action, if any, to be taken by the state to reasonably protect Native Hawaiian rights if they are found to exist.

The proposed sand recovery area is located offshore of Puʻu Kekaʻa. Hawaiian cultural practices adjacent to the sand recovery area include those centered on Puʻu Kekaʻa, which is a leina a kaʻuhane, and the use of nearshore waters and fishing grounds, with practices such as surfing, fishing, diving, and paddling.

The proposed project area is a dynamic sandy shoreline that experiences coastal erosion along the southern half, in the Hanakaʻōʻō Littoral Cell, and seasonal erosion in the northern half, the Kāʻanapali Littoral Cell. Due to ongoing and episodic erosion and accretion events, the active beach system is composed of relatively recently deposited sand and is highly unlikely to contain in situ resources. Traditional cultural practices in the area include gathering, fishing, diving, contemplation, canoe padding, surfing, and potentially other coastal activities that have not yet been identified.

Outside of the project area, surface and subsurface resources have been identified. These resources are located mauka of the terrestrial portion of the project area (e.g., the area of sand placement). Although the backshore area has been disturbed by agricultural and resort development, it is likely that there are still iwi kūpuna in the coastal plain, mauka of the beach. However, the proposed project will take place entirely makai of the shoreline which reduces the potential disturbance of any iwi kūpuna. Moreover, the terrestrial portion of the proposed project does not include any excavation actions.

The identity and scope of valued cultural and historical or natural resources in the petition area including the extent to which traditional and customary Native Hawaiian rights are exercised in the petition area.

Puʻu Kekaʻa, the iconic rocky headland at the north end of the project area and inshore of the sand recovery area, is a leina a kaʻuhane with an intangible boundary that may extend beyond the cliff itself. The leina a kaʻuhane is a cultural resource for the Hawaiian community and holds a deep and abiding significance for some members of the community.

A single archaeological site, the Hanakaʻōʻō grinding stones (SIHP 50-50-03-1204), has been identified outside of the sand placement area in Hanakaʻōʻō Beach Park. The site contains eight smooth, shallow, and roughly circular depressions distributed across the superior surfaces of two basalt boulders. These hoana, or grindstones, were used to shape and sharpen traditional Hawaiian adzes; the depressions were formed by the grinding action (facilitated by sand and water) of innumerable stone tools upon the boulder surfaces. The site is located among a cluster of basalt boulders on the Hanakaʻōʻō Beach Park, approximately 30 feet west of the park bathrooms, outside of the sand placement area.

Mauka of the project area, inshore of the active beach system, and outside of any proposed work, are numerous in situ and disturbed iwi kūpuna, which have been identified in previous investigations.

In the nearshore area around the sand recovery area, and sand transport and offloading areas, cultural practices such as fishing, diving, paddling, and surfing take place. Of great importance within the project area is the fishing and gathering community. Fishermen and gatherers have cultural value, and their efforts work to provide food for their families and community. These practices utilize the open ocean, waves and currents, and natural fishing grounds and marine ecology of the region.

Along and adjacent to the shoreline, practices such as fishing, gathering, contemplation, and worship may take place. Of great importance within the project area is the fishing and limu gathering community. Fishermen and gatherers have cultural value, and their efforts work to provide food for their families and community. These practices utilize the sand beach and the coastal and marine ecology, depending on the sandy coastal substrate.

The applicant is aware that additional cultural resources may be identified during public notices and community meetings. It is also possible that there may be artifacts in the submerged areas that may be encountered.

The extent to which those resources including traditional and customary Native rights will be affected or impaired by the proposed action.

Puʻu Kekaʻa: During construction, the use of some portions of the shoreline area and offshore areas may be prevented for public safety reasons. In addition, the sand recovery area is adjacent to the leina a kaʻuhane, located between approximately 150 feet to nearly 800 feet from the basalt headland. Though the sand recovery area is not on or abutting the leina a kaʻuhane, it will be conducted within sight of both the beach and the headland. Additionally, sand placement on the beach in the North Berm Enhancement area will be adjacent to, but not affecting the basalt promontory.

Hanakaʻōʻō grinding stones are outside of the project area and are not expected to be impacted by the project. Access to the site is not expected to be impacted, either, with direct access from the Hanakaʻōō Beach Park upper parking area outside of the proposed project area.

The iwi kūpuna, inshore of the active beach system and project area, are not expected to be impacted by the project activities. In addition, no excavation of terrestrial project areas is proposed, and thereby the potential for encountering or disturbing iwi kūpuna is minimized. Though the project is an interim action toward sea-level rise adaptation, with a potential life cycle of 20 years, it will provide protection for inland resources, such as iwi kūpuna in the coastal plain.

The currents and wave action in the sand recovery area mobilize sand on a regular basis, as evidenced by the very low fine grain content in the samples from Sand Recovery Area. Moreover, the general absence of an anoxic signature in the upper three feet also indicates high sediment mobility and oxygenation in the sand deposit. These resources and potential impacts from the proposed project are described in detail in the EIS: Sections 1.5.3 Sand Source – Sand Recovery Area, 2.1.8 Nearshore Bathymetry and Coastal Processes, 2.1.9 Sand Characteristics. Based on these findings, it is very unlikely that iwi kūpuna will be encountered or disturbed through the sand recovery process.

Fishing, diving, paddling, and surfing access will be intermittently impacted during the beach restoration processes. Sand recovery and transport will affect access to marine open water and ecologic resources in the immediate footprint of the proposed project. Access issues will be present for the duration of the sand recovery project. Impacts to the marine ecological resources will range from the duration of the project, for species that are mobile and will be displaced by the operations, to one year or less for those species dwelling in and directly affected by sand recovery operations. These resources and potential impacts and mitigation efforts are described in detail in Sections 1.5.3 Sand Source – Sand Recovery Area, 2.1.2 Tides, 2.1.4 Currents, 2.1.5 Offshore Waves, 2.1.7 Offshore Bathymetry, 2.1.8 Nearshore Bathymetry and Coastal Processes, 2.1.9 Sand Characteristics, 2.1.10 Water Quality, 2.1.11 Marine Biology, 2.1.17 Scenic and Open Space Resources, 2.2.5 Coastal and Nearshore Recreation, 2.2.6 Public Health and Safety, 2.5 Secondary and Cumulative Impacts, and 8 Unresolved Issues.

Fishing, gathering, contemplation, and worship along the shoreline will be intermittently impacted during beach restoration processes. Sand delivery, sand transport along the shoreline, and beach restoration actions at the daily work sites will all impact access to and along the shoreline. In addition, the placement of sand on the active beach face in the HLC will also have a short-term impact to coastal ecology. These resources and potential impacts from the proposed project are described in detail in the EIS: Sections 1.5.3 Sand Source – Sand Recovery Area, 2.1.8 Nearshore Bathymetry and Coastal Processes, 2.1.9 Sand Characteristics, 2.1.10 Water Quality, 2.1.11 Marine Biology, 2.1.17 Scenic and Open Space Resources, 2.2.4 Beach Access, 2.2.5 Coastal and Nearshore Recreation, 2.2.6 Public Health and Safety, 2.5 Secondary and Cumulative Impacts, and 8 Unresolved Issues.

To the extent to which traditional and customary native Hawaiian rights are exercised in the project areas, the anticipated impacts from the proposed action are expected to be short-term. Impacts related to access to and around resources will be limited to the duration of the proposed project, expected to be between 63 to 75 days. Impacts to the nearshore environment, including but not limited to waves, currents, and coastal and marine ecosystems, are anticipated to dissipate within one year after completion of the proposed beach restoration project.

The feasible action, if any, to be taken by the state to reasonably protect Native Hawaiian rights if they are found to exist.
Puʻu Kekaʻa: The project was designed to avoid physical contact with any portion of the basalt promontory, Puʻu Kekaʻa, and to minimize interaction with any potential practitioners at the site. The contractor and the State will accommodate the needs and practices of native Hawaiian practitioners in the region during construction (e.g., fishing, diving, paddling, surfing, gathering, worship, etc.) to the extent feasible and to the extent that such allowances do not impact public safety.

Project design will include requirements to maintain access to or cultural use of the Hanakaʻōʻō grinding stones. Engineering practices will be used as mitigation to prevent impacts during implementation of the project. Practices include clearly marking the southern extent of the project area and restricting project activities to the active beach restoration area. Access from the Hanaka'ōō Beach Park upper parking area to the site will be maintained for the duration of the proposed project. If issues arise, then State Historic Preservation Division (SHPD) will be notified, and the Department of Land and Natural Resources (DLNR) will work with the affected community to assess and remediate the situation.

Should any iwi kūpuna or cultural assets be discovered, the proper authority shall be contacted. No excavation is proposed for any terrestrial portion of the project area. An added benefit of the project is that it can provide interim protection from erosion and coastal hazards for inland resources, such as iwi kūpuna in the coastal plain. No iwi kūpuna have been identified in the Sand Recovery Area and the physical characteristics of the site do not support their presence in the area, so impacts to iwi kūpuna are not anticipated from the sand recovery process.

Although it is unlikely that iwi kūpuna are present in the project work area, the State has agreed to conduct archaeological monitoring during the project, as needed.

Fishing, diving, paddling, and surfing access in the project area will be accommodated by the contractor and the State during construction to the extent feasible and to the extent that such allowances do not impact public safety. Upon completion, the project is not expected to impact access to any of these important cultural activities. Impacts to the marine ecological resources affected by the proposed project are anticipated to dissipate within one-year, post-restoration, based on previous studies and analysis of the environment in the proposed project area's footprint.

Fishing, gathering, contemplation, and worship access in the project area will be accommodated by the contractor and the State during construction to the extent feasible and to the extent that such allowances do not impact public safety. Upon completion, the project would not impact access to any of these important cultural activities. Impacts to the coastal ecological resources affected by the proposed project are anticipated to dissipate within one-year, post-restoration, based on previous studies and analysis of the environment in the proposed project area's footprint.

Potential Impacts and Proposed Mitigation Measures

The project team empathizes and apologizes in advance for any impacts to cultural practices or resources. The team has endeavored to draft a design that minimizes the project footprint geographically and the duration of project impacts temporally. These efforts are focused on reducing or negating potential project impacts to the maximum extent possible.

Evaluation of previous studies, investigations related to the EIS, community input, and the proposed projects indicates that the proposed sand recovery and placement locations are located makai of any known archeological features in the Kā'anapali area. Within the KLC, sand in the placement area typically erodes and then recovers in an alternating manner between the northern and southern halves of the beach over summer and winter swell seasons. Within the HLC, the proposed sand placement area is located atop the fossil reef and against the active beach face. The proposed construction methodology in both areas includes no subaerial excavation; therefore, no disturbance to subaerial archaeological resources is anticipated. The offshore sand deposit is marine sands in 28 to 56 feet water depth, and there is currently no archaeological expectation to find iwi kūpuna within this deposit.

While project activities are not expected to affect any known archeological features, project activity will be monitored by a qualified archaeologist, as needed. If a historic property or iwi kūpuna are encountered during operations, all work in the surrounding area will immediately cease, and the appropriate agencies (including the State Historic Preservation Division) will be promptly notified. This is documented in Section 7.2.5 Best Management Practices Plan.

Design and evaluation of the proposed project is based on the expectation of no physical contact, and thus no direct physical impact to Puʻu Kekaʻa.

To the extent to which traditional and customary native Hawaiian practices are exercised in the project areas, such as surfing, diving, fishing, gathering, paddling, worship, and others, the proposed action will affect access to the project site during project construction. Upon project completion, access toproposed action does not appear to affect traditional Hawaiian rights, except possibly for a short period of time during project construction. Upon project completion, the cultural, historical or natural resources customarily or traditionally used by native Hawaiian's are not anticipated to be adversely affected within the area. During construction the contractor and the State will provide schedule updates and maps showing the locations and timing of work. An open ocean access route will be provided between the Sand Recovery Area and Puʻu Kekaʻa, to allow for access to ocean resources and activities in the region. Access to and from the shoreline will be facilitated by the contractor and the State during beach restoration activities, with the exclusion of active work areas on the coastline. Crossing guards will be utilized along sand transport paths to assist the public with access to and from the beach face.

Impacts to the marine and coastal ecology will range from temporary, during beach restoration, to less than one year, based on the previous studies and evaluation of the project area. Subsistence fishermen and gatherers will be impacted during the beach restoration effort and for up to a year post-restoration while these impacts dissipate. Engineering design, as discussed in Section 1.5 Proposed Action and Section 2 Description of the Existing Environment, Potential Impacts of the Proposed Action, and Mitigation Measures, is used to mitigate these impacts by:

- Utilization of a dominant current-parallel sand recovery basin.
- Shallow sand recovery basin design.
- Utilization of an environmental bucket for sand recovery.
- Use of highly beach compatible sand in the restoration effort.
- Tilling of the beach restoration areas at the completion of the proposed project.
- Placement of all sand on either the active beach profile or within the previous footprint of the beach.

~~Public meetings will be held, and the local community will be regularly consulted during project development to solicit community feedback concerning the potential recreational and cultural impacts of beach restoration and berm enhancement activity. Moreover, State Historic Preservation Division (SHPD) will be consulted to determine if any additional cultural best management practices are required. If cultural assets are discovered, all work will cease and the SHPD will be notified.~~

2.2.8 Archaeological Resources

Existing Condition

In 2015, International Archaeology, LLC prepared a literature review for use in a cultural impact assessment for the proposed project. That same year, OCCL initiated consultation with the State Historic Preservation Division on this project. Morgan E. David, then-Lead Archaeologist, Maui Section and Mr. Hinano Rodrigues, Cultural Branch Chief, met in Kāʻanapali for a site visit.

Like other parts of the Hawaiian Islands, West Maui was divided into districts and sub-districts, with the land ruled by the Aliʻi (ruling class). Pre-contact, the land was used primarily for agriculture, where such crops included taro, sugar cane, banana, breadfruit, coconut, and sweet potato. At least 8 heiau (temples) were reported around Lāhainā. The Kāʻanapali coastline was also the site of numerous battles.

The monumental basalt cliff Puʻu Kekaʻa within the project area is mentioned in Hawaiian tradition. Traditional Hawaiian religion sanctifies Puʻu Kekaʻa as a leina a kaʻuhane~~ka uhane~~, or a leaping place for departed souls where deceased spirits passed westward in the direction of the setting sun. ~~This is a transition for the souls into the afterlife. This function has been similarly attributed to westward-facing geographical features on other islands, such as Kaʻena Point on Oʻahu. This association with death and the afterlife might have attracted the large number of iwi kūpuna (pre-western-contact burials) on and around Puʻu Kekaʻa that have been noted in archaeological and historical records.~~ During the late 19th century, thousands of skeletons were reportedly visible on and around Puʻu Kekaʻa, completely covering the sand. Many of these skeletons were likely the remains of fallen warriors, left on the battlefield after days of engagement during Koko O Nā Moku.

Following a decline in the whaling industry in the mid-1800s, the Hawaiian capital moved from Lāhainā to Honolulu, after which the Lāhainā District economy transitioned to commercial sugar cane and pineapple agriculture. Puʻu Kekaʻa was used as a shipping point. Some of the agriculture land was developed into the present-day Kāʻanapali resort region. The expansive agriculture, and the subsequent resort development, reportedly greatly altered the landscape and disturbed the archeological record.

A single archaeological site, the Hanakaʻōʻō grinding stones (SIHP 50-50-03-1204), has been identified outside of the sand placement area in the HLC Beach Restoration subarea (Figure 2-74). The site contains eight smooth, shallow, and roughly circular depressions distributed across the superior surfaces of two basalt boulders. These hoana, or grindstones, were used to shape and sharpen traditional Hawaiian adzes; the depressions were formed by the grinding action (facilitated by sand and water) of innumerable stone tools upon the boulder surfaces. The site is located among a cluster of basalt boulders on the Hanakaʻōʻō Park beach, approximately 30 feet west of the park bathrooms, outside of the sand placement area and proposed project activities.

No archaeological features were identified within the project area beach likely due to several factors: Kāʻanapali beach is seasonally overturned by wave and tidal action; the beach and backshore area has been subject to severe erosion and wave overwash events related to extreme seasonal swell events, Kona storms, and hurricane waves; it has also been highly trafficked by visitors since the adjacent vacation resorts were built on the lands bordering the beach beginning in the 1960s. Given these conditions, any prehistoric or historic resources formerly located on the beach would almost certainly have been lost long ago. The offshore sand areas are highly unlikely to contain in situ cultural resources as these areas are subject to the same dynamic waves, storms, and current forces as the beach itself. Moreover, no underwater archaeological sites have been identified in the proposed project area during previous archaeological investigations nor have any sites been observed during site investigations of the area over the past ten years. Most recently, in 2019, a video survey was conducted in the sand borrow area to ensure the whole seafloor is clear of debris and macrofauna. A map showing the location of the video survey transects has been added to the EIS, in Section 2.1.11 Marine Biology. No objects, including potential archaeological sites or macrofauna, have been found in the proposed sand recovery area.

Figure 2-74. Hanakaʻōʻō Grinding Stones

Potential Impacts and Proposed Mitigation Measures

The CIA, completed in 2016 and included as Appendix A – Cultural Impact Assessment (International Archaeology, LLC)~~Appendix A – Cultural Impact Assessment (International Archaeology, LLC)~~, presents a thorough discussion on the previous archaeological investigations that have been performed in the region. Evaluation of these previous studies and the proposed projects indicates that the proposed sand recovery and placement locations are located makai of any known archeological features in the Kāʻanapali area. Within the KLC, sand in the placement area erodes and then accretes during the following swell season. Within the HLC, the proposed sand placement area is located atop the fossil reef and against the active beach face. The placement plan for the proposed beach restoration project~~HLC~~ does not include disturbance of the backshore geology typically associated with historic burials. ~~The offshore sand deposit is marine sands in 28 to 56 feet water depth, and there is no archaeological expectation to find iwi kūpuna within this deposit (International Archaeology, LLC, 2015).~~

While project activities are not expected to affect any known archeological features, ~~all~~ project activity will be monitored by a qualified archaeologist, as needed. If a historic property or iwi k~~k~~ūpuna are encountered during operations, all work in the surrounding area will immediately cease, and the appropriate agencies (including the State Historic Preservation Division) will be promptly notified. ~~The full extent of monitoring will be determined during the development of an Archaeological Monitoring Plan, which will be reviewed and approved by the SHPD before project construction begins.~~

The offshore sand deposit consists of marine sands in 28 to 56 feet water depth, and there is no archaeological expectation to find iwi kūpuna within this deposit (International Archaeology, LLC, 2015). The proposed project includes the recovery of sand from a marine sand deposit and placement of the sand atop and makai (seaward) of the existing dry beach. No excavation of the coastal plain is proposed. No further development of the backshore is planned as part of this proposed project or expected to occur as a result of the proposed project. Previous impacts, especially those associated with disturbances to iwi kūpuna, were associated with agricultural and development activities in the coastal plain. There is not expected to be a geographic overlap between historic development in the region and the beach restoration activities proposed in the EIS, so negative impacts are not anticipated from the proposed project. Assessment of cumulative impacts was limited to the geographic area of the proposed project. No secondary impacts are anticipated. No mitigation efforts are proposed at this time.

~~The proposed construction methodology includes no subaerial excavation; therefore, no disturbance to subaerial archaeological resources is anticipated.~~

2.2.9 Economy and Labor Force

Existing Condition

Before Kāʻanapali became a tourist destination, the West Maui economy was largely based on agriculture, including sugar cane and pineapple. In the early 20th century, immigrant workers lived in plantation camps that dotted the landscape. Evidence of West Maui's plantation history are still visible today at the Kekaʻa Landing Pier on the north side of Puʻu Kekaʻa, the Hanakaʻōʻō Cemetery behind Hanakaʻōʻō Beach Park, and the Lāhainā, Kāʻanapali, and Pacific Railroad (the "Sugar Cane Train") located inland of the Kāʻanapali Resort.

Post-war Maui saw a sharp decline in population due to the decline of the sugar and pineapple industries and the bourgeoning Oʻahu and mainland U.S. economies. Maui lost 24 percent of its population from 1940 to 1960 as the younger generation left in search of employment. In 1959, the *Report of Land Use for the Island of Maui*, prepared by Community Planning Inc., identified tourism as a potential solution to reversing the downward population trend on the island. Later in 1959, Amfac, Inc. (formerly American Factors) began developing the Kāʻanapali shoreline into a master-planned resort destination area, the first of its kind in Hawaiʻi. Over the next 50 years, extensive construction took place along Kāʻanapali Beach, and the backshore is now fully developed with resort hotels and condominiums.

The present-day West Maui economy is especially dependent on tourism, with Kāʻanapali Resort contributing an estimated $3 billion annually in economic impact during normal operations. During typical years, Kāʻanapali employs roughly 5,000 people, provides nearly $230 million in income, pays approximately $180 million in State and County taxes, not including income tax on the $230 million, donates more than $1 million to support nonprofits, and provides more than $5 million in community service and support.

During a 2008 study of Waikīkī Beach on Oʻahu, visitors said they are less likely to return if Waikīkī Beach is eroded or unavailable. Visitors to Kāʻanapali would likely have a similar response to beach erosion.

Potential Impacts and Proposed Mitigation Measures

The proposed project is expected to create up to 100 temporary construction and construction-related jobs. The proposed project would not create any permanent positions; however, a restored beach does improve the longevity and security of jobs related to beach health and coastal industries. Following the economic decline of the 1950's and the exodus of Maui's youth, there was a conscious decision to focus on tourism to rebuild the economy, creating local jobs. Today, much of island's economy is based on the tourism, so beach improvements are likely to have a positive effect on the local economy.

2.2.10 Population

Existing Condition

The region of West Maui has a permanent population of 28,300 settled over approximately 37.6 square miles, with the major population center being Lāhainā. The high density of hotels and condominiums results in a high transient population in West Maui that can at times outnumber the permanent residents.

Potential Impacts and Proposed Mitigation Measures

The proposed project is anticipated to have a negligible impact on transient or permanent population characteristics.

2.2.11 Housing

Existing Condition

There is no residential housing within Kā'anapali Resort and minimal housing located nearby. The nearest residential housing is mauka of Honoapi'ilani Highway. Most residential housing in West Maui is concentrated in Lāhainā, south of the project site.

Potential Impacts and Proposed Mitigation Measures

The proposed project is anticipated to have a negligible impact on housing.

2.3 Public Services

2.3.1 Solid Waste Disposal

Existing Condition

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.

Potential Impacts and Proposed Mitigation Measures

The proposed project is anticipated to have a negligible impact on solid waste disposal. Minimal construction waste is anticipated to be generated from the proposed project.

2.3.2 Medical Facilities

Existing Condition

Currently, the nearest hospital to Kā'anapali is the Maui Memorial Medical Center in Kahului. Ambulance service is operated under a state contract with American Medical Response (AMR). Two units operate in West Maui, out of the Napili Fire Station and the Lāhainā Comprehensive Health Center. Other health services in West Maui include the Maui Medical Group, Lāhainā Physicians, West Maui Healthcare Center, Kaiser Permanente's Lāhainā Clinic, and other small private practices.

The West Maui Hospital and Medical Center, if completed, would include a 24-hour emergency room with 25 critical access beds and three operating rooms. Also, on the campus would be a 40-bed Skilled Nursing Facility, a 40-bed Assisted Living Facility and a 40-bed Drug and Alcohol Rehabilitation Facility. Two new medical office buildings would provide clinical care as well.

Potential Impacts and Proposed Mitigation Measures

The proposed project is not anticipated to have a long-term~~an~~ impact on medical facilities in West Maui. The coastline and nearshore waters at and around the proposed project are currently one of the most dangerous shorelines in the State based on reported injuries. The project is not anticipated to cause a long-term change to the physical processes leading to these reported injuries.

2.3.3 Police and Fire Protection

Existing Condition

Law enforcement in West Maui is provided by the Maui Police Department, Lāhainā District. The Lāhainā Police Station is located at the Lāhainā Civic Center. Fire protection in West Maui is provided by the Maui County Department of Fire and Public Safety. Two fire stations are located in West Maui: the Lāhainā Fire Station, located at the Lāhainā Civic Center, and the Napili Fire Station, located on Honoapiʻilani Highway in Napili.

Potential Impacts and Proposed Mitigation Measures

The proposed project is not anticipated to have an impact on police and fire protection.

2.3.4 Schools

Existing Condition

The State of Hawaiʻi Department of Education (DOE) operates four public schools in West Maui. Additionally, two private schools serve the Kāʻanapali area. The University of Hawaiʻi Maui College operates the Lāhainā Education Center, which provides higher education opportunities to the area. West Maui schools are listed in Table 2-10.

Table 2-10. West Maui Schools and Educational Facilities

School	Type	Location
Kamehameha III	Elementary	Lāhainā
Princess Nāhiʻenaʻena	Elementary	Lāhainā
Lāhainā	Intermediate	Lāhainā
Lāhaināluna	High School	Lāhainā
University of Hawaiʻi Maui College (Lāhainā Ed Center)	Higher Education	Lāhainā
Maui Preparatory Academy	Private (PK-12)	Napili
Sacred Hearts School & Early Learning Center	Private (PK-8)	Lāhainā

Potential Impacts and Proposed Mitigation Measures

The proposed project is not anticipated to have an impact on schools and education facilities as it does not result in an increase in student count, decrease in teacher availability, or impact on DOE infrastructure.

2.3.5 Recreational Facilities

Existing Condition

Public recreational facilities in West Maui are concentrated in Lāhainā, including the Lāhainā Civic Center, the Lāhainā Aquatic Center and Skate Park, and the Lāhainā Recreation Center. The Kāʻanapali Resort has two 18-hole golf courses that are open to the public. The canoe regatta course offshore of Hanakaʻōʻō Beach Park can also be used by the public.

Potential Impacts and Proposed Mitigation Measures
The proposed project is anticipated to have a negligible impact on recreational facilities. Brief disruptions will occur in the canoe area at Hanakaʻōʻō Beach Park during sand placement operations. No offshore construction activity associated with the primary construction methodology is anticipated in the vicinity of Hanakaʻōʻō Beach Park that would prevent the use of the regatta course.

2.4 Infrastructure

2.4.1 Roadways

Existing Condition
West Maui is served by Honoapiʻilani Highway (Hawaiʻi Route 30). This is the only highway that provides vehicle access between West Maui and Kahului, the main population center of the island. Most traffic into and out of the Kāʻanapali Resort is via Kāʻanapali Parkway. Kekaʻa Drive also allows vehicle access between Kāʻanapali Resort and Honoapiʻilani Highway.

Potential Impacts and Proposed Mitigation Measures
Some large construction equipment is not available locally in West Maui, and some specialized equipment will have to be sourced from off-island. Construction mobilization and demobilization, therefore, will require bringing in large equipment from Central Maui and Kahului to West Maui via Honoapiʻilani Highway. Impacts to traffic patterns are anticipated to be minor during mobilization and demobilization efforts.

After demobilization, the proposed project is not anticipated to have an impact on the West Maui roadways.

2.4.2 Water System

Existing Condition
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 takes place at the Lāhainā Water Treatment Facility above Lāhaināluna High School. The average daily production is 1.6 million gallons per day.

Potential Impacts and Proposed Mitigation Measures
The proposed project is anticipated to have a negligible impact on the water system in West Maui as the construction methodology does not require the use of potable water.

2.4.3 Wastewater System

Existing Condition
Wastewater in Kāʻanapali is treated at the Lāhainā Wastewater Reclamation Facility (WWRF), located 2 miles to the north of the project site. Treated wastewater is either used to supplement irrigation of the Kāʻanapali golf courses or it is disposed into injection wells

at the facility. A tracer study (Glenn 2013) demonstrated a hydrogeologic connection between the injection wells at the Lāhainā WWRF and West Maui coastal waters.

Potential Impacts and Proposed Mitigation Measures

The proposed project is not anticipated to have an impact on the wastewater system or the hydrogeologic connection between the Lāhainā WWRF and the nearby coastal waters as the construction methodology does not result in wastewater production that would be input into the system nor changes to the coastline or nearshore areas adjacent to the WWRF.

2.4.4 Drainage System

Existing Condition

The Kāʻanapali Golf Courses lagoon water features provide drainage for the Kāʻanapali Resort. The lagoons have an outlet to the ocean via four diffuser pipes that run under the Hyatt Regency into the paleochannel.

Potential Impacts and Proposed Mitigation Measures

The proposed project is anticipated to have a negligible impact on the drainage system. The beach restoration fronting the Hyatt would restore the beach to the position shown in the 1988 aerial photo. The diffuser pipes in the paleochannel were built prior to 1988 and functioned properly under full beach width conditions; therefore, their performance should not be affected by the restored sand volume.

2.4.5 Electrical, Telephone, and Cable Television Services

Existing Condition

Electrical service to West Maui is provided by Maui Electric Company, Ltd. Hawaiian Telecom provides telephone service and Spectrum provides cable television service. No electrical, telephone, or cable television (CATV) infrastructure is located in the project area. Underground cables may be located where equipment will access the beach.

Potential Impacts and Proposed Mitigation Measures

The proposed project is not anticipated to have an impact or interruptions to electrical, telephone, and CATV services or infrastructure.

2.5 Secondary and Cumulative Impacts

Secondary impact, as defined in HAR §11-200-2:

"means effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems."

Secondary Impacts 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 of the impediments to growth.

Cumulative impacts, as defined in HAR §11-200-2:

"means the 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."

Cumulative impacts can be viewed as sum product of actions, past and present, on the project site and resources within the project site.

The Proposed Action does not create any new structures or uses. The proposed project is for is a restoration of an existing natural resource, with no expansion of uses and no additional improvements. The existing sand project and only intends to return the beach will be restored using recovered beach quality sand and the special coverage of the beach will not extend beyond to a previous extents.

Assessment of the Proposed Action for Secondary Impacts:

- condition. There will be no changes in land use, that of a sand beach, that would encourage further development.
- A certified shoreline will be surveyed and officially recorded with the State Department of Accounting and General Services – Survey Division as part of the permit process, establishing the shoreline prior to the project. Future developments will be limited to setbacks based on the pre-construction shoreline location until such time as the shoreline migrates mauka of the pre-construction location.
- Setbacks for development in the There will be no changes or additions to existing backshore are calculated and implemented during the County permitting process, prior to construction. These setbacks are calculated based on the location of a certified shoreline. A certified shoreline will be completed prior to the Proposed Action as part of the permit process, establishing a baseline in the infrastructure including parking and public record under current, pre-restoration, conditions for beach access paths. No future setback calculations. Setback requirements based on certified shorelines will continue to be employed, according to Hawaii Revised Statute §205A and Maui County Shoreline Rules Chapter 203, regardless of implementation of a shoreline project in the region.
- The restoration effort will provide additional sand volume to the littoral cells, mitigating erosion pressure for the coming years to decades; however, the certified shoreline location will be based on current conditions. This provides the double benefit or erosion mitigation and conservative setback locations for any potential future development projects in the region.

- Because of the shoreline and setback rules, an increase in density or makai migration of development is very unlikely to result from the Proposed Action. As evidence, there is no history of makai migration of development occurring due to beach restoration projects in the State of Hawaiʻi.
- The entire placement area, including the restored beach in the HLC, is within the State Conservation District and is State submerged land. Restoration of the beach does not affect private property boundaries, development rights, or result in expansion of existing uses on the shoreline.
- Presentation, review, and analysis of the current coastal conditions; projected future trends for the shoreline; and sea level rise impact assessments have all been central to the development of the Proposed Action by the State and KOA. These data and consequent discussions~~or actions~~ are presented throughout the EIS, starting with the Executive Summary. Secondary impacts to the economy may occur based on the Proposed Activity's incentivization, through increased awareness and understanding of coastal hazards and sea level rise risks, for coastal landowners to begin assessing potential long-term managed retreat strategies.
- Secondary impacts to the economy may occur based on improved tourist spending due to improved coastal resources, without increased density.
- Some studies have shown that long-term, multi-decadal beach nourishment programs can skew long-term erosion rates calculations and public perception of hazards. These data come from the US Atlantic Coast, where many nourishment programs have been operating for sixty or more years. Typically, these programs have placed millions of cubic yards of sand, expanding beaches along many miles of coastline. Locations where erosion rate calculations show changes from the longer-term trends are areas where the cumulative volume of sand, combined with the scale of project areas and many decades of placement, have changed the dynamics of the coastline. These project areas and long-term nourishment programs are not analogous to the Proposed Action, which is 75,000 cubic yards of sand, versus millions of cubic yards of sand, placed along approximately 7,450 feet of shoreline, versus many miles of shoreline.
- For the project site, coastal management now and into the foreseeable future will rely on a range of design and adaptation options that are best suited to local needs, priorities, and capabilities. The suitability of various design and adaptation options will continue to evolve based on the latest scientific projections for sea-level rise, observed erosion and flooding impacts, and availability of government programs and policies to support implementation of managed retreat or other adaptation measures. Additional restoration efforts may be suitable options in the coming decades, and should not be ruled out; however, that does not negate the need for parallel investigation of and eventual adoption of other long-term management and adaptation options. Beach restoration is a short to mid-term solution, intended to restore coastal resources while long-term solutions are investigated and implemented.
- Current statutory restrictions, with the recent (2020) Act 16 amendments to the Hawaiʻi Coastal Zone Management Act HRS §205A, act as deterrent for unsafe development along the shoreline. Moreover, the County of Maui has proposed amendments to their Shoreline Setback (Chapter 203) and Special Management Area (Chapter 202) rules, which are applied landward of the Certified Shoreline, and would further rely on and adapt for projected increasing hazards with sea-level rise.

- Assessment of the No Action alternative indicates that the absence of a coastal management strategy in the region results in significantly worse short-term shoreline responses, and negative impacts to regulatory and resources agencies, as well as adjacent landowners and the local economy.
- Notaking place nor will be required to take place in the ocean environment at Kāʻanapali Beach after the Proposed Action has been completed. As a result, no cumulative or secondary impacts are anticipated to the adjacent or regional marine ecosystems based on current or previous beach restoration actions in the State of Hawaiʻi. for the Proposed Action.
- The sand recovery site is described in detail in the EIS in Section 1.5.3, and anticipated changes to the seafloor are discussed in Section 2.1.7 Offshore Bathymetry. This section details the anticipated changes to the sand recovery area during and after the restoration project. Both empirical data from similar recovery basin designs and model results using site and project specific data agree that long-term changes to the recovery site will be minimal. Following completion of the project, the primary change to the sand recovery area is expected to be flattening of the steep margins in the sand around the perimeter of the recovery area. After the slopes on the margins flatten, the broad and shallow depression is expected to behave similarly to the adjacent sand field. The basin is not anticipated to become a sediment sink, pulling a large volume of sediment from the regional sand field, rather, after the post-recovery margins smooth to more gradual slopes, sand transport in the regional sand field is projected to function in a similar manner to the pre-recovery condition. Thus, no long-term or secondary impacts are expected from this effort.
- Investigations done as part of the Waikīkī Sand Replenishment Project in 2012 included an evaluation of changes in the benthic infaunal communities before and after sand removal. Results were inconclusive and showed a larger change in the infaunal community structure through time at the control sites than at the impact sites (Forsman, et al, 2012). It is anticipated that the infauna organisms in the sand recovery area will be lost during dredging and subsequent relocation to Kāʻanapali Beach. The time it will take for infauna to recover in the sand borrow area is unknown but is projected to be fast owing to the small size and rapid recruitment and regeneration time of most infaunal animals (Bailey-Brock and Krause, 2008). Many infaunal invertebrates are reproductively active throughout the year. As a result, these organisms will likely be recruited to the borrow area from adjacent non-impacted sand deposits relatively quickly. Some species may also repopulate the borrow area through the transport of their pelagic larval phase by local currents. Based on these studies, neither long-term nor secondary impacts are expected to the infaunal community in the sand recovery area.
- Sandy substrate in the sand recovery area has been surveyed, probed, sampled, and tested to thicknesses deeper than the proposed recovery effort. Sediment throughout the area, at depths deeper than the recovery effort, has produced similar results for grain size distribution and carbonate content. Post-recovery, after the basin has smoothed the perimeter slopes, the sandy substrate inside and outside of the basin will be of similar character, so no long-term changes to the character or the post-project shape of the substrate are expected after sand recovery is completed.

- Given the projected outcomes, including the continuity of sand content through and beyond recovery depth in the offshore sand field, the minor changes expected to the regional bathymetry, and the rapid infauna recovery, there is no expectation that the new sand surface would change the character or nature of nearshore ecology as a long-term or secondary impact. Based on this research and site-specific assessment, no long-term or secondary impacts are anticipated for native fish habitat and traditional and cultural fishing practices located at the sand recovery area.
- There is the potential to impact public safety as the seafloor and nearshore environment interact with the additional sand volume within the proposed sand placement areas. Kāʻanapali Beach presently has one of the highest incidences of injury and drowning in the State for coastal and nearshore recreation and practices due occasional rough ocean conditions and relatively high numbers of inexperienced users. Changes to seafloor conditions, currents, and wave characteristics may result from this project in and around the surf zone. These changes have the potential to affect public safety at the project site and emergency services requests based on those potential changes.

Assessment of the Proposed Action for Cumulative Impacts:

- This project does not propose to alter any existing uses or change the nature of the existing natural resources within the Proposed Action area.
- Cumulative impacts, though spanning a period of time, are addressed for Proposed Action's impact area.
- Proposed and conceptualized projects beyond the immediate and abutting littoral cells and abutting nearshore marine ecosystems are outside of the scope of projected and assessed cumulative impacts for the Proposed Action. The project area is isolated from littoral cells to the north and south by natural rocky shoreline.
- Pre-existing impacts on the terrestrial environment, mauka of Proposed Action's site in State submerged lands, were outside of the scope of the projected and assessed cumulative impacts.
- Beaches provide erosion protection to the coastal plain and terrestrial lands. Though the project may provide additional coastal hazard protection to these areas, no negative impacts are anticipated to either the land, terrestrial resources, or terrestrial improvements. A fortuitous benefit of beach restoration is protection of the remaining iwi kūpuna that may still lie *in situ,* mauka of the shoreline. Since the Proposed Action, beach restoration, is entirely makai of the certified shoreline (highest wash of the waves) and coastal plain, no negative impacts to iwi kūpuna are anticipated, thus, no cumulative impacts to iwi kūpuna are anticipated.
- No archaeological sites have been identified in the Proposed Action's footprint on the beach. To date, no archaeological sites have been discovered in or under the seafloor in the sand recovery area. As such, no cumulative impacts to archaeological sites are anticipated.
- Potential impacts to cultural resources were identified as a critical design consideration for any beach restoration project in the area, to be avoided and minimized to the greatest extent possible. A key design parameter was avoiding contact with, and maximizing distance from, any potential or known cultural resources in the region, including Puʻu Kekaʻa. The project is designed to be no closer than 150 feet to the basalt headland, with the sand recovery area located between 150 feet to more than 800 feet from the

promontory. Puʻu Kekaʻa is considered a leina a kaʻuhane. The CIA concluded that though the construction work in this region is not anticipated to impact cultural practices, there may still be a contentious response from individuals within the Native Hawaiian community due to the proximity of the project to Puʻu Kekaʻa. On November 18, 2020, the project was presented to the Maui Island Burial Council who voted to oppose the project. The analysis of impacts to cultural resources is separate and distinct from the analysis of potential reactions from a previously affected community or culture. Though a contentious response can be understood and empathized with, it is not reflective of actual contact with and impacts to the resource itself, which is a large basalt promontory on the coastline.

As a result of the above analysis, no Secondary or Cumulative impacts are anticipated for the Proposed Action, except for potential changes to public safety and emergency services resulting from potential changes to the nearshore seafloor, currents, and wave characteristics at the project site. The proposed mitigation for potential impacts to public safety and emergency services is to require appropriate signage along the shoreline, educating and warning beach and ocean users of the temporary changes to access and safety measures.

3. REGULATORY CONTEXT

Shorelines, beaches, and nearshore waters in Hawaiʻi are considered part of the Public Trust, with access and use available to all people. As a result, Hawaiʻi's shorelines are heavily regulated. The current definition of the "shoreline" in Hawaiʻi is as follows:

> "*Shoreline* means the upper reaches of the wash of the waves, other than storm or seismic waves, at high tide during the season of the year in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth, or the upper limit of debris left by the wash of the waves (HAR §13-222)."

Generally, county jurisdiction begins at the shoreline and extends landward. State jurisdiction begins at the shoreline and extends seaward. Federal jurisdiction 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); this area is also defined as the "navigable waters of the United States". Figure 3-1 shows relevant permit jurisdiction lines for shoreline construction in Hawaiʻi.

The county, state, and federal governments all have different objectives and rules regulating what can and cannot be done along the shoreline. Therefore, the definition and location of the "shoreline" is critical for the planning and permitting of any coastal construction. The *Certified Shoreline* is a line established by a licensed land surveyor and certified by the State, which reflects the shoreline definition stated above. The Certified Shoreline is valid for one year and is used to establish jurisdiction and Shoreline Setback boundaries.

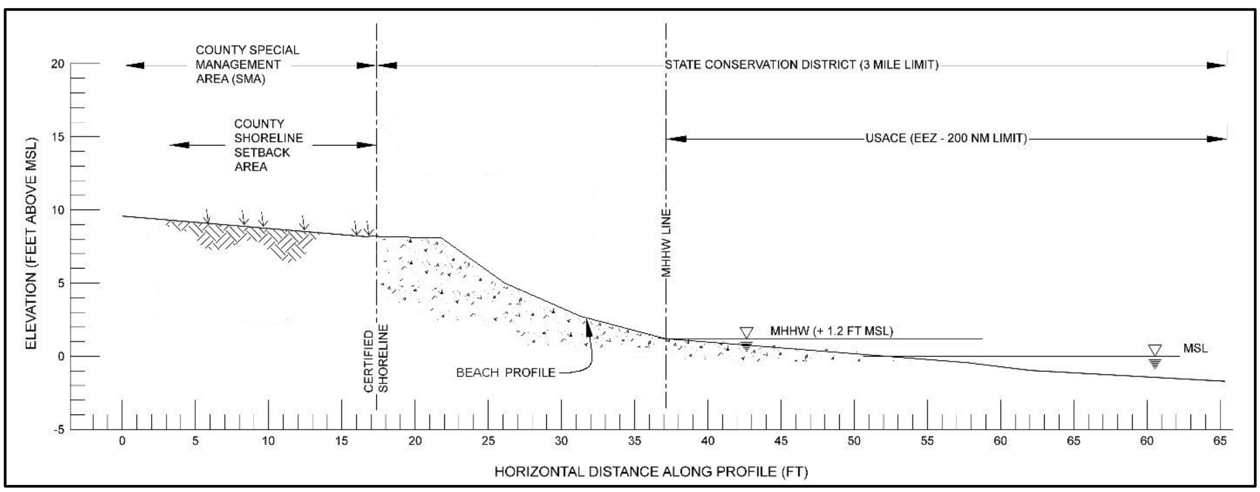


Figure 3-1. Relevant permit jurisdiction lines for shoreline construction in Hawaiʻi

3.1 Federal Laws and Regulations

Federal jurisdiction begins at the mean higher high water (MHHW) line and extends out to the boundary of the United States EEZ, 200 nautical miles offshore. This area is defined as the navigable waters of the United States.

3.1.1 Section 10 of the Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 (33 USC §403) requires a Department of the Army (DA) permit for any activity that obstructs or alters navigable waters of the U.S., 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 project will involve placing sand in the navigable waters of the U.S. it will require a DA permit issued pursuant to Section 10.

3.1.2 Clean Water Act

The Clean Water Act (CWA) of 1972 (33 USC §1344) is the key legislation governing surface water quality protection in the United States. The Clean Water Act (CWA) of 1977, as amended (33 USC §1251 et seq.), is the major federal legislation concerning the improvement of the nation's water resources. The CWA amended the Federal Water Pollution Control Act and requires federal agency consistency with state nonpoint source pollution abatement plans. Amended again in 1987, the CWA strengthens enforcement mechanisms and regulations for stormwater runoff, providing for the development of industrial and municipal wastewater treatment standard, and a permitting system to control wastewater discharges to surface waters.

Sections 401, 402, and 404 of the Act require permits for actions that involve wastewater discharges or discharge of dredged or fill material into waters of the United States.

3.1.2.1 Section 401 and 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 U.S. Army Corps of Engineers (USACE). Dredging activities and placement of fill trigger the need for a Section 404 permit.

For projects which require a Section 404 permit, a Section 401 Water Quality Certification (WQC) is also required. In Hawaiʻi, the U.S. Environmental Protection Agency has delegated responsibility for implementing Section 401 of the Act to the State Department of Health, Clean Water Branch (DOH-CWB). See Section 3.2.4 for more information regarding the WQC.

3.1.2.2 Section 402

Discharges of point sources of pollutants into surface waters of the U.S. are controlled under the National Pollutant Discharge Elimination System (NPDES) program, pursuant to Section 402 of the CWA. Pursuant to the CWA and amendments, states may be authorized to administer permit programs. The Hawaiʻi Department of Health (DOH), Clean Water Branch, under HAR §11-55, administers the NPDES program in Hawaiʻi.

3.1.3 Coastal Zone Management Act

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). The State of

Hawaiʻi developed Chapter 205A, HRS (the Hawaiʻi CZM Program) in 1977, which was later approved as a CZMP under the Act in 1978. A CZM Consistency Determination would be handled by the State of Hawaiʻi, Office of Planning, CZM Program, and is described in Section 3.2.3.

3.1.4 Archaeological and Historic Preservation Acts

The National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470 et seq.) established a program for the preservation of historic places throughout the United States. The Act requires Federal agencies having direct or indirect jurisdiction to take into account effects on any district, site, building, structure, or object that is included or is eligible for inclusion in the National Register of Historic Places (NRHP) prior to the approval of expenditure of any funds or issuance of any license or permit.

Consultation with the State Historic Preservation Division (SHPD) will be accomplished to ensure that the Proposed Action complies with the provisions of the NHPA. A NHPA Section 106 review will be accomplished during the Department of the Army permit processing for work in the water.

3.1.5 Clean Air Act

The Clean Air Act (CAA) and amendments (42 USC §7401 et seq.) comprise the comprehensive federal law that regulates air emissions from area, stationary and mobile sources. This law authorizes the U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. Pursuant to the CAA and amendments, state-operated permit programs serve to control emissions. In Hawaiʻi, the state operating permit program is implemented by the DOH, and emissions of regulated air pollutants within the state may be subject to permitting as required under HAR §11-60.1.

3.1.6 Endangered Species Act

The Federal Endangered Species Act (ESA) of 1973 (16 USC §1531 et seq.) establishes a process for identifying and listing threatened and endangered species. It requires federal agencies to carry out programs for the conservation of federally listed endangered and threatened plants and wildlife and designated 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. Section 7 of the ESA requires consultations with federal wildlife management agencies on actions that may affect listed species or designated critical habitat. Section 9 of the ESA prohibits the "taking" (through harm or harassment) of endangered species without an agency-issued permit. Section 7 consultation is accomplished during the Department of the Army permit processing for work in the water.

3.1.7 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (16 USC §1801 et seq.), as amended by the Sustainable Fisheries Act, PL 104-297, calls for action to stop or reverse the loss of marine fish habitat. The waters out to 200 nautical miles around the Hawaiian Islands are under the jurisdiction of the Western Pacific Regional Fishery Management Council (WPRFMC). The WPRFMC has approved a Fisheries Management Plans (FMP) for Hawaiʻi that designates all the ocean waters surrounding Maui, from the shore to depths of over 100 feet, including the area that would be affected by the Proposed Action as "Essential Fish Habitat" (EFH).

The proposed project is located within waters designated as EFH (including water column and all bottom areas) for coral reef ecosystem, bottomfish, pelagic and crustacean Management Unit Species (MUS).

The WPRFMC has also defined "Habitat Areas of Particular Concern" (HAPC). As defined in the 1996 amendments to the Act, these habitats are a subset of EFH that are "rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area." The area that would be affected by the proposed project is not within a HAPC.

EFH consultation is accomplished during the Department of the Army permit processing for work in the water.

3.1.8 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 USC §31), as amended, prohibits (with exceptions) the taking (i.e., harassment, hunting, capture or killing, or attempting to harass, hunt, capture or kill) of marine mammals in waters of the U.S. The implementing regulations at 50 CFR 216 identify definitions, prohibitions, exceptions, permit restrictions, and conditions associated with the MMPA.

3.1.9 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 USC §703 et seq.), establishes protections for migratory birds and prohibitions including those related to activities which "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export…" unless permitted by regulations. The MBTA prohibits the relocation of listed species without a permit from the U.S. Fish and Wildlife Service. 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.

3.2 State of Hawaiʻi Laws and Regulations

Beaches and nearshore submerged lands seaward of the certified shoreline are administered by the State Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL). Furthermore, permitting and enforcement of some Federal regulations have been delegated to State agencies.

3.2.1 Chapter 343, Hawaiʻi Revised Statutes

Chapter 343 HRS establishes the system of environmental review for proposed projects which ensures that environmental concerns are given appropriate consideration in decision making, along with economic and technical considerations. The Chapter establishes various circumstances that would necessitate the preparation of an Environmental Assessment or an Environmental Impact Statement.

State-funded projects and work within the State Conservation District are actions that require preparation and processing of an Environmental Assessment or an Environmental Impact Statement (EIS) per Hawai'i Revised Statutes (HRS) Chapter 343. The Proposed Action involves work within the State Conservation District. Furthermore, the project is receiving State funding through an MOU between the DLNR and KOA.

As the project could potentially have local and vicinity-related impacts along a broad reach of shoreline, an EIS is being prepared. Under Act 172 (12), the DLNR determined, based on their judgment and experience, that an EIS was likely to be required for the Proposed Action, and, therefore, allowed SEI not to prepare an EA and instead proceed directly to the preparation of an EIS Public Notice as the first step toward completion of the EIS process.

3.2.2 State Land Use Districts

Pursuant to Chapter 205A, Hawai'i Revised Statutes, all lands in the State have been divided and placed into one of four land use districts by the State Land Use Commission. These land use districts have been designated "Urban", "Rural", "Agricultural", and "Conservation". Conservation District lands are further broken down into four (4) subzones that dictate what types of development 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 has an additional subzone – Special, which is unique for each location it is applied to.

Coastal Lands include beaches, dunes, and rocky shorelines that are seaward of county jurisdictions. The Coastal Lands in the location of the Proposed Action are considered part of the Conservation District, Resource Subzone. The DLNR Office of Conservation and Coastal Lands (OCCL) is responsible for the management of these coastal resources. The Board of Land and Natural Resources (BLNR) regulates uses of the State Conservation District by issuing Conservation District Use Permits (CDUP) for approved activities.

3.2.2.1 State Conservation District

The Board of Land and Natural Resources (BLNR) regulates uses of the State Conservation District by issuing Conservation District Use Permits (CDUP) for approved activities. Statutes governing use administration procedures of the Conservation District are written in Hawai'i Revised Statutes, Chapter 183C (HRS Chapter 183C Conservation District). The administration is further clarified by the Hawai'i Administration Rules, Title 13, Chapter 5 (HAR Chapter13-5 Conservation District).

The identified land use for the Proposed Action is defined in HAR §13-5-22 P-16 Beach Restoration. As specified in HAR §13-5-24(a), the proposed use is permitted in the Resource Subzone with the issuance of a BLNR-approved "D-1" (Board) Conservation District Use Permit for sand placement in excess of 10,000 cubic yards:

> *"Sand placement in excess of 10,000 cubic yards 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."*

The criteria that the DLNR-OCCL will use in evaluating proposed actions within the State Conservation District are outlined in Hawai'i Administrative Rules §13-5-30. Each criterion is listed below, followed by a discussion of how the Proposed Action complies with it.

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

  Discussion: HAR §13-5-1 states 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." The proposed project is a beach restoration effort that is anticipated to protect and improve the important public trust resource, Kā'anapali Beach. The proposed project is designed as a management tool to promote the long-term sustainability of the beach resource, while also not materially impacting public health, safety, and welfare.

  The proposed project is not expected to alter the existing land use. The project is expected to restore the public beach, improve recreational resources, improve coastal lateral access, and restore the historical sandy nearshore ecosystem. This is consistent with the purpose of the State of Hawai'i Conservation District.

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

  Discussion: HAR §13-5-13 Resource (R) subzone states that the "…objective of this subzone is to ensure, with proper management, the sustainable use of the natural resources of those areas." The proposed action is an identified land use within the Resource subzone of the Conservation District, ~~according~~ pursuant to HAR §13-5-22, P-16, BEACH RESTORATION (D-1) Sand placement in excess of 10,000 cubic yards 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.

  As stated above, the proposed project is designed as a management tool to promote the long-term sustainability of the beach resource, while also not materially impacting public health, safety, and welfare. The proposed action involves the recovery of up to 75,000 cubic yards of sand from deposits located offshore of the beach~~Pu'u Keka'a~~ in a water depth of about 28 to 56 feet; transporting the sand to two or more onshore collection points on Kā'anapali Beach; and transport of the sand along the shore and placement to the design beach profile.

  The proposed project is not expected to alter the existing land use. The project is expected to restore the public beach, improve recreational resources, improve coastal lateral access, and restore the historical sandy nearshore ecosystem. This is consistent with the purpose of the State of Hawai'i Conservation District.

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

  Discussion: Detailed discussion of the proposed project's relationship to the Hawai'i Coastal Zone Management Program is presented below in Section 3.2.3 of this EIS.

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

  Discussion: Nourishment and restoration~~maintenance~~ of the existing sandy beach resource will contribute to the preservation and continuation of this natural resource. The offshore sand to be used to nourish the beach is essentially a sustainable resource in the context of the scope and scale of the proposed project. The offshore sand in large part is believed to have come from the shore through natural processes of offshore sand transport by waves and currents, and these processes are expected to continue. The proposed project would manually recycle the sand from offshore back onto the beach.

  Other than temporary, short-term environmental impacts during construction, the proposed project would not result in impacts which can be expected to degrade the environmental quality in the project area. Rather, the project would restore and maintain a valuable coastal resource. The addition of sand to the beach will improve the natural beach environment within the community without the addition of artificial structures.

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

  Discussion: The project is the restoration and management~~maintenance~~ of an existing public sand beach. The proposed land use does not include the erection of buildings, structures, or facilities. The proposed beach restoration effort is intended to improve the natural, public trust resource along the coastline. The beach restoration and berm enhancement project uses offshore sand that is compatible with the existing physical conditions of the beach fronting the project parcels. No new beach stabilization structures will be constructed, and the beach size will not exceed its 1988 limits.

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

  Discussion: The beauty of Kā'anapali's coastline draws millions of tourists to its sights and beaches each year. Due to its low elevation and profile, the proposed project does not have the potential to affect any significant views. Construction equipment, material stockpiles, and construction activities will be present within the project area for several months during the construction of the project. Additionally, the dredging equipment will be visible for a period of about 63-75 days while it is moored between~~about~~ 150 to 800 feet offshore of Puʻu Kekaʻa. All of these impacts are temporary and will not be present once the construction phase of the project is completed.

The proposed beach restoration~~maintenance~~ project is anticipated to have a positive long-term impact on the scenic and aesthetic resources of the Kāʻanapali area, as emergency shore protection that is currently installed may be removed and existing erosion scarps will be buried. The color of sand from the ~~Puʻu Kekaʻa~~ Sand Recovery Area is slightly greyer than the native beach sand; however, after a season of mixing and fading in the sun, the color difference is anticipated to be negligible. This will be an improvement of the open space characteristics for the public trust resource beach along this section of the coast.

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

  Discussion: The proposed project does not include the subdivision of land.

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

  Discussion: Kāʻanapali Beach is presently one of the most dangerous beaches in Hawaiʻi. The shorebreak can cause injuries that range from non-life-threatening scrapes and bruises, broken limbs, soft tissue tears, and joint dislocations to life-threatening spinal and brain injuries and drowning. There is no lifeguard tower at Puʻu Kekaʻa, and the nearest lifeguard tower is nearly 1.5 miles to the south at Hanakaʻōʻō Beach Park.

  The proposed nourished beach profile, including the beach face slope and the beach toe feature, will retain the pre-construction shape; the beach face will simply be translated further offshore. Thus, the project is not anticipated to change the hazard from breaking waves on the shoreline.

  Heavy equipment including barges, dump trucks, excavators, and boats could pose a hazard to the public. Public safety during the beach restoration and berm enhancement project will be of utmost importance. With the implementation of proper precautions, safety notices, markings, and outreach, no changes to public health hazards along the shoreline are anticipated as a result of the Proposed Action.

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

  The project will not alter the existing land use pattern shoreward of the beach restoration and berm enhancement area. The improved beach is likely to attract beach users who do not presently use this area; however, this increase will be consistent with the current recreational use of the area. The project could result in an increase in the general level of commercial activity in the area, and thus would have a long-term benefit. The proposed project has little or no potential to affect public infrastructure and services. Once completed, it will require no water, power, sanitary wastewater collection, or additional emergency services.

3.2.3 Coastal Zone Management Program

Enacted as Chapter 205A, HRS, the Hawaiʻi 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 miles from the shoreline.

The Proposed Action will require an application to be made to the State Office of Planning, CZM Program, for a CZM Consistency Determination. The Proposed Action will be measured against the objectives and policies of the CZM program listed in 205A-2, HRS. These objectives and policies, and their relationship to the Proposed Action are as follows:

1. Recreational Resources

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

- *Policy 1*: Improve coordination and funding of coastal recreational planning and management;
- *Policy 2*: Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:
  - i. Protect coastal resources uniquely suited for recreational activities that cannot be provided in other areas;
  - ii. Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;
  - iii. Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;
  - iv. Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;
  - v. Encouraging expanded public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value;
  - vi. Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;
  - vii. Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

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

Discussion: The proposed Beach Restoration and Berm EnhancementRehabilitation project would stabilize the recreational beach resource allowing for continued recreational use of the shoreline. Most recreational activities along Kāʻanapali are dependent on the existence of a healthy beach that is unique to the project area. During and after the project, all public access would be managed to promote the safety and welfare of the public as well as to maintain ample public access consistent with the conservation of the natural resource. To meet water quality standards for the project site, best management practices would be used to minimize sources of pollution to the marine environment. The restoration effort will be an improvement of the existing beach recreational opportunities as the restored beach is entirely for public use.

The proposed project is expected to restore the degraded Hanakaʻōʻō Littoral Cell to approximately its 1988 condition, when the beach was approximately 42 feet wider. No enlargement of the beach beyond its historical size or sand stabilizing structures are proposed. The work is scheduled to occur after the canoe paddling season and is not expected to significantly affect most existing recreational resources in the region. Some impacts will be imposed on vessel and recreational ocean transit in the sand recovery and sand transfer areas. Efforts will be made to notify potentially affected members of the local and visiting community. Removal of sand from the offshore deposit is expected to result in a net increase of approximately 6 feet in water depth within recovery area. Recent studies have shown that shallow, current parallel dredge areas have the least impact to nearshore bathymetry and sand transport. There will likely be short-term effects to the surf site at Hanakaʻōʻō Point while the sand is mobilized during the first summer swell season following the proposed beach restoration project.

2. Historic Resources

Objectives: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the CZM area that are significant in Hawaiian and American history and culture.

Policies:

- *Policy 1*: Identify and analyze significant archaeological resources;
- *Policy 2*: Maximize information retention through preservation of remains and artifacts or salvage operations; and
- *Policy 3*: Support state goals for protection, restoration, interpretation, and display of historic resources.

Discussion: Like other parts of the Hawaiian Islands, West Maui was divided into districts and sub-districts, with the land belonging to the Aliʻi (ruling class). Pre-contact, the land was used primarily for agriculture, where such crops included taro, sugar cane, banana, breadfruit, coconut, and sweet potato. At least 8 heiau (temples) were reported around Lāhainā. The Kāʻanapali coastline was also the site of numerous battles.

The monumental basalt cliff Puʻu Kekaʻa is the only location within the project area that is mentioned in Hawaiian tradition. Traditional Hawaiian religion sanctifies Puʻu Kekaʻa as a leina a kaʻuhane~~ka uhane~~, or a leaping place for departed souls, where deceased spirits passed westward—in the direction of the setting sun—into the afterlife; this function has been similarly attributed to westward-facing geographical features on other islands, such as Kaʻena Point on Oʻahu. This association with death and the afterlife might have attracted the large number of burials and cemeteries on and around Puʻu Kekaʻa that have been noted in archaeological and historical records. During the late 19th century, thousands of iwi kūpuna~~skeletons~~ were reportedly visible on and around Puʻu Kekaʻa, completely covering the sand.

Following a decline in the whaling industry in the mid-1800s, the Hawaiian capital moved from Lāhainā to Honolulu, after which the Lāhainā District economy transitioned to commercial sugar cane and pineapple agriculture. Puʻu Kekaʻa was used as a shipping point. Some of the agriculture land was developed into the present-day Kāʻanapali resort region. The expansive agriculture, and the subsequent resort development, reportedly greatly altered the landscape and disturbed the archeological record.

A single archaeological site—the Hanakaʻōʻō grinding stones (SIHP 50-50-03-1204)—has been identified adjacent to the project HLC Beach Restoration subarea. The site contains eight smooth, shallow, and roughly circular depressions distributed across the superior surfaces of two basalt boulders. These *hoana*, or grindstones, were used to shape and sharpen traditional Hawaiian adzes; the depressions were formed by the grinding action (facilitated by sand and water) of innumerable stone tools upon the boulder surfaces. The site is located among a cluster of basalt boulders on the Hanakaʻōʻō Park beach, approximately 30 feet west of the park bathrooms.

The general lack of archaeological features within the project area likely results from several factors: the Kāʻanapali shoreline is seasonally overturned by wave and tidal action; the beach has been subject to severe erosional events related to Kona storms and hurricane waves for at least the last 60 years; it has also been highly trafficked by visitors since the 1960s when the adjacent vacation resorts were built. Given these conditions, it is likely that prehistoric or historic resources formerly located on the beach have been displaced. The offshore sand areas are similarly unlikely to contain in situ cultural resources.

The proposed beach restoration project does not include excavation of the dry beach or dunes in Kāʻanapali. The offshore sand deposit is not expected to have the potential to contain archaeological materials or burials. The proposed sand placement areas are on actively mobile sands within the Kāʻanapali Littoral Cell and makai of the existing sand beach in the Hanakaʻōʻō Littoral Cell.

If any cultural or historical artifacts are discovered during project operations, work would cease, and the Hawaiʻi State Historic Preservation Division would be contacted. Public meetings will be held, and the local community will be regularly consulted during project development to solicit community feedback concerning the potential cultural impacts of the proposed beach restoration and berm enhancement activity.

3. Scenic and Open Space Resources

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

Policies:

- *Policy 1*: Identify valued scenic resources in the coastal zone management area;
- *Policy 2*: Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;
- *Policy 3*: Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and
- *Policy 4*: Encourage those developments that are not coastal dependent to locate in inland areas.

Discussion: The Kāʻanapali shoreline is a globally recognized visitor destination. The wide expanse of water with typically calm conditions, the deep blue colors of the ocean, and an unobstructed view of the island of Lānaʻi make the seaward and alongshore views from the shoreline spectacular. Kāʻanapali Beach itself is a scenic landmark, with millions of tourists each year traveling to see it. At the same time, the tall buildings that have been developed relatively close to the ocean along portions of the shoreline in the project area block views of the West Maui Mountains.

The appearance of the beach is of significant interest to the Kāʻanapali Resort, as their guests represent the most numerous and closest viewers. However, it is also of considerable interest to those who own and/or use adjacent areas and the Kāʻanapali Beachwalk. This beach, like all sandy shorelines in Hawaiʻi, is available to any member of the public and can be visited and enjoyed at any time. Thus, the project area is also of equal value to members of the public who visit the area.

The ongoing erosion within the HLC is having deleterious effects on the scenic and aesthetic value of the shoreline. Emergency shore protection in the form of geotextile sandbags, geotextile fabric, road plates, and jersey barriers have been or are currently deployed to protect the critical infrastructure from erosion. Emergency shore protection is typically unsightly, as are active erosion scarps, salt-damaged vegetation, collapsed trees, and turbidity from bank erosion.

Impacts to scenic and open space resources will largely be confined to the sand recovery and transfer phase of the proposed project. Visible turbidity during operations may impact the deep-blue colors of the ocean offshore of the Kāʻanapali shoreline. Turbidity is further discussed in Section 2.1.10.

Construction equipment including barges, tugboats, cranes, temporary piers or trestles or pipelines, dump trucks, off-road capable vehicles, loaders, etc., will be present both on the beach and offshore throughout the duration of construction. The dredge barge at the ~~Puʻu Kekaʻa~~ Sand Recovery Area is expected to be particularly visible for the duration of sand recovery efforts. During sand recovery operations, the barge and crane will at times be directly offshore and within 300 feet of the Moana Hale building of the Sheraton and adjacent to Puʻu Kekaʻa.

The proposed beach restoration~~maintenance~~ project, over the long-term, is anticipated to be compatible with the visual environment and improve the scenic and aesthetic resources of the area, as emergency shore protection that is currently installed may be removed and existing erosion scarps will be buried. The color of sand from the ~~Puʻu Kekaʻa~~ Sand Recovery Area is slightly greyer than the native beach sand; however, after a season of mixing and fading in the sun, the color difference is anticipated to be negligible.

4. Coastal Ecosystems

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

Policies:

- *Policy 1*: Improve the technical basis for natural resource management;
- *Policy 2*: Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;
- *Policy 3*: 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
- *Policy 4*: Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Discussion: The proposed project is designed to minimize potential impacts to the nearshore coral reef. A turbidity containment barrier will surround the work area during dry sand placement along the beach. Impacts on water quality due to the recovery, transport, and placement of sand on the beach are expected to be minor, temporary, and localized to the immediate vicinity of the work activities. No long-term impact on water quality is anticipated. There will be portions of the fossil reef, previously covered by sand beach in 1988, that will be re-occupied by littoral sands. In addition, there will also be impacts to the sandy seafloor at the ~~Puʻu Kekaʻa~~ Sand Recovery Area~~site~~, though they will be short-term.

The beach resource and its consequent ecological value has been severely degraded through erosion in this location. The proposed beach restoration project will return this resource to its prior healthy condition, supporting all manner of organisms that rely on the coastal sandy substrate, including sea turtles and Hawaiian monk seals. Best Management Practices (BMPs) as typically recommended by the National Marine Fisheries Service will be adhered to during construction to avoid impacts to turtles and seals.

5. Economic Uses

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

Policies:

- *Policy 1*: Concentrate in appropriate areas the location of coastal dependent development necessary to the State's economy;
- *Policy 2*: Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and
- *Policy 3*: Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:
    - i. Utilization of presently designated locations is not feasible;
    - ii. Adverse environmental effects are minimized; and
    - iii. Important to the State's economy.

Discussion: The proposed public improvement along Kā'anapali Beach would have a positive impact on the State's economy through the generation of taxes brought in by sustained or increased visitor populations. The proposed project is expected to create up to 100 temporary construction and construction-related jobs. The proposed project would not create any permanent positions; however, a restored beach does improve the longevity and security of jobs related to beach health and coastal industries. The infrastructure mauka of and dependent on the beach are visitor industry facilities. The proposed project would minimize or reverse the existing natural social, visual, and environmental coastal impacts currently hindering these visitor industry facilities.

The proposed project does not affect coastal development density or result in any proposed new coastal development. The proposed project would restore a major economic resource in an area currently zoned as resort.

Much of island's economy is based on the tourism, following the exodus of island youth during the economic decline of the 1950's. At that time there was a conscious decision to focus on tourism to rebuild the economy and create stable, local jobs. The proposed beach restoration and consequent improvement of beach related tourism is likely to have a corresponding effect on the local economy.

6. Coastal Hazards

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

Policies:

- *Policy 1*: Develop and communicate adequate information about storm wave, tsunami, flood, erosion, and subsidence hazard;
- *Policy 2*: Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard;
- *Policy 3*: Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

- *Policy 4*: Prevent coastal flooding from inland projects.

Discussion: Flood Insurance Rate Maps indicate that the Kāʻanapali coastline is exposed to flooding caused by storm waves and tsunami. The proposed project will extend the shoreline seaward, increasing the space between the ocean and the existing backshore development. This will greatly increase the wave energy dissipating properties of the beach and decrease the landward extent of wave runup. The increased energy dissipation of the widened beach is anticipated to reduce the susceptibility to backshore flooding from large swell events.

The proposed beach restoration effort is anticipated to have a negligible impact on the existing tsunami hazard for the area. This is because the proposed project does not include changing the elevation of the backshore. Damage from tsunamis depends on the height of the water level rise relative to the backshore elevation, neither of which will be affected by the proposed project.

7. Managing Development

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

Policies:

- *Policy 1*: Effectively utilize and implement existing law effectively to the maximum extent possible in managing present and future coastal zone development;
- *Policy 2*: Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and
- *Policy 3*: Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Discussion: This project is a proposed beach restoration effort and does meet the definition of development as defined in HRS 205A-22:

"Development" means any of the uses, activities, or operations on land or in or under water within a special management area that are included below:
(1) Placement or erection of any solid material or any gaseous, liquid, solid, or thermal waste;
(2) Grading, removing, dredging, mining, or extraction of any materials;
(3) Change in the density or intensity of use of land, including but not limited to the division or subdivision of land;
(4) Change in the intensity of use of water, ecology related thereto, or of access thereto; and
(5) Construction, reconstruction, demolition, or alteration of the size of any structure.

The proposed project would be reviewed by Federal, State, and County agencies as well as the general and affected public through the EIS and permit processes. All required permits will be obtained prior to project implementation, including the Department of the Army Section 10 and Section 404 permits, State of Hawaiʻi CZM Consistency Determination, State of Hawaiʻi Department of Health Section 401 Water Quality Certification, and a State Conservation District Use Permit. Additional communication opportunities were provided through public outreach meetings associated with the Draft EIS review process. Both potential short-term and potential long-term impacts are presented in this Draft and Final EIS and would be presented in future permit applications.

8. Public Participation

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

Policies:

- *Policy 1*: Promote public involvement in coastal zone management processes;
- *Policy 2*: 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
- *Policy 3*: Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Discussion: Both the recreational resource analysis and cultural investigation assessment incorporated public engagement with select sectors of public. The public was informed of the project through the publication of the EISPN in the Environmental Notice on July 23, 2018. Review and presentation of the proposed project included~~will include~~ additional public outreach activities during the Draft EIS publication process and will be conducted during the permit application efforts. Outreach during the permit review process will also include a public hearing. A project website will be hosted by the DLNR, as a knowledge resource for members of the community who are interested in finding out more about the project and to grant easy access for the public to communicate questions to project managers. ~~Regular updates will be sent to key stakeholder groups during the DEIS and permit application processes.~~

9. Beach Protection

Objectives: Protect beaches for public use and recreation.

Policies:

- *Policy 1*: 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;
- *Policy 2*: Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and
- *Policy 3*: Minimize the construction of public erosion-protection structures seaward of the shoreline.

Discussion: The purpose of the proposed project is to restore and enhance recreational and aesthetic enjoyment of the project area by nourishing and maintaining the beach without the addition of any structures. The improved beach will enhance recreational opportunities, facilitate lateral access along the shore, and augment the natural coastal resources. The objective is to restore and maintain the beach in a way that works with natural coastal processes while also mitigating existing erosion pressure on the Kāʻanapali coastline. No enlargement of the beach beyond its historical size or sand stabilizing structures are proposed.

10. Marine Resources

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

Policies:

- *Policy 1*: Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;
- *Policy 2*: Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;
- *Policy 3*: 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;
- *Policy 4*: Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and
- *Policy 5*: Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion: Based on detailed site investigations and analysis, no significant long-term impacts to marine resources are anticipated to result from the proposed project. Minor short-term impacts to the sand recovery area and the placement areas are likely. Environmental construction specifications and BMPs will be formulated to protect marine resources, including water quality, benthic flora and fauna, corals, fishes, and endangered species. The project will be coordinated with marine resource agencies, including the NOAA National Marine Fisheries Service, the U.S. Fish & Wildlife Service, The U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, and the State Division of Aquatic Resources.

The proposed beach restoration project is anticipated to have a long-term positive impact on the sandy coastal resource and ecology, providing both an environmental and economic benefit.

3.2.4 Water Quality Certification

The Clean Water Act (CWA) of 1972 (33 USC §1344) is the key legislation governing surface water quality protection in the United States. In Hawaiʻi, the U.S. Environmental Protection Agency (EPA) has delegated responsibility for implementing the Section 401 of the Act to the State Department of Health, Clean Water Branch (DOH-CWB).
Actions that may constitute fill into waters of the United States include:

- Placement of mooring blocks around the ~~Puʻu Kekaʻa~~ Sand Recovery Area

- Placement of temporary piers and mooring blocks at the North and South offloading locations
- Removal of sand from the Puʻu Kekaʻa Sand Recovery Area
- Placement of sand in the Hanakaʻōʻō Littoral Cell below the MHHW line

The DOH-CWB issues Water Quality Certifications (WQC) for projects that involve fill into the waters of the United States. The WQC will require submission of an Applicable Monitoring and Assessment Plan (AMAP) to the DOH. The AMAP will detail the water quality sampling and testing necessary before, during, and after construction to quantitatively ensure that the Best Management Practices (BMPs) implemented during the project isolate and minimize possible contamination of coastal waters.

3.2.5 HAR §11-55 – Water Pollution Control

Section 402 of the CWA requires a National Pollutant Discharge Elimination System (NPDES) authorization any time construction activity (including staging and laydown areas) covers an area one (1) acre in size or greater and is intended to prevent pollutants from reaching coastal waters as a result of storm water runoff. The Hawaiʻi Department of Health (DOH), Clean Water Branch, under HAR §11-55, administers the NPDES program in Hawaiʻi. Information required to obtain a permit includes project specific details and construction drawings, storm and non-storm water discharge, a Best Management Practices Plan (BMPP), and Post-Construction Pollutant Control Measures. The permit application procedure requires the applicant to show that the necessary BMPs will be in effect during the construction phase, and these BMPs must be sufficient to prevent potential pollution during conditions identified for a 10-year rain event.

3.2.6 Governor's Executive Order No. 4230

Governor's Executive Order No. 4230 grants regulation of ocean recreation, boating, and coastal activities at Kāʻanapali Beach to the Division of Boating and Ocean Recreation (DOBOR). Any construction on Kāʻanapali Beach will require a Right of Entry permit from DOBOR.

3.3 County of Maui Laws and Regulations

Coastal lands in Kāʻanapali landward of the shoreline are classified as Special Management Areas (SMA), and County rules and regulations apply.

3.3.1 Special Management Area (SMA)

The Hawaiʻi Coastal Zone Management (CZM) Program (HRS Chapter 205A) regulates all types of land uses and activities ("development") in the Special Management Area (SMA). The SMA on Maui is regulated by the County of Maui, Department of Planning. Portions of the proposed project staging areas and ingress/egress routes that are located within the SMA will be subject to the SMA rules and regulations for the County of Maui. The proposed action will require an SMA permit from the County of Maui, Department of Planning.

County Special Management Area rules are required by Chapter 205A (HRS) to promote the CZM policies and objectives for coastal areas that are in county jurisdiction. The project should, therefore, comply with the objectives and policies contained in 205A-2, HRS and the review guidelines contained in 205A-26, HRS. The relationship between the Proposed Action and these guidelines are described in Section 3.2.3.

3.3.2 Shoreline Setback Variance

A shoreline setback variance (SSV) is required for all proposed structures, facilities, construction or any such activities which are prohibited within the shoreline setback area. As construction activities may take place landward of the shoreline, an SSV may be required for the Proposed Action, as determined by the County of Maui.

3.4 Summary of Required Permits and Approvals

A summary of potential permitting requirements for the proposed action includes the following:

County of Maui

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

State of Hawai'i

- Conservation District Use Permit (CDUP) (DLNR-OCCL)
- Coastal Zone Management Consistency Review (DBEDT, Office of Planning, CZM Program)
- Clean Water Act, Section 401 Water Quality Certification (WQC) (DOH-CWB)
- National Pollutant Discharge Elimination System (NPDES) (DOH-CWB)
- Right of Entry Permit for Kā'anapali Beach (DOBOR)
- HRS, 6E Historic Preservation Review (DLNR-SHPD)

Federal

- Section 10, Work in Navigable Waters of the U.S. (U.S. Army Corps of Engineers)
- Section 404, Clean Water Act, for Fill in Waters of the U.S. (U.S. Army Corps of Engineers)
- Other Federal laws that may affect the project, including:
    a. Archaeological and Historic Preservation Act (16 USC § 469a-1);
    b. National Historic Preservation Act (NHPA) of 1966 (16 USC § 470(f));
    c. Clean Air Act (42 USC § 7506(C));
    d. Coastal Zone Management Act (16 USC § 1456(C) (1));
    e. Endangered Species Act (16 U.S.C. 1536(A) (2) and (4));
    f. Fish and Wildlife Coordination Act (FWCA) of 1934, as amended (16 USC §§ 661-666[C] et seq.);
    g. Magnuson-Stevens Fishery Conservation and Management Act (16 USC § 1801 et seq.);
    h. Marine Mammal Protection Act (MMPA) of 1972, as amended (16 USC §§ 1361-1421(H) et seq.);

i. Migratory Bird Treaty Act of 1918, as amended (16 USC §§ 703-712)

4. RELATIONSHIP TO LAND USE PLANS

This section discusses the compliance and compatibility of the Proposed Action with pertinent plans at County and State levels.

4.1 County of Maui

4.1.1 Maui Countywide Policy Plan

One objective of the Countywide Policy Plan (2010) is to improve the opportunity to experience the natural beauty and native biodiversity of the islands for present and future generations (A1). The proposed project will restore the Kāʻanapali coastline to its beach width in 1988 giving present and future generations the opportunity to enjoy the natural beauty of the coastline. It will also preserve and provide ongoing care for this important scenic vista, view plane, landscape, and open-space resource.

Another objective that will be supported by the proposed project is to improve the quality of environmentally sensitive, locally valued natural resources and native ecology of each island by strengthening coastal-zone management and the re-naturalization of shorelines where possible (A2). The Kāʻanapali beach restoration project will require the collaboration of agencies and shoreline businesses to work together to produce a judicious coastal-zone management plan in the form of a beach restoration effort.

The Countywide Policy Plan seeks to improve the stewardship of the natural environment by preserving and protecting natural resources with significant scenic, economic, cultural, environmental, or recreational value (A3). This objective will be met by the proposed project, which aims to protect the natural beach resource with an addition of sand to buffer the sediment supply. Preserving the beach would also preserve scenic, economic, cultural, environmental, and recreational values activities that are closely tied to the beach existence. A description of these activities is given in Section 2.

4.1.1.1 Maui Island Plan

The Maui Island Plan (2012) notes that while shoreline hardening is appropriate in some circumstances, the loss of Maui's beaches is often accelerated when private landowners attempt to protect their oceanfront property by armoring the shoreline. To support the Maui Island Plan objectives, the proposed project is a beach restoration and berm enhancement~~rehabilitation~~ effort that will meet the needs of the eroding shoreline and mitigate the need for shoreline armoring with an intent to protect the coastal and marine ecosystem. The project will also protect the Kāʻanapali Beachwalk maintaining public lateral and vertical access to the beach.

Policy 4.2.3 states that the visitor population on the island should not exceed one third of the resident population. Maui exceeded this ratio in 2018. Though exceedance in previous years speaks to the increase in visitors relative to residents, the proposed project is not anticipated to result in an increase in visitor accommodation space, new development, or alterations to infrastructure. The proposed project is management and restoration of an existing beach resource, entirely on submerged State land in the Resource Subzone of the Conservation District.

The proposed project will also support Objective 2.5.3 by protecting and enhancing Maui's scenic vistas and resources. The beach restorationmaintenance effort will return the shoreline to its 1988 position and provide enjoyable scenic views for years to come while also mitigating the need for unsightly erosion protection measures.

4.1.1.1.1 West Maui Community Plan

The West Maui Community Plan (1996) is one of nine community plans for Maui County. The community plans detail desired land use patterns and goals, objectives, policies, and implementing actions for various functional areas. The Kāʻanapali Resort is located on lands designated H (Hotel). The environmental goal set forth by the plan is a clean and attractive physical, natural and marine environment in which man-made developments on or alterations to the natural and marine environment are based on sound environmental and ecological practices, and important scenic and open space resources are preserved and protected for public use and enjoyment. One opportunity to achieve that goal is to prohibit the construction of vertical seawalls and revetments except as may be permitted by rules adopted by the Maui Planning Commission governing the issuance of Shoreline Management Area (SMA) emergency permits. This project implements beach nourishment by adding sand to the dry beach and increasing the beach's size vertically in the KLC and horizontally in the HLC. The proposed project follows the West Maui Community Plan by solving the erosion problem with beach nourishment, a sustainable alternative using natural marine sand, instead of building vertical seawalls and revetments. Another opportunity to meet the environmental goal is to preserve, protect and/or nourish the shoreline sand dune formations throughout the planning region. These topographic features are essential to beach preservation and a significant element of the natural setting that should be protected. The berm enhancement component of the proposed project will meet this objective by providing additional beach sand to support sand dune formations along the mauka reach of the beach, while also remaining on State submerged land in the Conservation District.

4.2 State of Hawaiʻi

4.2.1 Chapter 226, Hawaiʻi State Planning Act

The Hawaiʻi State Planning Act (Chapter 226, Hawaiʻi Revised Statutes, as amended) outlines themes, goals, guidelines, and policies for statewide planning. Objectives and policies are listed in sections 226-5 through 226-27 and focus on general topic areas, including population, economy, physical environment, facility systems, and socio-cultural advancement. Table 4-1 lists policies and objectives of the Hawaiʻi State Planning Act that are relevant to the proposed project.

Table 4-1. Hawaiʻi State Planning Act relevant objectives and policies

Section	Section Title	Relevant Policies and Objectives
226-5	Objective and policies for population	None
226-6	Objectives and policies for the economy in general	None
226-7	Objectives and policies for the economy-agriculture	None
226-8	Objective and policies for the economy-visitor industry	(3) Improve the quality of existing visitor destination areas. (4) Encourage cooperation between the public and private sectors in developing and

Section	Section Title	Relevant Policies and Objectives
		maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring communities and activities.
226-9	Objective and policies for the economy-federal expenditures	None
226-10	Objective and policies for the economy-potential growth and innovative activities	None
226-10.5	Objectives and policies for the economy-information industry	None
226-11	Objectives and policies for the physical environment-land-based, shoreline, and marine resources	(1) Exercise an overall conservation ethic in the use of Hawaiʻi's natural resources (4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage. (9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.
226-12	Objective and policies for the physical environment-scenic, natural beauty, and historic resources	(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.
226-13	Objectives and policies for the physical environment-land, air, and water quality	(3) Promote effective measures to achieve desired quality in Hawaiʻi's surface, ground, and coastal waters. (5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.
226-14	Objective and policies for facility systems-in general	None
226-15	Objectives and policies for facility systems-solid and liquid wastes	None
226-16	Objective and policies for facility systems-water	None
226-17	Objectives and policies for facility systems-transportation	(11) Encourage safe and convenient uses of low-cost, energy-efficient, non-polluting means of transportation.
226-18	Objectives and policies for facility systems-energy	None
226-18.5	Objectives and policies for facility systems-telecommunications	None
226-19	Objectives and policies for socio-cultural advancement-housing	None
226-20	Objectives and policies for socio-cultural advancement-health	None
226-21	Objective and policies for socio-cultural advancement-education	None
226-22	Objective and policies for socio-cultural advancement-social services	None
226-23	Objective and policies for socio-cultural advancement-leisure	(4) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or

Section	Section Title	Relevant Policies and Objectives
		biological values while ensuring that their inherit values are preserved. (5) Ensure opportunities for everyone to use and enjoy Hawaiʻi's recreational resources.
226-24	Objective and policies for socio-cultural advancement-individual rights and personal well-being	None
226-25	Objective and policies for socio-cultural advancement-culture	None
226-26	Objectives and policies for socio-cultural advancement-public safety	None
226-27	Objectives and policies for socio-cultural advancement-government	None

Section 226-8 Discussion: The proposed project will improve the quality of existing visitor destination areas by restoring Kāʻanapali Beach to its 1988 shoreline position preserving the beach destination for the future. The public and private sectors are working together on the project to develop a plan to maintain an environmentally sound, ecologically beneficial, well-designed, adequately serviced beach resource and the visitor industry that depends on it.

Section 226-11 Discussion: One goal of the proposed project is to conserve the natural beach by resupplying the sediment budget with native marine sand resources already within the project area. The project will be conducted with a suite of BMPs that are aimed at conserving the natural resources ethically and not causing any costly or irreparable damage. Preserving the beach resource increases the accessibility of the shoreline area for public, recreational, educational, and scientific purposes.

Section 226-12 Discussion: The proposed action will preserve the beach width, which will benefit the preservation of views and vistas to enhance the visual and aesthetic enjoyment of the ocean, scenic landscapes, and other natural features.

Section 226-13 Discussion: The sand that will be used for the beach restoration and berm enhancement project has a grain size, color, and composition that is anticipated to have a minimal impact on the desired quality in Hawaiʻi's surface, ground, and coastal waters. BMPs will be used throughout the project to protect the coastal water quality. In addition, an Applicable Monitoring and Assessment Plan (AMAP) will be followed to ensure that adequate measures are being taken to maintain the water quality during and after the proposed project. The proposed berm enhancement action will have a small reduction to the threat to life and property from erosion, flooding, tsunamis, and hurricanes by increasing beach elevations, but the reduction is not expected to be significant. Similarly, the proposed beach restoration action will also have a small reduction to the threat to life and property from erosion, flooding, tsunamis, and hurricanes by increasing beach widths and restoring previously eroding sand beach. There will be no impact to the threat of earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

Section 226-17 Discussion: The proposed action will restore the sand volume of Kāʻanapali Beach and reduce threats to the existing Kāʻanapali Beachwalk. The Beachwalk is a safe, convenient, low-cost, energy-efficient, non-polluting means of transportation that connects the entire resort community. Preservation of the Beachwalk will curtail the need for alternative forms of transportation in the area and meets this objective.

Section 226-23 Discussion: The Kāʻanapali Beach restoration and berm enhancement project will promote recreational and educational potential by increasing the beach sand volume. On a wider beach, public users would have more space for recreational and educational activities and ensure that there are opportunities for everyone to use and enjoy the recreational resource. In the beach's current state, the narrow sand regions limit recreational activities and the number of people who can enjoy the shoreline.

4.2.2 State Functional Plans

Functional plans set forth the policies, statewide guidelines, and priorities within a specific field of activity, when such activity or program is proposed, administered, or funded by any agency of the state. Functional plans are developed by the state agency primarily responsible for a given functional area, which includes agriculture, conservation lands, education, energy, higher education, health, historic preservation, housing, recreation, tourism, and transportation. The Conservation Lands, Recreation, and Tourism State Functional Plans are relevant to the Proposed Action.

4.2.2.1 Conservation Lands State Functional Plan (1991)

Objective IIA is the establishment of plans for natural resources and land management. To achieve that objective, Policy IIA(1) says to formulate and maintain a management plan for resources and lands having significant conservation value. Kāʻanapali Beach is a resource that has significant conservation value. The proposed action will support this objective by ensuring sustained use of the natural resource by increasing sand volume.

Objective IIC: Enhancement of natural resources. In accordance with Policy IIC(2), the proposed action will expand and enhance outdoor recreation opportunities. By increasing the sand volume, the beach will widen, and more space will be available to the public for outdoor recreational activities and the scenic value of the natural resource will be enhanced. Moreover, the restored littoral system will improve the sandy ecosystem value and services.

Objective IID: Appropriate development of natural resources. Following Policy IID(3), the beach restoration and berm enhancement project will develop recreational resources on the shoreline and mauka areas. If the shoreline becomes too narrow, the recreational resources along the beach will decrease. By performing the proposed action, the beach width will increase and the number of recreational opportunities on the natural resource increase accordingly.

4.2.2.2 Recreation State Functional Plan (1991)

Objective II-B of the Recreation State Functional Plan is to meet the special recreation needs of the elderly, the disabled, women, single-parent families, immigrants, and other groups. Policy II-B(2) says to give higher priority to providing physical access to the disabled. The proposed action will restore the sand volume of Kāʻanapali Beach and reduce threats to the existing Kāʻanapali

Beachwalk. The Beachwalk is a high priority ADA compliant physical access path along Kāʻanapali Beach that is currently threatened at pinch-points in the beach due to episodic and chronic erosion pressure. The Beachwalk extends over 3 miles along the coastline providing safe lateral access to residents and tourists alike, with over 18,000 pedestrian trips per day and approximately 6,570,000 pedestrian trips per year. This is the only coastal lateral access along Kāʻanapali Beach available for the disabled.

4.2.2.3 Tourism State Functional Plan (1991)

Objective II.A. of the Hawaiʻi State Tourism Function Plan is to develop and maintain well-designed visitor facilities and related developments that are sensitive to the environment, sensitive to neighboring communities and activities, and adequately serviced by infrastructure and support services. Policy II.A.8. calls for encouraging the development of hotels and related facilities within designated visitor destination areas with adequate infrastructure and support services before development of other possible visitor destinations. The Action II.A.8.a guidelines for tourism development list that effort should be made to minimize loss of public recreational opportunities. While the Kāʻanapali Owners Association along Kāʻanapali Beach is not new tourism development, they are making an effort financially and through operations to minimize loss of the public recreational resource by proposing to nourish the beach and enhance the berm.

5. ALTERNATIVES TO THE PROPOSED ACTION

5.1 Formulation of the Preferred Alternative

Several beach management plans have been written that encompass beaches of the Hawaiian Islands in general, the island of Maui, and specifically Kāʻanapali. The plans have the same general emphasis, outlining the problems and giving overviews of possible management alternatives. These plans, and any resulting actions generated from the plans, typically address key management issues identified for the region. The regulatory environment, coastal processes, shoreline history, and local and agency interests in the area produced the following key management considerations:

- DLNR prefers beach restoration over shoreline armoring. Coastal armoring can potentially affect physical, biological, and ecological characteristics of a shoreline. Community considerations could also be negatively affected by coastal armoring.
- Beach restoration is a nature-based management alternative for conserving beach environments and protecting shoreline development from the impacts of coastal erosion and flooding, which are increasing with climate change and SLR.
- Severe storms, such as the Kona storms of December 2007 and 2008, can cause rapid erosion damage along the entire coast.
- The KLC is highly dynamic and experiences large seasonal fluctuations in beach width at the ends of the cell. Transport of approximately 70,000 cubic yards of sand in a 2-month period and maximum average daily rates of 800 cubic yards were measured following the 1998 erosion event. Following the 2003 erosion event, approximately 19,000 cy of sand accreted in front of the Kāʻanapali Aliʻi within one to two weeks at an estimated rate of 1,350 to 2,700 cy/day. Occasional extreme seasonal events, such as those that occurred in 1998 and 2003, can result in rapid, significant shoreline erosion, beach narrowing, and damage to property.
- The HLC is less seasonally dynamic; however, it is experiencing chronic erosion and is also subject to severe storm damage. The beach is narrow, and dry beach may be non-existent at high tide.
- Inland dune sand is not available at this time and is not a good match for the beach sand in either the Hanakaʻōʻō or Kāʻanapali littoral cells.
- No other sources of compatible carbonate sand are presently available on island.

Given these considerations, SEI has developed a proposed action that satisfies the following beach management tasks:

- Recovering nearshore beach compatible sand from offshore of Kāʻanapali Beach. This would provide a local sand source that is a good match for both littoral cells.
- Restoration of the HLC, through beach restoration with placement of additional beach sand to widen the beach.~~.~~ This is a technique that is supported by the DLNR and County of Maui Planning Department regulatory agencies.
- Adding sand to the dry berm area ("berm enhancement") in the KLC. This would augment the existing sand volume, providing greater capacity for the littoral cell to respond to and recover from episodic events.

As part of this process, several alternatives were identified as being outside the realm of practicality and were not developed and assessed as alternatives to beach nourishment. These alternatives, though accepted engineering designs that have examples in Hawaiʻi or elsewhere, were identified during the early stages of concept development as being unsuited to the current environment. Early concepts were evaluated based on shoreline dynamics, marine and coastal ecosystem, recreational and cultural uses, constructability, and the Federal, State and County of Maui regulatory environment. The following options were eliminated at the early concept level:

- Offshore breakwaters
- Submerged breakwaters
- T-head groins
- Profile groins
- Groins
- Reef balls
- Artificial reefs
- Mangrove forest installation
- Living shorelines
- Biorock
- Sand grabbers
- Dune restoration

5.1.1 Alternative Sand Sources

A critical design element and most significant form of mitigation for project impacts is selection of a suitable and compatible sand source. Properly matching nourishment sand to the existing beach sand helps:

- Minimize the release of fine grains during and after placement;
- Provide continuity to beach processes, which are a function of the relationship between coastal energetics and sand grains in the littoral cell, before and after the nourishment project;
- Minimize impacts to the adjacent marine ecosystem by utilizing sand that closely matches the existing environment; and
- Minimize impacts to the coastal ecosystem, which is directly affected by changes to the sand beach.

After an extensive investigation, sampling, and analysis of available sand sources, the Puʻu Kekaʻa Sand Recovery Area has been identified as the best source of sand for the proposed beach nourishment project, including both beach restoration and berm enhancement project. Selection of the Puʻu Kekaʻa Sand Recovery Area was accomplished through elimination of other areas by review of surface and subsurface marine surveys followed by diver investigations, coring, and sample analysis. Nearshore sand fields were investigated from immediately offshore of the beach down to nearly 200 feet of water depth, and nearly two miles south and one mile north of the Sand Recovery Area.

Of all potential sand sources for beach nourishment at Kāʻanapali, the Puʻu Kekaʻa Sand Recovery Area sediment was a better match for the native beach than the sediment at the alternate sites. The sand quality is a very close match to the existing beach, it is located in a moderately high energy area that keeps the sand grain size larger and limits biological activity below the surface, and there is suitable volume to complete the project. In addition, the water depths at the sand deposit are suitable for recovery work, and the sand field is close to the proposed project shorelines. Proximity to the beach also supports the concept of returning beach sand to the beach from it originated, allowing for a recycling of marine sediment back to the shoreline.

Other sand sources considered for the proposed project, after extensive investigation of the regional seafloor, are discussed below in Table 5-1. Local prospective offshore sand resources and the larger investigation area are illustrated in Figure 5-1. Additional sand source investigations conducted in the Nāpili and Honokōwai nearshore waters have not resulted in sand matches that are as good, or even near the quality of the match found at the Sand Recovery Area.

Alternative Sand Source Descriptions:

"Sand Wave Area"

Sand source investigations in 2007 identified an area of potential beach quality sand in 115 to 130 feet of water depth offshore of Kā'anapali Beach.~~Pu'u Keka'a.~~ The Sand Wave Area covers approximately 8.5 acres with an estimated average thickness of 20 feet. This corresponds to a total estimated volume of 629,000 cubic yards of sand in the offshore deposit. Water depth, a wide range of grain sizes, dark sand color, and a high percentage of *halimeda* flakes make the Sand Wave Area less desirable as a sand source for the Kā'anapali Beach Restoration and Berm Enhancement project, when compared to the Sand Recovery Area~~Pu'u Keka'a~~ deposit.

Mala Ramp Sand Deposit

Sand source investigations in 2015 revealed a sand deposit located 3,000 feet to the northwest of Mala Wharf in Lāhainā. The sand deposit has a surface area of 10 acres, a sand thickness in excess of 6 feet, and was located in approximately 60 to 70 feet water depth.

Grain size analysis revealed that the sand at this location is too fine to be compatible with the Kā'anapali Beach sand. Furthermore, dry color comparison with native Kā'anapali Beach sand showed that the offshore sand was greyer in color. Fine grain size and grayish sand color make the Mala Ramp sand deposit less desirable as a sand source for the Kā'anapali Beach Restoration and Berm Enhancement project.

Reef Runway, O'ahu

Numerous offshore sand reconnaissance studies have indicated the presence of a relatively large and thick sand deposit approximately 4,000 feet offshore of the Daniel K. Inouye International Airport (HNL) "Reef Runway" on O'ahu. Seismic surveys, high-resolution subbottom profiling, and sand sample probes have confirmed the presence of the large sand field (Ocean Innovators 1997 and 1991; E.K. Noda and Associates 1991; Barry 1993; Sea Engineering 2017). The probing and subbottom profiling indicated variable thicknesses of sand with alternating deep and shallow pockets. The maximum probed sand thickness was 37 feet. Typical sand thickness is 10 to 15 feet.

More than 50 sand samples have been collected and analyzed from the deposit. Grain size distributions of the samples show that sand characteristics vary greatly within the deposit, with median grain sizes ranging from 0.18 mm to 1.4 mm. All samples analyzed were more poorly sorted, with a higher percentage of both fine and coarse material, than Kā'anapali Beach sand. The sand is primarily grayish in color.

High spatial variability of sand characteristics and deposit thickness, grayish sand color, and distance from Kā'anapali Beach make the Reef Runway sand deposit less desirable as a sand source for the Kā'anapali Beach Restoration and Berm Enhancement project.

Maui Dune Sand

Inland sand dunes behind Ma'alaea Bay have been built up over thousands of years by mostly wind-blown sand. Maui dune sand has been used in the past to nourish eroded beaches on the islands. The sand is typically medium to dark brown and moderately sorted. The typical median grain size is around 0.23 mm. Maui dune sand is significantly finer than Kā'anapali Beach sand, which has a median grain size around 0.32 mm. The Maui dune grain size distribution mostly falls outside the 20% compatibility limit required by State regulations.

Extensive screening could yield sand that falls within the required 20% compatibility limits for sand placement on Kā'anapali Beach. However, washing out all the material finer than 0.2 mm would entail removing 40% of the material.

Maui dune sand is presently unavailable per County policy. Lack of availability in the desired quantity and grain size characteristics make Maui dune sand less desirable as a sand source for the Kā'anapali Beach Restoration and Berm Enhancement project.

Table 5-1. Sand Sources Comparison Chart

Sand Source	**~~Puʻu Kekaʻa~~ Sand Recovery Area (preferred)**	**Sand Wave Area**	**Mala Ramp Sand Area**	**Reef Runway (Oʻahu)**	**Maui Inland Dune Sand**
Distance from Site (North Offloading, South Offloading)	1,000 feet, 1.6 miles	2,000 feet, 1.6 miles	2.7 miles, 1.4 miles	85 miles	>20 miles
Recovery and Placement Rate	2,000 cubic yards per day	1,800 cubic yards per day	2,000 cubic yards per day	Up to 1,700 cubic yards per day	2,000 cubic yards per day
Unit Cost Estimate	$85 per cubic yard	$100 per cubic yard	$85 per cubic yard	$200 per cubic yard	N/A
Water Depth	28 to 56 feet	115 to 130 feet	60 to 70 feet	80 to 300 feet	N/A
Distance from Shore	150 feet	1,600 feet	2,600 feet	4,000 feet	N/A
Available Volume	358,000 cubic yards	629,000 cubic yards	97,000 cubic yards	> 1,000,000 cubic yards	N/A
Median Grain Size	0.21 mm to 0.37 mm	0.21 mm to 1.0 mm	0.19 mm to 0.23 mm	0.18 mm to 1.4 mm	0.23 mm
Percentage Fines	< 0.16%	Up to 1.2%	2%	Up to 8%	0% (screened)
Color Match with Native	Similar	Darker	Greyer	Greyer	Darker
Issues	Close proximity to shore would cause disruption to ocean recreation; unsightly dredge plant close to shore	High percentage of halimeda flakes; water depth makes recovery difficult; unsightly dredge plant close to shore; coral cobble layers	High percentage of halimeda flakes; tendency to lithify; unpleasant smell; poor color match	Wide range of median grain sizes; abundance of fines; poor color match; distance from project site drastically reduces production rate and increases cost	Moratorium on inland dune sand mining; would require screening to remove up to 40% fine material

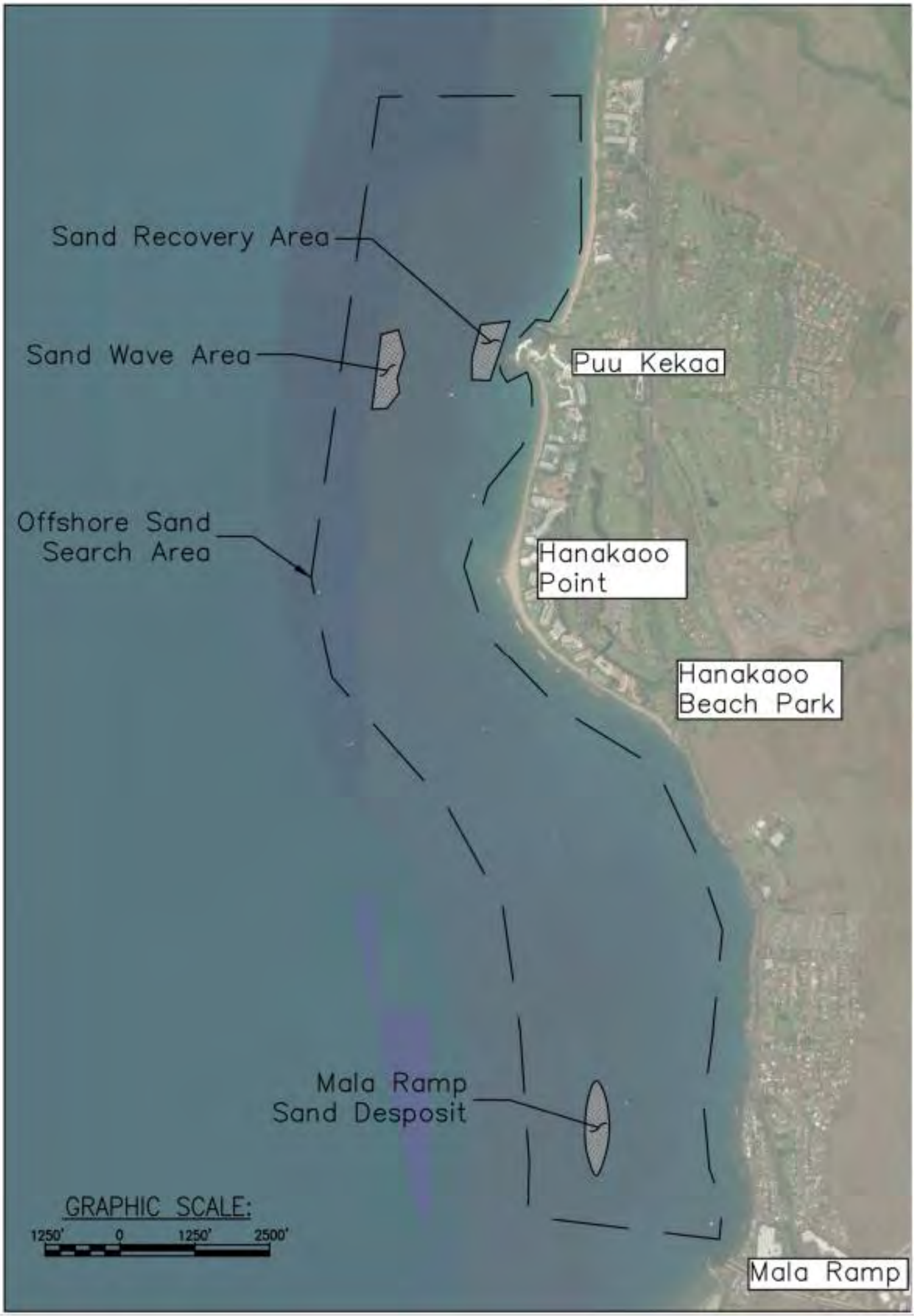


Figure 5-1. Sand resource investigation area and potential sand resource detailed investigation sites

5.2 No-Action Alternative and Deferral of Action Alternative – Unmanaged Retreat

The No-Action Alternative provides a benchmark against which to compare the magnitude of environmental effects of the proposed project. It provides a reasonable baseline for assessing the impacts of an "action" alternative. "Unmanaged Retreat" and "No-Action" have similar areas of coverage and similar impacts to the backshore. These two alternatives, therefore, are addressed together.

The shoreline along Kāʻanapali Beach is presently moving landward at up to 2 feet per year in the HLC. Episodic events and SLR are projected to cause increasing coastal erosion rates. The recently released *Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report* (Hawaiʻi Climate Change Mitigation and Adaptation Commission, 2017) used a combination of historical shoreline change trends and the RD-A model to estimate shoreline recession due to SLR along Hawaiʻi's beaches. With 2.0 feet of SLR (nearly equivalent to the NOAA Intermediate value for 2070), the report estimates that erosion rates along the shoreline at Kāʻanapali could triple. Figure 5-2 illustrates the projected erosion associated with SLR elevations of 0.5 ft, 1.1 ft, 2.0 ft, and 3.2 ft above current sea level. These projections indicate severe potential future erosion under the no action alternative.

Unmanaged retreat~~Retreat~~ would entail removing existing infrastructure in an unplanned manner as it is imminently threatened or fails along Kāʻanapali Beach while allowing the shoreline to naturally migrate landward. The Kāʻanapali Beachwalk is the first infrastructure that would be threatened by this option. The beach between Hanakaʻōʻō Beach Park and Hanakaʻōʻō Point (the HLC) is severely narrowed due to both chronic and episodic erosion. There is very little or no vegetative buffer remaining between the deflated beach face and the scarp on the seaward side of the Beachwalk in multiple locations. Portions of the Beachwalk have already been removed due to erosion, creating "pinch points" along the path, where relocation of the Beachwalk further landward is infeasible due to existing development. The unmanaged retreat or no-action alternative would, therefore, result in a temporary or permanent interruption to the only ADA compliant lateral shoreline access in the region.

There are numerous locations along the beach where development is located immediately mauka of the Beachwalk and abandoning or relocating the Beachwalk may mean abandoning or relocating the mauka development. This no-action, or unmanaged retreat alternative does not include planned, or managed retreat, rather it is retreat enacted in response to shoreline erosion, which severely limits response options, due to the presence of improvements along the length of the coast.

Erosion has reduced the area of "dry beach", the space between the vegetation line and the beach crest, at Kāʻanapali. During high tide and high wave conditions, a significant portion of the beach could be located in the swash zone or makai of the "wet-dry" line, meaning that backshore areas are exposed to erosion and wave overwash. This condition is especially prevalent within the HLC (see F~~D~~EIS cover photo). With higher sea levels and increasing erosion rates, this condition could be more frequent as the beach erodes quicker than the backshore fastland, further narrowing the beach. There is no guarantee that a beach would continue to be present on this coastline under higher sea levels, with the waterline at a more mauka location.

Sand resources have been identified in the backshore, mauka of the proposed project. Some of these sand resources may include beach quality sand, though they are typically mixed with finer carbonate and terrigenous materials in coastal plain settings. Erosion of the backshore under high sea levels or extreme erosion events, would release some of these sand resources. The sand volume suitable for beach sustenance would augment the greater littoral cell volume during these erosional events.

Erosion in this area is also known to release both terrigenous and fill material, including cinders and topsoil, into the nearshore waters. The "No Action", unmanaged retreat alternative has the potentialwould likely lead to increase turbidity and nearshore biological impacts as a result of continued bank erosion. Such impacts are already observed in the heavily eroded pinch points during episodic erosion events.

Figure 5-2. Coastal erosion at Kā'anapali Beach under the No Action alternative (from Hawai'i Sea-level rise Viewer)

5.3 Other Alternatives

There are three primary options for responding to the impacts of sea-level rise: Managed Retreat, Protection, and Accommodation. Beach nourishment is considered an accommodation strategy and, like any coastal management strategy, has tradeoffs and limitations. However, beach nourishment has proven to be a cost-effective strategy for maintaining beaches (Porro, 2020). While periodic nourishment efforts may be required, the economic, social, cultural, and environmental impacts of beach nourishment are relatively low, whereas the impacts and costs associated with continued beach erosion are very high given the social, cultural, and environmental significance of Kāʻanapali Beach. Additionally, the impact to the economies of the State of Hawaiʻi and County of Maui would be far reaching.

Nature based beach management practices, such as beach nourishment, can provide essential intermediate steps in the coming decades while long-term sea-level rise adaptation plans are developed. These long-term plans may include individual actions, such as beach nourishment or multi-faceted strategies such as managed retreat or modifications to existing developments in size, shape, and density or structural improvements along the coastline or some combination of these options and others.

Beach nourishment (accommodation) can be compared to other sea-level rise impact mitigation alternatives such as managed retreat, protection, and other accommodation strategies.

5.3.1 Temporary Shore Protection (Alternative 1)

Temporary, non-emergency shore protection has been used to protect landscaping, boardwalks, and pool complexes while permanent solutions are planned and designed, or until the erosion condition passes. The allowable installation term set forth by DLNR for temporary shore protection is typically less than three years, making these alternatives short-term to mid-term options. The most commonly utilized form of temporary shore protection in Hawaiʻi is stacks of large geotextile or natural fiber sandbags. Geotextile fabric draped over an erosion scarp ("erosion skirt") and sand-filled geotextile mattresses have both been successful at slowing the progress of erosion in areas of low wave energy. One feature that is attractive to permitting agencies is that temporary shore protection can be deployed and removed easier than permanent shore protection. Once the erosion condition passes, the material can be removed with minimal environmental impact. While deployed and if exposed to continued erosion pressure on the shoreline, temporary shore protection can affect beach processes in the immediate area. The effect, for some materials and configurations, can be similar to permanent shore protection, such as causing beach narrowing fronting the structure during erosion events and causing focused flanking erosion at the unprotected shoreline immediately adjacent to the temporary shoreline protection materials.

There is a long history of temporary shore protection structures being deployed on Kāʻanapali Beach (see Table 1-1Table 1-1). Temporary shore protection has been deployed along Kāʻanapali Beach in areas where property or infrastructure is threatened with damage. This was done recently on the narrow beach fronting the Hyatt, where the Beachwalk had become undermined. An erosion skirt installed in 2015 has successfully prevented further loss of the Kāʻanapali Beachwalk (Figure 5-3a). More recently, in January of 2018, a "sand-filled mattress" was installed fronting the

Kāʻanapali Beach Hotel to protect the Kāʻanapali Beachwalk (Figure 5-3b). In January of 2019, the beach in front of the Kāʻanapali beach Hotel had re-inflated and the mattress was removed.

Although temporary shore protection is initially less expensive than permanent shore protection, the temporary structures usually require frequent maintenance. Maintenance costs can quickly add up, making temporary shore protection more expensive than permanent shore protection over a typical project life. As there are minimal design guidelines for temporary shore protection, and performance in large wave events such as hurricanes or tsunamis is unpredictable. Thus, temporary shore protection projects have the tendency to degrade rapidly. In addition, the high failure rates associated with temporary protection materials can result in numerous repair efforts conducted during extreme erosion events when the beach is at its narrowest and structures are at their most vulnerable. Continued emergency construction and repair operations have potential impacts of their own, also.

Temporary shore protection, especially after it begins to wear, is often unsightly and unnatural in appearance. However, material suppliers are getting better at matching the material color with the sand color at Kāʻanapali Beach and the replacement of degraded materials can extend the life expectancy of the projects.

(a)

(b)

Figure 5-3. Examples of emergency shore protection at a) the Hyatt Regency Maui (2016) and b) the Kāʻanapali Beach Hotel (2018)

5.3.2 Permanent Buried Shore Protection (Alternative 2)

Permanent shore protection uses hard, durable materials to fix the shoreline in the desired location. Permanent shore protection includes revetments, seawalls, groins, and breakwaters. These structures are usually made out of stone, concrete, or sheet pile.

Revetments and seawalls are effective at protecting backshore lands from further erosion. A revetment is a sloping, uncemented structure built of wave-resistant material such as rock or concrete armor units. A seawall is a vertical or sloping concrete or concrete rubble masonry (CRM) wall used to protect the land from wave damage and erosion. If properly designed and constructed, both revetments and seawalls are proven, durable shore protection methods that require relatively low maintenance.

Permanent buried shore protection structures (also called "backstop structures") are a type of shore protection that is placed seaward of the infrastructure but set back from the shoreline. A buried rock revetment would achieve the project goal of protecting backshore infrastructure. Buried shore protection has been proposed in the past along Kāʻanapali Beach, most recently in 2010 at the Kāʻanapali Aliʻi after sustained high water and southern swells threatened backshore infrastructure including the Kāʻanapali Beachwalk.

Buried shore protection structures, as long as they remain buried, can be minimally invasive and are typically not noticeable. This would be in anticipation of future erosion that may threaten the infrastructure. Should erosion reach the structure, the structure would prevent damage to the development that it is fronting. Ideally, buried shore protection structures are coupled with long-term beach management~~maintenance~~ (i.e., ~~nourishment) programs~~nourishment) programs, where the structures provide protection to development between beach nourishment~~maintenance~~ efforts. Buried shore protection structures will ultimately lead to beach narrowing and loss on a ~~chronically eroding~~chronically eroding shoreline if beach nourishment and restoration~~maintenance~~ efforts are not kept up.

Although the project site is protected from most direct wave exposure, a buried revetment would need to endure infrequent high wave heights from extreme Kona storms or southern swells. Table 5-2 lists the breaking wave heights at Kāʻanapali Beach that would occur for a 50-year recurrence interval of waves from the south (southern swell and Kona storms), west (Kona storms and north swell), and north (north swell).

Table 5-2. 50-year wave heights at Kāʻanapali

	Deepwater Wave Height	Breaking Wave Height
North Sector (360°)	27.5 ft	15.1 ft
West Sector (Kona storm) (280°)	11.2 ft	15.6 ft
South Sector (190°)	15.4 ft	17.1 ft

A structure capable of withstanding a 17-foot breaking wave would require 3,000 lb. stones placed in two layers. 3,000 lb. stone has a nominal diameter of 2.8 feet. Geotechnical borings have shown that there is no hard substrate at Kāʻanapali to provide a foundation for the revetment structure. A revetment toe, therefore, would be included to protect the structure from scour. A typical cross-section of a buried shore protection structure for Kāʻanapali Beach is shown in Figure 5-4.

A typical unit cost used in estimating the project cost of a rock revetment is approximately $10,000 per linear foot of the structure. Backshore excavation and poor equipment access at Kāʻanapali Beach would likely increase costs per foot of revetment. The total project cost to build a backstop revetment from Puʻu Kekaʻa to Hanakaʻōʻō Beach Park, therefore, would likely be around $100 million.

A buried revetment would likely occupy land under both County of Maui and State of Hawaiʻi jurisdiction, and would, therefore, require the full suite of permits and approvals from both County and State agencies. The structure would likely be landward of the MHHW line and would not require Federal permits and approvals.

Other options for permanent shore protection include groins and breakwaters. Groins and breakwaters are structures, often made of rock or concrete, that extend offshore or are completely disconnected from the shoreline. One or more groins along Kāʻanapali Beach would likely slow the seasonal and episodic transport of sand. A well-engineered groin structure at Hanakaʻōʻō Point could adequately separate the two cells and provide limited protection from southern swell for a portion of the point within the Kāʻanapali Littoral Cell. The popularity of the surf break and the presence of a living reef would make this a difficult place to build a structure; however, a relatively short groin, which does not extend into the surf zone, might provide sufficient protection to the point. This structure would be buried during the accretion seasons and exposed during the erosion seasons. This groin would still be very effective at blocking the erosive waves that come across the point from the south when the sand volume at the point is diminished. Groins typically result in downdrift, or down current, erosion. The beach on the downdrift side of the groin will typically experience erosion during periods of high sediment transport, while the beach on the updrift side will accumulate sand. For a location such as Hanakaʻōʻō Point, where transport direction shifts from one season to the next, the beach response would change as well. Offshore breakwaters would not be effective within the Kāʻanapali Littoral Cell, due to the changing, oblique seasonal wave patterns. A breakwater may be partially effective at the paleochannel in the middle of the Hanakaʻōʻō Littoral Cell, where wave refraction creates an erosion hotspot along the shoreline. In this instance, changing the wave field characteristics may provide a partial improvement to the localized, accelerated, shoreline erosion problem. This location is unique, in that the surrounding area has a very shallow fringing reef that already significantly reduces wave energy on the adjacent shoreline areas.

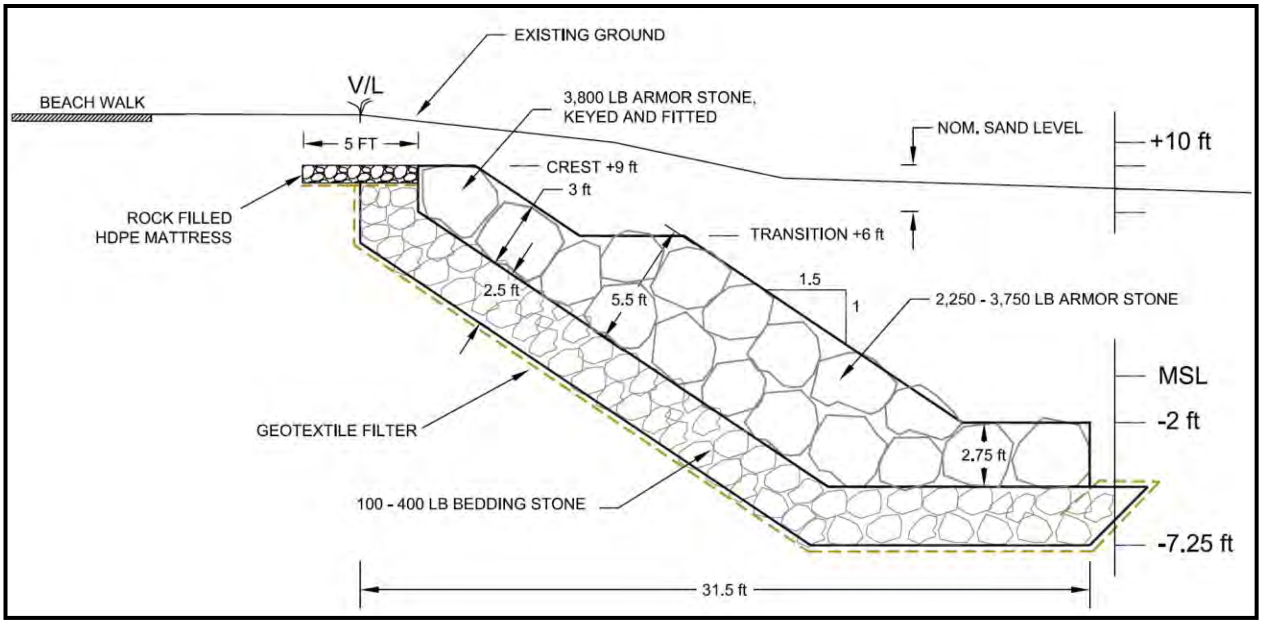


Figure 5-4. Sample buried revetment section

5.3.3 Vertical Accommodation~~Adaptation~~ (Alternative 3)

Vertical accommodation~~Adaptation~~ would entail preparing shorefront lands along Kāʻanapali Beach for inundation and land loss by elevating existing uses and structures above the shoreline. This allows~~while allowing~~ the shoreline to naturally migrate landward beneath the uses and structures.~~.~~ Erosion adaptation along the shoreline usually involves horizontal retreat (*No Action Alternative* and *Managed Retreat Alternative 4*) but may also include vertical accommodation (elevation of structures) in areas prone to intermittent flooding, but typically not erosion.

Horizontal retreat~~Retreat~~ or relocation of infrastructure to a more mauka location requires open land. In Kāʻanapali, inland areas have been utilized for existing infrastructure and development. As a result, any horizontal retreat or relocation requires removal of the current infrastructure and development to repurpose the land. In some instances, vertical accommodation can be investigated as an alternative to horizontal retreat. Typically, vertical accommodation works best in backshore areas where uses are not impacted by seasonal and annual changes in the wave environment and episodic erosion events.

The first system~~piece~~ of infrastructure that c~~w~~ould be investigated~~threatened~~ under a vertical accommodation alternative~~the adaptation option~~ would be the Kāʻanapali Beachwalk. Replacing the Beachwalk with an elevated boardwalk constructed on piles suitable for the nearshore environment has been assessed. The openness of the pile system would allow the shoreline to move under the boardwalk while not immediately threatening the coastal access path. Boardwalks are commonly constructed to allow users to traverse sensitive dune systems and back beach areas and are found worldwide. An elevated boardwalk has been installed along the shoreline at Wailea on the island of Maui. The boardwalk was initially supported by wooden piling; however, those pilings have been heavily reinforced with concrete as they have been progressively exposed to increased wave forces.

Though an elevated boardwalk would maintain coastal lateral access, it is not an ideal solution for this coastline. Erosion rates of around 2.0 feet per year would result in the boardwalk being detached from the backshore in numerous locations and suspended above the active beach face in the near future. This would limit ingress and egress points from the structure. The close spacing of large piles required to support the structure in an active wave impact environment would also limit beach use and potentially perturb coastal processes beneath the structure. Examples of an elevated boardwalk design for Kāʻanapali Beach are shown in Figure 5-5 and Figure 5-6. The beach near and beneath the structure would not be safe for use during wave events, due to turbulent water currents in and amongst the piles.

The Kāʻanapali Beachwalk is the simplest infrastructure on the shoreline to assess for implementation of the vertical accommodation alternative. Even this relatively minor improvement presents numerous challenges and long-term failure when implemented on a progressively eroding shoreline that is exposed to year-round wave attack. Larger structures and amenities exponentially increase the difficulty and reduce the practicality of vertical accommodation along Kāʻanapali Beach.

Figure 5-5. Alignment example for an elevated boardwalk along Kāʻanapali Beach

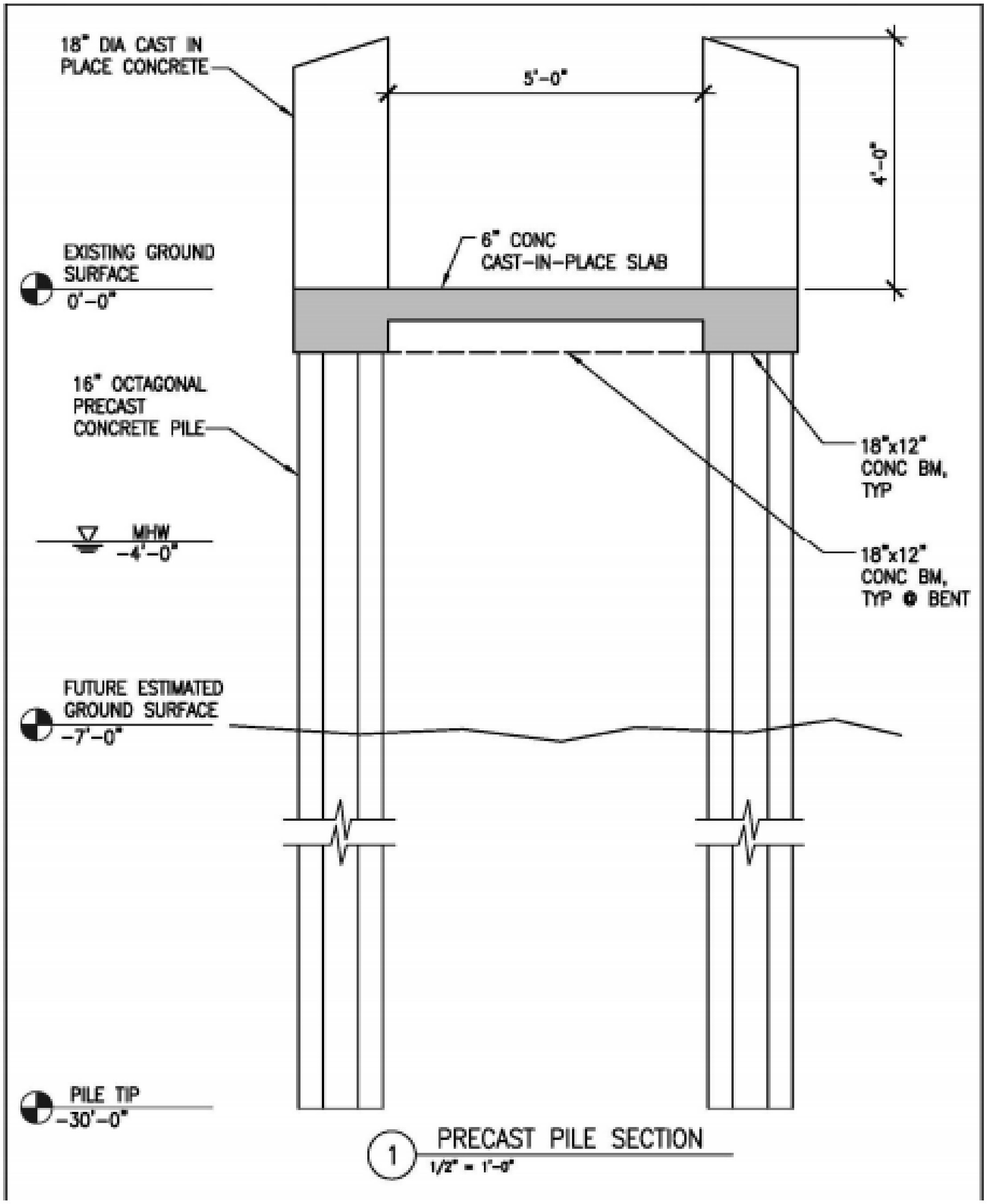


Figure 5-6. Example section for an elevated boardwalk along Kāʻanapali Beach

5.3.4 Managed Retreat (Alternative 4)

Managed retreat is a coastal management strategy for planned relocation of development away from the shoreline and out of vulnerable areas that is intended to allow the shoreline to naturally move inland, rather than fixing the shoreline with engineered shore protection structures. Managed retreat in a heavily developed high-rise resort community like Kāʻanapali is a multi-decadal process, requiring extensive planning and coordination between government, community, and affected property owners.

Nature-based management practices, such as beach restoration, can provide essential intermediate steps in the coming decades while long-term sea level rise adaptation plans are developed. These long-term plans may include wholesale retreat of Kāʻanapali's resort development away from the shoreline or a combination of strategies such as continued beach restoration plus intermittent 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.

From the perspective of adapting a densely developed resort community like Kāʻanapali, the discussion of alternatives is based on conservation and restoration of the beach in the near to mid-term while longer term adaptation plans and supporting government policies and programs are developed to address relocation of vulnerable development on the landward side of the shoreline. Though benefits and impacts to the backshore are discussed extensively in the analysis of the project, it has primarily been developed as a management practice for immediate erosion concerns along the dynamic sandy shoreline. Arguably, these immediate shoreline erosion concerns are also a motivating factor towards implementing managed retreat. However, managed retreat in Kāʻanapali is a multi-decadal planning, legal, financial, political, land use, and regulatory process that is guided by County and State government, driven by community engagement, and facilitated by landowner participation. Managed retreat is a long-term process focused on large scale development decisions behind the shoreline, while beach restoration is an interim action that is focused on management of a natural environmental and public resource.

Numerous government actions are needed prior to developing a managed retreat plan for the Kāʻanapali resort community, including developing a planning and regulatory framework specific to managed retreat that is needed to assess it thoroughly as a viable alternative. For managed retreat, beach conservation and management is but one of many project objectives, compared to beach restoration where the full intent of the project is management of the sandy shoreline. Investigation and development of managed retreat options and plans for the region may begin in the vision, actions, and policies developed through updates to community and island-scale plans. These plans provide a venue and process for collaborative engagement between community, government planners, and elected officials.

The 2019 report, *Assessing the Feasibility and Implications of Managed Retreat Strategies for Vulnerable Coastal Areas in Hawaiʻi*, published by the Hawaiʻi Office of Planning, presented next steps for the State of Hawaiʻi 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." 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 use 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

The study found that retreat is most effective when done voluntarily and that economic incentive programs to fund retreat (e.g., buyouts, transferrable development rights, rolling easements) are particularly challenging in Hawaiʻi due to the high value of coastal real estate. 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.

Until the policies, regulations, tools, and programs are in place to implement managed retreat in a heavily developed high-rise community like Kāʻanapali, other appropriate solutions should be considered as initial, iterative steps on the path to sea level rise adaptation. In this case, beach restoration would help to maintain the economic, social, cultural, environmental, and recreational value of Kāʻanapali Beach, while providing a protective buffer to reduce impacts from erosion and flooding.

The multi-decadal process of planning for managed retreat should not preclude the State from fulfilling its responsibility to conserve and, where feasible, restore beach resources and shoreline public access in the present.

Managed retreat should be part of community and more localized development planning processes.

Managed retreat will likely require substantial redevelopment or relocation of the 12 major resorts that currently operate along Kāʻanapali Beach. Relocation at this scale would require redevelopment of over 270 acres of land between Honoapiʻilani Highway and the shoreline, affecting over 26 individual private landowners and resorts, as well as the economies of the County of Maui and State of Hawaiʻi. A project of this magnitude fundamentally alters nearly every aspect of the environment and the community as it exists today. Managed retreat plans should be developed in coordination and collaboration with State and County agencies, the community, the landowners, and other stakeholders that would be affected. Ideally, managed retreat would be initially evaluated as part of the community development planning process, which is coordinated by the County of Maui. Kāʻanapali is part of the West Maui Community Development Plan, which is in the process of being updated for the first time in 25 years. Managed retreat at Kāʻanapali could be further developed through a more localized special area plan, redevelopment or special improvement district, or climate adaptation plan.

The geographic scale of managed retreat is disproportionately larger than the proposed beach restoration.

Kāʻanapali Beach consists of approximately 15 acres of Public Trust land, which represents approximately 5% of the terrestrial area of Kāʻanapali and has a single owner, the State. Thus, the geographic scale of Managed retreat at Kāʻanapali is over 18 times greater than the proposed beach restoration effort, effects 26 individual landowners and entails the complete redevelopment of a planned resort community.

Current retreat options within the existing regulations.
Managed retreat for individual land uses would involve modification, relocation, or removal of existing structures to reduce hazard exposure and maintain a natural shoreline. Shoreline setbacks are an existing regulation requiring individual development actions to be set back a minimum distance from the shoreline, creating a buffer zone that reduces the potential for shorefront development to be exposed to erosion and flooding. The County of Maui requires shoreline setbacks for new construction (including complete redevelopment) along the shoreline. The purpose of the shoreline setback is to protect and preserve the natural shoreline, lateral shoreline access, and open space along the shoreline while minimizing exposure of the built environment to coastal hazards.

The proposed action, restoration of a sand beach, is located in the State's Conservation District, entirely makai of the shoreline. The action of beach restoration and berm enhancement in the Conservation District is not subject to State or County setback requirements.

The proposed beach restoration project will not move the certified shoreline or shoreline setback area seaward. Setbacks for development in the backshore are calculated and implemented during the County permitting process, prior to construction. These setbacks are calculated based on the location of a certified shoreline. A certified shoreline will be completed as part of the permit process prior to the proposed beach restoration project, establishing a baseline under existing conditions for setback calculations. Setback requirements based on certified shorelines will continue to be employed, according to Hawaii Revised Statute Chapter 205A, regardless of implementation of a shoreline project in the region.

The restoration effort will provide additional sand volume to the littoral cells, mitigating erosion pressure for the coming years to decades; however, the certified shoreline location will be based on current conditions. This provides the double benefit of erosion mitigation and conservative setback locations for any potential future development projects in the region.

Any redevelopment involving new construction at Kāʻanapali would be required to conform the County's setback ordinance, which would improve resilience to coastal hazards. The County is presently discussing options for integrating sea level rise considerations into the setback ordinance.

Managed retreat is not the only option to adapt to sea level rise.
Managed retreat is an example of an adaptation strategy, which is one of three primary strategies for developed coastal areas – along with protection and accommodation – to respond to sea level rise. It is not the only option, and the other options may be assessed for implementation as stand-alone approaches or as a combination of two or more approaches to suite local needs and in consideration of feasibility. Beach restoration is considered a nature-based adaptation strategy and, like any coastal management strategy, has tradeoffs and limitations. However, beach restoration has proven to be a cost-effective strategy for maintaining beaches (Porro, 2020). While periodic restoration efforts may be required, the economic, social, cultural, and environmental impacts of beach restoration are low compared to the impacts and costs associated with continued

beach erosion given the economic significance of Kāʻanapali Beach to the economies of Maui and the State and the environmental impacts of materials and structures encroaching and collapsing onto the beach with ongoing, unmitigated shoreline erosion.

The timeline for managed retreat is disproportionately longer than beach restoration. Managed retreat should be evaluated through long-range planning beginning with the community planning process. One suitable avenue for assessment, community input, and prioritization of Managed retreat could be The West Maui Community Development Plan. It will take decades to envision, plan, fund, and implement a managed retreat plan for Kāʻanapali and community planning provides an appropriate multi-decadal planning outlook. Beach restoration can be completed in a matter of years as an iterative, interim mitigation and adaptation measure. Multiple beach restoration efforts, nature-based sea level rise adaptation measures, could be completed in the time it will take to implement a comprehensive and holistic managed retreat plan at Kāʻanapali. Moreover, beach restoration can be an integral step in a broader and more inclusive managed retreat plan, providing a nature-based solution and allowing additional time for other sea level rise adaptation measures on a coastline.

~~5.3.4~~5.3.5 *Alternatives Summary*

Table 5-3 summarizes anticipated short-term and long-term impacts associated with the presented alternatives. Short-term impacts are generally defined as impacts due to construction and conditions that will return to pre-construction condition within 6 months. Long-term impacts generally last longer than 6 months, are ongoing, or are permanent. Mid-term is used in several instances to call out impacts that can last between 6 months to several years but will not be ongoing or permanent in nature.

Table 5-3. Summary of Potential Impacts by Resource Area*

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
Climate						
Tides						
Sea-level rise	**Long-term impacts:** Mitigating impacts of increasing erosion and flooding with SLR while conserving and restoring the beach environment with a nature-based adaptation solution. Restores natural habitat and recreational resources.	**Short to Mid-term impacts:** Reduced susceptibility of backshore development to increasing erosion and flooding from SLR and seasonal beach loss (while temporarily deployed). May impact beach processes.	**Long-term impacts:** Reduced susceptibility of backshore development to increasing erosion and flooding from SLR and seasonal to permanent beach loss. May impact beach processes and beach health on an erosional coast.	**Long-term impacts:** Reduced susceptibility of backshore development to increasing erosion and flooding from SLR if development is relocated and/or elevated, allowing the beach environment to migrate inland. Potential loss or reduction of existing backshore uses. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Short to Mid-term impacts:** Beach erosion events will continue to impact the coastal plain and backshore improvements. Terrigenous material in the backshore will be released into marine water. **Long-term impacts:** Allows the beach to migrate inshore; however, there is no guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR. Requires relocation or removal of infrastructure, habitable buildings, and other	**Long-term impacts:** Increased susceptibility of backshore development to increasing erosion and flooding from SLR, in addition to impacts to water quality and the marine and coastal environment. Allows the beach to migrate inshore; however, there is no guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
					improvements in the coastal plain.	
Currents						
Offshore Waves						
Flood and Tsunami Hazard	**Long-term impacts:** Reduced susceptibility to flooding from large wave events.	**Short to Mid-term impacts:** Reduced susceptibility to flooding from large wave events.	**Long-term impacts:** Reduced susceptibility to flooding and erosion from large wave events.	**Long-term impacts:** Reduced susceptibility to flooding and erosion from large wave events and tsunamis by elevating and moving mauka. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Mitigates susceptibility to flooding and erosion from large wave events and tsunamis but requires relocation or removal of infrastructure, habitable buildings, and other improvements in the coastal plain. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Increased susceptibility to flooding and erosion from large wave events and tsunamis. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Offshore Bathymetry	**Short-term impacts:** 6' deep depression at the ~~Puʻu Kekaʻa~~ Sand Recovery Area.					
Nearshore Bathymetry	**Short-term impacts:**	**Short to Mid-term impacts:**	**Long-term impacts:**	**Long-term impacts:** Landward recession of the shoreline;	**Long-term impacts:** Landward recession of the shoreline; wave	**Long-term impacts:** Landward recession of the shoreline; wave

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
and Coastal Processes	Wave reflection at Hanakaʻōʻō Point during first season post-placement. Beach profile adjustments immediately after placement. **Mid-term impacts:** Increased beach berm height in the KLC. **Long-term impacts:** Beach width increases across both littoral cells.	Wave reflection off structures during erosion events; localized end effects where structures terminate; beach narrowing; reduced beach access (during temporary deployment).	Beach narrowing during seasonal erosion events where the backstop is exposed for short periods of time; wave reflection off structures when exposed during erosion events; localized end effects where structures terminate. Long-term beach narrowing and loss due to chronic erosion, if the beach migrates into the backstop.	wave interaction with pile supported structures and exposed structures during the relocation process. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	interaction with exposed structures prior to removal. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	interaction with exposed structures prior to removal or while being destroyed. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Sand Characteristics	**Short-term impacts:** Anoxic smell; change in beach color. **Long-term impacts:** Potential compaction or lithification of placed sand; potential placement of			**Long-term impacts:** Release of terrestrial and/or fill sediments from developed areas to the beach and marine environment during events that erode the backshore substrate. Figure 5-2 presents potential reach of backshore erosion under 0.5,	**Long-term impacts:** Release of terrestrial and/or fill sediments from developed areas to the beach and marine environment during events that erode the backshore substrate. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Release of terrestrial and/or fill sediments from developed areas to the beach and marine environment during events that erode the backshore substrate. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	some coral cobbles.			1.1, 2.0, and 3.2 feet of SLR.		
Water Quality	**Short-term impacts:** Increase in turbidity at the placement areas and at the ~~Puʻu Kekaʻa~~ Sand Recovery Area. **Long-term impacts:** Intermittent increases in turbidity as fines in placed sand are released during seasonal high waves and erosion (~1 year).			**Long-term impacts:** Increased turbidity due to release of terrestrial and/or fill sediments from developed areas to the beach and marine environment during events that erode the backshore substrate. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Increased turbidity due to release of terrestrial and/or fill sediments from developed areas to the beach and marine environment during events that erode the backshore substrate. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Increased turbidity due to release of terrestrial and/or fill sediments from developed areas to the beach and marine environment during events that erode the backshore substrate. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Marine Biology	**Short-term impacts:** Temporary loss of infaunal organisms at the dredge and placement areas. Potential impacts from vessel movement. Potential impacts from	**Short to Mid-term impacts:** Temporary-seasonal loss of coastal sandy habitat due to beach narrowing (while temporary measures are deployed)	**Long-term impacts:** Loss of coastal sandy habitat resulting from beach narrowing and loss due to chronic erosion.	**Long-term impacts:** Conservation of sandy habitat, assuming beach is able to migrate inland and development is relocated inland. No guarantee that the beach will be stable or present at higher sea levels.	**Long-term impacts:** Potential loss of coastal sandy habitat due to continued beach narrowing and loss in some areas if development is not relocated. No guarantee that the beach will be stable or present at higher sea levels.	**Long-term impacts:** Potential loss of coastal sandy habitat due to continued beach narrowing and loss in some areas if development is not relocated. No guarantee that the beach will be stable or present at higher sea levels.

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	construction and sand placement related turbidity. Temporary displacement of organisms in the location of the anchor systems at the sand recovery site and the sand transfer sites. Temporary displacement of organisms for emplacement of the sand transfer systems. **Long-term impacts:** Conservation and restoration of sandy habitat for coastal species. Hard marine substrate covered by sand within the 1988 beach footprint.					
Protected Species	**Short-term impacts:** Potential interaction with protected species	**Short-term impacts:** Potential interaction with protected species	**Short-term impacts:** Potential interaction with protected species during construction	**Long-term impacts:** Conservation of sandy coastal habitat for protected species, assuming beach is	**Long-term impacts:** Potential loss of coastal sandy substrate used by protected species when development	**Long-term impacts:** Potential loss of coastal sandy substrate used by protected species when development encroaches

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	during construction efforts. Interactions will be mitigated through application of BMPs. **Long-term impacts:** Conservation/restoration of sandy coastal habitat for protected species, especially in chronically eroded areas of the coastline.	during construction efforts. Interactions would be mitigated through application of BMPs. **Short to Mid-term impacts:** Temporary/seasonal habitat loss resulting from beach narrowing and loss (while temporary measures are deployed).	efforts. Interactions would be mitigated through application of BMPs. **Long-term impacts:** Habitat loss resulting from beach narrowing and loss due to chronic erosion.	able to migrate inland. Habitat loss may occur due to pile supported Beachwalk interactions with an eroding shoreline. No guarantee that the beach will be stable or present at higher sea levels.	encroaches into coastal habitat. No guarantee that the beach will be stable or present at higher sea levels.	into coastal habitat. No guarantee that the beach will be stable or present at higher sea levels.
Flora	**Short-term impacts:** Temporary displacement of cultivated vegetation at the mauka edge of the berm enhancement area. **Long-term impacts:** Conservation of vegetation at the	**Short-term impacts:** Temporary displacement or loss of cultivated vegetation along the upper beach and makai edge of the coastal plain. **Short to Mid-term impacts:** Continued deployment of	**Short-term impacts:** Temporary displacement of flora in the structure's footprint during construction. **Long-term impacts:** Permanent loss of flora and fauna habitat area in eroded regions.	**Long-term impacts:** Conservation of vegetation assuming the beach environment is allowed to migrate landward.	**Long-term impacts:** Conservation of vegetation assuming the beach environment is allowed to migrate landward.	**Long-term impacts:** Permanent loss of flora and fauna habitat area in eroded regions when development encroaches into flora at the back of the eroding/migrating beach environment.

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	mauka edge of project beach.	materials can result in long-term loss of cultivated vegetation at erosion site on the coastline.				
Air Quality	**Short-term impacts:** Local degradation of air quality due to construction related equipment exhaust.	**Short-term impacts:** Local degradation of air quality due to construction related equipment emissions.	**Short-term impacts:** Local degradation of air quality due to construction related equipment emissions.		**Long-term impacts:** Local degradation of air quality due to construction related equipment exhaust as the built environment is rebuilt in landward locations, then deconstructed near the shoreline.	
Noise	**Short-term impacts:** Increased noise from construction equipment.	**Short-term impacts:** Increased noise from construction equipment **Short to Mid-term impacts:** Increase noise from construction equipment during installation and maintenance/repair activities.	**Short-term impacts:** Increased noise from construction equipment.	**Long-term impacts:** Increased noise from construction equipment as backshore is reconfigured.	**Long-term impacts:** Increased noise from construction equipment as the built environment is rebuilt in landward locations, then deconstructed near the shoreline.	**Long-term impacts:** Increased noise from construction equipment as structures are removed or destroyed.

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
Streams	**Long-term impacts:** Alteration of the Hāhākea Gulch stream's path to the ocean by lengthening the intermittent stream channel across the restored beach berm. Similar to stream conditions prior to1988.					
Scenic and Open Space Resources	**Short-term impacts:** Turbidity, unsightly construction equipment, and minor sand color change. **Long-term impacts:** Improved views with increased beach width and removal of temporary erosion protection materials.	**Short to Mid-term impacts:** Unsightly construction equipment and temporary shore protection structures during erosion events.	**Short-term impacts:** Unsightly construction equipment **Long-term impacts:** Exposed boulders during seasonal erosion events and/or with permanent beach loss.	**Long-term impacts:** Unsightly construction equipment as backshore is reconfigured; increased turbidity during erosion events due to release of backshore terrigenous sediment and fill material. Conservation of scenic and open beach resources if development is relocated. No guarantee that the	**Long-term impacts:** Unsightly construction equipment as backshore is reconfigured; increased turbidity during erosion events due to release of backshore terrigenous sediment and fill material. Conservation of scenic and open beach resources as development is rebuilt in landward locations then deconstructed near the shoreline. No guarantee that the beach	**Short-term impacts:** Unsightly evidence of erosion (scarps, exposed root systems, exposed irrigation lines, etc.) **Long-term impacts:** Increased turbidity during erosion events due to the release of backshore terrigenous sediment and fill material. Encroachment of backshore development into the beach environment as the shoreline recedes. No guarantee that the beach

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
				beach will be stable or present at higher sea levels.	will be stable or present at higher sea levels.	will be stable or present at higher sea levels.
Surrounding Land Use	**Long-term impacts:** Protection of backshore land uses from erosion and coastal hazards, while conserving and restoring the natural beach environment.	**Short to Mid-term impacts:** Protection of backshore land uses from erosion and coastal hazards.	**Long-term impacts:** Protection of backshore land uses from erosion and coastal hazards.	**Long-term impacts:** Adjustments to land use as backshore is reconfigured. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Adjustments to land use as backshore is reconfigured through building replacement structures in landward positions, then deconstructing existing structures near the shoreline. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Adjustments to land use as structures are removed or destroyed. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Community Character	**Long-term impacts:** Protection of community character from erosion and coastal hazards, while conserving and restoring the natural beach environment.	**Short to Mid-term impacts:** Protection of community character from erosion and coastal hazards.	**Long-term impacts:** Protection of community character from erosion and coastal hazards.	**Long-term impacts:** Reduction in community character with loss of community facilities, businesses, and landmark features. Possible improvement of aesthetic value of the coastline. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Reduction in community character as the entire coastline undergoes a regional relocation effort with construction of replacement structures in landward positions, then deconstruction of existing structures near the shoreline. Possible improvement of aesthetic value of the coastline. Figure 5-2 presents potential reach	**Long-term impacts:** Reduction in community character with loss of ADA compliant lateral beach access and loss of community facilities, businesses, and landmark features. Possible improvement of aesthetic value of the coastline. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
					of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	
Tourism	**Short-term impacts:** Restricted access to portions of the beach that are undergoing nourishment efforts, and areas on the water that are being utilized for sand recovery, transport, and offloading operations. **Long-term impacts:** Improved beach resources provide long-term stability to coastal tourism.	**Short-term impacts:** Restricted access to construction areas and beach. **Short to Mid-term impacts:** Limited or restricted access to beach. Protection of tourism related backshore development.	**Short-term impacts:** Restricted access to construction areas. **Long-term impacts:** Limited or restricted access to beach when the structure is exposed seasonally to permanently. Protection of tourism related backshore development.	**Short-term impacts:** Restricted access to reconfiguration areas. **Long-term impacts:** Limited or restricted access within or below some reconfigured uses on the shoreline. Relocation or loss of tourism related development. Possible improvement of aesthetic value of the coastline. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Short-term impacts:** Restricted access to reconfiguration areas, both the new structures in landward locations and the old structures near the shoreline. **Long-term impacts:** Limited or restricted access within or below some reconfigured uses on the shoreline. Relocation or loss of tourism related development. Possible improvement of aesthetic value of the coastline. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Short-term impacts:** Restricted access to during periods of removal or destruction of facilities and structures. **Long-term impacts:** Loss of tourism related to backshore development. Possible improvement of aesthetic value of the coastline. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Beach Access	**Short-term impacts:**	**Long-term impacts:** Interruptions from construction	**Short-term impacts:** Interruption during construction.	**Short-term impacts:** Interruption as public right-of-ways and	**Short-term impacts:** Interruption as public right-of-ways and	**Long-term impacts:** Loss of lateral beach access as the Beachwalk is removed or destroyed

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	Interruption during construction. **Long-term impacts:** Conservation, restoration of public beach access and protection of the Beachwalk.	during erosion events and maintenance or repair efforts. **Short to Mid-term impacts:** Temporary loss of lateral beach access as structures are exposed by erosion (while temporarily deployed). Protection of the Beachwalk.	**Long-term impacts:** Temporary to permanent loss of lateral beach access as structures are exposed by erosion. Protection of the Beachwalk.	Beachwalk are reconfigured. **Long-term impacts:** Conservation of public beach access assuming development is relocated inland. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	Beachwalk are reconfigured. **Long-term impacts:** Potential loss of Beachwalk during the retreat process. Conservation of public beach access along the coastline as development is relocated inland. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	and other development encroaches into the retreating beach. No guarantee that the beach will be stable or present at higher sea levels. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Coastal and Nearshore Recreation	**Short-term impacts:** Closure of nearshore waters around dredge area and offloading locations; closure of portions of the beach during placement; brief disruption to canoe area at Hanakaʻōʻō	**Short-term impacts:** Closure of portions of the beach during construction and/or during beach erosion **Short to Mid-term impacts:** Temporary loss of beach and nearshore recreation as	**Short-term impacts:** Closure of portions of the beach during construction **Long-term impacts:** Temporary to permanent loss of beach and nearshore recreation as structures are exposed by erosion	**Short-term impacts:** Restricted access to reconfiguration areas. **Long-term impacts:** Conservation of beach and nearshore recreation, assuming shorefront development is relocated inland. Limited or restricted access within or below some reconfigured uses on	**Short-term impacts:** Restricted access to the deconstruction areas for old structures near the shoreline. **Long-term impacts:** Conservation of beach and nearshore recreation, after shorefront development is relocated inland. Limited or restricted access within or below some reconfigured uses	**Short-term impacts:** Restricted access during periods of removal or destruction of facilities and structures. **Long-term impacts:** Loss of beach and nearshore recreation as development encroaches into the retreating beach. Figure 5-2 presents potential reach of backshore erosion under

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	Beach Park; possible undesirable wave reflection at Hanakaʻōʻō Point surf break during first season post-placement. **Long-term impacts:** Conservation and restoration of beach recreation though natural restoration of the beach resource.	structures are exposed by erosion (while temporarily deployed)		the shoreline. Loss of tourism related infrastructure. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	on the shoreline. Loss of tourism related infrastructure. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	0.5, 1.1, 2.0, and 3.2 feet of SLR.
Public Health	**Short-term impacts:** Potential increase in return wave energy in the KLC due to higher berm elevation.					
Cultural Resources	**Short-term impacts:** Potential for conflict associated with interpretation of impacts in the area around Puʻu					

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	Kekaʻa as a leina a kaʻuhane, or a leaping place for departed souls.					
Archaeological Resources		**Short-term impacts:** Potential disruption of archaeological sites and iwi kūpuna if excavation in the coastal plain is required for temporary shore protection structures.	**Short-term impacts:** Potential disruption of archaeological sites and iwi kūpuna during excavation for shore protection structures.	**Short-term impacts:** Potential disruption of archaeological sites and iwi kūpuna during reconfiguration of existing infrastructure. **Long-term impacts:** Loss of potential backshore archaeological sites and iwi kūpuna as shoreline recedes. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Short-term impacts:** Potential disruption of archaeological sites and iwi kūpuna during reconfiguration of existing infrastructure. **Long-term impacts:** Loss of potential backshore archaeological sites and iwi kūpuna as shoreline recedes. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Loss of potential backshore archaeological sites and iwi kūpuna as shoreline recedes. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Economy and Labor Force	**Short-term impacts:** Creation of construction and construction-related jobs. **Long-term impacts:** Stability in coastal and beach	**Short to Mid-term impacts:** Creation of construction and construction-related jobs during emplacement and maintenance actions.	**Short-term impacts:** Creation of construction and construction-related jobs. **Long-term impacts:** Loss of tourism-related jobs as the	**Long-term impacts:** Creation of construction and construction-related jobs if development is relocated or reconstructed; loss of resort jobs if resort amenities are not relocated/reconstruct	**Long-term impacts:** Creation of construction and construction-related jobs as development is relocated in landward locations then deconstructed near the shoreline; loss of resort jobs if resort structures and amenities are not	**Long-term impacts:** Temporary creation of construction and construction-related jobs as resort buildings are removed or destroyed; loss of resort jobs as resort buildings are removed or destroyed. Figure 5-2 presents

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	related jobs at the project site.		beach is ultimately narrowed and lost.	ed. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	relocated. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Population						**Long-term impacts:** Reduction of the transient population as resort buildings are removed or destroyed.
Housing						
Solid Waste Disposal						
Medical Facilities						
Police and Fire Protection						
Schools						
Recreational Facilities	**Short-term impacts:** Brief disruption to canoe area at Hanakaʻōʻō Beach Park during sand placement.			**Long-term impacts:** Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR. Recreational facilities near the shoreline will need to be relocated.	**Long-term impacts:** Loss of canoe facility, parking area, shower facilities, and picnic areas at Hanakaʻōʻō Beach Park. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical Accommodation~~Adaptation~~ (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
Roadways	**Short-term impacts:** Transportation of heavy machinery during mobilization and demobilization	**Short-term impacts:** Transportation of heavy machinery during mobilization and demobilization	**Short-term impacts:** Transportation of heavy machinery during mobilization and demobilization	**Short-term impacts:** Transportation of heavy machinery during mobilization and demobilization	**Short-term impacts:** Transportation of heavy machinery during mobilization and demobilization	**Short-term impacts:** Transportation of heavy machinery during mobilization and demobilization for debris removal efforts. **Long-term impacts:** Disruption to traffic along Honoapi'ilani Highway behind Hanaka'ō'ō Beach Park during high water and wave events
Water System	**Long-term impacts:** Reduction in potential erosion threat to water systems through conservation and restoration of the sand beach through natural beach nourishment.	**Short to Mid-term impacts:** Protection of the water systems from erosion threat.	**Long-term impacts:** Protection of the water systems from erosion threat.	**Short-term impacts:** Disruption during relocation or reconfiguration of existing supply lines. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Short-term impacts:** Disruption during relocation of existing supply lines. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Eventual loss of water service to erosion area as infrastructure is removed or destroyed. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Wastewater System	**Long-term impacts:** Reduction in potential erosion threat to wastewater systems through conservation and	**Short to Mid-term impacts:** Protection of the wastewater systems from erosion threat.	**Long-term impacts:** Protection of the wastewater systems from erosion threat.	**Short-term impacts:** Disruption during relocation or reconfiguration of existing infrastructure. Figure 5-2 presents potential reach of backshore	**Short-term impacts:** Disruption during relocation of existing infrastructure. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1,	**Long-term impacts:** Eventual loss of wastewater service to erosion area as sanitary sewer lines are removed or destroyed. Figure 5-2 presents potential reach of backshore erosion

Resource Area	Proposed Action – Beach Restoration – Accommodation (Preferred Alternative)	Temporary Shore Protection (Alternative 1)	Permanent Shore Protection (Alternative 2)	Vertical AccommodationAdaptation (Alternative 3)	Managed Retreat (Alternative 4)	No Action – Unmanaged Retreat (No Action Alternative)
	restoration of the sand beach through natural beach nourishment.			erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	2.0, and 3.2 feet of SLR.	under 0.5, 1.1, 2.0, and 3.2 feet of SLR.
Drainage System						
Electrical, Telephone, and Cable Television Services	**Long-term impacts:** Reduction in potential erosion threat to communication and electrical systems through conservation and restoration of the sand beach through natural beach nourishment.	**Short to Mid-term impacts:** Protection of the communication and electrical systems from erosion threat.	**Long-term impacts:** Protection of the communication and electrical systems from erosion threat.	**Short-term impacts:** Disruption during relocation or reconfiguration of existing infrastructure. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Short-term impacts:** Disruption during relocation of existing infrastructure. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.	**Long-term impacts:** Eventual loss of electrical, telephone, and CATV service to erosion area as infrastructure is removed or destroyed. Figure 5-2 presents potential reach of backshore erosion under 0.5, 1.1, 2.0, and 3.2 feet of SLR.

*If entry is blank, no short- or long-term impacts are anticipated

6. SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS OF THE PREFERRED ALTERNATIVE WHICH CANNOT BE AVOIDED

The proposed project would be the first major construction project on the shoreline and in the nearshore at Kāʻanapali Beach. Emergency shore protection has been deployed during erosion events in the past; however, these installations have been temporary and have been or could be removed with minimal environmental impact.

Past beach nourishment projects in Hawaiʻi and domestically have generated data on potential project impacts. Adverse environmental effects which cannot be avoided include the following:

- 75,000 cubic yards of sand will be removed from the ~~Puʻu Kekaʻa~~ Sand Recovery Area, altering the bathymetry and temporarily disrupting the ecology in the dredge extents.
- Access to active work areas will be restricted and will affect the practice of traditional and customary native Hawaiian practices that are exercised in the area(s) during restoration activities.
- Sand recovered from the ocean, 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.
- Dredging, transport, and placement of carbonate sand can increase the percentage of fine sediment through mechanical abrasion of friable grains.
- Particles greater than one inch in diameter may be present in the recovered and placed sand.
- Compaction of the sand can occur in high traffic areas during sand delivery and placement operations.
- When sand is recovered from anoxic environments, such as portions of the recovery site, it will typically have a grey color and unpleasant scent immediately after recovery.
- During sand recovery operations, minor turbidity is expected as sand is brought from the seafloor to the barge with a clamshell bucket.
- Anchor lines around the ~~Puʻu Kekaʻa~~ Sand Recovery Area would be in place for the duration of sand recovery operations. Anchor lines would be in place at the active sand offloading site. Dredging and transport operations would likely disrupt marine ecology and ocean recreation in the area during construction.
- The machinery operating on the barge and the beach is noisy and would be run from the early morning until later in the afternoon each day.
- Delivery to shore would require the emplacement of bridge structures, floats, or pipelines from the shoreline to at least 15 feet of water depth. Bridge structures could disrupt marine ecology and ocean recreation in the area during construction.
- Any construction activities taking place in the nearshore waters are expected to directly impact marine ecology, ocean recreation and access in the area.
- Placement operations on the beach would require lengths of the coast to be cordoned off during trucking operations. Access across the cordoned off area will be limited to specific crossing points with crossing guards.
- Sand placement in the Hanakaʻōʻō Littoral Cell will bury areas of "live rock". These areas have been exposed through beach erosion in recent decades but were covered by beach sand as recently as 1988. Much of this area is fossil reef but does have portions of algal cover and some epifaunal inhabitation.

- Bathymetry at and adjacent to the nourishment efforts will be temporarily perturbated while the beach equilibrates to the new sand volume.

7. MITIGATION AND MONITORING

7.1 Monitoring Programs

Monitoring programs are proposed for beach conditions, water quality, and marine biology. These proposed monitoring programs are presented below. Details for each of these monitoring efforts will be expanded upon and may be modified during the permit process, as directed by the regulatory and resource agencies at the Federal and State levels.

7.1.1 Beach Monitoring Plan

Beach profiles and topographic features were measured and mapped during the design and permitting processes. Beach monitoring has been conducted in the region since early 2000, with recent efforts including detailed and frequent topographic mapping efforts. The cumulative volume of elevation data for the beach provides a strong foundation for future, post-construction monitoring efforts.

During construction, beach elevations will be collected regularly to identify where to place sand, as well as to measure the volume of sand after placement. These measurements are vital for both ensuring correct placement of restoration sand on the beach and for establishing post-construction beach shape.

Post-construction monitoring of the beach would also be done to evaluate project performance. Post-construction project performance and beach stability would be monitored by periodically surveying beach profiles and documenting the characteristics of the shoreline with photographs. Beach profiles are a common measurement technique used to investigate coastal processes and shoreline change. The profiles would be performed by measuring the land along a transect perpendicular to the shoreline and may extend as far shoreward or seaward as necessary to capture specific project features. For this project, the profiles would extend from the Kāʻanapali Beachwalk to a seaward point past the intersection of the beach slope with the existing natural sea bottom. Profiles would be measured at 13 locations along Kāʻanapali Beach:

- Six (6) profiles within the HLC
- One (1) profile at Hanakaʻōʻō Point
- Five (5) profiles within the KLC
- One (1) profile on the north side of Puʻu Kekaʻa

Recoverable benchmarks would be established at each profile location to ensure that all profiles are measured at the same location, azimuth, and with the same elevation control. These profiles would be collocated with the profile locations established during the project planning and investigation efforts. The profiles would be measured using standard survey equipment and techniques. The profiles would be plotted, and a summary and discussion of the results would be prepared following each survey. The schedule for beach monitoring profiles would be as follows.

1. Immediately (within 72 hours) after placement of the sand fill to the design beach shape at each profile location.
2. A complete set of profiles at all locations will be accomplished 30 days, 6 months and 12 months post-construction.

3. After the first year, post-construction profiles will be measured quarterly for 3 years, and may be collected, annually or quarterly, for up to 10 years.

Additional profile locations or measurement times may be added as deemed warranted by the project coastal engineer in order to more fully measure the performance of the project, e.g., should an atypical or unusual shoreline formation or change occur or should changes occur more rapidly than anticipated.

The beach monitoring program would provide information to determine the performance and impacts of the project, if any, as well as helping to establish a timetable for possible future beach management activities.

7.1.2 Water Quality Monitoring

Water quality monitoring will be conducted before, during, and after construction of the project according to the approved Department of Health (DOH) Water Quality Certification (WQC) for the project. The WQC defines the Applicable Monitoring and Assessment Plan (AMAP). The AMAP will define the water quality sample sites, parameters to be tested, and thresholds for evaluation of test results. Sampling frequency will be established in the AMAP, also.

The intent of the Applicable Monitoring and Assessment Plan (AMAP) is to conduct water quality sampling and analysis to monitor potential impacts caused by in-water work of the project, including dredging and sand placement work. The AMAP will include baseline (preconstruction), during construction, and post-construction monitoring. Data collected as part of the AMAP will be used to assess the adequacy of BMPs applied during construction and will facilitate assessing the impacts of the project on water quality of the nearshore waters in the project vicinity. If shown to be necessary by the monitoring data, BMPs will be modified during construction to better protect water quality.

The monitoring program will largely follow the General Monitoring Guidelines for Section 401 Water Quality Certification Projects (HDOH, 2000). Water quality parameters to be tested as part of the AMAP are pH, turbidity, dissolved oxygen (DO), salinity, and temperature.

During Construction:

- The Contractor shall follow the accepted Water Quality Monitoring Plan and Applicable Monitoring and Assessment Plan.
  Monitoring locations move through the project area as placement activities progress along the shoreline.

1. The Contractor shall incorporate all erosion control measures shown in the drawings and the Best Management Practices Plan (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 be submitted immediately to the DOH for review. The project may only proceed after DOH issues a written acceptance of the modified BMPP.
2. Turbidity outside the active project site shall not exceed the baseline turbidity geometric value, as defined in the AMAP. The Contractor shall cease all work if unusual turbidity is observed and take the necessary remedial action to correct the problem.

- Applicable Water Quality Monitoring and Assessment Program: Trained professionals (with degrees in marine sciences) will be conducting the monitoring, including pre-construction, during construction and post-construction monitoring. Monitoring and sample testing shall comply with the DOH Clean Water Branch (CWB) – "General Monitoring Guideline for Section 401 Water Quality Certification Projects."

Post-Construction:
Long-term water quality monitoring efforts will be tied to the beach monitoring program schedule and will sample the parameters identified in the AMAP. The sampling schedule will be:

- A set of samples at the beach restoration area and the berm enhancement area will be collected at 30 days, 6 months and 12 months post-construction.
- After the first year, post-construction samples will be collected annually for 3 years and may be collected up to 10 years.

7.1.3 Marine Biology Monitoring

Both a baseline and a comprehensive marine environmental assessment were completed for the design and environmental review of the proposed project. These documents will be used as the basis for evaluating marine biology monitoring results for the project area and control area.

During Construction:

- Monitoring will be conducted at the middle and end of construction.
- Marine biology monitoring stations will be located at the Ridge to Reef Monitoring Sites and three other locations on the forereef, offshore of the beach restoration project in the HLC (Figure 7-1).
- A control station will be established in the Kahekili Marine Reserve, north of the project area.
- Monitoring will consist of mapping the seafloor at the monitoring site with photomosaics of 10 m by 10 m areas of the seafloor. Visual comparison and analytical review of the photomosaics will provide the assessment for change.

Post-Construction:
Long-term monitoring for the project area will be completed, using the methodology presented above, at the following intervals:

- Photomosaics will be collected and analyzed at 6 months and 12 months post-construction.
- After the first year, post-construction marine biology monitoring will be conducted annually for 3 years and may be collected for up to 10 years.

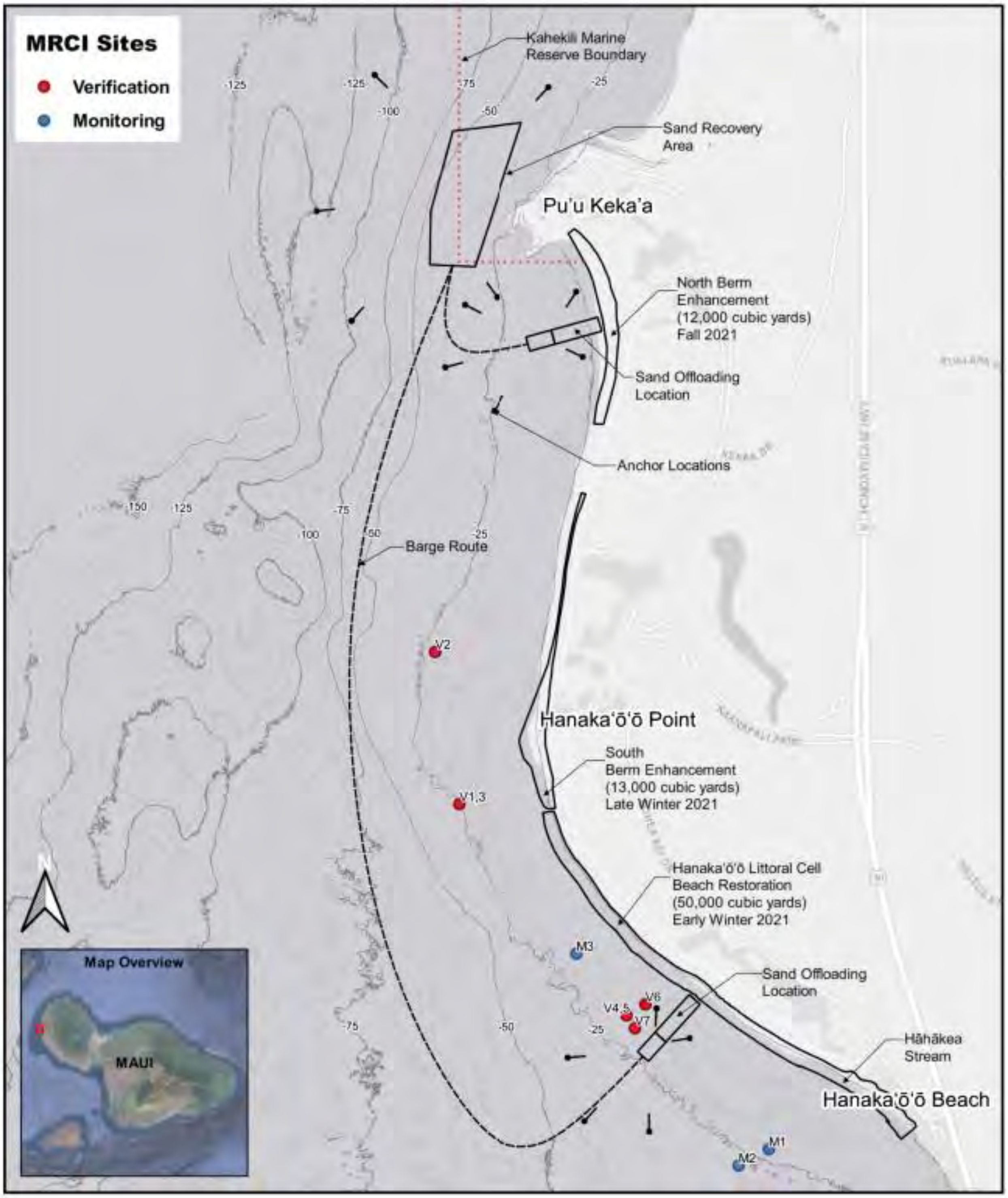


Figure 7-1. Marine Biology Monitoring Stations in the Project Area

7.2 During Construction Mitigation and Monitoring

7.2.1 Protection of Endangered Species - NMFS

The following endangered species BMPs, as recommended by the National Marine Fisheries Service, shall be adhered to during construction of the Proposed Action:

- 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 the 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 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.

7.2.2 Protection of Endangered Species - USFWS

The following endangered and threatened species BMPs, as recommended by the US Fish and Wildlife Service, shall be adhered to during construction of the Proposed Action:

- 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 (nēnē)
  - Do not approach, feed, or disturb Hawaiian geese.
  - 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 nēnē survey for nests 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
    - Consult with the Service three weeks 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.
    - Do not remove native dune vegetation.
    - 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 or dune 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 workday.
    - 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. The Maui Nui Seabird Project (https://www.mauinuiseabirds.org/) can provide additional guidance on the presence of wedge-tailed shearwaters in the vicinity of the project area.

- o 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.
- o 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
  - o Fully shield all outdoor lights so the bulb can only be seen from below bulb height and only use when necessary.
  - o 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
  - o 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.
  - o 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.

7.2.27.2.3 Monitoring of Dredged Sand for Impurities

Operational controls will include monitoring dredge sand for impurities and grains larger than 1 inch in diameter. Monitoring will be conducted during all phases of the operation (dredging, sand transfer, sand stockpiling, and sand placement) to identify any impurities or excessive content of larger grains at the earliest possible opportunity. If impurities or excessive content of larger grains are observed, then the sand recovery operation will be relocated to a new site. The recovery area where the material was dredged will be marked and will not be utilized again for the remainder of the project.

7.2.4 Monitoring Terrestrial Excavation Sites

No excavation of terrestrial or beach areas is proposed in the EIS. In the event that terrestrial excavation is required through the permit review process, an archaeological monitoring plan will be produced and submitted to the State Historic Preservation Division prior to construction.

7.2.37.2.5 Best Management Practices Plan

The purpose of this Best Management Practices Plan (BMPP) is to ensure that adequate protective measures are in place during the proposed project. 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 plan.

~~7.2.3.1~~7.2.5.1 General Requirements

This section covers the requirements of environmental and pollution control during construction activities. The Contractor shall be responsible for conforming to all appropriate State of Hawaiʻi Statutes.

1. With the exception of those measures set forth elsewhere in this plan, environmental protection shall 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 Hawaiʻi Revised Statute Title 19, Chapter 342D.1.

2. The work shall include the following:

   A. Make sure that all permits required for this plan are obtained and 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 of the Contractor and his subcontractors in the performance of the work performed shall 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 Hawaiʻi, Department of Health, Administrative Rules. Chapter 55. WATER POLLUTION CONTROL: Chapter 54, WATER QUALITY STANDARDS.

   B. State of Hawaiʻi, Department of Health, Administrative Rules, Chapter 59, AMBIENT AIR QUALITY: Chapter 60, AIR POLLUTION CONTROL LAW.

   C. State of Hawaiʻi, Occupational Safety and Health Standards, 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, Code of Federal Regulations Title 29, Part 1910.

~~7.2.3.2~~7.2.5.2 Department of The Army Regional Conditions

1. Pre-construction BMPs:

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.

~~7.2.3.3~~7.2.5.3 *Project Related Practices*

~~7.2.3.3.1~~7.2.5.3.1 Material Management

1. All equipment and material shall be free of contaminants of any kind including excessive silt, sludge, anoxic or decaying organic matter, clay, dirt, oil, floating debris, grease, foam, or any other pollutant that would produce an undesirable condition to the beach or water quality.

2. All materials shall 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.

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 area on land or onboard boats will be kept clean and well organized to prevent spills or run out.

7. Materials will be used in strict accordance with the manufacturer's instructions.

8. Submit Material Safety Data Sheets (MSDS) for all hazardous materials, if any, to be brought to the work site. This includes, but is not limited to, paints, solvents, welding rods and fluxes, petroleum products, caulking, and sealant. This submittal shall also include a list showing the quantities of hazardous materials to be stored on-site.

~~7.2.3.3.2~~7.2.5.3.2 Waste Management

Note: No hazardous wastes are anticipated for this project.

1. A Solid Waste Disclosure Form must be completed and submitted to the HDOH. The form can be downloaded at: https://health.hawaii.gov/shwb/files/2013/06/swdiscformnov2008.pdf

2. The Project Staging Area will be used as the primary point of collection of 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.

3. Portable chemical toilets will be located on-site and will be serviced weekly, at a minimum.

4. All waste will be collected and placed daily in the container located in the upland area inshore of the project area or on a vessel a safe distance away from the edge and then disposed of off-site.

5. The Contractor will arrange for pick up and disposal of the filled container(s) as necessary.

6. Cleanup of waste will be conducted through sweeping, shoveling, or vacuuming operations only.

7. Pick up solid wastes, and place in covered containers which are regularly emptied. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged.

8. 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.

9. Non-hazardous or less hazardous materials should be used whenever possible.

10. Hazardous waste shall be placed in secondary containment.

11. Hazardous waste shall not be mixed with other waste and repair debris placed in the dumpster.

12. 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.

10. The Contractor and the owner are responsible for the proper handling, storage and/or disposal of all waste generated by project activities.

11. Any beach restoration and berm enhancement 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.

12. The Contractor shall 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 shall be removed at the Contractor's own expense.

13. No contamination (trash or debris disposal, alien species introductions, etc.) of marine (reef flats, lagoons, open oceans, etc.) environments adjacent to the project site shall result from project related activities.

14. The Contractor shall 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.

15. In the event that floating hydrocarbon (oil, gas) products are observed, the Contractor or his designated individual will be responsible for directing that in-water work be halted so that appropriate corrective measures are taken in accordance with the Oil Spill Response Plan. The Department of Land and Natural Resources and Department of Health Hazard Evaluation and Emergency Response Office shall be notified as soon as practicable, and the activity causing the plume will be modified by containment. The responsible individual 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.

16. No contamination of the marine environment shall result from the permitted activities. 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, shall collect and dispose of this material at an approved upland disposal site.

17. Waste materials and waste waters directly derived from beach restoration and berm enhancement activities shall not be allowed to leak, leach or otherwise enter marine waters.

18. All debris shall have a sheet of plastic under the pile and plastic over the pile to prevent exposure to rainwater and the generation of runoff into the existing drainage system.

19. One or more job site dumpsters will remain on site throughout the duration of the project to collect any construction-related waste or debris.

20. Beach restoration and berm enhancement operations shall 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.

21. Care shall be exercised in the removal and transporting of debris and rubbish for disposal.

22. Any spillage on the work surfaces will be cleaned up immediately.

23. Loads will be covered when transported.

24. 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.

~~7.2.3.3.3~~7.2.5.3.3 Vehicle and Equipment Management

1. The contractor shall be responsible for the clearing and removal of all silt and debris generated by his construction work and deposited and accumulated on roadways and other areas.

2. 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.

3. Construction equipment (except small tools, generators, welders, etc.) shall 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.

4. 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.

5. Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the Contractor shall prevent any material from being carried onto the pavement. Wastewater shall 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.

6. Fuel tanks are required to have secondary containment in accordance with 40 CFR112 (SPCC). Secondary containment design includes but is not limited to berms and double wall construction.

7. An operator's daily checklist shall be filled out prior to operation of equipment on a daily basis. Any leaks or deterioration of hoses shall be noted and corrected prior to operation on equipment. At the end of a shift, the manlift or equipment shall be positioned or located away from nearby drains and drip cloth shall be placed under the equipment. Spill kits shall be staged within close proximity to the manlift or equipment.

~~7.2.3.3.4~~7.2.5.3.4 Historic or Cultural Features

1. An archaeological monitoring plan shall be developed and followed during project operations.

2. Should any unanticipated archaeological site(s), such as walls, platforms, pavements, mounds, or remains such as artifacts, burials, or concentrations of charcoal or shells be uncovered by the work activity, all work shall cease in the immediate area and the contractor shall notify the State Historic Preservation Division at 808-692-8015. No work shall resume until the owner/contractor obtains clearance from the Historic Preservation Division.

3. During construction, cultural practices will be respected and allowed to the greatest extent possible; however, the use of some portions of the shoreline area and offshore areas may be prevented for public safety reasons.

4. The contractor and the State will try to accommodate the needs of native Hawaiian practitioners during construction (e.g., fishing, gathering, worship), but will not do so if it endangers public safety.

~~7.2.3.3.5~~7.2.5.3.5 Environmental Protection

1. All permits and clearances shall be obtained prior to the start of any beach restoration and berm enhancement activities. The Contractor and his sub-contractors shall ensure that all work complies with all permit conditions and commitments made with environmental agencies.

2. Work will not be performed until a pre-construction survey is conducted, where necessary, to identify structures, significant environmental features, etc. This survey will determine baseline conditions to which the area will be returned, following the completion of construction. Resources landward of construction areas will be protected from construction activities as necessary.

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 shall be confined to areas defined by the drawings and specifications. No project materials shall 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 shall perform the work in a manner that minimizes environmental pollution and damage as a result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of the beach restoration and berm enhancement activities.

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

9. The Contractor shall provide notifications to the National Marine Fisheries Services, efhesaconsult@noaa.gov, at least 72 hours prior to the scheduled start of activities. The

notification shall include the associated permit numbers, a project description, and who the client is.

10. Project operations must cease if unusual conditions, such as storm events and high surf conditions affect the project site, except for efforts to avoid or minimize resource damage.

11. All vessels 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. Avoid contact with marine creatures to the extent possible.

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.

15. All dive gear, if any, shall be washed as part of mobilization for the project.

16. Consider performing the work outside of the main coral spawning period in summer (May to August).

17. No blasting will be allowed on this project.

18. Authorized dredging and filling-related activities that may result in the temporary or permanent loss of aquatic habitats should be designed to avoid indirect, negative impacts to aquatic habitats beyond the planned project area.

19. Turbidity and siltation from project-related work should be minimized and contained within the project area by silt containment devices and curtailing work during flooding or adverse tidal and weather conditions. BMPs should be maintained for the life of the construction period until turbidity and siltation within the project area is stabilized. All project construction-related debris and sediment containment devices should be removed and disposed of at an approved site.

20. All project construction-related materials and equipment (dredges, vessels, backhoes, silt curtains, etc.) to be placed in an aquatic environment should be inspected for pollutants

including, but not limited to: marine fouling organisms, grease, oil, etc., and cleaned to remove pollutants prior to use. Project related activities should not result in any debris disposal, non-native species introductions, or attraction of non-native pests to the affected or adjacent aquatic or terrestrial habitats. Implementing both a litter-control plan and a Hazard Analysis and Critical Control Point plan (HAC–P - see http://www.haccp-nrm.org/Wizard/default.asp) can help to prevent attraction and introduction of non-native species.

21. Project construction-related materials (fill, revetment rock, pipe, etc.) should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion (e.g., with filter fabric, etc.), to prevent materials from being carried into waters by wind, rain, or high surf.

22. Fueling of project-related vehicles and equipment should take place away from the aquatic environment to the maximum extent possible and a contingency plan to control petroleum products accidentally spilled during the project should be developed. The plan should be retained on site with the person responsible for compliance with the plan. Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of accidental petroleum releases.

23. All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.

~~7.2.3.3.6~~7.2.5.3.6 Protected Species

1. The project manager shall designate competent observers, who have been apprised of any listed species potentially present in the project area and the protections afforded to those species under federal laws, to survey the marine areas adjacent to the proposed action for ESA-listed marine species, including but not limited to the green sea turtle, hawksbill sea turtle, humpback whales, and Hawaiian monk seal. Monitor(s) will also observe for larger marine creatures, such as Spinner Dolphins, in an effort to minimize contact where possible.

2. There will be at least one observer onboard the dredge barge and at least one observer on the beach where equipment is being used.

3. Constant vigilance shall be kept for the presence of Federally Listed Species.

4. Visual surveys for ESA-listed species shall 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). During the survey period, the Observer shall record the environmental and project-related information, including but not limited to date, time, weather, action undertaken, and any ESA-listed marine animals. If no ESA-listed marine animal is sighted during the survey period, the project activities may commence. If an ESA-listed marine animal is sighted during the survey period, the Observer shall alert the on-site project manager immediately, and the animal shall be

monitored continuously. If the animal is within 50 yards (150 feet) of the work area, animal behavior observations shall be recorded. Work may not commence until the animal departs the area voluntarily or after 30 minutes passed since the last animal sighting.

5. Work shall be postponed or halted when ESA-listed species are within 50 yards of the proposed work and shall only begin/resume after the animals have voluntarily departed the area. If ESA-listed marine 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). For example, divers performing surveys or underwater work (excluding the use of toxic chemicals) is likely safe. The use of heavy machinery is not.

6. Do not attempt to feed, touch, ride, or otherwise intentionally interact with any ESA listed species.

7. 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 handbook explaining the laws and guidelines for listed species in Hawaiʻi may be downloaded from: http://www.fpir.noaa.gov/Library/PRD/Laws%20and%20Policies/HawaiiOceanUsersGuide_2004.pdf

8. The Contractor shall keep a record of all protected species sightings, incidents of disturbance, or injury, and shall 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.

9. 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 marine protected species enters the safety zone, and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals contact the Marine Mammal Response Coordinator, David Schofield, at 808-944-2269, as well as the monk seal hotline at 1-888-256-9840. For turtles, contact the turtle hotline at 808-983-5730.
10. The Contractor shall 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 Hawaiʻi, 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).

11. Before any equipment, anchors(s), or material enters the water, a responsible party 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.

12. 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.

13. All objects lowered to the bottom shall 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.

14. Equipment, anchor(s), or material shall not be deployed in areas containing live corals, seagrass beds, or other significant resources.

15. In-water tethers and mooring lines for vessels and marker buoys shall be kept to the minimum lengths necessary and shall remain deployed only as long as needed to properly accomplish the required task.

16. 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 sounds sources, respectively.

17. Vessel operators shall alter course to remain at least 100 yards from whales, and least 50 yards from other marine mammals and sea turtles.

18. 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.

19. If approached by a marine mammal or turtle, the vessel operator shall put the engine in neutral and allow the animal to pass.

20. Vessel operators shall 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).

7.2.3.3.7 7.2.5.3.7 Oil and Spill Containment

1. The Contractor shall ensure that the Emergency Spill Response Plan, detailed in this document, is in place which shall 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 shall be immediately reported to the DOH Clean Water Branch (808-586-4309) and through email: cleanwaterbranch@doh.hawaii.gov.

3. Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR 112, surround all temporary fuel oil or petroleum storage tanks with temporary berms or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation. The berm will be impervious to oil for 2 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

4. 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.

5. Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous waste spills.

~~7.2.3.3.8~~7.2.5.3.8 Monitoring/Measures for Visually Detected Containment

1. All work operations shall be performed in conformance with the applicable provisions of the HAR, Title 11 Chapter 55 Water Pollution Control and Title 11, Chapter 54 Water Quality Standards, and to the Erosion and Sedimentation Control Standards and Guidelines of the Department of Public Works, State of Hawaiʻi.

2. The Contractor shall 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 environs will be conducted by a trained designated individual, or his trained representative, to verify that the permitted activities do not result in uncontrolled adverse environmental impacts. Visual inspections will be documented with photographs, a photo orientation map, 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, etc.

    b. Deficiencies identified by daily inspections shall be corrected immediately. Work activities will stop and remain stopped until the deficiencies have been corrected.

~~7.2.3.3.9~~7.2.5.3.9 Erosion and Sediment Control Measures

1. A silt curtain will be installed around the active beach placement area.

2. Silt curtains, biosocks, booms, and/or silt fences will be individually anchored and regularly inspected during project operations.

3. Silt curtains, biosocks, booms, and/or silt fences will be left in place each night. All anchors will be inspected prior to sunset.

4. Visual inspections will be documented with photographs and written descriptions, if necessary.

5. Visual monitoring will include ongoing inspections for turbidity outside of the confines of the silt curtains and/or booms. In the event that turbidity is observed outside of the silt curtains, work shall stop, and the silt curtains shall remain in place until the turbidity dissipates. Silt curtains, booms, and anchors shall be inspected after dissipation and prior to returning to beach restoration and berm enhancement operations.

6. Drainage outlets shall be maintained to minimize erosion and pollution of the waterways during construction. Surface runoff shall be controlled in order to minimize silt and other contaminants entering the water. Should excessive siltation or turbidity result from the Contractor's method of operation, the Contractor shall install silt curtains or other silt contaminant devices as required to correct the problem.

7. 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 shall install additional silt curtains or other silt contaminant devices as required to correct the problem.

~~7.2.3.3.10~~7.2.5.3.10 Noise Control

1. Best management practices shall be utilized to minimize adverse effects to air quality and noise levels, including the use of emission control devices and noise attenuating devices.

2. Noise shall be kept within acceptable levels at all times in conformance with HAR Title 11 Chapter 46 Community Noise Control, State Department of Health, Public Health Regulations. The contractor shall 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 shall be equipped with suitable mufflers to maintain noise within levels complying with applicable regulations.

4. Starting of shoreline equipment meeting allowable noise limits shall not be done prior to 7:00 a.m. without prior approval. Equipment exceeding allowable noise limits shall not be started up prior to 7:30 a.m. Equipment meeting allowable noise limits shall not be done after 8:00 p.m. without prior approval.

5. Equipment located offshore of the coastline may utilize nighttime hours as determined through coordination with the local landowners.

6. Make the maximum use of low-noise-emission products, as certified by the EPA.

~~7.2.3.3.11~~7.2.5.3.11 Dust Control

1. If necessary, containment methods shall be employed to prevent uncontrolled release of dust or debris outside the designated construction and/or abatement control barriers/boundaries.

2. Dust, which could damage crops, orchards, cultivated fields, and dwellings, or cause nuisance to persons, shall be abated and control measures shall be performed. If there is dust, dust mitigation procedures will be used.

3. The Contractor, for the duration of the contract, shall maintain all excavations, embankments, haul roads, permanent access roads, plant sites, waste disposal areas, borrow 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 treating shall not be used.

4. The Contractor shall prevent dust from becoming airborne at all times including non-working hours, weekends and holidays in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 60.1 - Air Pollution Control.

5. 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. 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.

~~7.2.3.3.12~~7.2.5.3.12 Air Pollution Control

1. Emission: The Contractor shall not be allowed to operate equipment and vehicles that show excessive emissions of exhaust gases until corrective repairs or adjustments are made.

~~7.2.3.3.13~~7.2.5.3.13 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 meeting all permit requirements and including how they will be addressed in the work plans. The Contractor will provide the personnel, materials, and equipment necessary to meet the permit requirements for the project.

6. The contractor shall coordinate his haul route, staging area, and all associated requirements, such as use permits, with the contracting officer and the affected landowners.

7. The contractor shall take extreme care in performing work near existing concrete electrical/communication ducts and overhead wires. Appropriate protection shall be implemented as required to prevent damage to those lines.

8. All existing utilities, concrete walkways, steps, and walls, whether or not shown on the drawings, shall be protected from damage at all times during construction and grading work. Any damages to them shall be repaired by the contractor at his expense.

9. The contractor shall verify dimensions, locations, elevations, etc., that are indicated for verification and inform the contracting officer in writing of any differences prior to the installation of new facilities.

10. The contractor shall tone any area to be excavated to determine the location of uncharted utilities. The contractor shall be responsible and shall pay for all damages to existing utilities. The contractor shall also contact the necessary utility companies to properly locate the underground utilities and cables that lie in any areas to be excavated.

11. No contractor shall perform any demolition, grubbing, stockpiling, and grading operation so as to cause falling rocks, soil, or debris in any form to fall, slide, or flow onto adjoining properties, streets, or natural watercourses unless specified in the construction drawings. Should such violation occur, the contractor may be cited, and the contractor shall immediately make all remedial actions necessary.

12. The contractor shall provide for access to and from all existing driveways and walkways at all times.

~~7.2.3.3.14~~7.2.5.3.14 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 at least one (1) additional individual to properly install all BMP's and to comply with all aspects of this plan.

3. The Property Owner(s) is also responsible for compliance to the BMPP.

7.2.3.3.157.2.5.3.15 Training

1. Employees will be instructed in the proper installation of the BMPP materials.

2. BMP's will be covered in a toolbox safety meeting.

3. BMP's will be discussed, as applicable, for each new phase of work.

7.2.3.3.167.2.5.3.16 Health and Safety Plan

1. Areas of operation upon the shoreline will be clearly marked with fencing, barricades, caution tape, or other approved devices, to protect the public from the hazards of construction.

2. 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.

3. Crossing guards will be provided by the Contractor to assist the public with transiting safely across the beach.

4. Project implementation will not interfere with the public's right to reasonable navigation.

5. Public access along the shoreline during construction shall be maintained so far as practicable and within the limitations necessary to ensure safety.

6. The contractor is responsible for safety at the job site.

7. Fire department fire lanes, access to all laydown areas and construction areas shall be maintained at all times. Emergency vehicles shall always have access. Do not block egress.

7.2.3.3.177.2.5.3.17 Inspection and Monitoring

1. The Project Manager/Superintendent/Project Engineer or the assigned trained individual will conduct a visual inspection of all BMPP's daily.

2. All minor repairs and maintenance of the BMP's will be completed within 48 hours of detection. Major repairs of BMP's shall be completed as soon as practical, and in-water work shall be stopped until repairs are complete.

3. If any BMPP is damaged, work will immediately be stopped and shall not resume until repairs to the BMPP have been completed.

7.2.3.3.187.2.5.3.18 Emergency Procedures

1. Natural disaster-related pollutant discharge: See Contingency Plan

2. Spill prevention and control: See Emergency Spill Response Plan.

7.2.3.3.197.2.5.3.19 Record Keeping and Documentation

1. A copy of this plan will be kept on site.

2. All BMP inspection reports will be kept on site.

3. Records of inspection and repair of control measures will be retained in the project files for a minimum of five years.

4. In addition to other records required under the contract, the Contractor shall 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 shall conform to standard drafting practice and shall include such supplementary notes, legends, and details as necessary to clearly portray the as-built construction. Update drawings on a daily basis.

7.2.3.3.207.2.5.3.20 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 shall be cause for suspension of the work creating such violation. No additional compensation shall 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 they feel are creating pollution problems although they may not be in violation of the above-mentioned requirements. In this instance, the work shall be done by force account.

7.2.3.47.2.5.4 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 following construction project, Kāʻanapali Beach Restoration and Berm Enhancement, will follow this plan when a severe storm is either forecast or anticipated. Contractors must:

a. Regularly monitor local weather reports for forecasted and/or anticipated severe storm events, advisories, watches, warnings or alerts. The contractor shall inspect and document the condition of all erosion control measures on that day prior, during, and after the event. The contractor shall prepare for forecasted and/or anticipated severe weather events to minimize the potential for polluted discharges.
b. Secure the construction site. Securing the site should generally include:
    i. Removing or securing equipment, machinery, and nourishmentmaintenance materials.
    ii. Cleaning up all nourishment relatedmaintenance debris.
    iii. Implementing all Best Management Practices (BMPs) detailed in this BMPP. This includes BMPs for materials management, spill prevention, and erosion and sediment control.
c. 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.
d. Upon return to the site, all BMPs shall be inspected, repaired, and/or re-installed as needed. If repair is necessary, it shall be initiated immediately after the inspection and repairs, or replacement will be complete within 48 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.
e. When there either has been a discharge which violates Hawaiʻi Water Pollution rules and regulations or there is an imminent threat of a discharge which violates Hawaiʻi Water Pollution rules and regulations and/or endangers human and/or environmental health, the permittee shall at a minimum execute the following steps:
    i. Assess whether construction needs to stop or if additional BMPs are needed to stop or prevent a violation.
    ii. Take all reasonable measures to protect human and environmental health.
    iii. Immediately notify the DOH of the incident. The notification shall also include the identity of the pollutant sources and the implemented control or mitigation measures.
        1. Department of Health Clean Water Branch (during regular working hours): 808-586-4309
        2. Hawaiʻi State Hospital Operator (after hours): 808-247-2191
    iv. Document corrective actions, take photographs of discharge and receiving waters.
    v. Revise BMPP to prevent future discharges of a similar nature.

7.2.3.57.2.5.5 Emergency Spill Response Plan

7.2.3.5.17.2.5.5.1 Pre-Emergency Planning

a. An initial and periodic assessment shall 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.

b. 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.
c. Personnel will consult the applicable MSDS sheet prior to its use.
d. Personnel will handle hazardous materials safely and use personal protective equipment (PPE), recommended/required by the MSDS, when handling hazardous materials.
e. 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.
f. All personnel will be trained on the contents of this plan within the first month of beach restorationmaintenance 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.
g. Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids. Approved safety cans or DOT approved containers shall be used for 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 shall be used, for storage, use and handling of flammable liquids.
h. Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

7.2.3.5.27.2.5.5.2 Personal Protective and Emergency Spill Response Equipment

a. 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.

NOTE: Fire extinguishers should not be located "directly" with hazardous materials, so as to endanger first responders.

b. 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 shall 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.
c. Emergency response personal protective equipment (PPE) consists of:
    i. Face shield
    ii. Tyvex coveralls
    iii. Rubber gloves
    iv. 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 shall be designated and labeled as such; this equipment will be inspected at least every 30 calendar days and appropriate logbook entries made.

7.2.3.5.3 7.2.5.5.3 Personnel Roles, Lines of Authority and Communication

a. Emergency Response Coordinator (ERC)
   i. The Project Superintendent is the designated ERC. If the Project Superintendent is not available, the safety officer is the designated ERC.
   ii. The ERC will be in charge of and will coordinate the appropriate emergency response procedures in this plan.
b. Emergency Response Team (ERT)
   i. The ERT consists of Construction General Foreman, Labor Foreman, and a Laborer designated by the Project Superintendent.
   ii. The ERT will appropriately respond to the emergency in accordance with this plan at the direction of the ERC.

7.2.3.5.4 7.2.5.5.4 Emergency Alerting and Response Procedures

a. Any person causing or discovering a known hazardous or unknown release or spill will:
   i. Immediately alert nearby personnel who may be exposed to the effects of the release or spill.
   ii. 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.
   iii. If the spill or release is 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.
   iv. 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.
   v. The ERC will assess possible hazards to human health or the environment that may result from the release, fire, or explosion.
   vi. 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.
   vii. 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.
   viii. 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).

7.2.3.5.5 7.2.5.5.5 Emergency Notification and Reporting Procedures

a. In the event that a release enters the storm or sewer system, the ERC will immediately notify the National Response Center (NRC) at 1-800-424-8802, and the Hawai'i Department of Health, Hazard Evaluation and Emergency Response Office (HEER) at 808-586-4249.
b. The ERC will immediately notify appropriate agencies and submit written follow-up notification in accordance with the Hazardous Substance Release Notification Guideline.

~~7.2.3.5.6~~7.2.5.5.6 Safe Distance Staging Area

a. A staging area at a safe distance upwind and higher than the location of the spill or release and its source will be immediately established.
b. 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.

~~7.2.3.5.7~~7.2.5.5.7 Site Security and Control

a. If the spill or release is located on or near the roadway, stop all traffic until the release is cleaned up.
b. If the spill or release is located away from vehicle or pedestrian traffic, install barricades/safety fencing around the affected area.
c. If the spill or release occurs during night operations, provide adequate light and use ground guides to escort emergency vehicles to the affected area.

~~7.2.3.5.8~~7.2.5.5.8 Evacuation Routes and Procedures

a. 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.
b. Persons working at the affected area and who are not needed in the response effort will report to the staging areas for accountability.

~~7.2.3.5.9~~7.2.5.5.9 Decontamination and Disposal Procedures

a. Persons involved in the spill clean-up are required to perform personal hygiene, utilizing soap and fresh water prior to eating, drinking, or smoking.
b. Contaminated PPE shall be appropriately cleaned and disinfected if possible. If this is not possible it shall be disposed of per the same requirements of the contaminated substance.
c. Sorbent pads/materials and the spilled substance will be placed in appropriate containers and disposed of as specified by the appropriate MSDS.
d. 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.
e. 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.

~~7.2.3.5.10~~7.2.5.5.10 Emergency Medical Treatment and First Aid

a. First aid kits will be maintained at the project field office, all company vehicles, and gang boxes.
b. 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.
c. The appropriate MSDS(s) will be provided to emergency service personnel and are intended to be delivered to the emergency room physicians.

~~7.2.3.5.11~~7.2.5.5.11 After the Spill Procedures

a. The ERC will review what happened and implement changes, corrections, and/or improvements to prevent the 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.
b. The ERC will prepare a record of the spill response and keep it in the project files for a minimum of three (3) years.
c. The ERC will submit Follow-up Notification to HEER when required.
d. Spill response kits shall be replenished directly after the emergency.

~~7.2.3.6~~7.2.5.6 Emergency Contacts

National Response Center (NRC)		*1-800-424-8802*
Coast Guard Station Maui		
	(Working hours)	*1-808-986-0023*
	(After hours)	*1-808-927-0830*
Hawaiʻi State Department of Health Hawaiʻi Evaluation and Emergency Response (HEER)		*1-808-586-4249*
State Historic Preservation Division		*1-808-692-8015*
Maui Fire Department		*911*
In the event that a release enters the storm or sewer system, the ERC will immediately notify NRC and HEER		*1-808-935-2785*

8. UNRESOLVED ISSUES

Unresolved Issues	Discussion – Action to Resolve or Reason to Leave Unresolved
Anchor system placement locations	Prior to placement of anchors, as part of each location's anchoring system, the seafloor will be inspected by diver or camera to ensure that anchors and hardware to minimize impacts to benthic communities.
Sand transfer system seafloor contact	Prior to emplacement of the sand transfer system, at the proposed locations in the nearshore, the seafloor will be inspected by diver or camera to ensure that anchors and hardware to minimize impacts to benthic communities.
Potential Seabird nesting and Nēnē in the project area	Prior to commencing construction an ornithologist will investigate the project to ensure no seabird nesting sites will be impacted by the project. The ornithologist will also look for nēnē during the investigation. Should any active nesting sites or nēnē be identified, the project team will coordinate with USFWS.
Potential Endangered Vegetation in the project area	Prior to commencing construction an arborist will investigate the project to ensure no endangered vegetation will be impacted by the project. Should any endangered vegetation be identified, the project team will coordinate with USFWS.
Potential Turtle Nests in the Beach and Dune	Consultation with the Services to obtain the latest information on sea turtle activity in the area will take place and additional BMPs shall be employed to avoid impact to sea turtle nests and hatchlings during this period, including constant monitoring of the beach and ocean during beach restoration activities.
Ocean recreation access issues	Require coordination between the contractor and the local community, via website or other digital format, to relay updated schedules for vessel movement as well as updated lists and locations that have limited or no access due to restoration activities. Ensure ocean access between the sand recovery area and Pu'u Keka'a, suitable for outrigger, or similar, vessel traffic for the duration of the project.
Short-term to less than one-year economic impacts on subsistence fishers and gatherers	The sand recovery area may have fisheries utilized by subsistence fishers in the region. Require coordination between the contractor and the local subsistence fishing community, via website or other digital format, to relay updated schedules and projected locations for sand recovery, transport, and placement operations. Ensure the local subsistence fishing community has the maximum access allowable, given public safety concerns, to the sand recovery site and along the shoreline. Shoreline areas closed to the public will be limited to active construction areas utilized for sand offloading, sand transfer along the shoreline, and sand placement on the beach. Crossing guards will be available to assist beach users with safe transit across the transportation lanes, to and from the waterline.
Cultural Resources	Require coordination between the contractor and local cultural practitioners, via website or other digital format, to relay updated schedules for vessel movement as well as updated lists and locations that have limited or no access due to restoration activities. Ensure maximum feasible standoff between the sand recovery area and Pu'u Keka'a is maintained, within the practicable limits of the scope of the project.

Unresolved Issues	**Discussion – Action to Resolve or Reason to Leave Unresolved**
Public Safety Concerns - Changes to seafloor bathymetry at the sand recovery area	Educational and warning signs should be placed along the shoreline during and after the project. These signs should include warnings for beach and ocean users to address public safety issues.
Managed Retreat	Coastal management now and into the foreseeable future will rely on a range of design and adaptation options that are best suited to local needs, priorities, and capabilities. The suitability of the various design and adaptation options will continue to evolve based on the latest scientific projections for sea level rise, observed erosion and flooding impacts, and availability of government programs and policies to support implementation of managed retreat or other adaption measures.
Short-term impacts to Kona crab community in the sand recovery area	Previous studies indicate that Kona crab recolonize impacted regions within several months to years. Short-term impacts are anticipated to the Kona crab community at the sand recovery site; however, impacts are not anticipated in the regional sand field that represents the broader Kona crab habitat, outside of the sand recovery footprint.
Hawaiian Islands Humpback Whale National Sanctuary	Marine operations, including sand recovery in the nearshore, are scheduled to overlap with Humpback Whale season in the region. Additional coordination, through the permit process, will be completed before implementation of the project. BMPs for marine mammals are already included in Section 7.
User Conflicts – Beach and Offshore	Space on the beach and in the ocean will be restricted around the active work areas. To minimize potential user conflicts, the contractor will need to have open lines of communication with the local community, via website or other digital format. Communication should relay updated schedules for vessel movement, beach restoration, offloading scheduling, truck hauling routes, as well as updated lists and locations that have limited or no access due to restoration activities. Ensure ocean access between the sand recovery area and Puʻu Kekaʻa, suitable for outrigger, or similar, vessel traffic for the duration of the project. Ensure regularly spaced crossing guards are available to assist with beach access. Minimize restricted work areas to active work zones and upcoming work zones.
Compaction of the beach and vertical scarping during erosion events	Tilling of the placed sand will be completed at the end of each restoration activity to mitigate compaction and scarping of the beach profile.
Archaeological Monitoring Plan	No excavation of the beach profile is proposed for the preferred alternative. Ongoing coordination with SHPD will determine the need for an archaeological monitoring plan. If a plan is required, it will be submitted to, reviewed, and approved by SHPD prior to completion of permits.
Access to the Hanakaʻōʻō grinding stones	Access to and from the site will be a design requirement during the project. The site is located to the south of the beach restoration effort with existing access from the upper Hanakaʻōʻō Beach Park parking lot.

~~8.~~9. CONSULTATIONS AND OUTREACH IN THE PREPARATION OF THE ENVIRONMENTAL IMPACT STATEMENT

Consultation between Sea Engineering (SEI), the Kāʻanapali Operations Association (KOA), and the Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL) regarding Kāʻanapali Beach has been ongoing for several years. The purpose of this consultation was to develop a beach nourishment~~restoration~~ plan that best incorporates the OCCL's goals and objectives while minimizing disruption to resort operations.

Appendix E contains the comments and responses for the EISPN.

Appendix F contains the comments and responses for the DEIS.

9.1 Consultation Prior to the Preparation of the Draft Environmental Impact Statement

Prior to preparation of the Draft Environmental Impact Statement (DEIS), meetings were organized between SEI and the State of Hawaiʻi, Department of Boating and Ocean Recreation (DOBOR); the State of Hawaiʻi, Department of Aquatic Resources (DAR), Maui Land Division office; and the County of Maui, Planning Department.

The following agencies, organizations, and individuals will be directly notified of the publication of the Kāʻanapali Beach Restoration and Berm Enhancement DEIS.

Federal Agencies
Department of the Interior, U.S. Geological Survey, Pacific Islands Water Science Center
Department of the Interior, U.S. Fish and Wildlife Service
Department of Commerce, National Marine Fisheries Service
Department of the Interior, National Parks Service
Department of Agriculture, National Resources Conservation Service
Department of the Army, U.S. Army Corps of Engineers
Department of Transportation, Federal Aviation Administration
Department of Transportation, Federal Transit Administration
Department of Homeland Security, U.S. Coast Guard
Environmental Protection Agency

Hawaiʻi State Agencies
Department of Agriculture
Department of Accounting and General Services
Department of Business, Economic Development and Tourism
Department of Business, Economic Development and Tourism, Research Division
Library Department of Business, Economic Development and Tourism, Strategic Industries Division
Department of Business, Economic Development and Tourism, Office of Planning
Department of Defense
Department of Education, Hawaiʻi State Library, Hawaiʻi Documents Center
Department of Hawaiian Home Lands

Environmental Health Administration
Department of Land and Natural Resources
Department of Land and Natural Resources State Historic Preservation Division
Department of Transportation
University of Hawaiʻi, Water Resources Research Center
University of Hawaiʻi, Environmental Center
University of Hawaiʻi, Thomas H. Hamilton Library
University of Hawaiʻi, at Hilo Edwin H. Moʻokini Library
University of Hawaiʻi, Maui College Library
University of Hawaiʻi, Kauaʻi Community College Library
Office of Hawaiian Affairs
Legislative Reference Bureau Library

County Agencies
County of Maui Department of Planning
County of Maui Department of Public Works

State Libraries
Department of Education, Hawaiʻi State Library
Department of Education, Hawaiʻi State Library, Kaimuki Regional Library
Department of Education, Hawaiʻi State Library, Kaneohe Regional Library
Department of Education, Hawaiʻi State Library, Pearl City Regional Library
Department of Education, Hawaiʻi State Library, Hawaiʻi Kai Regional Library
Department of Education, Hawaiʻi State Library, Hilo Regional Library
Department of Education, Hawaiʻi State Library, Kahului Regional Library
Department of Education, Hawaiʻi State Library, Līhuʻe Regional Library

Media
Honolulu Star Advertiser
Hawaiʻi Tribune Herald
West Hawaiʻi Today
The Garden Island
Maui News
Molokaʻi Dispatch
Lāhainā News
Honolulu Civil Beat

Other
U.S. Senator Mazie Hirono
U.S. Senator Brian Schatz
U.S. Representative Tulsi Gabbard
State Senator Rosalyn Baker
State Representative Angus McKelvey
Maui County Council Representative Tamara Paltin

9.2 Distribution Matrix for EIS

Kā'anapali Beach Restoration - EIS Documents - Agencies and Parties Consulted			
Agency	**EISPN Scoping Meetings**	**DEIS Notification**	**DEIS Comments Received**
Federal Agencies			
Department of the Interior, U.S. Geological Survey, Pacific Islands Water Science Center		X	
Department of the Interior, U.S. Fish and Wildlife Service		X	X
Department of Commerce, National Marine Fisheries Service		X	X
Department of the Interior, National Parks Service		X	
Department of Agriculture, National Resources Conservation Service		X	
Department of the Army, U.S. Army Corps of Engineers	X	X	
Department of Transportation, Federal Aviation Administration		X	
Department of Transportation, Federal Transit Administration		X	
Department of Homeland Security, U.S. Coast Guard		X	
Environmental Protection Agency		X	

Kāʻanapali Beach Restoration - EIS Documents - Agencies and Parties Consulted

Agency	EISPN Scoping Meetings	DEIS Notification	DEIS Comments Received
Hawaiʻi State Agencies			
Department of Agriculture		X	
Department of Accounting and General Services		X	
Department of Business, Economic Development and Tourism		X	
Department of Business, Economic Development and Tourism, Research Division Library		X	
Department of Business, Economic Development and Tourism, Strategic Industries Division		X	
Department of Business, Economic Development and Tourism, Office of Planning		X	X
Department of Defense		X	
Department of Education, Hawaiʻi State Library, Hawaiʻi Documents Center		X	
Department of Hawaiian Home Lands		X	
Environmental Health Administration		X	
Department of Land and Natural Resources		X	
Department of Land and Natural Resources Division of Boating and Ocean Recreation	X	X	
Department of Land and Natural Resources Office of Conservation and Coastal Lands	X	X	
Department of Land and Natural Resources Division of Aquatic Resources	X		

Kā'anapali Beach Restoration - EIS Documents - Agencies and Parties Consulted			
Agency	**EISPN Scoping Meetings**	**DEIS Notification**	**DEIS Comments Received**
Department of Land and Natural Resources Maui Land Division Office	X		
Department of Land and Natural Resources State Historic Preservation Division		X	
Department of Transportation		X	
University of Hawai'i, Water Resources Research Center		X	
University of Hawai'i, Environmental Center		X	
University of Hawai'i, Thomas H. Hamilton Library		X	
University of Hawai'i, at Hilo Edwin H. Mo'okini Library			
University of Hawai'i, Maui College Library		X	
University of Hawai'i, Kaua'i Community College Library			
Office of Hawaiian Affairs		X	
Legislative Reference Bureau Library		X	
County Agencies			
County of Maui Department of Planning	X	X	X
County of Maui Department of Public Works		X	
County of Maui Department of Environmental Management		X	
County of Maui Department of Parks and Recreation		X	
County of Maui Department of Transportation		X	
State Libraries			

Kā'anapali Beach Restoration - EIS Documents - Agencies and Parties Consulted			
Agency	**EISPN Scoping Meetings**	**DEIS Notification**	**DEIS Comments Received**
Department of Education, Hawai'i State Library		X	
Department of Education, Hawai'i State Library, Kaimuki Regional Library			
Department of Education, Hawai'i State Library, Kaneohe Regional Library			
Department of Education, Hawai'i State Library, Pearl City Regional Library			
Department of Education, Hawai'i State Library, Hawai'i Kai Regional Library			
Department of Education, Hawai'i State Library, Hilo Regional Library			
Department of Education, Hawai'i State Library, Kahului Regional Library		X	
Department of Education, Hawai'i State Library, Līhu'e Regional Library			
Media			
Honolulu Star Advertiser		X	
Hawai'i Tribune Herald			
West Hawai'i Today			
The Garden Island			
Maui News		X	
Moloka'i Dispatch			
Lāhainā News		X	
Honolulu Civil Beat		X	
Elected and Other Officials			
U.S. Senator Mazie Hirono		X	

Kāʻanapali Beach Restoration - EIS Documents - Agencies and Parties Consulted			
Agency	**EISPN Scoping Meetings**	**DEIS Notification**	**DEIS Comments Received**
U.S. Senator Brian Schatz		X	
U.S. Representative Tulsi Gabbard		X	
State Senator Rosalyn Baker		X	
State Representative Angus McKelvey		X	
Maui County Council Representative Tamara Paltin		X	X

9.3 Public Comments Matrix for the EIS

Commenter	EISPN Comment and Response	DEIS Comment and Response
M. Silva		X
Ms. Keiser		X
Ms. Reyes		X
Mr. Roshon	X	X
Mr. Salvato		X
Mr. Ampong		X
Mr. Hanada		X
Dr. Iaukea		X
Mr. Werden		X
Ms. Evans		X
Mr. and Mrs. Cahill		X
Ms. Caskey		X
Mr. Lee		X
Mr. Hyde		X
M. Nahooikaika		X
Mr. Gallagher		X
Ms. Min		X
Mrs. Martinez		X
Mr. Archer		X
Ms. Aarona		X
West Maui Preservation Association		X
Mr. Steward		X
M. Kohler		X
Ms. Medeiros		X
M. Bodin		X
Ms. Dalton		X

Commenter	EISPN Comment and Response	DEIS Comment and Response
Hawaii Shore and Beach Preservation Association		X
Mr. Blair		X
Hawaii Surfrider Foundation		X
Mr. Abbott		X
M. Tancayo		X
Maui Tomorrow Foundation		X
Ms. Steward		
Ms. Lawrence		X
Ms. Brandenstein		X
Maui Chapter of the Sierra Club		X
Ms. Sherman	X	
Mr. Carafino	X	
Ms. Rockett	X	
Mr. Tramontano	X	
Mr. La Basco	X	

~~9.~~10. GLOSSARY

Accretion: The gradual addition of new beach to old by the deposition of sediment carried by the ocean

Beach berm: A low shelf or narrow terrace on the backshore of a beach, formed of material thrown up and deposited by storm waves or seasonal changes in wave climate.

Beach face: The section of beach normally exposed to the action of the wave uprush; the foreshore of the beach

Beach nourishment: The practice of adding large quantities of sand or sediment to beaches to combat erosion and increase beach width.

Beach profile: The trace of a beach surface on a vertical plane normal to the shoreline. It is commonly concave upward, as the slope is steeper above the water and more gentle seaward.

Beach restoration: The process of placing sand on an eroded beach to return it to a previous condition.

Beach scarp: An almost vertical slope fronting a berm on a beach, caused by wave erosion.

Berm enhancement: The process of adding sediment volume to a littoral cell by placing beach compatible sand atop an existing beach berm.

Certified shoreline: Is a line established by a licensed land surveyor and certified by the State, which reflects the shoreline definition stated in Chapter 13-222 (HAR) and Chapter 205A (HRS).

Depth of closure: The depth of closure is typically the deepest depth at which sediment transport connected to the beach system occurs.

Dredging: In this context - To bring up sand from an area of water.

Erosion: The wearing away of soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, wind, and underground water.

Environmental Restoration: Defined in 1987 by John J. Berger as "A process in which a damaged resource is renewed. Biologically. Structurally. Functionally."

Littoral cell: Is a coastal compartment that contains a complete cycle of sedimentation including sources, transport paths, and sinks.

Makai: toward the sea

Mauka: inland or toward the mountains

Rip current: A relatively strong, narrow current flowing outward from the beach through the surf zone and presenting a hazard to swimmers.

Sea-Level Rise: The average long-term global rise of the ocean surface. Regional sea-level rise refers to the long-term average sea-level rise relative to the local land level, as derived from coastal tide gauges.

Turbidity: The quality of being cloudy, opaque, or thick with suspended matter.

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