



Regional Shoreline Management Scoping Study for the State of Hawai'i

Appendices

February 2023



Coastal Planners, LLC

REGIONAL SHORELINE MANAGEMENT SCOPING STUDY FOR THE STATE OF HAWAI'I

APPENDICES

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Appendices

The appendices provide a compilation of various forms of input used to develop the recommended methodology and 5-year roadmap for the State of Hawai‘i Regional Shoreline Management Scoping Study (Scoping Study). The overview of the existing shoreline management framework (Appendix 1) summarizes key governance considerations for regional shoreline management. The recommended methodology (Chapter 3) recognizes traditional management boundaries such as a moku and ahupua‘a as an important starting point for delineating shoreline regions and identifying and engaging stakeholders. Federal, state, and county policies, plans, and programs establish both challenges and opportunities for implementing a regional shoreline management approach. Challenges and opportunities are explored further in Appendix 2 using input from wiki surveys conducted during the project. The input gathered from these surveys was used to inform the recommended methodology and as well as the 5-year roadmap (Chapter 5). Appendices 3 and 4 are a compilation of examples where a regional shoreline management approach is being planned and/or implemented within Hawai‘i’s existing governance framework. These examples provided valuable input to the methodology and process for delineating shoreline regions and subregions.

Appendix 1: Existing Shoreline Management Framework in Hawai'i

Traditional Shoreline Management

Traditional shoreline management in Hawai'i was a part of the ahupua'a system of governance. An ahupua'a is the basic unit of land management in the Hawaiian culture—a geologic and socioeconomic bounded area extending from the top of a ridge or mountain to the shoreline and extending into the nearshore waters. The ahupua'a contained most, if not all, of the climatic zones in Hawai'i and therefore the array of resources needed for survival in traditional times. The konohiki was the central decision maker and was appointed by a higher chief of greater land areas such as a mukupuni (island) or moku (district) to oversee each ahupua'a. The ahupua'a contained smaller ili and even smaller kuleana, which were tended by individual families, or ohana. The only artificial boundaries for the ahupua'a were found along the shoreline, an altar that was used for annual offerings of food and other products to the higher chief at the onset of the makahiki. Other boundaries were ridgelines, lava flows, and other prominent natural features on the landscapes (Figure A1-1).

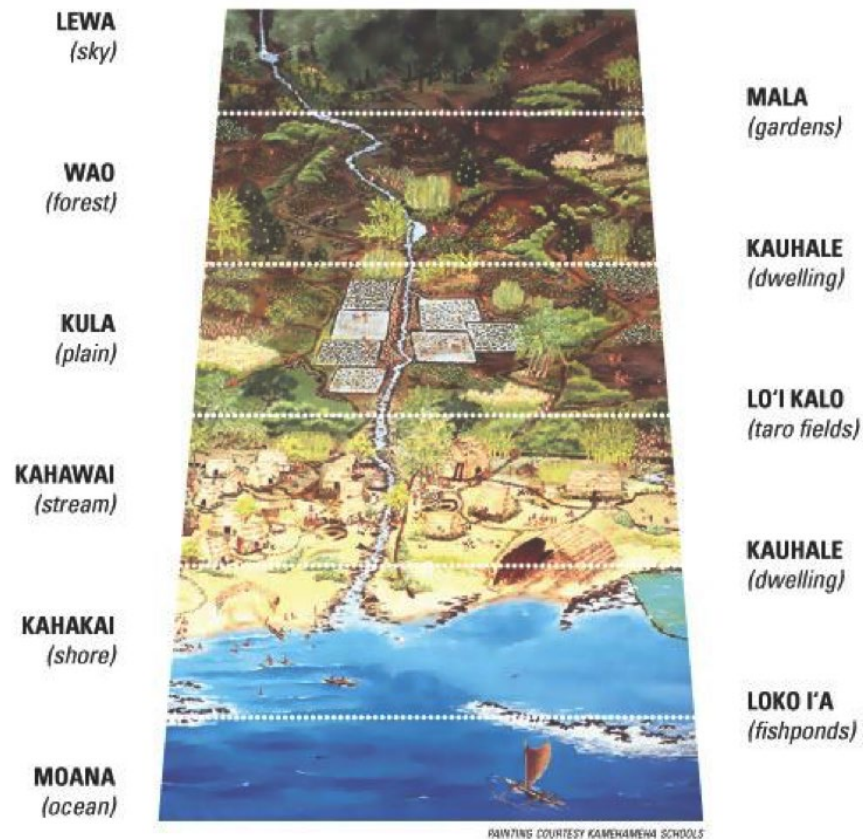


Figure A1-1. Illustration of a traditional ahupua'a

More than just a resource base for extraction, the ahupua'a bounded the area of stewardship responsibility by its inhabitants, and in turn was a claim to rights to the resources found therein. The objective was to sustain these resources so that their availability would be ensured for seven

generations into the future. As an example, ko'a referred to fishing shrines located on shore as well as a term for specific fishing grounds. Based on guidance from the Hawaiian moon calendar and the konohiki, fish were fed in certain ko'a on non-fishing days to increase abundance and ease of capture on fishing days. Ko'a were also managed by regulating threats, such as the presence of predator species.

The ahupua'a is more than simply a cultural overlay atop the natural landscape and nearshore waters. The ahupua'a system is an embodiment of the kinship between the native Hawaiian people and the natural environment. The landward boundaries mirrored watersheds as within the landscape water (wai) was a basic resource necessity and a source of wealth (wai wai). Natural conditions and geographic features dictated where boundaries were practically established.

The ahupua'a incorporates indigenous economic and sociopolitical considerations in addition to geographic and ecological characteristics. As such, it makes sense to utilize the ahupua'a in the definition of regional shoreline management in several ways:

- It recognizes that influences from the uplands, or mauka extent, greatly impact shoreline dynamics.
- It identifies the people who have heritage connection to the land and possess biocultural knowledge to guide regional shoreline management and kuleana in the cultural sites.
- It connects the present day families, organizations, and greater communities that can inform and/or engage in localized stewardship and shoreline management.

While a regional shoreline management approach seeks consistency in management of coastal areas, it is the uniqueness of each ahupua'a that provides the place-based concepts that are needed for successful outcomes.

As described in the main body of the Regional Shoreline Management Scoping Study (see Section 3; methodology), the basis for delineating regional units of the shoreline is primarily the physical shoreline dynamics, semi-bound by the littoral cell. While at times there is alignment of the boundaries of littoral cells and the ahupua'a, such as when the ahupua'a is based on watershed boundaries, a single ahupua'a often may contain multiple littoral cells or several ahupua'a may exist in one littoral cell (Figure A1-2). As such, the ahupua'a is an important unit for identifying the management considerations at the establishment of a regional shoreline initiative, in terms of:

- The cultural and archaeological resources in a region to be respected and protected
- The lineal descendants, kupuna, native Hawaiian organizations (e.g., Hawaiian Civic Clubs) of each ahupua'a within a shoreline region that will be consulted for project context, design, and outcomes
- The identification of shoreline traditions and practices that are to be preserved and perpetuated as part of a regional shoreline management approach in Hawai'i.



Figure A1-2. Alignment of littoral cell and ahupua'a boundaries on the south shore of Moloka'i

Identifying distinct regions and subregions in coastal areas provides the advantage of also recognizing all of the ahupua'a and associated cultural components within such regions at the time they are identified. A healthy and functioning physical shoreline is one that:

- Is resilient to coastal hazards and erosion associated with climate change and sea level rise in the present and future.
- Continues to serve as a resource base and preserve cultural resources and sites that are a foundation of the Hawaiian culture, for shoreline, backshore, and nearshore resources.

For example, vegetated dunes and the backshore plant community are a resource base for materials with a wide range of cultural uses, from la'au lapa'au to fishing implements, as well as for canoe and house building materials.

Mele, oli, and 'ōlelo no'eau ("songs, chants, and proverbs") were common means of passing important cultural traditions from one generation to the next, often with a specific place as part of their message. Traditional ecological knowledge regarding natural conditions of place—such as winds, currents, ground and surface water dynamics—coupled with the presence of particular types of fish, seaweeds, sea birds, and other marine life informed the native people about the character of a specific place or geography. This in turn informs modern shoreline management and provides a basis for cultural preservation to maintain a sense of place.

Therefore, the ahupua'a is a unique and fundamental layer in how regions and subregions are defined. It overlays directly on the physical landscape. It can help recognize and facilitate protection of important cultural features and resources. It identifies the people of the land with intergenerational knowledge of the land and sea and their interface along the shoreline. Through this recognition, an initial step in a

regional shoreline management plan and in project design is established and the ahupua'a can become the basis for the continuity of shoreline management and cultural perpetuation.

Policy Framework

Shorelines, beaches, and nearshore waters in Hawai'i are considered part of the public trust, with access and use available to all people. As a result, Hawaii's shorelines are heavily regulated but, some would argue, poorly managed when overlaid with a modern, western, property rights driven regulatory paradigm. The current definition of the "shoreline" in Hawai'i 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 (Hawai'i Revised Statutes (HRS) §205A-1)."

County jurisdiction begins at the shoreline and extends inland or landward. State jurisdiction begins at the shoreline and extends seaward. Federal jurisdiction begins at the mean higher high water line and extends to 200 nautical miles offshore. Figure A1-3 shows relevant permit jurisdiction lines for shoreline construction in Hawai'i.

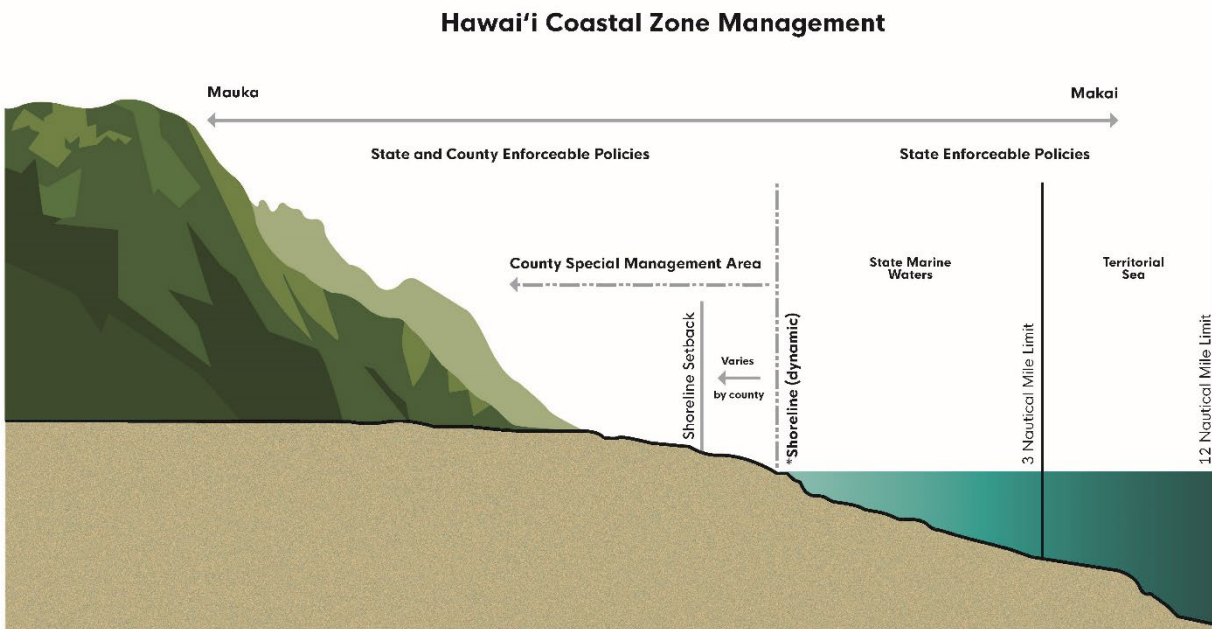


Figure A1-3. Relevant jurisdictional boundaries for shorelines in Hawai'i

Federal, State, and county governments 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's location at the time per the definition stated above. The certified shoreline is valid for one year and is used to establish jurisdictional authorities and the inland extent of shoreline setback areas. Where the shoreline is a pali

(cliff) feature, the top of cliff may serve as the alternative to the certified shoreline as stated in Hawai'i Administrative Rules (HAR) 13-222-16.

Federal

Federal jurisdiction begins at the mean higher high water line and extends out to the boundary of the U.S. exclusive economic zone, 200 nautical miles offshore. This area is defined as the navigable waters of the United States. The following policies apply in this area.

Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 (33 USC §403) requires a Department of the Army 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. Army permits are issued by the U.S. Army Corps of Engineers (USACE). Placing structures and/or materials in the navigable waters of the United States requires an Army permit pursuant to Section 10.

Clean Water Act

The Clean Water Act (CWA) of 1972 (33 USC §1251 et seq.) is the key legislation governing surface water quality protection in the United States. The CWA is the major federal legislation concerning the improvement of the nation's water resources. The CWA amended the Federal Water Pollution Control Act, requiring federal agency consistency with state nonpoint source pollution abatement plans. Amended in 1977 and again in 1987, the CWA strengthens enforcement mechanisms and regulations for stormwater runoff, providing for the development of industrial and municipal wastewater treatment standards and a permitting system to control wastewater discharges to surface waters. Sections 401, 402, and 404 of the CWA require permits for actions that involve wastewater discharges or discharge of dredged or fill material into waters of the United States.

CWA Section 404 defines requirements for discharges in navigable waters of the United States and sets limits on the discharge of dredged or fill material into navigable waters. Permit approval is through USACE. Dredging activities and placement of fill trigger the need for a Section 404 permit.

For projects that require a Section 404 permit, a Section 401 Water Quality Certification is also required. In Hawai'i, the U.S. Environmental Protection Agency has delegated responsibility for implementing Section 401 of the CWA to the Hawai'i Department of Health Clean Water Branch (DOH-CWB).

Discharges of point sources of pollutants into surface waters of the United States are controlled under the National Pollutant Discharge Elimination System program, pursuant to Section 402 of the CWA. Pursuant to the CWA and amendments, states may be authorized to administer permit programs. Under Section 11-55 HAR, DOH-CWB administers the National Pollutant Discharge Elimination System program in Hawai'i.

Coastal Zone Management Act

The Federal Coastal Zone Management Act of 1972 (16 USC §§1451-1464) was established as a U.S. national policy to preserve, protect, develop, and where possible, restore or enhance, the resources of the nation's coastal zone. The Act encourages coastal states to develop and implement coastal zone management plans but does not require states to participate. The State of Hawai'i Legislature enacted HRS 205A, (the Hawai'i Coastal Zone Management Act) in 1977. This was approved as a coastal zone management plan under the Act in 1978.

The Coastal Zone Management Act states that “global warming may result in a substantial sea level rise with serious adverse effects in the coastal zone,” and that “coastal states must anticipate and plan for such an occurrence.” See 16 USC § 1451.

Other Relevant Laws

The following federal laws may also apply to shoreline projects in Hawai‘i:

- Archaeological and Historic Preservation Acts
- Clean Air Act
- Fish and Wildlife Coordination Act
- Endangered Species Act
- Magnuson-Stevens Fishery Conservation and Management Act
- Marine Mammal Protection Act
- Migratory Bird Treaty Act
- National Marine Sanctuaries Act

State

HRS §205A, Coastal Zone Management

Coastal zone management policies are defined in HRS §205A, which has the following objectives:

1. **Recreational resources:** Provide coastal recreational opportunities accessible to the public.
2. **Historic resources:** Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.
3. **Scenic and open space resources:** Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.
4. **Coastal ecosystems:** Protect valuable coastal ecosystems, including reefs, beaches, and coastal dunes, from disruption and minimize adverse impacts on all coastal ecosystems.
5. **Economic uses:** Provide public or private facilities and improvements important to the State’s economy in suitable locations.
6. **Coastal hazards:** Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.
7. **Managing development:** Improve the development review process, communication, and public participation in the management of coastal resources and hazards.
8. **Public participation:** Stimulate public awareness, education, and participation in coastal management.
9. **Beach and coastal dune protection:**
 - A. Protect beaches and coastal dunes for:
 - i. public use and recreation
 - ii. the benefit of coastal ecosystems
 - iii. use as natural buffers against coastal hazards
 - B. Coordinate and fund beach management and protection.
10. **Marine and coastal resources:** Promote the protection, use, and development of marine and coastal resources to assure their sustainability with respect to climate change and sea level rise.

In 2021, the Hawai'i State Legislature passed Act 16 to amend HRS §205A. The Legislature determined that the granting of hardship variances along eroding beaches has resulted in a domino effect of shoreline armoring leading to beach loss and narrowing. Moreover, single-family residences on eroding shores have increased 20 percent in surface area, which, when combined with projected sea level rise, increases the risk of potential structural failure and resulting debris on public beaches. The amendments were focused on strengthening coastal zone management policy to protect state beaches and to reduce residential exposure to coastal hazards, including sea level rise.

A shoreline certification is the basis for establishing county shoreline setbacks for structures and development. The definition of **shoreline** was not amended by Act 16. In addition to the definition of shoreline (provided at the beginning of this section), the following are key definitions established for HRS 205A:

- **Beach** means a coastal landform primarily composed of sand from eroded rock, coral, or shell material, or any combination thereof, that is established and shaped by wave action and tidal processes. Beach includes sand deposits in nearshore submerged area, or sand dunes or upland beach deposits landward of the shoreline that provide benefits for public use, recreation, and coastal ecosystems, and that act as a natural buffer against coastal hazards.
- **Coastal hazard** means any tsunami, hurricane, wind, wave, storm surge, high tide, flooding, erosion, sea level rise, subsidence, or point or nonpoint source pollution.

A key revision is the requirement of Special Management Area (SMA) permits for the construction or reconstruction of all single-family dwelling units, regardless of size or type, on shoreline lots or lots impacted by waves, storm surge, high tide and shoreline erosion. The impacts of Act 16 on residential permitting on the Island of O'ahu are illustrated in Figure A1-4.

Other key revisions to HRS §205A, include:

- A more comprehensive definition of coastal hazards, to include hurricanes, wind, storm surge, high tide, erosion, and sea level rise
- A revised minimum setback of 40 feet from the certified shoreline (the previous minimum setback was 20 feet)
- An expanded definition of protected beach areas to include coastal dunes and coral reefs
- Very strong prohibitions against armoring the shoreline with seawalls or revetments on private property; these prohibitions are intended to help to protect and preserve beaches for public use, protect and restore coastal ecosystems, and limit the number and type of structures placed in areas prone to coastal hazards

Chapter 25: Special Management Area (SMA)

Impacts of Act 16 (2020) on Residential Permitting

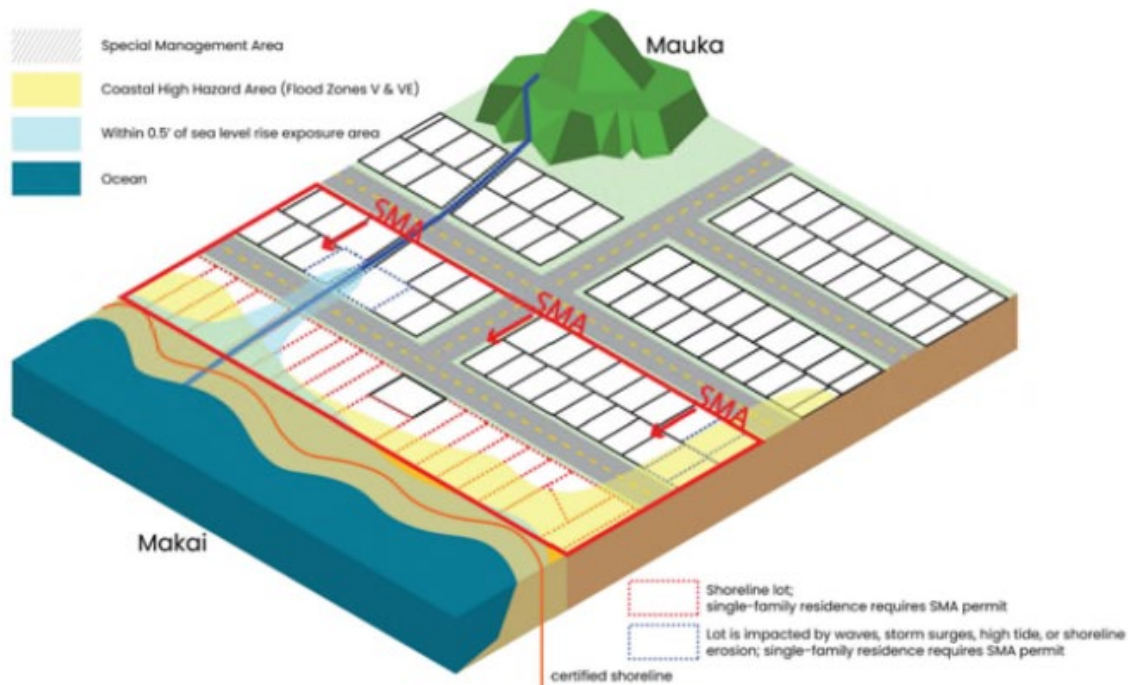


Figure A1-4. Schematic diagram developed by the City and County of Honolulu showing the impacts of 2020 amendments to HRS §205A on residential permitting

Section 13-5, HAR (Conservation District)

Pursuant to HRS §205, all lands in the State are categorized 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 five subzones that dictate what types of development can and cannot take place. These subzones range from the most restrictive to least restrictive and include (1) Protective, (2) Limited, (3) Resource, and (4) General and (5) 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. Coastal lands in the location of proposed actions are considered part of the Conservation District, Resource Subzone. The Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR-OCCL) is responsible for the management of these coastal resources. The Hawai‘i Board of Land and Natural Resources regulates uses of the State Conservation District by issuing Conservation District Use Permits for approved activities. Statutes governing use administration procedures of the Conservation District are written in HRS §183C (Conservation District). The administration is further clarified by 13-5, HAR (Conservation District).

HRS §226, Part III Priority Guidelines, Hawai'i State Planning Act

The Hawai'i State Planning Act establishes state priority guidelines intended to improve the quality of life for Hawai'i's present and future population through the pursuit of desirable courses of action in seven areas:

- Economic development
- Population growth and land resource management
- Affordable housing
- Crime and criminal justice
- Quality education
- Sustainability
- Climate change adaptation

State and county planners are required to ensure that the state priority guidelines are considered in developing and updating all plans. State priority guidelines take precedence when addressing areas of statewide concern. The priority guidelines that specifically apply to regional shoreline management include the following:

- Climate Change Adaptation Priority Guidelines
 - Ensure that Hawai'i's people are educated, informed, and aware of the impacts climate change may have on their communities.
 - Encourage community stewardship groups and local stakeholders to participate in planning and implementation of climate change policies.
 - Consider Native Hawaiian traditional knowledge and practices in planning for the impacts of climate change.
 - Foster cross-jurisdictional collaboration between county, state, and federal agencies and partnerships between government and private entities and other non-governmental entities, including nonprofit entities.
 - Encourage planning and management of the natural and built environments that effectively integrate climate change policy.
 - Explore adaptation strategies that moderate harm or exploit beneficial opportunities in response to actual or expected climate change impacts to the natural and built environments.
 - Encourage the preservation and restoration of natural landscape features, such as coral reefs, beaches and dunes, forests, streams, floodplains, and wetlands, that have the inherent capacity to avoid, minimize, or mitigate the impacts of climate change.
 - Invest in continued monitoring and research of Hawai'i's climate and the impacts of climate change on the State.
- Sustainability Priority Guidelines
 - Encouraging planning that respects and promotes living within the natural resources and limits of the State.

- Consider the principles of the ahupuaʻa system.
- Population Growth and Land Resources
 - Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.
 - Identify critical environmental areas in Hawaiʻi to include but not be limited to the following: watershed and recharge areas; wildlife habitats (on land and in the ocean); areas with endangered species of plants and wildlife; natural streams and water bodies; scenic and recreational shoreline resources; open space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.
 - Utilize Hawaii's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generation.
 - Protect and enhance Hawaii's shoreline, open spaces, and scenic resources.

Other Relevant Laws

The following State statutes and administrative rules may also apply to shoreline projects in Hawaiʻi:

- HRS §343—Environmental Impact Statements
- HRS §6E—Historic Preservation
- Section 11-200.1, HAR—Environmental Impact Statement Rules
- Section 11-54, HAR—Clean Water Standards
- Section 11-55, HAR—Water Pollution Control
- Section 13-222, HAR—Shoreline Certifications

County

Special Management Area (SMA)

The SMA permit set forth in the Hawaiʻi Coastal Zone Management Program regulates all land uses allowable by land use policies, including zoning designations, county general plans, and community development plans. State SMA policies under HRS §205A are implemented by the County planning departments. Each county has delineated SMA boundaries and adopted rules and regulations consistent with HRS 205A that regulate development within the SMA.

Shoreline Setbacks

Pursuant to HRS §205A, the shoreline area that is regulated by the counties encompasses the land between the certified shoreline and the shoreline setback line, which is a minimum of 40 feet. The County of Kauaʻi and County of Maui have adopted more progressive shoreline setbacks that are based on historical rates of erosion and a parcel's average depth. The County of Maui and City and County of Honolulu recently proposed amendments to their SMA and shoreline setbacks ordinances and rules that would expand the shoreline setback area and further regulate development in areas predicted to be subject to coastal hazards.

Shoreline Setback Variances

Structures and activities are strictly regulated within the shoreline setback area and shoreline armoring is prohibited without a shoreline setback variance. Each island has adopted rules and regulations that determine the process for requesting a shoreline setback variance. Private property applicants are typically required to demonstrate that the action is the practicable alternative that best conforms to the purpose of the SMA and shoreline setback rules and that a hardship would result if the action is not allowed within the shoreline area.

Plans and Programs

Many studies, plans, and recommendations on shoreline management in Hawai'i have been formulated over the last 40 years (Table A1-1). In the 1980s, sea level rise and coastal erosion were beginning to be recognized as potential issues related to development. Studies and plans were developed to address these issues in subsequent decades, but few were fully implemented.

Federal

The Regional Sediment Management Program administered by the U.S. Army Corps of Engineers is a nationwide program that has been active in Hawai'i for many years. The program has two primary functions: to conduct research to inform management decisions; and to evaluate RSM concepts through demonstration projects to improve sediment management activities. USACE has developed the following individual plans in Hawai'i:

- **Kaua'i**—Kekaha, Po'ipū
- **O'ahu**—Diamond Head to Pearl Harbor, Mōkapu to Makapu'u, Hale'iwa, Sunset Beach
- **Maui**—Kahului, Kihei, and West Maui

A regional shoreline management approach compartmentalizes the shoreline based on littoral cells, which are primarily defined by physical features and processes that drive sediment transport and shoreline change. The regional sediment management plans in Hawai'i have proposed various demonstration projects. While many demonstration projects have been identified few have been funded. Despite the lack of funding, the Regional Sediment Management Program provides valuable technical data, information, and recommendations to inform the development of shoreline management projects. Multiple projects are currently being proposed that align with the littoral cells identified through the RSM program (Figure A1-5).

Table A1-1. History of Studies, Plans, and Programs in Hawai'i

Year	Plan
1981	Beach Changes on O'ahu
1985	Effects on Hawai'i of a Worldwide Rise in Sea Level Induced By the "Greenhouse Effect"
1989	O'ahu Shoreline Study - Management Strategies
1989	Hawai'i Shoreline Erosion Management Study
1990	Erosion Management Program Recommendations for Hawai'i
1990	Kauai Shoreline Erosion Management Study
1991	Aerial Photograph Analysis of Coastal Erosion on the Islands of Kaua'i, Moloka'i, Lāna'i, Maui and Hawai'i
1991	Hawai'i Ocean Resources Management Plan
1991	O'ahu Shoreline Management Plan
1991	Recommendations for Improving the Hawai'i Coastal Zone Management Program
1992	Beach Management Plans with Beach Management Districts
1993	Beach Nourishment Viability Study
1994	Shoreline Certification Review and Recommendations
1997	Beach Management Plan for Maui (1st edition)
1999	Hawai'i's Emergent Coastal Zone Management Program
2000	Hawai'i Coastal Erosion Management Plan
2000	Kā'anapali Beach Management Plan
2005	Hawai'i Coastal Hazard Mitigation Guidebook
2005	Papohaku Dunes Cultural and Natural Resources Preservation Plan
2006	3-Year Plan for Beach Restoration Studies and Projects
2006	Southeast O'ahu Regional Sediment Management Demonstration Project (updated 2009)
2006	Hawai'i Ocean Resources Management Plan
2008	Beach Management Plan for Maui (2nd edition)
2009	Kailua Beach Management Plan
2011	Sea-Level Rise and Coastal Land Use in Hawai'i: A Policy Tool Kit for State and Local Governments
2011	Hawai'i Regional Sediment Management Plan: Kekaha and Po'ipū Regions, Kaua'i
2011	Hawai'i Regional Sediment Management Plan: Kahului and Kihei Regions, Maui
2012	National Assessment of Shoreline Change: Historical shoreline change in the Hawaiian Islands
2014	Hawai'i Regional Sediment Management Needs Assessment
2015	Beach Restoration in Hawai'i: Challenges and Opportunities
2017	Hawai'i Sea Level Rise Vulnerability and Adaptation Report
2018	Hawaiian Islands National Shoreline Management Study
2018	Waikiki Beach Management Plan
2019	Feasibility & Implications of Managed Retreat Strategies for Vulnerable Coastal Areas in Hawai'i
2019	O'ahu Resilience Plan
2020	2020 Ocean Resource Management Plan
2021	Hawaiian Islands National Shoreline Management Study

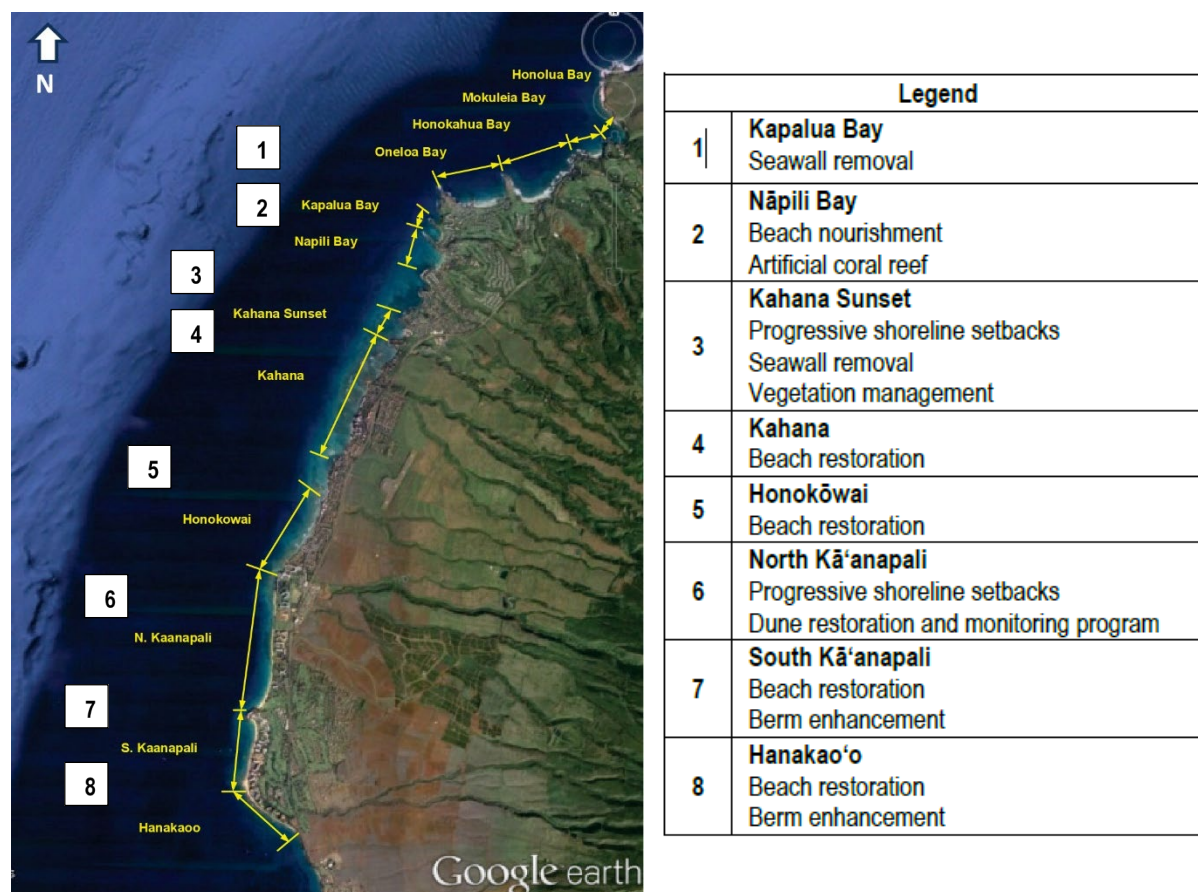


Figure A1-5. West Maui littoral cells¹ and planned/implemented shoreline management actions

State

The State of Hawai'i has implemented a variety of plans and programs that relate to shoreline management. Plans generally focus on establishing specific goals, objectives, and recommended actions to improve shoreline management, whereas programs generally focus on implementing specific types of shoreline management strategies and/or interventions.

Hawai'i State Plan

The Hawai'i State Plan (HRS §226) is a long-range comprehensive plan that establishes the overall theme, goals, objectives, policies, and priority guidelines for statewide planning. The Hawai'i State Plan provides a framework for determining priorities, allocating public resources, and improving coordination between State and county plans, policies, programs, projects, and regulatory activities.

Ocean Resources Management Plan

The Hawai'i Ocean Resources Management Plan (ORMP) is a statewide plan that seeks to resolve coastal problems and issues that are not adequately addressed by existing laws and rules. The plan is a requirement under HRS §205A-62(1) and is a main component of the Coastal Zone Management

¹ US Army Corps of Engineers, West Maui Regional Sediment Management, https://rsm.usace.army.mil/hawaii/west_maui.htm, accessed May 10, 2022.

Program. Unlike plans that are created and administered by a single entity, the ORMP is unique in its collaborative implementation through the Coastal Zone Management Network, which includes federal, state, county, and community representation. The ORMP is required to be updated periodically through a process that involves statewide public input and government feedback (HRS §205A-62(2)). Since its mandate in 1985, the ORMP has gone through four revisions, most recently in 2020.

Conservation District Functional Plan

Functional plans set forth statewide policies, guidelines, and priorities within a specific field of activity proposed, administered, or funded by any State agency. 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 1991 Conservation Lands State Functional Plan establishes objectives to create plans for natural resources and land management, enhance natural resources, and ensure appropriate development of natural resources.

Coastal Erosion Management Plan

In 2006, the Hawai'i Department of Land and Natural Resources (DLNR) published the Hawai'i Coastal Erosion Management Plan as a framework for community discussion and assessment of coastal erosion and beach loss in Hawai'i. The purpose of the plan is to develop mechanisms to conserve and restore Hawaii's beaches, mitigate the impacts of erosion, and reduce exposure to coastal hazards for future generations.

Hawai'i Sea Level Rise Vulnerability and Adaptation Report

In 2017, the Hawai'i Climate Change Adaptation Commission published the Hawai'i Sea Level Rise Vulnerability and Adaptation Report. The report emphasized the conservation of beaches as a priority and outlined the following actions:

- Conduct a statewide assessment to identify legacy beach conservation priorities and how they integrate into greater shoreline management objectives.
- Establish a "willing seller" program to move development away from legacy beaches.
- Amend the State Legacy Lands Act to set aside funding for priority coastal lands and enable the use of a variety of practices and tools.
- Expand the area of national, state, and county parks and wildlife refuges to preserve critical coastal wildlife habitats.
- Prioritize coral reef preservation to buffer the impacts of coastal hazards with sea level rise.
- Develop public-private partnerships for coastal land acquisition, beach management, and reef protection.

Small-Scale Beach Nourishment Program

In 2006, the DLNR-OCCL established the Small-Scale Beach Nourishment Program to streamline the permit process for beach nourishment projects involving less than 10,000 cubic yards of sand.

Ho'āla Loko I'a Program

In 2015, the DLNR-OCCL established the Ho'āla Loko I'a Program to streamline the permitting process for the restoration of traditional Hawaiian fishpond systems (*loko i'a*). The program obtained an approved Final Environmental Assessment and Finding of No Significant Impact (FEA-FONSI) and is authorized by a Conservation District Use Permit (CDUP ST-3703).

Other Programs

Other programs that may be applicable to shoreline management in Hawai'i include:

- Legacy Lands Program (Hawai'i Department of Land and Natural Resources)
- Natural Area Reserves Program (Hawai'i Department of Land and Natural Resources)

County

At the County level, shoreline management objectives are generally established through general plans and may be further refined in community plans, zoning codes, or other powers under HRS §46.

General Plans

County general plans typically establish broad goals, objectives, policies, and implementing actions to capture the overall vision for future development in each county. General plans provide a policy framework for a county as a whole and guide the development of individual community plans. General plans typically address matters related to the following topics:

- Population
- Economies
- Natural Resource Management
- Housing and Community Development
- Public Infrastructure
- Land Use and Development
- Public Safety
- Health
- Education
- Culture
- Recreation
- Government Operations
- Fiscal Management

While shoreline management is typically not identified as a standalone category, most general plans include goals, objectives, policies, and implementing actions that relate to shoreline management though topics such as water quality, coastal resource management, coastal habitat preservation and restoration, beach preservation, and climate change resilience.

Community Development Plans

Each county in Hawai'i requires the development of community development plans (CDPs) to implement the goals, policies, and objectives established in the county's general plan. CDPs provide a mechanism for community engagement and input to inform decisions regarding zoning, development, natural resource management, public infrastructure and services, and other land use matters. There are 30 CDP planning areas in the State of Hawai'i (Table A1-2).

Table A1-2. Community Development Plan areas in Hawai'i

Kaua'i (6)	O'ahu (8)	Maui (9)	Hawai'i (7)
South Kaua'i Līhu'e Kapaa-Wailua North Shore Hanapēpē-Ēleele Waimea-Kekaha	Central O'ahu East Honolulu 'Ewa Ko'olau Loa Ko'olau Poko North Shore Primary Urban Center Wai'anae	Kīhei - Mākena West Maui Pā'ia – Haiku Lana'i Wailuku - Kahului Moloka'i Makawao - Pukalani - Kula Kaho'olawe Hāna	North and South Kona Puna North Kohala South Kohala Ka'u Hāmākua Hilo

CDPs may be a good entry point for establishing community-driven goals and objectives for shoreline management. While some CDPs address aspects that relate to shoreline management, this is not required. Each County requires that CDPs be updated periodically. CDPs have legal basis when signed by County Councils.

Management Plans

In addition to CDPs, counties may address shoreline management through functional plans, area improvement plans, strategic plans, capital improvement plans, beach management plans, etc. These plans are generally focused on specific topics (e.g., beach management) or geographic areas. Examples of these plans include:

- O'ahu Shoreline Management Plan (1991)
- Beach Management Plan for Maui (1997, 2008)
- Kaanapali Beach Management Plan (2000)
- Kailua Beach and Dune Management Plan (2010)
- Waikīkī Beach Management Plan (2018)
- O'ahu Resilience Strategy (2019)

These plans are generally developed as guidance and are not backed by the force of law, which can make implementing the plans challenging. The plans also generally lack specific mandates or dedicated funding to support implementation. While these plans may not facilitate project implementation, they do provide useful information that can help to inform planning and design for shoreline management projects.

Appendix 2: Challenges and Opportunities for Regional Shoreline Management in Hawai‘i

Challenges and opportunities for implementing a regional shoreline management approach in Hawai‘i were identified based on a review of existing literature, studies, notes from focus group discussions initiated by OPSD-CZM before the Scoping Study, practical and on-the-ground experience, and stakeholder input (see Chapter 1 of the Scoping Study). Four questions were developed based on this review:

1. What are challenges and opportunities for managing a highly **complex and diverse shoreline**?
2. What are challenges and opportunities for **community and cultural engagement** in shoreline management in Hawai‘i?
3. What are **governance** challenges and opportunities for shoreline management in Hawai‘i?
4. What are **technical and financial management capacity** challenges and opportunities for implementing a shoreline management in Hawai‘i?

Five key challenges were drafted for each question by the project team with input from the Hawai‘i Ocean Resources Management Plan (ORMP) Action Team. A wiki survey was developed to rank the five key challenges for each question. Participants of the first RSM Scoping Study workshop completed the survey, together with other stakeholders identified by OPSD-CZM, the ORMP Action Team, and the project team. Survey respondents ranked the five key challenges for each question and identified other challenges and opportunities to address these issues.

This appendix provides the results of the wiki survey for each question and lists other relevant issues and opportunities identified by the survey respondents.

Shoreline Complexity

With over 750 miles of diverse coastline, Hawai‘i is a challenging environment for shoreline management. Hawaii’s shoreline is characterized by the following types of features that vary island by island:

- Physical features are defined by geology, hydrology, geomorphology, oceanography, and coastal hazards.
- Cultural features are expressed through traditional cultural resources and practices that are rooted in a deep sense of connection to place.
- Social and economic features add complexity to the shoreline with structures, dense development, water-dependent facilities, and critical infrastructure located along the shoreline or in low-lying coastal areas.

Many of these shoreline features are changing from sea level rise and the impacts of climate change and will continue to change for centuries. Climate change exacerbates the vulnerability of the shoreline and increases the complexity of the dynamic processes that drive and create physical shoreline characteristics.

The results of the wiki survey on challenges of shoreline complexity are shown in Figure A2-1. The challenge of greatest concern to survey respondents was the vulnerability of development and critical infrastructure to coastal hazards. This concern was followed by the need to develop site-specific adaptation strategies that are appropriate for the complex array of shoreline types in Hawai'i.

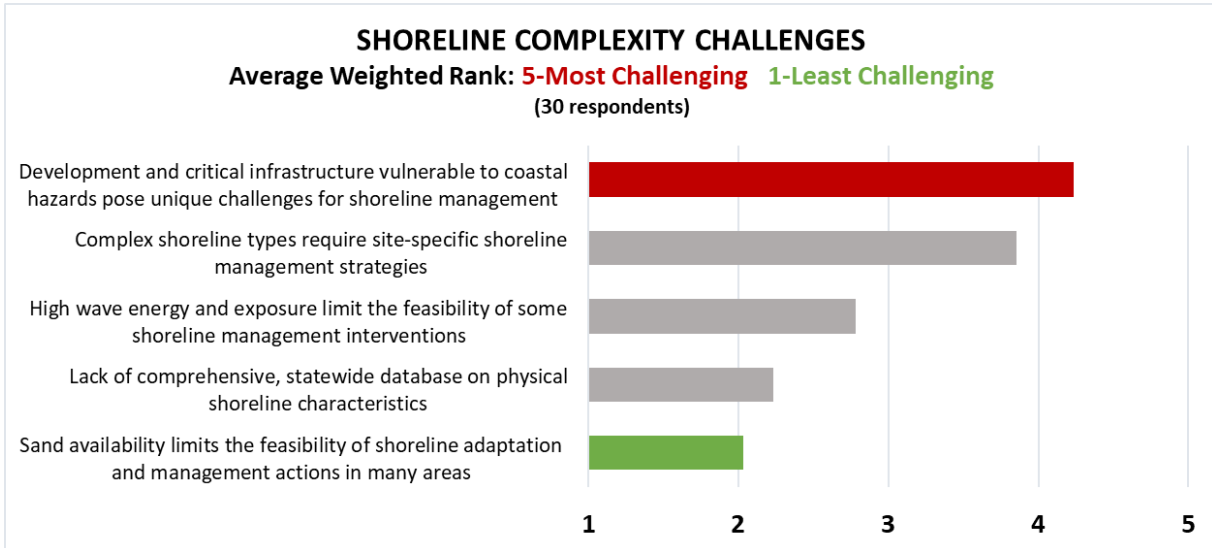


Figure A2-1. Ranking of shoreline complexity challenges related to regional shoreline management based on wiki survey

Other issues highlighted by survey respondents included:

- Shoreline areas that are currently experiencing erosion and flooding threats have no time for planning
- Unauthorized structures and improvements along the shoreline
- Political will and other competing needs, like tourism
- Preserving health of coastal ecosystems and public access is highly important and a responsibility of the State

Opportunities identified by survey respondents included:

- Establish standards for repair, maintenance, modification, and/or replacement of existing shore protection structures to mitigate erosion and protect existing development and critical infrastructure.
- Identify developed shorelines where managed retreat, combined with natural-based shoreline restoration, may be feasible.
- Prioritize protection and conservation of coastal areas that are undeveloped or sparsely developed, or have land use designations such as rural, agricultural, conservation, open space, and undeveloped (Greenfields) for nature-based adaptation strategies.
- Identify and map shoreline types.
- Create smaller shoreline planning areas with distinct planning characteristics.
- Develop a comprehensive, statewide database on physical, ecological, cultural, and community shoreline characteristics including certified shorelines, permits and violations.

- Categorize coastal environments in Hawai‘i (wave environment, backshore geology, erosion rate, etc.) and potential adaptation and management considering those environmental conditions.
- Conduct pilot projects on how to slow down wave energy offshore to improve the function of shoreline management projects.
- Identify feasible options for adaptation and shoreline management informed by physical, ecological, cultural, and community features.
- Conduct a comprehensive sand resource inventory for priority areas.
- Establish requirements to preserve and protect sand sources that may be suitable for beach and dune restoration purposes.

Community and Cultural Engagement

Hawaiian culture is characterized by a strong sense of place and connection with the natural environment. Located at the interface between the *‘āina* (land) and *moana* (sea), the shorelines of Hawai‘i provide and support a diverse range of natural, cultural, aesthetic, recreational, and socioeconomic benefits and uses. Access to and along the shorelines of Hawai‘i is an indisputable right of every citizen. The public’s right to access the shoreline is rooted in common law, the public trust doctrine, and the Hawai‘i Constitution—all affirming that the lands below the shoreline are held by the State as a public trust for the people of Hawai‘i.

Hawaii’s shorelines are widely recognized as a unique and valuable public resource; however, communities have traditionally had limited involvement in shoreline management projects. Community plan policies often require shoreline management projects, but direct community engagement usually is limited to projects undergoing environmental review or already in final design and permitting. Such engagements are valuable, but robust, inclusive feedback from communities in earlier stages of projects could better facilitate conflict resolution and consensus building. A key challenge for community engagement is how to identify and connect with interested community members, particularly Native Hawaiians. Developing shoreline management strategies and interventions that are feasible and appropriate at a given location requires considerable knowledge and understanding of the local and regional coastal setting and the dominant physical processes that shape that environment. These complex processes are often oversimplified in public discourse, resulting in misconceptions about the processes that impact the shoreline and the feasibility and impacts associated with specific shoreline management interventions.

The results of the wiki survey on challenges for community and cultural engagement are shown in Figure A2-2. The challenge of greatest concern to survey respondents was the tension between private rights and access to public land as coastal erosion and sea level rise blur the lines between private and public lands. This concern was followed by the challenge of achieving consensus between different stakeholders on goals and objectives for shoreline management.

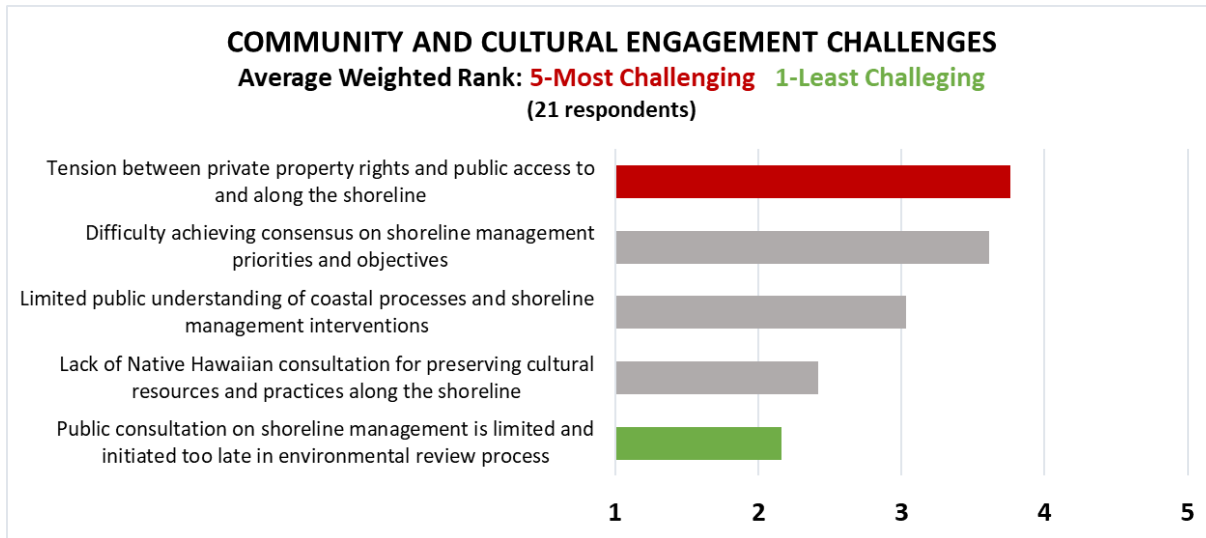


Figure A2-2. Ranking of community and cultural engagement challenges related to regional shoreline management based on wiki surveys

Other issues highlighted by survey respondents included:

- Difficulty in properly defining the community stakeholders and balancing the priorities of various interests with the ecological wellbeing of the shoreline
- Influence of large, influential property owners on decision-making
- Government has historically valued private property above the public beach
- Controversial treatment of shoreline management projects by the media
- Distrust of government and politicians regarding sea level rise and response options
- A notion that sea level rise can be solved, and that impacts can be fully mitigated
- Resistance to accepting scientific data and conclusions regarding climate change impacts on the shoreline, which is exacerbated by shifting or conflicting scientific data
- Community is only engaged on specific projects, most often at the property-scale; no larger-scale management planning
- Other issues, such as tourism management, become entangled with the shoreline management approaches

Opportunities identified by survey respondents included:

- Enhance opportunities for meaningful engagement and information exchange with the Native Hawaiian community.
- Incorporate Native Hawaiian cultural and traditional ecological knowledge and perspectives early in shoreline management planning and decision making.
- Define community or stakeholders for engagement in planning and implementing shoreline management, and prioritize the needs of various stakeholders/community groups while protecting public trust resources.
- Engage large landowners, neighborhood boards, and community associations to identify opportunities to reduce conflict.
- Weigh common good over individual gains in permitting decisions. Blocking future sea walls was a win.

- Conduct talk story sessions, both in person and on social media and websites. There are some good models on Maui.
- Use multiple methods of gathering input, e.g., online, in person, anonymous. Use natural community gathering events: farmers markets, surf events, schools, beach parking lots, etc.
- Seek to clarify and resolve socioeconomic and legal issues associated with private property rights and public resources.
- Explore options to acquire or designate private lands for conservation purposes.
- Explore options to establish special districts for unique and high-priority areas and facilities.
- Increase public knowledge and understanding of coastal processes to promote effective shoreline management.
- Increase community engagement in shoreline management.
- Proactively engage with the public to educate the public about the available tools and, importantly, to listen to community concerns and perspectives. Engagement should happen in a place-based inclusive manner. There is not a state-wide solution, it will vary by island and location on each island.
- Compile and publish a comprehensive database of known historical, cultural, and archaeological resources along Hawaii's shorelines.
- Develop a single source of information for all shoreline-related projects. This should be located online and include maps, data, planning documents, permit applications, and other relevant documents/data within a GIS database, with linked documents to maintain transparency throughout planning, design, permitting, and construction.
- Foster community-led projects and stewardship committees with funding to implement needed projects.
- Develop cultural preservation protocols and vetted actions by ahupua'a for cultural resources and iwi kūpuna at risk of exposure from coastal flooding and erosion in coordination with relevant State and county entities and cultural and lineal descendants.
- For large projects with environmental assessments or environmental impact statements, consultations with the community need to go beyond what is prescribed in the regulatory process. Consider working with a local liaison to organize community meetings.

Governance Framework

Shoreline management in Hawai'i is subject to a myriad of federal, State, and county laws, rules, and policies, most of which regulate activities along the shoreline. Shoreline management projects typically require approvals from the U.S. Army Corps of Engineers, Hawai'i Department of Health, Hawai'i Department of Land and Natural Resources, and county planning and public works departments. Each of these agencies has different missions, goals, objectives, and policies for shoreline management. Currently, there is no lead permitting agency designated as a centralized authority for shoreline management projects or programs. The permitting system depends on the location of a project and the jurisdictions involved, rather than the activity to be permitted. This system of shared but not unified governance offers the advantage of multiple levels of oversight but increases regulatory burden on applicants and creates opportunities for differing results where policies are not well aligned.

There is also some ambiguity among government agencies in defining shoreline management. The shoreline is an administrative line that establishes a boundary between dry lands and submerged lands,

defines public domain verse exclusively private property, and serves as the baseline for calculating shoreline setbacks. The shoreline also establishes the boundary between areas under State jurisdiction and those under county jurisdiction for planning and permitting. This can introduce a layer of uncertainty on highly mobile shorelines such as eroding beaches or projects where the shoreline's location is artificially fixed by manmade structures such as seawalls, revetments, or boulder or rubble mounds. Because the shoreline is a line, rather than an area, the landward and seaward limits of the shoreline management area are unclear.

A regional shoreline management approach in Hawai'i will require clarification of agency roles and may require new mandates to establish the geographic scope of the shoreline management area. A thorough review of existing policies, plans, and programs will be required to identify factors that enable or inhibit regional shoreline management. Efforts should be made to resolve legal issues and concerns, particularly those related to the public trust doctrine and private property rights, such as regulatory takings, inverse condemnation, and eminent domain. A regional shoreline approach will require extensive collaboration between agencies.

The results of the wiki survey on governance challenges are shown in Figure A2-3. The challenge of greatest concern to survey respondents was that the current parcel-by-parcel approach is insufficient by itself to address threats to Hawai'i's shoreline from coastal erosion exacerbated by sea level rise and other climate change impacts. This concern was followed by the complementary issue that the shoreline is highly regulated but not really managed.

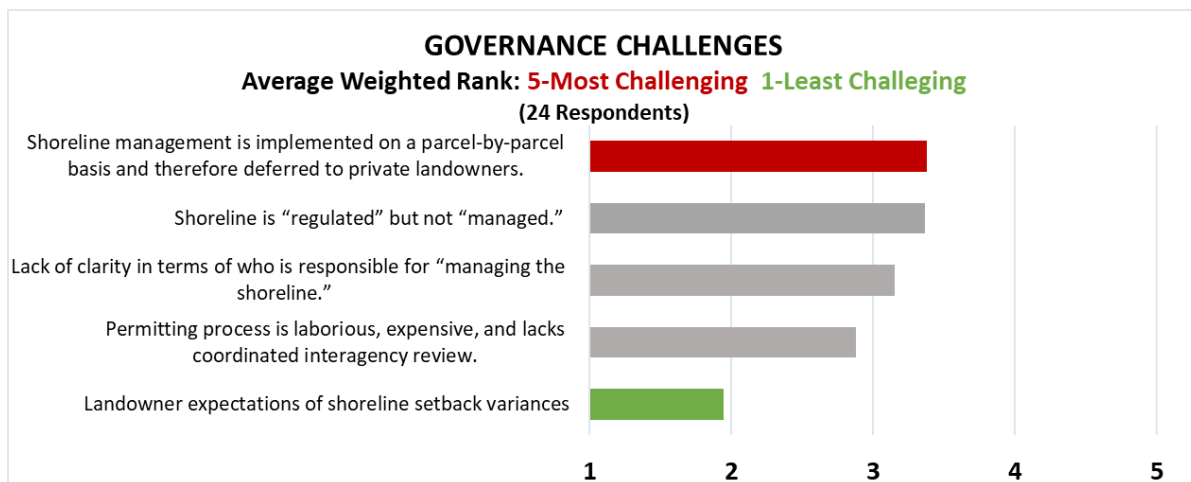


Figure A2-3. Ranking of governance challenges related to regional shoreline management based on wiki surveys

The results of the wiki survey on legal and regulatory barriers are shown in Figure A2-4. The challenge of greatest concern to survey respondents was lack of enforcement of violations of shoreline regulations. This concern was followed by the lack of comprehensive shoreline management regulations and guidance..

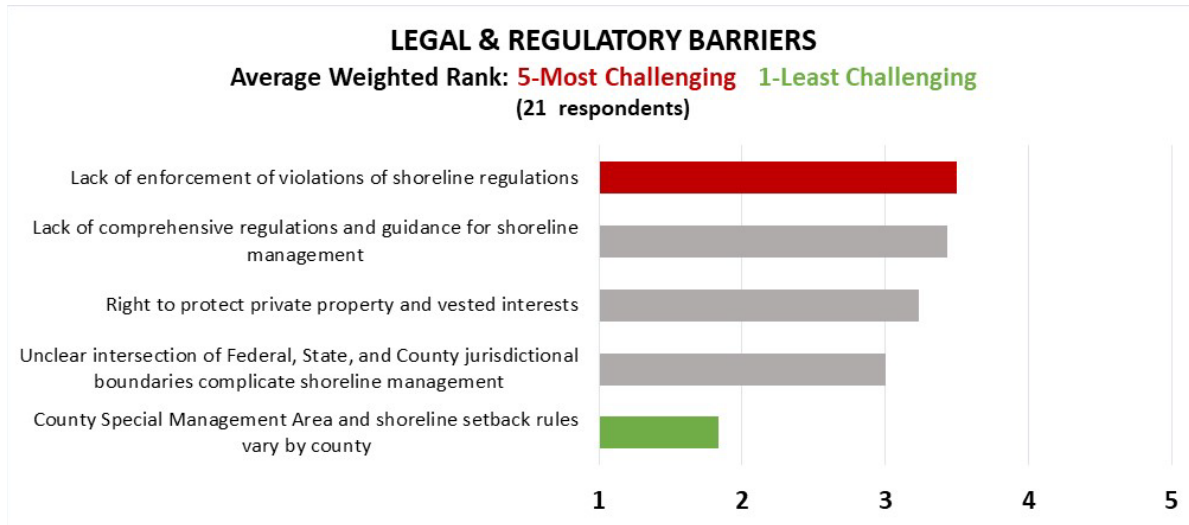


Figure A2-4. Ranking of legal and regulatory challenges related to regional shoreline management based on wiki surveys

Other issues highlighted by survey respondents included:

- Distinction of the shoreline delineating property ownership is very contentious and is poorly understood by most landowners
- Shoreline management is not clearly defined or mandated in the existing governance framework
- Too many agencies (OCCL, DLNR-Land, City-DPP, DOT, Parks, USACE) with different agendas regulating the shoreline
- Lack of a statewide shoreline management plan for implementation
- Lack of clear and consistent data on shoreline structures, conditions, and non-conforming uses
- Lack of enforcement tools for contractors performing unauthorized work along the shoreline
- Lack of a clear and succinct roadmap through the legal and regulatory processes needed for shoreline restoration projects; there are too many silos and very little cross coordination.
- Lack of an integrated and coordinated management across the state, rules, regulations, statutes, policies; Hawai'i needs a more centralized coastal management approach

Opportunities identified by survey respondents included:

- Clarify roles, responsibilities, and authority for shoreline management in Hawai'i. Evaluate options to coordinate and streamline regulatory review of shoreline management projects.
- Develop statewide, regional, and local shoreline management strategies and beach management plans.
- Bring together permitting agencies at county, State and federal levels and create a coordinated and streamlined process.
- Conduct comprehensive review of the current shoreline certification process, in terms of the existing guidance and requirements for shoreline development and projects.
- State could assign the location of each island's shoreline in a georeferenced continuous GIS layer.
- Identify shoreline regions and subregions that require unique shoreline management strategies and develop policies and programs to support their implementation.
- Establish co-management arrangements to facilitate shoreline management projects.
- Identify locations where shoreline access can be improved.

- Form a central Hawai'i coastal management agency and do away with most of the multitude of decentralized county and State jurisdictions, rules, and regulations.
- Consolidate coastal management under one roof with sufficient trained and experienced staff (engineers, scientists, planners).
- Create a new authority to manage the shoreline.
- Simplify the regulatory system for at least State and county authorities by combining coastal review/permitting authority.
- Adopt laws that reflect the needs of the next two generations as well as current landowners. The legal system needs to be protective of future anticipated shoreline modifications driven by climate change.
- Develop a shoreline management plan as a legal requirement of implementation and incorporate shoreline management into county land use policies, including zoning.

Management Capacity

Hawai'i has the fourth longest coastline in the United States. The length, complexity, and diversity of shoreline types found in Hawai'i presents a unique management challenge for agencies, communities, and private landowners. As the impacts of erosion, flooding, and other coastal hazards continue to be exacerbated by rising sea levels, the need for more proactive shoreline management is becoming more apparent and pressing. With limited resources, government agencies lack the capacity to comprehensively address shoreline management in Hawai'i:

- Federal funding for shoreline management in Hawai'i has typically focused on regulatory oversight, scientific research, monitoring, and conceptual planning. Federal funding available on a competitive basis is often limited to disaster risk reduction rather than resource management.
- At the State level, shoreline management projects have typically been funded through legislative appropriations or cost-sharing agreements with private organizations. To justify the use of public funding, appropriations have typically prioritized areas with economic significance, such as Waikiki, O'ahu and Kā'anapali, Maui.
- At the county level, availability of capital improvement program (CIP) funding is limited, so projects have typically focused on managing county-owned facilities and parks along the shoreline. OPSD provides participating county planning departments with funding for professional positions to help build and retain agency capacity to manage the shoreline through planning and permitting. The University of Hawai'i has provided support for Sea Grant Agents embedded in county planning departments to assist permitting staff with sound science.

Due in part to government resource limitations, the burden of responsibility for shoreline management often falls on communities and private landowners. Over half of all beach nourishment and beach maintenance projects in Hawai'i have been funded by private landowners. This is problematic because private landowners have no rights or vested interest in submerged lands seaward of the shoreline and are not responsible for managing public trust resources, such as beaches and coastal dunes.

The results of the wiki survey on management capacity challenges are shown in Figure A2-5. The challenge of greatest concern to survey respondents is insufficient staff and funding for shoreline management. This concern was followed by the high costs of shoreline management projects.

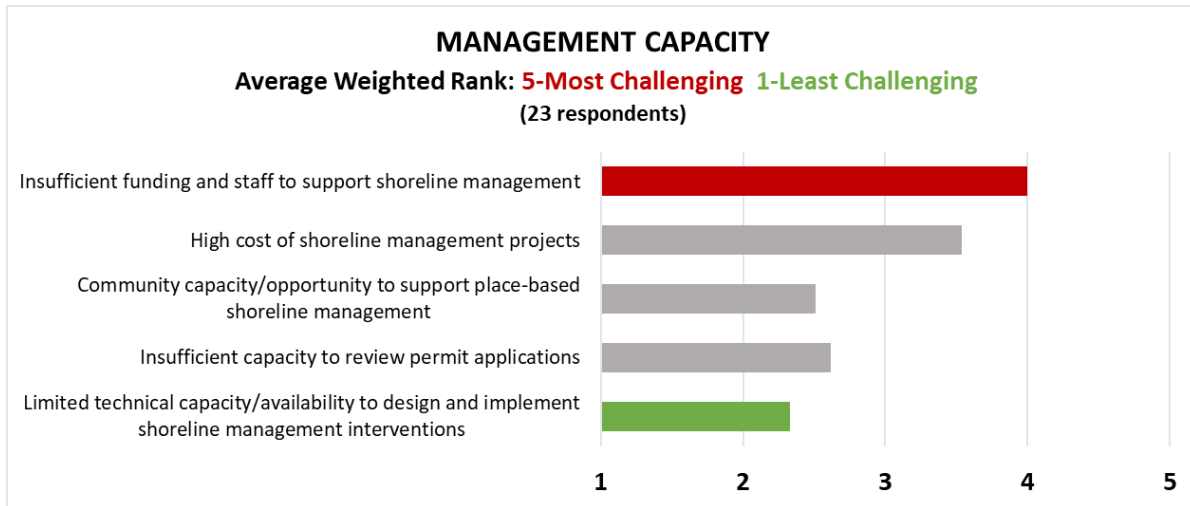


Figure A2-5. Ranking of management capacity challenges related to regional shoreline management based on wiki surveys

Other issues highlighted by survey respondents included:

- State and county funding and staff for shoreline management is not commensurate with the challenges of climate change or the social, cultural, and economic values of Hawaii's shorelines.
- The DLNR is significantly underfunded and staffed to carry out its conservation mission. The DLNR has strong regulatory authority but little to no management capacity.
- Staffing is not sufficient to inspect and issue citations and follow through with enforcement actions. Rarely are the laws upheld with regard to illegal shoreline actions.
- The regulatory burden increases costs for large-scale shoreline management projects.
- There is not enough staff to properly attend to violations in a timely manner, which leads to more violations.
- Management capacity, interagency coordination, and enforcement are insufficient.
- State and county agencies have limited technical and ocean/coastal engineering capacity to review proposed coastal projects.
- There is a lack of funding for land acquisition and buyouts for conservation along the shoreline.
- There is an immense need for enforcement capacity.

Opportunities identified by survey respondents included:

- Provide more training and assistance to help shoreline management staff review projects that require a cultural impact assessment.
- Train county staff to increase cultural literacy.
- Build enforcement capacity to address current violations of existing regulations.
- Dedicate funding for regional shoreline management at State and county levels.
- Provide more community collaboration and volunteer efforts.
- Leverage resources/funds better among federal agencies.
- Identify co-management arrangements to support cost-sharing for regional shoreline management projects.

- Identify multiple sources of funding for shoreline management, including user fees for tourists, development fees, special (revenue) funds, and federal infrastructure funds.
- Conduct more cost-benefit analyses upon which to make decisions about shoreline management options.
- Develop a State coastal adaptation and resilience fund.

Appendix 3: Examples of Regional Shoreline Management Projects in Hawai‘i

The methodology for delineating shoreline regions and subregions described in the Regional Shoreline Management Scoping Study was based on a comprehensive review of regional shoreline management examples in Hawai‘i and elsewhere. This appendix presents examples of how regional shoreline management is already being used in Hawai‘i. (Figure A3-1).

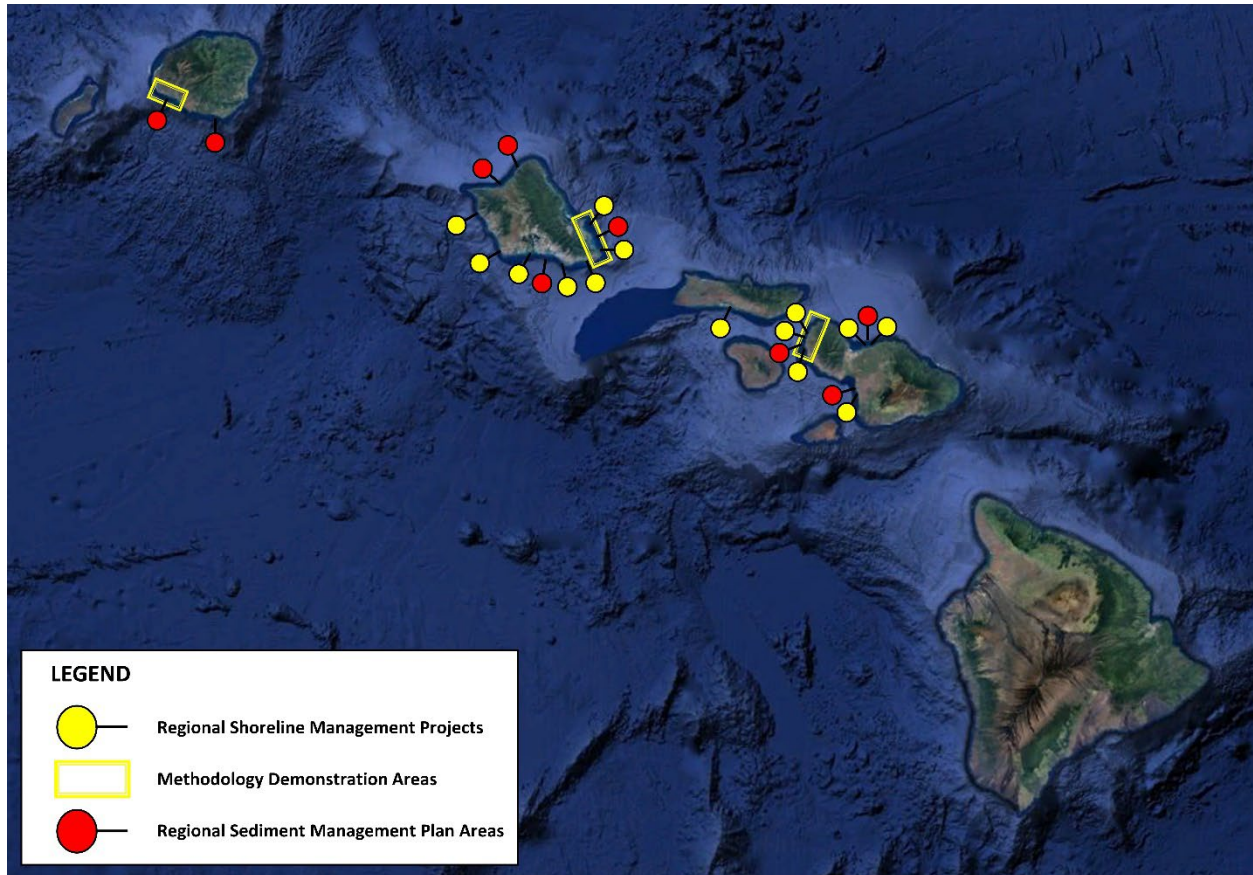


Figure A3-1. Locations of regional shoreline management plans and projects in Hawai‘i

The examples shown include the following general project types:

- USACE has developed eight **regional sediment management plans** in Hawai‘i that range from 2 to 18 miles of shoreline and 3 to 12 littoral cells. Regional sediment management plans typically involve technical studies related to sediment transport and shoreline change, mapping of littoral cells, evaluation of potential adaptation strategies, and recommendations for projects.
- The geographic scopes of **beach and dune management plans** in Hawai‘i range from the island level (e.g., [Beach Management Plan for Maui](#)) to the regional level (e.g., [Waikiki Beach Management Plan](#), [Kailua Beach and Dune Management Plan](#)).
- **Beach restoration and maintenance projects** have been implemented in Hawai‘i since the early 1900s. The geographic scope of these projects ranges from the regional level (e.g., [Waikiki Beach Improvement and Maintenance Program](#), [Kā‘anapali Beach Restoration and Berm](#)

[Enhancement](#)) to the subregional level (e.g., [Waikīkī Beach Maintenance](#), [Iroquois Point Beach Restoration](#), Sugar Cove Beach Maintenance, Koʻolina Lagoons Beach Maintenance). Periodic beach maintenance, including sand backpassing and sand pushing, is also routinely performed at public beach parks.

- The geographic scope of **dune restoration projects** in Hawaiʻi has typically been at the subregional level (e.g., Kamaʻole, Kalepolepo). The Hawaiʻi Sea Grant Program recently published the [Hawaiʻi Dune Restoration Manual](#), which provides an overview of dune management practices, guidance for planning and implementing dune restoration projects, and recommendations for dune monitoring and maintenance. Planning efforts are currently underway to develop dune restoration plans at Kanaha Beach Park and [Kapukaulua](#) (see Appendix 4)
- Ancient Hawaiian loko iʻa (fishponds) are historical and cultural assets that are unique to Hawaiʻi. Loko iʻa were part of an integrated food production system that stretched from the mountains to the sea within the ahupuaʻa. In 2015, the Hawaiʻi Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL) established the [Hoʻāla Loko Iʻa Program](#) to streamline the permitting process for the **restoration of traditional Hawaiian fishpond systems**. Fishpond restoration projects are currently underway at [Heʻeia](#), [Pāhonu](#), Huilua, and other locations throughout Hawaiʻi.

Hawaiʻi Kai, Oʻahu

Hawaiʻi Kai is located in Maunaloa Bay on the south coast of Oʻahu. Hawaiʻi Kai Marina is a man-made water facility (also referred to as a lagoon) that is privately owned and managed by the non-profit Hawaiʻi Kai Marina Community Association (Figure A3-2).



Figure A3-2. Hawaiʻi Kai Marina (Hawaiʻi Kai, Oʻahu)

The marina was originally dredged from Kuapā Pond and later developed and subdivided into residential tracts with a marina and channels. The channels are separated by fingers of land and islands developed

with residential lots and commercial properties. Dredging transformed the shallow coastal inlet and wetlands into a marine embayment. With nearly 13 miles of shoreline, Hawai'i Kai Marina is the largest privately owned water facility in Hawai'i. The marina is connected to the ocean via two entrance channels. There are no beaches in the marina and the shoreline is not exposed to wave-induced erosion or flooding. Nearly the entire length of the shoreline within the marina is armored by seawalls that stabilize the shoreline and provide protection from tidal flooding.

Hawai'i Kai Marina is densely developed with thousands of residential waterfront parcels and large commercial properties. The primary issue in the marina is tidal flooding. The primary shoreline management approach in Hawai'i Kai Marina is **shore protection** consisting of repair and maintenance of the existing seawalls. The Hawai'i Kai Marina Community Association also conducts maintenance dredging to maintain safe navigation and coordinates a water quality monitoring program that consists of routine water quality sampling at locations around the marina. An important long-term consideration is how to adapt the existing seawalls to accommodate rising sea levels.

Waikīkī, O'ahu

The Waikīkī region extends from Hilton Hawaiian Village east to Kaimana Beach, spanning 10,250 feet of shoreline (Figure A3-3).



Figure A3-3. Conceptual rendering of proposed beach improvements at Waikīkī, O'ahu

The region includes eight littoral cells. Each cell is bound by man-made structures (e.g., groins, drainage outfalls) and subject to littoral processes that are unique to that cell; therefore, the proposed adaptation measures are tailored to each specific cell. The primary issues in Waikīkī are erosion, beach narrowing, structural damage, and loss of shoreline access. The primary approach to shoreline

management has been beach improvements and beach maintenance. Past projects have consisted of beach nourishment (e.g., Kūhiō Beach Nourishment (2006), Waikīkī Beach Maintenance (2012 and 2021), Kūhiō Sandbag Groin (2019), and Royal Hawaiian Groin Replacement (2020)).

Additional projects are currently proposed as part of the Waikīkī Beach Improvement and Maintenance Program. A combination of adaptation measures is proposed, including beach maintenance (sand backpassing), traditional beach nourishment (with no stabilizing structures), beach restoration (with stabilizing structures), and structural modifications (segmented breakwater). The sand to support these projects is sourced from several offshore sand deposits located within the littoral system. Projects are through a joint public-private partnership between the DLNR and the Waikīkī Beach Special Improvement District Association. An important long-term consideration in Waikīkī is how to adapt when existing and proposed structures are no longer effective in stabilizing beaches due to rising sea levels.

Kā'anapali, Maui

The Kā'anapali region in West Maui spans 7,450 feet of shoreline from Pu'u Keka'a (Black Rock) south to Hanaka'ō'ō Beach Park (Figure A3-4). The region is divided into two littoral cells, each of which is subject to different littoral processes. The cells are not separated by a hard physical feature (e.g., headland or structure), so there is active exchange of sand between them. The primary issues in Kā'anapali are erosion, beach narrowing, and structural damage. Shoreline management in Kā'anapali has traditionally consisted of vegetation management with occasional beach maintenance (e.g., sand pushing). Temporary erosion control measures have been installed at certain locations where erosion and beach loss are severe or recurring. No substantial beach improvements have been completed in Kā'anapali.

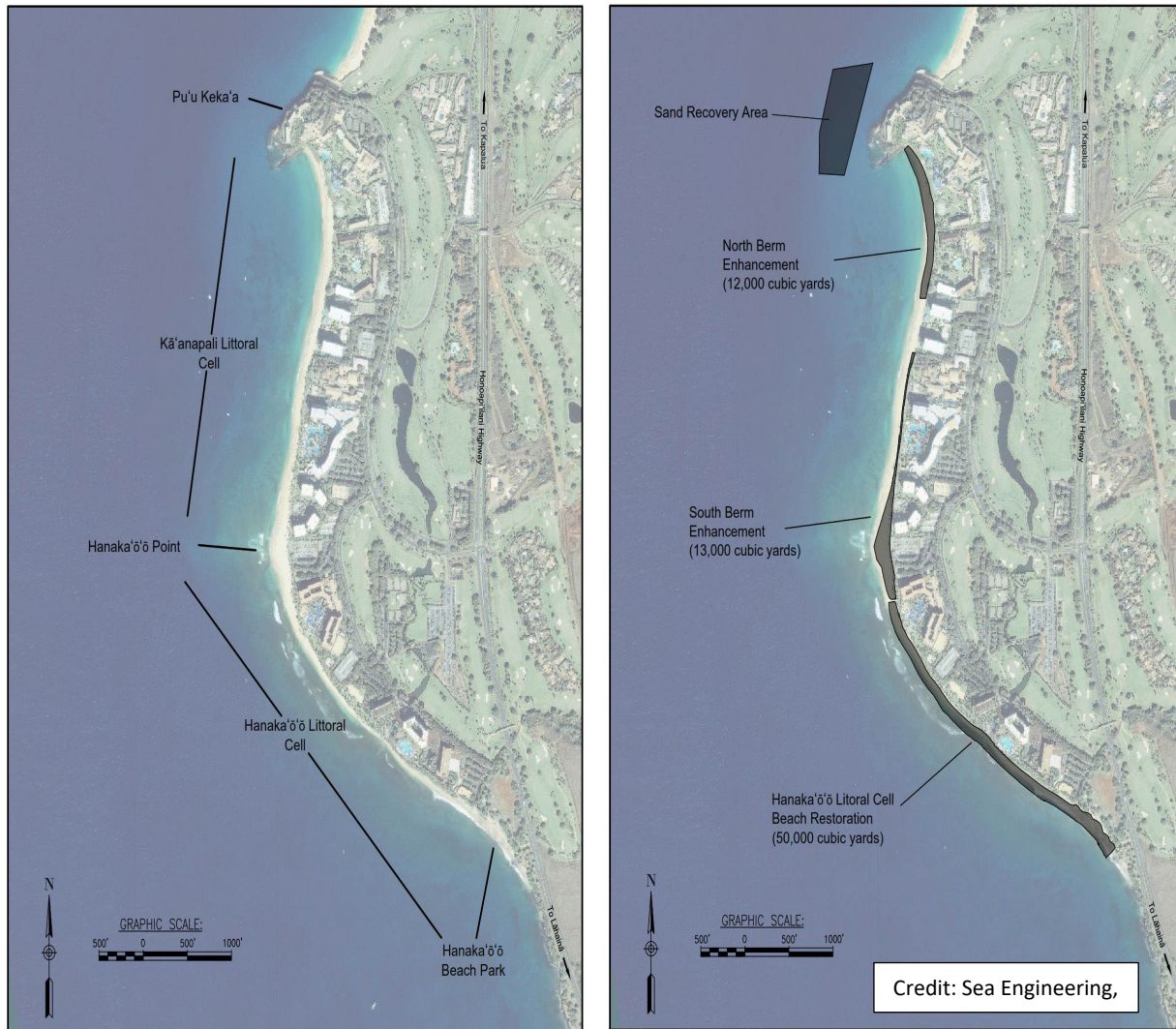


Figure A3-4. Proposed beach restoration and berm enhancement at Kā'anapali, Maui

Beach restoration is currently proposed for the Hanaka'ō'ō littoral cell (Hanaka'ō'ō Beach Park to Hanaka'ō'ō Point). Beach berm enhancement, which would raise the elevation of the dry beach by 3.5 feet, is proposed for the South Kā'anapali littoral cell (Hanaka'ō'ō Point to Puu Keka'a). The approximately 75,000 cubic yards of sand needed for the proposed project would be recovered from an 8.5-acre sand deposit, located approximately 150 feet offshore of Pu'u Keka'a. The project is being funded through a joint public-private partnership between the DLNR and the Kā'anapali Operators Association. An important long-term consideration is how to manage the shoreline when periodic beach renourishment is no longer effective in maintaining a stable beach as sea levels continue to rise.

Kahana Bay, Maui

The Kahana Bay region in West Maui spans 7,450 feet of shoreline (Figure A3-5). The region consists of a single littoral cell that extends from Pōhaku Park north to Kahana Stream. The primary issues in Kahana Bay are erosion and beach loss that are threatening multiple oceanfront condominiums. Shoreline

management in Kahana Bay has traditionally consisted of a combination of permanent shore protection structures (e.g., seawalls) and temporary erosion control measures. No substantial beach improvements have been completed in Kahana Bay.

Beach restoration is currently proposed at Kahana Bay. The proposed project consists of beach nourishment with seven rock rubble mound T-head groins and a reinforced rocky headland. The project would widen the existing beach by 35 to 150 feet (approximately 50-foot average width). It is estimated that renourishment would be required in approximately 30 years following the initial construction. The approximately 50,000 to 100,000 cubic yards of sand needed for the project would be recovered from offshore sand deposits at the south end of the littoral cell. The project is being funded by the Kahana Bay Steering Committee, a private organization representing nine oceanfront condominiums and one kuleana parcel. The Steering Committee is exploring the option of establishing a community facilities district to fund the project through the County of Maui. An important long-term consideration at Kahana Bay is how to manage the shoreline when the proposed groins are no longer effective in maintaining a stable beach due to rising sea levels.

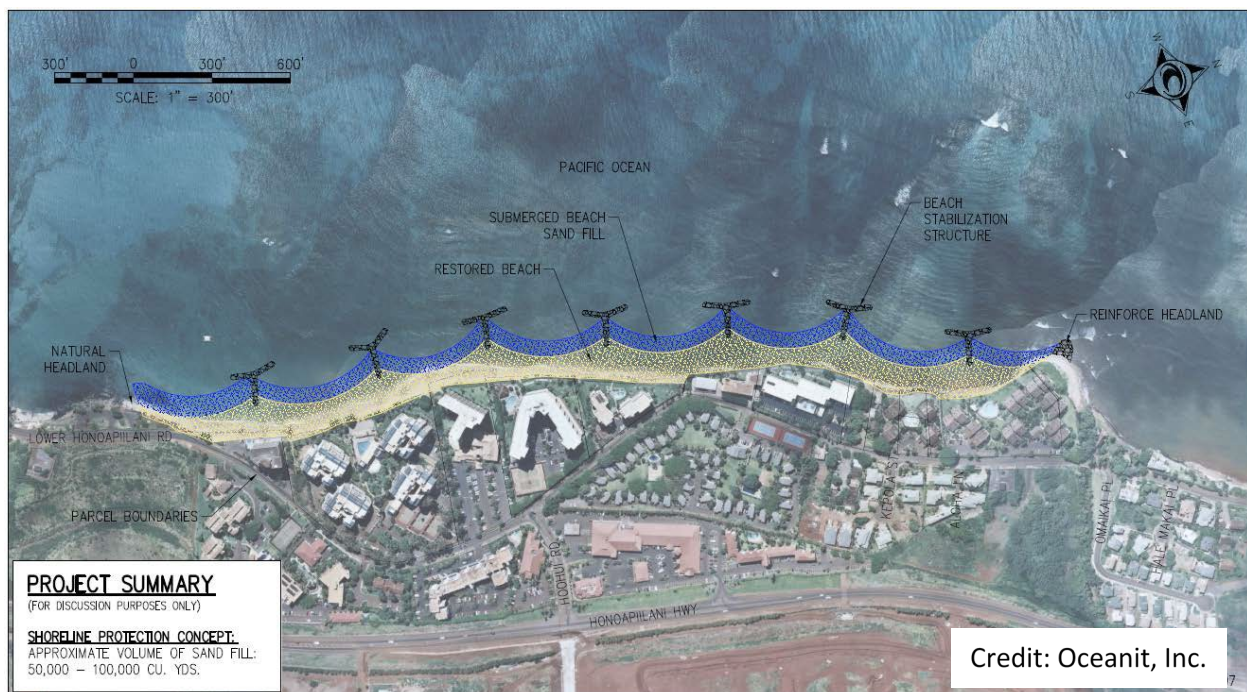


Figure A3-5. Conceptual sketch of proposed beach nourishment with stabilizing structures at Kahana Bay, Maui Sugar Cove, Maui

Sugar Cove is located in Spreckelsville on the north coast of Maui (Figure A3-6). The region consists of a single littoral cell that consists of an embayment between two rocky headlands and spans approximately 700 feet of shoreline. The eastern portion of the shoreline is armored by seawalls and the western portion of the shoreline is armored by a rock rubblemound revetment that is fronted by a sandy beach. The primary issues at Sugar Cove are chronic erosion and beach loss. Shoreline management at Sugar Cove has consisted of periodic small-scale beach nourishment. A beach maintenance program initiated in the 1990s has been ongoing for nearly three decades. The program is authorized by the DLNR-OCCL

through the Small-Scale Beach Nourishment program, which authorizes placement of compatible beach quality sand in the Conservation District.

Beach nourishment at Sugar Cove has traditionally been performed using Class A Maui dune sand sourced from inland dune deposits. In January 2018, the County of Maui implemented a moratorium on mining of Maui inland dune sand in central Maui. At this time, inland dune sand is no longer commercially available on Maui. The beach maintenance program is funded by the Sugar Cove Association of Apartment Owners, a private organization representing 18 individual property owners. Important long-term considerations at Sugar Cove are identification of an alternative sand source to support future beach nourishment efforts and how to manage the shoreline when small-scale beach nourishment is no longer effective in maintaining a stable beach due to rising sea levels.



Figure A3-6. Small-scale beach nourishment at Sugar Cove at Spreckelsville, Maui

Ko'olina, O'ahu

Ko'olina is a 642-acre resort north of Barbers Point on the southwest coast of O'ahu (Figure A3-7). The natural shoreline consists of a carbonate bench with perched cobble and boulder beaches along approximately 8,300 feet of shoreline. The property was originally developed in the 1980s, at which time four **man-made lagoons** were constructed. The lagoons were excavated from the carbonate coastal plain, and sand was placed in each lagoon to provide recreational beach area. Inlet and outlet channels were constructed through the carbonate bench to facilitate the exchange of marine water to maintain water quality. The lagoons are privately owned water facilities that were opened to the public in 1993. Each lagoon is geographically isolated and functions as a distinct littoral cell. The lagoons are an example of a novel approach to construct man-made beaches and improve shoreline access in areas

that lack sandy shorelines. The primary issue at Koʻolina is chronic erosion due to reduced wave energy and intense recreational use within the lagoons.

Shoreline management at Koʻolina has primarily consisted of **beach maintenance**. Sand is dredged from within each lagoon and pumped to shore, where it is dewatered in a trench along the upper beach. Beach maintenance is privately funded by the Koʻolina Community Association. An important long-term consideration at Koʻolina is evaluation of potential lagoon modifications that may be necessary to accommodate increased erosion and flooding and maintain the beaches as sea levels continue to rise.



Figure A3-7. Man-made lagoons (Koʻolina, Oʻahu)

Iroquois Point, Oʻahu

Iroquois Point is located west of the Pearl Harbor entrance channel on the south coast of Oʻahu at the east end of the ʻEwa Beach littoral cell. The cell consists of a narrow, linear sandy beach that spans approximately 17,500 feet of shoreline (Figure A3-8). The primary issues at Iroquois Point are chronic erosion and beach loss caused by a combination of wave-induced erosion and longshore sediment transport. The predominant direction of sediment transport in the ʻEwa Beach littoral cell is west to east. As sand was transported alongshore, severe beach loss occurred at Iroquois Point. The shoreline had been chronically eroding for over 50 years, receding 300 feet at the west end. Due to the severity of the erosion and the local sediment transport dynamics, it was determined that groins were necessary to restore and maintain a stable beach.

The primary approach to shoreline management at Iroquois Point is **beach restoration and stabilization**. The Iroquois Point Beach Restoration and Stabilization project, completed in 2013, consisted of the construction of nine rock rubblemound T-head groins, recovery of 95,000 cubic yards of sand from the

Pearl Harbor entrance channel where the eroding sand had been deposited, and placement of the sand in the beach cells created between the groins. This is the largest single beach nourishment project ever accomplished in Hawai'i. A unique aspect of the project was the removal of 16 oceanfront homes and conversion of the backshore to open space with public parking, restrooms, and a restaurant. The combination of beach restoration and stabilization and converting vulnerable areas to open space resulted in a stable beach with reduced hazard vulnerability and improved shoreline access. The project was funded by the U.S. Navy.



Figure A3-8. Beach nourishment with stabilizing groins at Iroquois Point, O'ahu

Kahekili, Maui

Kahekili is located between Kā'anapali and Honokōwai in West Maui (Figure A3-9). Kahekili is part of the North Kā'anapali littoral cell, which extends from Pu'u Keka'a (Black Rock) north to Honokōwai Point. The shoreline consists of a sandy beach and dune system that spans approximately 7,000 feet of shoreline. The primary issues at Kahekili are erosion, beach narrowing, and degradation of the coastal dune system. Sediment transport in the North Kā'anapali littoral cell is seasonally variable, with southerly swell transporting sand from south to north during the summer, and northerly swell transporting sand from north to south during the winter. During periods when the beach is narrow, the dune system is exposed to erosion and wave overtopping.

The northern half of the North Kā'anapali littoral cell consists of four individual parcels and two public beach parks that span approximately 3,200 feet of shoreline. The properties along this portion of the shoreline were not developed until the early 2000s. When new development was proposed, the

availability of open space enabled implementation of more progressive shoreline setbacks and a dune restoration and monitoring program that consisted of removing and replacing existing vegetation with native species, installing a continuous lateral walkway along the landward side of the dune, installing a series of dune walkovers to mitigate negative impacts of foot traffic on the dunes, and implementing a long-term dune monitoring program. The project was privately funded by the adjacent landowners.

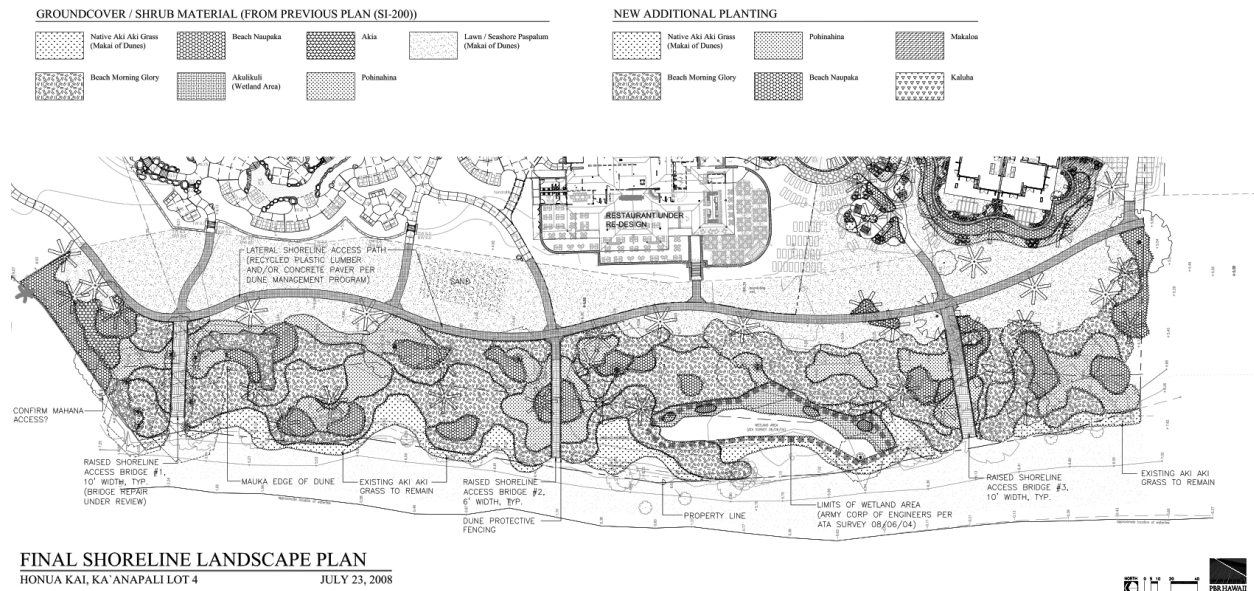


Figure A3-9. Conceptual sketch of proposed beach nourishment with stabilizing structures (Kahana Bay, Maui)

Kama'ole, Maui

Kama'ole is located between Kihei and Wailea along the southwest coast of Maui (Figure A3-10). Kama'ole consists of three sandy beach and dune systems (Kama'ole I, II, and III) that are separated by rocky headlands along approximately 5,300 feet of shoreline that extends from Kaluaehakoko Point south to Kihei Small Boat Harbor. The area between South Kihei Road and the shoreline consists primarily of public lands that are owned by the State of Hawai'i and managed as public beach parks by the County of Maui Department of Parks and Recreation. Each beach is geographically isolated and functions as a distinct littoral cell. The primary issues at Kama'ole are erosion and dune damage caused by wave action and intense recreational use. Kama'ole lacks a protective fringing reef and is exposed to southerly swell and Kona storm waves.

The primary approach to shoreline management at Kama'ole has consisted of **dune restoration**, which has included sand placement, dune fencing, designated shoreline access pathways to reduce damage from foot traffic, installation of dune signage, and reestablishing native dune vegetation. Multiple dune restoration efforts have been implemented over the past several decades. Sand to support dune restoration was recently sourced from a State-funded dredging effort at Kihei Small Boat Harbor at the south end of the littoral cell. Important long-term considerations at Kama'ole are identification of alternative sand sources to support future dune restoration efforts and how to reduce chronic erosion and maintain a stable beach as sea levels continue to rise.



Figure A3-10. Dune restoration at Kama'ole Beach Park II (Kama'ole, Maui)

South Moloka'i Shoreline Erosion Management Plan

The Hawaiian Homestead communities of Kalama'ula, Kapa'akea, and Kamiloloa-One Ali'i are located along the south shore of the island of Moloka'i (Figure A3-11). The collection of homes is on the low lying coastal plain between Kamahameha V Highway and the ocean.

The coastline consists of low-energy, shallow, nearshore waters along a sandy, silty, sediment-laden shoreline absent of cliffs or bluffs. A large fringing reef breaks waves offshore and reduces their energy, but afternoon winds can create turbulence within the shallow inner reef. Wetlands, mangroves, stream outlets, drainages, fishponds, shoreline hardening, and the causeway to the Kaunakakai Wharf and Harbor substantially influence the sediment movement along the shoreline and within the inner reef zone. While most of the oceanfront lots experience some level of coastal erosion and/or wave overtopping and flooding due to King Tides, the 17 oceanfront homes of the Kapa'akea community have experienced the most severe impacts, with some lots exhibiting 25 feet or more of shoreline retreat.

Five ahupua'a from Makakupa'ia in the east to Kalama'ula in the west encompass this 3.5 mile-long stretch of coastline. The ahupua'a was used to better understand the relationships between land and ocean ecosystems and between the homesteaders and their environment. Within this section of coastline, four littoral cells compartmentalize the source, sinks, and flow of sediment along the shoreline. Emphasis was placed on the littoral cell, rather than individual parcels, as a means to more effectively study the causes and consequences of shoreline erosion and to develop appropriate strategies to mitigate the effects of shoreline erosion in the mauka-to-makai context. In many cases, restoring native plants (versus invasive) and natural sand berms would positively influence shoreline dynamics and buffer erosion processes. In select cases, constructing dry stack walls or kuapā, along with reconfiguration and relocation of buildings, could effectively reduce exposure to coastal hazards.



Figure A3-11. Littoral cells within the South Moloka'i Shoreline Erosion Management Plan

Pāhonu, O‘ahu

Pāhonu is a kuapā-style loko i‘a (fishpond) located near Kaiona Beach Park in Waimānalo, O‘ahu (Figure A3-12). The outer wall is approximately 780 feet long and extends between 80 and 110 feet offshore. Pāhonu is located in the Waimānalo Bay littoral cell, which spans approximately 32,000 feet of shoreline from Makapu‘u Point north to Wailea Point. The primary issue at Pāhonu is wall damage caused by wave action.

Shoreline management at Pāhonu has primarily consisted of loko i‘a restoration, which has consisted of restacking the rocks using traditional dry-stack techniques to create a flat top extending 2 feet above the high tide line. Once the fishpond is restored, the Waimānalo Limu Hui plans to use the restored fishpond to replenish the native limu (seaweed) in the area and educate people on limu ecology and propagation. The restoration work was authorized by the DLNR through the Ho‘āla Loko I‘a Permit Program, which is a streamlined permitting process for the restoration of traditional Hawaiian fishpond systems. The project is privately funded by Ke Kula Nui O Waimānalo, a non-profit organization, in partnership with Kua‘aina Uta ‘Auama and the ‘E Alu Pu network. An important long-term consideration at Pāhonu is evaluation of potential structural modifications that may be necessary to accommodate increased wave action and water levels as sea levels continue to rise.



Figure A3-12. Loko i‘a restoration at Pāhonu (Waimānalo, O‘ahu)

City and County of Honolulu Beach Parks, O‘ahu

The City and County of Honolulu manages 67 public beach parks and 168 public beach right of ways on the island of O‘ahu (Figure A3-13). Due to the large number of residents and visitors and the popularity of beaches on O‘ahu, public beach parks are subject to intense recreational use. Primary issues affecting

beaches and dunes include erosion, beach narrowing, and damage due to overcrowding and foot traffic. Shoreline management at public beach parks has traditionally consisted of ***periodic beach maintenance*** in the form of sand pushing, sand backpassing, and beach nourishment.

Sand pushing involves moving sand from the lower beach face to the upper beach to restore an eroded beach profile and reduce exposure of the backshore to wave action. Sand pushing has been performed at 'Ehukai Beach Park, Ala Moana Beach Park, Sunset Beach Park, Sandy Beach, and Hanauma Bay.

Sand backpassing involves recovering sand from portions of a beach where sand has accreted and placing it in areas that are subject to erosion and beach loss. Sand backpassing counters the natural longshore movement of sand and can be an effective strategy in areas with dominant seasonal or long-term erosion and sand transport in a particular direction along the shoreline and a surplus of sand accumulating in the area of accretion. Sand backpassing has been performed at Mākaha Beach Park and Kailua Beach Park.

Beach nourishment typically involves placement of beach fill to specified design profiles. Beach nourishment is intended to augment the natural morphology of the beach to offset the effects of chronic, seasonal, or episodic erosion. Beach nourishment has previously been performed at Kūhiō Beach Park and is currently proposed at Ala Moana Beach Park and Hale'iwa Beach Park. An important long-term consideration for public beach parks O'ahu is how to prioritize and fund additional beach maintenance projects and identifying alternative options to manage the shoreline as sea levels continue to rise.



Figure A3-13. Sand pushing and dune restoration at Sunset Beach Park along the North Shore, O'ahu

U.S. Army Corps of Engineers, Regional Sediment Management Program

The USACE Regional Sediment Management Program is a nationwide program that has been active in Hawai'i for many years (<https://rsm.usace.army.mil/hawaii/index.html>). The program has two primary functions:

- To conduct research to inform management decisions
- To evaluate regional sediment management concepts through demonstration projects to improve sediment management activities.

USACE has developed the following regional sediment management plans for Kaua'i, O'ahu, and Maui:

- Kaua'i (Kekaha, Po'ipū)
- O'ahu (Diamond Head to Pearl Harbor, Mōkapu to Makapu'u, Hale'iwa, Sunset Beach)
- Maui (Kahului, Kīhei, and West Maui)

The program compartmentalizes the shoreline based on littoral cells. The littoral cells are primarily defined by physical features and processes that drive sediment transport and shoreline change. The program proposed various potential demonstration projects. Despite the lack of funding for these projects, the program provides valuable technical data, information, and recommendations to inform the development of shoreline management projects. In fact, multiple projects are currently being proposed that align with the littoral cells that have been identified through the program:

- Kā'anapali (beach restoration and berm enhancement)
- N. Kā'anapali (long-term dune monitoring program, larger shoreline setbacks)
- Honokōwai (beach restoration and stabilization)
- Kahana Bay (beach restoration and stabilization)
- Nāpili Bay (beach nourishment, biorock coral reef)

Appendix 4: Case Study in Regional Shoreline Management – Kapukaulua, Maui¹

Overview

The University of Hawai'i Sea Grant Program (Hawai'i Sea Grant) was awarded a grant from the 2019 National Fish and Wildlife Foundation (NFWF) National Coastal Resilience Fund to develop site-specific plans for dune restoration at Kapukaulua (Baldwin Beach) from Lower Pā'ia Park to Wawau Point ("Baby Beach"). In the face of sea level rise, the long-term goal of the project is to implement dune restoration activities that have the complementary benefits of ecosystem restoration and community resilience. This regional-scale project was intended to initiate the restoration of up to 12 acres of impaired coastal sand dunes by applying strategies tailored to Hawai'i as well as the region and community it serves ([Kapukaulua \(Baldwin Beach\) Dune Restoration Project](#)).



Damaged pavilion at Baldwin Beach Park, Maui, following high waves in February 2022
Source: Maui County Department of Parks and Recreation

The project was conducted in partnership with the Maui County Department of Parks and Recreation (DPR). The DPR's 2019 Master Plan for Baldwin Beach Park identified dune restoration as a priority and part of the first phase of sea-level rise adaptation. The project was further informed by the 2021 DPR

Beach Parks Vulnerability and Adaptation Study of 65 beach parks in Maui County conducted by Tetra Tech, Inc. (Tetra Tech). The vulnerability assessment identified the park area, number of facilities, and areas vulnerable to sea level rise at Baldwin Beach Park. The existing sand dunes and availability of land sources of marine sands supported dune restoration as a primary shoreline management strategy for Baldwin Beach Park.

To support the design of regional dune restoration, Tetra Tech developed conceptual site plans, detailed engineering plans and specifications, an implementation plan, and draft permit applications. A stakeholder advisory group provided input throughout the project, which was completed between October 2020 and September 2021.

Funding for implementation of the regional dune restoration project has been awarded in 2023 by NFWF and activities will take place over 4 years, including community engagement, permitting, restoration actions, and monitoring.

Region

The project planning area is within the Baldwin Beach littoral cell defined by the USACE Regional Sediment Management Plan for Kahului and Kihei (2010). The Baldwin Beach littoral cell is bounded by the headlands to the east and west of the park (Figure A4-1). The eastern end of the littoral cell, which includes a portion of the beach and a rocky shoreline with an abutting residential area, was not considered in the project, primarily because the involved parcels are privately owned and outside of the public park area.

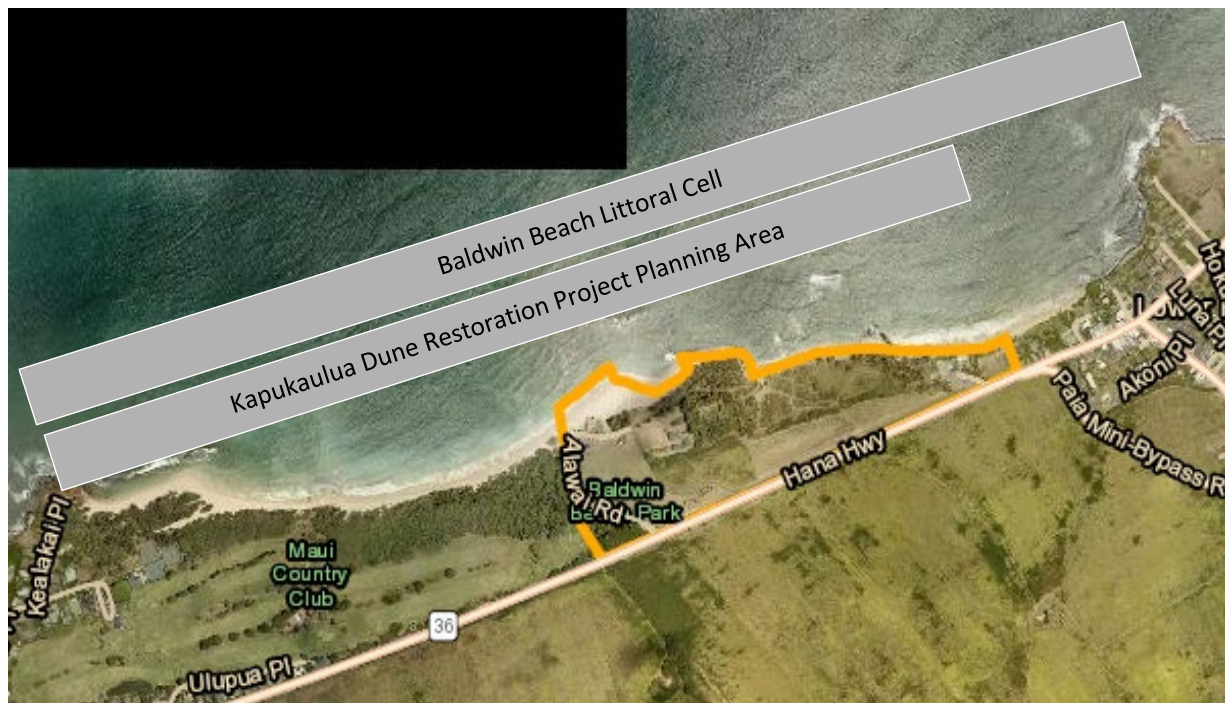


Figure A4-1. Baldwin Beach littoral cell and Kapukaulua dune restoration project planning area

The landward project boundary was based on the projected future shoreline area with 3.2 feet of sea level rise from the [Hawaii Sea Level Rise Viewer](#). (Figure A4-2). This area was needed to plan a robust dune restoration design that factors in landward migration resulting from sea level rise.

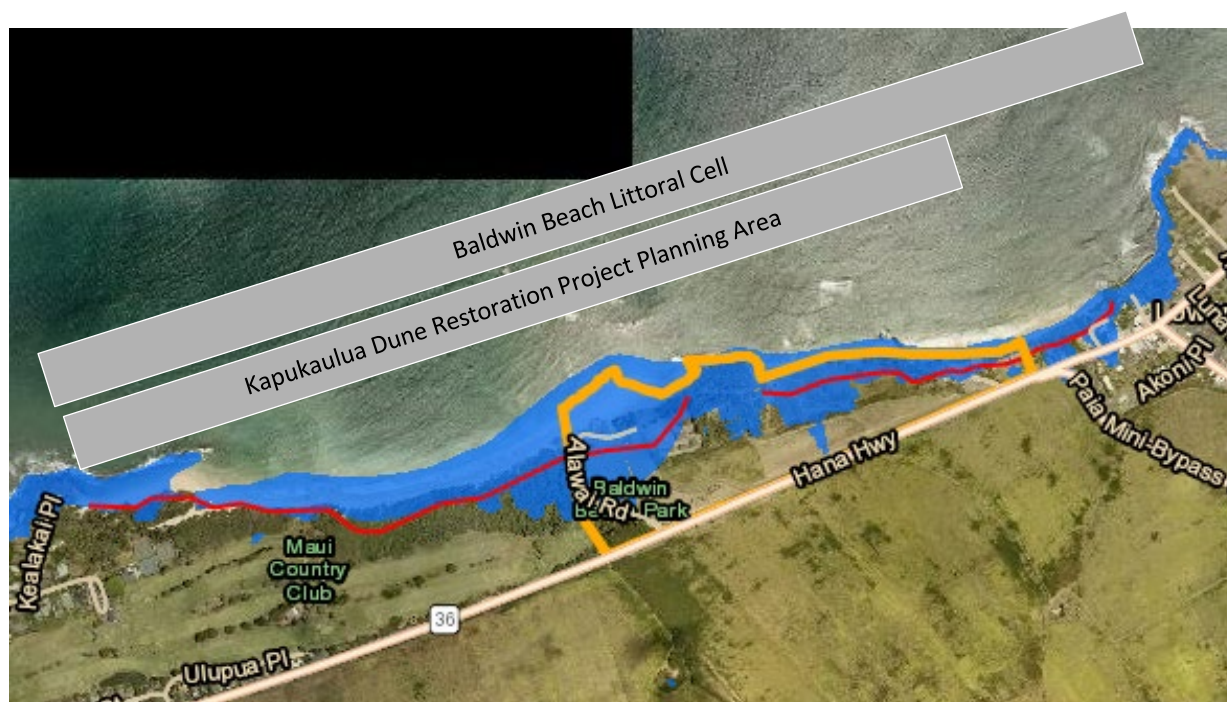


Figure A4-2. Landward extent of the Kapukaulua shoreline region defined by the projected future coastal erosion line with 3.2 feet of sea level rise

The highest rates of historical erosion on Maui are documented at Kapukaulua (Figure A4-3) owing in large part to a history of extensive sand mining from the beach and dunes. In the 1900s, a lime kiln was positioned along the beach to extract lime from sand that was then spread on sugar cane fields as fertilizer.



Figure A4-3. Historical and projected future shoreline positions at Kapukaulua

Although erosion is expected to persist in the future, there is a good opportunity to conserve and restore dunes and natural areas to provide buffering capacity for improving habitat and community resilience. There is sufficient undeveloped land in the back shore to allow sand and dunes to shift. Sand and dune material is present throughout the project site to mitigate landward beach migration. Dune restoration was identified as the most appropriate ecosystem-based shoreline management strategy for Kapukaulua.

The project planning area was used to define the geographic scale for technical studies, such as LiDAR, flora, and fauna surveys needed to support dune restoration planning and design (Figure A4-4). Although there are multiple landowners, DPR is initiating additional studies, including archaeological and hydrological surveys for the park (outlined in gold on Figure A4-2) and the project planning area overall.

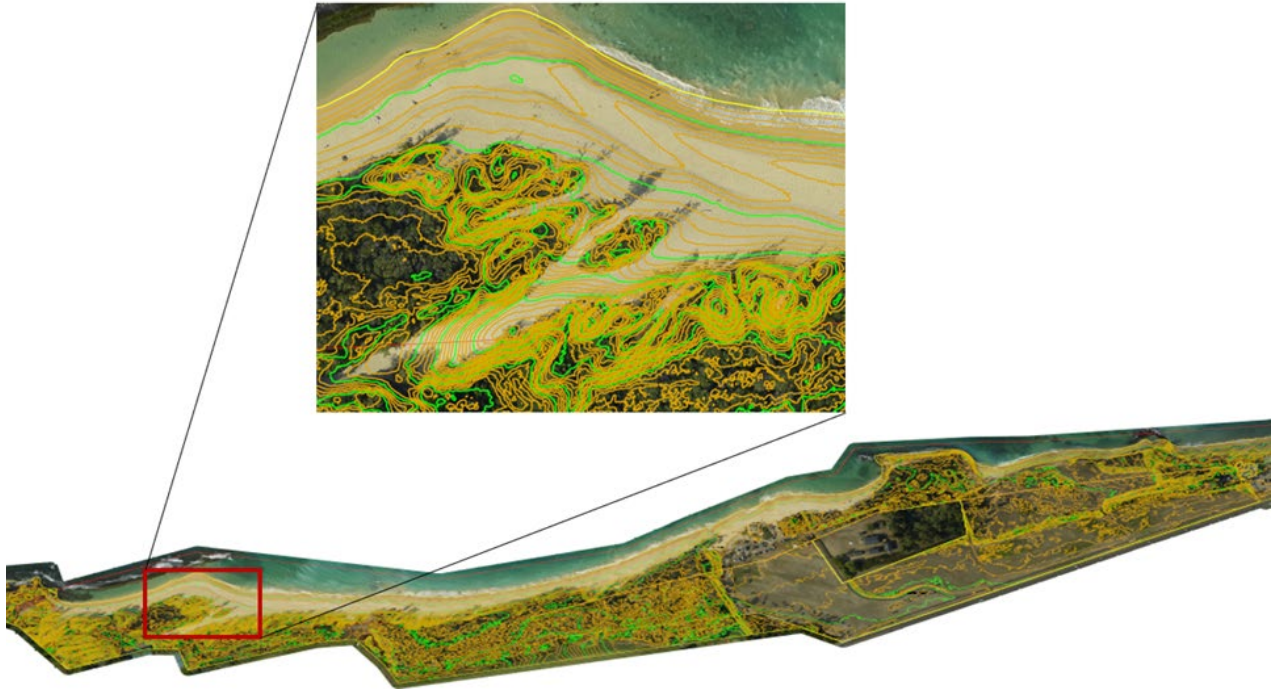


Figure A4-4. Shoreline topography of Kapukuaulua obtained through aerial LiDAR survey

Subregions

The project planning area was divided into seven subregions (Zones 1 to 7) based on key features of the shoreline and back shore environments (Figure A4-5). Zones 1 and 3 were defined by the shoreline revetments that interrupt the along-shore movement of sand. These features act as a sublittoral cell as they may force some sand far enough offshore to be temporarily or even permanently lost to the system. Other zones were defined based on backshore conditions such as the availability of marine sands on land (Figure A4-6), human uses, floodways, or the management interventions for dune restoration.



Figure A4-5. Subregions (Zones 1 – 7) delineated to tailor management interventions to specific shoreline and backshore conditions



Figure A4-6. Dune and marine sand deposits in the backshore of the Baldwin Beach littoral cell

The zone boundaries were adjusted to the final delineation shown in Figure A4-5 by considering the complexity of both the shoreline and management interventions. In addition to technical considerations, these zones support a phased implementation approach so that the project is adaptable to continuing community input, permitting constraints, and funding sources and timelines.

Conceptual site plans were developed for each zone, with specific management techniques to address site-specific conditions. Figure A4-7 and Figure A4-8 show example conceptual site plans for Zones 1, 2, and 4. Design specifications, an implementation plan, and permit applications were prepared to support grant applications for funding. Additional documentation and procedures may be necessary to obtain final approvals to implement the project.

Dune restoration was grouped for Zones 4, 5, and 6 because these zones represent an artificial sub-littoral cell created by the large revetment in Zone 3; therefore, seasonal erosion and recovery largely involves sand exchanged among these three zones. The projects also are linked by the two potential sand sources that can be used to implement the dune restoration:

- Option 1 – use of sand in a large dune blowout located in Zone 6 to construct dunes in Zone 4 and backshore enhancement and a dune in Zone 6.
- Option 2 – sand skimming along the backshore areas of Zones 4, 5 and 6 to create dunes in Zones 4 and 6.



Figure A4-7. Conceptual shoreline management plan for Zones 1 and 2



Figure A4-8. Conceptual shoreline management plan for Zone 4

Discussion of Challenges and Opportunities

Shoreline Complexity

The shoreline within the Baldwin Beach littoral cell is largely dominated by a degraded dune system and sandy beach interrupted by two shoreline revetments. Beach Park facilities, such as restrooms, showers and a pavilion, are located close to the shoreline. A former restroom and showers were removed and relocated substantially inland due to shoreline erosion. Mining and extraction of beach sand in the early 20th century is a key contributor to very high rates of historical shoreline erosion, leading to exposure and vulnerability of infrastructure in the heavily utilized portions of the park. The western and eastern headlands that define the limit of the cell are dominated by rocky shoreline and residential development. Abundant open space, with valuable dune and marine sand deposits, and little development in the backshore provide a rare opportunity to implement ecosystem-based adaptation as part of a regional shoreline management approach.

Removal of the two shoreline revetments to restore the natural shoreline processes of the littoral cell was discussed, but such work was concluded to be outside the scope and available funding for the project. Additional studies, such as an environmental assessment and coastal modeling, would be required to determine and communicate the feasibility and potential beneficial or negative impacts of removing these man-made structures, unearthing anthropogenic materials behind them, and altering sand movement and exchange within the littoral cell and adjacent subregions.

Community and Cultural Engagement

Community and cultural engagement provided important inputs to the project. The Kapukaulua Advisory Group, consisting of 25 members representative of the community, non-profit, private and public sectors, was established to provide knowledge, insight, and guidance to support the project. The advisory group participated in multiple stakeholder meetings and talk story sessions. Several site visits were organized with representatives from the Hāmākuapoko Aha Moku Council, local residents, and lineal descendants of the area to gain a better understanding of the project area and to discuss different approaches to dune restoration. Stakeholder feedback was used to develop guiding principles (see box below) for this dune restoration project.

Guiding Principles for Kapukaulua Dune Restoration

- Let nature take its course: Dune restoration will be designed and conducted to transition the project area into a natural ecosystem
- Factor in sea level rise: Dune restoration will factor in sea level rise over the next 30 years and beyond
- No sand from the land: No sand from outside the project area will be used in dune restoration activities
- Make the beach safer: Debris and vegetation will be removed that are posing a threat to public safety

The advisory group greatly enhanced knowledge of the history and cultural significance of the area so as to inform shoreline adaptation strategies and management interventions. The engagement process is proposed to continue throughout the implementation phase. Proposed innovative approaches to community engagement included monitoring restoration impacts through huli 'ia, an observational process that builds and supports a foundation by observing and understanding the natural cycles of a place. Monthly "nā kilo 'āina" (observation of land and nature) sessions with community members will be facilitated by Hawai'i Sea Grant. One product of the huli 'ia is a seasonal calendar showcasing the dominant natural cycles and seasonal changes across landscapes.

Governance Arrangements

A shoreline adaptation area plan could not serve as a mechanism for coordinated long-term management. The project planning was spearheaded by Hawai'i Sea Grant in partnership with the DPR, but long-term management roles and responsibilities after implementation were not fully defined. These roles and responsibilities, which need to be defined and documented, will involve state and county government, private landowners (the Maui Country Club), and nongovernmental organizations (Pā'ia Youth Center).

Discussions with the DPR regarding long-term management are ongoing. In December 2022, the County acquired lands in the project area from private landowner A&B properties. Engagement with the community provides an opportunity to develop co-management arrangements that support monitoring, maintenance, and participation in the dune restoration activities.

A draft permit package was prepared as a key output of the project. Five county permits and one state permit must be submitted and approved to implement the project. Figure A4-9 outlines the permit process. The permit applications required similar information but in slightly different ways.

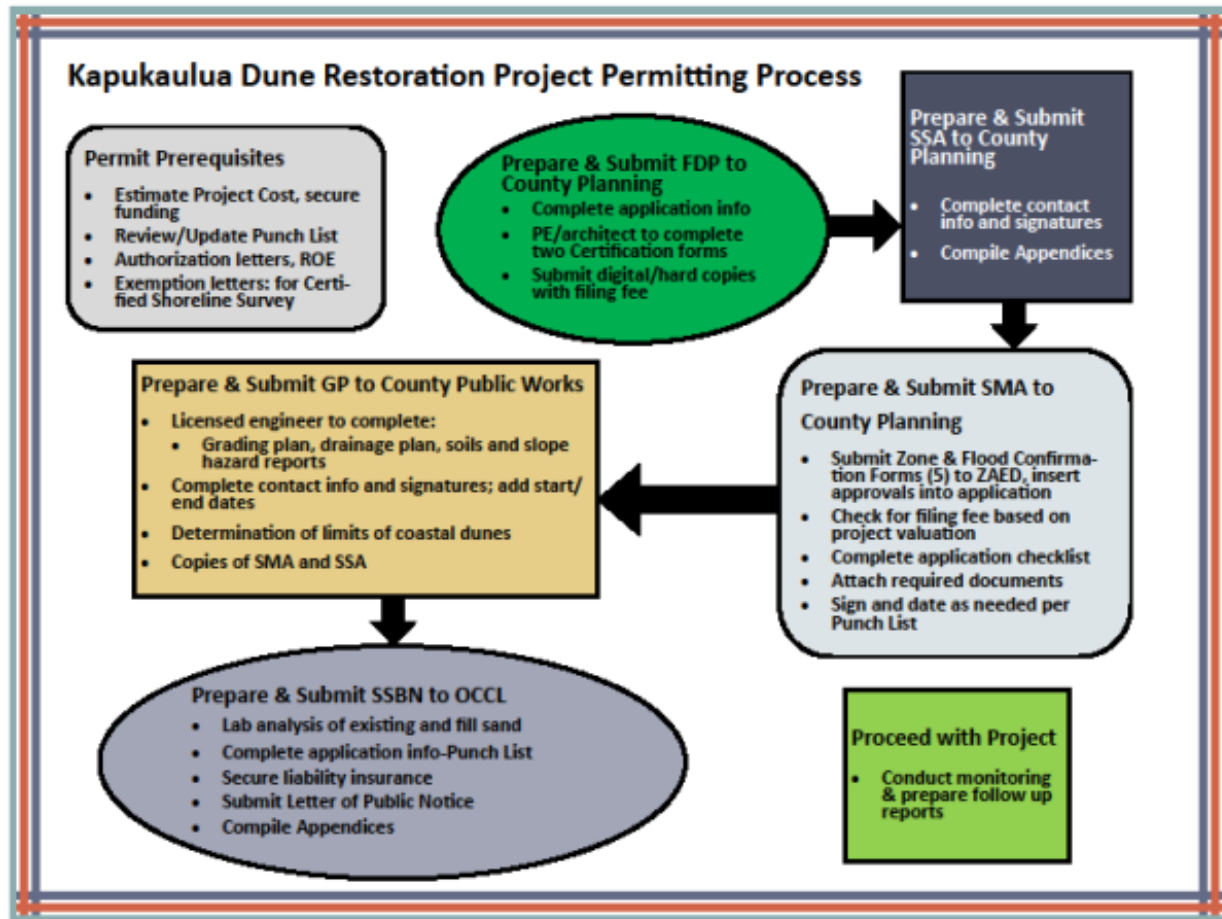


Figure A4-9. Permitting process for Kapukaulua Dune Restoration Project

Management Capacity

While the project had State, county, and private sector partners, Hawai'i Sea Grant led the project and applied for and obtained federal funding for the project. Hawai'i Sea Grant extension faculty on Maui and four Tetra Tech staff were involved in developing the project plans.

Key Take-Aways for Regional Shoreline Management

- The shoreline region was delineated by large scale-physical features and processes.** The shoreline region provided a practical and technically appropriate scale for shoreline management planning. If planning for dune restoration had occurred at a parcel level (e.g. just for Baldwin Beach Park), then options for sand sources would have been limited. The littoral cell in this location actually extends farther to the east than what was considered in the dune restoration plan because the other parcels are privately owned and outside the public park area. The park boundaries constrained the regional definition in this case. While management actions were not addressed for the parcels outside the public park boundaries, the marine and coastal processes outside the project area were still considered in a regional shoreline management approach.
- Shoreline subregions were delineated and characterized by unique, small-scale features and processes that were needed to be considered to design dune restoration strategies.** Conceptual

adaptation strategies and management interventions were developed and vetted at the regional and subregional levels.

3. **Shoreline region and subregions provided opportunities for place-based community and cultural engagement.** Ahupua'a and community planning boundaries were used to identify stakeholders. Stakeholder participation and engagement were fostered through an advisory group. Multiple outreach and engagement channels fostered a transparent planning and decision-making process. Community members, cultural advisors, and lineal descendants in the project planning area were identified and engaged in discussions of guiding principles, historical and cultural context of the area, and specific management interventions.
4. **Physical and ecological variations within a littoral cell need to be considered in designing management interventions.** There are no one-size-fits-all solutions to shoreline management, given the complexity of the shoreline within a littoral cell. Different techniques for dune restoration were identified depending on specific physical conditions in each subregion. The delineation of the subregions was an iterative process that required an understanding of the specific opportunities and constraints for various management techniques.
5. **Regional shoreline management requires broader participation and collaboration among state and county agencies.** Depending on the complexity of the region (e.g., existing land use and development, coastal hazards, geology and shoreline type, and other factors), multiple state and county departments will need to be fully engaged in planning and implementing a regional shoreline management approach.
6. **Regional shoreline management requires dedicated financial and human resource capacity.** Dune restoration and other shoreline management projects are chronically underfunded statewide. State funds are typically used in areas with high tourist value such as Waikiki. NFWF funding provided valuable support for planning. Additional funds were then received by NFWF for implementation.
7. **Integrated and streamlined permitting process is needed to support regional shoreline management.** A streamlined and integrated process at the county level synchronized with State requirements would greatly improve the likelihood that needed shoreline management projects, such as this, can be approved and implemented.

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