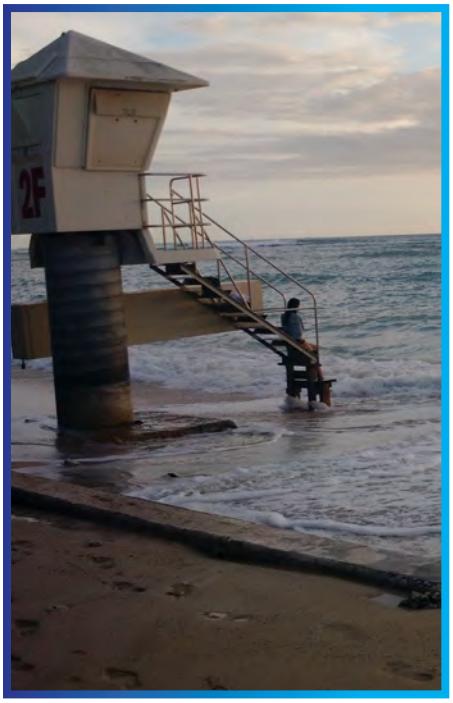
Guidance for Addressing Sea Level Rise in Community Planning in Hawai‘i



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TETRA TECH

Guidance for Addressing Sea Level Rise in Community Planning in Hawai‘i

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PREFACE

Through a National Oceanic and Atmospheric Administration (NOAA) Regional Coastal Resilience Grant, the Hawai‘i Sea Grant College Program together with the State of Hawai‘i Department of Land and Natural Resources (DLNR), Office of Planning, and Tetra Tech, Inc., developed statewide guidance documents and tools to improve community resilience to coastal hazards and sea level rise effects. The guidance documents and tools contained in this report support implementation of the recommendations of the *Hawai‘i Sea Level Rise Vulnerability and Adaptation Report*. The purpose of these guidance documents is to develop plans and pre-disaster recovery frameworks at the county levels that incorporate opportunities to adapt to sea level rise. These statewide guidance documents and tools include:

- **Hawai‘i Sea Level Rise Viewer**: An online interactive atlas with map data depicting projections of future hazard exposure and vulnerabilities due to rising sea levels using the results of the Hawai‘i Sea Level Rise Vulnerability and Adaptation Report (hawaiisealevelriseviewer.org).
- **Guidance for Disaster Recovery Preparedness in Hawai‘i**: A guidance document, with recommended practices and model resources, to assist state and county governments in establishing resilience-focused recovery practices before a disaster event, to enable communities to recover quickly while also protecting sensitive coastal environments (https://seagrant.soest.hawaii.edu/resources/program-publications/). This Guidance is a companion to Guidance for Addressing Sea Level Rise in Community Planning in Hawai‘i, as it provides tools that will better equip counties to take advantage of opportunities to adapt to sea level rise after a disaster event.
- **Guidance for Addressing Sea Level Rise in Community Planning in Hawai‘i** (this document): A guidance document, with recommended practices, examples, and resources, to assist county government in addressing sea level rise and coastal hazards as part of county planning and implementation framework.

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KEY TERMS

1%-Annual-Chance Coastal Flood Zone with Sea Level Rise – the area defined by modeling the 1% annual-chance-coastal flood event with 3.2 feet of sea level rise (1%CFZ-3.2) (Hawai‘i Emergency Management Agency, 2018). The 1%CFZ-3.2 was mapped for the 2018 Hawai‘i Hazard Mitigation Plan using the FEMA HAZUS program and includes the 1%-annual-chance stillwater elevation, wave setup, and wave run-up with 3.2 feet sea level rise.

Adaptation Strategy – an approach or combination of approaches that may include protection, accommodation, retreat, or ecosystem-based measures, to reduce vulnerability to sea level rise (Oppenheimer et al., 2019). An adaptation strategy includes policies, actions, and projects that defines the series of planned phases for implementation which may be done pre-emptively or triggered by particular environmental thresholds.

Adaptive Management – a process of iteratively planning, implementing, and modifying strategies for managing development and resources in the face of uncertainty and change (IPCC, 2018). Adaptive management involves adjusting adaptation approaches in response to observed impacts and evolving predictions of future vulnerabilities.

Coastal squeeze – refers to the narrowing and potential loss of beaches and other coastal ecosystems from rising water levels and/or erosion as a landward migrating shoreline comes in contact with development and engineered structures (e.g., seawalls) (IPCC, 2018).

Community Plan – a long-range placed-based plan that provides a vision and detailed land use and development policies and actions for a community planning area. Counties use different terms to describe area- or region-based planning under their charters including: community development plans (Hawai‘i County), community plans (Maui and Kaua‘i Counties), and development plans and sustainable community plans (City & County of Honolulu). In this Guidance, the term “community plan” is used to refer to these detailed plans for an area or region within a county.

Community Planning Area – defines the geographic scope of a community plan, which can vary in size such as a region, town, or neighborhood.

General Plan – a long-range comprehensive plan that establishes overarching policy goals and objectives for development of a county.

Hazard Overlay Zone –applies an additional layer of requirements or standards to areas within the defined overlay boundary, regardless of the underlying base zoning district (Colorado State Department of Local Affairs and University of Colorado Denver). The overlay zone could include specific requirements for sea level rise adaptation actions as part of a community or general plan update or a county-wide resilience planning effort (South Florida Regional Planning Council, 2014).

Inter-departmental Climate Adaptation Working Group– a group composed of representatives from various relevant county departments to support consistency and collaboration in planning, implementing, monitoring, and evaluating climate adaptation strategies, policies, and actions.

Land Use and Development Alternatives – maps and describes options for growth and land use to achieve a community's vision based on analysis of existing conditions, projected trends, and the community's input on issues, opportunities, and expressed preferences.

Native Hawaiian Cultural Landscape – any place in which a relationship, past or present, exists between a spatial area or resource and an associated group of indigenous Hawaiian people whose cultural practices, beliefs, or identity connects them to that place. (Van Tilbrug et al., 2017).

Plan and Policy Alignment – is a process of analyzing and ensuring consistent and collaborative approaches across related plans and policies toward shared goals of reducing vulnerability and adapting to natural hazards, climate change, and sea level rise; also referred to as plan integration (U.S. Department of Homeland Security, 2017).

Repetitive Loss Structure - any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978, whether or not the proper is currently insured by the NFIP (FEMA, 2020b).

Resilience – the capacity of social, economic, and environmental systems to cope with a hazardous event, trend, or disturbance, and responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation (IPCC, 2018).

Risk Tolerance – the degree to which responsible parties or stakeholders are willing to accept risk to an entity, asset, system, network, or geographic area (FEMA, 2020b).

Sea Level Rise Scenario – used to describe a sea level rise projection and associated modeling, also usually associated with a particular timeframe. For example, chronic flooding and land loss from 3.2 feet of sea level rise in the latter half of the century as described in the Hawai'i Sea Level Rise Vulnerability and Adaptation Report is a sea level rise scenario (Hawai'i Climate Mitigation and Adaptation Commission, 2017).

Sea Level Rise Exposure Area (SLR-XA) – a combined area defined by modeling three chronic flooding hazards with sea level rise (passive flooding, annual high wave flooding, and coastal erosion) for the Hawai'i Sea Level Rise Vulnerability and Adaptation Report (Hawai'i Climate Mitigation and Adaptation Commission, 2017). The SLR-XA is associated with long-term, chronic flooding hazards and land loss occurring on an annual to permanent basis. The three hazards were modeled at a range of future sea level rise scenarios. Herein, SLR-XA generally refers to the exposure area with 3.2 feet of sea level rise, unless otherwise noted.

Triggers – used to determine when a threshold (e.g., occurrence of repeat flooding) is met and adaptation measures need to be initiated (California Coastal Commission, 2018b).

Vulnerability – the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including hazard exposure, sensitivity or susceptibility to harm, and lack of capacity to cope and adapt (IPCC, 2018).

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List of Figures and Tables

1. OVERVIEW

This *Guidance for Addressing Sea Level Rise in Community Planning in Hawai'i* (Guidance) is intended to assist county planners to build upon and improve existing efforts to address sea level rise. Developed through extensive input from the county planning departments and based on Hawaii's existing planning context (Section 2), this Guidance is organized under four key topics: *vulnerability assessment, land use and development alternatives, plan and policy alignment, and adaptive management* (Figure 1). Collaboration and consistency among planning efforts is encouraged to integrate sea level rise vulnerability assessments and adaptation strategies across related county plans and implementation policies. Recommended practices under each guidance topic can be applied at county-wide and community-scale planning (Section 3). Examples of and resources are provided in Appendix 1 to demonstrate and further guide in the application of recommended practices. Hyperlinks are provided throughout document to relevant examples and resources in Appendix 1. A few closing thoughts are included in Section 4. In addition, the References include hyperlinks to documents used for the recommended practices, examples and resources. Finally, a summary of recommended practices for relevant Hawaii State Priority Guidelines is provided in Appendix 2.

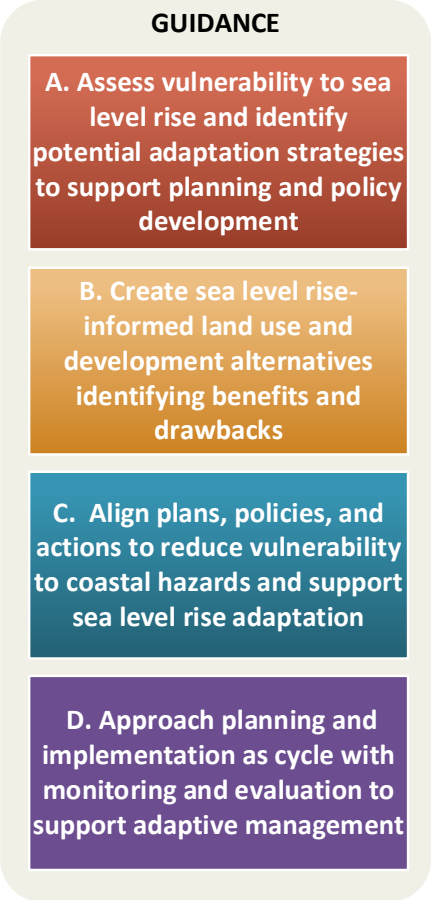

Figure 1. Guidance for addressing sea level rise in planning

While the focus of this Guidance is on county general and community plans, it can also be used by other county and state agencies to support their planning efforts especially where collaboration and plan integration is needed with county planning efforts. The Guidance may also be useful for community groups or Hawaiian Homelands that may be developing site-specific adaptation plans at different scales outside the jurisdiction of the state and county.

Why is addressing sea level rise in local planning critical?

Located in the Central North Pacific, Hawai'i is uniquely exposed to impacts of climate change and sea level rise. We have chosen to develop too close to hazard prone and low-lying shorelines leaving our communities and infrastructure vulnerable. Beach erosion and coastal inundation are already major problems along Hawaii's coasts. Seventy percent of beaches are eroding; eighty percent on Maui (Fletcher et al., 2012). Seawalls once thought to provide permanent protection are failing from undermining and overwash by waves. Planners and regulatory staff in county and state offices are overwhelmed with requests to mitigate erosion on disappearing shoreline properties. Clearly, a major shift

is needed in how we plan for the future of our coastal communities in this time of growing risks. High-resolution map data depicting future sea level rise hazard exposure is now available. Community planning provides the scale, scope, and opportunity for community engagement needed to guide growth and development in a future with rising seas.

The State and counties of Hawai‘i are taking vital first steps in preparing for sea level rise. In 2012, Hawai‘i became one of the first states in the nation to adopt a statewide policy for addressing the impacts of climate change by adding Climate Change Adaptation Priority Guidelines to the State Planning Act (*see Chapter 2. Planning Context*). The 2014 and 2017 Hawai‘i Climate Change Mitigation and Adaptation Initiatives recognize that climate change poses immediate and long-term threats to the State's economy, sustainability, security, and way of life (Act 32, Session Laws Hawai‘i, 2017). The 2017 Hawai‘i Sea Level Rise Vulnerability and Adaptation Report (Hawai‘i Sea Level Rise Report), provides the first state-wide assessment of vulnerability to sea level rise (Hawai'i Climate Mitigation and Adaptation Commission, 2017) with a companion Hawai‘i Sea Level Rise Viewer serving as an online interactive atlas and data portal for the Report’s high resolution exposure and vulnerability maps. The Hawai‘i Sea Level Rise Report features nine key recommendations centered on sustainable and resilient land use and community development (Figure 2).

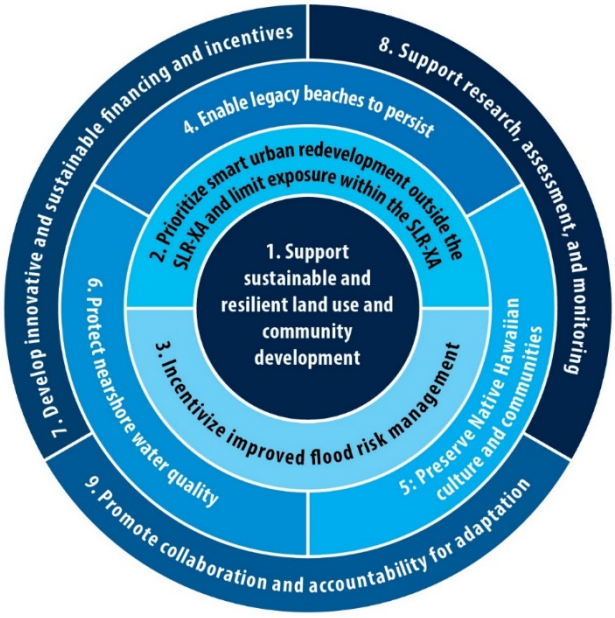

Figure 2. Recommendations to improve Hawaii’s capacity to adapt to sea level rise (Hawai'i Climate Mitigation and Adaptation Commission, 2017)

This Guidance was developed through extensive input from the Hawai'i, Maui, Honolulu, and Kaua‘i Counties. Recommended practices and examples were developed through research, consultations with planners, and through shared learning from ongoing community and general plan updates. Webinars, in-person meetings, and workshops with state and county entities and other stakeholders were used to gain a deeper shared understanding of opportunities and challenges in addressing sea level rise in county planning as well as to obtain feedback on draft products. Input to the development of the Guidance was gathered through 15 outreach events to over 100 county staff and other stakeholders. Written comments were also received from state and county entities and were essential to refining the Guidance. Example practices from ongoing efforts of county planners to address sea level rise were documented from the Hawai‘i County General Plan, West Maui Community Plan, Honolulu Primary Urban Center Development Plan, and West Kaua‘i Community Plan. Hawai‘i Sea Grant was actively engaged in in the West Maui, Honolulu, and West Kaua‘i community plans, and Kaua‘i General Plan updates, providing technical reports on climate

change and sea level rise vulnerability and informing development of adaptation actions and policies. In addition, planning approaches from other states and countries were reviewed and used to further inform the recommended practices and serve as additional examples and resources in this Guidance.

Adapting to sea level rise requires communities to make difficult decisions, weighing priorities and consequences. As communities grapple with how to adapt to sea level rise, plans and policies must still provide a vision for community vitality and sustainability, accommodate growth and development where desired, ensure social equity, and protect natural and cultural resources. Globally, there is recognition that responses to sea level rise impacts require a locally-appropriate combination of decision analysis, land use planning, public participation, and conflict resolution approaches (IPCC, 2019). As such, this Guidance focuses on the community planning process as a critical entry point for addressing sea level rise.

Planning for Climate Change Adaptation Needs to Embrace Uncertainty and Anticipate Change (*Excerpts from Quay (2010)*)

"The complexity, uncertainty, and distant planning horizon associated with climate change cannot be managed sufficiently for the traditional predict-and-plan approach to yield good decisions about the significant social and capital investments likely to be required for adaptation. To be successful, social institutions must embrace new methods that explore uncertainty and that provide strategic guidance for current and future decisions."

"It will be critically important for localities to institutionalize flexible decision-making frameworks that extend long into the future, possibly for 50 or more years. Such frameworks will exceed the careers of existing politicians and policy managers and, even if initiated successfully, may be difficult to sustain. Politicians are often unwilling to make investments that pay off only after they leave office. Public support for such efforts may also diminish as the costs of energy, water, and taxes to pay for adaptation increase over time. Strong and ongoing stakeholder participation in the process may be critical to sustaining political and public support for 50 to 100 years."

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2. PLANNING CONTEXT

Sea level rise is one of a number of concerns related to climate change. The State and counties are giving particular attention to sea level rise because Hawai‘i is a coastal-focused society and relatively abundant information is available on present day and projected sea level rise scenarios and impacts. Planning for sea level rise is also guided by a growing body of work on locally appropriate responses utilizing a range of adaptation strategies including protection, accommodation, ecosystem-based adaptation, and retreat. Existing county planning frameworks, with overarching policy in the State Planning Act’s Climate Adaptation Priority Guidelines, provide the context for integrating the best available information on sea level rise and the latest tools for planning and adaptation to make communities more resilient

Sea Level Rise Scenarios, Impacts, and Responses

The rapid build-up of greenhouse gases from human activity, particularly carbon dioxide but also methane, nitrous oxide, and fluorinated gases, is causing global warming and climate disruption (Hawai'i Climate Mitigation and Adaptation Commission, 2017). Global atmosphere and ocean warming are leading to a complexity of global, regional, and local drivers of sea level rise. Global mean sea level rise from glacier mass loss and ocean thermal expansion is accelerating due to increasing rates of ice loss from the Greenland and Antarctic ice sheets (IPCC, 2019; Oppenheimer et al., 2019).

Sea Level Rise Scenarios. The Hawai‘i Sea Level Rise Report modeled exposure to chronic coastal flooding and erosion using projections from the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (IPCC, 2013) where the high end “business as usual” scenario was up to 3.2 feet of sea level rise by the end of the century. For the islands of Maui, Oahu, and Kaua‘i, the Sea Level Rise Exposure Area with 3.2 feet of sea level rise (SLR-XA) is based on modeling passive inundation, coastal erosion, and annual high wave runup. For the islands of Hawai'i, Moloka‘i, and Lānai, the SLR-XA includes only passive inundation.

The National Oceanic and Atmospheric Administration (Sweet et al., 2017) updated global and regional projections based on a review of the most up-to-date scientific literature on sea level rise. These projections describe 3 feet of sea level rise in this century as a mid-range scenario and includes a “physically plausible” upper-end projection of 6 to 8 feet of sea level rise by the end of this century if worst-case scenarios for greenhouse gas emissions and increasing instability of the Antarctic and Greenland ice sheets should be realized.

The City and County of Honolulu Climate Commission issued sea level rise guidance (City & County of Honolulu Climate Change Commission, 2018) for the county to use areas exposed to 3.2 feet of sea level rise as a planning benchmark for most development and also consider 6 feet of sea level rise as a planning benchmark for critical infrastructure with long expected lifespans and low risk tolerance. For the Hawaiian Islands, the difference in area exposed to 3.2 and 6 feet of sea level rise varies due to the geomorphology of the islands as well as the difference in modeling results available to create the SLR-XA (Figure 3).

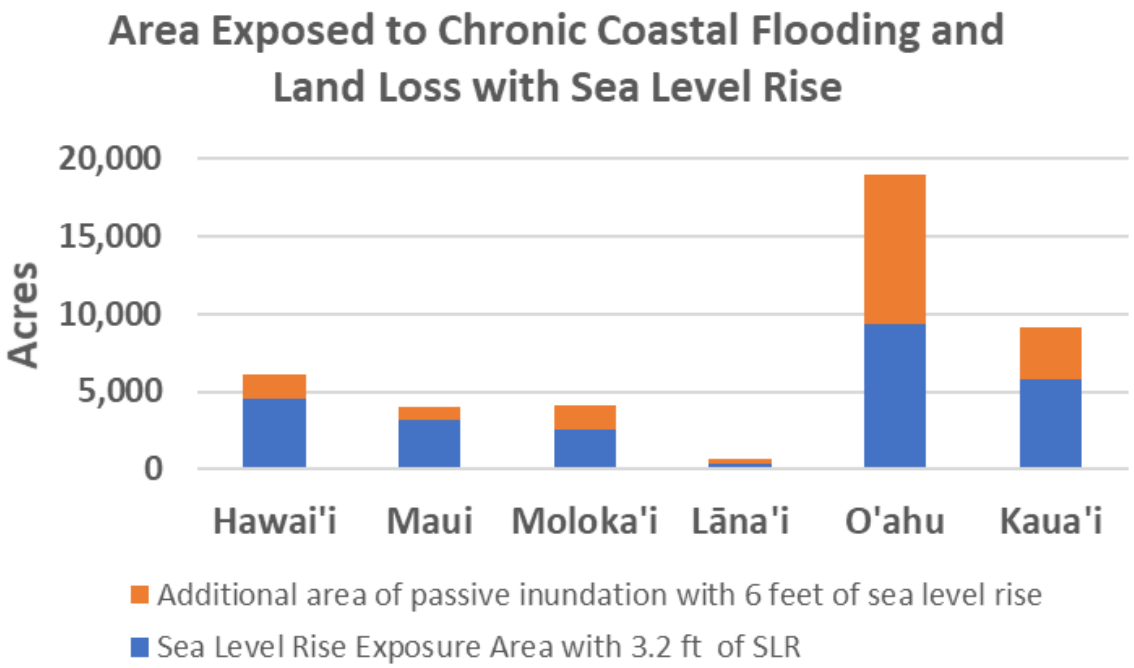


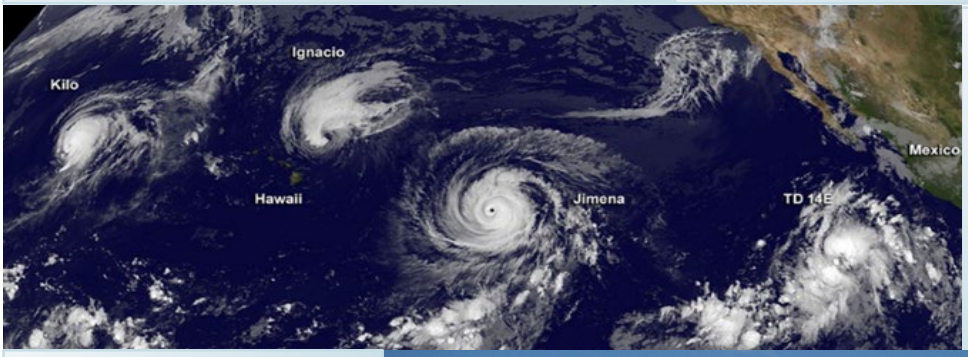
Figure 3. Projected area exposed to chronic flooding and land loss with sea level rise by island

A 2019 IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (IPCC, 2019; Oppenheimer et al., 2019) reafirms that global sea level rise is accelerating and that the contributions of glaciers and ice sheets are the dominant source of of global sea level rise. For this reason, it is vital that we track the magnitude and rate of sea level rise as new projections emerge. Plan now for at least 3 feet of sea level rise in the latter half of this century, and be ready to adjust that projection if needed. It is also important to recognize that global sea level rise will not stop at 2100 but will very likely continue for centuries.

Sea Level Rise Impacts. Sea level rise threatens communities and natural ecosystems in Hawai‘i by multiplying impacts from coastal hazards leading to increasing loss of land and ecosystem services, and damage to the built environment (Figure 4). Sea level rise will result in accelerating shoreline erosion, increasing chronic and event-based flooding along the shoreline and in low lying areas, impeded stormwater drainage, and in some locations permanent submergence of land. In many communities erosion and rising water levels are resulting in narrowing of beaches and other coastal ecosystems, or “coastal squeeze,” as the landward migrating shoreline comes in contact with development and engineered structures (IPCC, 2018).

Urbanized coastal areas become increasingly vulnerable to flooding during high tide water and high wave events resulting in rising groundwater tables and drainage system failure with impacts to development above and below ground.

Seasonal high wave, which affect all Hawai'i coasts will flood further landward and cause more damage, as sea level continues to rise.



Damaging flooding will increase when hurricanes, other extreme rainfall events, and tsunami strike.

Nearshore water quality is impaired from backshore erosion and wave overwash.

Saltwater intrusion of streams and coastal wetlands threatens low-lying agriculture (e.g., kalo farming) and wildlife sanctuaries.

Wave and eventually still water overtopping of Loko i'a kuapā (fishpond walls) will change interior circulation and destabilize fishpond connections to the shore

Coastal squeeze" is leading to beach loss as eroding shorelines and increasing wave runup encounters seawalls and other development in the backshore

Figure 4. Multiple ways in which rising seas threaten communities and natural ecosystems (adapted from City & County of Honolulu Climate Change Commission (2018))

Sea Level Rise Responses. Responses to improve coastal community resilience to sea level rise should emphasize locally appropriate approaches including scenario analysis, land use planning, public participation, and conflict resolution (Oppenheimer et al., 2019). An integrated and place-based response to sea level rise will be needed based on an analysis of trade-offs and an iterative approach that can be adjusted over time. The need to develop locally appropriate responses means there may not be one 'right' approach (Gregg, Kershner, & Hansen, 2018). A range of adaptation strategies including protection, accommodation, ecosystem-based adaptation, and retreat (Table 1) will likely need to be implemented across a community depending on existing conditions (e.g. natural vs. heavily engineered shoreline), vulnerability, and community priorities expressed through public participation.

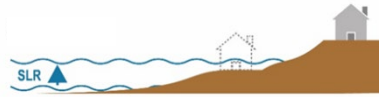
IPCC Special Report on the Ocean and Cryosphere in a Changing Climate
Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities

Planning Practices Based on Sea Level Rise Adaptation Experience

(adapted from Oppenheimer et al. (2019)

- Adaptation experience demonstrates that using a locally appropriate combination of decision analysis, land use planning, public participation, and conflict resolution approaches can help to address governance challenges faced in responding to sea level rise.
- **Effective sea level rise responses depend on taking a long-term perspective when making short-term decisions**, explicitly accounting for uncertainty of locally-specific risks beyond 2050 and building governance capabilities to tackle the complexity of sea level rise risk.
- Improved coordination of sea level rise responses across scales, sectors, and policy domains can help to address sea level rise impacts and risk.
- Prioritizing consideration of social vulnerability and equity underpins efforts to promote fair and just climate resilience and sustainable development and can be helped by creating safe community areas for meaningful public deliberation and conflict resolution.
- Public awareness and understanding about sea level rise risks and responses can be enriched by drawing on local, indigenous and scientific knowledge systems, with a shared goal of learning about locally-specific sea level rise risk and response potential.

Table 1. Sea level rise adaptation strategies (adapted from Oppenheimer et al. (2019))

Strategy	Description
 **Protection**	**Protection** reduces coastal risk and impacts by blocking the inland migration of the shoreline and other effects of mean or extreme sea levels. This includes hard protection such as seawalls, breakwaters, and revetments to protect against flooding and erosion. In some locations it may be appropriate to apply protection in combination with ecosystem-based adaptation strategies.
 **Accommodation**	**Accommodation** measures modify new or existing development in-place to increase the resiliency of development to the impacts of coastal hazards with sea level rise. Flood-proofing and relocation of vulnerable utilities from ground levels to higher floors are examples of accommodation. Accommodation measures for flooding include building codes, raising house elevation (e.g., on piles), and lifting utilities and living spaces to higher floors.
 **Ecosystem-based Adaptation**	**Ecosystem-based adaptation** responses provide a combination of benefits based on sustainable management, conservation, and restoration of ecosystems. Examples include the conservation or restoration of coastal ecosystems such as beaches, dunes, wetlands, and reefs. Ecosystem-based adaptation measures protect the coastline by attenuating waves (e.g., reefs and beaches) and storm surge flows (e.g., wetlands) by acting as obstacles, providing retention space and raising elevation for flood waters and mitigating erosion by stabilizing and/or restoring beaches.
 **Retreat**	**Retreat** strategies relocate or remove existing development and limit the construction of new development in high-hazard areas. Shoreline building setbacks, rolling easements, acquisition and buy-out programs, transfer of development rights programs, and removal of critically damaged or encroaching structures are examples of managed retreat approaches. A retreat strategy provides opportunities for maintenance of open space to buffer coastal hazards and for recreation value and enables migration and conservation of beaches, wetlands, and other coastal habitats with rising seas.

Note: Figures do not depict the impact of sea level rise on groundwater and resultant flooding in lowland areas behind the shoreline.

County Planning and Implementation Framework

The Hawai'i State Planning Act (Chapter 226, HRS) and the county planning programs provide the existing framework for planning and implementing locally appropriate approaches for sea level rise adaptation. This framework consists of a hierarchy of plans and implementing regulations and ordinances (Figure 5).

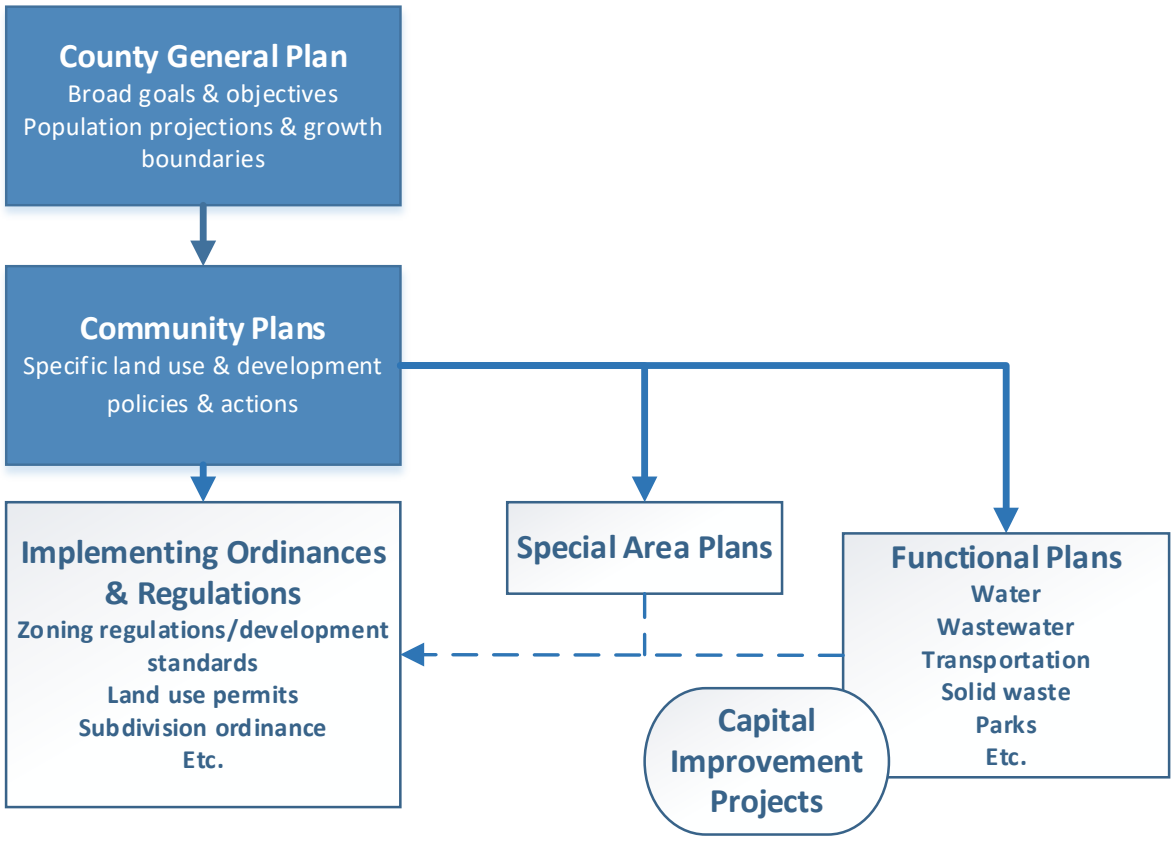


Figure 5. County planning and implementation framework (City & County of Honolulu Department of Planning and Permitting, 2015; County of Kaua'i Planning Department, 2017)

The county planning and implementation framework includes:

- **County general plans** establish a vision, overarching policy goals, and objectives for long-range development of the county and establishes priorities for public investments typically over a 20-year planning horizon.
- **Community plans** translates goals and objectives from the general plan into detailed land use and development policies and actions for a community planning area (City & County of Honolulu Department of Planning and Permitting, 2015). The community planning process provides a forum for community input into establishing county policy at the regional level and coordinating the delivery of County services to the community.

- **Special area plans** give specific guidance concerning the identity, function, organization, and/or character of towns, neighborhoods, or specialized resource areas. These plans are developed in accordance with the area's community plan.
- **Functional plans** provide long-range guidance for the development of public facilities and infrastructure, such as water and transportation. Some of these plans are mandated by state or federal regulations. State functional plans are required under the State Planning Act to address critical infrastructure to support county-wide needs.
- **County implementing rules and regulations** are adopted to support plan implementation. Ordinances are developed to support implementation and enforcement of land use policies, building restrictions, and other policies or actions identified in county general and community plans. The objectives and policies of a general or community plan are ultimately implemented at the project or property scale when a land use application, major building permit, and/or environmental assessment is reviewed for consistency with the plan and relevant policies.

A county's multi-hazard mitigation plan, which is updated every 5 years, is also an important part of the framework.

Hawai'i State Climate Change Adaptation Priority Guidelines

The Hawai'i State Planning Act establishes seven State Priority Guidelines (HRS Chapter 226 Part III) intended to improve the quality of life for Hawaii's present and future population through the pursuit of desirable courses of action in: economic development, population growth and land resource management, affordable housing, crime and criminal justice, quality education, principles of sustainability, and climate change adaptation (Figure 6). State and county planners are required to ensure that the State Priority Guidelines are considered in developing and updating all plans.

Figure 6. Categories of State Priority Guidelines

The Hawai'i State Climate Change Adaptation Priority Guidelines (Hawai'i Climate Adaptation Priority Guidelines), amended to Hawai'i State Planning Act in 2012, establishes priorities for addressing climate change in planning at state and county levels (Table 2). This Guidance provides recommended practices in updating general and community plans that also address these priorities.

Table 2. Hawai'i State Climate Change Adaptation Priority Guidelines

1.	Ensure that Hawaii's people are educated, informed, and aware of the impacts climate change may have on their communities.
2.	Encourage community stewardship groups and local stakeholders to participate in planning and implementation of climate change policies.
3.	Consider Native Hawaiian traditional knowledge and practices in planning for the impacts of climate change.
4.	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.
5.	Encourage planning and management of the natural and built environments that effectively integrate climate change policy.
6.	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.
7.	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.
8.	Promote sector resilience in areas such as water, roads, airports, and public health, by encouraging the identification of climate change threats, assessment of potential consequences, and evaluation of adaptation options.
9.	Use management and implementation approaches that encourage the continual collection, evaluation, and integration of new information and strategies into new and existing practices, policies, and plans.
10.	Invest in continued monitoring and research of Hawaii's climate and the impacts of climate change on the State

Other State Priority Guidelines, especially Population Growth and Land Resources, Affordable Housing, and Sustainability (Figure 6), have a strong nexus with climate change and sea level rise adaptation. It is recommended that counties consider climate change and sea level rise as a cross-cutting consideration for all of the relevant State Priority Guidelines throughout the planning process. Appendix 2 provides sea level rise-related recommended practices for the relevant State Priority Guidelines.

3. GUIDANCE AND RECOMMENDED PRACTICES

Guidance and recommended practices are aligned with specific steps in the community planning and implementation cycle (Figure 7). Emphasis in this Guidance is placed on community planning as it provides the scale, scope, and community engagement needed to guide climate resilient growth and development in a future with rising seas.

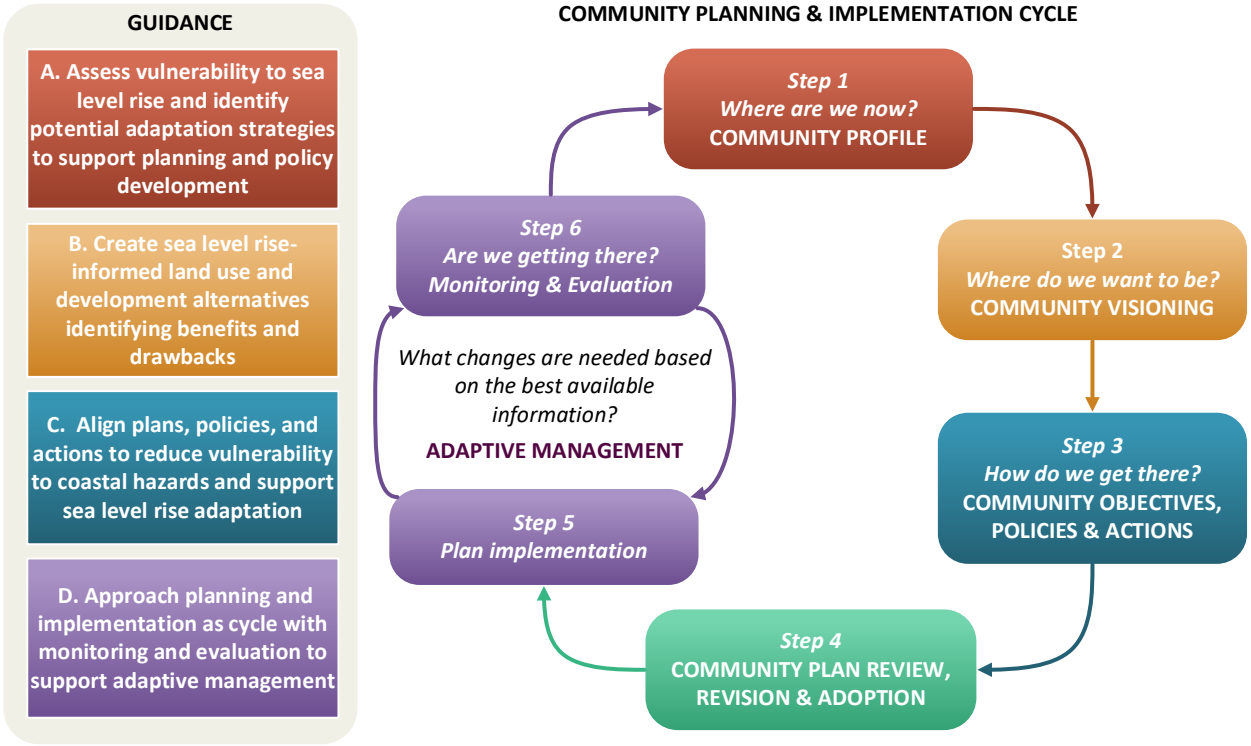


Figure 7. Guidance for addressing sea level rise as part of the community planning and implementation cycle

Recognizing that community planning is just one critical step in addressing sea level rise, recommended practices are also provided for application in related but broader county-wide planning and programs. Counties may choose different entry points and geographic scales to advance their work in addressing sea level rise depending on the timing of plan updates and capacity. For example, a vulnerability assessment could be conducted at the scale of a community plan area at the beginning of the plan update process. Alternatively, a vulnerability assessment could be completed at the county or island scale at the beginning of a general (or island) plan or county hazard mitigation plan update. Icons are used to indicate whether each recommended practice may be applied county-wide or for a specific community planning area (Table 3).

Table 3. Icons used to indicate application of recommended practices

	Applied or conducted county-wide
	Applied or conducted for a specific community planning area

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Honoapi'ilani Highway, Olowalu, Maui
Source: Asa Ellison

A. Assess vulnerability to sea level rise and identify potential adaptation strategies to inform plan and policy development

The Hawai'i Climate Adaptation Priority Guidelines (*see Chapter 2, Table 2*) encourage county planners to assess vulnerability and identify climate adaptation strategies in developing plans and promoting sector resilience. A vulnerability assessment provides quantitative and qualitative information about exposure, sensitivity, and adaptive capacity of valued community assets to coastal hazards with sea level rise. Potential adaptation strategies (*see Chapter 2, Table 1*) are typically identified as part of a vulnerability assessment. The results of a vulnerability assessment can be used to support multiple county efforts including education and outreach, community plan updates, and improvements to or development of new county implementing rules and regulations. Recommended Practices for Guidance A are described in this section and hyperlinks are provided to Examples and Resources in Appendix 1 to demonstrate and further guide in application of the Recommended Practices.

A. Assess vulnerability to sea level rise and identify potential adaptation strategies to inform plan and policy development	
Recommended Practices	**Application**
A1. Establish an interdepartmental climate adaptation working group to support coordination on vulnerability assessments and throughout the planning and implementation cycle	
A2. Conduct county-wide and community-scaled sea level rise vulnerability assessments using best-available data and identify potential adaptation strategies	
A3. Conduct sector-specific vulnerability assessments and identify potential adaptation strategies	
A4. Use the results of sea level rise vulnerability assessments to support community outreach activities, to inform all plan elements, and to create or revise policies and rules	

Applied or conducted county-wide

Applied or conducted for a specific community planning

A1. Establish an interdepartmental climate adaptation working group to support coordination on vulnerability assessments and throughout the planning and implementation cycle

The establishment of an interdepartmental climate adaptation working group or Climate Resilience Team with members from key county departments can support coordination among vulnerability assessments and identify potential adaptation strategies that will likely cross multiple sectors. Counties may consider including a GIS database specialist that can support the working group with data requests and analyses. An interdepartmental climate adaptation working group responsibilities may include:

- Tracking and developing a shared understanding of climate change science and potential impacts
- Developing a systematic approach for conducting a community-scaled vulnerability assessment
- Coordinating climate change-related assessments and planning efforts across departments
- Reviewing plans, policies, and capital improvement projects for consistency in approaches to reducing vulnerability to sea level rise and other climate impacts
- Integrating sustainability and environmental values into county plans, programs, and policies
- Reporting to county government, county planning commissions, and county council
- Reaching out to federal and state partners who may be conducting vulnerability assessments and capital improvement projects

Interdepartmental coordination should be carried throughout all steps in the planning and implementation cycle (Figure 7). In addition to coordination among county departments, regular contact with state and federal agencies is recommended in order to address the long-term, complex, and cross-jurisdictional nature of adapting to sea level rise.

See examples and resources in Appendix 1: Interdepartmental Coordination

A2. Conduct county-wide and community-scaled sea level rise vulnerability assessments using best-available data and identify potential adaptation strategies

Vulnerability is defined as “the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes” (IPCC, 2007). The physical, social, economic, cultural, and environmental dimensions of vulnerability require a detailed assessment of an area’s exposure, sensitivity and adaptive capacity. A vulnerability assessment to support community planning would include all community assets, natural and man-made, private and public. The assessment should be completed at the start of a plan update and the results integrated in all relevant plan elements. Opportunities to conduct a vulnerability assessment include:

- Before initiating a general plan update where sea level rise vulnerability can be assessed island-wide and at the community planning area scale
- Before initiating a community plan update where sea level rise vulnerability can be assessed for a community planning area
- As part of a 5-year County Hazard Mitigation Plan update where sea level rise vulnerability is analyzed island-wide and at the community planning area scale

Sea level rise scenarios to use for a vulnerability assessment recommended in the State Sea Level Rise Report include:

- **Sea Level Rise Exposure Area.** Using the 3.2 ft Sea Level Rise Exposure Area (SLR-XA) as a hazard overlay for chronic coastal flooding and land loss is a critical first step in assessing vulnerability and identifying adaptation strategies. This data layer and other useful layers area available on the Hawai'i Sea Level Rise Viewer, www.hawaiisealevelriseviewer.org
- **Exposure to Passive Inundation with 6 feet of sea level rise.** For planning decisions related to critical infrastructure with long expected lifespans or low risk tolerance, counties may wish to also consider exposure to passive inundation with 6 feet of sea level rise. Available from the NOAA Sea Level Rise Viewer, https://coast.noaa.gov/digitalcoast/tools/slr.html

The state-wide vulnerability assessment in the Hawai'i Sea Level Rise Report, map data available on the Hawai'i Sea Level Rise Viewer, and other map layers available from county and state GIS programs can be used to conduct a vulnerability assessment at the community plan scale. Counties are encouraged to carefully review the description of the sea level rise exposure data layers included in the Hawai'i Sea Level Rise Report and/or Hawai'i Sea Level Rise Viewer to gain a full understanding of the assumptions and limitations of each data layer.

The vulnerability assessment can also provide an opportunity to consider other hazards and climate risks, in a multi-hazard approach. For example, the impacts of sea level rise on storm surge from severe coastal events, such as hurricanes, was assessed in the 2017 State Hazard Mitigation Plan by modeling the spatial extent and wave height of a 1% annual chance coastal flood event with 3.2 ft of sea level rise (1%CFZ-3.2). These data layers, available from HI-EMA, can be used in combination with FEMA flood insurance rate maps (FIRMs) to better assess the impacts of both riverine and coastal flooding.

Potential adaptation strategies, such as protection, accommodation, retreat and ecosystem-based adaptation (*see Chapter 2, Table 1*), are typically identified as part of the vulnerability assessment. A combination of adaptation strategies may need to be identified over different locations, timeframes, or phases of implementation.

See examples and resources in Appendix 1: County and Community Vulnerability

A3. Conduct sector-specific vulnerability assessments and identify potential adaptation strategies

More detailed sector-specific vulnerability assessments may be needed for critical infrastructure, parks and recreational facilities, natural and cultural resources, and economic assets to support community planning and broader county programming. Areas for more in-depth vulnerability assessment may include:

- **Critical Facilities and Infrastructure.** Assessments of vulnerability and adaptation strategies for critical facilities and infrastructure, also more broadly referred to as *community lifelines* (FEMA, 2020a), are needed to support planning in coordination with other county offices, as well as state and federal entities. For example, an assessment of state and county coastal roads will identify priorities and adaptation options for specific road segments that should be integrated with land use and development alternatives in community planning.
- **Natural Resource Landscape.** Assessments of vulnerability and adaptation strategies for beaches and dunes, wetlands, and reefs, and other conservation or park lands is needed to support planning and to support interagency coordination, particularly between county planning offices and State resource agencies. For example, a vulnerability assessment for county beach parks, including conservation/preservation areas, recreation areas and fields, plus existing and any planned park facilities, may be needed to prioritize adaption strategies and investments for maintaining access or restoring beach parks as ecosystem-based adaptation.
- **Historical and Cultural Landscape.** Assessments of vulnerability and adaptation strategies for intangible and tangible cultural and historical resources require close collaboration and partnership with community including Hawaiian cultural organizations and practitioners, as well as relevant State agencies. For example, an assessment of Hawaiian cultural practices and resources may be needed to identify places and customs that require continued access to the shoreline and to support development and application of protocols for addressing impacts to cultural sites from inundation or erosion.

See examples and resources in Appendix 1: Sector-specific Vulnerability

A4. Use the results of sea level rise vulnerability assessments to support community outreach activities, to inform all plan elements, and to create or revise policies and rules

The results of a vulnerability assessment can be used to inform many aspects of planning and policy development. Some of these uses include:

- **Community engagement and outreach**. County agencies and their communities should continue to build a shared understanding of the latest and best science on climate change and sea level rise along with evolving approaches to adaptation through ongoing engagement and outreach. Residents can also provide important information about vulnerabilities in their community. This information can feed into the vulnerability assessment and community plan. Regular coordinated briefings to the County Planning Commission and County Council by the inter-departmental climate adaptation working group may also support approval of needed policy update and appropriate consideration of sea level rise in their reviews of major projects and budgeting. University researchers, boundary organizations like Sea Grant, and non-profit entities can assist in "translating" science and conducting outreach. Citizen science programs like the Hawai'i and Pacific Islands King Tides Project can also help to engage communities in monitoring and understanding the impacts of sea level rise.
- **Sea level rise as a cross-cutting consideration.** The results of a sea level rise vulnerability assessment can be used in analyzing existing and future conditions across relevant plan elements such as population growth, land use, parks and recreational facilities, and impacts to county revenues such as property taxes. This information can be integrated into plan elements through the preparation of topical resource papers developed at the beginning of a community or general plan update. Counties should consider the Hawai'i State Priority Guidelines (*see Chapter 2, Figure 6*) in cross-cutting considerations in general and community plans. Recommended practices for selected State Priority Guidelines most relevant to sea level rise are listed in Appendix 2.
- **Creation and revision of policies and rules.** A vulnerability assessment can also provide the scientific basis for establishing policies such as a county-wide coastal hazard overlay zone with guidelines for new development and improvements, revising Special Management Area boundaries, updated shoreline setbacks, improvements to flood management, and other implementing rules and regulations.

See examples and resources in Appendix 1: Revision and Creation of Policies

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Flooding in open space created after two tsunamis, Hilo Hawai'i
Source: County of Hawai'i

B. Create sea level rise-informed land use and development alternatives and analyze tradeoffs

The Hawai'i Climate Adaptation Priority Guidelines require that state and county planners give special attention to identifying and evaluating adaption strategies that will minimize harm to the natural environment, preserve and restore natural landscapes and resources, consider Native Hawaiian traditional practices, and promote sector resilience (*see Chapter 2, Table 2*). Improving understanding of sea level rise vulnerability and adaptation options will help communities envision a more resilient future and develop sea level rise informed adaptation strategies and development alternatives. Recommended Practices for Guidance B are described in this section and hyperlinks are provided to Examples and Resources in Appendix 1 to demonstrate and further guide in application of the Recommended Practices.

B. Create sea level rise-informed land use and development alternatives and analyze tradeoffs	
Recommended Practices	**Application**
B1. Use community visioning to develop sea level rise adaptation strategies	
B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs	
B3. Identify and retain disaster redevelopment alternatives that support adaptation to sea level rise in the event of a catastrophic coastal event	

Applied or conducted county-wide Applied or conducted for a specific community planning area

B1. Use community visioning to develop sea level rise adaptation strategies

Community visioning, informed by a sea level rise vulnerability assessment and potential adaptation options, enables planners along with the community to weigh options and identify preferences for directing land use and growth while conserving natural and cultural resources and other valued community assets. A community planning area may have multiple visions and adaptation strategies depending on existing land use, natural and cultural landscapes, and public infrastructure. In considering sea level rise hazards and adaptation, it is recommended that visioning extend over a 50-year timeframe, beyond the typical 20-year outlook for community plans. Land use decisions made today will have expected lifespans well into the latter half of this century. Questions to consider in facilitating community visioning:

- What is the vision for area exposed to sea level rise in 50 years?
- Where should population growth be directed or relocated based on projected impacts to private development and infrastructure?
- Would public infrastructure need to be fortified, realigned, or relocated?
- Which beaches, wetlands, and other coastal ecosystem services should be prioritized for conservation?
- What historic and Native Hawaiian cultural resources would need to be protected or relocated?
- What adaptation strategies should be considered to achieve that vision?

A combination of sea level rise adaptation strategies, including protection, accommodation, ecosystem-based adaptation, and managed retreat, may be needed in one community and over different time periods (see Table 2). Design charrettes and maps, typically used by counties to support visioning, are important tools in helping the community envision a future with sea level rise.

See examples and resources in Appendix 1: Community Visioning

B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs

Creating land use and development alternatives is typically part of the community visioning process and should also be informed by sea level rise vulnerabilities and adaptation strategies. An analysis of tradeoffs among development alternatives provides important information needed to help understand benefits and drawbacks in terms of effects on community assets and resources. As with the vulnerability assessment, this is an opportunity to also consider improved resilience to other hazards such as increasing temperature and extreme rainfall. Questions to consider in analyzing trade-offs between land use and development alternatives may include:

- What agriculture, conservation, and open space lands would be lost or gained?
- Are there disproportionate impacts or benefits to particular income groups?
- What aspects of the cultural landscape or sense of place could be impacted or improved?
- Is access to the shoreline negatively impacted or improved?

The analysis of tradeoffs between alternatives can also begin considering implementation strategies. Scenario planning software such as Urban Footprint and CommunityViz, used by some counties, can be useful in analyzing tradeoffs among alternatives.

See examples and resources in Appendix 1: ***Sea Level Rise Informed Land Use and Development Alternatives***

B3. Identify and retain disaster redevelopment alternatives that support adaptation to sea level rise in the event of a catastrophic coastal event

Counties should consider identifying and retaining disaster redevelopment alternatives as part of the community planning process or other disaster recovery preparedness activities to support dual goals of recovery and sea level rise adaptation. A disaster redevelopment alternative describes potential land use and development changes that would be triggered should a catastrophic event occurred in a high hazard area, such as the sea level rise exposure area or coastal hazard overlay zone (Figure 8). Community planning provides opportunities to develop and vet these alternatives which can serve as a starting point for the county should catastrophic damages occur. The disaster redevelopment alternative may not be the preferred alternative used to create land use and development policies and actions in the community plan but is retained in the plan for future reference or as part of disaster recovery preparedness activities.

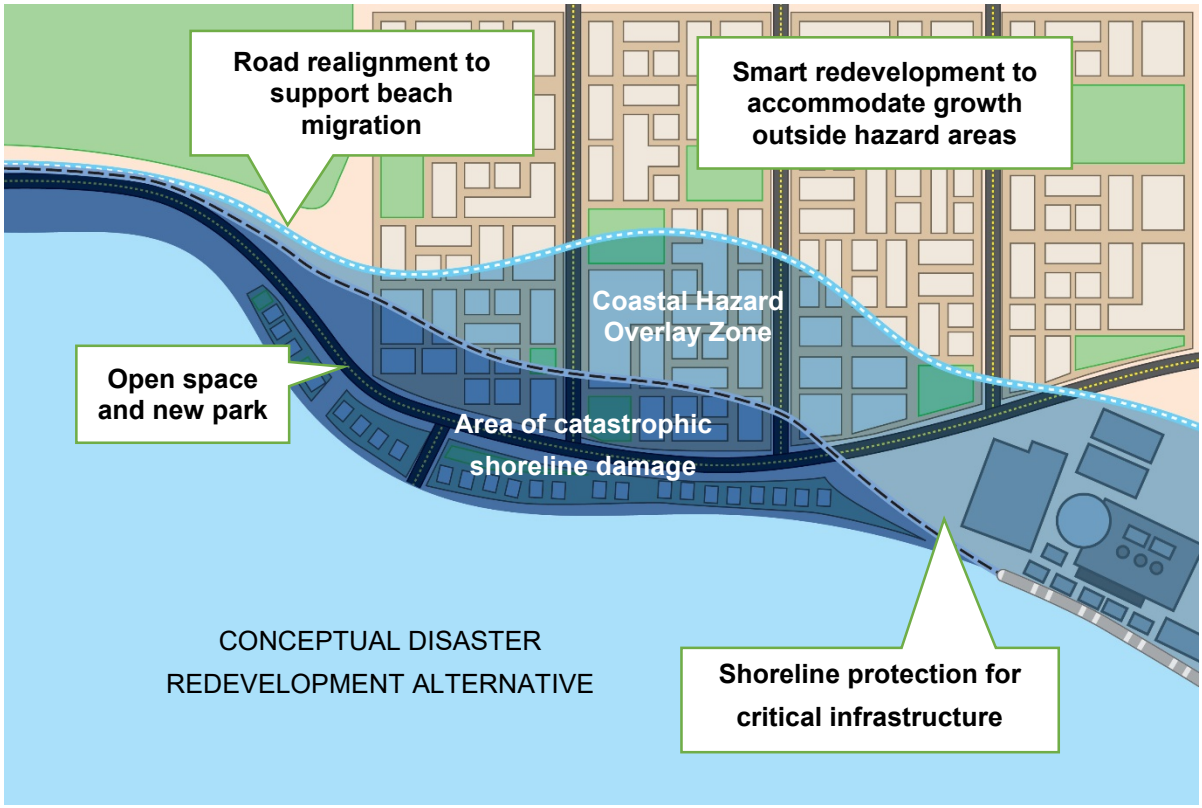
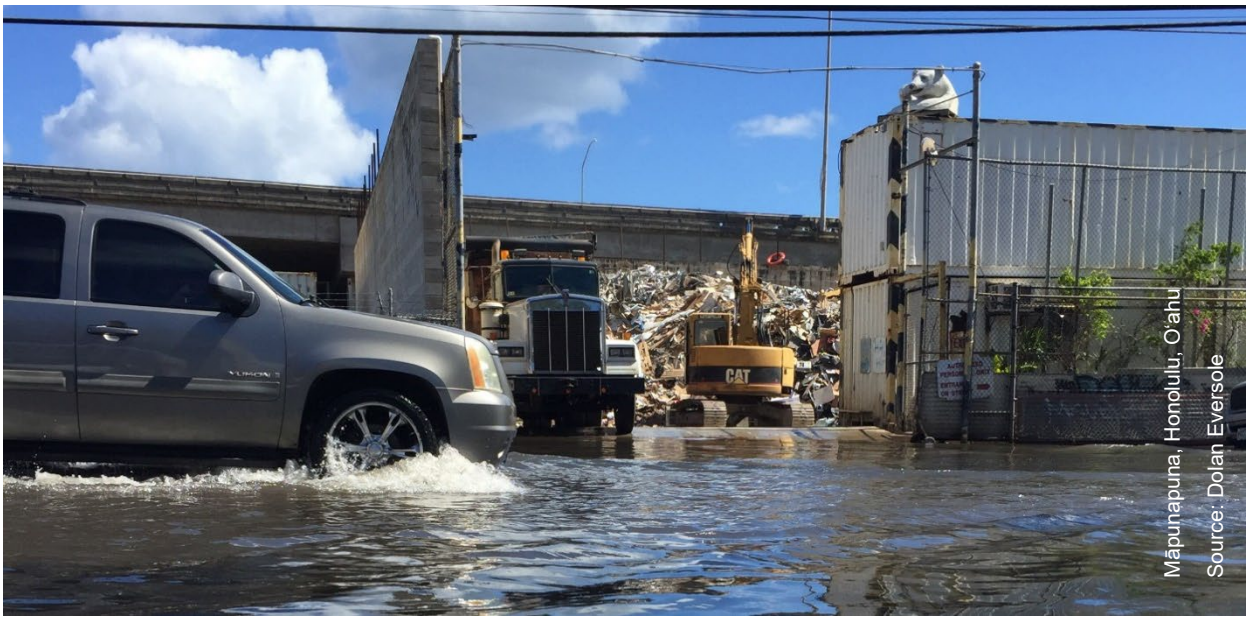


Figure 8. Conceptual disaster redevelopment alternative that could be triggered in the event of catastrophic shoreline damage

See examples and resources in Appendix 1: Disaster Redevelopment



Māpunapuna, Honolulu, O'ahu
Source: Dolan Eversole

C. Align plans, policies, and actions to reduce vulnerability and support adaptation to sea level rise

The State Climate Adaptation Priority Guidelines encourage integrating climate change policies in planning for the natural and built environments (*see Chapter 2, Table 2*). Plan and policy integration is a process by which local governments look critically at their network of plans and policies and align efforts to reduce risks from natural hazards and build community resilience (FEMA 2015, U.S. Department of Homeland Security 2017). Recommended Practices for Guidance C are described in this section and hyperlinks are provided to Examples and Resources in Appendix 1 to demonstrate and further guide in application of the Recommended Practices.

C. Align plans, policies, and actions to reduce vulnerability and adapt to sea level rise	
Recommended Practices	**Application**
C1. Facilitate consistency and alignment of new policies and actions by coordinating across departments	
C2. Prepare draft ordinances and rules to submit concurrently with the plan to align plans and implementing rules	

Applied or conducted county-wide Applied or conducted for a specific community planning area

C1. Facilitate consistency and alignment of new policies and actions by coordinating across departments

Efforts to integrate sea level rise data and considerations in a plan provides opportunities to review and align policies and actions across other related plans, and throughout the county planning and implementation framework. This alignment may be initiated through a community plan, general plan, or island plan update or any other planning efforts, such as hazard mitigation plans or resiliency plans that the county may undertake (Figure 9). Whichever the case at the time, a collaborative approach may be required to integrate different plans and establish priority policies and actions that will reduce vulnerability risk and support adaptation to sea level rise. An interdepartmental climate adaptation working group (*see Recommended Practice A1*) can play a critical role in plan and policy review and alignment. Geographic analysis of policy coherence is also recommended. The review would analyze proposed county policies and actions in the draft plan to address two basic questions:

- To what extent do proposed plans and policies (plans, ordinances, capital improvement projects, etc.) increase or decrease vulnerability and support adaptation to sea level rise?
- What revisions or new policies and actions are needed to align existing or new plans and policies to reduce risk and build community resilience to adapt to sea level rise?

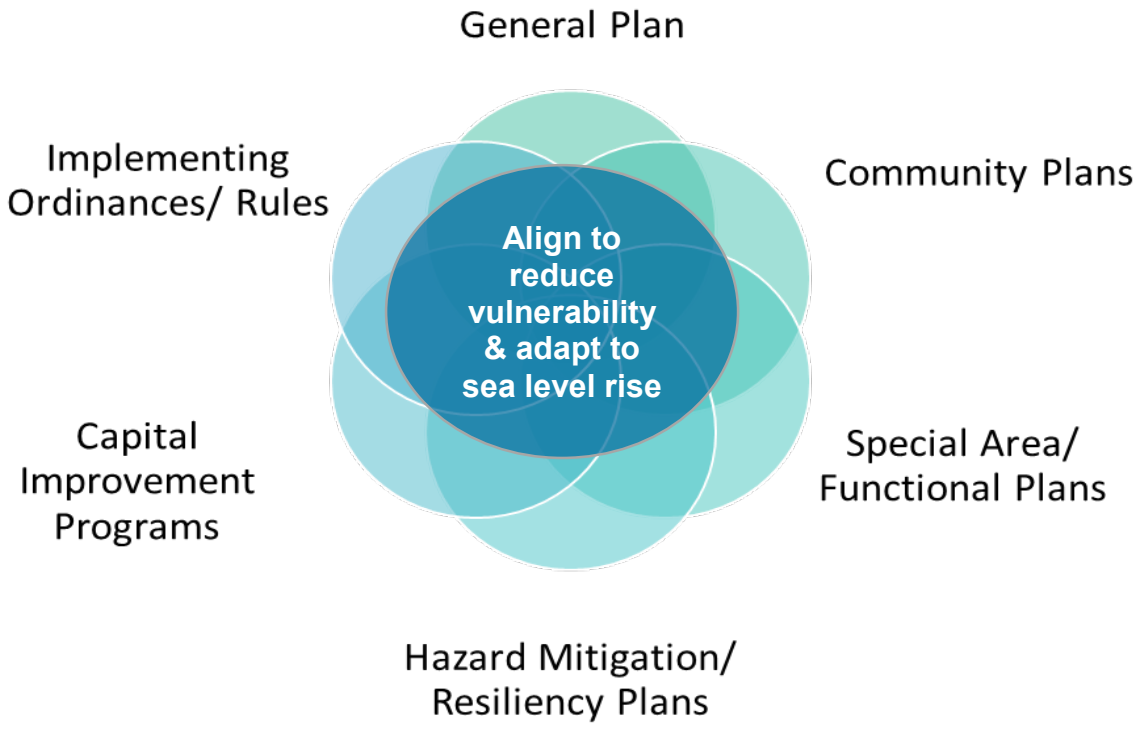


Figure 9. Network of plans and policies for alignment and consistency

See examples and resources in Appendix 1: Plan and Policy Integration

C2. Prepare draft ordinances and rules to submit concurrently with a plan to support consistency in implementing plan policies and actions

Community plans often call for changes in zoning or other rules. Revisions to ordinances and rules needed to support plan implementation should be submitted to the County Planning Commission and County Council along with the draft community plan. This will expedite plan implementation and ensure consistency between the plan and implementing rules and regulations.

See examples and resources in Appendix 1: Ordinances and Rules to Support Community Plan Implementation

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D. Approach planning and implementation as a cycle with monitoring and evaluation to support adaptive management

The Hawai'i Climate Change Adaptation Priority Guidelines call for an adaptive management approach (see Definitions) to planning for climate change (*see Chapter 2, Table 2*). An adaptive management approach means that decisions to take action are based on the best available information with the knowledge that adjustments may need to be made in the future as new data becomes available and should more adaptation options become viable through new policies and funding sources. In support of an adaptive management approach, it is recommended that community planning and implementation be approached and communicated to the public as a cycle (*see Figure 7*) with opportunities to use new information to update planned activities or make course corrections. Recommended Practices for Guidance D are described in this section and hyperlinks are provided to Examples and Resources in Appendix 1 to demonstrate and further guide in application of the Recommended Practices.

D. Approach planning and implementation as a cycle with monitoring and evaluation to support adaptive management	
Recommended Practices	**Application**
D1. Place greater emphasis on plan implementation, monitoring, and evaluation to track performance and make course corrections	
D2. Conduct pilot projects to demonstrate the viability of adaptation strategies and develop collaborative pathways for planning, funding, and implementation	

Applied or conducted county-wide Applied or conducted for a specific community planning area

D1. Place greater emphasis on plan implementation, monitoring, and evaluation to track performance and make course corrections

Policies and actions that support adaptation to sea level rise will need to be implemented over varying timeframes and be responsive to changing conditions. An enhanced implementation, monitoring, and evaluation process can provide information and feedback on what is working and where changes need to be made. An implementation, monitoring, and evaluation strategy may be included in a community plan update as part of an overall county strategy to support adaptive management. Key elements of such a strategy include:

- **Triggers** are a phased implementation approach that details the timing, sequence, and pathways for implementing key policies and actions. Triggers may be environmental thresholds or other conditions such as a number of repeat flooding days. They should allow sufficient time for appropriate planning, stakeholder engagement and funding to be achieved for the next action in the sequence. Example triggers include:
    - Number of high tide flooding days that disrupt traffic flow and other basic services
    - Number of repetitive loss structures in an area
    - Catastrophic damage to shoreline and structures from a disaster event
    - Loss of beach and public access
- **A Monitoring and Evaluation Strategy** can describe timing, methodology, and reporting requirements for adaptive actions and projects. The monitoring and evaluation strategy would also include indicators to measure progress and effectiveness of adaptation strategies and triggers. Indicators for monitoring and evaluation might include.
    - Number of properties requesting emergency shoreline erosion protection
    - Miles of roads realigned and/or elevated
    - Length of hardened shoreline versus nature-based approaches
    - Number of development rights transferred to low sea level rise risk areas
    - Percent of building permits issued in areas exposed to sea level rise, tsunamis, and other coastal hazards

  A monitoring and evaluation strategy can also define roles and responsibilities for implementation, monitoring and evaluation, and reporting to the community, planning commission, county council, an interdepartmental climate adaptation working group, and other venues. Processes may also be needed for capturing lessons and documenting adjustments in implementation.

See examples and resources in Appendix 1: Implementation, Monitoring, and Evaluation

D2. Conduct pilot projects to demonstrate the viability of adaptation strategies and develop collaborative pathways for planning, funding, and implementation

Pilot projects can be used to demonstrate the viability of adaptation approaches in the most vulnerable priority locations that are identified through a community plan and/or vulnerability assessment. Pilot projects can apply and test techniques or methods that offers potential environmental benefits and climate adaptation advantages compared to current practices and that can be scaled-up if proven effective (EuroAccess, 2020). These projects aim to assess the effectiveness of the method, inform other stakeholders of the results, improve collaboration, develop funding pathways, and encourage use of successful techniques and methods in similar settings. A pilot project can document implementation steps and lessons learned to be shared with other communities and decision-makers facing similar challenges.

See examples and resources in Appendix 1: Pilot Projects (D2)

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4. CLOSING THOUGHTS

Adapting to sea level rise will be challenging and disruptive even with the most well thought out plans, policies, and programs. However, disruption brings opportunity for innovation and creativity. Adapting to sea level rise presents the chance to re-envision our communities as more just, equitable, and sustainable through the implementation of complementary goals such as increasing affordable housing, multi-modal transportation, low-impact development, and more walkable communities with "complete streets" – outside of hazard areas.

Implementing the Recommended Practices in this Guidance may require additional funding and added human resources beyond what is currently available in most planning departments. However, inaction will be the costliest and most complicated path for government and taxpayers in the long run, with ever-increasing requests for emergency responses along eroding shorelines and flooding communities. To limit the need to compete with other budget priorities, county staff can continue to emphasize climate change and sea level rise adaptation as cross-cutting, rather than stand-alone, considerations by integrating adaptation into required plan updates, capital improvement program requests, and other budget priorities. Coordination and collaboration through an interdepartmental climate adaptation working group or similar body can help to eliminate redundant or conflicting efforts and promote cost-sharing. Boundary organizations like Sea Grant and nonprofit groups are available to assist county and state agencies in providing added capacity for planning and adaptation projects, ensuring access to the latest science and planning tools, and helping to pursue supplemental grant funding.

The Hawai‘i Climate Change Mitigation and Adaptation Commission is working to bring additional resources to support state and county climate change and sea level rise adaptation efforts. In an April 2019 meeting, the Commission voted in support of the formation of a sea level rise adaptation program to assist agencies and communities in maintaining best available information and practices for sea level rise adaptation actions. In response, the Climate Commission's coordinator is working to develop a "Climate-Ready Hawai'i" program to act as an information hub for sea level rise science and planning, provide further guidance for the application of tools such as the Hawai‘i Sea Level Rise Viewer, demonstrate how to perform vulnerability analysis using the latest climate hazard exposure data, continue to support statewide community engagement to address climate vulnerability, and develop funding pathways to support sea level rise planning and adaptation projects.

The process of developing this Guidance has emphasized the importance of sharing evolving knowledge and good practices among county and state government agencies. Local and national organizations provide valuable forums to share emerging information on sea level rise adaptation. Established venues for sharing include the Hawai‘i Climate Change Mitigation and Adaptation Commission, Ocean Resources Management Plan (ORMP) Coordinated Working Group, American Planning Association, National Adaptation Forum (NAF), and membership in groups such as the Association of Climate Change Officers and American Society of Adaptation Professionals. Annual conferences like the Hawai‘i Congress of Planning of Officials (HCPO) and Pacific Risk Management ‘Ohana (PRiMO) are optimal venues to share

best practices with colleagues statewide. We invite users of this Guidance to share their experiences with implementation of the Recommended Practices within these forums.

Through this project we conducted and participated in over 80 agency and public outreach events, sharing the latest science and discussing pathways and priorities for making our communities more resilient. We are very grateful for all the valuable time that was contributed to consultation meetings, project discussions, and workshops at statewide conferences. Mahalo nui loa.

Queen's Beach, Waikīkī, Oʻahu.
Source: Hawaiʻi Sea Grant College Program, King Tide's Project

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APPENDIX 1 – EXAMPLES AND RESOURCES FOR RECOMMENDED PRACTICES

Examples and Resources for Guidance A

Interdepartmental Coordination (A1)

City Resilience Team. The City and County of Honolulu Office of Climate Change, Sustainability and Resiliency (Resilience Office), established by City Charter in 2016, is tasked with tracking climate change science and potential impacts on facilities, coordinating actions and policies of departments within the City to increase community preparedness, developing resilient infrastructure in response to the effects from climate change, and integrating sustainable and environmental values into plans, programs, and policies. A sub-cabinet City Resilience Team, composed of representatives from relevant City departments, has been formed to foster interdepartmental collaboration. Together, the City Department of Planning and Permitting and the Resilience Office are fostering collaboration with other departments and organizations such as emergency management, transit-oriented development, and water supply in the update of the Honolulu Primary Urban Center Development Plan, as well as through the City's Resiliency Strategy and its updated Hazard Mitigation Plan.

→***Return to Recommended Practice A1***

County and Community Vulnerability Assessments (A2)

County of Kauaʻi Vulnerability Assessment. The County of Kauaʻi commissioned the Hawaiʻi Sea Grant College Program to conduct a county-wide Kauaʻi Climate Change and Coastal Hazards Assessment (University of Hawaiʻi Sea Grant College Program, 2014). The assessment was conducted to provide an inventory of available information for the purpose of planning. A gap analysis was also conducted identifying scientific data and modeling needed to support policy decision-making. Recommendations from the assessment, including the need for more detailed vulnerability assessments using updated sea level rise exposure data, were incorporated into the General Plan which led to a West Kauaʻi Community Vulnerability Assessment.

County of Hawaiʻi Vulnerability Assessment. The County of Hawaiʻi conducted a county-wide, community-scaled, assessment of high-risk hazard areas including tsunami inundation, storm surge, volcanic hazards, and the SLR-XA (Figure 10) (County of Hawai'i, 2020b) and used the results to define policies in their draft 2040 General Plan update and a Kīlauea Recovery and Resilience Plan. These policies include establishing natural hazard overlay zones with appropriate conditions for land use, siting, and design; identifying redevelopment opportunities within or adjacent to Urban Growth Areas but outside of high-risk hazard areas; and discouraging infrastructure investments and incentivizing infrastructure expenditures outside high risk hazard areas. The County is also exploring a range of land reallocation tools, such as transfer of development rights, land banking and development restrictions, for the County's

consideration, as well as examples of where each tool has been used and a general discussion of any constraints on where the tool might be effective to reduce risks associated with development in mapped hazard areas.

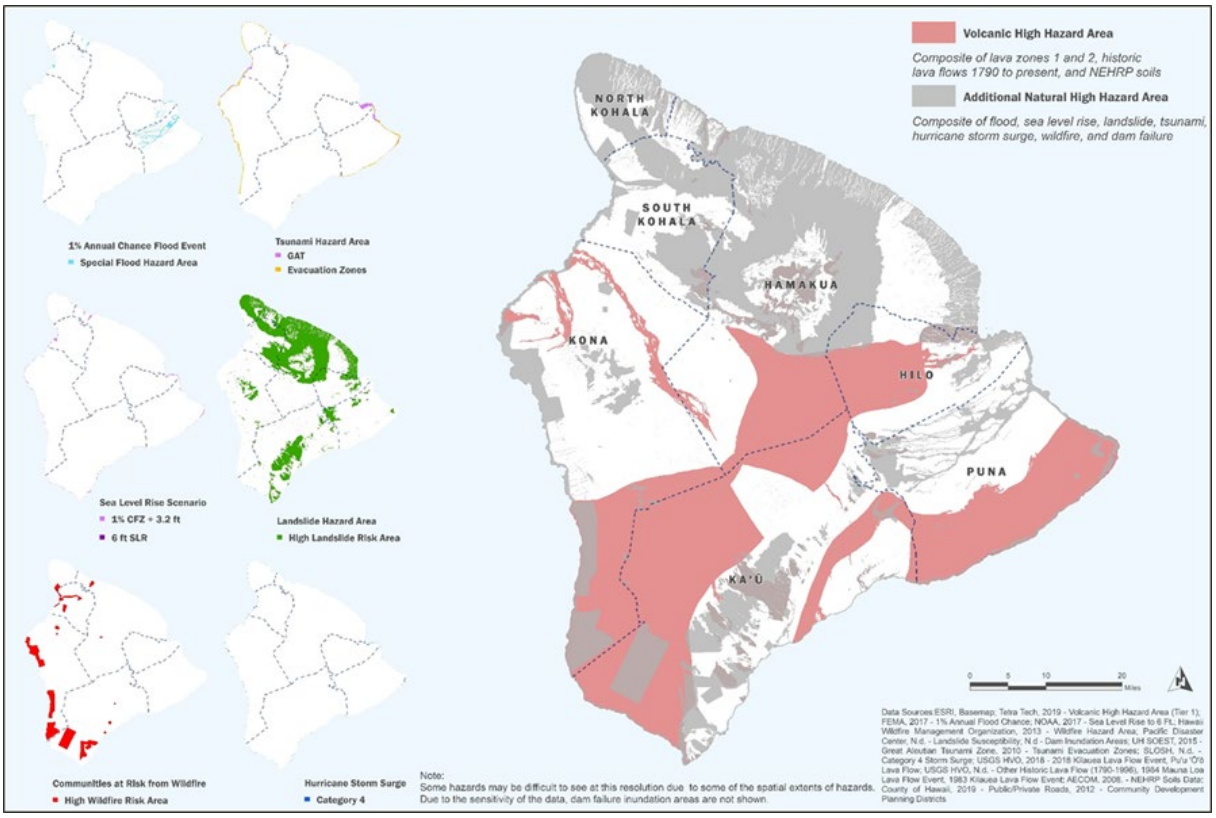
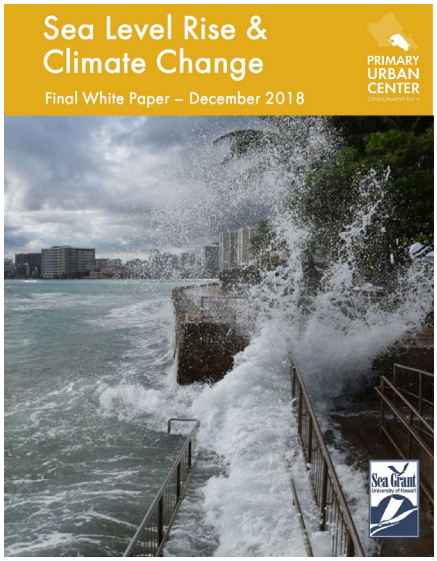


Figure 10. County of Hawai'i multi-hazard assessment conducted to inform the development of draft General Plan update and Recovery Plan

Honolulu Primary Urban Center Vulnerability Assessment. Technical resource studies for community plan updates for West Maui and the Honolulu Primary Urban Center included sea level rise and climate change vulnerability assessments. The Honolulu technical white paper provided a summary of key trends, hazards, and vulnerabilities with sea level rise down-scaled to the Primary Urban Center planning area using data from the Hawai'i Sea Level Rise Viewer, City and State GIS programs, and elsewhere (Figure 11). It also explored adaptation strategies and policy options for building resilience, adapting to climate change and sea level rise, and reducing greenhouse gas emissions. Similarly, a Technical Resource Paper to support the update to West Maui Community Plan provides a summary of existing conditions related to coastal hazards, key challenges for the future including vulnerabilities with sea level rise, and possible planning strategies.



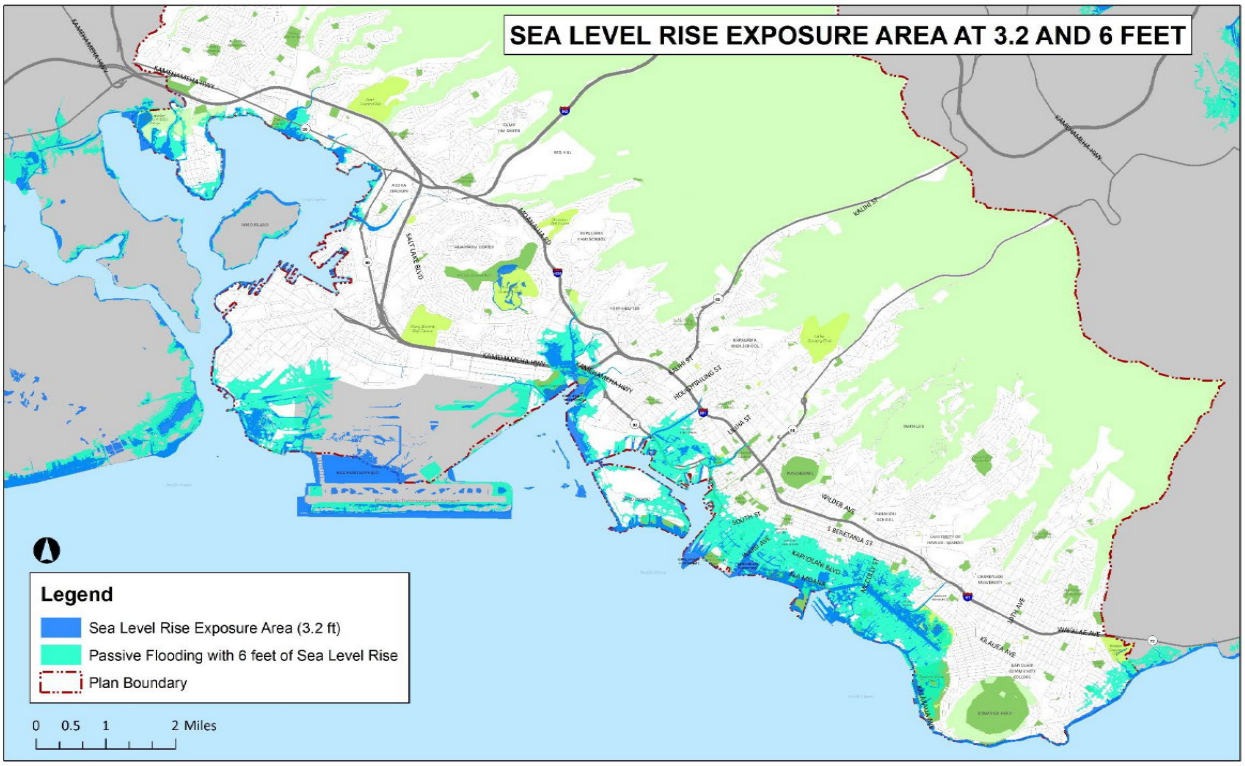


Figure 11. Sea level rise projections used to assess vulnerability in the Honolulu Primary Urban Center Development Plan update

Vulnerability Assessment in Hazard Mitigation Plans. The State and all four counties are expanding consideration of climate change and sea level rise in their Hazard Mitigation Plan updates (City & County of Honolulu, 2019; County of Hawai'i, 2020a; County of Kaua'i, 2020; County of Maui, 2020; Hawai'i Emergency Management Agency, 2018).These updates are conducted every 5 years and use the best available data on hazard risk. The County of Hawai'i conducted detailed risk assessment for both the SLR-XA and 1% annual-chance-coastal flood zone with 3.2 feet of sea level rise (1%CFZ-3.2) and reported results by community planning area. Their draft Multi-hazard Mitigation Plan update's high priority actions to address sea level rise and other hazards include:

- Integrating the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans, and strategic plans.
- Leveraging existing County public outreach programs and utilizing the best available data and science to communicate risk from all hazards assessed by this plan to the public to promote prevention, preparedness, response, recovery, and mitigation actions at the local scale.
- Updating county codes and policies to require that all coastal development consider and incorporate measures to address sea level rise.
- Updating county shoreline setback policies to include coastal erosion in order to better regulate development in the high-risk areas

- Developing overlay hazard zones and conditions for land use and design within the zones and adjacent urban growth areas outside of hazard zones.

West Kaua‘i Community Vulnerability Assessment. As part of the West Kaua‘i Community Plan update, the University of Hawai‘i Sea Grant College Program engaged the community in using the Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS) tool to identify vulnerabilities and generate ideas for adapting to change (Figure 12) (University of Hawai'i Sea Grant College Program, 2019). The SLR-XA was used to develop maps and assess vulnerability of community assets. This process, which involved a series of in-depth meetings and field trips for community members and county department staff, interweaves the latest scientific data and climate projections with the knowledge of the community and uses this information to develop adaptation measures. The results of this process were integrated in the visioning portion of the community plan update.

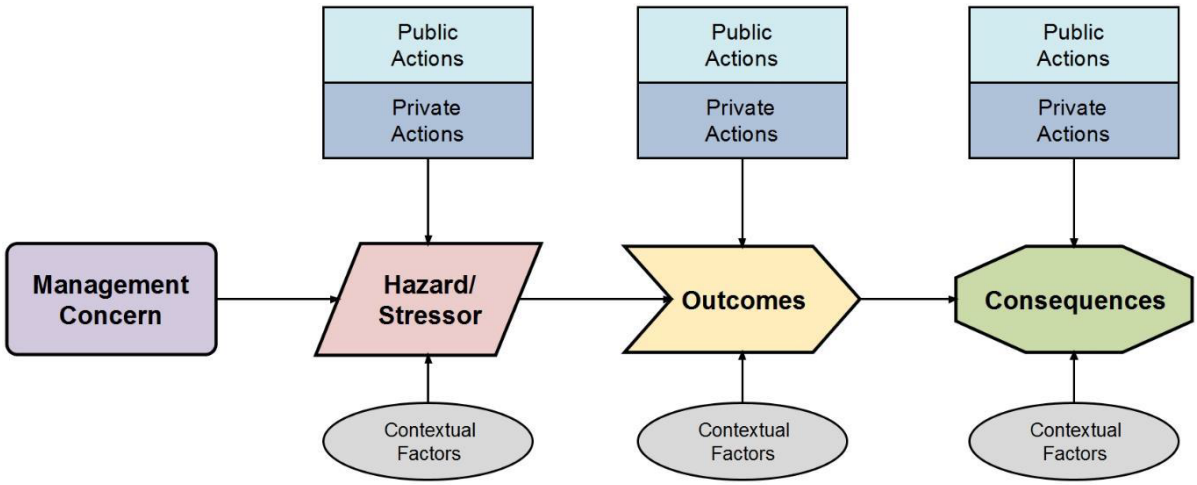


Figure 12. Process diagram for the Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS) tool

→*Return to Recommended Practice A2*

Sector-specific Vulnerability Assessments (A3)

Coastal Roads Vulnerability. The State Department of Transportation completed a vulnerability assessment of state coastal highways in 2019 (Brandes, 2019; Francis et al., 2019). The vulnerability assessment used a Coastal Road Erosion Susceptibility Index (CRESI) that considers beach and coast geomorphologies, erodible land buffer volume, ground slope, coastal ground cover and structures, road base or subgrade, armoring, relative sea-level change rate, shoreline accretion or erosion rate, mean tidal change, and significant wave height as principal factors that determine coastal erosion and road degradation. Coastal roads segments are rated as low, medium, or high susceptibility to structural degradation (Figure 13). Five general categories of adaptation strategies – relocate, protect, accommodate, monitor, and a combined option, were evaluated and assigned to each road segment. While this study was conducted primarily to prioritize roads that needed immediate remedies, it could be used to identify areas for longer-term adaptation, such as realignment and relocation and as input to community planning.

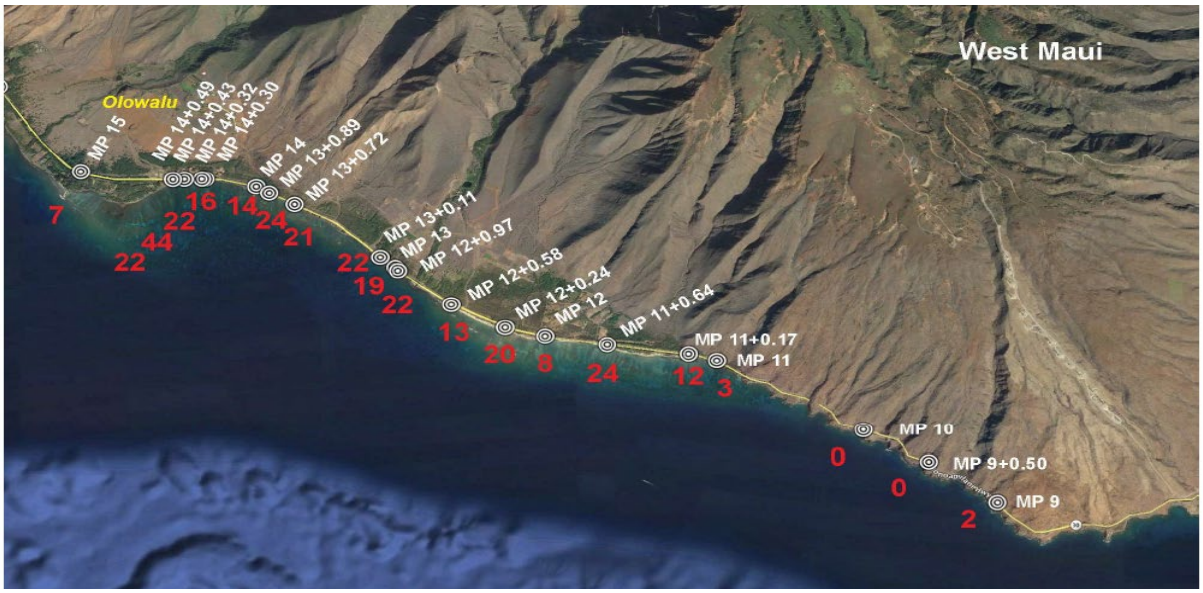


Figure 13. Coastal Road Erosion Susceptibility Index values for Maalaea to Olowalu, Maui (Francis, Brandes, Zhang, & Ma, 2019)

Water Supply Vulnerability. The Honolulu Board of Water Supply assessed vulnerability of water resources to climate change and sea level rise and identified a suite of adaptation strategies to address the range of anticipated changes (Figure 14). This sector-specific vulnerability assessment examined impacts to: (1) fresh water supply with forecasted temperature increases and reduction in precipitation, (2) groundwater quality from salt water intrusion, and (3) coastal water system infrastructure from projected sea level rise (Nakano et al., 2019).

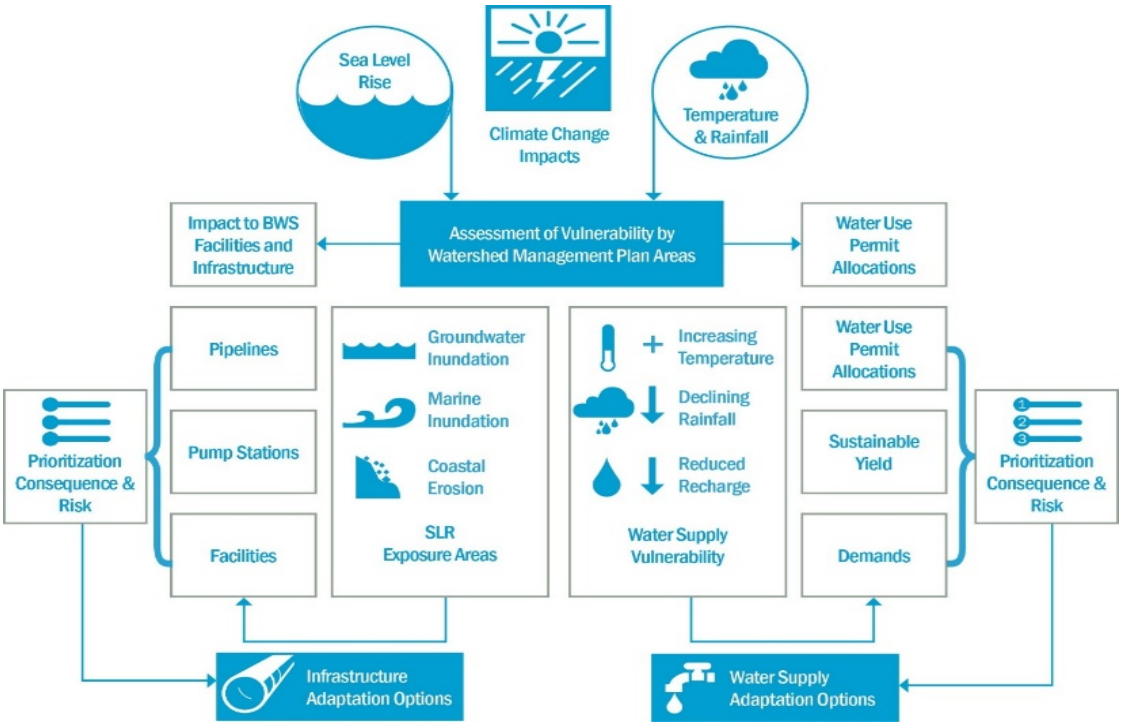


Figure 14. Vulnerability Assessment Approach to Identifying Adaptation Strategies for the Honolulu Board of Water Supply (Nakano, Stephens, Turk, Mukai, & Stultz, 2019).

Considering Design Lifetime of Critical Infrastructure with Climate Adaptation. Infrastructure agencies may utilize the expected design lifetime of infrastructure and timing of planned updates or improvements to implement adaptation measures (Table 4). Much of our existing infrastructure may be at or near its design lifetime providing opportunities for increasing resilience by prioritizing upgrades for the assets with the highest vulnerability based on an assessment. A new Florida law (Statutes 161.551) which became effective July 1, 2021, requires that all publicly financed major construction projects in coastal building zones conduct a Sea Level Rise Impact Projection (SLIP) study. The requirements for conducting the SLIP study are detailed in the new law and include assessing flood inundation and wave action damage risks for the coastal structure over its expected life or 50 years, whichever is less.

Climate Change and Sea Level Rise in Hawaii's Environmental Review Process. New rules for Hawaii's environmental review process (known as HEPA; HAR Chapter 11-200.1) require incorporating climate change and sea level rise considerations in environmental assessments (EA) and environmental impact statements (EIS). Under the new rules, which came into effect on Aug. 9, 2019, climate change and sea level rise were added as administrative criteria for determining "significance" of potential impacts. Agencies must consider whether a proposed action is likely to have a substantial adverse effect on or is likely to suffer damage by being located in a sensitive area such as the SLR-XA. Sea level rise exposure maps should be included in EAs and EISs to demonstrate the potential vulnerability. Further guidance on incorporating climate change and sea level rise may be forthcoming from the State Office of Environmental Quality Control.

Table 4. Considering average life expectancy of select infrastructure types and potential climate-related vulnerabilities in assessing vulnerability of public infrastructure (Gibson, 2017)

Mode	Infrastructure Type	Design Lifetime	Potential Climate-Related Vulnerabilities
Transportation	Paved Roads	10–20 Years	Softening, deterioration, and buckling caused by heat. Scour and erosion caused by flooding and storm surge. Sea level rise inundation. Accelerated corrosion in coastal areas caused by sea level rise. Road closures caused by landslides and washouts during heavy precipitation events. Damage to foundation caused by changes in soil moisture.
	Bridges	50–100 Years	Erosion and scour caused by flooding, storm surges, and sea level rise inundation. Accelerated corrosion in coastal areas caused by sea level rise and saltwater intrusion. Reduced vertical clearance over major waterways caused by sea level rise. Damage to foundation by changes in soil moisture or higher waterway levels.
Energy	Transmission Lines	50 Years	Lower transmission efficiency caused by increased temperatures; peak demand during highest temperatures compounds vulnerability. Wooden utility poles destroyed and damaged in storms or wildfires.
	High-Voltage Transformers	40 Years	Service disruptions caused by more frequent and severe precipitation events, flooding, and wildfires. Lower transmission efficiency caused by increased temperatures.
	Generating Plants/ Substations	35–80 Years 35–45 Years	Inundation of coastal power plants and substations caused by king tides, storm surge, and sea level rise. Service disruptions caused by more frequent and severe extreme heat, precipitation events, flooding, and wildfires.
Water	Reservoirs & Dams	50–80 Years	Lower water availability caused by higher temperatures and droughts in some regions can decrease water supplies and hydropower. More severe precipitation events threaten dam integrity or dam breaching. More frequent and severe wildfires leave ash and eroded sediment in drinking water supplies.
	Treatment Plants/Pumping Stations	60–70 Years	System overwhelmed with storm water resulting from more extreme precipitation events and, in coastal areas, with seawater driven by storm surge. Increased water quality treatment needs during drought periods.
	Drinking Water Distribution/ Storm & Sewage Collection Systems	60–100 Years	Storm water management and collection complicated by more extreme precipitation events and changes in water availability caused by higher temperatures.

Natural Resources Vulnerability. The Hawai'i Sea Level Rise Report provides an initial assessment of vulnerability of natural resources to sea level rise highlighting the potential loss of beaches and changes in size, salinity and other impacts on wetlands. Climate vulnerability and adaption options for 15 coastal habitats and 9 ecosystem services were assessed on each island using a using a collaborative expert elicitation approach in the Hawai'i Islands Climate Vulnerability and Adaptation Synthesis project (Greg R.M. (Editor), 2018). Of the 15 coastal habitats evaluated, eight were assessed as having an overall moderate-high or high vulnerability.

Cultural Resources Vulnerability. Sea level rise vulnerability assessments have been conducted for Hawaiian Homelands and Native Hawaiian cultural and historical resources (Hawai'i Climate Mitigation

and Adaptation Commission, 2017; Kane et al., 2012; University of Hawai‘i Department of Regional and Urban Planning, 2015). The Native Hawaiian Cultural Landscape Approach (Van Tilbrug et al., 2017) provides a framework for gathering information on tangible and intangible cultural and natural heritage resources in an area through research and community engagement. The information gathered using this approach could serve as a basis for establishing a baseline from which to assess vulnerability of cultural resources and identify adaptation strategies (Table 5).

Table 5. Native Hawaiian cultural landscape approach (Van Tilbrug et al. (2017)) with steps 5 and 6 adapted here to support sea level rise vulnerability assessment

1. Identify ahupua‘a (land division usually extending from the uplands to the sea), identify Native Hawaiian Organizations and their kūpuna and cultural practitioners
2. Determine consultation process and develop mutually beneficial assessment design and data management plan
3. Conduct information gathering through oral and written resources based on consultation agreement: ▪ Intangible cultural heritage – information on Akua (gods), Ali‘i (chiefs), kākau (writings), hula (dances), mele (songs), etc. collected through oral and written resources ▪ Tangible cultural heritage - information on Heiau (shrines, places of worship), Iwi kūpuna (burials), cultural deposits, lo‘i (irrigated terraces), etc. collected through oral and written resources) ▪ Natural heritage – information on flora and fauna including native forests and fisheries, etc.
4. Develop a descriptive narrative of a Native Hawaiian Cultural Landscape based on information gathered.
5. Assess vulnerability of the Native Hawaiian Cultural Landscape, including heritage resources, using the sea level rise exposure area with 3.2 feet of to sea level rise
6. Identify potential adaptation options through consultation processes with Native Hawai‘i Organizations and their kūpuna and cultural practitioners

→***Return to Recommend Practice A3***

Uses of the Results of Vulnerability Assessments (A4)

Recent and Ongoing Community Outreach for Plan Updates. Community engagement is an essential part of the community planning process. Counties are utilizing sea level rise and coastal hazards information and maps, as well as innovated outreach programs, to develop a shared understanding of risks and inform development of adaptation actions and policies.

- **Hawai‘i County General Plan.** During the public review of the August 2019 Draft General Plan, the SLR-XA was included in outreach materials including printed bulletin boards at large “speak out” events as well as included in focused discussion presentations addressing natural resources, hazards, and climate change.
- **West Maui Community Plan.** The previous West Maui Community Plan from 1996 did not explicitly address coastal hazards. Recognizing coastal changes that have occurred since then along with timely information on sea level rise in Hawai‘i, the West Maui Community Plan update process emphasized coastal hazards, climate change, and sea level rise. The process began with a Technical Resource Paper targeted to the community to document existing and future coastal conditions. This was followed by a workshop dedicated to coastal resilience as well as open houses with the opportunity for the public to interact with SLR-XA maps and subject matter experts. Finally, community design workshops provided the opportunity to examine sub-areas of West Maui and draft visions for the community based on many considerations, including sea level rise.

Community members discuss sea level rise exposure maps for the West Kaua‘i Community Plan update. Source: Ruby Pap

- **Honolulu Primary Urban Center Development Plan.** The City and County of Honolulu conducted multiple community outreach activities on sea level rise utilizing information from the white paper on sea level rise and climate change, developed at the beginning of the planning process and shared on the county website. On-line and mail-in surveys were used to gauge community concerns about sea level rise and support for a range of adaptation strategies and policies. Open houses and listening sessions were held to present the results of the white paper with experts available to address community questions and to discuss growth and development options considering sea level rise. The County also conducted 16 sea level rise "pop-up" sessions to further reach stakeholders in public spaces where they live, work, and gather and discuss vulnerabilities and policy options for adapting to sea level rise. As part of these pop-ups community members were asked to provide feedback on a range of potential sea level rise adaptation strategies (Figure 15).

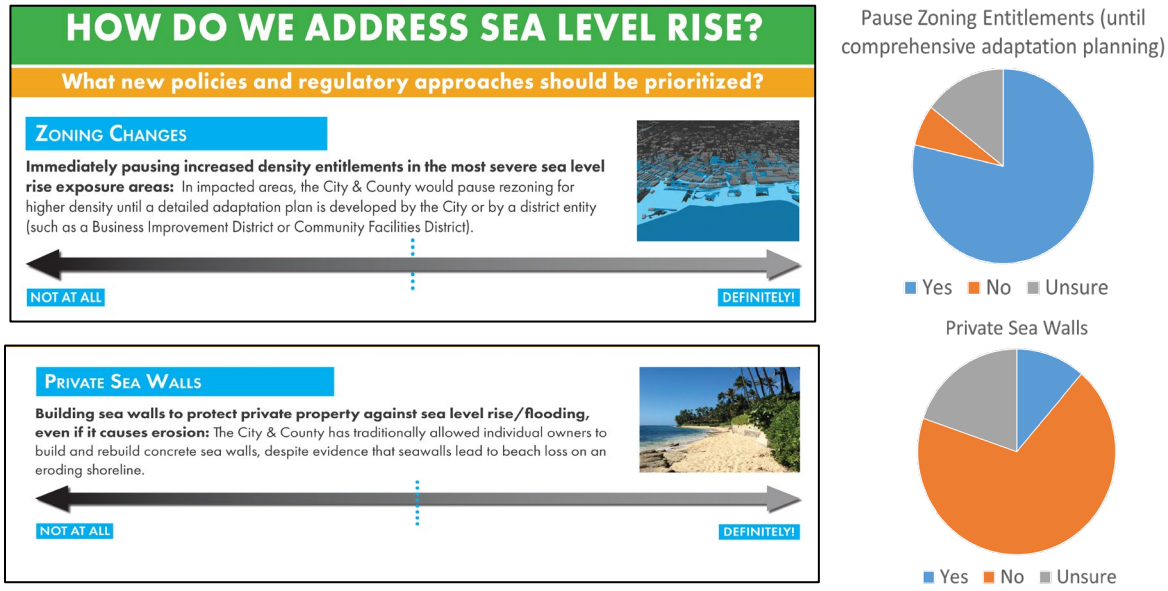


Figure 15. Example results of voting on policies to address sea level rise (Honolulu Department of Planning and Permitting)

- **West Kaua'i Community Plan Outreach**. Building off of the West Kaua'i Community Vulnerability Assessment, the County of Kaua'i conducted open houses and breakout sessions in each town in the community that included maps and discussion integrating hazards and sea level rise with other important topics such as housing and infrastructure. The results of these community sessions informed the policies and actions in the community plan.
- **Community Sea Level Rise Monitoring and Engagement.** Programs like the Hawai'i and Pacific Islands King Tides Project, which collects photos of coastal flooding impacts during the highest tides of the year ("king tides"), has be instrumental in documenting and educating communities and decision-makers on the impacts of sea level rise (University of Hawai'i Sea Grant College Program, 2016). The project engages community to document high water level events using smart phones and a web-based platform to better understand localized impacts of sea level rise and other coastal hazards. King tides provide a window into our future, showing how increasing high tide flooding will

impact low-lying coastal areas decades ahead of projected global mean sea level rise benchmarks. For example, king tides photographs were included in outreach materials for the Honolulu Primary Urban Center Development Plan update (Figure 16). Similar king tides citizen science programs are active around the world (kingtides.net).

King tide flooding at Waikīkī
Source: Hawai'i and Pacific Islands King Tides Project.

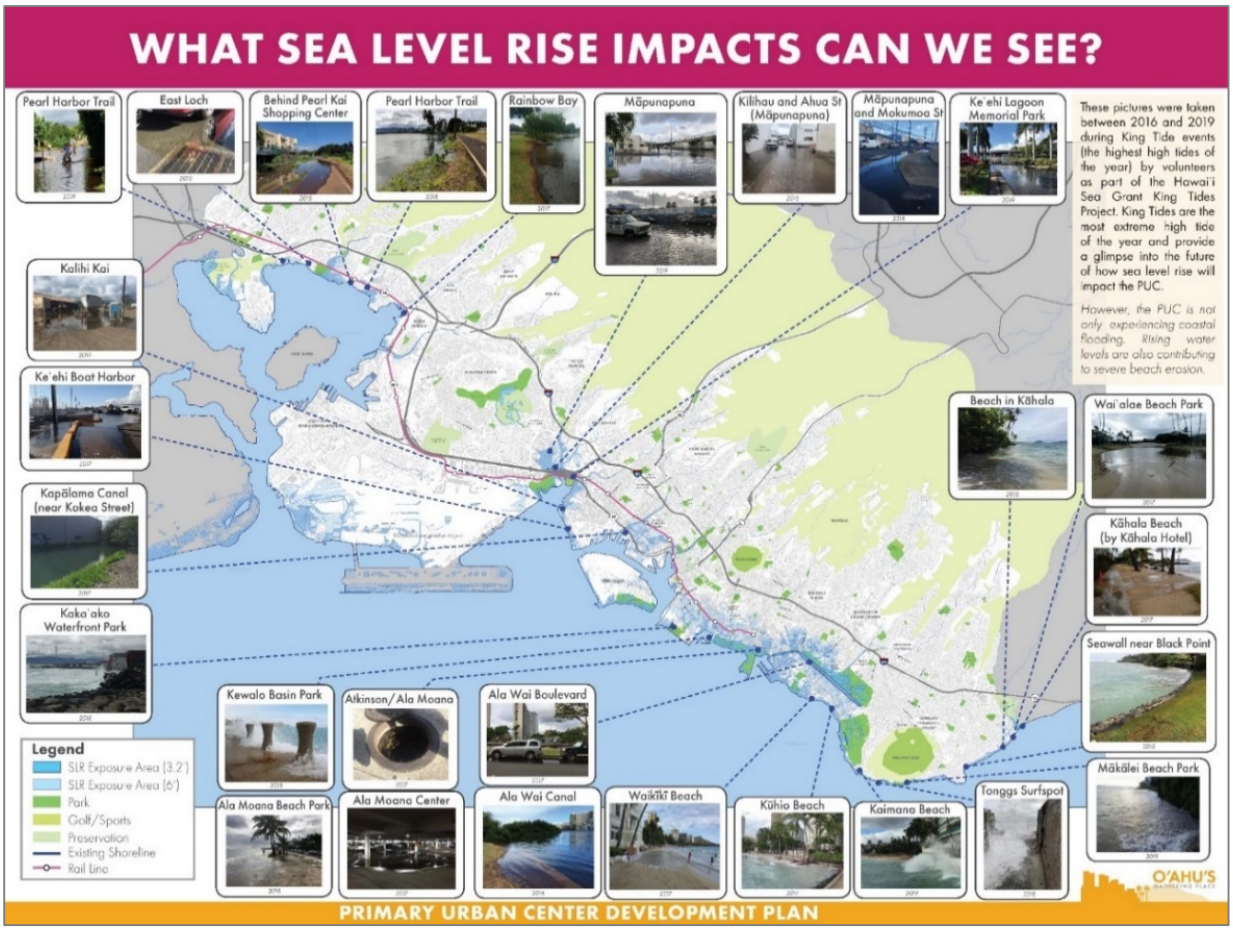


Figure 16. Poster used in community planning meetings showing impacts of sea level rise (City & County of Honolulu Department of Planning and Permitting; Hawai'i and Pacific Islands King Tides Project)

Policies and Adaptation Actions in Community Plans. Vulnerability assessments provide essential information and data to develop and defend new policies and regulations. Local planners have a fairly robust toolbox of planning, regulatory, spending, and market-based tools to implement sea level rise adaptation strategies (e.g., Codiga, Hwang, & Delaunay, 2011; Codiga & Wager, 2011; Colorado State Department of Local Affairs and University of Colorado Denver; Grannis, 2011). Even before the release of the Hawai'i Sea Level Rise Report, the counties began incorporated policies that encouraged relocation or discourage development and critical infrastructure inside of areas vulnerable to coastal hazards and sea level rise before the release of the Hawai'i Sea Level Rise Report (Table 6).

Table 6. Example policies from county general and community plans in Hawai'i that address coastal hazards and sea level rise

Sea Level Rise-Informed Policy Objectives	Example Policies Addressing Coastal Hazards and Sea Level Rise from Recent County General and Community Plans
Use best available information and regular policy review to support adaptive management	▪ Conduct historical erosion analysis to determine rates of beach erosion and use results to determine setback calculations that also factor in incremental effects of sea level rise[1] ▪ Support the integration of science-based coastal hazards information into land use planning and permitting, including revision of the Special Management Area boundary[1]
Address vulnerability of critical infrastructure to coastal hazards and sea level rise	▪ Encourage the location or relocation of all critical infrastructure, facilities, and development out of evacuation and inundation zones vulnerable to coastal hazards[1] ▪ Consider multiple scenarios of sea level rise and associated flooding, wave inundation, and erosion impacts when developing and approving Capital Improvement Projects[2] ▪ Prioritize an alternate road or landward realignment to address vulnerability to tsunami and coastal hazards and sea level rise[2]
Direct development away from areas exposed to coastal hazards and sea level rise	▪ Restrict development in areas that are prone to natural hazards and disasters with sea-level rise[3] ▪ Study viable options for transitioning commercial and population centers away from the threat of sea level rise and coastal inundation[1] ▪ Modify shoreline setbacks as needed to protect the natural shoreline, lessen the impact to coastal processes, and address sea level rise[6] ▪ Minimize redevelopment within coastal hazard areas and direct future growth away from high risk areas[2]
Support preservation and landward migration of beaches, wetlands, and other coastal habitats	▪ Designate coastal areas as open space to be preserved, protected, and connected to the rich network of natural and cultural resources in the region[5] ▪ Protect undeveloped beaches, dunes, and coastal ecosystems, and restore natural shoreline processes[3] ▪ Support the protection and restoration of natural systems, such as wetlands and dunes, for flood mitigation and climate change adaptation[1] ▪ Prohibit the use of shore armoring structures, considering alternative measures such as beach replenishment[6] ▪ Consider shoreline lands and protected areas as candidates for acquisition by state or county funds[2]
Identify opportunities to avoid repetitive losses and support resilient disaster redevelopment	▪ Develop a Post-Disaster Recovery and Reconstruction Plan that will ensure Maui's resilience to coastal hazards[4]

[1]Moloka'i Community Plan (2018); [2]Līhu'e, Kaua'i Community Plan (2015); [3]Maui County-wide Policy Plan (2010); [4]Maui Island Plan (2012); [5]Ka'ū Community Development Plan (2017); [6]Ko'olaupoko Sustainable Communities Plan (2017)

Sea Level Rise Hazard Overlays. Hazard overlays based on the results of a vulnerability assessment can be an important tool to inform the public about risks and regulate land use and development to reduce vulnerability in high hazard areas. The Hawai'i Sea Level Rise Report recommended that counties consider adopting the SLR-XA as a hazard overlay for planning and to identify additional regulations. A number of steps have been taken by Hawaii's counties to implement that recommendation:

- **Hawai'i County Coastal Hazards Overlay.** The County of Hawai'i incorporated an analysis of high-risk hazard areas including the SLR-XA as a basis for defining policies in the draft 2040 General Plan update. These policies include establishing natural hazard overlay zones with appropriate conditions for land use, siting, and design; identifying redevelopment opportunities within or adjacent to Urban Growth Areas but outside of high-risk hazard areas; and discouraging infrastructure investments and incentivizing infrastructure expenditures outside high risk hazard areas.
- **Kaua'i ST-CE Land Use District and Zoning Overlay.** The County of Kaua'i is proposing to establish a new Special Treatment – Coastal Edge (ST-CE) land use District in the West Kaua'i Community Plan and an accompanying zoning overlay in the Comprehensive Zoning Ordinance (County of Kaua'i 2020) New standards will apply to properties that are located makai (seaward) of a public access roadway and identified as particularly vulnerable to storm impacts, erosion, passive flooding, and wave inundation from sea level rise. The proposed zoning amendment will result in changes that govern the permitting process by which the development of new structures or permissibility of certain uses will be reviewed and approved.
- **Maui Special Management Area and Setback Policies Updates.** Maui County is proposing revisions to the Special Management Area (SMA) and Shoreline Rules for the Maui Planning Commission based in part on map data from the Hawai'i Sea Level Rise Report and Viewer. Among other things, proposed changes in the SMA rules include incorporating the sea level rise exposure area and impacts in project assessments. The county's proposed shoreline setback rules would use the coastal erosion hazard line with 3.2 feet of sea level rise in the Hawai'i Sea Level Rise Viewer as a basis for updated shoreline setbacks.
- **Norfolk, Virginia Coastal Resilience Overlay.** A Coastal and Upland Resilience Overlays and Resilience Quotient System have been established in Norfolk, Virginia (City of Norfolk, 2019) to improve resilience of new development located in areas that are vulnerable to flooding. Floodplain and Coastal Hazard Overlay areas must meet certain requirements including elevating homes and utilities; using only salt-tolerant and native species for landscaping and incorporation of pervious surfaces for infiltration of stormwater. Through the Resilience Quotient System, developers earn points for incorporating resilient measures to support plan approval and permitting. Upland Resilience Overlay area are targeted for transit-oriented, walkable, and bikeable neighborhoods.
- **Boston Flood Overlay District.** The Climate Ready Boston program established a zoning overlay district based on modeling the 1 percent annual chance flood risk in the year 2070 with 40" of sea level (Figure 15) (Boston Planning and Development Agency, 2019). Coastal flood resilience design

guidelines were developed to help Boston property owners and developers make informed, forward-looking decisions about flood protection for existing buildings and new construction.

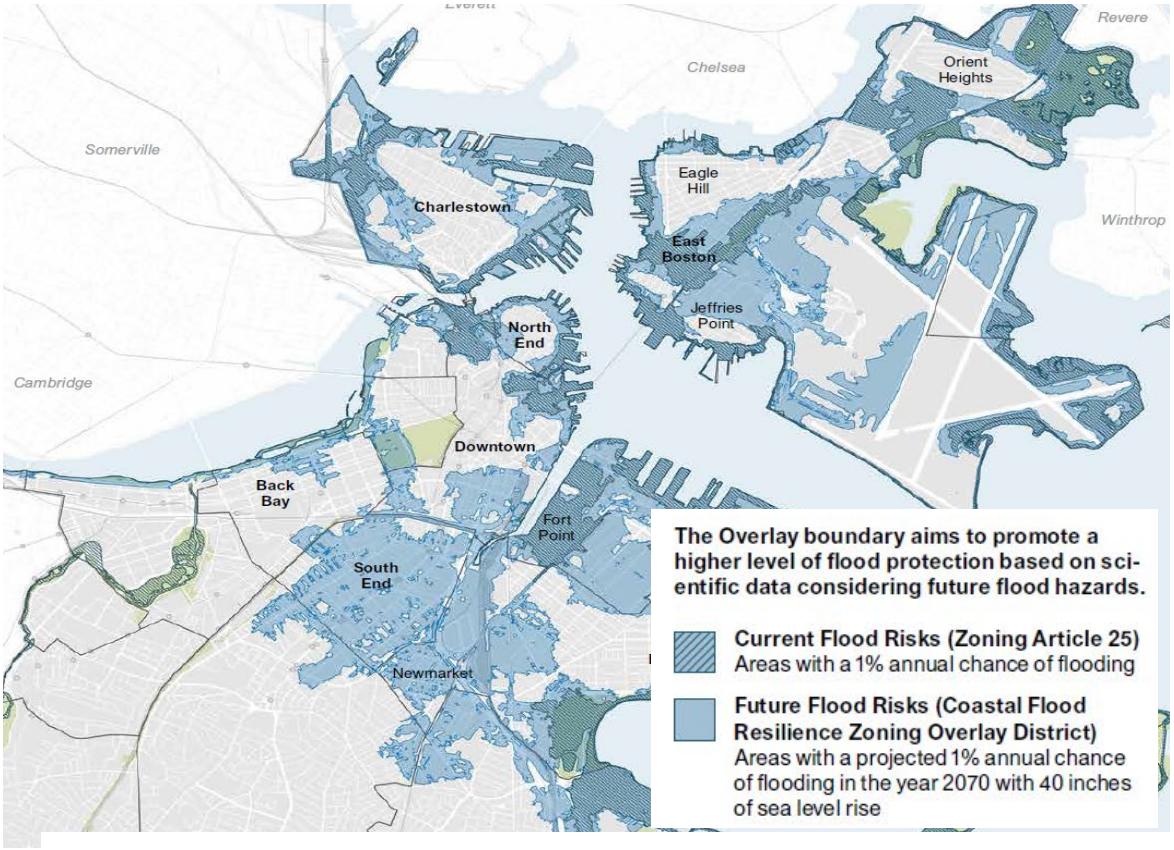


Figure 17. Boston Coastal Resilience Overlay based on 1% annual chance of flooding with sea level rise

- **Florida Adaptation Action Areas.** Florida's Community Planning Act (CPA) was revised in 2011 to make significant changes to the State's growth management laws, including the addition of optional Adaptation Action Areas within a local government's comprehensive plan (South Florida Regional Planning Council, 2014). Local governments may pursue adaptation planning strategies within the area and prioritize funding for appropriate infrastructure improvements. Strategies within the area include post-disaster mitigation opportunities to reduce vulnerability to coastal flooding, while simultaneously addressing the long-term impacts of sea level rise.

→*Return to Recommended Practice A4*

Examples and Resources for Guidance B

Community Visioning (B1)

Managed Retreat. Managed retreat will become an increasingly necessary sea level rise adaptation strategy in many communities and should be weighed with other strategies in the visioning process, especially for the most vulnerable areas where preservation of beaches, wetlands, anchialine ponds, and other natural resources are identified as priorities. Managed retreat is a challenging concept and has been the focus of much discussion as planners begin to grapple with how to implement this strategy. In support of these discussions, the State Office of Planning conducted a study titled Assessing the Feasibility and Implications of Managed Retreat Strategies for Vulnerability Coastal Areas in Hawai‘i (Hawaii State Office of Planning, 2019). The study discusses environmental, social, and economic considerations for four hypothetical locations for a range of development types in Hawai‘i that may consider retreat due to sea level rise and other coastal hazards (Figure 17).

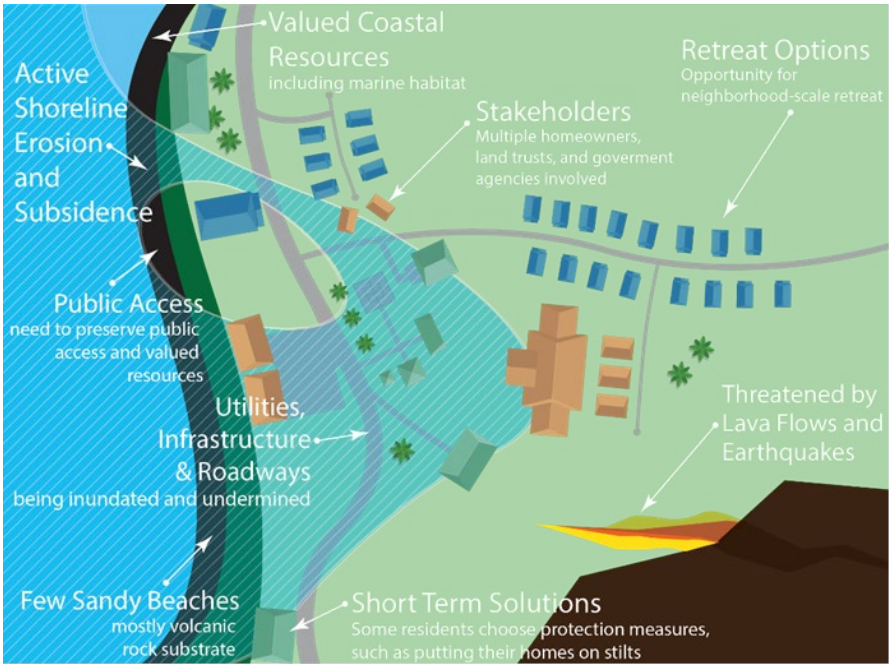


Figure 18. Environmental, social, and economic considerations for a managed retreat scenario for a single family residential communities in Hawai‘i (Hawaii State Office of Planning, 2019)

Visioning Sea Level Rise Adaptation for Urban Honolulu. The City and County of Honolulu used maps showing the SLR-XA and proposed growth areas to help the community envision a future with sea level rise as part of the Honolulu Primary Urban Center Development Plan update (Figure 18). During multiple community outreach events, community members were invited to indicate where growth should occur including consideration of sea level rise exposure. Maps were developed for different portions of the community planning area which extends across dense urban areas and less dense suburban neighborhoods.

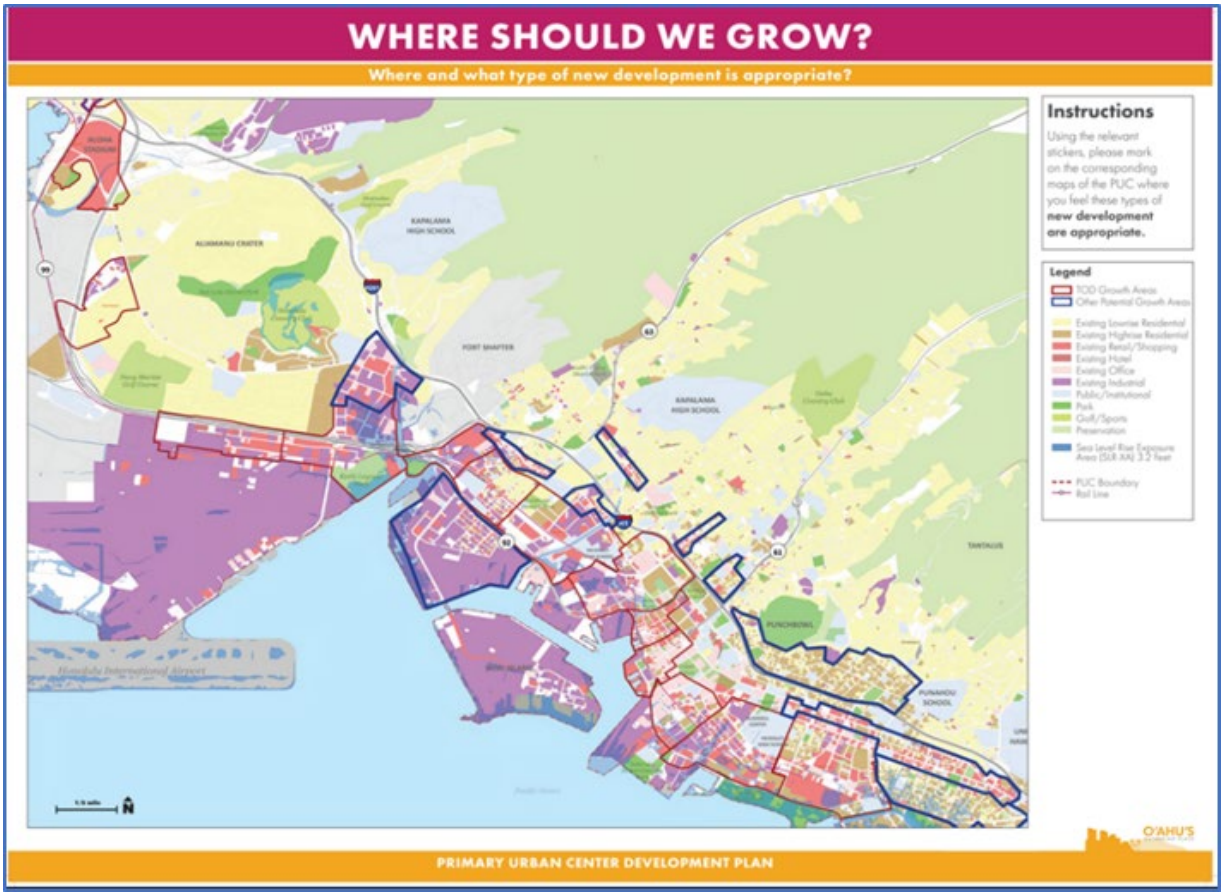


Figure 19. Example map for the Honolulu Primary Urban Center Development Plan update showing the Sea Level Rise Exposure Area with 3.2 feet of sea level rise in relation to potential growth areas (Honolulu Department of Planning and Permitting)

50-year Vision for Flood Adaptation in Louisiana. Visioning, as part of Louisiana's Strategic Adaptations for Future Environments (LA SAFE), a statewide resilience policy framework (LA SAFE, 2018), uses three risk zones and associated adaptation strategies to guide the development of a 50-year community vision (Figure 19):

- Areas projected to experience in excess of 14 feet of flood inundation in a 100-year storm event within 50 years from now are resettlement zones. In this zone, the strategy is to depart from the most vulnerable geographies.
- Areas projected to experience between 3 feet and 14 feet of flood inundation in a 100-year storm event within 50 years from now are retrofit zones. In this zone, the strategy is to fortify economic assets and maintain a community development footprint to service those assets.
- Areas projected to experience less than 3 feet of flood inundation in a 100-year storm event within 50 years from now are reshaping zones. In this zone, the adaptation strategy is to maximize underdeveloped areas – in which minimal risk is projected to catalyze thoughtful, high quality community development in higher ground areas.

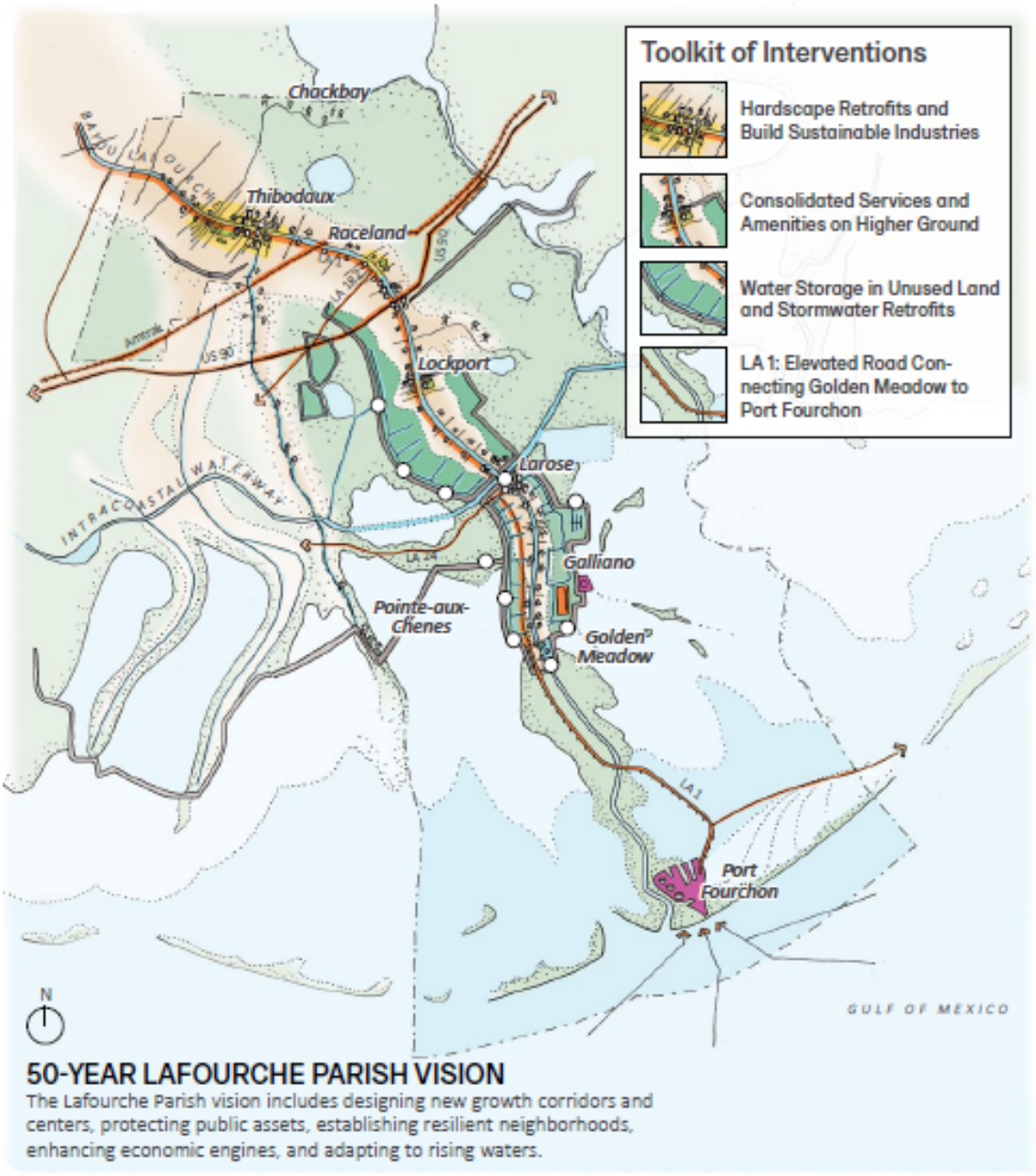


Figure 20. 50-Year vision for adapting to future flood hazards for Lafourche Parish, Louisiana, including "resettlement, retrofit, and reshaping zones" (Louisiana Office of Community Development and the Foundation for Louisiana, 2019)

Nature-Based Adaptation Strategies in San Francisco Bay. A Sea Level Rise Adaptation Framework used by Marin County, California prioritizes visioning and adaptation strategy development focused on nature-based approaches (Figure 20) (Point Blue Conservation Science, 2019). Three hypothetical visions were developed as part of a case study included strategies to: (1) hold the line, (2) buffer with public open space, and (3) maximize habitat/minimize risk. These visions consider societal and ecological values and were developed to provide a range of strategies for potential nature-based adaptation measures.

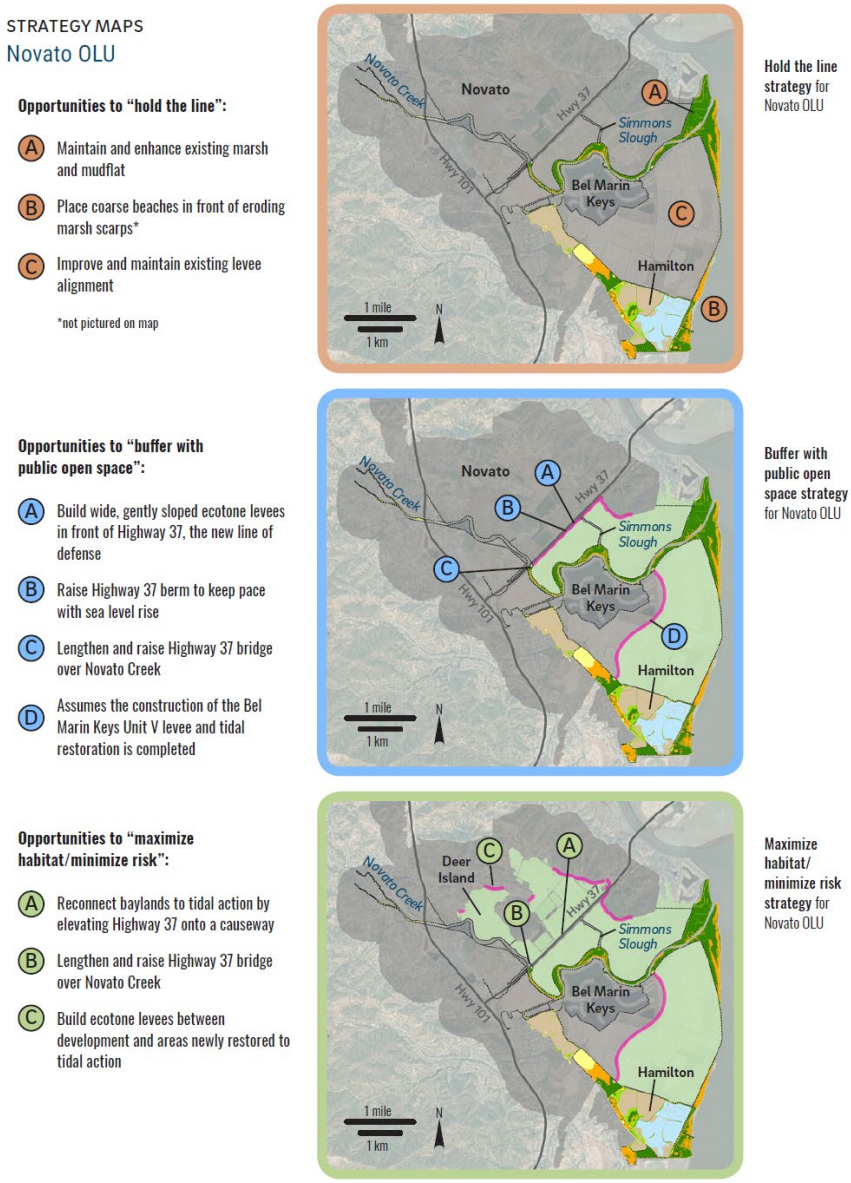


Figure 21. Examples of nature-based adaptation strategies for sea level rise at Novato, California (Point Blue Conservation Science & San Francisco Estuary Institute, 2019)

→*Return to Recommended Practice B1*

Sea Level Rise Informed Land Use and Development Alternatives (B2)

West Maui Community Plan Development Alternatives. County plans are integrating the results of sea level rise vulnerability assessments in creating and analyzing land use and development alternatives (County of Maui, 2019). The draft West Maui Community plan explores four alternatives for addressing growth with sea level rise: Infill, Expansion, Centers, and Disperse Growth (Figure 21).

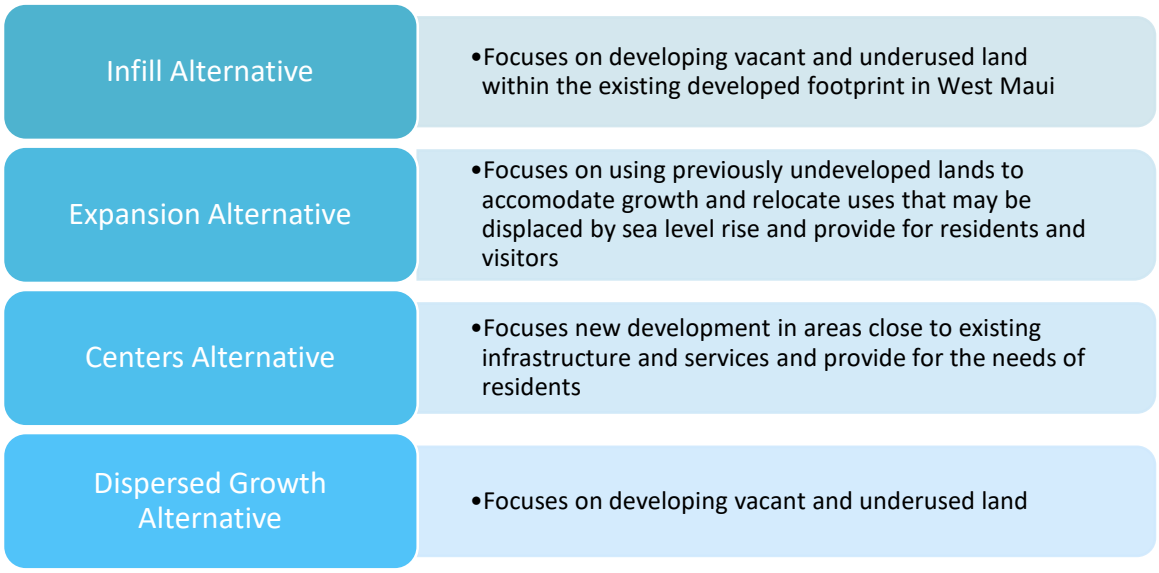


Figure 22. Sea level rise-informed land use and development alternatives in the draft West Maui Community Plan (County of Maui, 2019)

West Kaua'i Community Plan Adaptation Strategy. A community-wide adaptation strategy for West Kaua'i was developed as part of the draft community plan update that incorporates both new growth and existing development (County of Kaua'i, 2020). Three key elements of the proposed adaptation strategy include:

- Directing new growth away from the most vulnerable areas by locating new communities inland and at higher elevations in areas located outside the floodplain and sea level rise exposure areas. These areas have the potential to not only meet the growth projections for the region but provide areas for the potential retreat and relocation of existing development with sea level rise.
- Increasing the resiliency of the existing built environment to sea level rise through the designation of a Special Treatment – Coastal Edge (ST-CE) Land Use District and accompanying zoning overlay which defines areas especially vulnerable to sea level rise as those properties exposed to 3.2 feet of sea level rise and located between the shoreline and a public thoroughfare. These proposed areas would be subject to additional permit scrutiny.
- Supporting green infrastructure, low impact development, and flood proofing for vulnerable development that may be appropriate to keep in place in the near term but will need to be re-evaluated in the future with higher sea level rise.

Analyzing Development Alternatives. Scenario planning software can be used to develop, analyze, and compare costs and benefits of different land use and development alternatives. The City and County of Honolulu used Urban Footprint to analyze tradeoffs of sea level-rise informed land use alternatives for the Honolulu Primary Urban Center Development Plan update. The County of Hawaii used CommunityViz to analyze growth and development alternatives informed by sea level rise and other hazards. Kamehameha Schools, the largest landowner in Hawai'i, used the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) tool to analyze ecosystem-service tradeoffs into land-use decisions (Goldstein et al., 2012).

County of Hawaii Scenario Planning. Through their General Plan update process, the County of Hawai'i was able to analyze a variety of geospatial data at various community scales with the use of Community Viz. One of the most powerful applications of Community Viz is the land suitability analysis: the process of determining which locations are best suited for certain uses. The CommunityViz Suitability Tool allows the user to set up a weighted suitability analysis (sometimes referred to as multivariate suitability). Suitability combines multiple factors having to do with location – such as proximity, overlap, slope, or value – and comes up with a combined rating or score for each place (i.e., feature) on the map. "Weighted" suitability analysis places more importance on some factors and less on others, so that the combined rating more fairly represents the relative importance of each location criterion. This technique was used for a County of Hawai'i Conservation and Urban Suitability analyses, which used best-available GIS information to represent diverse themes including native habitats, coastal resources, hazards, culture, history and agriculture. The SLR-XA was included in the hazards GIS data. This resulted in a weighted conservation score that was then compared with another scoring system that measured suitability for urban development. Areas that had both high conservation scores and high urban scores were then highlighted to identify areas of potential conflict.

→***Return to Recommended Practice B2***

Disaster Redevelopment Alternatives (B3)

Waikīkī Redevelopment Scenario. A conceptual disaster redevelopment scenario was created as part of a Waikīkī Pre-Disaster Recovery Planning Project (Figure 22) (National Disaster Preparedness Training Center 2017). A broad cross-section of stakeholders in Waikīkī were engaged through workshops and meetings to identify ways to improve Waikīkī through redevelopment. A scenario like this, developed with community input, could serve as an initial vision to be included in a community plan and for more comprehensive post-disaster recovery preparedness planning.

Figure 23. Example conceptual disaster redevelopment scenario for Waikīkī (National Disaster Preparedness Training Center, 2017)

Hilo Tsunami Redevelopment. The redevelopment of Hilo, Hawai‘i after two devastating tsunamis serves as an enduring example of how a community can implement transformative land use and development using disasters as opportunities to mitigate future hazards (U.S. Indian Ocean Tsunami Warning System Program, 2007). While it took some time and was not without controversy, the Hilo Downtown Development Plan was completed after a devastating tsunami in 1960. The plan led to major changes in redevelopment of the area (Figure 23) and identified safe areas to build based on inundation zones from 1946 and 1960 tsunamis that severely damaged the waterfront industrial area. A large area of former industrial and commercial development near the shoreline was turned into floodable parkland as a nature-based buffer for the community. All new buildings in tsunami impact areas were required to conform to newly adopted urban design and building standards. By doing this, Hilo reduces the risk of repetitive loss damages.

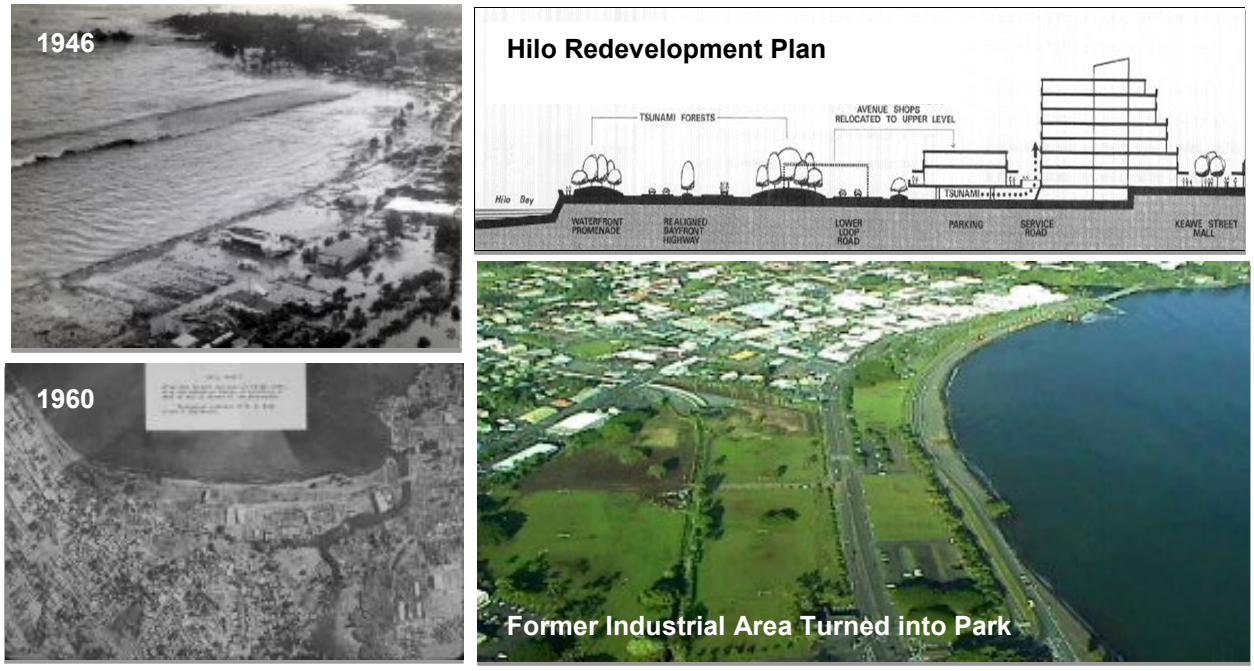


Figure 24. Hilo redevelopment plan after tsunami in 1946 and 1960.

Maui Disaster Reconstruction Guidelines. The County of Maui developed post-disaster reconstruction guidelines and protocols designed to conserve sensitive coastal ecosystems while also streamlining the repair and reconstruction of homes, businesses, structures and private property (County of Maui, 2015). The guidelines provide an approach for post-disaster permit processing based on level of damage, type of structure, and type of coastal environment (Figure 24).

Disaster Recovery Preparedness. The Guidance for Disaster Recovery Preparedness in Hawai‘i (Courtney et al., 2019) provides recommendations and model resources to assist counties in taking advantage of windows of opportunity to improve community resilience provided by a disaster event. Disaster recovery preparedness includes activities to define a recovery management organizational structure as well as process and protocols for recovery and reconstruction established before a disaster event to set the stage for streamlined and resilient recovery (Figure 25). The County of Hawai‘i is in the process of developing a disaster recovery framework using a model resource in the Disaster Recovery Preparedness Guidance and lessons learned in the recovery process from the 2018 Kīlauea eruption.

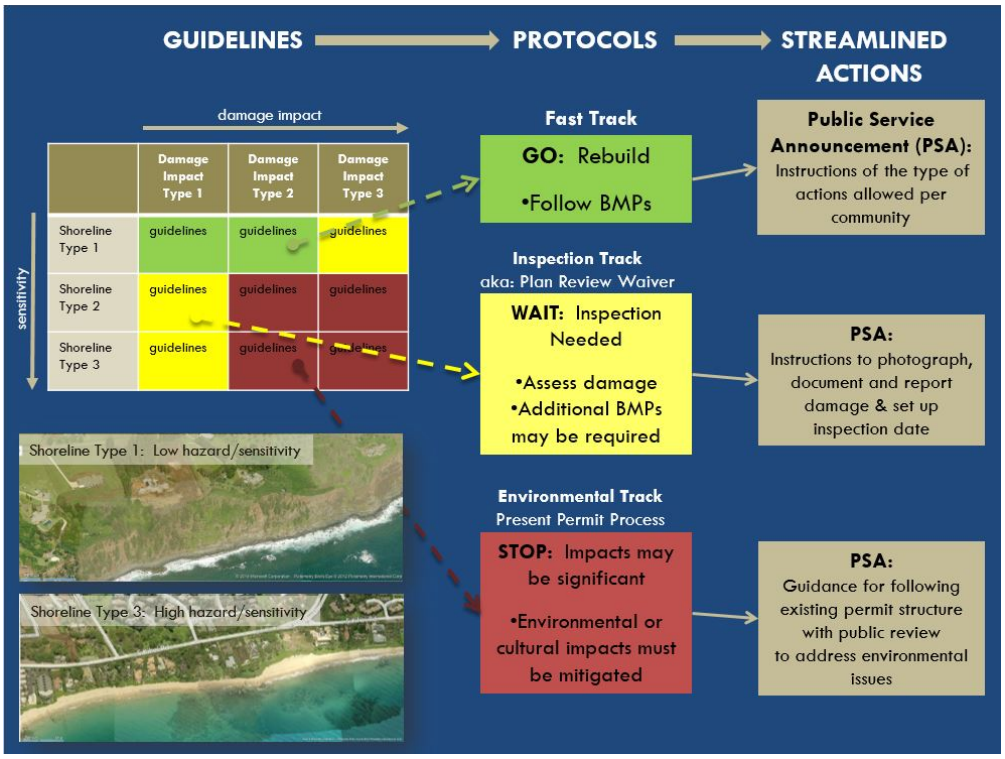


Figure 25. Potential post-disaster permit processing that supports resilient disaster reconstruction (County of Maui, 2015)

Figure 26. Disaster recovery preparedness as part of the county planning and implementation framework (adapted from (FEMA, 2017)

Disaster Redevelopment and Hawaii Urban Renewal Law. Counties should review the Hawai'i Urban Renewal Law (HRS Title 6 Chapter 53) as part of their disaster preparedness activities and identify opportunities to put in place the authority for redevelopment before a disaster strikes. The law provides broad authority to counties to plan and implement urban renewal and redevelopment especially in disaster areas (§53-7) and even provides special consideration for areas that have been certified by the council of a county to be in the need of renewal, redevelopment, or rehabilitation as a result of a seismic wave, flood, fire, hurricane, earthquake, storm, volcanic activity, explosion, or other catastrophe, natural or of human origin. It also provides all of the rights, powers and privileges to these redevelopment agencies in preparing, planning, financing, acquisition, and disposal of real property, and the execution generally of an urban renewal project for disaster areas. Under this law, counties have the authority to declare blighted areas for redevelopment and establish a redevelopment authority to prepare and implement redevelopment plans and projects. In the context of disaster recovery and reconstruction, blighted areas are defined broadly and include those areas which exhibit unsafe conditions or the existence of conditions which endanger life or property by fire or other causes; or any combination of these factors or conditions detrimental to the public health, safety, and welfare.

New York Reconstruction Plans. The New York Rising Program encourages communities to conduct planning for the future of a community after a major disaster through the development of a Community Reconstruction Zone Plan (State of New York, 2013). This plan is intended to guide rebuilding, resilience and economic development and position the community to receive implementation funds.

Florida Pre-Disaster Recovery Planning. In Florida, pre-disaster planning for resilient recovery allows local officials to make more effective use of the windows of opportunity after a disaster to integrate hazard mitigation and climate adaptation into the recovery process (State of Florida Department of Economic Opportunity Division of Emergency Management, 2018).

→*Return to Recommend Practice B3*

Examples and Resources for Guidance C

Plan and Policy Integration (C1)

State Ocean Resources Management Plan Coordination. The Ocean Resources Management Plan (ORMP), a State mandated plan, works to resolve coastal problems not adequately addressed by existing laws and rules. The Hawai'i Office of Planning - Coastal Zone Management (OP-CZM) Program is the lead agency to coordinate the Plan's development and implementation (Hawaii Revised Statutes (HRS) § 205A-62(1)) and collaborates with an extensive network of county, state, and federal partners with coastal management responsibilities from mauka to makai. In seeking to resolve coastal issues, the ORMP and its network of partners regularly meet as a forum for the sharing and refining of best practices, policies, and guidelines such as development of the Climate Change Priority Guidelines. The 2020 ORMP identifies three Focus Areas for the planning horizon of 2020-2030. Focus Area I is 'Development and Coastal Hazards', which was established in recognition of the need to 'Develop a statewide integrated shoreline management strategy to address the compounding impacts to Hawaii's shorelines of coastal development, climate change and sea level rise, erosion, and other chronic coastal hazards'.

Hawai'i County Plan Alignment. The County of Hawai'i is capitalizing on opportunities to align policies to improve community resilience following the 2018 Kīlauea Volcano eruption through three ongoing planning efforts: a Kīlauea Strategic Recovery Plan, a General Plan update, and Multi-hazard Mitigation Plan update. A volcanic risk assessment was conducted which delineates volcanic high hazard areas and additional natural high hazard areas including coastal areas exposed to 6 feet of sea level rise. This multi-hazards overlay zone is being used to develop policies and projects for the county's network of plans (Figure 27). The 2040 General Plan policies specify reducing development in identified high risk hazard areas. The County is also incorporating lessons learned from the first 10-15 years of implementing Community Development Plans. These plans were enabled by the 2005 General Plan, but many of the details regarding implementation of the plans were not articulated. Per discussion with County staff, this led to some inconsistencies with policies within these plans and sections of the County codes. Moving forward the County intends to more clearly articulate the Community Development Plan authority, scope, purpose, and implementation. In cases where amendments to the County code are prioritized in the Community Development Plans, it would be ideal to have the code amendments as companions to the plans and adopted concurrently to avoid future conflicts.

Honolulu Plan Alignment. Actions and policies are being aligned at Honolulu City & County through ongoing updates to the Honolulu Primary Urban Center Development Plan, O'ahu Resiliency Strategy, and Board of Water Supply's Watershed Masterplan. Coordination between watershed plans and community plans is especially critical in Hawai'i where marine, groundwater, and stormwater flooding converges on low-lying coastal plains. The City is discussing a "one-water" collaboration framework and draft ordinance to align and coordinate polices and management of water resources, stormwater management, and sea level rise adaptation (City and County of Honolulu Climate Change Commission, 2020). The City Office of Climate Change, Sustainability, and Resilience has been given responsibility for future hazard mitigation plan updates and integrating the results into the City's Resiliency Strategy and other plans.

Figure 27. Network of County of Hawai'i plans being aligned to build community resilience to sea level rise, volcanic, and other natural hazards

Plan Integration Tools. Tools are available to support the review and alignment of plan, policies, and projects. Following are two examples:

- The Community Resilience: Implementation and Strategic Enhancements (C-RISE) Local Assessment Tool helps communities approach hazards and risks comprehensively; and assess and refine policies and regulations in a way that improves resilience and helps achieve desired community outcomes (U.S. Environmental Protection Agency and FEMA, 2017). The tool works by assessing two critical elements of building resilience: (1) the "how" – once identified, resilience-enhancing measures can be successfully integrated into existing land use laws, building codes, and planning policies; and (2) the "what" – gaps in policies and regulations that support resilience.
- The Plan Integration for Resilience Scorecard (U.S. Department of Homeland Security, 2017) outlines an approach that counties may wish to undertake to spatially evaluate networks of plans to reduce hazard vulnerability. Instead of planning in isolation, the Scorecard reveals spatial incongruities and policy conflicts in networks of plans by mapping and overlaying policies in planning districts with hazard zones (Figure 28). The Scorecard can be used to: (1) identify incongruities within networks of plans, (2) integrate and improve local plans in ways that reduce losses from hazard events, and (3) provide communities developing new plans or updating existing plans with a guidance framework to reduce future hazard exposure.

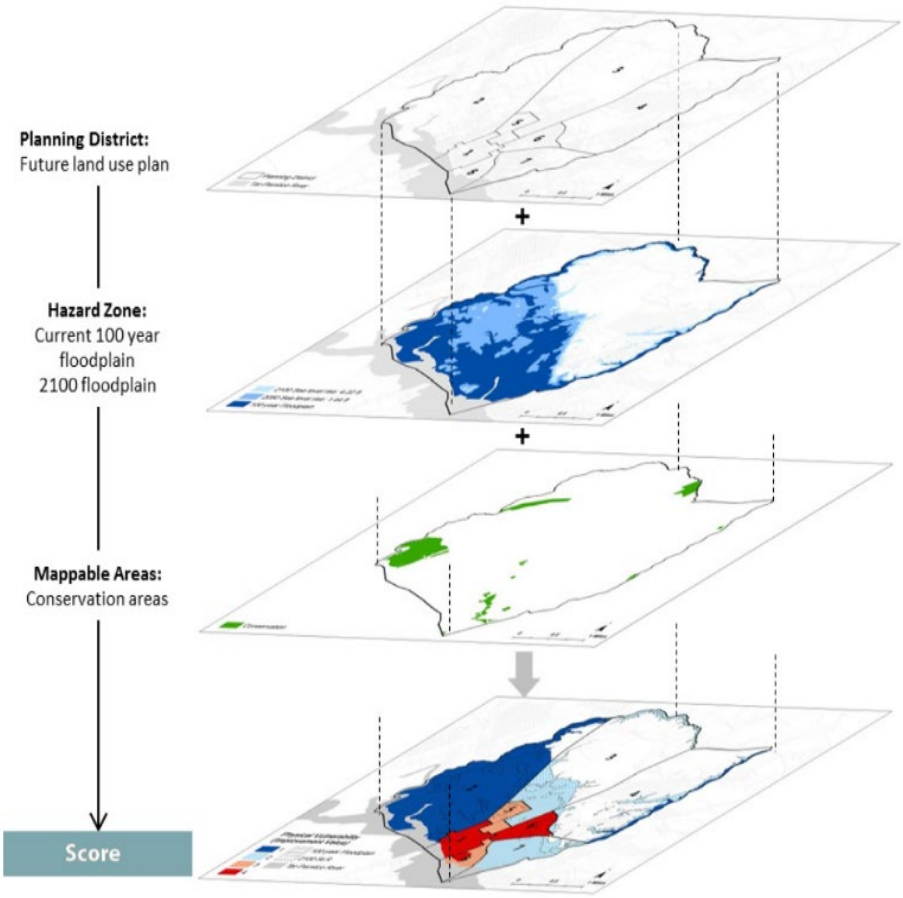


Figure 28. Plan Integration for Resilience Scorecard approach for spatially evaluating and integrating related plans (U.S. Department of Homeland Security, 2017)

→*Return to Recommended Practice C1*

Ordinances and Rules to Support Community Plan Implementation (C2)

The West Kauaʻi Community Plan process was guided by residents and stakeholders through facilitated meetings, interactive workshops, and online platforms from August 2018 to November 2019. The Plan was approved by the Kauaʻi Planning Commission on May 26, 2020. To support implementation of the West Kauaʻi Community Plan, ordinances were developed concurrently and adopted by the Commission on Form-based Codes and zoning specific to West Kauai. One ordinance requires regional policies in the Kauaʻi General Plan be aligned with the West Kauaʻi Community Plan. Another ordinance allows for the establishment of a new Special Treatment - Coastal Edge (ST-CE) District that specifies additional performance requirements for development in particularly vulnerable areas along the coastline. The approval of the plan together with the ordinances ensures that the community plan can be fully implemented and new or revised zoning can be enforced.

→**Return to Recommended Practice C2**

Examples and Resources for Guidance D

Implementation, Monitoring, and Evaluation (D1)

Kaua‘i General Plan - Adaptative Management. Adaptive management has been widely adopted and pursued in diverse fields including agriculture, natural resources management, business, and education (Stankey, Clark, & Bormann, 2005). The County of Kaua‘i adopted an adaptive management approach as part of their County General Plan to respond to the inherent uncertainty in the rate and extent of climate change impacts (Figure 29) (County of Kaua‘i, 2018). As such, planning and implementation is depicted as a cycle with implementation and feedback loops. Emphasis is placed on tracking progress, assessing outcomes, and adjusting course. Providing opportunities for community input is an important component throughout the adaptive management cycle.

Figure 29. Adaptive management cycle adopted in the County of Kaua‘i General Plan (County of Kaua‘i, 2018)

Maui County Plan Implementation Division. The County of Maui created a Plan Implementation Division in 2014 (County of Maui) to provide dedicated focus on the implementation of the County General Plan, a Countywide Policy Plan, the Maui Island Plan, community plans, and other long-range plans. The Plan Implementation Division coordinates among County departments, as well as State and Federal agencies, to monitor the County’s progress towards implementation of its plans. This Division is in the process of developing a report that tracks implementation benchmarks and quality of life indicators to monitor progress towards the attainment of County goals and objectives from the General Plan.

Moloka‘i Community Plan Performance Indicators. Performance indicators are needed to monitor whether implementation is on schedule and policies are effective in reducing vulnerability to sea level rise. The Moloka‘i Island Community Plan 2018 includes 39 core indicators, one of which is focused on sea level rise vulnerability by tracking the percent of building permits issued in tsunami inundation zone and sea level rise exposure area (County of Maui, 2018).

California guidance on trigger-based adaptation. Trigger-based adaptation establishes an implementation approach that can be phased over time (California Coastal Commission, 2018a, 2018b). Guidance from the California Coastal Commission encourages local governments to analyze vulnerability of a range of sea level rise projections to understand the best and worst case scenarios and to identify amounts of sea level rise and related conditions that would trigger severe impacts and the associated time period for when such impacts might occur. Appropriate triggers and adaptation actions are developed based on these scenarios.

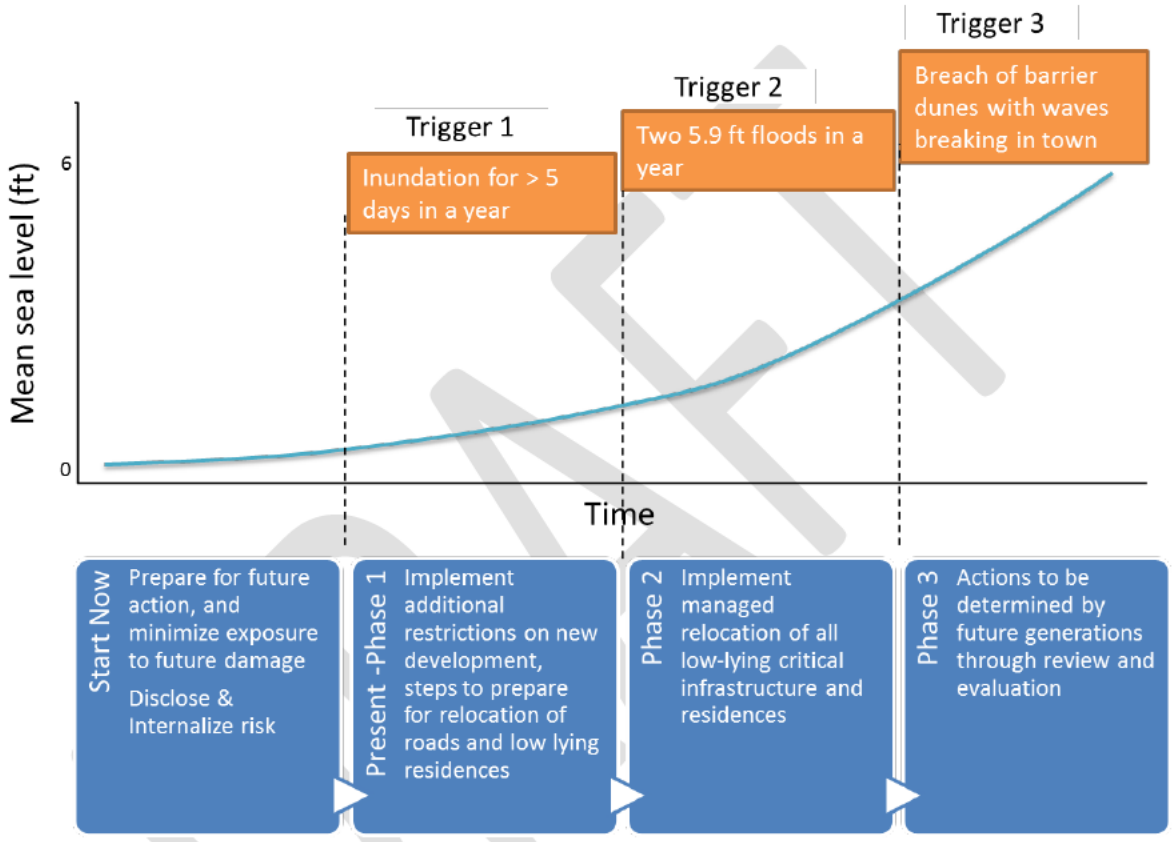


Figure 30. Conceptual phased implementation plan for adaptation actions with triggers for sea level rise impacts (California Coastal Commission, 2018b)

Guidance for monitoring and evaluation of coastal adaptation. Guidance for monitoring and evaluation of coastal adaptation by local governments used in Australia (Thomsen et al., 2014) focuses on three key components: (a) best practices in planning, (b) adaptive capacity, and (c) monitoring outcomes. The foremost aim of the monitoring and evaluation process is to promote reflection among local government teams on the strengths and weaknesses of adaptation planning, on the capacities required to implement plans, and on the progress for delivering on planned objectives and strategies. A template is provided for each component to support the evaluation of coastal adaptation efforts by local governments. These templates could serve as a starting point for monitoring and evaluation by counties in Hawai‘i.

→*Return to Recommended Practice D1*

Pilot Projects (D2)

Maui Dune Restoration. Sand dune restoration in the County of Maui began as a pilot project to test various techniques and stakeholder engagement processes. In 2007, the Kamaole III Beach Park Sand Dune Restoration project was awarded the National Association of County Parks and Recreational Officials Award for Environmental Conservation. Over time, the county documented lessons and good practices and was able to scale up dune restoration across the county. Community volunteers were crucial in these efforts for building dune walkovers, planting due vegetation, installing sand fences, and many other important activities to support these projects.

Other Examples of Pilot Projects. The Hawai‘i Department of Land and Natural Resources, through funding from the O‘ahu Metropolitan Planning Organization, is investigating feasibility of beach restoration at Punalu‘u, O‘ahu as a pilot project for nature-based alternatives to protect vulnerable sections of coastal highway. The proposed Honolulu One-Water Collaboration identifies demonstration projects for piloting and showcasing innovative ideas, driving collaboration, and proving safety and efficiency of new technologies (City and County of Honolulu Climate Change Commission, 2020). Pilot projects have been used to support risk-informed decision making elsewhere, such as by the U.S. Army Corps of Engineers for integrated water resource management planning for the West Maui watershed (U.S. Army Corps of Engineers, 2012) and by the Federal Transportation Administration to conduct a transportation asset climate risk assessment for Honolulu (SSFM International Inc., 2011). The County of San Mateo, California established small grants for Community Adaptation Planning Pilot Projects to assess and plan for climate change impacts and develop neighborhood or community-specific adaptation plans to increase community resilience to changing climate (County of San Mateo, 2020).

Dune Restoration Project at Kamaole Beach Park I, Maui
Source: South Maui Volunteers

→*Return to Recommended Practice D2*

APPENDIX 2 –SUMMARY OF RECOMMENDED PRACTICES BY SELECTED STATE PRIORITY GUIDELINES

SELECTED PRIORITY GUIDELINES	RECOMMENDED PRACTICES FOR ADDRESSING SEA LEVEL RISE IN PLANNING [1]
Climate Change Adaptation	
1. Ensure that Hawaii's people are educated, informed, and aware of the impacts climate change may have on their communities	▪ A2. Conduct county-wide and community-scaled sea level rise vulnerability assessments using best-available data and identify potential adaptation strategies ▪ A4. Use the results of sea level rise vulnerability assessments to support community outreach activities, to inform all plan elements, and to create or revise policies and rules
2. Encourage community stewardship groups and local stakeholders to participate in planning and implementation of climate change policies	▪ B1. Conduct visioning exercises informed by sea level rise vulnerability assessments and adaptation options
3. Consider native Hawaiian traditional knowledge and practices in planning for the impacts of climate change	▪ A3. Conduct sector-specific vulnerability assessments and identify potential adaptation strategies
4. 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	▪ A1. Establish an interdepartmental climate adaptation working group to support coordination on vulnerability assessments and throughout the planning and implementation cycle ▪ C1. Facilitate consistency and alignment of new policies and actions by coordinating across departments
5. Encourage planning and management of the natural and built environments that effectively integrate climate change policy	▪ B1. Use community visioning to develop sea level rise adaptation strategies ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs
6. Explore adaptation strategies that moderate harm or exploit beneficial opportunities in response to	▪ B1. Use community visioning to develop sea level rise adaptation strategies ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs

[1] "Priority guidelines" means those guidelines which shall take precedence when addressing areas of statewide concern. Seven categories of Priority Guidelines are established in the Hawai'i State Planning Act to guide planning at State and County levels. This table lists recommended practices associated with all climate change adaptation priority guidelines and a subset of priority guidelines from other categories (see Chapter 2, Figure 6) deemed most relevant to sea level rise. Recommended practices are cross-referenced to recommended practices in Guidance A through D.

SELECTED PRIORITY GUIDELINES	RECOMMENDED PRACTICES FOR ADDRESSING SEA LEVEL RISE IN PLANNING [1]
actual or expected climate change impacts to the natural and built environments	▪ D2. Conduct pilot projects to demonstrate the viability of an adaptation approaches and support collaborative pathways for planning, funding, and implementing adaptation actions and to support
7. 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	▪ A3. Conduct sector-specific vulnerability assessments and identify adaptation options to inform plan and policy development ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs
8. Promote sector resilience in areas such as water, roads, airports, and public health, by encouraging the identification of climate change threats, assessment of potential consequences, and evaluation of adaptation options	▪ A3. Conduct sector-specific vulnerability assessments and identify potential adaptation strategies ▪ B3. Identify and retain disaster redevelopment alternatives that support adaptation to sea level rise in the event of a catastrophic coastal event ▪ C1. Facilitate consistency and alignment of new policies and actions by coordinating across departments
9. Use management and implementation approaches that encourage the continual collection, evaluation, and integration of new information and strategies into new and existing practices, policies, and plans	▪ A1. Establish an interdepartmental climate adaptation working group to support coordination on vulnerability assessments and throughout the planning and implementation cycle ▪ C1. Facilitate consistency and alignment of new policies and actions by coordinating across departments ▪ D1. Place greater emphasis on plan implementation, monitoring, and evaluation to track performance and make course corrections ▪ D2. Conduct pilot projects to demonstrate the viability of an adaptation approaches and support collaborative pathways for planning, funding, and implementing adaptation actions and to support
10. Invest in continued monitoring and research of Hawaii's climate and the impacts of climate change on the State	▪ A1. Establish an interdepartmental climate adaptation working group to support coordination on vulnerability assessments and throughout the planning and implementation cycle ▪ D1. Place greater emphasis on plan implementation, monitoring, and evaluation to track performance and make course corrections

SELECTED PRIORITY GUIDELINES	RECOMMENDED PRACTICES FOR ADDRESSING SEA LEVEL RISE IN PLANNING [1]
	▪ D2. Conduct pilot projects to demonstrate the viability of an adaptation approaches and support collaborative pathways for planning, funding, and implementing adaptation actions and to support
Sustainability	
11. Encourage balanced economic, social, community, and environmental priorities	▪ A1. Establish an interdepartmental climate adaptation working group to support coordination on vulnerability assessments and throughout the planning and implementation cycle ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs ▪ C1. Facilitate consistency and alignment of new policies and actions by coordinating across departments
12. Encouraging planning that respects and promotes living within the natural resources and limits of the State	▪ A3. Conduct sector-specific vulnerability assessments and identify potential adaptation strategies ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs
13. Consider the principles of the ahupua‘a system	▪ A3. Conduct sector-specific vulnerability assessments and identify potential adaptation strategies ▪ B1. Conduct visioning exercises informed by sea level rise vulnerability assessments and adaptation options ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs ▪ C1. Facilitate consistency and alignment of new policies and actions by coordinating across departments
Population Growth and Land Resources	
14. Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures, and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.	▪ B1. Use community visioning to develop sea level rise adaptation strategies ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs ▪ C2. Prepare draft ordinances and rules to submit concurrently with the plan to align plans and implementing rules

SELECTED PRIORITY GUIDELINES	RECOMMENDED PRACTICES FOR ADDRESSING SEA LEVEL RISE IN PLANNING [1]
15. Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.	▪ B1. Use community visioning to develop sea level rise adaptation strategies ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs ▪ C2. Prepare draft ordinances and rules to submit concurrently with the plan to align plans and implementing rules
16. In order to preserve green belts, give priority to state capital-improvement funds which encourage location of urban development within existing urban areas except where compelling public interest dictates development of a noncontiguous new urban core.	▪ B1. Use community visioning to develop sea level rise adaptation strategies ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs ▪ C2. Prepare draft ordinances and rules to submit concurrently with the plan to align plans and implementing rules
17. Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.	▪ B1. Use community visioning to develop sea level rise adaptation strategies ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs ▪ C2. Prepare draft ordinances and rules to submit concurrently with the plan to align plans and implementing rules
18. Identify critical environmental areas in Hawaii 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.	▪ A2. Conduct county-wide and community-scaled sea level rise vulnerability assessments using best-available data and identify potential adaptation strategies ▪ A3. Conduct sector-specific vulnerability assessments and identify potential adaptation strategies ▪ C1. Facilitate consistency and alignment of new policies and actions by coordinating across departments
19. 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 generations.	▪ A2. Conduct county-wide and community-scaled sea level rise vulnerability assessments using best-available data and identify potential adaptation strategies ▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs
20. Protect and enhance Hawaii's shoreline, open spaces, and scenic resources	▪ A3. Conduct sector-specific vulnerability assessments and identify potential adaptation strategies

SELECTED PRIORITY GUIDELINES	RECOMMENDED PRACTICES FOR ADDRESSING SEA LEVEL RISE IN PLANNING [1]
	▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs ▪ D2. Conduct pilot projects to demonstrate the viability of an adaptation approaches and support collaborative pathways for planning, funding, and implementing adaptation actions and to support
Economic Development	
21. Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.	▪ B2. Create land use and development alternatives based on different sea level rise adaptation strategies and analyze tradeoffs ▪ C1. Facilitate consistency and alignment of new policies and actions by coordinating across department
Affordable Housing	
22. Seek to use marginal or nonessential agricultural land, urban land, and public land to meet housing needs of extremely low-, very low-, lower-, moderate-, and above moderate-income households.	▪ A2. Conduct county-wide and community-scaled sea level rise vulnerability assessments using best-available data and identify potential adaptation strategies
23. Improve information and analysis relative to land availability and suitability for housing.	▪ A2. Conduct county-wide and community-scaled sea level rise vulnerability assessments using best-available data and identify potential adaptation strategies