Florida Adaptation Planning Guidebook

February 2026 Update

Acknowledgments

This guidebook was created by the Florida Department of Environmental Protection's (DEP) Resilient Florida (RF) Program, within the Office of Resilience and Coastal Protection (ORCP) in partnership with the resilience team from APTIM, to act as a resource for local community efforts when developing adaptation plans through the RF Program's planning grants. The original guidebook was developed in 2018 and was updated in February 2026. Special acknowledgments to the contributors of both guidebooks are provided to Krista Slyter, Eddy Bouza, Dr. Samantha Danchuk, Dr. Cigdem Ozkan, Julie Dennis, Dr. Barbara Lenczewski, Whitney Gray, Katherine Beck, Joseph Bauer, APTIM, Atkins and participants in the stakeholder listening sessions.

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Acronyms

AAA	Adaptation Action Area
ADAPT	Adaptation Database for Planning Tool
ADCIRC	Advanced Circulation Model
ARPA	Archaeological Resources Protection Act
AP	Adaptation Plan
BRIC	Building Resilient Infrastructure and Communities
CAKE	Climate Adaptation Knowledge Exchange
CBA	Cost-Benefit Analysis
C-CAP	Coastal Change Analysis Program
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant-Disaster Recovery
CERP	Comprehensive Everglades Restoration Plan
CFR	Code of Federal Regulations
CHHA	Coastal High Hazard Area
CIP	Capital Improvement Plan
CLG	Certified Local Governments
ClimRR	Climate Risk and Resilience Portal
COAST	Coastal Adaptation to Sea Level Rise Tool
CPA	Community Planning Act
CRS	Community Rating System
CCVI	Climate Change Vulnerability Index
CVI	Coastal Vulnerability Index
CWSRF	Clean Water State Revolving Fund
DEM	Digital Elevation Model
DOT	United States Department of Transportation
DSAS	Digital Shoreline Analysis System
EAR	Evaluation and Appraisal Review
EBM	Ecosystem-Based Management
EDA	Economic Development Administration
EDP	Economic Development Plan
EEC	Energy Efficiency and Conservation Block Grant
EPA	United States Environmental Protection Agency
ESR	Expedited State Review
EWP	Emergency Watershed Protection
F.A.C.	Florida Administrative Code
FC	FloridaCommerce
FCMP	Florida Coastal Management Program
DEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FERR	Florida Estuarine Research Reserve
FFRMS	Federal Flood Risk Management Standards
FGDL	Florida Geodatabase Library
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
FNAI	Florida Natural Areas Inventory
FRCP	Florida Resilient Coastlines Program
F.S.	Florida Statute
FWC	Florida Fish and Wildlife Conservation Commission
GATOR	Geospatial Assessment Tool for Operations and Response
GCM	Global Climate Model
GDP	Gross Domestic Product
GI	Green Infrastructure
GIRP	Grid Resilience and Innovation Partnerships
GIS	Geographic Information Systems
GOAA	Gulf of America Alliance Resilience Team
Gulf TREE	Gulf Tools for Resilience Exploration Engine
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HPP	Historic Preservation Plan
HUD	United States Housing and Urban Development
UF/IFAS	University of Florida Institute of Food and Agricultural Sciences

InVEST	Integrated Valuation of Environmental Services and Tradeoffs
IPCC	Intergovernmental Panel on Climate Change
LCP	Local Comprehensive Plan
LID	Low Impact Development
LMS	Local Mitigation Strategy
MPO	Metropolitan Planning Organization
MSA	Metropolitan Statistical Areas
NAI	No Adverse Impact
NBS	Nature-Based Solutions
NFIP	National Flood Insurance Program
NNBF	Natural and Nature-Based Features
NOAA	National Oceanic and Atmospheric Administration
NOEP	National Ocean Economics Program
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRI	National Risk Index
PDM	Pre-Disaster Mitigation
PDRP	Post-Disaster Redevelopment Plan
RAPT	Resilience Analysis and Planning Tool
RF	Resilient Florida Program
RRE	Regional Resilience Entity
SAMP	Special Area Management Plan
SFHA	Special Flood Hazard Area
SFWMD	South Florida Water Management District
SHPO	State Historic Preservation Officer
SimCLIM	Simulator of Climate Change Risks and Adaptation Initiatives
SLAMM	Sea Level Affecting Marshes Model
SLAT	Sea Level Analysis Tool
SLIP	Sea-level Impact Program
SLOSH	Sea, Lake and Overland Surges from Hurricanes
SLR	Sea Level Rise
SMP	Stormwater Master Plan
SoVI	Social Vulnerability Index
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, Environmental
SVA	Statewide Vulnerability Assessment
SWMM	Storm Water Management Model
SWOT	Strengths, Weaknesses, Opportunities and Threats
TDR	Transfer of Development Rights
THPO	Tribal Historic Preservation Officer
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VA	Vulnerability Assessment
VAST	Vulnerability Assessment Scoring Tool
WMP	Watershed Master Plan
WEMo	Wave Exposure Model
WFPO	Watershed Protection and Flood Prevention

Glossary

Adaptation: The process of making adjustments in natural or human systems to minimize negative impacts and capitalize on opportunities associated with change, thereby enhancing resilience and reducing vulnerability to climate-related hazards.

Coastal flooding: Flooding which occurs when water is driven onto land from an adjacent body of water. The source of flooding may be high tides, storm surge, sea level rise, seepage or a combination.

Compound flooding[1]**:** Flooding caused by complex interactions between two or more oceanographic, hydrological or meteorological processes such as the combination of pluvial (rainfall-induced flooding, such as flash, surface water, drain and sewer floods), fluvial (riverine floods), coastal (sea level rise, tides, waves, storm surge and nuisance floods) or groundwater flooding.

Flood: An overflow of water onto normally dry land. The inundation of a normally dry area caused by rising water in an existing waterway, such as a river, stream or drainage ditch. Flooding is a longer-term event than flash flooding — it may last days or weeks.

Flash flood: A flood caused by heavy or excessive rainfall in a short period of time, generally less than six hours. Flash floods are usually characterized by raging, quick-moving water after heavy rains.

King tide: A spring tide occurring during a full or new moon, yielding higher than normal water levels. In the fall and occasionally spring seasons, these tides have led to coastal flooding with sea level rise.

Mean sea level: A tidal datum and elevation determined by averaging hourly water levels over a 19-year period.

Nature-based solutions (NBS)[1]**:** Actions that rely upon natural processes to protect, restore and sustainably manage ecosystems, as well as solutions that address socio-environmental challenges using natural resources and processes.

Sea level rise: An observed increase in the average local sea level or global sea level trend. The two major causes of global sea level rise are thermal expansion caused by the warming of the oceans (since water expands as it warms) and the loss of land-based ice (such as glaciers and polar ice caps) due to melting.

Stormwater runoff: Water from precipitation that flows over land surfaces and is not absorbed into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots and building rooftops), it accumulates pollutants that could adversely affect water quality if the runoff is discharged untreated.

Storm surge: A rise of water generated by a storm over and above the predicted astronomical tides. Storm surge should not be confused with storm tide, which is defined as the water level rise due to the combination of storm surge and the astronomical tide.

Plans

Adaptation Plans (AP)[1]**:** A plan that develops goals, priorities, strategies and actions to best minimize impacts of flooding, sea level rise or other threats and vulnerabilities, as applicable, and establishes a process to implement those actions.

[1] Chapter 62S-8.002, Florida Administrative Code (F.A.C.), "Statewide Flooding and Sea Level Rise Resilience Plan"

Capital Improvement Plan (CIP): A plan that guides the scheduling of spending on public improvements, such as capital projects and equipment purchases. A CIP can serve as an important mechanism for guiding future investments and improvements away from identified hazard areas. It can be used to modify an existing project to add a mitigation/resilience component.

Comprehensive Plan: A plan adopted by local government which provides the principles, guidelines, standards and strategies for the orderly and balanced future economic, social, physical, environmental and fiscal development of the area that reflects community commitments to implementing the plan and its elements.[2]

Economic Development Plan (EDP): A plan that provides an overview of the economy, sets policy direction for economic growth and identifies strategies, programs and projects for improvement. These policies and strategies can guide future investment and economic growth or activities to areas that are safe and that have reduced exposure to hazard risks.

Hazard Mitigation Plan (HMP) or Local Mitigation Strategy (LMS): A plan intended to reduce death, injuries and property losses caused by natural hazards. This plan identifies hazards based on the history of disasters within the state/locality and lists goals, objectives and actions for mitigating risk and reducing future losses.

Statewide Resilience Plan: Per section 380.093(5)(a), Florida Statutes (F.S.), Statewide Resilience Plan is a plan developed by DEP on a three-year planning horizon and submitted to the Governor on Dec. 1 of each year. It consists of ranked projects that address risks of flooding and sea level rise to coastal and inland communities in the state.

Stormwater Master Plan (SMP): A local government or utility plan that includes regulatory compliance activities, an asset inventory, goals for water quality and human health, maintenance and replacement schedules, projection of future needs, and processes for evaluating and improvement performance.

Vulnerability Assessment (VA)[1]: An evaluation that identifies risks to a community, including flooding and sea level rise, as applicable; meets all the required statutory elements for VAs listed in sections 380.093(3)(c) through (d), F.S.; and includes, but is not limited to, any supplemental plans, assessments, documents, reports, strategies, maps or electronic databases that identify or address risks of flooding and sea level rise to critical or regionally significant assets.

Watershed Master Plan (WMP): A watershed master plan is a strategic tool designed to help communities within a watershed manage and reduce flooding risks associated with development on a broad scale. It involves evaluating the watershed's runoff response to various storm scenarios under current and future conditions, assessing the impacts of sea level rise and climate change, identifying and protecting wetlands and other natural areas within the watershed and safeguarding natural channels. Additionally, it implements regulatory standards for new developments to control peak flows and volumes, provides specific mitigation recommendations to ensure community resilience and secures a dedicated funding source, such as a stormwater utility, to implement these mitigation strategies. [1]

Numbers in square brackets (e.g., [1]) indicate in-text citations throughout this Guidebook. Please see Chapter 6.3 for full list of references.

[2] section 163.3177(1), F.S.

Executive Summary

The Florida Adaptation Planning Guidebook provides a framework and compendium of resources to develop Adaptation Plans based on current Florida laws, requirements and best practices. Per section 380.093, F.S., the Resilient Florida (RF) Program within the Florida Department of Environmental Protection (DEP) may provide grants for community resilience planning such as Adaptation Plans and projects to prepare for the threats from flooding and sea level rise and adapt critical assets. The guidebook is intended to be used by local and regional government planners to assist in the development and implementation of Adaptation Plans as well as preparation of funding applications and scopes of work for planning. This latest revision of the guidebook includes lessons learned from practitioners, relevant research and available funding sources such as RF Program grants.

Using this guidebook, communities can move through the steps of adaptation planning as outlined on the Road Map (Figure 1) on the next page. The first recommended step is to establish the unique requirements for the community through a description of **Context** (Chapter 1). An adaptation plan should be based upon a **VA** (Chapter 2) that lists and ranks the vulnerable critical assets at risk to projected hazard scenarios and describes the adaptive capacity of the community. The listed needs and understanding of capacity will inform the identification, evaluation and selection of feasible **Adaptation Strategies** (Chapter 3) to address the specific challenges that face your community in a planning horizon that is applicable and realistic. A matrix of adaptation strategies and their respective eligible funding sources is also included. The last step of planning is to determine the **Implementation Strategies** (Chapter 4) necessary to fund, sequence projects and organize resources, partners and processes for successful adaptation.

The appendix of this guidebook contains specialty topics such as compound flooding, compounding hazards, and impact on cultural and natural resources. A list of funding sources is included as well as examples of completed Adaptation Plan elements for reference. These additional resources are provided to ease the research burden, share collective knowledge and expedite implementation.

The unique challenges that flooding and sea level rise will pose within communities will require patience and diligence in the face of constantly changing conditions and information. Adaptation planning offers numerous benefits, including enhanced resilience, risk reduction, economic savings, public health and safety, environmental protection, and improved compliance and funding eligibility. For instance, strengthened flood defenses reduce damage and speed recovery after storm surge and coastal flooding, while early investments in resilient infrastructure save on future repairs and emergency aid. Adaptation planning also preserves ecosystems through nature-based solutions like wetland restoration. Moreover, meeting regulatory requirements for floodplain management through adaptation planning may improve eligibility for funding, grants and insurance discounts.

Adaptation planning will highlight the necessity of proactive measures, multi-sector collaboration, continuous monitoring and community engagement. Implementing adaptation strategies proactively is more cost-efficient than reactive measures, and coordinated efforts between urban planners, public health officials and environmental agencies will yield comprehensive resilience strategies. Continuous monitoring and adjustments based on new data ensure that adaptation measures remain effective, while engaging local communities enhances the overall effectiveness of these measures. Ultimately, adaptation planning sets the foundation for resilient communities, ensuring that critical assets are safeguarded against future flooding and sea level rise, thereby securing long-term sustainability and protection for all stakeholders.

Steps to Create Adaptation Plans

Figure 1. Communities can follow this roadmap of steps to create an adaptation plan.

Introduction

All 8,436 miles of Florida's coastline [2] sustains and enchants both visitors and residents of the state. The coast's relationship with the state's economy is vital. Lined with beaches, wetlands, inlets and rivers, Florida's coast spans 35 coastal counties that house 67% of the state's population [3] and contribute nearly $1 trillion in economic activity — 83% of the state's total economy [4].

According to Florida Ocean Alliance research, Florida's key ocean resources have provided over 1 million jobs for Floridians. Florida has 14 deep-water seaports and holds the title of the unrivaled global hub for cruises, housing large cruise terminals such as Miami, Canaveral and Port Everglades within its borders. The state's abundant oceanic and coastal assets support its economy and are pivotal to its overall prosperity. While the coast may be the state's greatest asset, Florida's communities are taking proactive steps to address coastal hazards, including the challenge of rising sea levels. With sea level rise expected to accelerate, there is a growing focus on innovative solutions and resilience-building efforts to protect Florida's coastlines and ensure a sustainable future for residents. Three feet of sea level rise puts over 300,000 homes, 490,000 people and 2,500 miles of road at risk [5]. The ability to adapt to a changing coastline is vital for the state's sustainability and continued prosperity over the next decades.

An adaptation plan is a sound and sensible method for Florida's coastal communities to develop and enhance their strategies for protecting coastal populations and infrastructure. This guidebook prepared by DEP provides many resources and offers a reasonable framework for developing an adaptation plan. It includes four recommended components that break down the action steps needed to build an effective plan and additional information to address special considerations like historic and natural resources. The components are Context, VA, Adaptation Strategies and Implementation Strategies.

These components, discussed in greater detail in the following chapters, interact and build upon one another to create an approach to adaptation planning for the community. However, this guidance avoids a prescriptive formula to follow, recognizing that each community is different and unique. Rather, it provides a process to follow with enough latitude to allow for different approaches to reaching the same goal. There are sample sections from existing adaptation plans around the state to help guide communities developing a plan for the first time or looking to update their plan.

An adaptation plan does not require all the components described in this guide to be developed at once. The process can be incremental (meaning that the community and the planning team may assemble a component, or all components relative to a specific aspect of flooding) and then return to the planning process when convenient. In addition, the outcomes of this planning process are meant to be incorporated into other ongoing community plans and decision-making processes. Adaptation plan strategies may be adopted on a schedule that conforms to the community's existing or projected timeline to adopt and implement actions and policies from other plans.

This guidance approaches adaptation planning through both participatory and science-based methods. Through participatory methods, communities seek input from their stakeholders to take advantage of

local knowledge and to tailor a strategy that aligns with the local needs, culture and capacity. Through science-based methods, the guidebook provides references to tools that have been developed by respected agencies that depict the likely future impacts of our changing climate. With the overlap of these two methods, communities may gain access to a broad range of local perspectives that can be balanced with the best available science to chart a path forward to a more resilient future.

a. Adaptation Planning Basics

The four essential components of the adaptation plan, and where they are found, are:

- Context, Chapter 1.
- VA, Chapter 2.
- Adaptation Strategies, Chapter 3.
- Implementation Strategies, Chapter 4.

Context refers to the preliminary actions that a community should take to facilitate an inclusive planning process in addressing the remaining three components. The VA draws from the methodologies found in the Florida Statewide VA [6] to meet the requirements of **section 380.093, F.S.**[3]**,** and to maximize funding for the DEP's RF Program grant awardees. A VA measures the hazard exposure of a community and its sensitivity (e.g., population, built environment, natural environment) to the identified hazards. Adaptation Strategies are the toolkit of responses for a community to address flooding as well as the steps taken to decide which adaptation strategies are the best fit based on the needs of individual communities. Finally, the Implementation Strategies component outlines a process for communities to move their plan into action considering available funding for adaptation activities, describes the need to assign groups/individuals to complete tasks and suggests mechanisms to evaluate how effectively strategies are being accomplished.

As shown in Figure 2, within these four main components there are many supporting tasks (i.e., sub-components) that provide further breakdown the work. From establishing a steering committee, to conducting exposure and sensitivity analyses, to monitoring and evaluating, the chapters in this guide will describe each component and subcomponent in more detail. Different approaches will be illustrated using examples from projects around the state.

The four components and their associated actions are mostly a sequential process to be completed in the order that they are presented in this guidebook (i.e., Context first, then VA, etc.). However, flexibility is key in getting new planning processes, including flooding and sea level rise adaptation, off the ground. Steps that occur further along in the process may identify some fatal flaws that will require revisiting a previous step. It is also recommended that this process be revisited periodically to assess its relevancy and need for updating (e.g., more accurate sea level rise data becomes available). It is also vital to identify unintended consequences of adaptation actions, in advance, to avoid them during implementation by conducting a failure chain analysis and determining potential points of failure.

[3] s. 380.093, F.S.

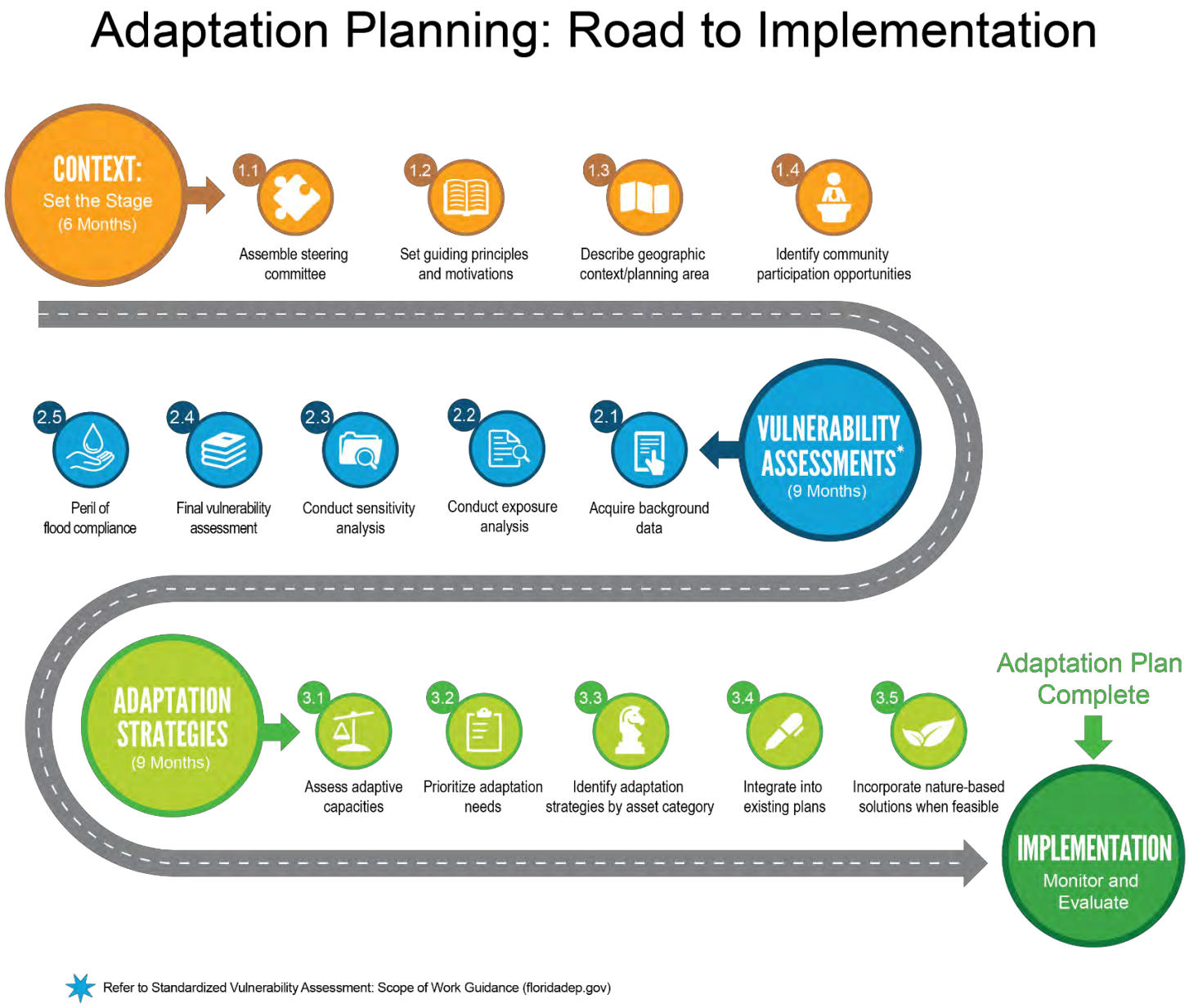


Figure 2. Four Steps of Adaptation Planning in Florida

The other parts of the guidebook include:

- Executive Summary
- Summary
- Appendices with the following specialty topics:
    - Compound Flooding.
    - Compounding Hazards.
    - Water Quality Management and Funding Sources.
    - The Economic Value of Flooding and Sea Level Rise Adaptation.
    - The Community Rating System and Adaptation Planning.
    - Protecting and Preserving Historic and Cultural Resources.
- Funding Opportunities
- References
- Acquiring Example Documents

b. History of Adaptation Planning in Florida and Enabling Legislation

One of the state's first sustained adaptation planning efforts was the Southeast Florida Regional Climate Change Compact Leadership Summit, first held in Fort Lauderdale in 2009 and then annually ever since. The focus of the summit was to facilitate climate-related collaboration and knowledge sharing. In January 2010, Broward, Miami-Dade, Monroe and Palm Beach counties formed the Southeast Florida Regional Climate Change Compact to coordinate mitigation and adaptation activities across county lines.

In 2011, the Florida Legislature passed the Community Planning Act. Within this legislation, local governments are given the option to develop an Adaptation Action Area within their jurisdiction to help address the impacts of flooding and sea level rise. In 2013, the National Oceanic and Atmospheric Administration (NOAA) approved the Florida Coastal Management Program's (FCMP) Section 309 Strategy, including an initiative to be conducted by FloridaCommerce titled: "Community Resiliency: Planning for Sea Level Rise." This five-year initiative examined the statewide framework and best practices for integrating adaptation into the existing planning processes as well as how to coordinate adaptation efforts across Florida [7].

The City of Fort Lauderdale was selected by FloridaCommerce as an initial pilot project in 2013. The City of Fort Lauderdale evaluated and incorporated Adaptation Action Areas into its existing comprehensive plan. In 2014, the City Commission approved the Adaptation Action Areas and its 14 policies. In 2016, three additional pilot projects were conducted in Escambia County, the City of Clearwater and the City of St. Augustine. These local communities each created Adaptation Plans as a result of a Coastal VA and Workshop that was conducted by FloridaCommerce and funded by NOAA.

In 2015, Governor Rick Scott signed Senate Bill (SB) 1094 into law, which is known as the "Peril of Flood" Statute. This law requires the consideration of future flood risk from storm surge and sea level rise in certain parts of local government comprehensive plans. As a result of SB 1094, section 163.3178(2)(f)1, F.S. includes sea level rise as one of the causes of flood risk that must be addressed in the "redevelopment principles, strategies and engineering solutions" to reduce flood risk.

The law also changes the requirements of flood insurance offered by insurance carriers, requires local governments to include a redevelopment component oriented towards flood risk reduction when drafting comprehensive coastal management plans and requires surveyors and mappers to submit elevation certificates to the Division of Emergency Management within 30 days after completion of the certificate [8].

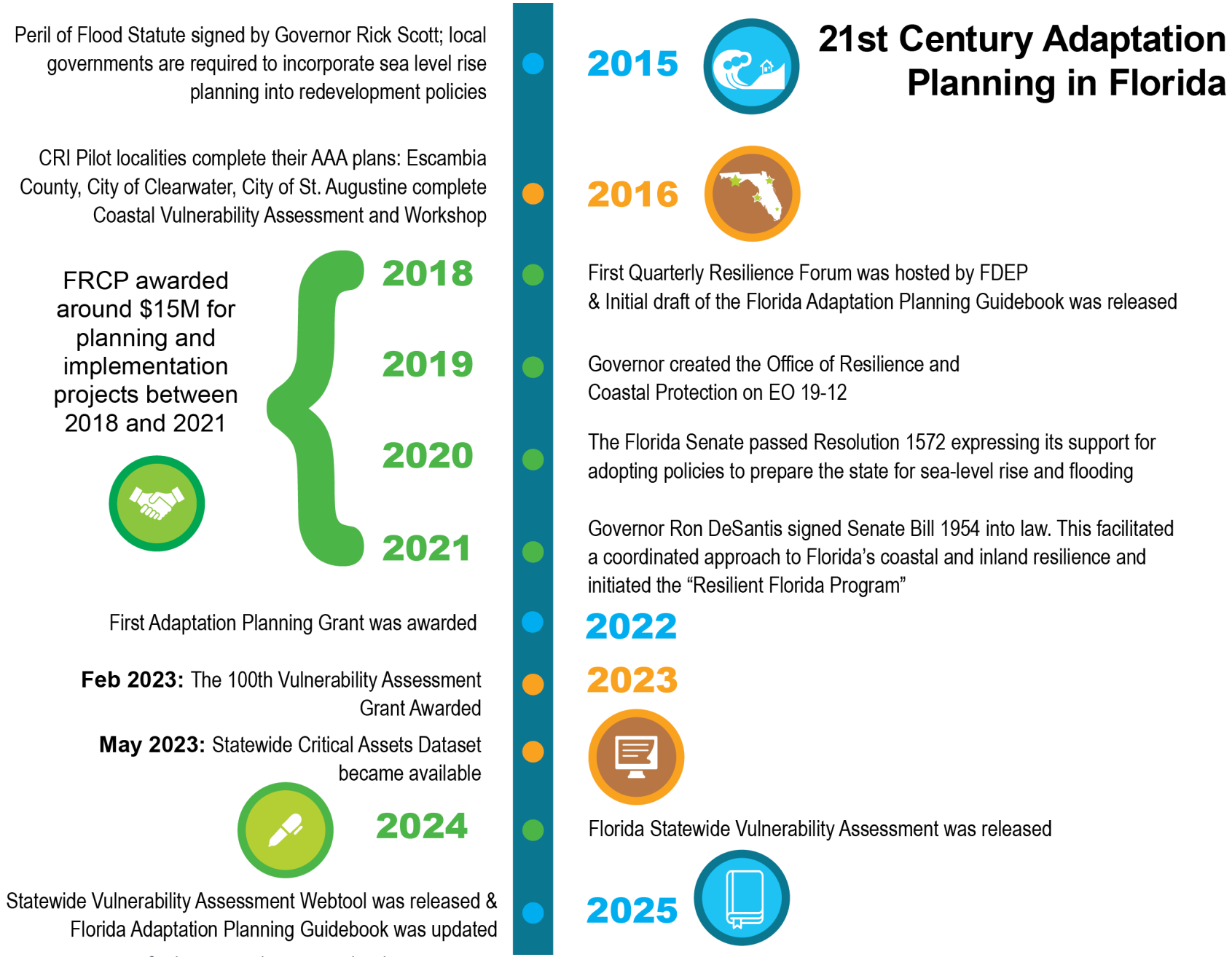


Figure 3. History of Adaptation Planning in Florida

In 2018, the initial Florida Adaptation Planning Guidebook was released, and the first Quarterly Resilience Forum was hosted by DEP with the purpose of sharing adaptation and resilience knowledge within the state. Florida Resilient Coastlines Program (FRCP) began funding projects in 2018 with the goal of preparing the state of Florida for the effects of rising sea levels, such as coastal flooding, erosion and habitat changes. Between 2018 and 2021, FRCP awarded around $15 million for planning and implementation projects.

In 2021, Governor Ron DeSantis signed SB 1954 into law. This comprehensive legislation establishes the RF Program and ensures a coordinated approach to Florida's coastal and inland resilience. The program enhances the state's efforts to protect inland waterways, coastlines and shores, which serve as invaluable natural defenses against flooding and sea level rise. The legislation yielded the largest investment in Florida's history to prepare communities for the impacts of sea level rise, intensified storms and flooding.

The Sea-level Impact Projection (SLIP) tool was also established in 2021. In 2023, Governor Ron DeSantis signed House Bill (HB) 111 into law. This legislation created section 380.0937, F.S., which modifies the SLIP study requirements for state-financed construction projects within areas at risk due to sea level rise that commence after July 1, 2024.

c. Benefits of Adaptation Planning

As mentioned earlier, the coastline of Florida is a huge contributor to the state's economy and warrants protection. There is significant value in exploring adaptation actions that mitigate current coastal and inland flooding and potential future impacts of sea level rise to help maintain a productive and thriving economy. A study by the National Institute of Building Sciences, called Mitigation Saves, determined that there is a savings of $11 for every $1 spent on hazard mitigation efforts by adopting the latest building code requirements, and there is an additional savings of $4 for every $1 spent surpassing building codes [9]. According to the Federal Emergency Management Agency (FEMA), higher building standards adopted by 786,000 structures across the country since 2000 have saved the nation $484 million a year in prevented flood damages [10].

When communities participating in FEMA's NFIP implement activities that exceed the minimum NFIP criteria, they receive credits by participating in FEMA's Community Rating System (CRS). These credits provide a reduction in flood insurance premiums for community residents. The higher the CRS rating, the deeper the insurance premium discount.

Adaptation planning benefits society by reducing loss of life and property damage thus creating safer communities. Communities across Florida are already engaged in hazard mitigation planning and the actions taken by these communities to reduce their vulnerability to coastal flooding are similar to those actions Florida communities may choose to implement for adaptation. The main difference is that adaptation assumes a longer planning horizon for impact and, therefore, a longer period for planning and implementation.

Communities should view adaptation as an investment that may save them money in the long term. Actions taken to reduce risk may lead to a reduction in storm-related business interruption across a variety of important coastal industries such as the tourism, recreation, seaports and ocean transportation, marine and fishing/living resources industries. By supporting a resilient business and community environment, workforces can return to work more quickly after coastal hazard events, customers will return more quickly with limited interruptions in service delivery and suppliers will be able to continue to provide the level of service that businesses need.

Another important reason to address the impacts of changing environmental conditions and sea level rise is that bond credit rating agencies like Moody's Investors Service, Standard & Poor's and Fitch Group are beginning to consider using this more in their ratings. For example, Moody's lists six indicators it uses "to assess the exposure and overall susceptibility of U.S. states to the physical effects of climate change." They include the share of economic activity that comes from coastal areas, hurricane and extreme-weather damage as a share of the economy and the share of homes in a floodplain [11]. States that are listed at the highest risk from climate change by Moody's include Florida along with other coastal states like Georgia, Mississippi and Texas.

Sea level rise has the potential to alter a variety of key Florida industries:

- Ocean tourism.
- Recreation.
- Water transportation.
- Marine.
- Fishing/living resources.

To maximize returns and benefits, Florida communities are considering the impacts of sea level rise and flooding on coastal infrastructure and environments.

The impacts of sea level rise and changing environmental conditions, such as coastal flooding, extreme precipitation and compound flooding (see Chapter 6.1.1. for further information on compound flooding) will increasingly impact a community's finances. Data shows that as sea level rise encroaches into neighborhoods and business districts, property values are going down, emergency service costs are increasing and business disruption costs are escalating. According to research conducted by Freddie Mac in 2022, homes in sea level rise exposed areas that are also located in FEMA 100-year floodplains sell for 4.6% less [12]. These consequences will both reduce revenue, as homeowners abandon properties and sales taxes decline in flood-prone areas, while also increasing costs as communities manage the aftermath of flooding.

Due to the impact of coastal flooding in Florida, historical property values dropped by approximately $50 billion, and the decline is expected to reach $80 billion in the next 30 years [13]. According to a 2018 study by the Union of Concerned Scientists, Florida, New Jersey and California are ranked as the top three in current value of properties that are predicted to be at risk in 2045 [14]. Commercial properties in Florida are also at risk. The research predicts that 30% of the 2,300 commercial properties expected to be at risk by 2045 and 50% of the 38,000 at risk by 2100 are commercial office buildings. These include medical and financial offices, as well as general offices and mixed-use buildings.

These negative financial trends make it more difficult for communities to pay back bonds. Recurring events drain local coffers and reduce financial ability to pay back bonds as funds are diverted or revenues lessened. Financial factors like these are weighed by bond rating agencies, and when they become substantial, the cost of borrowing money increases. As a result, a downgrade in the bond rating could force communities to pay more to borrow money for projects like building, maintaining and rebuilding facilities and infrastructure including even the type of measures needed to adapt to sea level rise. The resulting increased cost of borrowing may then be passed on to residents and businesses as communities struggle to cope. Developing an adaptation plan is a step in the right direction to identify the areas at greatest risk and identify a tangible process for addressing the impacts.

DEP is committed to marshalling resources to prepare Florida's communities and habitats for changing environmental conditions. DEP's vision is that Florida's coastal communities are resilient and prepared for resulting flooding, erosion and ecosystem changes. With our partners at FloridaCommerce, we provide this guidebook to further our mission of synergizing community resilience planning, natural resource protection tools and funding to prepare Florida's coastline for the effects of changing environmental conditions, especially rising sea levels and intensifying inland and coastal flooding.

CHAPTER 1: CONTEXT

City of Deerfield Beach

Chapter 1. Context

For the first part of an adaptation planning process, communities are encouraged to consider factors typical of all planning exercises, with a focus on how each factor relates to flooding and sea level rise adaptation. This is referred to as the planning context and includes a survey of existing geographic, social, infrastructural and environmental conditions. It also entails the creation of principles (e.g., goals, objectives and policies) to guide the planning process, which are distinct from prioritized needs set during the Adaptation Strategies analysis phase. The sub-components in the Context component include: 1) Assemble a Steering Committee; 2) Set Guiding Principles and Motivations; 3) Describe the Geographic Context and 4) Identify Opportunities for Community Participation.

By addressing the context, communities can better guide the adaptation planning process as it unfolds in their individual community. These subcomponents are where the planning environment — politically, socially and geographically — should be tailored to respond effectively through the next three components (VA, Adaptation Strategies and Implementation Strategies) in a manner that creates meaningful stakeholder engagement. Establishing the Context early in the planning process also helps provide working knowledge of the participants and area to optimize the other activities later in the process, such as deciding on focus areas after the Sensitivity Analysis (see Chapters 2.2 and 2.3) or setting priority Adaptation Needs (see Chapter 3.2).

1.1 Assemble a Steering Committee

To develop an effective adaptation plan that reflects the expertise and interests of the community's local stakeholders, a steering committee should be assembled to assist the organization responsible for writing the plan. Steering committees can enhance all ensuing activities in the adaptation planning process. Because they have an influential role in providing data and implementing actions, local government officials or champions are the best candidates to chair or lead the steering committee or working group for the planning process. However, steering committees can accomplish their ultimate purpose, to engage the whole community, if they also include non-governmental representation with strong ties to the community (e.g., businesses, non-profits and neighborhood groups).

It is recommended that the planning team recruit a steering committee whose composition is a blend of community champions, knowledgeable community development officials and technical experts that understand flooding and coastal dynamics. In addition to guidance, steering committee members may work directly with the adaptation planning team to write the adaptation plan so that components such as the VA and Adaptation Strategies follow professional standards. Because flood resilience is an emerging topic, DEP and NOAA urge communities to think of sources of technical assistance in organizations that routinely address the subject. Universities and their cadres of graduate students, Florida Sea Grant agents, regional planning council staff and NOAA Coastal Management Fellows are some examples.

The planning team is encouraged to look at the private sector (e.g., green building contractors, engineering firms experienced with flood issues), nonprofits (e.g., 1000 Friends of Florida, The Nature Conservancy) and universities for potential steering committee members. Coastal biologists, geologists, engineers, public finance specialists, researchers and residents with local knowledge may all be able to support adaptation planning endeavors. By strategically populating the steering committee, the ensuing activities in the adaptation planning process may benefit from creative ideas.

Another source for steering committee members can be local mitigation steering committees, floodplain management planning committees and other similar groups. Participation by these committees in adaptation planning may even earn the community a bonus in their respective planning processes. The Community Rating System (CRS) [1] Activity 412.d (Higher study standards) awards additional credits if the community

shows areas that are predicted to be susceptible to flooding in the future because of climate change or sea level rise. For this activity, the community must use an estimate of the anticipated sea level rise that is at least as high as the NOAA "intermediate-high" projections for year 2100. Thus, involving local floodplain managers may result in earning CRS points.

Figure 4 provides a comprehensive list of potential Steering Committee members based on NOAA's Participants Checklist for Risk and VA [15] and input collected during the DEP's Stakeholder Workshop on April 29, 2024.

Figure 4. Potential steering committee members.

The steering committee is not the only guiding force behind the planning process. As discussed later in this chapter, stakeholders provide additional support in the planning process that includes even wider representation than the steering committee. Individuals considered for the steering committee that were not part of the final roster should be involved as stakeholders.

1.2 Set Guiding Principles and Motivations

By determining guiding principles and motivations, the community can establish its compass for navigating through the remaining components of the planning process. The guiding principles and motivations are one of the plan's most interactive sub-components and should assist decision-making activities in the subsequent components (i.e., VA, Adaptation Strategies and Implementation Strategies).

The community's guiding principles and motivations for adaptation planning should be set by the plan development team and the steering committee. The principles and motivations examine how the community operates and sets its vision for the future which leads to planning goals. Convening a group to set the overarching goals is one primary method for identifying and organizing guiding forces into a single planning process. The principles may align well with goals and motivations can be aligned as objectives to meet one or more goals. Setting goals is also a part of the comprehensive planning process and Local Mitigation Strategy process (see 44 Code of Federal Regulations [CFR] 201.6 (c)(3)(i)), which are both recognized at the state and federal level as a key step in facilitating hazard planning efforts. Communities should ensure that the goals of their adaptation plan align well with the goals set by the county and state, as well as other planning mechanisms such as their Local Mitigation Strategy, Post-Disaster Redevelopment Plan, Comprehensive Plan, Watershed Master Plan, Historic Preservation Plan and others if applicable. To avoid conflicting priorities among the community and the county/state, stakeholders reported that maintaining a resilience steering committee within the county has been beneficial. This allows the community to focus

on implementation projects while supporting the county's plan. This collaborative approach reduces administrative burdens and ensures that major projects are included in the county's plan without duplicating efforts.

Stakeholders also emphasized the importance of integrating adaptation and resilience efforts into capital projects. Incorporating resilience assessments into the capital improvement project approval process may ensure that resilience and mitigation measures are considered and integrated into the budgetary and approval processes at the local level, aligning city and county adaptation plans with capital projects.

1.3 Describe the Geographic Context

Describing the geographic context delineates the boundaries of the planning area and the assets, buildings and structures contained therein. Per section 380.093(3)(c), F.S., a VA and the subsequent adaptation plan must encompass the entire county or municipality.

It is important for the planning team to contextualize the physical location for which a community is planning. Describing the geographic context should include maps with the location of the community within the larger region as well as topographical, hydrological and zoning layers that indicate current limitations and opportunities for development activities.

The maps and information developed in this plan sub-component should support the activities within the VA component. As presented in the Exposure Analysis (see Chapter 2.2) and Sensitivity Analysis (see Chapter 2.3), maps of the community showing potential sea level rise and other flooding scenarios are a crucial piece of information for the adaptation planning process.

1.4 Identify Opportunities for Community Participation

Community members beyond the steering committee should participate to shape the outcome of the planning process. Examples of targeted participation opportunities include holding focus group meetings, conducting workshops, and addressing the topic during neighborhood gatherings, homeowner association meetings, and town hall (public) meetings as well as social media and multi-media events such as broadcasts and surveys. It is important to provide a variety of channels for the community to contribute their feedback considering the demographics, availability and preferred method of surveying. Ranging from in-person surveys or mailers to virtual workshop or social media poll options, the stakeholders should feel comfortable participating in adaptation planning. An effective example of Community Participation in an adaptation planning effort is to walk through a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis to outline issues more systematically. Participation activities such as these can help build and strengthen stakeholder and community support for the project as well as serve to highlight concern areas that the planning team may not have previously considered or addressed.

1.4.1 Stakeholder Identification

Stakeholders, those local individuals from a variety of organizations with interest in community planning and the shaping of the future, are best identified by determining who and what the planning efforts will impact. This can include additional governmental entities (other than the lead), community organizations and leaders, businesses and the public. Utilizing a community outreach strategy, as described further below, will pull in the most appropriate stakeholders. For a flooding adaptation plan to be designed for a particular community and its distinctive population, input from a wide range of stakeholders is required. By involving stakeholders in the overall process as additional community representation, local government officials and the steering committee can communicate

messages and results, identify local priorities and scope, and implement projects and planning actions.

It is the responsibility of the local government officials (or their consultants) and the steering committee to lead the efforts of stakeholder engagement by determining the appropriate organizations and individuals to take part in the overall process. They must decide on the best option for promoting and fostering engagement based on the target audience. Individuals and groups from all levels of government, including federal, state and tribal groups, as well as representative groups from across the community should be offered the opportunity to participate. Outreach to vulnerable populations should also be a priority, so they can participate in the planning process and become vested in activities that could directly affect them.

Local Government Officials[4]

Stakeholder engagement should include local executive-level staff like elected officials, other local departments with a role in adaptation, as well as regional planning councils and water management districts and/or neighboring communities. Local executive staff can bring political awareness to the planning process that can be a boost to public engagement. Other departments may have technical or project experience in fields related to adaptation like coastal flooding. In addition, the planning, zoning, stormwater and public works departments may create project scope and manage implementable projects that result from the planning effort. This guidance during strategic development will assist future project implementation. Neighboring community stakeholders may be able to enlighten the community by sharing their own adaptation or mitigation experience.

Community Organizations and Champions

Community organizations and champions comprise an additional stakeholder group to engage. Connections can be made by reviewing their event calendars and meeting agendas to find a time and way to introduce the adaptation planning process and enlist their involvement. Potential partners may include church groups, Rotary clubs, civic organizations, homeowners' associations and specific interest groups. Community partnerships can provide support and local buy-in to adaptation and resilience planning efforts. To increase stakeholder engagement, it is well served to utilize existing community activities and forums where individuals are already involved.

Major Businesses

The local business community has a vested interest in the long-term success of the overall community and is a natural stakeholder to the forward-looking adaptation planning process. These businesses may be directly impacted by flooding or work in an industry like real estate where their book of business may be impacted. Local businesses, especially those that are water dependent or benefit from coastal proximity, can provide an additional support dimension and help spread the word as well as provide resources. The insurance industry is often absent from these discussions but also has a valuable perspective.

Consultants (Private Sector)

Consultants from the private sector bring specialized skills and experience in adaptation planning, engineering and public policy. Their involvement can provide technical support, innovative approaches and practical solutions to complex challenges posed by sea level rise and other flooding scenarios. By leveraging their expertise, the planning process can benefit

[4] When working with public officials, please consult with the local government attorney about compliance with Florida Sunshine Law requirements.

from a professional, efficient and results-driven approach, ensuring the implementation of effective and sustainable adaptation measures.

Nonprofits

Non-profits are essential stakeholders in the planning process as they often represent community interests, advocate for vulnerable populations and mobilize grassroots support. Their involvement ensures that the concerns of diverse community members are heard and addressed. Non-profits can also facilitate outreach, education and engagement efforts, helping to build broad-based support for adaptation initiatives and fostering a sense of community ownership and resilience.

Academia Members

Academia can play a key role in community planning against flooding impacts by offering research, expertise and data analysis. Universities and research institutions can provide scientific insights, innovative solutions and educational resources that enhance the planning process. Engaging academics ensures that the planning efforts are grounded in the latest scientific knowledge and benefit from innovative research, thereby strengthening the overall adaptation strategy.

General Public

Often, members of the public have had experiences in the past that can significantly contribute to discussions of vulnerabilities and adaptation possibilities. The wealth of knowledge in the local community should not be discounted, and every effort should be made to gather it and use it.

The first step is education and awareness, allowing individuals to understand the threats of sea level rise and flooding based on the effects of total water level. Efforts to educate local stakeholders on current and future flood hazards can be enhanced by directly engaging the public using non-traditional outreach techniques, such as social media and interviews.

Figure 5. Public workshop facilitated by APTIM in Deerfield Beach, FL. (Photo credit: APTIM)

Future generations will continue the task of addressing these climate issues, and some individuals will likely embrace involvement. Youth can help contribute their skill with things like social media to enhance the outreach effort. They also can bring energy, a fresh perspective, dedication to shaping their future and willingness to think 'outside the box' to help find innovative ideas and concepts to advance adaptation planning. A prime example of empowering youth in climate action is the Broward Youth Climate Summit, an annual event held in Broward County, Florida. This summit brings together students, educators and experts to discuss climate science, share sustainable practices and develop strategies for mitigating climate impacts in their communities.

1.4.2 Public Outreach Approach

Public participation is important for identifying social, cultural, economic and physical factors, which need to be considered during the establishment of guiding principles used to develop community adaptation strategies. It is also the appropriate avenue for 'socializing' the plan. When local ideas, concerns and preferences are considered, adaptation strategies can be tailored to meet community needs and

desires. Plans and policies that are developed with broad stakeholder participation are more likely to be well-received and gain public support when residents have participated in the process from the start. While some members of the public may not welcome the process initially, meaningful involvement in the various components generally helps to establish trust. Whereas educational sessions such as community forums or webinars can bridge gaps in understanding, providing valid and urgent reasons why flooding and sea level rise adaptation is needed.

Community conversations to identify goals should be centered on topics including:

- Background information and critical risks.
- The steps that can be taken to reduce risks.
- Why adaptation planning efforts are important for the community.
- How the proposed strategies will impact the community.
- Which proposed strategies the community prefers.
- Steps residents can take to assist in community adaptation efforts.
- Equity considerations to ensure fair outcomes for all community members, particularly those which are most vulnerable.

In doing so, an informed set of stakeholders may be equipped to add value to the critical thinking behind focus area identification (see Chapter 2.3).

Outreach Strategies

The success of adaptation strategies largely depends upon confidence in the idea that reductions in long-term risk exposure, combined with present day mitigation efforts, will be sustained. Outreach is an important activity that can help build this confidence and lead to future action; however, each community's outreach strategy will be unique to reflect local conditions. Outreach communication materials should be translated for non-English speakers and should use various forms of multimedia to keep the public engaged while explaining complex topics. To ensure that adaptation is well received in the community, simply posting information on the community's website and social media pages is a first step, although it will not be adequate on its own. Consider the possibility of implementing localized outreach initiatives that are tailored to specific neighborhoods. This could include mobile outreach units or door-to-door surveys to gather input from residents who may not have the ability to attend traditional meetings.

Figure 6. When local ideas, concerns and preferences are considered, adaptation strategies can be tailored to meet community needs and desires.

Positive public information efforts that outline what people can do are more likely to impact behavior. It is not enough that people know they are in a hazardous area; they need to want to do something about it. Community members must understand the effects each strategy will have on them and what actions they can take. Therefore, messaging is especially important.

A key public engagement approach is to shift from "telling" towards "asking" about what should be done. Residents are deeply connected to where they live and crowdsourcing information can add a new layer to components like the VA (e.g., allow citizens to tell their personal

experiences of how their homes, streets or the businesses they frequent have been impacted by King tides and pinpoint these locations on a map with a tag describing the impact).

It is important to prepare for outreach and create specific content areas. A community with a proactive outreach strategy that speaks to specific community social, cultural and political views will have a greater chance of moving beyond "informing" to "prompting community members to act." Determining the different stakeholder views will lend itself to a more tailored and appropriate outreach strategy, a challenging task. As part of an early outreach strategy, it is recommended to incorporate a chart of the recorded sea levels for the nearest NOAA tide gauge over the last 50 to 75 years to represent the historic sea level rise trend. This action should help establish evidence-based reasons for approaching adaptation, help get beyond individual opinions and start a process of deeper community conversations about what to do about increased risk of flooding.

Figure 7. Each community's outreach strategy will be unique to reflect local conditions.

Community Conversations

Messaging is the center of effective public outreach efforts. These are specific statements that the community considers important for its audience. This needs to be repeated many times and through different means before people hear and absorb their meaning. Messaging is more likely to be accepted if it is delivered by trusted stakeholders or at least visibly supported by them. Partnerships in message delivery are more effective than a single agency (and they can be less expensive when local governments combine resources). It is important to recognize that various outreach and messaging approaches bring different results among distinct audiences (e.g., the various age and population groups within a community). Therefore, outreach programs need to be constantly monitored, evaluated and revised for effectiveness. It is also important to be on the lookout in social media, neighborhood bulletins and the news for false rumors and to address these quickly with facts.

Effective messages address why citizens should become knowledgeable and involved. They should explain how flooding impacts everyday life, which should cultivate a call to action. Figure 9 shows an example illustration showing the impacts of sea level rise if no adaptation measure is taken. Applicable and engaging messages consider the target audience and not just systems for information distribution. Communication focuses on how the issue affects people where they live, work, shop, access key services such as health care and conduct other necessary day-to-day activities. Factors considered during the development of messaging include:

HEALTH — The health impacts of flooding are varied and they can be based on three impacts: higher storm surge — causes physical and social issues resulting from property damage, displacement or injury and accidents; increased flooding — causes waterborne disease vectors, housing displacement, limited health care access, nutrition/food supply, exposure to mold and drowning; and raised water table — causes contaminated water supply (from landfill/brownfield seepage, sewage and toxic pollutants release and saltwater intrusion) and unstable foundation from saturated soil.

SAFETY — Storm surge heightened by sea level rise can increase damage. Disruptions at emergency response centers such as fire and police stations, emergency shelters and health-care facilities located in high-risk areas could prevent effective response and have public safety risks.

WHERE PEOPLE LIVE — This includes damage to homes and entire neighborhoods as well as disruptions to essential services like utilities.

PEOPLE'S LIVELIHOODS — Impacts on employment centers as well as employees' access to jobs via roads and transit.

Figure 8. Overarching concepts pulled from individuals' ideas resulting in crowd-sourcing information can provide valuable input when engaging the community.

Figure 9. Effective messages explain how sea level rise and flooding impacts everyday life. (Sea Level Rise simulation credit: Monroe County Vulnerability Assessment)

SOCIALLY VULNERABLE (UNDERSERVED) POPULATIONS — Populations such as renters, non-English speakers, persons with health or physical mobility constraints and others who face greater barriers and fewer resources in planning for and responding to impacts.

NATURAL RESOURCES — Consequences to ecosystems, habitats and public spaces such as beaches, parks and other highly valued recreation opportunities.

All of these factors can be tied back to adaptation options and the benefits that will arise from addressing each issue. The linkages tie together financial, socioeconomic and environmental risks and the corresponding opportunities for resilience. Mitigating areas affected by sea level rise could lead to creative repurposing of land use to include recreational areas that serve both the residents and bring in more tourism.

1.5 Stakeholder Participation Methods

The Context component of the adaptation planning process includes defining the specific points at which public participation should occur. Five public participation points during the adaptation planning process have been highlighted in Figure 11.

Table 1 details a spectrum of stakeholder participation methods, ranging from in-person to virtual communication.

Figure 10. St. Andrews State Park

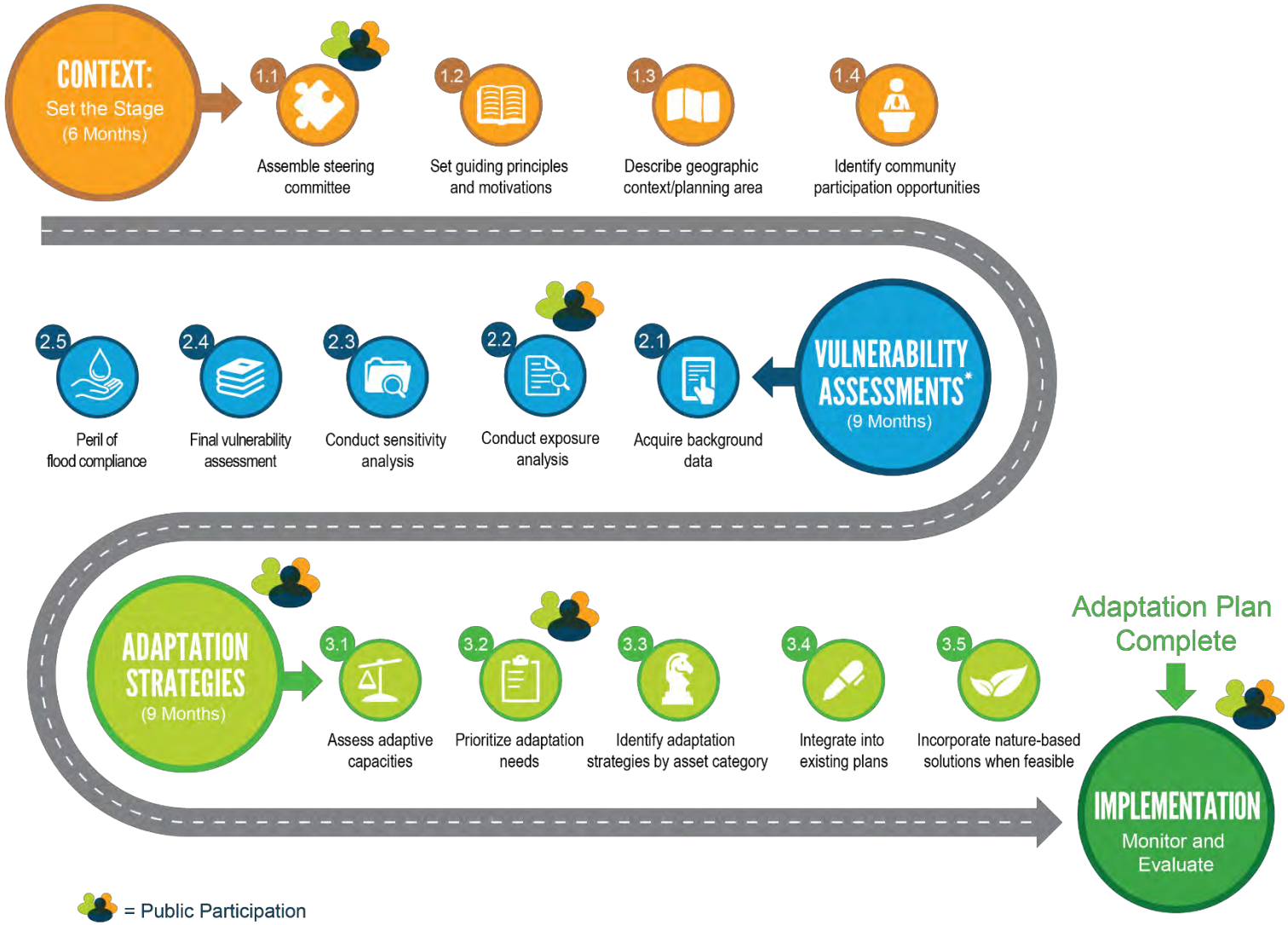


Figure 11. Public participation points during the adaptation planning process.

Table 1. Stakeholder Participation Methods (Adapted from NOAA, 2015 [12])

Method	Description
Advisory group/task force	Small group of people representing various interests set up to give advice on programs or actions. In this planning process, an advisory group of more technically oriented individuals may be appropriate for something like Exposure Analysis.
App	A program that operates on a smartphone. Could be used to poll, disseminate information or provide services.
Charrette	Intense, single or even multi-day effort to design something or solve a problem with robust input from experts and stakeholders.
Field trip	Trip to specific location organized so that participants can match mental images to real conditions.
Focus group	Small discussion group led by a facilitator who draws out in-depth stakeholder input on specific questions.
Hotline	Widely advertised telephone number that directs callers to someone who can answer questions and collect input.
Internet	Dialogue between agencies and stakeholders using Internet technology such as chatrooms, online bulletin boards, email and Web conferencing.
Interview	Face-to-face or telephone interaction with stakeholders conducted by the agency or by a third-party representative.
Large group/small group meeting	Opening presentation then division into smaller groups to discuss an issue or complete a task.
Open house	Event in which the public is invited to visit a location with staffed booths or stations. These stations could include areas with maps (either paper maps or computer stations) facilitated by the meeting organizers staffed with various subject matter experts.
Poll or Survey (in person or online)	Written or oral lists of questions to solicit community impressions/facts about issues at a specific moment in time. Kahoot, Mentimeter, Slido, Vevox, SurveyMonkey, Poll Everywhere and Google Forms are some examples of online surveying and polling tools.
Public hearing	Formal, single meeting where stakeholders present official statements and positions that are recorded.
Public meeting	Large public comment meeting where comments are made to entire audience.
Referendum	A direct vote by the whole electorate on its support of specific proposals.
Retreat	Concentrated, informal meeting that emphasize social interaction as well as issue discussion.
Social media	Information and interactive event and issue marketing are carried out through web and app platforms such as Facebook, X and Instagram.
Story map	An interactive, web-based map that provides enhanced information about locations.
Town hall meeting	Less formal public hearing where stakeholders could speak and/or vote.
Website	An online resource center that may provide (on the front end) information, interactive data, feedback mechanisms and (on the back end) analytics to administrators.
Workshop	Small stakeholder gathering, typically fewer than 25 people, designed to complete a specific assignment in a brief time.

1.6 Best Practices in Stakeholder Involvement

Best practices in stakeholder involvement and participation are determined by the principles established at the beginning of the planning process and are the preferred result of the chosen strategy. Depending on the type of audience and engagement, the best possible techniques for stakeholder involvement will vary. All the best practice strategies may not be applicable for each stage in the adaptation planning process, but all are factors that can shape how community involvement may be designed. Key best practices typically include all of the elements below:

- Centering community voices.
- Motivated participants.
- Influence on the final decision.
- Best available information exchange.
- Informed decision-making.
- Constructive dialogue.
- Adequate analysis.
- Transparency.
- Representative participation.
- Cost-effectiveness.
- Accessibility and inclusivity.
- Limited influence of sponsor.
- Positive social conditions.
- Social learning.

Specifications for each best practice element are matched with the medium of communication and the stakeholders that are involved. Best practice activity examples are outlined below to include the description, format, preparation, duration, approach, outcome, potential barriers and how to overcome barriers.

Figure 102. Successful adaptation is a result of coordinated planning, which stems from the inclusion of several viewpoints from multiple stakeholders. Images illustrate in-person (upper) and virtual (bottom) stakeholder meeting settings. (Photo credit: APTIM)

Opportunities for Public Participation
OPEN HOUSE

Activity Description: Public awareness outreach

Format: Open house

Preparation, Pre- Activity:

- **General public** – None
- **Local representative** – Choose a sea level rise visualizer and database of resources to present, and peruse it. (1 hour)
- **Meeting facilitators** – Prepare salient visualizations of the community available through the visualizer and "talking points" about the upcoming process.

Length: 2 – 4 hours

Approaches: In this activity, community members will be solicited by the project team to attend an informational meeting in which issues will be presented and attitudes gauged. A theme used in a Ft. Lauderdale open house, "This is happening, let's do something about it," helped avoid speculation on the causes or reality of coastal changes.

Outcome: To engage a segment of the public in person, to spread word about the process, and to attend future decision meetings.

Barriers to Desired Outcome: Poor attendance of event, "Position" attendees who want to debate existence and causes of sea level rise, and lack of participant buy-in to proposed planning effort.

How to Overcome Barriers:

- **Widespread advertising** – Ensure that event advertising is widespread and occurs in advance to the scheduled open house. Hold the open house in a prime community location. Have a Facebook event with RSVP tracking (i.e., "going", "not going", "maybe").
- **Avoid "position", focus on "interest"** – ask participants to clarify their values rather than their position. This will help reach an explanation that is satisfying to all parties.
- **"Bridge and pivot"** – acknowledge comments posed by disruptive attendees, and re-orient the dialogue by segueing back to the topic at hand.

Techniques to engage buy-in:

- **Co-benefits of adaptation planning** – making assets and populations more equipped to deal with flooding will make them more productive and healthier today.
- **Sustainability principles** – satisfy the needs of the present without compromising the ability of future generations to meet their needs.
- **Cutting edge planning** – helping the community to leverage the best planning mechanisms available to improve quality of life.
- **Hazard planning** – communities already plan for hazards; this set of activities represents an elaboration of flood-based resiliency planning.

Set Motivations and Guiding Principles
LARGE GROUP/SMALL GROUP MEETING

Activity Description: Citizen empowerment via goal-setting process

Format: Large group/small group meeting

Participant Preparation, Pre-Activity:

- **General public** – Visit a selection of sea level rise related resources and consider local impacts. (1 hour)
- **Local representative** – Review local regulatory documents and assess gaps in goals related to coastal flood planning. (2 hours)
- **Meeting facilitators** – Review local regulatory documents and assess gaps in goals related to coastal flood planning. Create sample goal templates for Infrastructure, Real Estate, Environmental, and Social issues related to coastal flood planning.

Length: 2 – 4 hours

Approaches: Through this activity, community stakeholders, steering committee members, and representatives will work to create new motivations for undertaking adaptation planning. These will guide the planning process and possibly even future policy language. From a general assembly, small groups will break out and create their own sets of goals for various topic areas. Smaller groups should also include steering committee members and representatives.

Outcome: Increased stakeholder buy-in. Coastal Flooding Adaptation Plan Goals.

Barriers to Desired Outcome: Poorly understood meeting objective, belief that planning effort lacks importance, contradictory goals, and lack of diversity in stakeholder participant opinion in goals.

How to Overcome Barriers:

- **Publicize the meeting** through proven methods.
- **Target multiple different demographics** for invitation to the meeting.
- **Clarify**, during the invitation phase, the **meeting objective**.
- **Include links to information about saliency** of adaptation planning before meeting, and briefly address saliency at beginning of meeting.
- **Plan for multiple large group/small group meetings** in different locations.

Choose Projection Tools and Method
FOCUS GROUP

Activity Description: Stakeholder input and plan-guiding process

Format: Focus group with stakeholder representatives from a diverse group of community interests (i.e., chamber of commerce, conservation groups, HOA groups, utilities representatives, other major group representatives) and Steering Committee members.

Participant Preparation, Pre-Activity:

- **Stakeholder representatives:** study a selection of sea level rise projection visualizers and tools and various information about the local sea level rise context. (2 hours)
- **Local representatives:** same as above, and additionally: review future land use maps and tide gauge data for the nearest location, IPCC sea level rise and emissions scenario information, and historic tidal flooding records in the community. (3 hours)
- **Meeting facilitators:** same as above, and additionally: prepare 3 model and scenario options for participants to choose from, that include horizon year, amount of rise based on scenario, and other coastal flooding effects and model outputs.

Length: 4 hours

Approaches: Through the focus group selection exercise, a variety of interests may bring value to the projection and model selection. By involving diverse groups in a more intensive activity, it is likely that more issues may arise concerning a final solution. However, through good facilitation techniques, decisions can be made that will ripple back into the respective areas of the community from where focus group members came. In turn, greater understanding from community groups may result.

Outcome: A projection method and model through which to project future impacts. Model output will affect decisions related to strategies, which will in turn affect regulatory mechanisms such as the future land use map, or current zoning maps, in addition to other documents.

Barriers to Desired Outcome: Non-participation of stakeholder representatives from diverse community backgrounds, disagreement over projection method and tool selection, excessive discussion prohibits decision making, and participant confusion or non-comprehension of topic.

How to Overcome Barriers:

- **Ensure** diverse stakeholders are approached and RSVP for the event.
- **Assist** participants to obtain the information recommended in "pre-activity" above.
- **Pro-actively ensure** that stakeholders comprehend some of the material before the event.
- **Apply** good meeting facilitation techniques.

Focus Area Assignment Based on Projection
LARGE GROUP/SMALL GROUP MEETING

Activity Description: Information sharing and empowerment through focus area choice

Format: Large group/small group meeting

Participant Preparation, Pre-Activity:

- **General participant:** Familiarize with project and model being utilized. (1 hour)
- **Community representative:** Consider projection output as it relates to land uses, assets, and other community features. (3 hours)
- **Meeting facilitators:** prepare all model outputs into large and medium-sized maps. (6 hours)

Length: 2 – 4 hours

Approaches: Through a large group/small group meeting, the planning team may enhance focus group participation from the prior community engagement. More stakeholders may attend, and smaller groups may be partitioned to include a mix of different stakeholder backgrounds. By examining the model outputs, groups may then collaboratively vote on where they would like to see adaptation efforts focused.

Outcome: Categorical and spatial descriptions of key community assets on which adaptation strategy creation will be focused. Community anticipation and interest in development of adaptation strategies, and the role of resilience, in planning the future for the community.

Barriers to Desired Outcome: Belief that personal/business rights may be infringed upon (e.g., eminent domain), anxiety to promote something as a focus area because of perceived changes to the current state in which the area or asset exists, and disagreement over location/categories of focus areas.

How to Overcome Barriers:

- **Include strong evidence** within the presentation to indicate co-benefits of adaptation planning.
- **Develop a plan** to show that 'property rights infringement' is not an adaptation strategy.
- **Practice** good facilitation techniques.

Poll Community-Preferred Adaptation Strategies SURVEY

Activity Description: Community member consultation for desired adaptation strategies, which will integrate preferences expressed according to costs and benefits. Costs and benefits may include dollar values and/or other non-monetized preferences.

Format: Survey (e.g., online poll or mail-out)

Participant Preparation, Pre-Activity:

- **Participants:** None
- **Community representatives:** Identify ways to communicate the proposed strategies. (1 hour)
- **Meeting facilitators:** Develop the survey format and questions. Create the survey in the desired medium (e.g., printed, survey-monkey.com, etc.). (8 hours)

Length: Open response period – 1 week; time to complete 15-30 min.

Approaches: A survey will allow a great number of people to experience the pro-active planning effort, perceive co-benefits, and express their preferences for interventions that represent the main outcomes of adaptation planning.

Outcome: To have a solid foundation of community opinion registered, in an "informal referendum" format, and to fold into the implementation step of the process.

Barriers to Desired Outcome: Lack of response participation, misunderstanding of survey goals, and lack of response diversity.

How to Overcome Barriers:

- **Assess** which survey medium will garner the most results (e.g., online, paper).
- **Target** community stakeholders and assist them in answering the survey.
- **Clearly define** the process steps taken to date and the current task at the beginning of the survey.

CHAPTER 2: VULNERABILITY ASSESSMENT

City of Fort Lauderdale

Chapter 2. Vulnerability Assessment

The VA represents the second component in the adaptation planning process. It consists of measuring the impact of flooding-related hazards and identifying the people, infrastructure and land uses that may be affected. Vulnerability is often used interchangeably with risk when measuring hazard impacts. NOAA provides a useful definition of vulnerability that informs the follow-on actions described later in this chapter:

"The potential for loss of or harm/damage to exposed assets largely due to complex interactions among natural processes, land use decisions and community resilience." [16]

There is sometimes confusion related to whether a community is conducting a "risk analysis," "vulnerability analysis" or some combination of both. For this guide, risk and vulnerability overlap in their inputs and outputs. The main difference is that risk analyses are outlined for use in local hazard mitigation strategies by the CFR (44 CFR §201.6). Risk analysis entails determining the extent to which any hazard may impact a community. Because the focus of this adaptation guide is on inland or coastal flooding and sea level rise, communities can devote more resources to projecting their specific hazard impact, including a more extensive inquiry into affected land uses and populations than is outlined as a minimum requirement in the CFR for a general risk assessment (44 CFR §201.6).

Benefits of performing a VA extend beyond the goal of an adaptation plan. For example, a VA fulfills a statutory requirement of section 380.093, F.S., to maximize funding for DEP's RF Program grant awardees. The recommended analyses also form the basis for complying with the "Peril of Flood" comprehensive plan requirements as found in section 163.3178(2)(f)(1-6), F.S. By integrating the best available scientific methods and developing a keen awareness of different structural and social assets that may be vulnerable to coastal and inland flooding, the community may ensure that the most useful basis for planning is established.

Why do you need a VA?
A VA helps a community determine which structural and social assets are likely to be impacted by coastal and inland flooding and sea level rise.

A variety of supporting analyses may be contained within the scope of a VA. Information in this chapter draws from the methodologies found in the "**Florida Statewide Vulnerability Assessment" (FSVA)** [6]. As such, the VA is broken down into the following sub-components: **Acquiring Background Data, Exposure Analysis, Sensitivity Analysis and Focus Area Identification and Mapping** and **Peril of Flood Compliance.**

This guidebook and the methodologies found in the Florida Statewide VA aim to assist local governments, both coastal and inland, in developing the project, project cost estimates and assist communicating requirements to consultants, when applicable, in the preparation of a statutorily compliant VA. The following are the scope of work tasks that a VA typically includes:

1. **Kick-off Meeting:** Form a project team and define the project goals, schedule and deliverables with local government.
2. **Assemble Steering Committee and Conduct Public Outreach:**
   - Recruit representatives from various sectors to the steering committee.
   - Hold meetings to get feedback and data for the VA.
3. **Acquire Background Data:**
   - Collect data on critical/regionally significant assets, topography and flooding scenarios as defined by section 380.093, F.S.

4. **Draft VA**:
    - **Conduct Exposure Analysis** to identify areas affected by flooding under different scenarios.
    - **Conduct Sensitivity Analysis** to measure the impact of flooding on critical assets.
    - **Identify focus areas** that are particularly vulnerable.
5. **Final VA:**
    - Finalize the VA report with findings, maps, tables and a list of impacted critical assets.
    - Present the results of the VA to the public.
6. **Peril of Flood Compliance (if applicable):**
    - Update local comprehensive plans to comply with flood risk reduction requirements.
7. **Local Mitigation Strategy**
    - Use the VA results to inform the local mitigation strategy.

To ultimately write an adaptation plan that reflects the expertise and interests of the community's local stakeholders, public involvement should be included at each step. Community members need to know about the potential threat of flooding, and they need to know concrete information about the planning being done to confront it. Early introduction of flooding visualization tools can indicate the great level of detail that scientists have already committed to projecting and mapping future change and can be very tangibly felt when shown in a specific community. Integrating testimonials of those who have perceived experience with flooding and sea level rise can contribute to the authenticity and local focus of the process. Longtime residents of an area may contribute valuable information about lost barrier islands or coastal areas where they once recreated or did business. Often vulnerabilities are brought out by community members that are not evident from mapping and studies.

See Appendix 6.1 for Economic Development, Historic and Cultural Resources and Natural Resources special considerations.

2.1 Acquire Background Data

Acquiring background data is essential for laying the groundwork of the entire VA process. The project team conducting the VA should collect information on three main categories: critical/regionally significant assets, topography and flood scenarios (**Error! Reference source not found.**13). Critical assets include everything from infrastructure, such as bridges and power plants, to community facilities, like schools and hospitals. As defined in section 380.093, F.S., **"regionally significant assets"** are critical assets that support the needs of communities spanning multiple geopolitical jurisdictions, including, but not limited to, water resource facilities, regional medical centers, emergency operations centers, regional utilities, major transportation hubs and corridors, airports and seaports. Essentially, anything vital to the daily functioning of the community should be accounted for in the VA. One useful data source can be DEP's Statewide Critical Assets Dataset [17] to locate critical assets geographically. See Chapter 2.6 for a list of relevant data sources.

To understand flood risk, detailed topographic data is required. This comes in the form of elevation information from various sources, including survey data and LiDAR, Digital Elevation Model (DEM). Finally, data related to potential flood scenarios is essential. This encompasses everything from precipitation data to sea level rise projections.

It should be noted that data gaps might exist from the VA before starting an adaptation plan. Identifying and rectifying them whenever possible, depending on available funding, is important for a comprehensive adaptation plan.

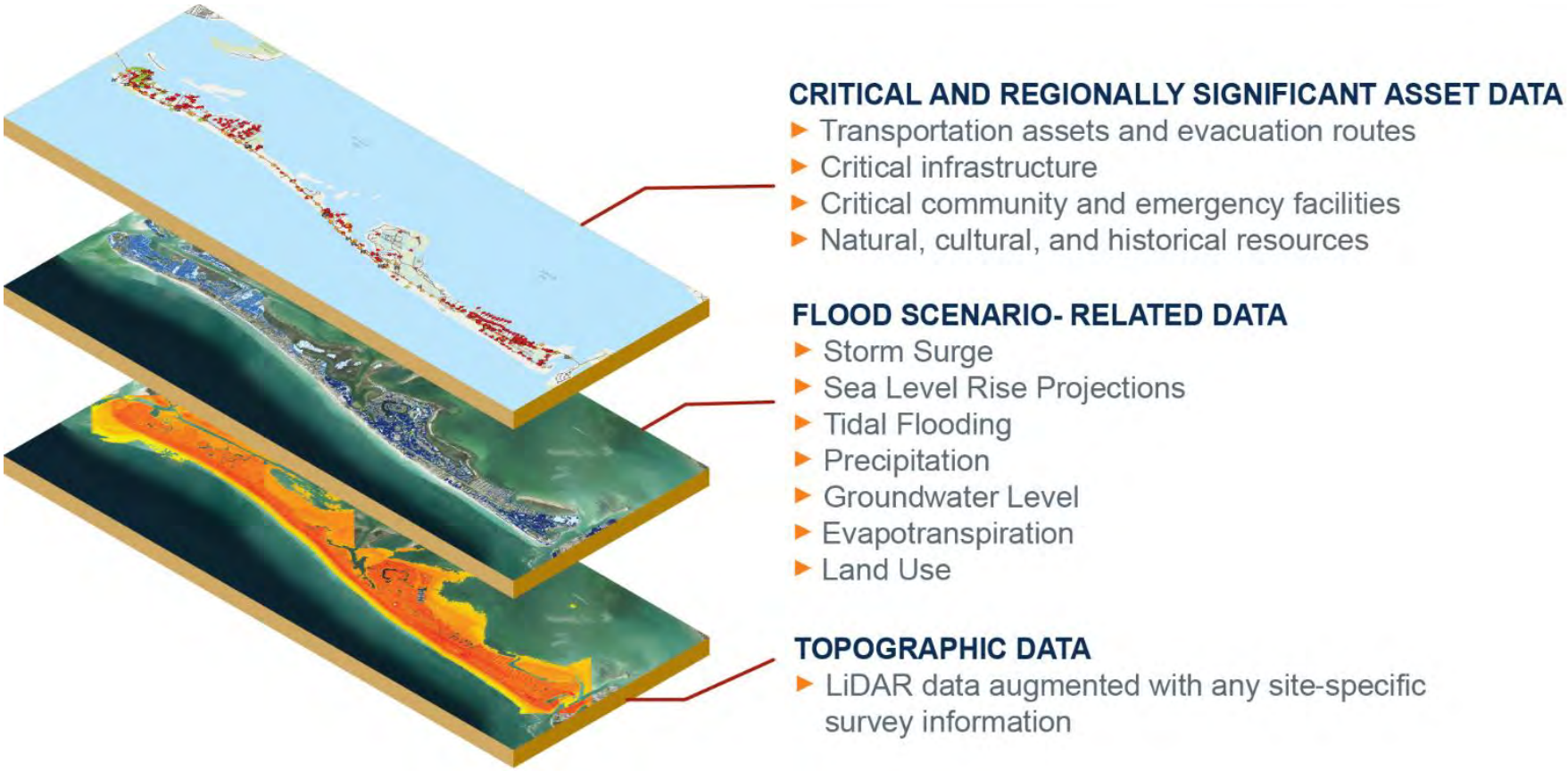


Figure 13. Data layering in Geographic Information Systems (GIS) environment for exposure and sensitivity analyses.

Draft Vulnerability Assessment

The draft VA should include exposure and sensitivity analyses. Identifying focus areas for adaptation and hosting a public outreach meeting at this phase of the VA are recommended. The public outreach meeting can be used to present the results from the exposure analysis, sensitivity analysis and draft VA and to receive public feedback on prioritization of focus areas for the development of adaptation strategies and implementation projects.

2.2 Conduct Exposure Analysis

The purpose of the exposure analysis is to determine water depths caused by various flooding scenarios, including sea level rise, storm surge, rainfall and compound flooding. To achieve this, the project team must follow the methodologies found in the "Florida Statewide Vulnerability Assessment" (FSVA) [6] and the

Exposure Analysis
An Exposure Analysis identifies baseline risk and allows a community to understand risk in terms of spatial extent and level of exposure.

requirements of section 380.093, F.S. which dictates assessing the following flood hazard scenarios:

- **Sea Level Rise:** At a minimum, NOAA's 2022 intermediate-low and intermediate sea level rise scenarios for 20-year and 50-year planning horizons should be used.
- **Tidal flooding**: Current and future high tide flooding, which must use thresholds published and provided by DEP. To the extent practicable, the analysis should also geographically display the number of tidal flood days expected for each scenario and planning horizon.
- **Current and future storm surge flooding:** The initial storm surge event used must equal or exceed the current 100-year flood event. Higher frequency storm events may be analyzed to understand the exposure of a critical asset or regionally significant asset. Publicly available NOAA or FEMA storm surge data may be used in the absence of applicable data from the Florida Flood Hub.
- **Rainfall-induced flooding** (to the extent practicable): Using a GIS-based spatiotemporal analysis or existing hydrologic and hydraulic modeling results. Future boundary conditions should be modified to consider sea level rise and high tide conditions. VAs for rainfall-induced flooding must include the depth of rainfall-induced flooding for a 100-year storm and a 500-year storm, as defined by the applicable water management district or, if necessary, the appropriate federal agency. Future rainfall conditions should be used, if available. Noncoastal communities must perform a rainfall-induced flooding assessment.
- **Compound flooding** (to the extent practicable) or the combination of tidal, storm surge and rainfall-induced flooding.

NOAA's Sea Level Rise Viewer and Sea Level Rise Calculator tools [19] can be utilized to visualize the extent of sea level rise impacts on communities. Other tools to visualize and download flood-scenario related data are listed in Chapter 2.6. If applicable, local sea level data should be interpolated between the two closest NOAA tide gauges that can be located using NOAA's Tides and Current web page [20], or data from a single gauge with higher mean sea level can be used.

Geographically, the analysis should encompass the **entire municipality or county, including all critical assets**. The data and modeling standards require the use of the latest publicly available DEM with a 3-meter cell size. The minimum standard modeling technique is the Modified Bathtub Model, which identifies all areas under a target elevation as potentially flooded, applying a hydrologic connectivity filter to remove isolated inundated areas not connected to a major waterway.

2.3 Conduct Sensitivity Analysis

Sensitivity Analysis
A Sensitivity Analysis provides an inventory of community assets, such as populations, structures, and economic functions, and quantifies and measures the impacts of flooding on those assets.

Sensitivity can be defined as the responsiveness of a system to hazard impacts [21]. Sensitivity Analysis builds upon the Exposure Analysis and is usually conducted utilizing the same tool that was used to make the exposure map. Conducting a Sensitivity Analysis helps the community to identify natural resources, structures, populations and other features located in areas that are at risk in the flooding scenarios projected during Exposure Analysis. The sensitivity analysis will determine **inundation depths** for critical and regionally significant assets under each flood scenario, through the examination of water levels in relation to asset elevations determined via local LiDAR and site-specific survey information where available. Flood depths vary across scenarios and timeframes ranging from a depth of less than 1 foot (nuisance flooding) and a depth of 1-2.5 ft. (disturbance), to a depth greater than 2.5 ft. (impact), with

Critical Asset Category/ Risk Ranking	Critical Community and Emergency Facilities	Critical Infrastructure	Natural, Cultural and Historic Resources		Transportation and Evacuation Routes	
			Buildings	Parcels	Bus Terminals and Marinas	Roadway Intersections
Low	< 3”	< 3”	< 3”	< 25%	< 3”	0” – 3”
Medium	3” – 18”	3” – 18”	3” – 18”	25% – 50%	3” – 18”	3” – 6”
High	> 18”	> 18”	> 18”	> 50%	> 18”	> 6”

Table 2. Critical Asset Category — Risk Ranking Criteria as presented in Florida Statewide Vulnerability Assessment [6].

greater depths corresponding to increasing impacts. Table 2 provides the risk criteria for flood depths above the asset elevation per asset category as outlined in FEMA’s Preliminary Damage Assessment Guide and FSVA.

The Sensitivity Analysis serves as an opportunity for the planning team and its steering committee to identify the land uses, buildings, resources and people affected by the flooding scenarios and potential sea level rise projected by the Exposure Analysis. By mapping all entities in the community’s jurisdiction, the planning team develops a basic representation of which entities have the potential to be affected by flooding.

The planning team may introduce and analyze new layers of structural and population sensitivity by including various characteristics in the Sensitivity Analysis mapping. For buildings, this may include physical characteristics that will better respond to sea level rise, such as raised, floodable and anchored structures. For natural areas, this may include information about wildlife, ecosystems, floodplains, water tables and industry-supporting habitats (such as oyster coves). For populations, this can include social demographics, such as household size and income by census tract. Examples of Best Practices are identified in Chapter 2.7.

Identify Focus Areas

Building on the insights gained from the exposure and sensitivity analyses, communities can pinpoint locations or assets that are particularly vulnerable to flooding and prioritize them for the development of targeted adaptation strategies by identifying focus areas with the assistance of the steering committee and community stakeholders. The focus areas can help the community designate areas to start their adaptation process and narrow the field to build a track record of implementation.

Deciding on focus areas is a step where the planning team engages the community to address the findings from the Exposure and Sensitivity Analyses. It is recommended that before the VA begins, criteria be established to guide the public’s input (e.g., focus areas are established where critical facilities or infrastructure are located and/or where the highest affected population resides). To do this, it is important to convey information about the potentially affected entities to both steering committee members and community stakeholders and to record their feedback about what should become a focus area and why. Preferential areas which receive steering committee and community attention may then be deemed focus areas that can benefit from adaptation strategies directed toward them using the following components.

City of North Miami, Stormwater Park

2.4 Final Vulnerability Assessment

Incorporating feedback from the Steering Committee, public outreach efforts and the local government, the project team should develop a Final VA report according to the guidelines in section 380.093, F.S. This may include a list of identified focus areas when applicable. The final VA should encompass all results from the exposure and sensitivity analyses, providing a summary of identified risks and assigned focus areas.

The assessment should list critical and regionally significant assets impacted by flooding and sea-level rise, detailing the specific flood scenarios affecting each asset. The project team must also complete the VA Compliance Checklist [22]. As required by statute, the final submission should include:

- A detailed report of the assessment's findings, including a list of critical assets and regionally significant assets, impacted by flooding and sea-level rise.
- All electronic mapping data illustrating the identified impacts of flooding and sea-level rise.
- GIS data incorporated into the Florida State Plan Coordinate System.
- Metadata adhering to DEP's prescribed standards.

2.5 Peril of Flood Compliance (if applicable)

The Peril of Flood Statute, section 163.3178(2)(f), F.S., signed in 2015 requires communities that have a Coastal Management Element as a part of their comprehensive plan to develop a redevelopment component with principles that must be used to eliminate inappropriate and unsafe development in the coastal areas. If receiving RF Program planning grant funds to complete a VA, communities are required to update their comprehensive plan coastal management element language to comply with the Peril of Flood requirements.

2.6 Data Sources, Tools and Resources

The tools and resources listed in this section can be used by a planning team to conduct an Exposure Analysis and Sensitivity Analysis and for decision-making purposes when identifying focus areas (Table 4-Table 6). Table 3 lists the asset types and categories of critical and regionally significant assets, which may be necessary for VAs. Publicly available critical and regionally significant asset data can be found in DEP's Statewide Critical Assets Dataset [17]. Additional data sources are noted on the table as needed for gap analysis.

Table 3. List of Asset Types for VAs and Relevant Data Sources

Asset/Data Type	Asset/Data Class
Airports	Transportation and Evacuation Routes
Bridges	Transportation and Evacuation Routes
Bus Terminals	Transportation and Evacuation Routes
Ports	Transportation and Evacuation Routes
Major Roadways	Transportation and Evacuation Routes
Marinas	Transportation and Evacuation Routes
Rail Facilities	Transportation and Evacuation Routes
Railroad Bridges	Transportation and Evacuation Routes
Wastewater Treatment Facilities and Lift Stations	Critical Infrastructure
Stormwater Treatment Facilities and Pump Stations	Critical Infrastructure
Drinking Water Facilities	Critical Infrastructure
Water Utility Conveyance Systems	Critical Infrastructure
Electric Production and Supply Facilities	Critical Infrastructure
Solid and Hazardous Waste Facilities	Critical Infrastructure
Military Installations	Critical Infrastructure
Communications Facilities	Critical Infrastructure
Disaster Debris Management Sites	Critical Infrastructure
Schools	Critical Community and Emergency Facilities
Colleges and Universities	Critical Community and Emergency Facilities
Community Centers	Critical Community and Emergency Facilities
Correctional Facilities	Critical Community and Emergency Facilities
Disaster Recovery Centers	Critical Community and Emergency Facilities
Emergency Operation Centers	Critical Community and Emergency Facilities
Fire Stations	Critical Community and Emergency Facilities
Health Care Facilities/Emergency Medical Service Facilities	Critical Community and Emergency Facilities
Hospitals	Critical Community and Emergency Facilities
Law Enforcement Facilities	Critical Community and Emergency Facilities
Local Government Facilities	Critical Community and Emergency Facilities
Logistical Staging Areas	Critical Community and Emergency Facilities
Affordable Public Housing	Critical Community and Emergency Facilities
Risk Shelter Inventory	Critical Community and Emergency Facilities
State Government Facilities	Critical Community and Emergency Facilities
Conservation Lands	Natural, Cultural and Historical Resource
Parks	Natural, Cultural and Historical Resource
Shorelines	Natural, Cultural and Historical Resource
Surface Waters	Natural, Cultural and Historical Resource
Wetlands	Natural, Cultural and Historical Resource
Historical and Cultural Assets	Natural, Cultural and Historical Resource
Seaplane Base	Transportation and Evacuation Routes
Heliports	Transportation and Evacuation Routes
Parcels, including marinas	Critical Community and Emergency Facilities
Building Footprints	Critical Community and Emergency Facilities
Seawalls	Critical Infrastructure

Tools are divided into three types: 1) visualization tools; 2) modeling tools; and 3) decision support tools.

Visualization tools can be used to create simulations and graphics of current and potential future conditions. These tools often perform analyses but generally require less user input and customization than other analytical tools. Often, they do not have the ability to run customized analyses with local data. These tools are generally easy to use and do not require specific software or hardware.

Modeling tools are computer software programs or GIS add-ins that can calculate future coastal flood scenarios and visualize current and potential conditions of geophysical, biological and/or socioeconomic processes in a map-based, tabular or graphic format. These tools are generally the most technically challenging to use and often require GIS software and appropriate hardware, technical expertise and training. Modeling tools also generally require local data on the process being investigated.

Decision support tools help develop scenarios of future conditions resulting from potential sea level rise and flooding conditions, as well as management decisions.

These tools can integrate outputs from various methods, such as models, to help develop "what if" scenarios and investigate a wide variety of management outcomes. Decision support tools generally require at least a moderate degree of technical capacity such as GIS expertise.

A brief description of each tool is provided as well as a "ranking" of the level of resource commitment and/or degree of specialty required to use that tool. This ranges from **User-Friendly** (★) — requires limited or no experience/training, **Moderate Complexity** (★★) — requires at least basic experience using GIS software and **Advanced** (★★★) — requires extensive technical modeling experience. The type of analysis each tool can be used to conduct is also identified as either **Exposure Analysis (E)**, **Sensitivity Analysis (S)** or **Identify Focus Areas (F)**.

Note that since URLs often change, no hyperlinks or weblinks have been provided. Please use an online search engine to access the tools and find more information.

Table 4. List of Visualization Tools

Tool/Resource Name	Purpose	Ranking	Type of Analysis
Visualization Tools			
DEP Combined FSVA and Sea-Level Impact Projection (SLIP) Study Tool	This tool presents the environmental risks across Florida. It visualizes the results of the SVA that examines the impacts of climate change, sea-level rise, extreme weather, human activities on natural resources, infrastructure and communities. This tool guides policy decisions, resource management and actions to enhance resilience, protect public health and ensure sustainability.	★	E, S, F
CanVis (NOAA)	This tool allows users to create photo-realistic simulations for visualizing the potential impacts from coastal development and sea level rise.	★	E
NOAA Sea Level Calculator	This tool uses Quick Views to present curated sets of data and interactive visualizations that focus on different dimensions of coastal inundation and sea level rise.	★★	E, F
NOAA Sea Level Rise Viewer	This tool is an online viewer that allows users to visualize potential impacts from sea level rise.	★★	E
NOAA Sea Level Trends	This tool illustrates regional trends in sea level with arrows representing the direction and magnitude of change. This can be used to determine areas which have experienced the highest rates of change and may be most vulnerable to future sea level rise.	★	E
Social Vulnerability Index (SoVI) (University of South Carolina, Hazard and Vulnerability Research Institute)	This tool measures the social vulnerability of U.S. counties and census tracts to environmental hazards, including sea level rise.	★	E, S, F
FEMA National Risk Index	The National Risk Index is a dataset and online tool to help illustrate the U.S. communities most at risk for natural hazards. The Index leverages available source data	★	E, S, F

Tool/Resource Name	Purpose	Ranking	Type of Analysis
	for 18 natural hazards, social vulnerability and community resilience to develop a baseline relative risk measurement for each U.S. county and Census tract.		
United States Geological Survey (USGS) Coastal Change Hazards Portal	This interactive tool enables users to access coastal change science and data for U.S. coasts.	★	E
USGS Digital Shoreline Analysis System (DSAS)	This tool can be used to measure coastal erosion and accretion, which can help users determine the areas that have experienced the highest rates of change and may be most vulnerable to sea level rise.	★★	E
NOAA Coastal Flood Exposure Mapper	This is an online visualization tool that supports communities by assessing their risks to multiple coastal flooding hazards.	★★	E
National Hurricane Center Storm Surge Risk Maps	This national depiction of storm surge flooding vulnerability helps people living in hurricane-prone coastal areas. These maps show that storm surge is not just a beachfront problem, with the risk of storm surge extending many miles inland from the immediate coastline in some areas.	★★	E
Climate Risk and Resilience Portal (ClimRR)	The Climate Risk and Resilience Portal seeks to empower non-technical individuals, organizations, planners and decision-makers at state, local, tribal and territorial governments to gain awareness of simulated future climate conditions at mid- and end-of-century for a range of climate perils. It aids with climate risk-informed analyses to support decision-making and adaptation efforts.	★	E
U.S. Army Sea Level Analysis Tool	The Sea Level Analysis Tool (SLAT) is a user-friendly web application that enables users to visualize observed sea level, tidal and extreme water level data as it intersects with elevation thresholds related to local infrastructure (e.g., roads, power generating facilities, dunes).	★	E

Tool/Resource Name	Purpose	Ranking	Type of Analysis
DEP SLIP Study	The purpose of the SLIP Study Tool is to facilitate the conduction of SLIP studies for state-funded construction within the coastal building zone in accordance with section 161.551, F.S.	★	E
South Florida Water Management District (SFWMD) South Florida Flood Information Resource	A resource for collecting and consolidating flood observations to help us better understand evolving flood patterns associated with King Tides, Rainfall, Tropical Storms, Hurricanes and Storm Surge. Flood Information and Current Event Viewers are designed for exploration of publicly shared Flood Information Repository content.	★	E
Climate Mapping for Resilience and Adaptation Assessment Tool	The Assessment Tool is an interactive application that provides statistics, maps and reports on climate conditions for every county in the United States.	★	E

Table 5. List of Modeling Tools and Software

Tool/Resource Name	Purpose	Ranking	Type of Analysis
Modeling Tools			
ADvanced CIRCulation Model (ADCIRC) (University of North Carolina at Chapel Hill, University of Notre Dame, University of Texas at Austin)	This tool can be used to analyze the effects of sea level rise on storm surge. Future scenarios can consider a given rate of sea level rise and determine how much additional inundation is predicted during a storm event compared to that under initial conditions.	★★★	E, S
Hazus-MH (FEMA)	This tool is a risk assessment methodology for analyzing potential losses. Although it is not specifically designed for sea level rise planning applications, many communities have used it to assess potential losses due to sea level rise.	★★	E, S
Integrated Valuation of Environmental Services and Tradeoffs (InVEST) (Nature Capital Project)	This tool is a suite of software models that are used to map and model ecosystem services and their variation under different management and climate scenarios. The Coastal Vulnerability Model can be used to calculate a vulnerability index for the impacts of erosion and inundation on coastal communities that accounts for projected change in sea level rise.	★★★	E, S
NatureServe Climate Change Vulnerability Index (CCVI)	This is an Excel-based tool that identifies plant and animal species that are particularly vulnerable to the effects of climate change and can help assess the relative vulnerability of species of interest occurring on the coast that may be impacted by sea level rise.	★★	E, S
NOAA Wave Exposure Model (WEMo)	This is a free tool that estimates wave energy and its effects on ecosystem functions as well as on developed coastal and inland-water areas.	★★★	E, S
Sea Levels Affecting Marshes Model (SLAMM) (Warren Pinnacle Consulting, Inc.)	This tool simulates wetland conversion and shoreline modification resulting from long-term sea level rise. As such, the tool can be used for projecting the effects of sea level rise on the distribution of coastal wetlands and the geomorphic configuration of coastal areas.	★★★	E, S

Tool/Resource Name	Purpose	Ranking	Type of Analysis
Simulator of Climate Change Risks and Adaptation Initiatives (SimCLIM) (CLIMsystems Ltd.)	This tool can be used to model site-specific sea level rise. The tool can create scenarios and project impacts of sea level rise.	★★★	E, S
United States Army Corps of Engineers (USACE) Sea Level Change Curve Calculator	This tool can be used to calculate the amount of predicted sea level change for any location along the U.S. coast from 1992 forward. Results are shown as a graph.	★	E, S
StormWise™ (previously ICPR4)	This tool is a hydrologic and hydraulic modeling software that has aided engineering professionals with identifying flood risks and floodplains, modeling flood scenarios, reducing construction costs, better planning and decision-making and compliant stormwater management.	★★★	E, S
HEC-RAS	HEC-RAS is designed to perform one-dimensional and two-dimensional hydraulic calculations for a full network of natural and constructed channels, overbank/floodplain areas, levee protected areas, etc.	★★	E, S
Storm Water Management Model (SWMM) (XPSWMM, PCSWMM, EPASWMM)	The United States Environmental Protection Agency's (EPA) Storm Water Management Model (SWMM) is used throughout the world for planning, analysis and design related to stormwater runoff, combined and sanitary sewers and other drainage systems. It can be used to evaluate gray infrastructure stormwater control strategies, such as pipes and storm drains and create cost-effective green/gray hybrid stormwater control solutions.	★★★	E, S
MIKE SHE/MIKE HYDRO	MIKE SHE is integrated catchment hydrological modelling software designed to simulate surface water and groundwater interactions in complex systems. This tool is widely used by hydrologists, engineers, researchers to evaluate water resources, predict flooding events and optimize water management strategies.	★★★	E, S

Tool/Resource Name	Purpose	Ranking	Type of Analysis
Delft3D	Delft3D is an Open-Source Software and facilitates the hydrodynamic (Delft3D-FLOW module), morphodynamic (Delft3D-MOR module), waves (Delft3D-WAVE module), water quality (Delft3D-WAQ module including the DELWAQ kernel) and particle (Delft3D-PART module) modelling.	★★★	E, S
SFWMD South Florida Flood Impact Assessment Tool	The SFWMD's Flood Impact Assessment Tool (SFWMD-FIAT) was specifically designed for the SFWMD to run quick, consistent and well-founded flood damage and risk calculations. This functionality will support deciding on appropriate courses of action and help underpin the benefits of flood mitigation and adaptation measures when recommending priority infrastructure investments.	★★	E, S
Coastal Green-Gray Cost-Benefit Analysis (CBA) Tool	This tool was developed to illuminate the business case for green-gray infrastructure and address key knowledge and data gaps that inhibit widespread adoption of these solutions. It enables the user to compare green, green-gray or gray infrastructure alternatives — whether the project is at the conceptual stage or further along with detailed data available.	★★★	E, S

Table 6. List of Decision Support Tools

Tool/Resource Name	Purpose	Ranking	Type of Analysis
Decision Support Tools			
BEACH-fx (USACE)	This tool is a comprehensive analytical framework for evaluating the physical performance and economic benefits and costs of shore protection projects, including sea level rise adaptation projects.	★★★	S, F
ClimRR	The Climate Risk and Resilience Portal aids with climate risk-informed analyses to support decision-making and adaptation efforts.	★	E, S
Coastal Adaptation to Sea Level Rise Tool (COAST)	This software helps users answer questions addressing the costs and benefits of actions and strategies to avoid damages to assets from sea level rise through 3D visualizations. Developed at the University of Southern Maine with funds. The EPA, in collaboration with partners at Battelle, the Maine Geologic Survey, the University of New Hampshire and Blue Marble Geographics.	★★	S, F
CommunityViz (Placeways LLC)	This tool provides a means for visualizing and communicating potential future land use change scenarios driven by sea level rise.	★★★	S, F
NOAA Inundation Analysis Tool	This is an online tool that can be used to create scenarios of increased sea level rise. The output may be used to compare how many high tides and total hours of inundation would have been experienced during a selected period, assuming a given amount of sea level rise versus the historical data.	★	S, F
NOAA — Digital Coast	The Digital Coast was developed to support informed coastal management in communities by providing not only coastal data, but also tools, training and other valuable information. Content comes from many sources vetted by NOAA. Data sets range from economic data to satellite imagery. The site contains visualization tools, predictive tools and tools that make data easier to find and use. Information is also organized by focus area or topic.	★	S, F

Tool/Resource Name	Purpose	Ranking	Type of Analysis
U.S. Climate Resilience Toolkit	The U.S. Climate Resilience Toolkit offers information from across the U.S. federal government in one easy-to-use location. The goal is to improve people's ability to understand and manage their climate-related risks and opportunities, and to help them make their communities and businesses more resilient to extreme events.	★	S, F
FEMA Resilience Analysis and Planning Tool (RAPT)	RAPT helps you visualize and analyze data about your community. RAPT is a free GIS web map with over 100 pre-loaded data layers and easy to use analysis tools. RAPT supports emergency management decisions for outreach, planning, mitigation, response and recovery.	★	E, S, F
NOAA Adapting Stormwater Management for Coastal Floods	Communities can use this tool to determine how the flooding of today and tomorrow can affect their stormwater systems and generate reports that can be used to display local information about the current and future flooding impacts to inform planning efforts.	★	F
NOAA+FEMA Federal Flood Standard Support Tool Beta	Understand whether your project is located within a Federal Flood Risk Management Standards (FFRMS) floodplain and assess its vulnerability to future flooding scenarios, adhering to FFRMS. It is Step 1 of the 8-step decision-making process used to comply with Executive Order 11988.	★★★	E, S
Gulf Tools for Resilience Exploration Engine (TREE)	This tool is a decision-support search engine designed to help you confidently identify the best climate tool for your needs.	★	F
SFWMD Resilience Metrics Hub	This Hub hosts the latest Water and Climate Resilience Metrics information and data analysis results, as well as related information that is relevant to the context of each metric discussion.	★	F
Risk Factor — Climate Risk Reports	This tool allows users to find leading physical climate risk modeling for any property in the U.S. comprehensive risk overview and access detailed reports about past, present and future risks as well as high-level solutions to help mitigate risk.	★	E, S

2.7 Best Practices and Funding Opportunities

Recommended Tools and Resources

While choosing from the range of recommended tools provided above, communities should consider their own needs in terms of population, vulnerability and capacity/capability (the community's access to administrative, technical, fiscal and political capital).

DEP has introduced the **Combined SVA and SLIP Study Tool**, a comprehensive resource designed to help local governments and stakeholders evaluate and address the impacts of sea-level rise and flooding across Florida. This integrated tool facilitates the assessment of infrastructure and community vulnerabilities, supporting the development of effective adaptation and mitigation strategies. It provides results from the FSVA Study, identifying potential risks to critical assets, including natural, cultural and historical resources, as well as transportation and evacuation routes. Additionally, the platform allows communities to develop and submit their SLIP studies for DEP review. The SLIP Tool offers sea-level rise projections, enabling users to visualize future coastal changes and plan accordingly. By leveraging these capabilities, the tool supports informed decision-making, fostering resilience and sustainability in Florida communities

NOAA's Sea Level Rise Viewer and **Sea Level Rise Calculator** tools are recommended for local governments to use for visualizing the local potential impacts of sea level rise. The Sea Level Rise Viewer shows how various levels of sea level rise will impact a coastal community through a "horizon year" slider bar that illustrates inundation levels based upon a future year, and it provides simulations of sea level rise at local landmarks. It can also communicate the spatial uncertainty of mapped sea levels, model potential marsh migration due to sea level rise, overlay social and economic data onto potential sea level rise and examine how tidal flooding will become more frequent with sea level rise. The Sea Level Rise Calculator uses Quick Views to present curated sets of data and interactive visualizations that focus on different dimensions of coastal inundation and sea level rise, including extreme water levels, changes in flood frequency, observed sea level trends and seasonal variation.

FEMA's RAPT is a GIS-based resource designed to enhance disaster preparedness, response, recovery and mitigation efforts by providing an interactive map with over 100 data layers covering community resilience indicators, natural hazards, infrastructure and community resources. It incorporates data from FEMA's National Risk Index (NRI) and the CDC's SoVI, offering users the ability to perform custom analyses and scenario planning tailored to specific community needs. RAPT aids emergency managers and planners in identifying vulnerable populations, critical infrastructure and resources, supporting risk assessment, resource allocation and public communication.

The Gulf TREE is another resource that can be used by communities across the Gulf of America to provide guidance in climate tools and model selection when completing a VA during the adaptation planning process. Since it can be difficult to find the right tool and to know which tool to select, Gulf TREE was developed to serve as an interactive decision-support tree to help users find the right climate tool. Gulf TREE allows users to walk through a series of questions to help them identify the best climate tool for their needs. Acting as a search engine, Gulf TREE matches users with the right tool or model for their climate resilience project with more confidence, less time and greater ease than they could on their own.

Once the tools have been selected, it is useful to walk through how to use these tools for each of the three VA sub-components:

Exposure Analysis

As described earlier, the Exposure Analysis sets the parameters that will guide when and how much flooding is likely to occur. The Exposure Analysis process may be defined in four steps. First, a 20-year and a 50-year planning horizon date should be chosen based on the year of

assessment (e.g., 2050 and 2080 planning horizons for an assessment conducted between 2025 and 2029) and other flood-related data should be overlaid in GIS environment. Then the tools are used to obtain static sea level rise elevations for "how much" sea level rise is projected at the chosen horizon time points. Finally, current and future inundation areas are located (typically within a GIS map window). The output of this step is important because it generates a listing or mapping of the areas that are likely to be impacted. The Exposure Analysis includes assumptions regarding the way the eustatic (the total volume of ocean water) and vertical changes in sea levels could affect a community.

Next Step: VA to Adaptation

To best utilize the VA before moving into adaptation planning and improve the likelihood of securing adaptation planning funds, communities are encouraged to:

- Create a figure showing the boundary of the VA, its focus areas and the areas where the adaptation plan strategies will occur.
- Create a summary report that includes description of VA results in the selected focus area(s) relevant to the adaptation strategies that are considered for the Adaptation Plan. The summary should clearly state if the adaptation strategies were based on hazard scenarios analyzed in the VA or if different scenarios were used.
- A list of relevant adaptation projects within focus area(s) that are included in local government plans and their expected implementation date.
    - Update assets inventory by removing assets that no longer exists/function (e.g., remove pump stations that were damaged during a hurricane) and by adding newly constructed assets.

Sensitivity Analysis

As described earlier, the Sensitivity Analysis builds on the findings from the Exposure Analysis to create a greater understanding of impacts. A Sensitivity Analysis is also important to include in a VA because it can answer the question: who and what will be affected by flooding and potential sea level rise? For such an analysis, additional GIS data layers are needed to assess where the projected inundation is likely to affect structures, populations, conservation areas and other entities.

It is recommended to overlay the Exposure Analysis model outputs (i.e., GIS flood-related data layers) with all entities identified in the Table 3 and additional socio-economic layers such as property values, population, high social vulnerability population, population of color, businesses, houses of worship, proximity to EPA's National Priorities List (NPL) sites and brownfields, future land use and habitat type (Table 7).

Table 7. Socio-economic elements to consider in sensitivity analysis.

Socio-Economic Elements for Sensitivity Analysis	
Property Value	Population of Color
Population	Habitat Type
Homes	Roads
Businesses	Future Land Use
High Social Vulnerability Population	EPA Superfund sites and Brownfields

The array of data inputs may help to create a broad survey of affected structures, populations and natural areas. This process is described in greater detail in Chapter 6.1.6, which includes Historic and Cultural Resources and Natural Resources special considerations.

Focus Areas

Focus areas should be based upon the findings generated during the Exposure and Sensitivity Analyses. Focus areas can be defined on a map according to the following characteristics: a specific geographic area (e.g., development along coastlines), certain vulnerable populations or communities (e.g., the elderly and those with climate-related health

risks), natural and built systems (e.g., local stormwater drainage systems and infrastructure) and other assets identified and quantified during the Sensitivity Analysis.

Funding Opportunities

In addition to potential grants available through DEP RF Program, NOAA and other federal and non-profit agencies (see Appendix 6.2 for examples of specific funding programs), funding opportunities to complete a VA may come in the form of partnerships. A VA can support many local planning efforts in addition to adaptation planning. As such, resources could be shared to support the development of a VA that could be integrated into multiple local plans. Integrating adaptation planning into existing local plans is discussed further, in Chapter 3.6.

2.8 Public Outreach Approach, Communicating Risk and Opportunities for Community Participation

Identifying focus areas is an opportunity to conduct public outreach and seek community participation in the VA component as discussed earlier in this chapter. The VA public outreach, including sharing the results of the Exposure and Sensitivity Analyses, is an excellent forum to inform the public and stakeholders about the future risk of potential increased flooding and sea level rise. It also provides a basis for the next round of meetings which includes identifying mitigation strategies to address vulnerability (see Chapter 3). Interactive web tools such as GIS-based StoryMaps (an example shown in Figure 15) and PowerBi have been more commonly used across Florida to present results of VAs. These tools can help communicate the risk and opportunities to the community and streamline the stakeholder engagement.

The public should be given the chance to provide input about what should become focus areas for the community. Information about the potential encroachment of the sea into land areas and the entities affected by sea level rise and current and future frequent flooding should be conveyed to the public during a workshop or public meeting. Based on the feedback received from the public, preferential areas can be determined that may be deemed focus areas. The completion of this round of public outreach sets the stage for who will be affected and to what degree to set up the adaptation strategies.

Figure 14. Public outreach sets the stage for who will be affected and to what degree to set up the adaptation strategies. (Photo credit: Pexels)

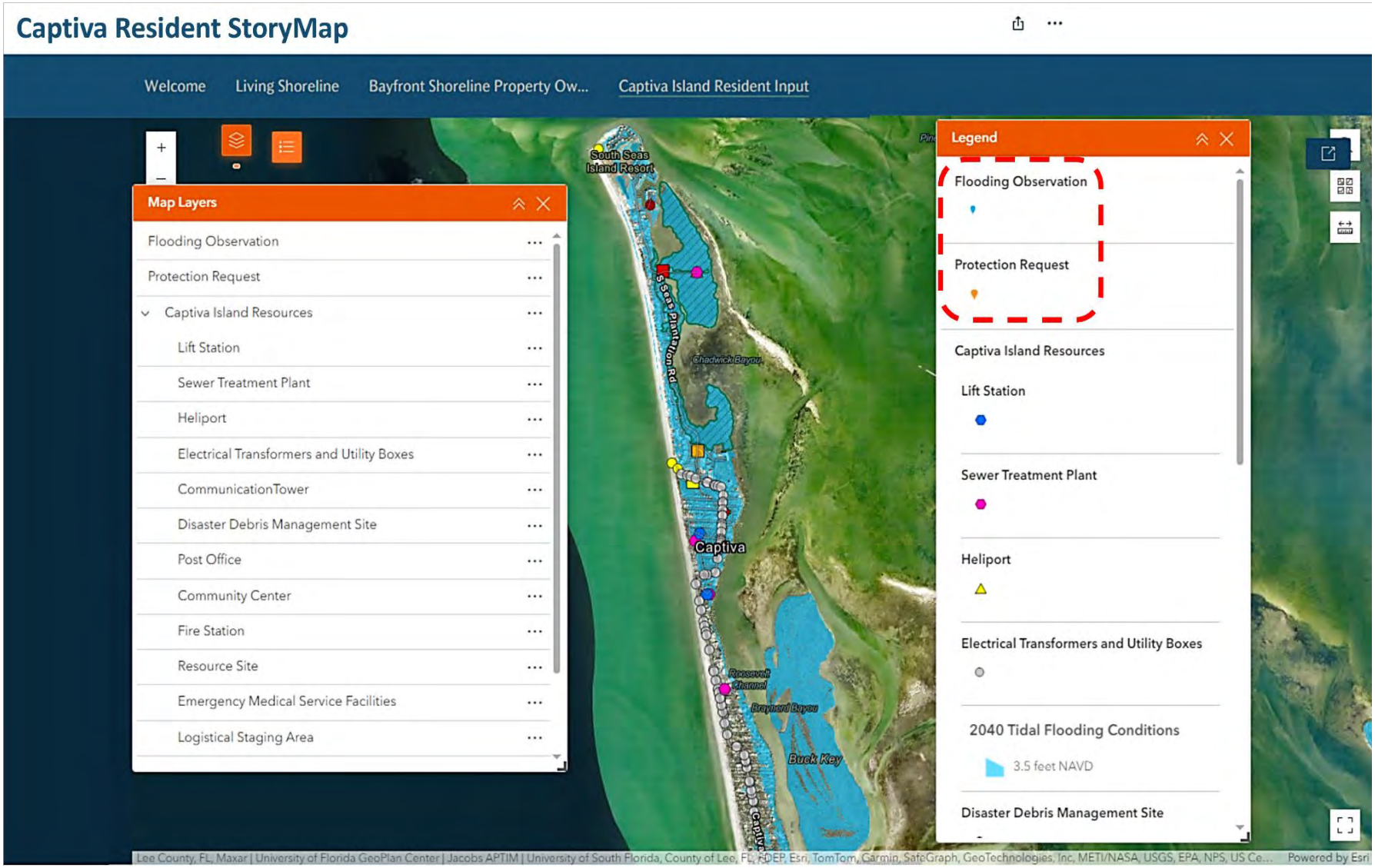


Figure 15. Example GIS-based StoryMap created to communicate flood risk to Captiva Island residents, collect public input on frequently flooded areas and requests for adaptation to identify focus areas (circled in red). Content courtesy of APTIM and Captiva Erosion Prevention District.

CHAPTER 3: ADAPTATION STRATEGIES

Oysters and Mangroves in Indian River Lagoon

Chapter 3. Adaptation Strategies

Adaptation Strategies are how a community can transform itself to reduce the negative impacts of flooding and sea level rise while finding co-benefits.

Adaptation Strategies are the third component in the flood adaptation planning process and provide a framework to respond to the findings in the VA. According to NOAA, an "adaptation plan identifies and assesses the impacts that are likely to affect the planning area, develops goals and actions to best minimize these impacts and establishes a process to implement those actions. The goal is communities that are organized to act, have the necessary tools and are taking action to plan for and adapt to the impacts of changing environmental conditions."[16] Decision-making about applying specific adaptation strategies to the challenges outlined by the VA occurs in this step. This is where a wide range of engineering, political and planning solutions come into play. Extensive collaboration and public input are needed to develop a strategy that is locally accepted.

The Adaptation Strategies component is broken down into the following sub-components: **Assess Adaptive Capacities, Prioritize Adaptation Needs, Identify Adaptation Strategies** and **Integrate into Existing Plans.** Adaptation Strategies themselves are classified according to their status as **Protection, Accommodation, Retreat** or **Avoidance**.

3.1 Assess Adaptive Capacity

The Intergovernmental Panel on Climate Change have defined adaptive capacity as "the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities or to cope with the consequences." Even when an asset is sensitive to a hazard, it does not automatically make it vulnerable. Adaptive capacity, or the ability to adapt to new conditions, lessens the potential impact on a community.

To assess community adaptive capacity, the planning team and steering committee are encouraged to develop a framework to evaluate the community's capacity to address the impacts of sea level rise and current and future flooding. This may include, but is not limited to, an assessment of [23] :

1. **Regulatory and planning capabilities** (e.g., protection of human life, development and redevelopment restrictions, coastal management regulations, hazard mitigation, sustainability, shoreline management, post-disaster recovery/emergency plans, infrastructure placement and financial impacts).
2. **Administrative and technical capabilities** (e.g., the number of sea level rise experts, planners, engineers, GIS and mapping resources, and modeling capabilities).
3. **Fiscal capacity** (e.g., taxes, bonds, grants, impact fees withholding spending in hazard zones and insurance).
4. **Infrastructure** (e.g., flood and erosion control structures, evacuation routes and redundant water, wastewater and power systems).
5. **Redevelopment opportunities** (e.g., availability of development incentives, utility capacity, policy applicability and coverage, enforcement and resolution rate, community resource availability including green spaces, housing availability, multi-modal trips and other metrics already tracking for land use or zoning change decision-making).

The regulatory assessment provides an opportunity to catalogue capacities that are currently being used but are not yet known or recognized as resilience planning. In Florida, commonly developed plans dealing with flood hazards such as the local mitigation strategies, Local Comprehensive Plans, floodplain management plans and/or master stormwater plans are often the best documents to turn to for identifying existing planning strategies that can be expanded upon in the adaptation planning effort. The adaptation planning effort should include both short- and long-term strategies, so the adaptive capacity should reflect both.

Figure 16. Adaptive Capacity Metric Categories

Below, questions can be asked to assess a community's adaptive capacity:

Infrastructure and Built Environment

1. **Flood Defenses:**
    - Are there existing flood barriers, levees or seawalls in place? What are their condition and effectiveness?
    - Has the community implemented flood-resistant building codes and zoning regulations?
2. **Drainage Systems:**
    - Is the stormwater drainage system adequately maintained and capable of handling heavy rainfall?
    - Are there permeable surfaces and green infrastructure (like rain gardens) to reduce runoff?

Emergency Preparedness and Response

3. **Emergency Plans:**
    - Does the community have a comprehensive emergency response plan specifically for flooding?
    - Are there designated evacuation routes and shelters for flood emergencies?
4. **Early Warning Systems:**
    - Is there a reliable early warning system in place for floods? How effectively are warnings communicated to residents?

In addition to the traditional adaptive capacity metrics listed above, communities are encouraged to use **Performance-Based Adaptive Capacity Metrics** such as:

- Housing availability
- Multi-modal trips
- Development incentives
- Policy enforcement
- Utility capacity
- Community resource availability including green spaces
- Federal funding received
- Efficiency

Community Engagement and Education

5. **Public Awareness:**
    - Are residents informed about flood risks and the measures they can take to protect themselves and their property?
    - Is there ongoing community education on flood preparedness and response?

Social and Economic Factors

6. **Vulnerable Populations:**
    - How are vulnerable populations (e.g., elderly, low-income families) supported during flood events?
    - Are there social support networks and services in place to assist affected residents?

7. **Economic Resources:**
    - Are there financial resources available, such as utility funds, operational budget, grants or insurance, to help with flood response, recovery and mitigation?
    - How resilient is the local economy to disruptions caused by flooding?

Natural Resource Management

8. **Wetlands and Natural Buffers:**
    - Are natural buffers like wetlands, mangroves or floodplains protected and maintained to absorb floodwaters?
    - How does the community manage land use to preserve natural flood mitigation features?

Governance and Policy

9. **Regulations and Policies:**
    - Are there policies in place that encourage or mandate flood resilience measures in new developments?
    - How are land use and development regulated in flood-prone areas?
10. **Coordination and Collaboration:**
    - Does the community collaborate with regional, state or national agencies on flood management?
    - Are there partnerships with non-governmental organizations and private sectors to enhance flood resilience?

Technological and Innovative Solutions

11. **Data and Monitoring:**
    - Is there a system for monitoring water levels and flood risks in real-time?
    - How is flood data collected, analyzed and used to inform decision-making?
12. **Infrastructure Innovation:**
    - Are there ongoing projects or plans to upgrade infrastructure with flood-resilient technologies?
    - How does the community incorporate climate change projections into infrastructure planning?

Recovery and Adaptation

13. **Post-flood Recovery:**
    - How quickly can the community recover from a flood event? What are the mechanisms for support and rebuilding?
    - Are there plans in place to improve resilience based on lessons learned from past flooding events?
14. **Adaptation Strategies:**
    - What long-term adaptation strategies are being considered or implemented to address future flood risks?
    - How does the community plan to integrate these strategies into overall development and land-use planning?

Best Practices

- **Cultivating relationships** is necessary to increase adaptive capacity. Capacity may be in the form of consistent political support to enforce or iterate policy, sharing model results to plan for growth or peer review to avoid conflicts.
- **Set expectations to sequence adaptation concurrently with redevelopment.** Target addressing additional loading from new construction within a year of construction.
- Find new models that work. Fort Lauderdale developed a hybrid stormwater fee to distribute costs to visitors not just residents based on trip generation and land use. As another model example, the city **reimbursed a neighborhood for its project costs based on flood reduction performance.**
- **Be proactive.** By acknowledging regulations and environmental conditions will change over the next 50 years, prepare, fund and invest in necessary mitigation projects to avoid shocks and costs.

3.2 Prioritize Adaptation Needs

Once the adaptive capacities of the local community have been identified, a prioritization framework can follow. At this point in the planning process, the community should be aware of the impacts of flooding and potential sea level rise, have identified its focus areas to address the impacts and/or have inventoried the capacity of the community to adapt. It is at this step that the community combines those findings and creates a concise list of its biggest challenges to determine what can feasibly be done where and when.

During the stakeholder meeting for input on the updated Guidebook, a key challenge in adaptation planning was identified as **competing priorities and achieving consensus**, especially when dealing with multiple stakeholders like the county, city and utility. Stakeholders highlighted that each entity might have different projects and priorities, which could complicate coordination efforts. Aligning the priorities with existing plans such as a Watershed Master Plan (which could be a unifying factor among all entities) and prioritizing projects based on social equity and other socio-economic metrics were discussed as potential strategies for achieving consensus on priorities.

Articulating a community's biggest challenges to flooding is a necessary step in identifying adaptation needs. For example: "The most important challenge facing the local agency is adequately addressing the current state of the wastewater treatment plant which is at increased risk to flooding" or "Elevating the many bridges in the local agency's jurisdiction to withstand 2 feet of sea level rise is our highest priority." Prioritizing adaptation needs sets the stage for the next sub-component — creating specific adaptation strategies.

Prioritization can be as simple as selecting the needs that can be addressed currently (using capacities already identified as robust in the "Assess Adaptive Capacity" step or categorized as "low-hanging fruit") and saving the more involved solutions for later. Conversely, it may be more important for a local agency to tackle large-scale expected impacts first, regardless of cost and complication, due to urgency. Whichever way the priorities are set, the amount of funding needed will likely determine the rate of implementation. However, it is not necessary for a local agency to immediately produce a large financial investment to show commitment to the process. A significant amount of work will have been completed to get this far in the adaptation planning process. Economic development projects also go through a lengthy initial planning process to line up the needs with the will to act before engaging in major implementation. It is perfectly acceptable for priorities to be defined and even phased so that, when funding becomes available, those projects can be implemented more quickly. In addition, it is important that the planning occur first so that if the community is affected by a major disaster, it can accelerate its adaptation program to leverage available disaster assistance resources.

The particularly cautious public agency can engage in pre-disaster planning for post-disaster policy changes by making the occurrence of a disaster a trigger for changes to land use restrictions or other requirements for vulnerable infrastructure segments. Disasters can "ground-truth" expected impacts, and if direct impacts are not anticipated in the short term, it is beneficial and prudent to allow infrastructure to utilize as much of its useful life as is. However, as the Escambia Adaptation Plan describes, "disasters scrape away the undue optimism that can cloud individuals' and communities' approach to valued but highly vulnerable places and structures." It is important to keep in mind that this approach of waiting to install solutions also raises the risk of incurring more damage when the expected disaster does occur. This can increase the long-term cost of adaptation strategies.

3.3 Identify Adaptation Strategies

Once major needs and priorities are defined, specific adaptation strategies can be developed, vetted and defined. It is important to note that many options are available when an area is projected to be flooded, either permanently or intermittently. A community can select from a wide range of adaptation strategies in the following categories: **Protection, Accommodation, Retreat** and **Avoidance.**

Protection strategies involve both hard and soft (or "gray" and "green") structurally defensive measures to mitigate impacts of flooding while leaving the vulnerable structures behind these measures largely unaltered. Seawalls, revetments and levees are examples of gray protection strategies, while beach nourishment, oyster reef restoration and living shorelines are all examples of green protection strategies.

Accommodation strategies alter physical design to allow the structure or land use to stay in place. Examples of this are floodable development, floating structures and increased stormwater storage via implementation of Low Impact Development or Green Infrastructure (LID/GI) in upstream locations. LID/GI upstream improvements reduce downstream flows by allowing more stormwater to infiltrate in place, thereby taking the pressure off the existing downstream stormwater infrastructure. In the Netherlands, a concept known as "Room for the River" helps dictate land use compatible with periodic flooding being designated adjacent to all major Dutch rivers.

Retreat from areas or infrastructure where protection or accommodation will not be efficient or effective can be voluntary, incentivized or done gradually. It can also involve new building designs in vulnerable areas to be altered or moved when appropriate in the future. Communities can also plan for an eventual retreat from barrier islands and coastal high hazard areas but, in the meantime, continue to invest in assets in a limited fashion based on that asset's expected lifetime and projected inundation. It is important to note that communication about retreating can be difficult. The language used to convey adaptation strategies can make a difference in how communities react to proposals. The term "retreat" often conveys a defeat, which can deter stakeholders from embracing the strategy. They may instead fight it. Other possible terms to use include "managed relocation" and "realignment." Home buyout programs, rolling

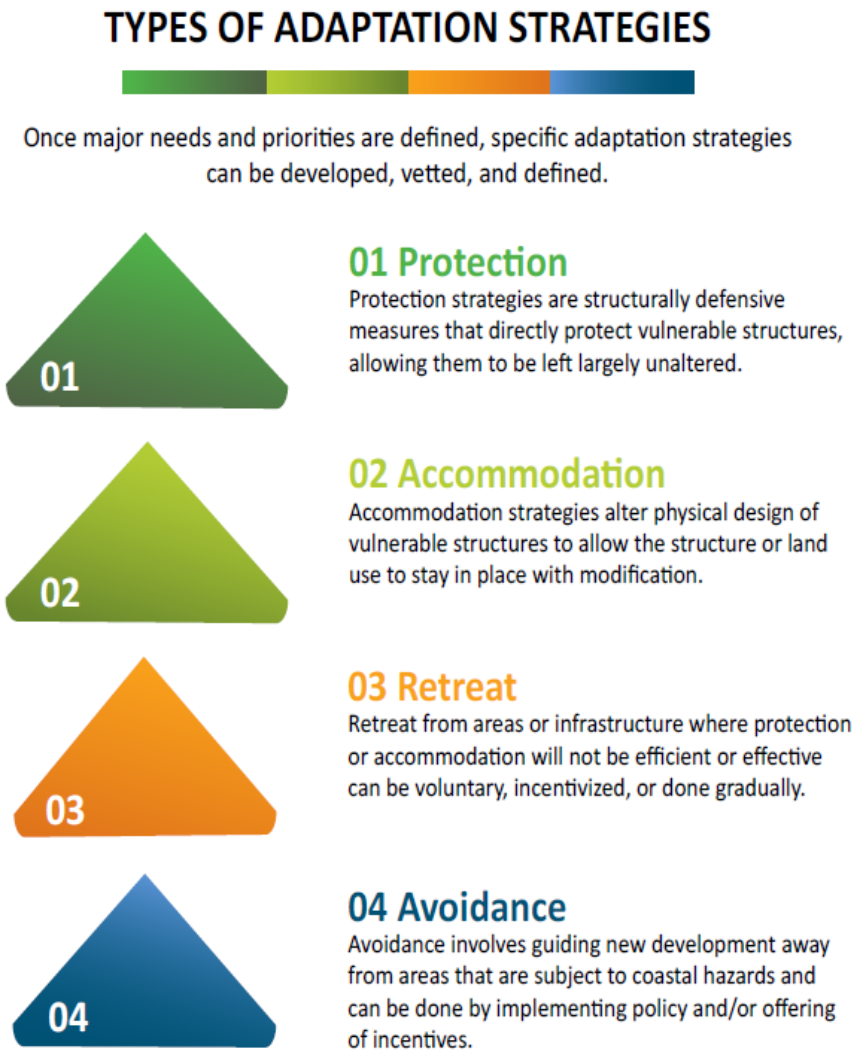


Figure 17. Types of Adaptation Strategies.

easements and land swaps are a few possible mechanisms that communities can investigate to implement managed retreat. There is also a growing body of case law in this arena.

Avoidance involves guiding new development away from areas that are subject to coastal hazards and can be done by implementing policy and/or offering incentives. Since capital infrastructure is developed and maintained for a relatively long lifespan, planning for future changes in sea level should be a part of initial design or incorporated when plans are due for periodic update. City and County Land Development Regulations and Codes, as well as zoning regulations, can be used to direct development and redevelopment to more suitable areas where flooding and erosion are less troublesome.

3.3.1 Nature-Based Solutions

Nature-based solutions (NBS) use natural processes and ecosystems to address environmental challenges, providing sustainable and multi-functional benefits. In Florida, NBS are increasingly being adopted to address erosion and storm surge impacts. Also referred to as Natural and Nature-Based Features (NNBF), these strategies harness the power of natural ecosystems to mitigate the impacts of flooding while providing additional environmental and societal benefits. One effective NBS is the restoration and preservation of mangrove forests along Florida's extensive coastline. Mangroves act as natural barriers, reducing the energy of storm surges and tidal waves, thereby protecting coastal communities from flooding. Their complex root systems trap sediments and stabilize shorelines, preventing erosion. Additionally, mangroves provide crucial habitats for a diverse range of marine species, supporting local fisheries and enhancing biodiversity (Figure 19).

Another NBS is the restoration of wetlands and the creation of living shorelines. Wetlands, both freshwater and saltwater, function as natural sponges, absorbing and storing excess water during heavy rainfall and high tides. In Florida, projects such as the Comprehensive Everglades Restoration Plan (CERP) [25] aim to revive the natural water flow, enhancing the region's capacity to manage floodwaters and mitigate sea level rise impacts. Living shorelines, which use natural materials like plants, sand, oyster shells and rock to stabilize coasts, are also gaining traction (Figure 20). These structures not only protect against erosion and flooding but also create habitats for wildlife and improve water quality by filtering pollutants.

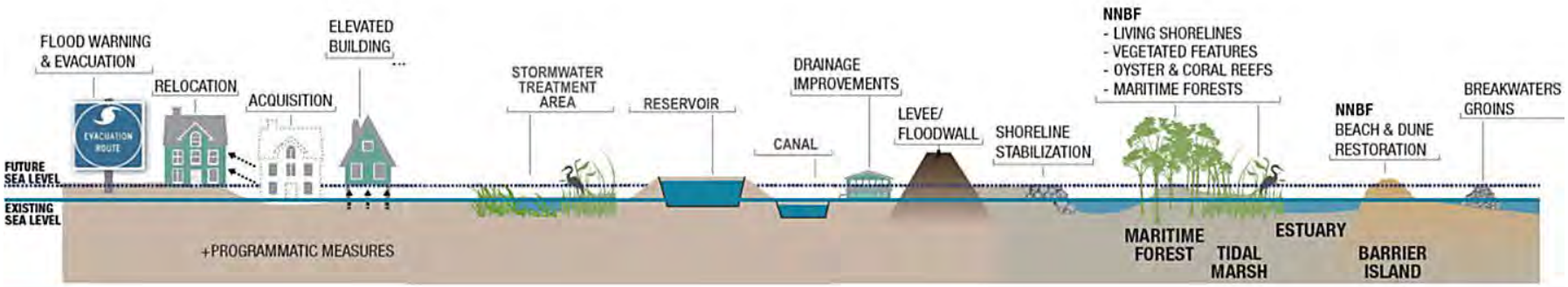


Figure 18. Adaptation Strategies for Coastal and Inland Areas (Adopted from SFWMD [24])

Urban green infrastructure is another critical component of Florida's flood adaptation strategy. Incorporating green roofs, permeable pavements and rain gardens (Figure 21) into urban planning helps manage stormwater runoff more effectively. These green infrastructures reduce the burden on traditional drainage systems, lower flood risks in urban areas, and provide green spaces that improve urban aesthetics and residents' quality of life. Collectively, NBS offer a resilient and sustainable approach to managing the increasing threats posed by flooding and sea level rise in Florida, promoting both ecological health and community well-being.

Nature-based Solutions Best Practices:

- Identify, compare and select nature-based solutions for reduced runoff, erosion, wave energy and inundation.
- Estimate impacts on floodplain, inundation levels, flood frequency and water quality.
- Evaluate ecosystem services, including habitat, biodiversity, carbon sequestration, and air and water quality.
- Predict shoreline morphology changes and ensure no invasive species are introduced.
- Conduct feasibility analysis, cost estimation and address technical and permitting challenges.
- Create monitoring and maintenance plans, including tracking vegetation growth.
- Explore funding sources and pilot emerging technologies and hybrid protection elements

The list of funding sources that support NBS applications has been expanding in the past few years thanks to their proven effectiveness. RF Program grants, EPA Clean Water State Revolving Fund (CWSRF) and DOE's WaterSMART Aquatic Ecosystem Restoration Projects funds are some of the funding sources for NBS applications. See Chapter 6.2 for an extensive list of funding opportunities.

Figure 19. Oysters attached to mangrove roots in Indian River Lagoon. (Photo credit: APTIM)

Figure 20. A living shoreline application in Southwest Florida.

Figure 21. Green infrastructure like this smart rain garden in Veterans Memorial Park, City of Cape Canaveral is an example of Accommodation. Low impact development and green infrastructure in upstream locations reduce downstream flows by allowing more stormwater to infiltrate in place, thereby taking the pressure off the existing downstream stormwater infrastructure. (Photo credit: Zachary Eichholz, City of Cape Canaveral Chief Resilience Manager)

3.3.2 Adaptation Action Areas

The designation of "Adaptation Action Areas" is a comprehensive planning strategy that has been available since 2011 with the passage of the Community Planning Act by the Florida Legislature. Local governments can choose to designate specific low-lying coastal zones as Adaptation Action Areas. These areas can be chosen among the regions experiencing coastal flooding due to extreme high tides and storm surges and are vulnerable to the impacts of rising sea levels. Local governments that establish an Adaptation Action Area can create policies within the coastal management element to enhance resilience to flooding caused by high-tide events, storm surges, flash floods, stormwater runoff and related impacts of sea-level rise. The criteria for defining an Adaptation Action Area can include areas with land elevations below, at or near mean higher high water, those with a hydrologic connection to coastal waters or those designated as evacuation zones for storm surges. Adaptation Action Areas lend themselves to a flexible form of zoning overlay that delineates the physical areas where certain measures, restrictions or prioritized funding would apply. It is beneficial to designate Adaptation Action Areas because local agencies have the

> Adaptation Action Areas designates one or more areas that experience coastal flooding due to extreme high tides and storm surge and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning as outlined in section 163.3164(1), F.S.

option to devise criteria for their designation and the flexibility to edit them as circumstances change. It demonstrates planning efforts to identify areas of concern for coastal flooding which could make the grant application more attractive to funders such as RF Program.

Adaptation Action Areas can complement the Coastal High Hazard Area footprint or expand it locally. FEMA defines the Coastal High Hazard Area as an area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. The Coastal High Hazard Area is identified as Zone V on Flood Insurance Rate Maps. Special floodplain management requirements apply in V Zones, including the requirement that all buildings be elevated on piles or columns. An Adaptation Action Area can be designed to apply the more stringent requirements of Zone V in other areas that are not part of the Zone V designation. In summary, Adaptation Action Area designations can allow communities to apply higher standards to help protect areas that are subject to increased vulnerability to flooding and sea level rise.

City of Fort Lauderdale is one of the early adopters of Adaptation Action Areas. In 2014, the City of Fort Lauderdale adopted an ordinance amending the Coastal Management Element of the Comprehensive Plan to incorporate a new goal, objective and policies associated with Adaptation Action Area. Designated areas have been prioritized for infrastructure upgrades and other improvements aimed at reducing the impact on assets currently affected by coastal flooding and minimizing future risks from sea level rise. The City of Fort Lauderdale's Public Works Department is also enhancing resilience in Adaptation Action Areas through its Stormwater Operations and Stormwater Engineering programs. Over the years, they completed several stormwater Repair and Replacement projects to reduce street stormwater runoff and tidal flooding in the 18 Adaptation Action Areas. Each year, the City of Fort Lauderdale highlights the changes in the designated Adaptation Action Areas and tracks planned, designed, constructed or completed projects in a dedicated chapter of the City of Fort Lauderdale's five-year Community Investment Plan. In the upcoming fiscal years, the City of Fort Lauderdale will retire several of the original locations where adaptation investments are complete and designate several new Adaptation Action Areas associated with future phases of the City of Fort Lauderdale's Stormwater Master Plan [26].

Figure 22. Before and after seawall improvements along Isle of Palms Drive, Fort Lauderdale. (Photo credit: City of Fort Lauderdale)

3.3.3 Selection of Strategies

In coordination with public input (which is described in greater detail in Chapter 3.5), the planning team assesses the relative merits and costs of each adaptation strategy within a given focus area to prioritize the preferred adaptation strategy. Community understanding and buy-in should be thoughtfully balanced with the planning team's expertise when prioritizing strategies. This may be accomplished through a cost-benefit analysis, alternatives analysis or even new output from a tool utilized during the VA.

Communities that have already gone through this process have also identified the value of doing a "business as usual" baseline assessment that will help compare the costs anticipated by the adaptation strategies.

While adaptation strategies carry a cost, sometimes a significant one, over time a cost-benefit analysis may show that properly planned adaptation yields measurable savings as compared to doing nothing.

Chapter 3.4 — Matrix of Adaptation Strategies provides a "menu of adaptation options" for communities to choose from based on their needs. The matrix also lists the benefits of adaptation, approach/project type, adaptation infrastructure solution timeline, relative cost and eligible funding sources for each adaptation strategy.

Figure 23. Potential adaptation strategies are illustrated on a drone image in Captiva Island to help stakeholders visualize possible coastline enhancements and guide the selection of appropriate strategies. (Rendering credit: Sasaki)

3.3.4 Best Practices

When developing and selecting adaptation strategies, communities are encouraged to:[5]

a. Identify if the projects in plan will require a **404 permit**[5].

b. Establish short-, medium- and long-term community goals with stakeholders.

c. List infrastructure improvements such as berms, levees, floodwalls, stormwater drainage systems and green infrastructure that may reduce flood risk.

d. Identify and evaluate infrastructure improvements such as berms, levees, floodwalls, stormwater drainage systems and green infrastructure. Assess feasibility and benefits for flood risk reduction, considering equitable outcomes among focus areas. Consider criteria for prioritization to inform eligibility for implementation funds.

e. Incorporate integrated water management to address water supply, flood control and environmental conservation, emphasizing co-benefits and partnerships. Explore regional public-private partnership projects, temporary flood storage areas and integration with larger resilience plans.

f. Reference technical standards like the Waterfront Edge Design Guidelines for adaptation measures. Evaluate failure conditions, life cycle and adaptability of strategies, ensuring alignment with grant funding criteria.

g. List land use policies, zoning codes and incentives promoting resilient design. Include pilot, experimental or innovative strategies such as real-time monitoring for flood control response.

h. Provide a detailed report on exposure and sensitivity analysis changes resulting from adaptation strategies. Quantify impacts on flood severity, land area inundation and critical assets affected. Update asset risk levels based on implementation assumptions.

i. Offer adaptation recommendations for critical and regionally significant assets identified in the VA. Plan for adaptation to future conditions post-construction.

j. Calculate benefit-cost ratio or return on investment considering project costs and benefits. Factor in economic growth, job creation, environmental quality and public safety. Assess infrastructure sector loss costs and implementation feasibility.

k. Provide implementation analysis, evaluating feasibility, authority and participation requirements on public or private property. Assess risks to plan implementation, including resource constraints, hazard impacts and infrastructure failure. Consider non-flood hazard risks to adaptation measures.

[5] State 404 Program | https://floridadep.gov/water/submerged-lands-environmental-resources-coordination/content/state-404-program

3.4 Matrix of Adaptation Strategies

Example adaptation strategies and their respective eligible funding resources are listed in Table 8. Most of the strategies listed may be eligible for DEP's RF Program grants, therefore RF grants were not listed to avoid repetition (See Chapter 6.2 for detailed information). The funding sources referenced in the matrix are:

1. DOD — Defense Community Infrastructure Program (OLDCC)
2. DOE — Grid Resilience State Formula Grants (GRSFG)
3. DOE — Grid Resilience and Innovation Partnerships (GRIP)
4. DOE — WaterSMART Aquatic Ecosystem Restoration Projects (WS)
5. EPA — Green Infrastructure Grants (GIG)
6. EPA — Clean Water State Revolving Fund (CWSRF)
7. FEMA — Flood Mitigation Assistance (FMA) Program
8. FEMA — Hazard Mitigation Grant Program (HMGP)
9. FEMA — Building Resilient Infrastructure and Communities (BRIC)
10. FEMA — Pre-Disaster Mitigation (PDM) Program
11. DEP — Beaches Funding Program (BFP)
12. DEP — Florida Beach Erosion Control Program (BECP)
13. DEP — Florida Coastal Management Program (FCMP) Grants
14. DEP — Coastal Partnership Initiative Grants (CPIG)
15. FDOT — Complete Streets Implementation Grants (CSIG)
16. FDOT — Transportation Alternatives Program (TAP)
17. FloridaCommerce — Rebuild Florida Mitigation General Infrastructure Program (FC)
18. Florida FWC — Coastal Habitat Restoration Grants (CHRG)
19. Florida FWC — State Wildlife Grants (SWG)
20. Florida Inland Navigation District (FIND) — Waterways Assistance Program
21. Gulf of America Alliance (Gulf Star) Funding Program
22. U.S. Department of Housing and Urban Development (HUD) — Community Development Block Grant Disaster Recovery Program (CDBG-DR)
23. HUD — Community Development Block Grant Mitigation Program (CDBG-MIT)
24. NFWF — National Coastal Resilience Fund (NFWF-NCRF)
25. NFWF — Coastal Program (NFWF-CP)
26. NOAA — Coastal Resilience Grants (NOAA-CRG)
27. NOAA — Coastal Zone Management Grants (CZMG)
28. NOAA — Transformational Habitat Restoration and Coastal Resilience (NOAA-THRCR)
29. OLDCC — Defense Community Infrastructure Program (DCIP)
30. Southeast RCAP Financial Service (SE RCAP)
31. Southwest Florida Water Management District — Cooperative Funding Initiative (SWFWMD-CFI)
32. The Nature Conservancy (TNC) — Coastal Resilience Program (CRP)
33. The Rockefeller Family Foundation (RFF)
34. The Walton Family Foundation (WFF)
35. USDA — Emergency Watershed Protection Program (EWP)
36. USDA — Community Facilities Grant Program (CFGP)
37. USDA — Rural Utilities Service (RUS) Water
38. USDA — Waste Disposal Loan and Grant Program (WDLGP)
39. USDA — Watershed and Flood Prevention Operations Program (WFPO)
40. USACE — Beach Erosion and Hurricane and Storm Damage Reduction (CAP 103)
41. USACE — Ecosystem Restoration in Connection with Dredging (CAP 204)
42. USACE — Environmental Restoration Program (ERP)
43. USACE — Flood Damage Reduction program (CAP 205)
44. USACE — Clearing and Snagging for Flood Control Program (CAP 208)
45. USACE — Aquatic Ecosystem Restoration (CAP 206)
46. USACE — Emergency Streambank and Shoreline Protection (CAP 14)
47. USACE — Flood Control and Coastal Emergency (FCCE) Program
48. USFWS — National Coastal Wetlands Conservation Grants Program (USFWS)
49. U.S. Fish and Wildlife Service (FWS) Coastal Program
50. Wildlife Conservation Society (WCS) Climate Adaptation Fund

Table 8. Matrix of Adaptation Strategies

Adaptation Category	Benefit of Adaptation	Approach/Project Type	Adaptation Infrastructure	Solution Timeline	Relative Cost ($, $$, $$$)	Eligible Funding Sources
Accommodation	Flood Protection	Elevated Utility Systems	Gray	Long Term	$	FEMA-BRIC, HMGP, FMA; HUD-CDBG-MIT, CDBG-DR; DOE-GRSFG, GRIP; USDA-RUS, USDA-WDLGP
Accommodation	Runoff Mitigation	Injection wells behind seawalls	Gray	Long Term	$$$	EPA-CWSRF; FC
Accommodation	Wave Attenuation	Salt marsh restoration	Green	Long Term	$$	NOAA-THRCR; NFWF-NCRF; USACE-CAP 206; USFWS; SWFWMD-CFI; WFF
Accommodation	Wave Attenuation	Seagrass restoration	Green	Long Term	$$	USACE-CAP 206, USACE-ERP; NOAA-THRCR; USFWS; FWC-CHRG, SWG; DEP-CPIG; Gulf Star; SWFWMD-CFI; WCS; WFF
Accommodation	Flood Control	Floodable Park/Water Square	Hybrid	Intermediate	$$	USDA-CFGP
Adaptation	Seawall removal to create natural shorelines/beaches	Seawall removal	Green	Long Term	$$	NOAA-CZMG; NFWF-CP
Avoidance	Flood Protection	Build on Elevated Areas	Hybrid	Long Term	$$	FEMA-BRIC, HMGP PDM; DOD-OLDCC; HUD-CDBG-MIT; HUD-CDBG-DR; USACE-CAP 103
Avoidance	Flood Protection	Elevate Finished First Floor	Gray	Long Term	$$$	FEMA-BRIC, HMGP, PDM, FMA; HUD-CDBG-MIT, CDBG-DR; USACE-CAP; OLDCC-DCIP
Avoidance	Environmental Sustainability	Use of low-carbon concrete for engineered structures	Green	Long Term	$$	FEMA-HMGP; HUD-CDBG; NFWF-CP; DOD-OLDCC

Adaptation Category	Benefit of Adaptation	Approach/Project Type	Adaptation Infrastructure	Solution Timeline	Relative Cost ($, $$, $$$)	Eligible Funding Sources
Protection	Flood Control	Install Check Valve or Non-Return Valves	Gray	Intermediate	$$$	FEMA-BRIC, HMGP, PDM; HUD-CDBG-MIT, CDBG-DR; SE RCAP; USACE-CAP; DOE-WS
Protection	Flood Protection	Elevated Flood Wall/Flood Gate	Gray	Long Term	$$$	FEMA-BRIC, HMGP, PDM; HUD-CDBG-MIT; USACE-CAP 205; OLDCC-DCIP; Gulf Star
Protection	Flood Protection	Flood Barriers (Passive or Active)	Gray	Intermediate	$$	FEMA-BRIC, HMGP, PDM, FMA; HUD-CDBG-MIT; USACE-CAP 103 and 205; NFWF-CP, NFWF-NCRF; USDA-EWP, WFPO; NOAA-CRG; USFWS; FC; Gulf Star
Protection	Flood Protection	Raising Land	Hybrid	Long Term	$$$	FEMA-HMGP; HUD-CDBG; USACE-FCCE, CAP 103
Protection	Flood Control	Reduce Paved Surfaces	Green	Long Term	$$	FDOT-TAP; FDOT-CSIG; EPA-GIG
Protection	Overtopping Protection	Berm reinforced with geotextile mats	Gray	Long Term	$$$	FEMA-HMGP; HUD-CDBG-MIT; DEP-BFP; USACE-CAP 14
Protection	Overtopping Protection	Buried seawalls	Gray	Long Term	$$$	FEMA-HMGP; FEMA-PDM; USACE-CAP 14; DOD-OLDCC; NFWF-CP; DEP-BFP;
Protection	Overtopping Protection	Seawalls	Gray	Long Term	$$$	FEMA-BRIC, HMGP, PDM; HUD-CDBG-MIT, CDBG-DR; DEP-BECP; USACE-CAP 103, CAP-14
Protection	Overtopping Protection	Seawalls with attached or floating planters or habitat panels	Hybrid	Long Term	$$$	FEMA-BRIC, HMGP; DEP-BECP; RFF; NFWF-CP, NFWF-NCRF

Adaptation Category	Benefit of Adaptation	Approach/Project Type	Adaptation Infrastructure	Solution Timeline	Relative Cost ($, $$, $$$)	Eligible Funding Sources
Protection	Overtopping Protection	Filling above mean high water	Hybrid	Intermediate	$$$	FEMA-HMGP; USACE-CAP; HUD-CDBG-MIT
Protection	Overtopping Protection	Flood-proof glass walls along the shorelines where the unobstructed view is desired	Hybrid	Long Term	$$$	FEMA-HMGP; USACE-CAP; HUD-CDBG-MIT
Protection	Overtopping Protection	Automated flood barriers along shoreline	Gray	Long Term	$$$	FEMA-BRIC, HMGP; HUD-CDBG-MIT; USACE-CAP; DOD-OLDCC; FC
Protection	Wave Attenuation	Dune Restoration/Beach Renourishment	Green	Intermediate	$$$	FWC-CHRG; FEMA-HMGP; NOAA-CZMP; DEP-CPIG, BFP; NFWF-CP; WCS
Protection	Wave Attenuation	Living Shorelines	Hybrid	Long Term	$$	FEMA-BRIC; NOAA-THRCR, NCRF; NFWF-CP, NFWF-NCRF; TNC-CRP; DEP-BFP; FC; USFWS; USACE-CAP 206; WCS; Gulf Star
Protection	Wave Attenuation	Mangrove planting and management (trimming, removal, mitigation requirements, renourishment with sand to elevate)	Green	Long Term	$$	DEP-BFP; DEP-CPIG; FWC-CHRG, SWG; NOAA-THRCR; NFWF-NCRF; USACE-CAP 206; USACE-ERP; USFWS; FCMP; Gulf Star; SWFWMD-CFI; WCS-CAF; WFF
Protection	Wave Attenuation	Fill submerged lands (below mean high water) to change habitat	Hybrid	Intermediate	$$$	NOAA-CZMP; DEP-CPIG

Adaptation Category	Benefit of Adaptation	Approach/Project Type	Adaptation Infrastructure	Solution Timeline	Relative Cost ($, $$, $$$)	Eligible Funding Sources
Protection	Wave Attenuation	Nearshore emergent breakwaters	Gray	Long Term	$$$	DEP-BFP; NOAA-THRCR; NFWF-NCRF; USACE-CAP 14
Protection	Wave Attenuation	Oyster reef balls	Green	Long Term	$$	TNC-CRP; NOAA-THRCR; USACE-CAP 206; USFWS
Protection	Wave Attenuation	3D printed concrete blocks	Hybrid	Long Term	$$	NOAA-CRG
Protection	Flood Control	Wetland Restoration/Retention Pond	Green	Long Term	$$	USACE-CAP 204 and 206, ERP; USFWS; WFF
Retreat	Flood Protection	Relocate Structure	Hybrid	Long Term	$$$	FEMA-BRIC, HMGP, FMA, PDM; HUD-CDBG-MIT, CDBG-DR

3.5 Public Outreach Approach and Opportunities for Community Participation

The Adaptation Strategies step is the most "solution-based" part of the Adaptation Planning process. An extensive public involvement component is appropriate for this point and should build off the findings of the VA. Unique local solutions are only possible when people with different expertise and interests come together and collaborate.

Structured discussion will help guide collaboration and keep the conversation on task and productive. It is possible to delve into great depth on issues, and this type of detail is not always appropriate in settings with large numbers of attendees. Questionnaires sent to participants before the workshops that ask about their goals and expectations for the workshop can be especially helpful as is a second questionnaire sent after the workshop to ask participants about how they would like to make use of the Adaptation Plan in their respective departments.

Engaging the community to gain buy-in for adaptation strategies is essential. Effective public outreach, through education and participatory planning, ensures that residents understand the local climate risks and the benefits of proposed measures. When community members are actively involved, they are more likely to support and participate in the implementation of these strategies. Without buy-in, adaptation plans may face resistance or delays or may fail to address the community's needs and concerns, ultimately undermining their effectiveness. Community understanding and buy-in should be thoughtfully balanced with consultant expertise when prioritizing strategies.

Figure 24. The Mosaic Group hosting an outreach event for the City of Miami Gardens Where You Want to Be Reboot Campaign. (Photo credit: Mosaic Group)

3.6 Integrating Adaptation Strategies into Existing Plans

Adaptation Planning outcomes are more effective when integrated into specific local planning products. Other planning products may already exist in a local community that are appropriate to amend with adaptation planning strategies.

A Local Comprehensive Plan (LCP) is required of all Florida counties and municipalities, guiding future growth and development. LCP policies generally influence a community's day-to-day land use decisions and capital facilities expenditures. These policies play a key role in determining local development patterns, which in turn determine the degree to which people and property are exposed to natural hazards, injury and damage.

If applicable per section 163.3178(2)(f), F.S., Florida local agencies are required to integrate or add accommodations for the 2015 "Peril of Flood" statute into their LCP. This requirement should be contained in a new or existing redevelopment component of their coastal management planning element. This component should eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.

The redevelopment component of the coastal management planning element must:

1. Include development and redevelopment principles, strategies and engineering solutions that reduce the flood risk in coastal areas which

results from high-tide events, storm surge, flash floods, stormwater runoff and the related impacts of sea level rise.

2. Encourage the use of best practices for development and redevelopment principles, strategies and engineering solutions that will result in the removal of coastal real property from flood zone designations established by FEMA.
3. Identify site development techniques and best practices that may reduce losses due to flooding and claims made under flood insurance policies issued in this state.
4. Be consistent with, or more stringent than, the flood-resistant construction requirements in the Florida Building Code and applicable flood plain management regulations set forth in 44 CFR part 60.
5. Require that any construction activities seaward of the coastal construction control lines established pursuant to section 161.053, F.S., be consistent with Chapter 161, F.S.
6. Encourage local governments to participate in the National Flood Insurance Program Community Rating System administered by FEMA to achieve flood insurance premium discounts for their residents.

3.6.1 Tools and Resources for Integrating Adaptation Strategies into Existing Plans

The following tools, many of which were described in more detail in Chapter 2, can be used to support specific aspects of the other relevant local plans such as LCP, HMP (also known as Local Mitigation Strategy (LMS)), SAMP, EDP, PDRP, CIP, SMP and HPP. Detailed descriptions of these plans can be found in the Glossary. In the following table, if the tool outputs can directly support and enhance a given local planning effort, the tool was considered a "match" as indicated by a checkmark.

Table 9. Tools that can support aspects of local plans. (The assessment tools followed with an "*" are not tools that are able to produce outputs but are resources and reports.)

Assessment Tool Name	LCP	HMP	SAMP	EDP	PDRP	CIP	SMP	HPP
Adaptation Database for Planning Tool (ADAPT)	✓	✓			✓			
ADvanced CIRCulaton Model (ADCIRC)	✓	✓	✓	✓	✓	✓	✓	✓
BEACH-fx		✓			✓	✓		
CanVis	✓	✓	✓	✓		✓	✓	✓
Climate Adaptation Knowledge Exchange (CAKE)	✓	✓			✓			✓
Climate Mapping for Resilience and Adaptation Assessment Tool	✓	✓	✓	✓				

Assessment Tool Name	LCP	HMP	SAMP	EDP	PDRP	CIP	SMP	HPP
ClimRR		✓					✓	
Coastal Adaptation to Sea Level Rise Tool (COAST)	✓	✓			✓	✓		✓
Coastal Green-Gray CBA Tool	✓			✓		✓		
CommunityViz	✓	✓	✓	✓	✓	✓		
Delft3D		✓	✓		✓		✓	
Ecosystem-Based Management (EBM) Tools Network and Database	✓	✓	✓		✓			
DEP Combined SVA and SLIP Study Tool		✓						
FEMA RAPT	✓	✓	✓		✓			✓
DEP Map Direct Gateway	✓	✓	✓		✓			
Florida Natural Areas Inventory (FNAI)	✓	✓	✓		✓			
Georgetown Climate Center*	✓	✓	✓		✓			
Geospatial Assessment Tool for Operations and Response (GATOR)	✓	✓		✓	✓	✓	✓	
Gulf TREE		✓					✓	
Hazus-MH	✓	✓		✓	✓	✓	✓	✓
HEC-RAS		✓	✓				✓	
InVEST	✓	✓	✓	✓	✓			

Assessment Tool Name	LCP	HMP	SAMP	EDP	PDRP	CIP	SMP	HPP
MIKE SHE/MIKE HYDRO		✓	✓				✓	
National Hurricane Center Storm Surge Risk Maps	✓	✓	✓	✓	✓		✓	✓
NatureServe CCVI	✓	✓	✓		✓			
NOAA — Digital Coast		✓					✓	
NOAA Adapting Stormwater Management for Coastal Floods		✓					✓	
NOAA Coastal Change Analysis Program (C-CAP) Land Cover Atlas and Coastal Comparison Tool	✓	✓	✓				✓	
NOAA Coastal Flood Exposure Mapper		✓	✓	✓			✓	✓
NOAA Inundation Analysis Tool	✓	✓						
NOAA Sea Level Rise Viewer	✓	✓	✓	✓	✓	✓	✓	✓
NOAA Sea Level Trends	✓	✓			✓			
NOAA WEMo	✓	✓	✓	✓	✓	✓	✓	✓
NOAA+FEMA Federal Flood Standard Support Tool Beta	✓	✓			✓		✓	✓
Risk Factor — Climate Risk Reports		✓						
SLAMM	✓	✓	✓		✓	✓	✓	
SFWMD Resilience Metrics Hub		✓					✓	
SFWMD South Florida Flood Impact Assessment Tool	✓	✓		✓	✓		✓	

Assessment Tool Name	LCP	HMP	SAMP	EDP	PDRP	CIP	SMP	HPP
SFWMD South Florida Flood Information Resource	✓	✓	✓				✓	
SimCLIM	✓	✓	✓	✓	✓	✓	✓	✓
SoVI	✓	✓			✓			
StormWise™ (previously ICPR4)						✓	✓	
SWMM (XPSWMM, PCSWMM, EPASWMM)		✓	✓				✓	
U.S. Army Sea Level Analysis Tool	✓	✓	✓				✓	✓
U.S. Climate Resilience Toolkit	✓	✓	✓	✓	✓	✓		✓
U.S. DOT VA Scoring Tool (VAST)	✓	✓		✓		✓		
USACE Sea Level Change Curve Calculator	✓	✓						
USGS Coastal Change Hazards Portal	✓	✓	✓		✓	✓		
USGS DSAS	✓	✓	✓		✓	✓		
weADAPT*	✓	✓			✓		✓	

CHAPTER 4: IMPLEMENTATION STRATEGIES

Jewell Cove Mangroves

Chapter 4. Implementation Strategies

Once a set of adaptation strategies has been developed and analyzed, it is time to transition to implementation activities to move the strategies from plan to action. This process includes identifying, preparing for and applying for potential funding opportunities; creating a schedule of adaptation actions for the future; and monitoring and evaluating progress.

Implementation strategies are the specific steps a community takes to incorporate the adaptation strategies into existing planning, budgeting and staffing mechanisms. The Assess Adaptive Capacities sub-component (Chapter 3.1) should outline the ability of the community to act. Even before the VA is conducted, communities may want to consider possible implementation strategies based on available capacities, existing implementation schedules or available funding sources. Communities must be able to support and implement adaptation activities to successfully reduce the negative impacts of flooding and sea level rise that were identified during a VA. The ability to implement can increase over time, so communities should not simply settle for what is available at the current time but expect that, as they undertake the first round of implementation, their knowledge and capacity will grow.

The Implementation Strategies component contains most of the adaptation plan's "logistics" — the actions and functions that need to take place for the product (adaptation strategies) to be delivered. By carefully aligning the schedule of activities to funding opportunities and assigning groups who can competently prepare each of the adaptation strategies for incorporation into their appropriate plan or physical location, the planning team can bring the plan to life and ensure it is not written only to "sit on a shelf." Monitoring new data and updated inundation models also helps safeguard the adaptation plan's relevancy as the applicable science advances.

4.1 Survey of Funding Options

It is recommended that a systematic review of all known funding sources, as well as inquiry into new funding opportunities that may facilitate a successful implementation strategy, be completed.

The availability of funds is often a key determinant as to what activities could be undertaken. Funding can originate at non-profit, private, local, state and federal levels. It may originate from a source such as penny sales tax, tax-increment financing, cooperative banking or grants. Available grants often change, but the following list identifies agencies that may offer grants to fund adaptation strategies as well as past and current grant examples:

- DEP — RF Program grants
- NOAA — Office for Coastal Management Broad Agency Announcement for special projects
- EPA — P3 awards: A national student design competition for sustainability.
- HUD — Community Development Block Grants
- DEP — Florida Coastal Partnership Initiative
- FloridaCommerce (FC) — Community Planning Technical Assistance Grants
- Local land conservation trusts
- Mitigation banking

FEMA also provides several kinds of assistance to communities that have prepared a local mitigation strategy that conforms to the standards set forth in the CFR (44 CFR §201.6). FEMA funding can be applied to coastal Protection, Accommodation and Retreat measures as follows:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Building Resilient Infrastructure and Communities (BRIC)

FEMA publishes the Hazard Mitigation Assistance Program and Policy Guidance, which provides detailed information on these mitigation grant programs, available annually. In some instances, funding can be obtained to assist with the VA component. Hazard Mitigation Plans (also known as the Local Mitigation Strategy or LMS) can be funded under HMGP and PDM and can also include Avoidance measures.

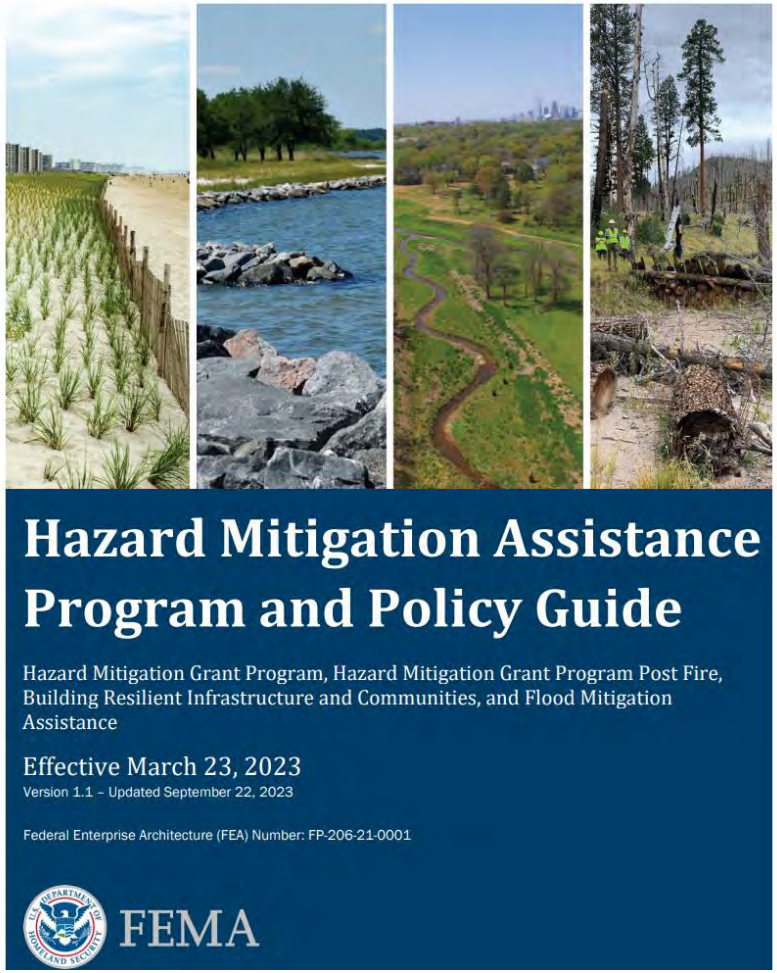


Figure 25. FEMA's "Hazard Mitigation Assistance Program and Policy Guidance"

The CDBG-MIT is an initiative administered by HUD. It provides funding to state and local governments to implement projects that reduce the risk and impact of future natural disasters. The CDBG-MIT Program focuses on proactive mitigation efforts aimed at strengthening community resilience, including critical infrastructure retrofitting, elevation and floodproofing efforts, drainage improvements, and coastal protection and shoreline stabilization.

After major disasters, HUD can provide mitigation grants under its CDBG-DR program when Congress approves a disaster supplemental. The eligible activities vary from disaster to disaster and would be provided in the Federal Register notice along with the State Action Plan that must be developed.

In addition, the Natural Resources Conservation Service, under the U.S. Department of Agriculture, has two programs that may be available to communities: the EWP Program and the WFPO Program. The EWP Program is a federal emergency recovery program available after disasters and aids communities to relieve imminent threats to life and property caused by natural disasters that impair a watershed. The WFPO is a cooperative program between the federal, state and local governments to prevent floodwater and sediment damage and erosion and work towards conservation of water and land in authorized watersheds.

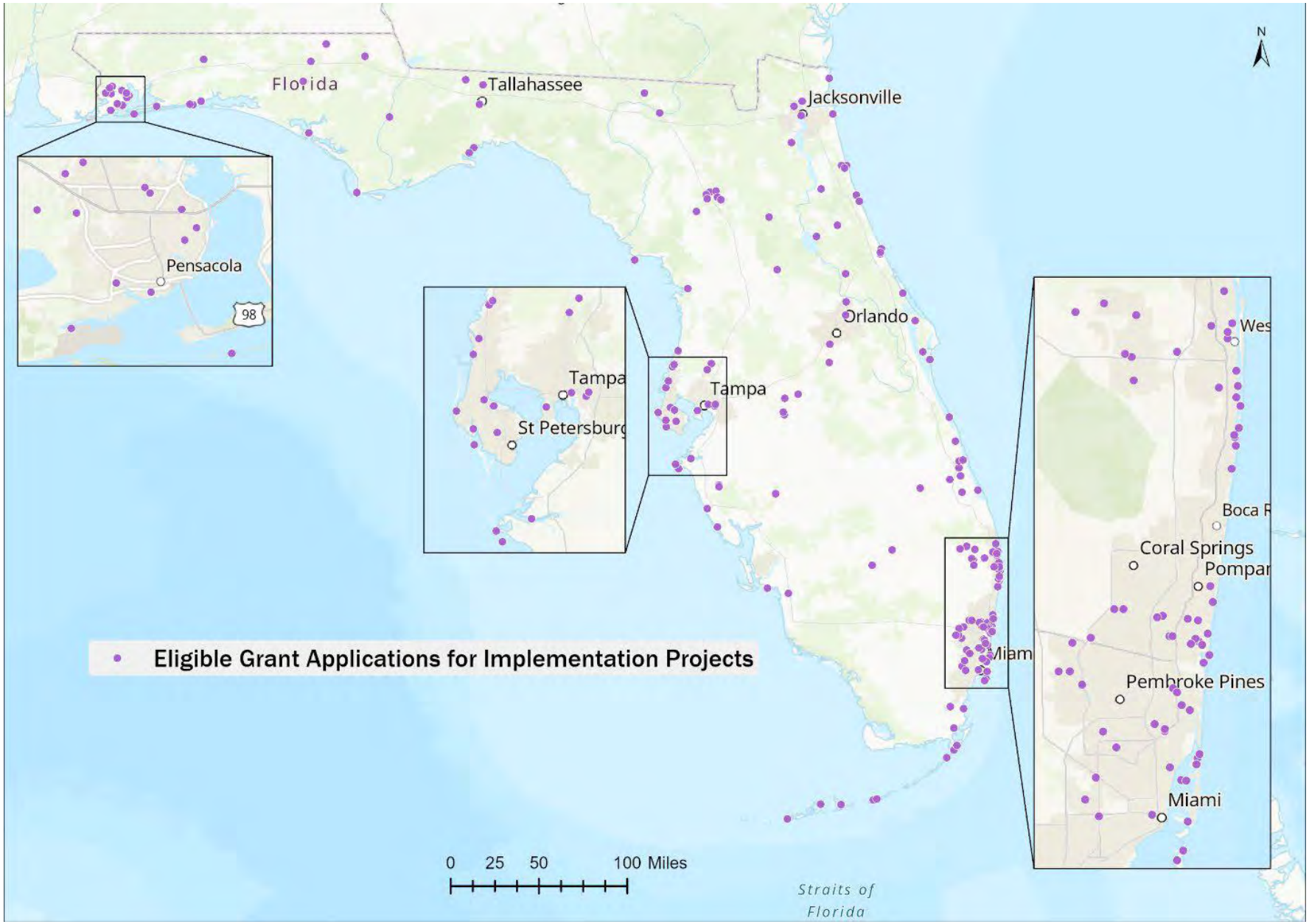


Figure 26. A distribution of eligible proposals submitted during the 2023 RF Program Implementation Grant application cycle [27].

DEP offers several types of grants under the RF Program, each designed to support projects that enhance community resilience to climate change impacts, particularly flooding and sea level rise. The Resilience Planning Grants support the development of plans and assessments that help communities identify risks and strategize mitigation and adaptation measures. Eligible projects include VAs and the integration of resilience measures into local government planning processes. The Implementation Grants fund projects that directly address identified vulnerabilities, such as infrastructure improvements for stormwater management, construction of flood protection structures and nature-based solutions like wetland restoration and mangrove planting. Green infrastructure projects, such as permeable pavements and bioswales, are also eligible.

FloridaCommerce manages the Florida Disaster Recovery Program and assists communities "in developing economic development strategies, meeting the requirements of the Community Planning Act, addressing critical local planning issues and promoting innovative planning solutions to challenges identified by local government applicants." Community Planning Technical Assistance Grants are for one fiscal year and are awarded on a cost-reimbursement basis. Deliverables must be approved before reimbursement. The grants provide communities with the opportunity to develop innovative planning and development strategies to promote a diverse economy, create vibrant rural and suburban areas, and meet the requirements of the Community Planning Act while protecting environmentally sensitive areas. In addition, the community is encouraged to brainstorm innovative local funding ideas and plan activities to build awareness and capacity for self-directed programs. If a community identifies a lack of funding, a key consideration in assessing management priorities may be to identify and develop additional funding resources. See Chapter 6.2 for an extensive list of funding opportunities.

4.1.1 Prioritize Strategies

Once a community has identified Protection, Accommodation, Retreat and Avoidance strategies, it may prioritize actions within its focus areas. Funding should be prioritized for adaptation activities and actions, reducing risk in the most cost-efficient way. It is important to maintain a balance between the urgency of the moment to address current risks while showing foresight to plan for future impacts. In several instances, it is a minimal cost to add an additional safety margin to a project which will also help maintain the project's effectiveness as vulnerability and risk may increase over time. Keep in mind that many facilities and infrastructure are built to last 30 to 50 years, if not longer, and future risk in the latter stages of development's useful life should be factored. Consideration of all possible options and the related costs and benefits of each will allow for a "no-regrets strategy" to be designed.

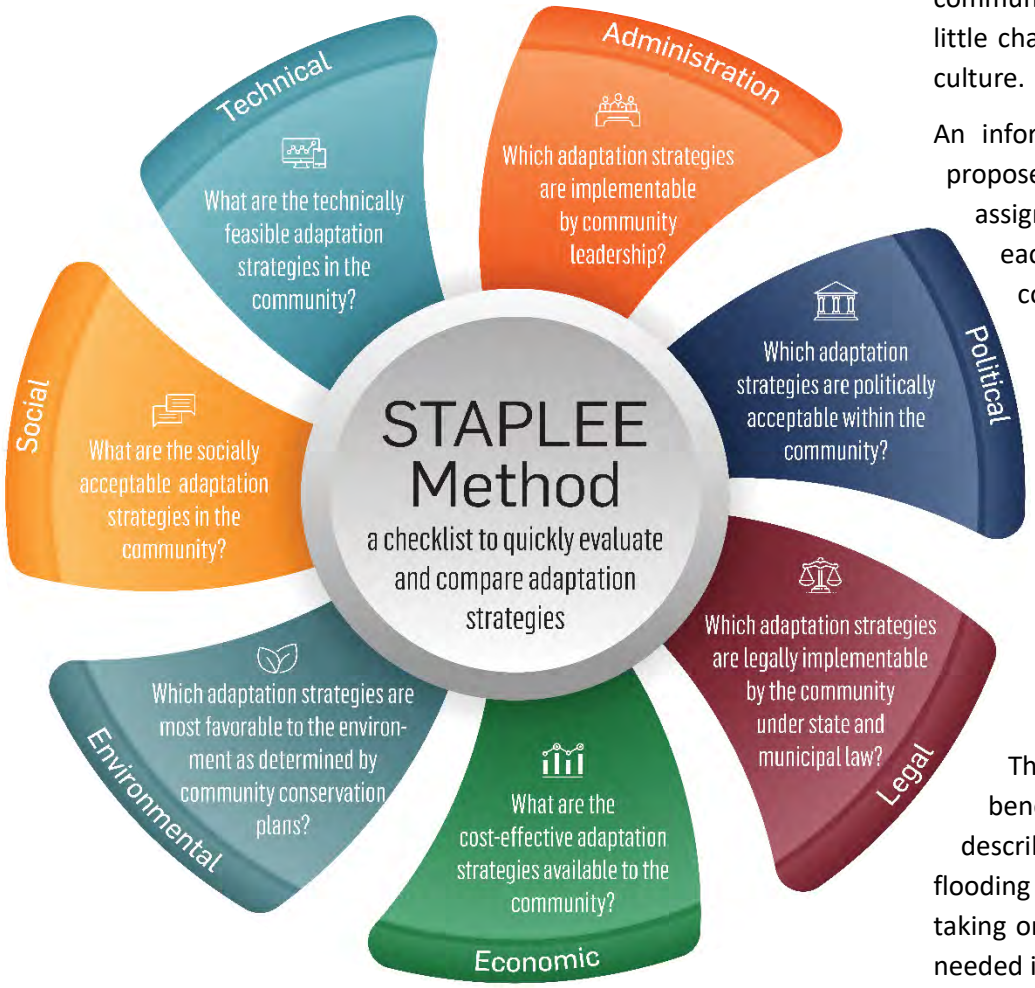
Prioritizing projects based on a cost-benefit analysis and social equity and other socio-economic metrics can be beneficial for achieving consensus on priorities.

STAPLEE Method

Priorities should be based on risks identified and potential losses as a result of those risks and reviewed in relation to funding, ability to implement and consistency with other plans. FEMA and NOAA have developed a comprehensive but quick checklist of considerations known as "STAPLEE" that help evaluate each proposed action [28]:

- **S**ocial — What are the socially acceptable adaptation strategies in the community?
- **T**echnical — What are the technically feasible adaptation strategies within the community?
- **A**dministrative — Which adaptation strategies are implementable by community leadership?
- **P**olitical — Which adaptation strategies are politically acceptable within the community?
- **L**egal — Which adaptation strategies are legally implementable by the community under state and municipal law?

- **E**conomic — What are the cost-effective adaptation strategies available to the community?
- **E**nvironmental — Which adaptation strategies are most favorable to the environment as determined by community conservation plans and statewide guidance?



By using the STAPLEE categories, a community may prioritize adaptation strategies that meet local capacity and preferences. The STAPLEE method can evaluate costs in relation to benefits of implementing one particular action over another. Using STAPLEE serves as a 'reality check' that helps communities avoid putting too much effort into a type of action that has little chance of success due its circumstances, preferences, history and culture.

An informal cost-benefit analysis can also be conducted to review proposed adaptation actions. Ratings of high, medium or low can be assigned to the anticipated costs and the benefits associated with each action based on general criteria that are established by the community. Examples of ratings could include criteria such as:

- High cost — existing funding is not adequate.
- Medium cost — existing funding would require budget reapportionment or amendment.
- Low cost — funding available under existing budget.
- High benefit — action would have a significant impact on risk reduction.
- Medium benefit — action would have an impact on risk reduction.
- Low benefit — long-term benefits are difficult to quantify in the short term.

This methodology provides a framework for the overall costs and benefits of each action to be considered when setting priorities. As described in Chapter 3, there are situations where the impacts from flooding are significant and already present or imminent that may warrant taking on the bigger challenges in the near term even if all the funding needed is not presently identified.

Figure 27. STAPLEE Method: A checklist to quickly evaluate and compare adaptation strategies.

Ranking based on RF Program — Implementation Grants Scoring Criteria

To rank adaptation strategies and projects, communities may utilize metrics that can identify the most critical infrastructure within the most vulnerable areas. Chapter 62S-8, F.A.C. was developed to establish project scoring criteria that, pursuant to RF Program Implementation Grants, is used in DEP's hierarchical ranking system of submitted project grant proposals [29]. Independent from the community's interest in pursuing an RF or any other grant, these scoring criteria can aid the planning team when prioritizing implementation strategies. Using this scoring system as a starting point, communities may choose to develop a set of customized criteria to evaluate and prioritize their adaptation strategies.

The RF Program Implementation Grants include the following tiers and criteria[6]:

Tier 1 accounts for 40% of the total score and consists of the following criteria:

- The degree to which the project addresses the risks posed by flooding and sea level rise identified in the local government VAs or the comprehensive statewide flood vulnerability and sea level rise assessment, as applicable.
- The degree to which the project addresses risks to regionally significant assets.
- The degree to which the project reduces risks to areas with an overall higher percentage of vulnerable critical assets.
- The degree to which the project contributes to existing flooding mitigation projects that reduce upland damage costs by incorporating new or enhanced structures or restoration and revegetation projects.

Tier 2 accounts for 30% of the total score and consists of the following criteria:

- The degree to which flooding and erosion currently affect the condition of the project area.
- The overall readiness of the project to proceed in a timely manner, considering the project's readiness for the construction phase of development, the status of required permits, the status of any needed easement acquisition and the availability of local funding sources.
- The environmental habitat enhancement or inclusion of nature-based options for resilience, with priority given to state or federal critical habitat areas for threatened or endangered species.
- The cost-effectiveness of the project.

Tier 3 accounts for 20% of the total score and consists of the following criteria:

- The availability of local, state and federal matching funds, considering the status of the funding award and federal authorization, if applicable.
- Previous state commitment and involvement in the project, considering previously funded phases, the total amount of previous state funding and previous partial appropriations for the proposed project.
- The exceedance of the flood-resistant construction requirements of the Florida Building Code and applicable floodplain management regulations.

Tier 4 accounts for 10% of the total score and consists of the following criteria:

- The proposed innovative technologies are designed to reduce project costs and provide regional collaboration.

[6] section 380.093(5)(g), F.S.

- The extent to which the project assists financially disadvantaged communities.

Ranking Based on Criticality

While the above scoring system assigns points based on the potential benefit and readiness of adaptation strategies, it is equally important to consider the consequences and likelihood of failure if that strategy is not implemented and relevant systems fail. For example, if a need for raising a roadway on an evacuation route is not addressed, it results in cascading impacts from loss of life and access to economic burdens. To assess the consequences and likelihood of failure, planning teams may use a prioritization matrix as shown in Figure .

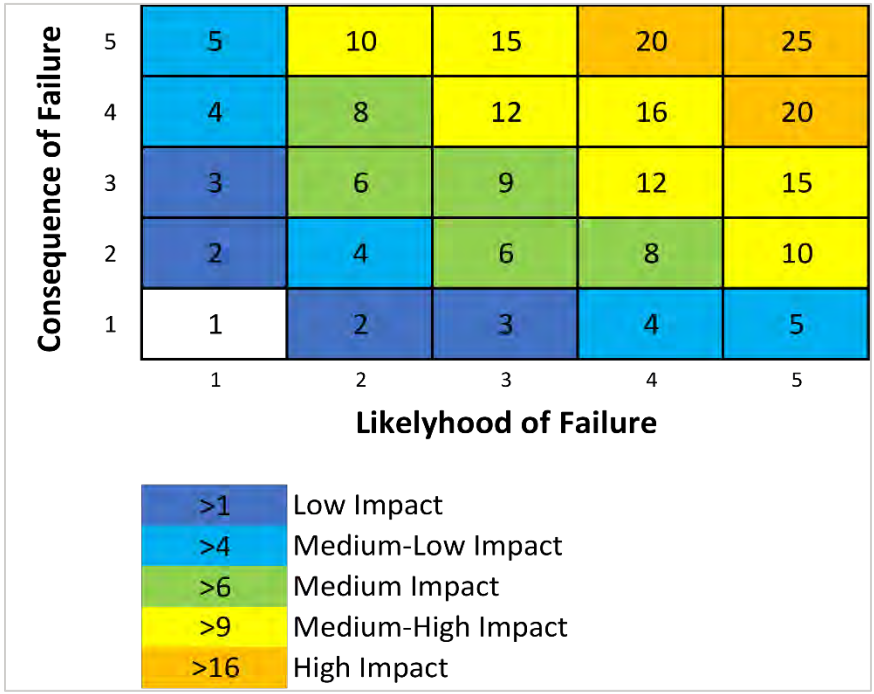


Figure 29. Resilience Prioritization Matrix

Multi-factor Ranking

By developing a weighted scoring system that integrates both the benefits and consequences, while also considering funding availability and project readiness, communities can create a final prioritized list of strategies. An example prioritization matrix from SFWMD's 2024 Sea Level Rise and Flood Resilience Plan [24] in Figure .

Projects	Likelihood of System Deficiency	Consequence of System Deficiency	Benefits from System Enhancement	Project Total Points	Project Status
Hardening of S-2, S-3, S-4, 5-7, S-8 Engine Control Panels	35.5	24.5	17.5	6	83.5
Coastal Structures Enhancement and Self Preservation Mode	39.5	21.7	18.5	1	80.7
Big Cypress Basin Microwave Tower	38.5	23.3	17.5	1	80.3
South Miami-Dade Curtain Wall	37	15.3	18.5	1	71.8
L-31E Levee	38.5	15.1	16.5	1	71.1
Corbett Levee Water Control Structures	19.9	19.7	17.5	1	58.1
JW Corbett Wildlife Management Area	20.9	17.3	18.5	1	57.7
Everglades Mangrove Migration Assessment	22.9	12.9	19	1	55.8

Figure 28. An example prioritization matrix from SFWMD's 2024 Sea Level Rise and Flood Resilience Plan [24]. (Table is recreated and shortened for graphical purposes.)

Legend
Priority Levels
Lower
Medium
Medium High
High

Prioritization enhances the impact of focus area-driven adaptation strategies by ensuring that the community adds additional aspects to the comprehension of flooding in the greater context and functioning of the community.

4.2 Create a Schedule of Activities, Actions and Actors

Creating a Schedule of Activities, Actions and Actors takes the second half of implementation into account — providing impetus to the actions to be completed and the agency/department/staff/stakeholder responsible for each action. This sub-component can serve to program different types of adaptation activities according to their prioritized need (see Chapters 3.2 and 4.1.1) and, in pairing with funding opportunities, generate a concise and easy-to-follow plan. An example Implementation Matrix that includes priority projects, project source, total estimated cost, status of implementation and status of funding is illustrated in Figure 30.

To create a schedule that is flexible yet delegates responsibility, the planning team should identify the appropriate responsible party who has the ability to complete a task, activity or strategy. Local government staff shall provide overall leadership, set priorities, develop policies, secure funding and establish monitoring mechanisms. State and federal agency staff may offer technical guidance, financial assistance, regulatory frameworks and essential data to support local efforts. Community organizations and NGOs shall advocate for community needs, raise awareness, build local capacity, facilitate engagement and assist in volunteer-led project efforts. The private sector contributes by investing in projects, developing innovative solutions, participating in infrastructure development, integrating climate risk assessments into operations and forming public-private partnerships. Residents and community members participate in consultations, adopt resilient practices and help monitor local conditions. Financial institutions and donors provide necessary funding, incorporate climate risk into investment decisions, offer financial incentives and collaborate on innovative financing mechanisms. Roles and responsibilities should be assigned to each stakeholder based on their verified capacity. Once this is established, clear implementation goals, objectives and actions with timelines and expectations can be designated.

Once actors have been informed of the schedule and actions required, the planning team can monitor and evaluate the implementation schedule (see Chapter 4.5) with the responsibility of following up with the responsible actors as needed. Scheduling transfers responsibility to the implementing entity to set and maintain timelines while ensuring that a coordinating group remains informed and responsive to the activity as it is carried out and later evaluated. However, due to the multi-disciplinary approach needed to undertake many adaptation measures, it is recommended that support personnel be assigned to projects to assist the primary with the additional skill sets, knowledge base and contacts needed to successfully implement a project.

Scheduling activities and assigning staff may emphasize the utility of planning ahead as the various elements of the schedule come online. By naming the person or group responsible for each activity's implementation, more accurate timelines can be made which may economize the implementation process. As discussed in Chapter 3.6, integrating adaptation into existing plans, if the strategy involves incorporating activities into a regulatory document, provides an opportunity to program capacity building measures. For this subcomponent, the planning team is encouraged to consider consultants outside of local government staff. A diverse set of participants within the steering committee could connect individuals or entities from a wide berth in the private sector, non-profits and universities.

List of Resiliency Priority Water Control Structure Projects, including implementation and funding status

Project Name / Water Control Structures	Project Source	Project below the expected service level (25-year/4%)?	Total Cost Estimate [1]	Status of Implementation	Status of Funding	Funds Expended (through June 30 2023) [2]
S-28 Coastal Structure and C-8 Basin Resiliency	FPLOS Phase II	Yes	$261,446,031	Not Started (Conceptual Design Completed)	Staff, H&H and Design Funds Construction partially funded $50M FEMA BRIC Award Recommendation + Match	$665,325
S-29 Coastal Structure and C-9 Basin Resiliency	FPLOS Phase II	Yes[3]	$355,280,352	Ongoing Design Start: FY22 End: FY24	Staff, H&H and Design Funds Construction partially funded $50M FEMA BRIC Award Recommendation + Match	$1,648,560
S-27 Coastal Structure and C-7 Basin Resiliency	FPLOS Phase II (Pilot)	Yes	$126,870,189	Ongoing Design. Start: FY22 End: FY24	Staff, H&H and Design Funds Construction partially funded $50M FEMA BRIC Award Recommendation + Match	$1,407,923
S-26 Coastal Structure Resiliency	FPLOS Phase I	Yes	$ 144,858,126	Not Started	Not yet funded	$0
G-57 Coastal Structure Resiliency	FPLOS Phase I	Yes	$ 33,394,620	Not Started	Not yet funded	$0
S-22 Coastal Structure Resiliency	FPLOS Phase I	Yes	$92,414,986	Not Started	Not yet funded	$0
S-37A Coastal Structure Resiliency	FPLOS Phase I	No	$ 149,094,074	Not Started	Not yet funded	$0
G-58 Coastal Structure Resiliency	FPLOS Phase I	Yes	$20,927,917	Not Started	Not yet funded	$0
S-123 Coastal Structure Resiliency	FPLOS Phase I	Yes	$ 104,958,469	Not Started	Not yet funded	$0

Figure 30. Implementation Matrix from SFWMD's 2023 Consolidated Annual Report. This matrix provides information on the priority water control projects. It includes the project source, total estimated cost, status of implementation and status of funding.

Best Practices

As part of the workshop hosted to gather stakeholder input, participants were asked to list their most valuable lessons-learned and commonly followed best practices for implementation of the adaptation strategies. Below is some of the common feedback from stakeholders:

1. **Establish Clear Goals and Objectives:**
   - Know your end goal first to determine the desired level of protection or service.
   - Break down projects into manageable phases and define concrete deliverables to translate high-level plans into actionable projects.
2. **Community Engagement and Buy-in:**
   - Engage the community to gain buy-in for adaptation strategies.
   - Involve stakeholders early and frequently throughout the implementation process.
3. **Comprehensive Planning and Coordination:**
   - Coordinate with capital improvement planners to integrate adaptation strategies.
   - Tie adaptation strategies into the capital improvement program.
   - Connect with existing local priorities and planned capital projects.
   - Ensure comprehensive thinking within the watershed.
4. **Consider Social Equity and Economic Impact:**
   - Prioritize projects considering social equity and community values.
   - Vet adaptation strategies to minimize adverse impacts on socially vulnerable communities.
5. **Utilize Existing Resources and Regional and Local Plans:**
   - Integrate adaptation strategies to existing projects proposed by Regional Planning Councils.
   - Recommend comprehensive collection of building Finished Floor Elevations to understand flood risk.
   - Add projects to local recovery plan to be reprioritized post-disaster. An Adaptation Plan should have contingency plan to re-evaluate after a disaster. Local governments can reprioritize as necessary with local officials based on changing conditions.
6. **Integration and Harmonization:**
   - Integrate regional and local structural measures for effective adaptation.
   - Sequence projects based on funding availability, stakeholder interest, urgency, hazard frequency, likelihood of CRS score impact and permitting requirements.
   - Evaluate which projects or phases can be combined to reduce disruption during construction.
   - Combine structural and non-structural solutions, including NBS.
   - Harmonize adaptation strategies considering other ongoing projects, adjacent land uses and areas (Figure 1).
   - Ensure effective coordination across jurisdictions and agencies for strategy selection, funding and implementation.
7. **Continuous Education, Communication, Advocacy and Collaboration:**
   - Prioritize education, communication, advocacy and collaboration for successful adaptation.
   - Strive for comprehensive understanding and collaboration among stakeholders to address challenges collectively.

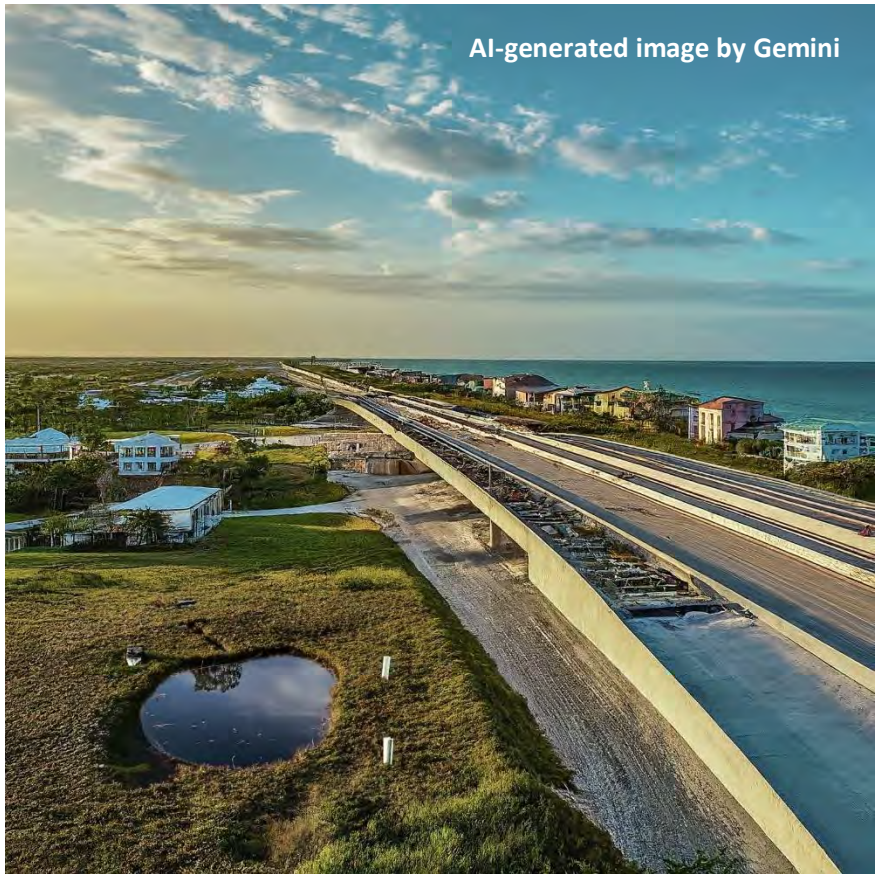


Figure 31. Harmonization of adaptation strategies and implementation projects is an important concept for a successful adaptation plan. This AI generated image aims to convey the interconnectedness of infrastructure projects where raising a roadway by the coast may adversely impact the nearby residential areas or stormwater systems.

4.3 Capital Planning and Budgeting

Incorporating adaptation projects into the capital planning and budgeting process is essential for communities to address the growing threats posed by hazards, as well as the increasing frequency and intensity of these events. This integration requires careful consideration of several factors, including the urgency of specific asset maintenance projects, the significant costs associated with adaptation and available funding opportunities for resilience projects.

To effectively integrate adaptation projects into the capital improvement planning process, communities should:

- **Evaluate Benefits and Funding Availability:** It is crucial that communities assess the potential return on investment (ROI) for each adaptation project and identify opportunities for cost-sharing and external funding. By prioritizing projects that offer the greatest benefits and leveraging external funding sources, communities can maximize their resources and enhance the overall effectiveness of their adaptation efforts.
- **Schedule Proposed Projects Based on Urgency and Funding Availability**: Communities should create a phased implementation schedule that considers the urgency of each project, the availability of funding and the potential for bundling projects together to achieve greater efficiency. Schedules for implementation should be flexible and adjustable based on changes in hazard occurrences or sea level rise rates, ensuring that the community's adaptation efforts remain aligned with its risk tolerance levels. Projects with immediate benefits or high vulnerability are prioritized for early implementation to address pressing climate risks and protect vulnerable communities. Meanwhile, projects with longer-term benefits or broader resilience objectives are scheduled for implementation over subsequent years, allowing for a strategic allocation of resources over time.
- **Plan for Short- and Long-term Adaptation Projects**: Selected adaptation projects are incorporated into the community's CIP, which outlines the prioritized infrastructure investments over a specified period, typically ranging from five to 10 years. Each adaptation project is assigned a specific timeline and budget within the CIP, reflecting its importance and urgency.
- **Budget Allocation and Resource Planning**: Communities then allocate funding resources to support the implementation of prioritized adaptation projects within the CIP. This involves setting

aside dedicated funding streams for adaptation initiatives and prioritizing expenditures based on the urgency and long-term impact of each project. Budgetary allocations are aligned with the municipality's financial capacity and overall strategic priorities and are reviewed yearly.

- **Advance Resilience Projects for Funding Requests**: In the aftermath of a disaster event, communities should advance projects for funding requests to support the implementation of their adaptation plans. This requires close collaboration with county administration to ensure that the community's priorities are well understood and supported. Reviewing the capital plan in advance of hurricane season is crucial to identify which resilience projects are eligible for funding and to determine if they should be prioritized over other recovery projects or competing needs.
- **Promote Regional Coordination and Harmonization**: Collaboration with neighboring communities and county governments can enhance efficiency and effectiveness by ensuring that adaptation efforts are aligned with broader regional goals and objectives. This regional approach can help maximize resources, share best practices and address usual challenges more effectively.

By following these steps, communities can effectively integrate adaptation projects into their capital planning and budgeting processes. This ensures that resources are allocated strategically to address climate risks and enhance resilience within the community. A proactive and well-coordinated approach helps mitigate the impacts of hazards, promotes long-term sustainability and strengthens the overall resilience of the community.

4.4 Value Engineering

Adaptation planning requires a thorough analysis of preliminary design concepts and associated costs to support the effective selection, prioritization and sequencing of projects. Integrating value engineering, cost-benefit analysis and ROI analysis into this process provides invaluable insights for public outreach, decision-makers and funding partners.

Preliminary Value Engineering for Adaptation Concept Refinement

Value engineering in adaptation projects involves systematically enhancing the function, reliability and cost-efficiency of measures such as flood protection. By applying value engineering best practices, stakeholders can ensure their mitigation efforts are effective, sustainable and economically viable, improving community resilience and safety. Key strategies include:

- **Incorporate Flexibility:** Design infrastructure to adapt to changing conditions and future uncertainties, such as climate change impacts. This can include modular construction techniques or adaptable infrastructure.
- **Broaden Scope:** Expand project scope to include additional features or services that increase overall benefits. For example, adding green spaces and recreational areas to a flood control project can provide community and environmental benefits.
- **Community Consultation:** Engage with local communities to identify opportunities that address multiple needs, such as improving public health and safety alongside infrastructure resilience.
- **Use of Technology:** Implement smart sensors and Internet of Things for real-time monitoring and management of infrastructure projects to optimize performance and reduce maintenance costs.
- **Renewable Energy:** Integrate renewable energy sources in building projects to reduce operational costs and environmental impact.
- **Resilient Materials:** Select flood-resistant materials and construction techniques that minimize damage and maintenance costs.

CBA to Select and Prioritize Adaptation Concepts

A CBA helps identify potential risks and uncertainties associated with a project and assesses their impacts on costs and benefits. By incorporating risk analysis, agencies can develop mitigation strategies to enhance project resilience and reduce unforeseen costs. Federal agencies require CBA for projects and grants to ensure public funds are used efficiently and effectively. CBA involves calculating and comparing the benefits and costs of a project to assess its economic feasibility and overall value. This is particularly valuable when resources are limited and strategies need to be prioritized. Risk and potential losses calculated as part of the VA can be used in estimating the benefits of adaptation strategies. Prioritizing strategies with the best cost-benefit ratios enhances the likelihood of funding eligibility.

By incorporating CBA and adjusting projects to maximize benefits, federal agencies ensure that investments yield the highest possible returns, promote public welfare and enhance the sustainability of government-funded initiatives. For example, FEMA directs a portion of disaster recovery funds towards mitigating future risks through its funding programs. This approach promotes resilience and reduces long-term disaster costs.

Maximizing ROI in Adaptation Projects

To maximize ROI, clearly define the desired outcomes, whether they are financial returns, social impacts or strategic benefits. Use capital budgeting techniques to prioritize projects with the highest potential returns, such as calculating net present value, internal rate of return and payback periods. Streamline operations, take advantage of tax incentives and consult with financial experts. Identify synergies with other projects to amplify benefits, and design projects to serve multiple purposes, such as flood risk reduction, water quality improvement and recreational opportunities. Leverage diverse funding sources, including federal and state grants, public-private partnerships and community funding initiatives. Integrate natural and green infrastructure solutions, such as wetlands restoration, green roofs and permeable pavements, to enhance flood mitigation benefits and environmental quality.

Incorporating value engineering, CBA and ROI analysis into adaptation planning provides a robust framework for making informed decisions that maximize the effectiveness and sustainability of projects. This integration supports the development of resilient, cost-effective strategies that safeguard communities against future risks.

4.5 Monitor and Evaluate

To ensure that adaptation strategies continue to serve their intended purpose — to robustly respond to the community-prioritized flood vulnerabilities — it is recommended that an adaptation plan include a Monitoring and Evaluation component. Monitoring and Evaluation extends throughout the horizon of the plan's implementation, which could span many years. The ability to communicate the guiding goals of the plan across iterations of implementing managers is essential. This is done through a Monitoring and Evaluation plan that uses consistent criteria, such as "indicators" that can be tracked throughout the implementation horizon and rated by different implementing managers.

Monitoring and Evaluation should be approached with an "Adaptive Management" mindset to constantly strive to improve the approach as lessons learned are obtained and new data is available. This sustained effort helps keep the planning process viable over many years and should help build momentum to adapt to the changing environment.

For this subcomponent, the planning team is encouraged to use indices or performance indicators to easily determine if an adaptation strategy is performing adequately. For example, point values could be assigned based on various levels or percentages of project completion to measure the progress towards completion or project benchmarks or major

milestones could be established to track accomplishments and project status.

Monitoring the adaptation strategies is a check-in to see that strategies are being carried out as anticipated and intended. This can include review of successful actions identified and implemented, review of barriers or obstacles to implementation for strategies that were identified but not completed, need for revisions to activities based on review and reevaluation of proposed timelines based on new information on impacts and funding. Once the progress attained is evaluated, activities can be revised where needed to make certain the adaptation plan goals are being achieved. Revisions and updates of the strategies can also consider potential changes in hazard vulnerability, local capabilities and resources, and risk reduction priorities. Lessons learned during the implementation should be shared across the community and even with other communities to expand the knowledge base of what is working, what would work better with some modifications and the pitfalls to avoid.

In addition to monitoring activities, it is important to revisit the data and methodologies that go into the VA. Of these, the sea level rise projection model and rainfall intensity changes may be two of the most important aspects of an adaptation plan to monitor. Over an example horizon of five years, global climate models and viewing tools may increase their accuracy and level of representation. The planning team can respond to this by incorporating model update results into new iterations of their adaptation plan. For example, new projection model updates could project a faster or slower rate of sea level rise and therefore, the planning horizon and timelines for implementing adaptation activities may be adjusted to reflect the updated or best available information.

Post-disaster evaluation efforts are a productive combination with adaptation monitoring and updates. Moreover, if a community experiences a disaster event, more attention will shift toward adaptation efforts and higher incidences of buy-in for certain adaptation activities may arise. Particularly, larger-scale disaster events could greatly accelerate the implementation schedule. Therefore, the schedule of activities can be changed to reflect new timelines for more robust measures.

Figure 32. Monitoring and surveying updated locations of wetland resources at St. Lucie Inlet South Jetty, Martin County, FL. (Photo credit: APTIM)

Best Practices:

- Plan to track effectiveness of adaptation measures as compared to design specifications and adjust plan as needed based on events.
- Measure the decrease in floodplain area, the number of critical assets protected and the reduction in potential damage from flood event.
- Evaluate the functionality, reliability and durability of flood control and drainage systems.
- Document any adverse impacts and benefits for the community and environment.
- Ensure continued project compliance with regulations.
- Review and update plan at set interval.
- Add adaptation measure location and elevation data to geodatabase.
- Collect stakeholder feedback on performance.
- Evaluate progress towards goals and objectives of plan.
- Evaluate effectiveness of information sharing after plan adoption.
- Track if activities were performed as planned and report progress.

4.6 Public Outreach Approach and Opportunities for Community Participation

As it is in the first three steps of adaptation planning, outreach is valuable for implementating adaptation strategies. Outreach meetings in this step can be utilized to affirm stakeholder buy-in and educate the community on the next steps by utilizing outreach methodologies listed in Chapters Public Outreach Approach 1.4.2, 1.5, 2.8 and 3.5.

Figure 11. Best Practice: Collect stakeholder feedback on project performance. (Photo credit: Pexels)

CHAPTER 5: SUMMARY

Florida Keys

Chapter 5. Summary

Between 2018 and 2022, the Florida Resilient Coastlines Program (FRCP) awarded 28 Adaptation Planning and 27 VA grants statewide. While 80% of the grants were awarded towards planning activities, implementation activities received 20% of the total funds distributed by the program (Figure 34).

FRCP's successor, the RF Program, has awarded over $1.5 billion to planning, implementation and Regional Resilience Entity (RRE) projects since its inception in 2021. As adaptation plans are being completed across the state, RF implementation grants are receiving an increasing number of applications from eligible entities (Figure 35). From Fiscal Year (FY) 2021-22 to FY 2024-25, 364 implementation projects, 304 planning projects and 21 RRE projects have been awarded with RF grants. Stakeholders' lessons learned notes from these projects have been collected to inform best practices shared throughout the guidebook.

Regarding adaptation planning progress in Florida, stakeholders listed:

- Government leaders are becoming increasingly transparent with essential data for informed decision-making.
- Processes are being streamlined into actionable plans.
- There is a growing reliance on scientific analysis to identify vulnerabilities and adaptation capacities.
- Despite challenges, there is increased interest from legislators, leading to more funding opportunities.
- Adaptation planning efforts are accelerating, with a focus on implementation readiness.

The Florida Adaptation Planning Guidebook includes reference to a multitude of community aspects and scenarios to consider while planning as well as a library of datasets and tools to access to enhance the understanding of adaptive capacity, risks and feasibility of adaptation strategies. In general, an adaptation plan should be organized to provide context for the community's existing conditions and vulnerabilities, describe the capacity for adaptation of critical assets within chosen focus

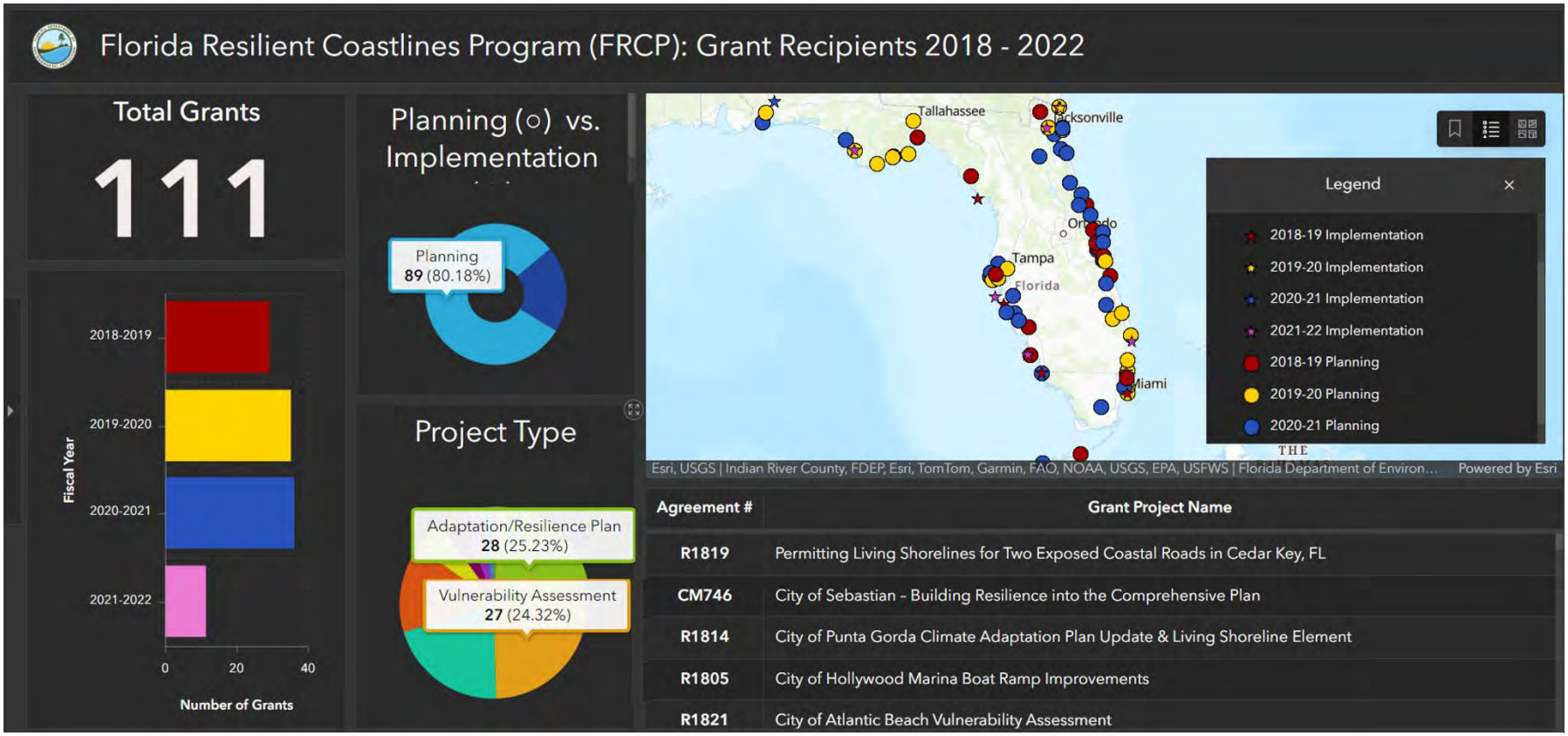


Figure 34. FRCP: Grant Recipients 2018-2022

areas and explain the strategies evaluated and selected to address known vulnerabilities. The plan should also include implementation strategies to sequence projects by need, funding availability or stakeholder priority.

Successful adaptation planning requires a comprehensive and proactive approach to addressing the multifaceted challenges posed by flooding and sea level rise. This guidebook has outlined essential steps, including conducting detailed VAs, engaging stakeholders from various sectors, developing tailored adaptation strategies that integrate both structural and non-structural measures, and effective implementing strategies summarized in Figure 36. Emphasizing the importance of flexibility and continuous monitoring, the guidebook highlights that adaptation plans must be dynamic, evolving with new data and changing conditions to remain effective.

By fostering collaboration among urban planners, public health officials, environmental agencies and community members, adaptation planning can yield robust and sustainable solutions. Ensuring that all voices are heard and that plans are inclusive of the most vulnerable populations is crucial for building resilience. Ultimately, this guidebook serves as a roadmap to safeguard critical assets, enhance community resilience and promote long-term sustainability in the face of an uncertain climate future. As we move forward, the principles and strategies detailed here will be invaluable in creating adaptive, resilient communities prepared to meet the challenges of tomorrow.

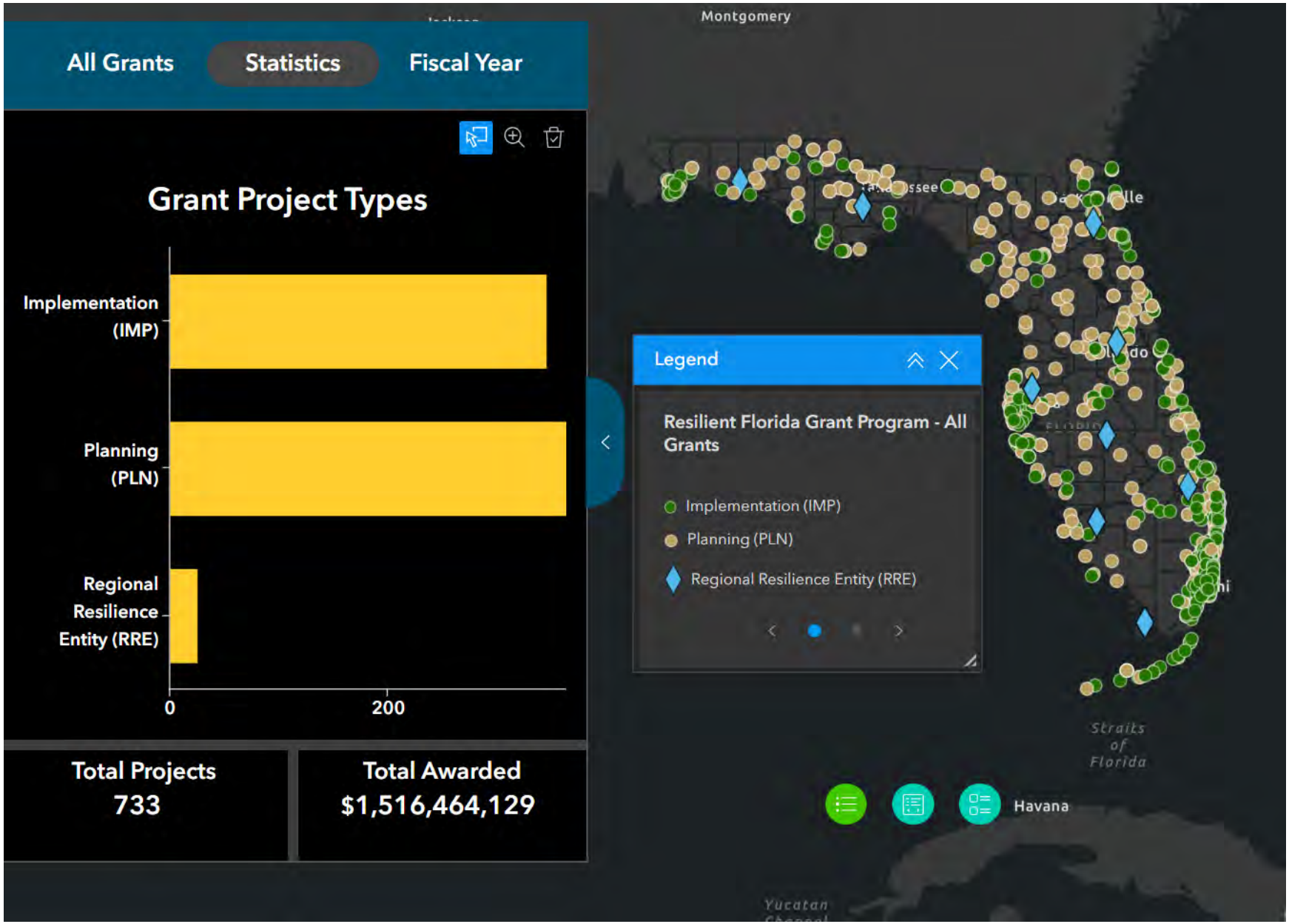


Figure 35. RF Program — Distribution of Grants from FY 2021-22 to FY 2024-25.

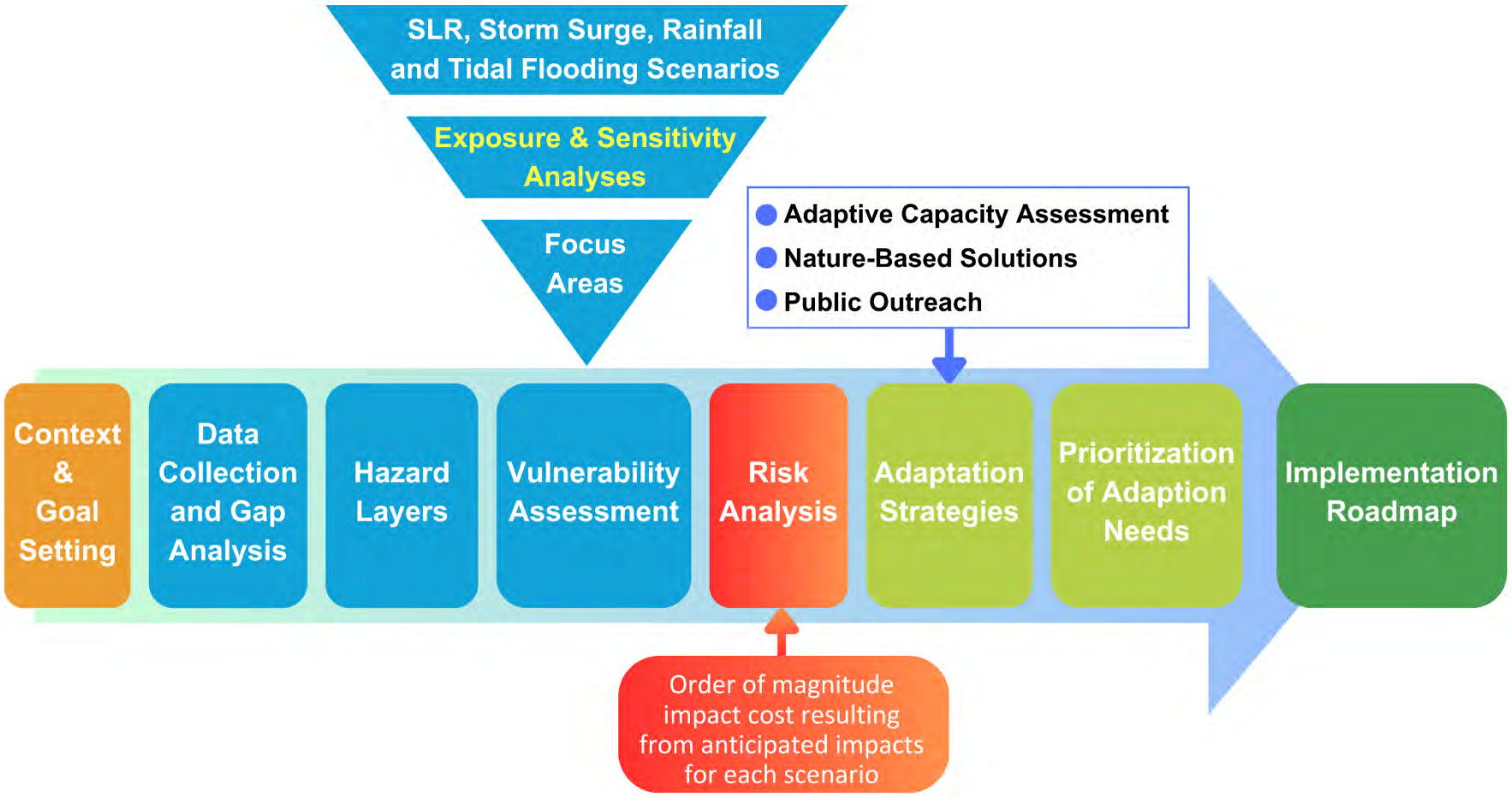


Figure 36. Steps to Climate Adaptation

CHAPTER 6: APPENDICES

Pensacola Living Shorelines

Chapter 6. Appendices

6.1 Specialty Topics

6.1.1 Compound Flooding

Several factors influence compound flooding. The volume of water and its arrival methods, such as rainfall, storm surges, river or canal flow and elevated water tables, play a significant role. The speed and persistence of water arrival are crucial, as are the antecedent conditions — what the land was like before the water arrived. Topography, or the elevation of the land, also affects the compounded flooding. Presence of protective features and flood defenses, both natural and human-built, like berms and levees, are important in mitigating flood impacts. Additionally, flood risk reduction assets and operations, including pumps, structures and storage facilities, help manage excess water. The location of flood-prone areas and critical assets further influences the extent and severity of flooding.

Common concerns during heavy rainfall events include the risk of compound flooding, which occurs when heavy rainfall coincides with high tide, exacerbating flood conditions. Reduced stormwater discharge capacity and limited water storage capacity can lead to severe flooding, as can the exceedance of wastewater infiltration and pumping capabilities. Head loss and choke points further impede water flow, while water quality concerns arise from contaminated floodwaters. The key takeaway is that an integrated interagency operational response and collaborative resiliency planning are essential to effectively manage and mitigate these challenges.

Localized flooding is a common result of heavy rainfall events and can lead to increased flood risk to roadways, residential structures and commercial structures, particularly in identified impact areas. This flooding can reduce road access and usage, thereby limiting emergency response capabilities.

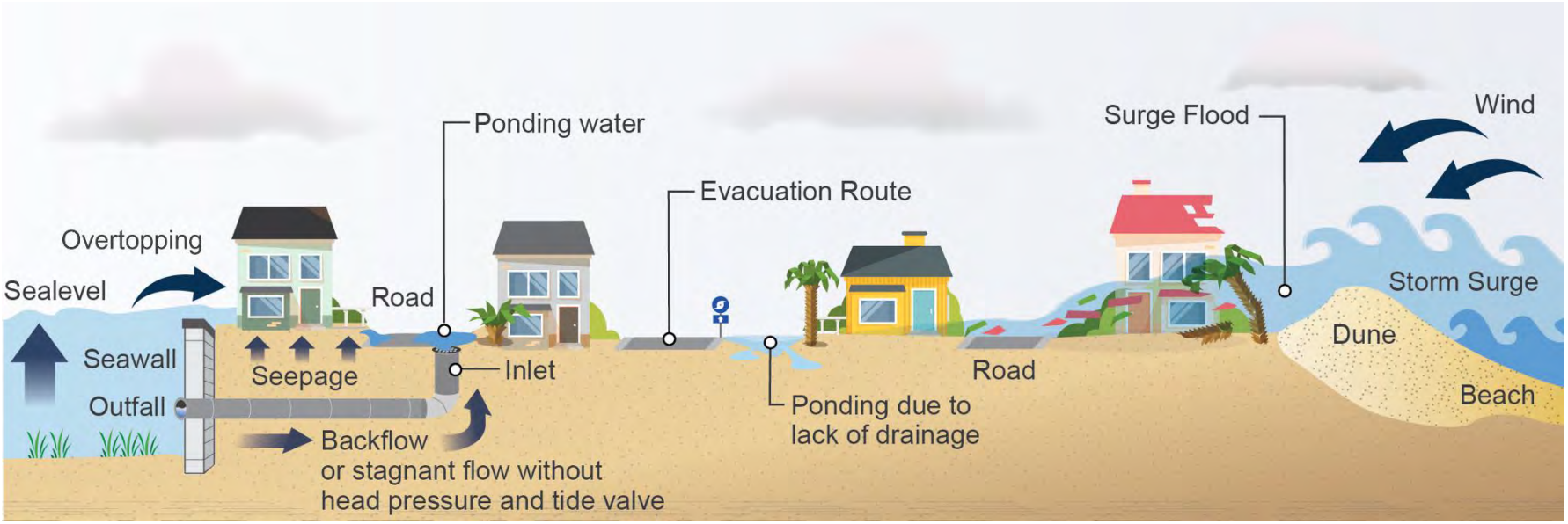


Figure 37. Elements of Compound Flooding (Graphic created by APTIM)

Additionally, heavy rainfall can overwhelm secondary stormwater discharge systems, rendering them less effective. Structures may become submerged and inoperable, necessitating the implementation of stormwater pumping operations to manage the excess water.

Non-coastal Community Focus Groups Discussions

There are several existing inland flooding vulnerability studies completed across the State of Florida, and a series of focus group discussions held on March 28-29, 2022, in which several experts from government agencies, academic institutions and private consulting firms provided their expert opinion on what should define a minimum standard practice in flooding vulnerability studies [6].

Key points from the focus group discussions:

- The inland (also applicable to coastal) flood studies should account for the non-stationarity introduced by the future variability in land use, sea-level, groundwater level and climate conditions across the state.
- Studies that plan to include any data with future projections should also consider addressing the bias and uncertainties present in the analysis due to these future projections.
- Common metrics should be established for modeling inland flooding, including precipitation, groundwater levels, future land use changes, soil storage capacity and soil moisture, riverine flooding and upstream flows.
- At the minimum, the hydrologic response must be simulated for a 100-year, 24-hour design storm event. However, some agencies such as FDOT and Water Management Districts use a suite of multiple design storms with varying storm volume, temporal distribution and return period for flood modeling.
- Common H&H modeling tools used for flood simulation are StormWise (previously known as ICPR4), HECRAS, SWMM (XPSWMM, PCSWMM, EPASWMM), Flo 2D, MIKE SHE/MIKE HYDRO, XPSWMM in combination with Delft3D, and HSPF in combination with SWMM/EFDC/HEC-RAS. The selection of an appropriate H&H model depends on the study area characteristics, data requirement/availability and preference of the H&H modeling team. A flexible framework is preferred where municipalities can use their preferred modeling platform depending on their specific needs.
- The distinction between coastal and non-coastal flooding is difficult due to complex interactions between several non-linear processes. Since many counties/municipalities in Florida lie in an area that requires a compound flooding analysis, a unified model for the entire state could be created to run coastal models coupled with inland models.

6.1.2 Compounding Hazards

Compounding hazards refer to the simultaneous or sequential occurrence of multiple climate-related events that can exacerbate the overall impact on communities and ecosystems [30]. In the context of climate adaptation planning, addressing these overlapping threats requires comprehensive and integrated strategies [31]. For instance, Florida is increasingly experiencing the combined effects of flooding, extreme heat and hurricanes [32]. The interaction of these hazards can magnify vulnerabilities, complicate response efforts and increase the resilience threshold needed for communities and infrastructure. Flooding from hurricanes can be followed by extreme heat, which hampers recovery efforts and strains water resources already stressed by drought and saltwater intrusion conditions. This complex interplay necessitates holistic approaches that consider the interconnected nature of these risks.

Adaptation strategies for compounding hazards involve integrating measures that address multiple threats simultaneously. Enhancing natural infrastructure, such as restoring wetlands and mangroves, can mitigate flooding and storm surges while also providing cooling effects to

counteract extreme heat. Urban planning should incorporate green infrastructure like green roofs and permeable pavements to manage stormwater, reduce urban heat islands and enhance resilience to extreme heat. Water management practices that include the creating reservoirs and sustainable groundwater extraction are crucial to buffer against both flooding and drought. Community preparedness plans should be multi-hazard in focus, incorporating early warning systems, emergency response protocols and public education campaigns that address the spectrum of risks. By fostering an adaptive capacity that is versatile and robust, Florida can better navigate the complexities posed by compounding climate hazards.

6.1.3 Water Quality Management and Funding Sources

Florida's extensive network of waterways — from sparkling springs to vast coastal ecosystems — showcases the state's environment, economy and very identity. To ensure the health of these vital resources, Florida has established a robust water quality management program. This program integrates monitoring, pollution prevention efforts, restoration initiatives and public education. DEP's Water Quality Assessment Program forms the backbone of this system, continuously assessing the health of both surface and groundwater.

Recent initiatives highlight the state's ongoing commitment. In January 2024, Governor Ron DeSantis awarded $20 million for water quality improvement projects in Biscayne Bay [33]. There is a growing synergy between water quality management and adaptation strategies for flooding and sea level rise. Many nature-based solutions designed to address these issues, such as restored wetlands and living shorelines, offer a co-benefit of improved water quality. Wetlands naturally filter pollutants, as they act like biological sponges that remove contaminants from water as it flows through. Healthy shorelines with native vegetation stabilize the coast, reduce erosion and improve water clarity by filtering out sediment runoff. By embracing these solutions, Florida has begun to achieve a dual benefit — building resilience against flooding while improving the quality of its precious water resources.

A project described by EPA highlights how treated municipal wastewater can be used to create and maintain wetlands. This recycled water provides a steady source of water for the wetland, while the wetland itself filters the water, removing pollutants before it reaches natural waterways. This is just one example of how nature-based solutions can provide a win-win scenario for both water quality and climate change adaptation. Projects funded under Caloosahatchee Water Quality Improvements Grant Program can be examples of this methodology:

Frank Mann Preserve Water Quality Improvement Project has received $15.5 million for a water quality improvement project at the 560-acre Frank Mann Preserve in Lehigh Acres. This initiative aims to mitigate potential flooding during major storms and enhance water quality by installing three water pumps to cleanse water from the preserve's canals before it flows northward to the Caloosahatchee River. By integrating nature-based solutions, such as water quality filter marshes and wetlands restoration, the project not only addresses environmental concerns but also provides community recreational opportunities, promoting ecological health and community well-being [34].

Current DEP Water Quality Protection Grant opportunities include[7]:

- Water Quality Implementation Grants
- Alternative Water Supply Grants
- Springs Restoration Grants
- Wetlands Restoration and Protection Grants
- Innovative Technology for Harmful Algal Bloom Grants

[7] Grants | Water Quality Dashboard (protectingfloridatogether.gov)

- Local Government Water Supply Pilot Grants
- Nonpoint Source Management Grants
- Florida's Coral Reef Restoration and Recovery Initiative Grants

6.1.4 The Economic Value Flooding and Sea Level Rise Adaptation

Planning for and implementing actions to reduce risk to coastal hazards maintains and strengthens the local economy and makes communities more attractive to new investment and job growth.

Florida's 8,436 miles of coastline [2] sustain and enchant both visitors and residents of the state. The coast's relationship with the state's economy is vital. Lined with beaches, wetlands, inlets and rivers, Florida's coast spans 35 coastal counties that house 67% of the state's population [3] and contribute $996 billion in economic activity — 83% of the state's total economy as of 2021 [4]. Florida's ocean and coastal resources directly contribute around $73.9 billion annually [36]. These resources also support over one million jobs directly and indirectly. According to Visit Florida, a record-breaking 140.6 million visitors were announced in 2023 surpassing the previous record set in 2022 [37]. Despite the 2020 COVID-19 pandemic's impact, visitors spent $105.1 billion and supported 1.7 million Florida jobs [38]. Top counties for ocean and coastal industry employment (hotels and restaurants, by number of employees) ranked from one to five as follows: Miami-Dade, Broward, Palm Beach, Hillsborough and Duval.

There is significant value in exploring adaptation actions that mitigate potential future impacts of flooding and sea level rise and help maintain a productive and thriving economy. With tens of thousands of homes and businesses vulnerable to even one foot of sea level rise, it is easy to see that the potential increase in risk could translate into large economic losses. Planning for saltwater intrusion, increased storm surge, shoreline erosion and coastal flooding can help mitigate those losses. For example, a study of mitigation grants determined that every $1 spent on hazard mitigation efforts federal mitigation grants saves society up to $11 overall [9]. The same study concluded that mitigation activities associated with coastal hazards produced an even higher return on investment. Communities across Florida are already engaged in hazard mitigation planning. The actions taken by these communities to reduce their vulnerability to coastal flooding are similar to those actions Florida communities may choose to implement for adaptation. Complementary planning efforts can multiply the investment.

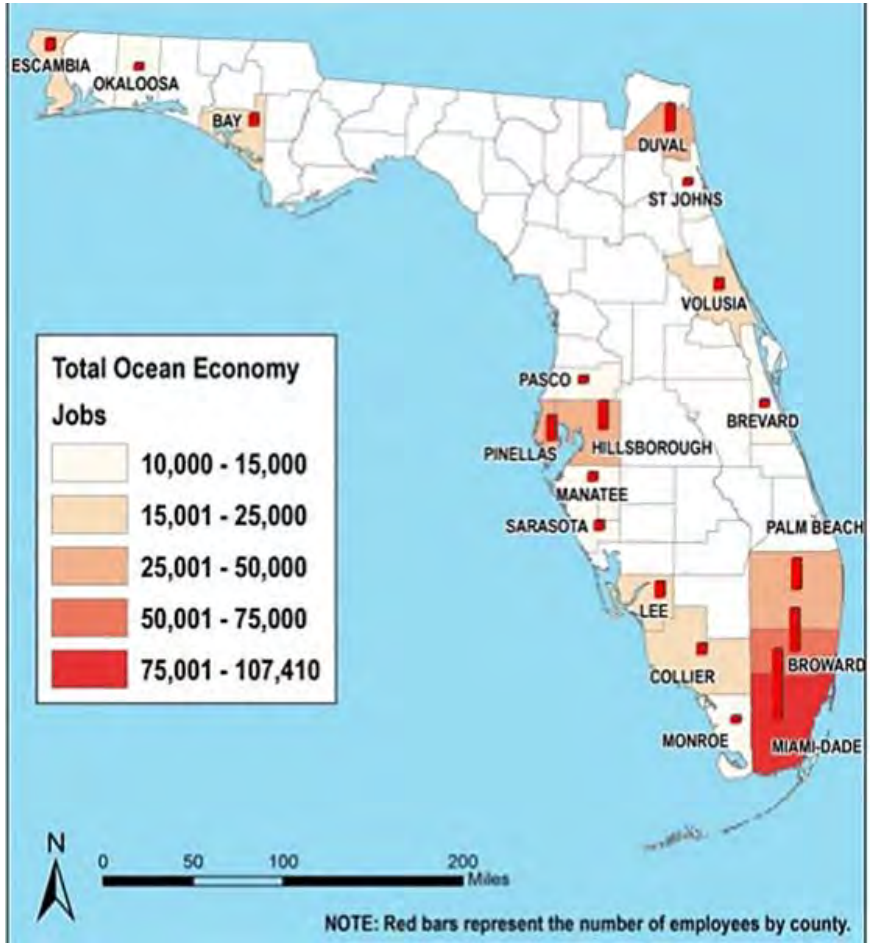


Figure 3128. Florida's Ocean Economy Employment Map (Adopted from Florida Ocean Alliance)

Communities should view adaptation as an investment that may save them money in the long term. Actions taken to reduce risk may lead to a reduction in storm-related business interruption across a variety of important coastal industries such as tourism, recreation, seaports and ocean transportation, and marine and fishing/living resources industries. By supporting a resilient business and community environment, workforces can return to work more quickly after coastal hazard events, customers will return more quickly with limited interruptions in service delivery, and suppliers will be able to continue to provide the level of service that businesses need. A 2007 study by Rose et al. found that hazard mitigation projects that focus specifically on reducing business interruption have the largest return on investment.

More importantly, the cost of doing nothing should be factored into the decision to move forward with adaptation planning. Economic models, like REMI PI+, exist that can help communities quantify what they stand to lose by maintaining a "business as usual" approach instead of planning for change. Employment losses, gross domestic product and other economic indicators can be modeled using storm and/or sea level rise scenarios to show how the losses from downtime and damage balance out with the gains from rebuilding.

6.1.5 The Community Rating System and Adaptation Planning

In 2011, FEMA established a Climate Change Adaptation Policy to integrate climate change adaptation planning and actions into FEMA's programs, policies and operations[8]. FEMA's National Flood Insurance Program's (NFIP) CRS is a voluntary incentive program that recognizes and encourages a range of community floodplain management activities that exceed the minimum NFIP standards [1]. Depending on the level of participation, flood insurance premium rates may be discounted from 5% up to 45%. The CRS uses a class rating system to determine flood insurance premium reductions. As a community engages in additional mitigation activities, eligibility for greater premium discounts increases.

		Premium Reduction	
Class	**Credits**	**In SFHA[9]**	**Outside SFHA**
1	4,500 +	45%	10%
2	4,000 to 4,499	40%	10%
3	3,500 to 3,999	35%	10%
4	3,000 to 3,499	30%	10%
5	2,500 to 2,999	25%	10%
6	2,000 to 2,499	20%	10%
7	1,500 to 1,999	15%	5%
8	1,000 to 1,499	10%	5%
9	500 to 900	5%	5%
10	0 to 499	0%	0%

[8] FEMA Climate Change Adaptation Policy Statement

[9] SFHA: Special Flood Hazard Area

The CRS encourages a comprehensive approach to floodplain management activities that increase public safety, reduce property damage and economic loss, and help protect the environment.

Participating in the CRS provides an incentive to maintaining and improving a community's floodplain management program over time. Implementing CRS activities can help community projects qualify for certain other Federal assistance programs.

Some of the communities that have the highest CRS ratings are listed below. Each has developed a floodplain management program tailored to its own unique character, hazards and goals. Each carries out varied activities, many of which are credited by the CRS.

As of April 2024, 244 Florida communities participated in the CRS, with 1.2 million policies in force and $807.9 million worth of premiums issued[10]. The highest CRS rating in Florida is in Pinellas County with a Class 2 rating which earns a 40% percent discount on flood insurance premiums in the Special Flood Hazard Area (SFHA). Most Florida communities are in Classes 5 through 8 and have an average of 15% off flood insurance premiums because of their participation in the CRS.

Lower cost flood insurance rates are only one of the rewards a community receives when participating in the CRS. Other benefits include:

- CRS community participants have increased opportunities to learn about risk, evaluate their vulnerabilities and act to protect themselves, their homes and their businesses.
- Floodplain management activities under the CRS provide for improved public safety, damage reduction to property and public infrastructure, and avoidance of economic disruption and loss.
- Technical assistance in designing and implementing some activities is available to community officials.

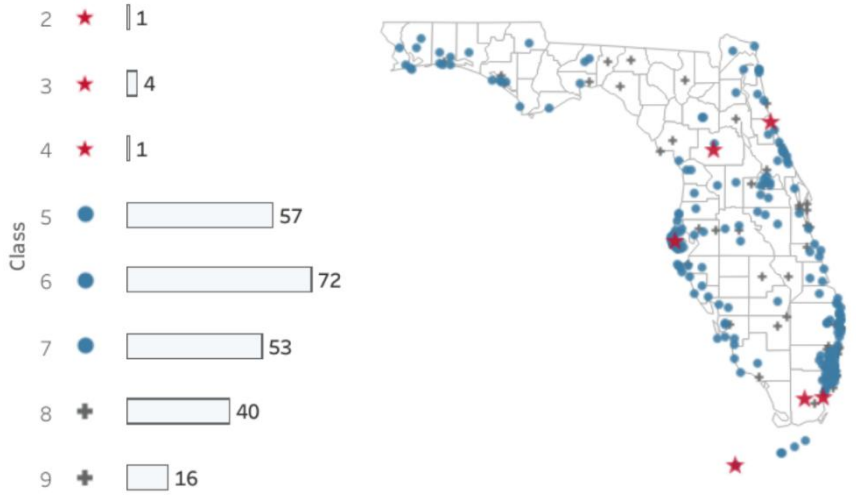


Figure 39. CRS Classifications of Florida Communities (Adopted from FEMA CRS)

For Florida, FEMA Region IV has developed a skilled workforce to support communities and first responders to work together to build, sustain and improve capabilities to prevent, prepare for, protect against, respond to, recover from and mitigate all hazards. FEMA's assistance to Florida includes hazard mitigation planning, hazard mitigation assistance, floodplain management and insurance, and community education and outreach.

By using FEMA's National Flood Insurance Program Community Rating System Coordinator's Manual [1] and visiting Florida Disaster CRS webpage[11] local governments can identify strategies to address flooding and sea level rise concerns while also receiving CRS credits to increase flood insurance discounts.

[10]https://www.fema.gov/floodplain-management/community-rating-system#visualizations

[11] https://www.floridadisaster.org/dem/mitigation/floodplain/crs/

6.1.6 Protecting and Preserving Historic and Cultural Resources

People living in Florida have long depended on its coastline for food, shelter and transportation [39]. Early Native American inhabitants left behind historical evidence of their coastal habitations. Continued dependence and existence of people on the Florida coast through subsequent centuries have left a rich legacy of historic and valued cultural resources. These cultural resources have unique needs that will need to be addressed through adaptation strategies to ensure their continued capacity to teach and be used, appreciated and enjoyed by future generations. In some Florida communities, the historic nature of many of their properties is the foundation for a substantial, tourism-driven economic base. Some familiar historic districts in Florida include the South Beach Art Deco District in Miami Beach, Old St. Augustine in northeast Florida, Historic Key West and Ybor City in Tampa.

A historic property review often begins with properties that are 50 or more years old which are further evaluated for their historic context and significance. Context is defined by "those patterns or trends in history by which a specific occurrence, property or site is understood and its meaning within history or prehistory is made clear." [39]. Significance means that it must represent a significant part of the history, architecture, engineering or culture of an area and can be defined by (a) a significant event, (b) a significant person or (c) physical features like the work of a master, last of its kind or culturally significant.

Historic integrity is maintained when both the "why" and "when" are apparent in the structure. Seven facets define this: location, design, setting, materials, workmanship, feeling and association.

- Location — the place where the historic property was constructed or the place where the historic event took place.
- Design — the composition of elements that constitute the form, plan, space, structure and style of a property.
- Setting — the physical environment of a historic property that illustrates its character.
- Materials — the physical elements combined in a particular pattern or configuration to form the property during a period in the past.
- Workmanship — the physical evidence of the crafts of a particular culture or people during any given period of history.
- Feeling — the aesthetic or historic sense of a past period that a property invokes.
- Association — the direct link between a property and the event or person for which the property is significant.

The National Register of Historic Places (NRHP) lists six types of historic and culturally significant properties. They are as follows:

- Historic Property — This overarching term encompasses all types of historic resources. It is defined as "a district, site, building, structure or object significant in American history, architecture, engineering, archaeology or culture at the national, state or local level."

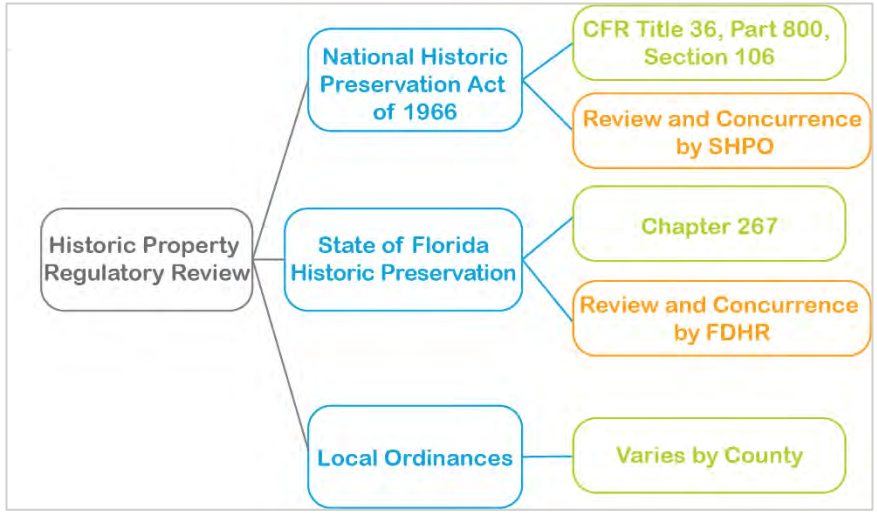


Figure 40. Any alteration to qualifying historic properties is overseen by governmental units at either the Federal, State or local level. Relevant statutes and laws are identified in this graphic.

- Building — "A building, such as a house, barn, church, hotel or similar construction, is created principally to shelter any form of human activity. The term 'building' may also be used to refer to a historically and functionally related unit, such as a courthouse and jail or a house and barn." Examples of buildings include administrative buildings, churches, courthouses, forts, houses, hotels, post offices, schools, stores, theatres and train stations.
- Structure — "The term 'structure' is used to distinguish from buildings those functional constructions made usually for purposes other than creating human shelter." Examples of structures include aircraft, automobiles, bridges, fences, gazebos, lighthouses, silos, trolley cars and windmills.
- Object — "The term 'object' is used to distinguish from buildings and structures those constructions that are primarily artistic in nature or are relatively small in scale and simply constructed. Although it may be, by nature or design, moveable, an object is associated with a specific setting or environment." Examples of objects include boundary markers, fountains, monuments and sculptures.
- Site — "A site is a location of a significant event, a prehistoric or historic occupation of activity or a building or structure, whether standing, ruined or vanished, where the location itself possesses historic, cultural or archeological value regardless of any existing structure." Examples of sites include battlefields, campsites, cemeteries, ceremonial sites, habitation sites, natural features with cultural significance, rock carvings, ruins of a building or structure, shipwrecks and village sites.
- District — "A district possesses a significant concentration, linkage or continuity of sites, buildings, structures or objects united historically or aesthetically by plan or physical development."

Federal, State, and Local Historic Preservation Laws and Ordinances

Any action that is proposed for any of these six types of historic properties, including adaptation of these places to sea level rise, may require state or federal review. Federal laws concerning this are from the National Historic Preservation Act of 1966, details of which are contained in the CFR Title 36, Part 800, Section 106. Historic properties can include properties on the National Register or can be properties that meet the criteria for the National Register. If an undertaking affects a property that falls into either of these categories, the appropriate State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Officer (THPO) must be consulted by the Federal agency throughout the rest of the process. Other consulting parties that are entitled to participate include the Advisory Council on Historic Preservation, local governments and applicants for Federal assistance, permits, licenses and other approvals.

The State of Florida has its own historic resource statutes, Chapter 267, that outline a similar review process for state actions to historic properties. If properties considered for adaptation to sea level rise are State-owned or if the project is even partially State-funded or requires a State-permit, then Chapter 267 will be triggered, and the proposed actions will come under review by the Florida Division of Historic Resources (referred to as "the Division"). This will allow for consultation between the Division and the owner who may potentially alter the property.

Local preservation ordinances are also part of the legal framework that governs adaptation actions for historic properties. Local ordinances vary by community, although a typical code of ordinances usually establishes an architectural, design and/or variance review board, review process and criteria to review plans to alter, relocate or demolish locally designated resources. All Certified Local Governments (CLG) are required to have a preservation ordinance to obtain CLG status, but local governments not participating in the CLG program may also have local preservation ordinances. As per Federal regulations, communities that participate in the CLG program are automatically prioritized for funding allocations annually from the Division.

Archaeology Laws and Exemptions for Historic Properties

There are laws specific to the protection of archaeological sites at both the Federal and State levels. At the Federal level, the Archaeological Resources Protection Act of 1979 (ARPA) establishes uniform regulations that must be met before Federal authorities can issue a permit to excavate or remove any archaeological resource on Federal or Native American lands. Chapter 267, Florida Statutes (F.S.), includes a section that grants the Division of Historic Resources title to sites and artifacts on State-owned and State-controlled land (see sections 267.031 and 267.115, F. S.). Chapter 267, F.S. also requires a permit to conduct archaeology, provides penalties for removing or disturbing sites to objects without a permit and makes it illegal to offer or sell forged artifacts (see sections 267.12 and 267.13, F. S.). Adaptation actions proposed for sites with archaeological resources will need to abide by these laws before any actions are taken that may remove, disturb, deface, destroy or otherwise alter archeological sites and their resources. There are also State regulations impacting archaeological resources such as the Cemetery Act (Chapter 872, F. S.) and the Native American Graves Protection and Repatriation Act (Public Law 101-601; 25 United States Code, 3001- 3013) that will affect what adaptation options can be taken on sites with human remains.

The Florida Building Code may also affect what can be done to historic properties since it is tailored to Florida's specific needs like wind and flood load forces. Chapter 11 of the Florida Building Code, Existing Buildings, is dedicated to design standards for historic buildings and allows for additional flexibility for historic properties. Other more stringent requirements that may apply include the high velocity hurricane zone, windborne debris regions and floodplain management ordinances. The NFIP allows for exemptions or variances to local flood ordinance requirements for historic properties (e.g., a registered historic property could be floodproofed instead of having to be elevated).

Local Approach and Inventorying Historic Properties

Local communities can choose to focus on historic properties as a separate planning process or include them as one type of property in a more comprehensive adaptation planning process. In the initial planning steps, consider including historic preservation professionals in the steering committee or as part of a focus group. This group may include architects, engineers, policy makers, non-profits and organization representatives. An important consideration is to identify how and when community

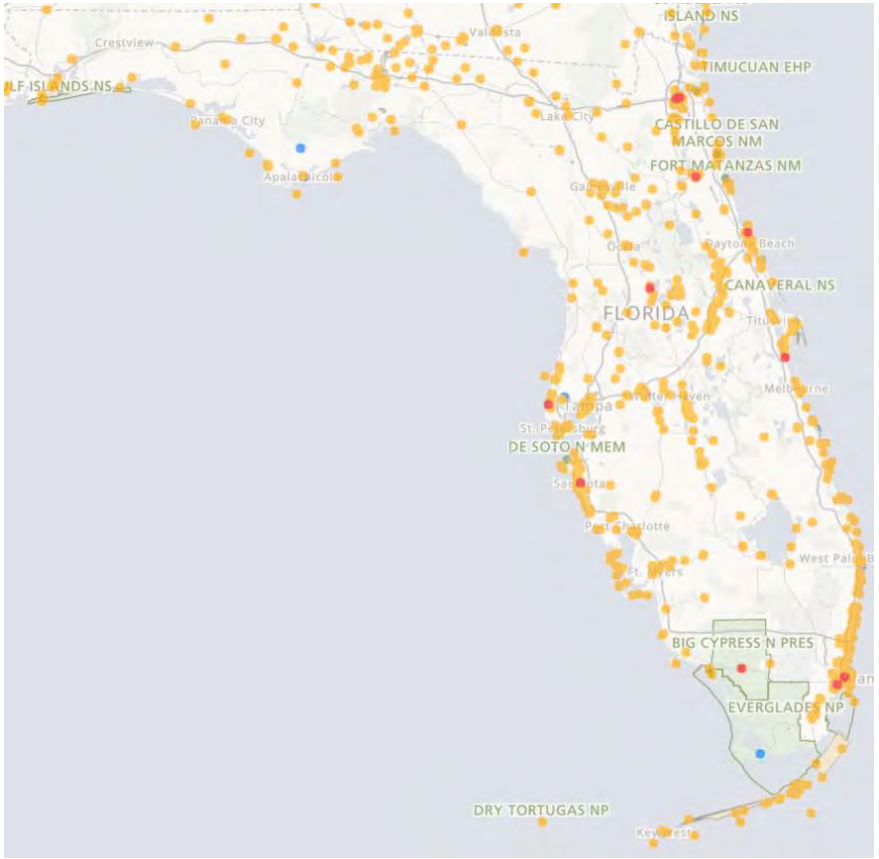


Figure 41. Florida buildings on the National Register of Historic Places. (Map is adopted from National Park Service.)

discussions will include historic resources and consider specific needs of property owners of historic properties. Include specific historic preservation goals in the adaptation plan, for example, "Enhance the ability of vulnerable historic properties and cultural resources to withstand the anticipated impact of hazards while maintaining their historic integrity."

A major step in this process is making a baseline inventory of historic properties and archaeological sites within the local agency's boundaries and compiling it into a GIS layer if that resource is available to the local agency. This layer could be included in the Adaptation Plan to determine which historic resources are within the Adaptation Action Areas or other such designated vulnerable areas. Much of this information is already in this format and can be easily expanded if needed by GIS-capable professionals. Present sources of information include the National Register of Historic Places, the Florida Master Site File and the property appraiser's website (to identify buildings 50 years old and older). Detailed information about each historic property can be contained within this format in a well-designed attribute table and easily overlaid with vulnerable locations. Attribute information to consider includes:

- Geographic location
- Type of resource
- Name
- Tax identification number
- Street address
- Condition of resource
- Distinguishing features or characteristics (especially those features and characteristics that are related to the historic property's integrity)
- If the property is listed on the National Register or may be eligible for the National register
- Owner
- Individual(s) with maintenance responsibility and availability
- Date of construction
- Square footage
- Structural system
- Primary material(s) of property/resource
- Current function
- Property characteristics: building type, type of foundation, vegetation, topography and distance from hazard zone.

Once a satisfactory inventory has been compiled, standard steps to adaptation planning can continue. This may be part of a more comprehensive Adaptation Plan in which all property types are included. A Vulnerability Analysis for historic properties is the same as for other properties, consisting of an Exposure Analysis, a Sensitivity Analysis and assigning focus areas. The next step, Adaptation Strategies, consists of assessing Adaptive Capacities, prioritizing Adaptation Needs and identifying Adaptation Strategies. The STAPLEE evaluation method (described in greater detail in Chapter 4, Implementation Strategies) is an example analysis type for prioritization that would work well for historic properties. Detailed information on the steps contained in this paragraph are contained in the guidebook titled "Adaptation Planning for Historic Properties: A Product of the Community Resilience Initiative."

Potential Historic Preservation Adaptation Strategies

Special considerations to historic properties include the adaptation strategy itself. The Secretary of Interior's advisory (not regulatory) Standards for the Treatment of Historic Properties are divided into four sections: (a) Preservation, (b) Rehabilitation, (c) Restoration and (d) Reconstruction. These standards are based on the understanding that there is a need to alter or add to historic properties to meet the requirements of continuing or new uses of the property while simultaneously retaining the property's historic character. Details regarding these standards for each of these four types can be found on the National Parks Service Technical Preservation Services webpage.

The chosen adaptive strategy for historical resources should include input from the public. Does the community value the historic resource? Does

the community have a preference on how to preserve the historic resource? Once a consensus is reached, cost may prove to be the biggest hurdle for any community when implementing a chosen adaptive strategy for a number of historic properties. Consider that tourism and economic growth are often linked to communities that have historic properties. Dan Scheidt, of the National Parks Service, says, "We cannot save everything; we have to set priorities. We live in a time when things are going to change."

Real life examples of adaptation strategies for historic properties include:

- A new seawall to protect one of the seven historic districts and a historic seawall in St. Augustine.
- Protecting the Turtle Mound National Register Historic Site from erosion through implementation of living shoreline techniques in the Canaveral National Seashore.
- The Homeowner Elevation Grant Program, which was part of rebuilding efforts for historic properties damaged by Hurricane Katrina in Mississippi, resulted in an elevation design guidelines book created by the Mississippi Development Authority, providing a step-by-step process for both property owners and local officials.
- Darlington, Wisconsin's flood accommodation strategies for repetitive flooding in its historic downtown business district along the Pecatonica River.
- The Bachman Wilson House designed by Frank Lloyd Wright in Somerset County, New Jersey was relocated to Arkansas from its original location along the Millstone River.

Relocation is generally sought as a last resort; however, it may be the best choice in some cases. Daniel Odess, PhD, of the National Park Service, says, "On one hand, the context and setting of a historic property is critical to understanding it, but a more pragmatic view dictates that while you may lose some of that integrity if you relocate, it's going to lose a lot more if it's gone."

Funding sources specific to historic resources include the following:

- Division of Historic Resources: Special Category Grant. Assists in funding major restoration of a historic property for relocation or rehabilitation or funding to support a major archaeological investigation.
- Division of Historic Resources: Small Matching Grants. Assist in the identification, protection and rehabilitation of historic and archaeological sites in Florida.
- National Trust Preservation Funds.
- National Trust for Historic Preservation: Johanna-Favrot Fund for Historic Preservation.
- National Trust for Historic Preservation: Cynthia Woods Mitchell Fund for Historic Interiors.
- Save America's Treasures Funding.
- Preserve America Grant Program.
- Federal Investment/Rehabilitation Tax Credit.
- National Park Service Historic Preservation Fund Grants-in-Aid.

6.2 Funding Opportunities

Funding for adaptation planning can originate at non-profit, private, local, state and federal levels. The following tables identify potential funding programs and resources. Note that since URLs and points of contact often change, no weblinks or contact information has been added. Please call the funding agency or use an online search engine for more information.

6.2.1 Recommended Funding Programs by Project Type

Shoreline Protection and Flood Resilience

- Transformational Habitat Restoration and Coastal Resilience
- Beach Erosion and Hurricane and Storm Damage Reduction
- National Coastal Resilience Fund
- RF

Roadway Improvements

- Building Resilient Infrastructure and Communities (BRIC)
- PROTECT (Formula and Competitive Discretionary programs)

Affordable Housing

- Community Development Block Grant (CDBG) Entitlement Program

Resilience Hubs

- CDBG Entitlement Program
- BRIC
- Hazard Mitigation Grant Program (HMGP)

Resilient Utilities

- BRIC
- Clean Water and Drinking Water State Revolving Fund
- Grid Resilience State Formula Grants
- Grid Resilience and Innovation Partnerships (GRIP) Program
- Energy Efficiency and Conservation Block Grant (EECBG) Program

Federal Funding Opportunity	Description and Details
U.S. Department of Commerce Economic Development Administration (EDA) Investment for Public Works and Economic Development Facilities	EDA provides assistance to support the construction or rehabilitation of essential public infrastructure and facilities necessary to generate or retain long-term private sector jobs and investments, attract private sector capital and promote regional competitiveness. Grants may be used for projects such as expanding and upgrading infrastructure to attract new industry, supporting technology-led development, redeveloping brownfield sites, promoting eco-industrial development and supporting heritage preservation development. Generally, EDA investment assistance may not exceed 50% of the project cost. Projects may receive an additional amount that shall not exceed 30%, based on the relative needs of the region in which the project will be located, as determined by EDA. Additional financial limitations may apply depending on the recipient.
U.S. Department of Education (DOE) — WaterSMART Aquatic Ecosystem Restoration Projects	The WaterSMART Aquatic Ecosystem Restoration Projects, managed by the Bureau of Reclamation, aim to improve aquatic ecosystems by restoring fish and wildlife habitats, enhancing water quality and supporting ecological health. Eligible projects include river and stream restoration, wetland restoration, riparian habitat restoration, and coastal and estuarine restoration. Activities may involve removing barriers to fish passage, planting native vegetation, controlling invasive species and enhancing natural hydrologic processes. Eligible applicants include states, tribes, irrigation districts, water districts and other organizations with water or power delivery authority. Non-profit conservation organizations can also apply in partnership with these entities. The program provides financial assistance for planning, design, construction and monitoring. Proposals are evaluated based on ecological benefits, project readiness and collaboration with other entities. Detailed guidelines and funding opportunities are available from the Bureau of Reclamation.
DOE — GRIP	The GRIP program funds projects across three separate programs to enhance grid flexibility and improve the resilience of the power system against extreme weather threats. The Grid Resilience Utility and Industry Grants support activities that modernize the electric grid to reduce impacts from extreme weather and disasters. Application Period: December-April Historical Grant Size: Funding capped at the amount the eligible entity has spent in the previous three years on hardening efforts.

Federal Funding Opportunity	Description and Details
DOE — Grid Resilience State Formula Grants	The DOE Grid Resilience State Formula Grants program is designed to strengthen and modernize the power grid, making it more resilient to wildfires, extreme weather and other natural disasters. This initiative provides funding to states, territories and federally recognized Indian Tribes over a five-year period, with allocations based on a predetermined formula. The overarching goal is to enhance the reliability and resilience of the electric grid, ensuring it can better withstand and recover from natural disasters. Eligible projects under this program include a range of initiatives aimed at improving grid resilience. These projects may involve the hardening of electrical grid infrastructure to enhance durability against extreme weather events, the installation of advanced technologies to increase grid flexibility and adaptability and the deployment of distributed energy resources like renewable energy and energy storage systems to enhance grid stability. Additionally, the program supports the upgrading of transmission and distribution systems to reduce outage times and improve overall resilience. Funding can also be used to develop and implement emergency response plans and procedures to quickly restore power after disruptions. States can issue subawards to electric grid operators, electricity storage operators, transmission owners and operators and distribution providers, fostering a comprehensive approach to building a more resilient and reliable power grid across the nation.
EPA BEACH Grants	EPA makes grants available to eligible coastal and Great Lakes states, territories and tribes to help them implement programs to monitor water quality at their beaches and to notify the public when water quality problems exist.
EPA Coastal Program	The U.S. Fish and Wildlife Service (FWS) Coastal Program partners with communities to provide technical and financial assistance to assess, protect and restore or enhance priority coastal habitats for the benefit of fish and wildlife. The program is delivered through a network of 24 field offices in priority coastal habitats along the Atlantic, Pacific and Gulf of America coasts and in the Great Lakes. Program biologists provide restoration expertise and financial assistance to federal and state agencies, local and tribal governments, businesses, private landowners and conservation organizations such as local land trusts and watershed councils.
FEMA (BRIC)	Risk and loss reduction project implementation focus on infrastructure projects benefiting disadvantaged communities, nature-based solutions, climate resilience and adaption and adopting hazard resistant building codes. Eligible applicants include states and territories that have experienced a disaster in the last seven years. Tribes that are federally recognized and are located entirely or partially in such states are also eligible. All applicants must have a FEMA approved state or tribal Hazard Mitigation Plan. Local governments (cities, townships, counties, special district governments, state agencies and tribal governments) can be considered as sub applicants and must

Federal Funding Opportunity	Description and Details
	submit applications to the main applicant. Local governments can apply on behalf of public utilities, private non-profit (PNP) and private for-profit (PFP) utilities.
FEMA Community Disaster Loan Program	FEMA provides direct loans to local governments to offset the loss of tax or other revenues as a result of a major disaster. The local government must demonstrate a need to maintain local governmental functions such as police and fire protection or water and sewer services. Loans are not to exceed 25% of the local government's annual operating budget for the fiscal year in which the major disaster occurs, up to a maximum of $5 million. To apply: The State's Governor requests a Presidential declaration of an emergency or disaster. An applicant should consult the office or official designated as the single point of contact in the state for more information on the process. Upon declaration, one may apply for assistance through the Governor's authorized representative.
FEMA Flood Mitigation Assistance (FMA) Program	FEMA provides funds to local governments, tribes and some non-profits to reduce or eliminate claims made under the NFIP. Specifically, the program aims to reduce the number of repetitive loss structures insured by NFIP. (Repetitive loss structures are those that have sustained two or more losses, each exceeding $1000, within a 10-year period.) There are three types of grants that fall within the FMA program area: 1. Planning Grants to prepare flood mitigation plans; 2. Project Grants to implement measures to reduce flood losses, such as elevation, acquisition or relocation of NFIP-insured structures; 3. Technical Assistance Grants for the state to help administer the FMA program and activities. To apply, projects should be submitted as the need arises to the state which then selects applications based on predetermined priorities set forth in a disaster specific Mitigation Strategy to send to FEMA for final approval.
FEMA Hazard Mitigation Grant Program	FEMA provides funds to local governments, tribes and some non-profits to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Grants given through the states to local governments following an official Presidential disaster declaration are used to implement long-term hazard mitigation measures that provide a long-term solution to a specific risk. For example, the grant could be used to elevate flood-prone homes or businesses, thus allowing floodwater to flow under the house rather than through it. FEMA will pay up to 75% of the project cost, while the remaining 25% must be funded through the state, local government applicants or individual property owners. In-kind services and materials can be used.

Federal Funding Opportunity	Description and Details
Gulf of America Alliance Gulf Star Funding	The Gulf Star Program is a public-private partnership that funds projects focused on enhancing the environmental and economic health of the Gulf of America. Priority areas include sustainable seafood, habitat conservation, water resources, community resilience and stewardship of coastal resources. The program encourages strategic partnerships to leverage resources and achieve measurable results.
HUD CDBG-DR	Disaster relief, long term recovery, infrastructure restoration, housing and economic revitalization. Eligible applicants include main cities of Metropolitan Statistical Areas (MSAs), metropolitan cities with populations of at least 50,000, qualified urban counties with populations of at least 200,000 (excluding the population of entitled cities), and states and insular areas.
HUD CDBG-MIT	Risk reduction to community services that benefit human health and safety or economic security. Eligible applicants include main cities of MSAs, metropolitan cities with populations of at least 50,000, qualified urban counties with populations of at least 200,000 (excluding the population of entitled cities), and states and insular areas.
National Association of Counties (NACo) Strengthening Coastal Communities Challenge	NACo's Strengthening Coastal Communities Challenge provides direct technical assistance to coastal counties in the Gulf of America to enhance their resilience to extreme weather and climate-related hazards. The initiative offers training, workshops and consultations with local officials to develop strategies for protecting communities and ensuring economic vitality.
NOAA Office for Coastal Management Coastal Resilience Grant	Provides funding to coastal communities to address risks and vulnerabilities associated with extreme weather and climate-related hazards. Projects should enhance the resilience of coastal communities and ecosystems, addressing issues such as sea level rise, coastal flooding and habitat degradation. This is an annual, competitive grant program.
National Science Foundation — Division of Ocean Sciences	Funds research projects on physical oceanography and the effects of climate change on the ocean, ecosystems and coastal communities. The program supports scientists, engineers and educators from a wide variety of institutions.
NFWF-CP	Focuses on protecting, restoring and enhancing coastal habitats for fish and wildlife. Eligible projects include habitat restoration and invasive species control. Funding covers planning, design, implementation and monitoring.
NFWF-NCRF	Supports projects that strengthen coastal communities by restoring natural habitats and enhancing resilience to extreme weather events and sea level rise. Eligible projects include marsh, wetland, dune restoration and more. Funding covers all phases.
OLDCC — DCIP	Addresses shortcomings in community infrastructure that supports military installation, enhancing military value, installation resilience and the quality of life for military families. Any infrastructure project related to transportation, facilities or utilities that bolsters a military installation, is prepared for construction, has the backing of the local commander representing the installation and will improve the quality of life, resilience or military significance at the supported installation.

Federal Funding Opportunity	Description and Details
PDM Grant Program	The PDM program provides annual funding to support states, territories, Indian tribal governments, communities and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. This program promotes implementation of activities designed to reduce injuries, loss of life and damage and destruction to property from natural hazards. Administered by the state, the PDM program is a competitive federal grant program that was created to assist communities with the implementation of cost-effective mitigation activities prior to disasters. The intent of this program is to reduce overall risk to people and property, while also minimizing the cost of disaster recovery. The State of Florida provides workshops to explain the purposes of the program, eligible project types and application requirements. A 25% local match is required (to the federal contribution of 75%); this is a cost reimbursement program.
Rural Development Water and Waste Disposal Loan and Grant Program	Provides long-term, low-interest loans and grants to rural communities and towns with populations of up to 10,000 for the development, replacement or repair of rural water supply and waste disposal systems, including solid waste disposal and storm drainage systems. The program encourages joint funding with private funding.
USACE — Aquatic Ecosystem Restoration	Section 206 Aquatic Ecosystem Restoration program, under the Continuing Authorities Program (CAP), provides federal funding and technical support for projects that restore degraded aquatic ecosystems. This grant is designed to improve ecological function and habitat value in rivers, streams, wetlands and other waterbodies. Funding can be used for planning, designing and constructing restoration projects that provide environmental benefits, such as reestablishing wetlands — which in turn provide flood reduction benefits, improving fish and wildlife habitats and enhancing water quality. Cost-sharing is required, with the federal government covering up to 65% of project costs.
USACE — Clearing and Snagging for Flood Control	Authority for this action is provided under Section 208 of the Flood Control Act of 1954, as amended. Program authority provides for minimal measures to reduce nuisance flood damage caused by debris and minor shoaling of rivers. Work under this authority is limited to in stream clearing and snagging or channel excavation and improvement with limited embankment construction by use of materials from the channel excavation. The source is continuing authority given by Congress to the USACE. There is a total of $7.5 million available nationwide per fiscal year under this authority. The federal funding limit per project is $500,000.
USACE — Ecosystem Restoration in Connection with Dredging	Authority for this action is provided under Section 204 of the Water Resources Development Act of 1992. This program authorizes “projects for the protection, restoration and creation of aquatic and ecologically related habitats, including wetlands, in connection with dredging an authorized navigation project.” The source is continuing authority given by Congress to the USACE. There is a total of $15 million available nationwide per fiscal year under this authority. There is no per project federal funding limit for this authority.

Federal Funding Opportunity	Description and Details
USACE — Flood Plain Management Services Program	Section 206 of the 1960 Flood Control Act, as amended, provides authority for the USACE to provide technical assistance and planning guidance to support effective floodplain management. Assistance is provided at the request of states, tribes, counties and other public entities without charge. Floodplain management services include development of comprehensive floodplain management plans, floodplain delineation studies, dam break analyses, hydrologic analyses and flood warning/preparedness planning. Assistance is provided through congressionally appropriated funds as well as by cost recovery in certain instances.
USACE — Hurricane and Storm Damage Reduction Projects	Authority for this action is provided under Section 103 of the River and Harbor Act of 1962, as amended. This authority may be used for protecting multiple public or private properties and facilities, and for the protection of single non-federal public properties against damages caused by storm-driven waves and currents. This authority allows federal participation in the cost of protecting the shores from hurricane and storm damage. The source is continuing authority given by Congress to the USACE. There is a total of $30 million available nationwide per fiscal year under this authority. The federal funding limit per project is $5 million.
USACE — Emergency Streambank and Shoreline Protection	Authority for this action is provided under Section 14 of the Flood Control Act of 1946, as amended. Program authority is for "emergency streambank and shoreline protection to prevent damage to public services such as highways, bridge approaches, public works facilities, churches, public and non-profit hospitals, schools, and other non-profit public facilities endangered by flood-caused bank and shoreline erosion." The source is continuing authority given by Congress to the USACE. There is a total of $25 million available nationwide per fiscal year under this authority. The federal funding limit per project is $1.5 million.
USACE — Environmental Restoration	Authority for this action is provided under Section 1135 of the Water Resources Development Act of 1986, as amended. Program authority allows for modifications of structures and operations of water resources projects constructed by the USACE to improve the quality of the environment. Non-structural alternatives can also be developed and implemented. The source is continuing authority given by Congress to the USACE. There is a total of $40 million available nationwide per fiscal year under this authority. The federal funding limit per project is $5 million.
USACE — Flood Damage Reduction	Authority for this action is provided under Section 205 of the Flood Control Act of 1948, as amended. Program authority is for the planning, design and construction of small flood control projects, such as local protection projects, channel improvements and modifications to existing flood control projects. The source is continuing authority given by Congress to the USACE. There is a total of $55 million available nationwide per fiscal year under this authority. The federal funding limit per project is $7 million.
USDA — EWP Program	Provides technical and financial assistance to address watershed impairments caused by natural disasters. Eligible projects include debris removal, erosion control and infrastructure restoration. Funding supports immediate and long-term recovery.

Federal Funding Opportunity	Description and Details
USDA — WFPO Program	Aims to improve watershed health and reduce flooding impacts through conservation practices. Eligible projects include flood control structures and soil erosion prevention. Funding supports planning, design and implementation.
USDA — Community Facility Grant Program	Provides grants for the development of essential public facilities in low-income rural areas and towns of up to 20,000 in population. Eligible projects include health care, fire and rescue facilities, police stations, libraries, schools, day care centers and other essential public facilities. Grant assistance may be available for up to 75% of project costs, depending on population and income of the service area. The program encourages joint funding with state and local governments as well as private and non-profit organizations.
USDA — Community Facility Loan Program	Provides loans and loan guarantees for developing essential public facilities in rural communities and towns of up to 20,000 in population. Eligible projects include health care, fire and rescue facilities, police stations, libraries, schools, day care centers and other essential public facilities. The program encourages joint funding with state and local governments as well as private and non-profit organizations.
USDA — Rural Utilities Service (RUS) Water and Waste Disposal Loan and Grant Program	The USDA RUS Water and Waste Disposal Loan and Grant Program aims to improve the quality of life and promote economic development in rural areas by providing funding for essential water and waste disposal infrastructure. This program offers financial assistance to rural communities, including loans, grants and loan guarantees, to develop, improve or expand water and waste disposal systems. Eligible projects under this program include the construction, improvement or expansion of water treatment plants, distribution systems and waste disposal facilities. This funding can be used for projects that address the public health and environmental needs of rural communities, such as installing or upgrading water pipelines, constructing or renovating sewage treatment facilities, and implementing systems for the collection, treatment and disposal of wastewater. Additionally, the program supports initiatives to address regulatory compliance issues, enhance system reliability and efficiency and ensure sustainable water and waste management practices.
USDA/RD — Business and Industry Loan Program	Provides loans and loan guarantees to businesses in rural areas for a variety of purposes, including the purchase and development of land, supplies and materials; payment of start-up costs; and supplying working capital. Loans may be used for real estate acquisition, development and construction, equipment purchase, start-up costs and working capital. Loans are made by commercial lenders and guaranteed by USDA, with up to $10 million available for each project. The maximum percentage of guarantee ranges from 60% to 80%, depending on loan size.
USFWS — National Coastal Wetlands Conservation Grants Program	Supports the acquisition, restoration and enhancement of coastal wetlands for fish and wildlife. Eligible projects include wetland restoration and habitat enhancement. Funding supports planning and implementation phases.

State Funding Opportunities

State Funding Opportunity	Description and Details
DEM — Residential Construction Mitigation Program (RCMP)	Funds the RCMP to support hurricane loss mitigation. Annually, the Florida Legislature appropriates $10 million from the Florida Hurricane Catastrophe Fund. Funding opportunities are announced via the Florida Administrative Weekly and the Florida Disaster website.
FloridaCommerce — Rebuild Florida Mitigation General Infrastructure Program	Provides funding to local governments for projects that enhance community resilience and reduce disaster impacts. Eligible projects include stormwater management, flood control and critical facility upgrades. Funding covers design and construction.
DEP — Clean Water State Revolving Fund Loan Program	Provides low-interest loans for planning, designing and constructing water pollution control facilities. Eligible entities include cities, counties, authorities and special districts responsible for sewerage services, stormwater management and estuary protection. Loan terms include a 20-year amortization with low-interest rates. Applications are solicited annually for project prioritization.
DEP — Coastal Partnership Initiative	The Coastal Partnership Initiative promotes the protection and effective management of Florida's coastal resources in four priority areas: Resilient Communities, Coastal Resource Stewardship, Access to Coastal Resources and Working Waterfronts. Eligible applicants include Florida's 35 coastal counties, municipalities, public colleges, universities, regional planning councils, national estuary programs and non-profit groups. Applications are accepted annually in response to a "Notice of Availability of Funds" published in the Florida Administrative Weekly. Projects must be completed within one year.
DEP — Drinking Water State Revolving Fund Program	Provides financial assistance for improvements to drinking water facilities, prioritizing projects addressing public health risks and compliance with the Safe Drinking Water Act. Approximately $65 million is available annually. Eligible applicants must submit a "Request for Inclusion on a Priority List" form, facilities plan and obtain all necessary permits.
DEP — Florida Beach Erosion Control Program	Established to protect, preserve and restore coastal sandy beach resources. Eligible activities include beach restoration, nourishment, engineering studies, environmental monitoring, inlet management planning and dune restoration. Projects must comply with the Florida Strategic Beach Management Plan and cost-sharing requirements are up to 50% for beach restoration and up to 75% for inlet management projects. Annual budget plan updates are due Sept. 1.
DEP — Florida Greenways and Trails Program - Financial Assistance	Aims to acquire lands for establishing a statewide system of greenways and trails. Eligible applicants include federal, state, local governments, non-profit organizations and individuals. The program receives 1.5% of state allocations under the Florida Forever Act. Applications must meet specific criteria and be submitted by deadlines published in the Florida Administrative Weekly.

State Funding Opportunity	Description and Details
DEP — Recreational Trails Program	Provides funds for projects that create, renovate or maintain recreation trails, including motorized, non-motorized and mixed-use projects. Eligible applicants include municipal, county, state or federal government agencies and Florida non-profit corporations. A 50/50, 60/40 or 80/20 match is required. Applications must be site-specific and submitted during announced periods.
DEP — RF Program	DEP offers several types of grants under the RF Program to enhance community resilience to flooding and sea level rise. The planning grants support developing plans and assessments to identify risks and strategize mitigation and adaptation measures. The implementation grants fund projects addressing identified vulnerabilities, such as stormwater infrastructure improvements, flood protection structures and green infrastructure like bioswales. Regional Resilience Entities Grants support multi-jurisdictional collaborations to develop and implement regional resilience plans and projects involving multiple local governments.
FIND — Waterways Assistance Program	Provides financial assistance to municipalities and county governments within the district's 12 counties for waterway-related improvement projects. Approximately $10 million is available annually. Projects require a 50% match, with some exceptions for public navigation dredging. Applications are due April 1, with funding available as of Oct. 1 each year.
Florida Fish and Wildlife Conservation Commission (FWC) — Florida Boating Improvement Program (FBIP)	Provides competitive grants for boating access projects and other boating-related activities on Florida's coastal and inland waters. Eligible activities include channel marking, boat ramps, piers, docks, derelict vessel removal, boater education and economic development initiatives. No cash match is required, though some in-kind match is needed. Eligible applicants include county governments, municipalities and other governmental entities.
FIND — Cooperative Assistance Program	Provides financial assistance for waterway-related improvement projects within the district's 12 counties. Eligible applicants include federal, state and regional governments. Projects require a 50% match, except for some public navigation dredging projects. Applications are due April 1, with funding available as of Oct. 1 each year.
FWC — State Wildlife Grants	Supports efforts related to climate change, sea level rise or resilience initiatives.
SWFWMD — Cooperative Funding Initiative	A cost-share program providing up to 50% of project costs for sustainable water resources, conservation, natural system restoration and flood protection projects. Approximately $25 million is available yearly. Eligible applicants include local governments and community partners.
State of Florida Pollution Control Bond Program	Provides loans to local governments for construction of water, wastewater, solid waste, stormwater and air pollution control facilities. Proceeds from state-sold bonds provide up to $300 million annually. Eligible entities must submit complete loan applications with plans and specifications.

State Funding Opportunity	Description and Details
State Revolving Fund Loan Program for Wastewater Treatment	Provides low-interest loans for water pollution control activities and facilities, including wastewater and stormwater treatment, agricultural stormwater runoff pollution control, brownfields and estuary pollution control. Funded by federal and state appropriations, loan repayments, investment earnings and bond proceeds. Eligible applicants include municipalities, county governments, special districts and non-governmental parties for agricultural stormwater pollution control.

Non-Profit Funding Opportunities

Non-Profit Funding Opportunity	Description and Details
Alfred P. Sloan Foundation	Offers grants in six major program areas, including "Public Understanding of Science" and "Basic Research." Provides grants for high-quality, original STEM research and projects that engage the public in science and technology through various media. No application deadlines, grants are made year-round.
Southeast RCAP Financial Service	A regional non-profit lender helping rural communities with water, wastewater, housing and economic development activities in Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia and Florida. Offers interim funding up to $500,000 with interest rates as low as 3% and flexible terms. Provides financial assistance for reconstructing and refurbishing wells. Loans cover 75-100% of project costs, up to $150,000. No deadlines, applications are accepted year-round. Eligible applicants include local governments, public service authorities, user associations and non-profits.
Surdna Foundation	Supports projects in Sustainable Environments, Strong Local Economies, Thriving Cultures, Community Revitalization and Effective Citizenry. An example grant is $200,000 to the American Planning Association for integrating energy sustainability and climate change into planning practices. U.S.-based non-profits are encouraged to apply. No deadlines, grants are assessed three times a year (February, May and September).
The Doris Duke Charitable Foundation	The Environmental Program supports strategic wildlife habitat conservation, reducing landscape impacts from energy development, land stewardship, sustainability and building a clean-energy economy. Grants awarded align with these strategies.
The Kresge Foundation	Invests in projects related to climate change adaptation, place-based adaptation strategies and climate-wise policies. Primarily accepts grants by invitation, but preliminary applications can be submitted. 501(c)(3) organizations and government entities are encouraged to apply.
TNC — Coastal Resilience Fund	TNC's Coastal Resilience Program is designed to help communities become resilient by restoring and preserving natural coastal ecosystems. This program focuses on utilizing nature-based solutions to enhance the resilience of coastal areas, protect vital habitats and support local economies. Eligible projects under the TNC Coastal Resilience Program include the restoration of wetlands, mangroves and oyster reefs, which serve as natural buffers against storm surges and flooding. The program also supports the creation and maintenance of living shorelines, which use natural materials and vegetation to stabilize coastlines and reduce erosion. Additionally, the program promotes the use of innovative tools and technologies to model and predict coastal vulnerabilities, enabling communities to plan and implement effective adaptation strategies.

Non-Profit Funding Opportunity	Description and Details
The Rockefeller Family Foundation	Focuses on public education about conservation of natural resources, environmental health protection and public participation in environmental policy debates. The foundation is interested in initiatives designed to enact aggressive policies to reduce carbon emissions and bring many voices into the climate debate. U.S. non-profits engaged in activities of national significance are encouraged to apply.
The Trust for Public Land (TPL) — Conservation Finance Program	A national non-profit organization offering services such as conservation real estate transactions and conservation finance. It helps local governments gauge public support for open space and craft initiatives to generate funding for conservation. TPL has created over $22 billion in new funding for land conservation through successful state and local measures. No application deadline: contact TPL as needed. Local governments and citizen groups are encouraged to apply.
The Walton Family Foundation	The Walton Family Foundation is deeply invested in funding climate resilience initiatives that address pressing environmental challenges and foster sustainable solutions. Through strategic funding allocations, the foundation aims to bolster the resilience of communities and ecosystems, ensuring they can withstand the growing threats posed by climate-related risks. Eligible projects for funding from the Walton Family Foundation encompass a wide range of endeavors, including the restoration and conservation of natural habitats, the implementation of green infrastructure projects and the promotion of sustainable water resource management practices. Additionally, the foundation supports efforts to conserve biodiversity, protect critical ecosystems and advance policy advocacy and research initiatives focused on climate resilience. By partnering with various stakeholders, including nonprofit organizations, research institutions and community groups, the foundation endeavors to catalyze impactful projects that integrate environmental conservation, community engagement and evidence-based decision-making to build resilience.
The Wildlife Conservation Society's Climate Adaptation Fund	Provides funding for on-the-ground conservation projects focusing on climate adaptation at a landscape scale. U.S.-based non-profits with IRS 501(c)(3) status can apply. Public agencies, tribal governments and universities may partner with eligible non-profits. Offers a 1:1 match ranging from $50,000 to $250,000, with a maximum of 50% match funding from in-kind sources.

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6.4 Acquiring Examples

Example Vulnerability Assessments, Adaptation Plans, Adaptation Plan Outlines and Updated Grant Work Plan Tasks and Deliverables are available upon request. Please reach out to Resilience inbox at Resilience@FloridaDEP.gov to request example documents.