

# ADAPTATION ACTION AREAS

A  
**Planning  
Guidebook**  
FOR FLORIDA'S  
LOCAL GOVERNMENTS

PREPARED BY THE SOUTH FLORIDA REGIONAL PLANNING COUNCIL IN PARTNERSHIP WITH DEO, BROWARD COUNTY AND THE CITY OF FORT LAUDERDALE



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## Overview

*"Adaptation action area" or "Adaptation Area" is an optional comprehensive plan designation for areas that experience coastal flooding and are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning. Local governments that adopt an Adaptation Action Area may consider policies within the coastal management element to improve resilience to coastal flooding.*

**Florida communities** have been actively and increasingly addressing both coastal and inland flooding over the last several decades. This has partly been in response to increasing risk and exposure, but it has also reflected a major paradigm shift from post disaster recovery to proactive resilience that prevents and mitigates risks. This new awareness has stimulated innovative approaches: increasing partnerships and outreach, new risk assessment tools, and forward-thinking mechanisms in planning. An example of one of these multi-layered community collaborative responses is the leadership in Palm Beach, Broward, Miami-Dade, and Monroe Counties via the Southeast Florida Regional Climate Change Compact (SFRCC). Statewide, there are more trailblazing communities that have laid the foundation for adaptation to current and future coastal flooding risk. By addressing current flood issues with updated policy and design criteria, these communities instill co-benefits as they integrate planning and regulatory objectives to address impacts related to sea level rise. Effective strategies are now supported by State Statute to promote and support further adaptation initiatives around Florida.

**Adopted into the Florida Statute in 2011 through the Community Planning Act, Adaptation Action Areas provide a flexible and optional framework** that can be applied to the entire State through individual local action. At the request of coastal communities, DEO created this guidance to assist communities understand how they can use Adaptation Action Areas to adapt to coastal flooding. Florida (Chapter 163, Fla. Stat.) requires each local government authority to create, adopt and maintain a comprehensive land use plan. The local comprehensive plan is a key driver of development and redevelopment because it outlines legally enforceable guidelines and strategies, directly influencing the decision-making process. Comprehensive plans can be amended to create strategies for merging growth with resilience. This creates possibilities for continuously revisiting and updating best practices for sustainable development, post-disaster redevelopment, green infrastructure, water management, and protection of natural resources. In the context of sea level rise, planning today via tools such as Adaptation Action Areas improves the preparedness and resilience of communities, in a way that persists over time.

**The voluntary policy option described here** is a formative way to assist local governments in addressing the potential hazard impacts associated with sea level rise. This Guidebook is intended to be a "how-to" illustration to guide local governments interested in integrating Adaptation Action Areas into policy and operational frameworks. This Guidebook will describe a broad process for engaging community stakeholders, identifying vulnerability, developing planning tools, adopting policies, and implementing strategies. Finally, we loop back to the pilot to illustrate lessons learned at the local level and how they can be applied to other areas. The intention is to introduce ways to tailor adaptation solutions to the unique vulnerabilities of a community, which can be utilized by coastal communities around Florida. The information presented here has been structured to support initiatives around Florida to utilize the Adaptation Action Areas strategies and to meet other local goals for community resilience.

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## Introduction

### Adaptation Action Areas Resources

The Adaptation Action Areas Guidebook is part of a series of resources intended to support local governments, working with their region and with the State of Florida, to create the best opportunities for merging growth with resilience by implementing Adaptation Action Areas. Other resources include a Fort Lauderdale pilot project case study (see Appendix 1), a policy options for adaptive planning report, informational videos focused on Adaptation Action Areas, and a Community Adaptation Action Area Checklist (see Appendix 3: The Adaptation Action Area Checklist).

### Background

In 2010, the Board of County Commissioners for Broward, Miami-Dade, Monroe and Palm Beach Counties signed a Southeast Florida Regional Climate Change Compact (the Compact). This partnership has thrived and successfully moved many adaptation efforts forward. The Compact recognized that the South Florida region, which comprises 30 percent of State's population, has and will continue to be prone to coastal hazards, "... especially sea level rise", and therefore "must give significant consideration to adaptation strategies designed to protect public infrastructure, property, water resources, natural areas and native species, and basic quality of life." The Compact's initiative to promote Adaptation Action Areas and to proactively plan for resilience led to a requests from Florida communities that the State provide guidance on how to implement Adaptation Action Areas and, subsequently, to this current effort to create such guidance resources for the State.

#### The Compact

The compact represents regional cooperative framework designed to set the agenda for adaptation planning in the region. In addition, the Compact provides a means for state and federal agencies to engage with technical assistance and support. The Compact has been successful in amending Florida planning legislation to incorporate efforts to address sea level rise, and prioritize funding for this purpose. The Compact hosts an annual summit to bring key partners together to learn about new projects, ideas, and research relating to regional impacts.



In January 2011, National Oceanic & Atmospheric Administration (NOAA) approved the Florida Coastal Management Program's (FCMP) Coastal Zone Enhancement Grant (Section 309) strategy number 10, which supported the statewide Community Resiliency Initiative, coordinated by DEO. The Initiative is a 5-year project to integrate adaptation to potential sea level rise into current planning mechanisms including the local comprehensive plan, local hazard mitigation plan and post-disaster redevelopment plan. This effort is steered by a Focus Group of statewide experts on adaptation and coastal vulnerability as well as stakeholders in the coastal area. First, DEO researched similar efforts in other states as well as how the "Adaptation Action Area" may be implemented at the local level.

### Community Resiliency Initiative – 5-year Scope of Work

- Year 1: Partnership building, information gathering and establishing parameters;
- Year 2: Evaluating vulnerability analyses methodology and tools, selecting pilot communities and developing preliminary statewide guidance on adaptation planning / City of Fort Lauderdale Adaptation Action Areas Pilot Project;
- Year 3: Piloting adaptation planning guidance in two different coastal communities;
- Year 4: Compiling lessons learned and disseminating results; and,
- Year 5: Information dissemination and outreach.

This guidance and related work is part of a Project of Special Merit (PSM) funded by NOAA and coordinated through the Florida Coastal Management Program (DEP) and DEO's Community Resiliency Initiative, focused on developing and implementing Adaptation Action Areas policy, advancing partnership between the City of Fort Lauderdale, Broward County, South Florida Regional Planning Council and the Southeast Florida Regional Climate Compact. The collaboration in support of this initiative is to serve as an example to create guidance for statewide dissemination. DEO has compiled and created a repository of resources on their website (<http://www.floridajobs.org/adaptationplanning>), which include:

- Background information on Adaptation Action Areas and sea level rise impacts;
- Adaptation Funding Opportunities;
- Community Resiliency Focus Group Roster;
- Implementing "Adaptation Action Area" Policies in Florida;
- How Countries, States, and Florida Address Sea Level Rise - A Compendium of Adaptation Research - National, State, and Local Adaptation Projects;
- Descriptions and links to key adaptation planning research projects, plans, and publications at the national, state, and local level; and,
- Descriptions and links to explore a host of adaptation planning tools.

As part of this work to assist in the research for Adaptation Action Areas implementation strategies, South Florida Regional Planning Council (SFRPC) worked with the City of Fort Lauderdale and Broward County on a pilot to:

- Study and develop a State strategy for Adaptation Action Areas;
- Test adaptation policy options incorporated into the City's Comprehensive Plan;
- Develop this Adaptation Action Areas Guidebook to assist other coastal communities in Florida; and,
- Produce an interactive series of videos to illustrate Adaptation Action Areas.

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## Guidebook Sections

This guidebook will explain Adaptation Action Area activities within the larger suite of adaptation planning. Readers may utilize the first chapter to develop an understanding of the overall adaptation planning process (as proposed by *Recommended Components of an Adaptation Plan*, a guidance document developed by DEO). The first chapter also connects the activities undertaken for the Adaptation Action Areas process to corresponding components of the overall process. The following chapters then explore each major component of adaptation planning, with examples provided from Adaptation Action Area projects from around the state.

Readers who are new to Adaptation Action Areas and the Adaptation Planning Process may begin with Chapter 1 of this guidebook. For readers who wish to analyze the way in which pilot communities integrated Adaptation Action Area planning into their community preparedness efforts, examples are provided throughout Chapter 2 – Chapter 5. Detailed case studies and additional policy language may be found in the appendices.

## Definitions & Descriptions

This guidebook utilizes terms commonly used in adaptation planning. The guidebook also focuses on the Florida statutory policy tool, Adaptation Action Areas. In order to maximize clarity for the reader, this section defines and describes Adaptation Action Areas and associated terms.

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“Adaptation Action Area” or “Adaptation Area” means a designation in the coastal management element of a local government’s comprehensive plan which identifies 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.

*Section 163.3164(1), Florida Statutes*

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In 2011, the Florida Legislature passed an amendment to the Community Planning Act (CPA) (§163 and §380, Fla. Stat.) which made significant changes to the State’s growth management laws, including the addition of an optional designation of Adaptation Action Areas within the Coastal Management Element of a local government’s comprehensive plan. The intent of such a designation would be to address coastal hazards and potential sea level rise impacts in a specific location.

Local governments may pursue adaptation planning strategies within the designated area and prioritize funding for appropriate infrastructure improvements. Local governments may consider possible strategies which are in line with adaptation, as described in the State Statute addressing the principles, standards etc. of the coastal management element.

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### Section 163.3177(6)(g)(10), Florida Statutes

At the option of the local government, develop an Adaptation Action Area designation for those low-lying coastal zones that are experiencing coastal flooding due to extreme high tides and storm surge and are vulnerable to the impacts of rising sea level. Local governments that adopt an Adaptation Action Area may consider policies within the coastal management element to improve resilience to coastal flooding resulting from high-tide events, storm surge, flash floods, stormwater runoff, and related impacts of sea-level rise. Criteria for the Adaptation Action Area may include, but need not be limited to, areas for which the land elevations are below, at, or near mean higher high water, which have a hydrologic connection to coastal waters, or which are designated as evacuation zones for storm surge.



Adaptation Action Areas and other spatial designations are intended to guide a community in reaching their own goals for coastal resiliency. The goal of Adaptation Action Areas is to improve resilience to coastal flooding or any other resilience-related objective of a local government's choosing, and it can be met via a wide range of adaptation options. Some communities may choose to direct infrastructure away from vulnerable areas, while others may choose to prioritize infrastructure improvements to maintain and protect designated areas. In some cases, communities are already planning for and implementing adaptation activities, through hazard mitigation or environmental conservation projects. Such actions can be better leveraged when recognized as having current and future benefits.

#### **Keywords related to Adaptation Action Areas defined:**

- **Adaptation:** Adjustment in natural or human systems in response to actual or expected stimuli or their effects, which moderates harm or exploits beneficial opportunities.
- **Coastal flooding:** Flooding which occurs when water is driven onto land from an adjacent body of water. This generally occurs when there are significant tropical storm events, such as hurricanes.
- **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 6 hours. Flash floods are usually characterized by raging, quick moving water after heavy rains.
- **Mean sea level:** The height of the sea surface averaged over all stages of the tide over a period of time, typically computed over a 19-year period.
- **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.

- **Storm surge:** An abnormal 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.

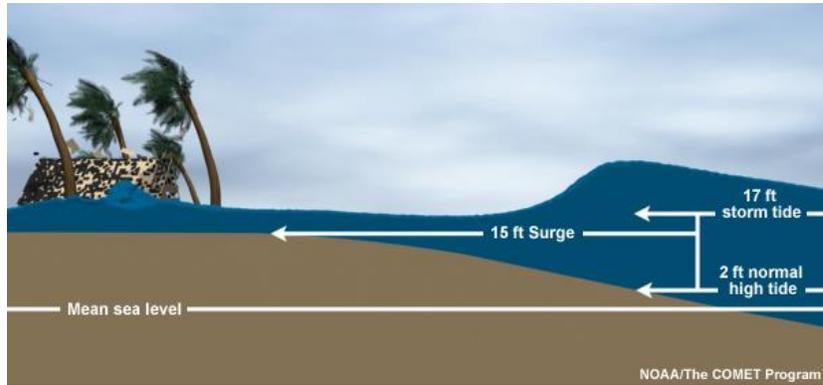


Figure 1: Illustration of Storm Surge and Tide Heights

- **Stormwater runoff:** Is generated when precipitation flows over land or impervious surfaces and does not percolate 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.

### Keywords related to high-tide events defined:

- **Local tides:** are related to astronomical considerations (related to the position of the Earth, sun and moon) and non-astronomical factors such as configuration of the coastline, local depth of the water, ocean-floor topography, and other hydrologic and meteorological influence.
- **Extreme water levels:** extremely high or low water levels at coastal locations are an important public concern and a factor in coastal hazard assessment, navigational safety, and ecosystem management. Exceedance probability, the likelihood that water levels will exceed a given vertical elevation, is based on a statistical analysis of historic water levels.
- **Highest astronomical tide (King tide):** the elevation of the highest predicted astronomical tide expected to occur at a specific tide station. Tides are acted upon by gravitational forces of the moon and sun are produced when ocean waters undergo "heaping" action resulting from the horizontal flow of water toward two regions of the earth being pulled on by the sun and moon.
- **Perigean tide:** occurs when the moon is closest to the earth.
- **Spring tides:** occur twice each lunar month (during full or new moons), during which high tides are a little higher and low tides are a little lower.
- **Perigean spring tides:** are the largest astronomical tides, occurring when spring tides and perigean tides coincide. They occur at intervals that are slightly more than six months long, so each year they are later in the season than the preceding year. For this reason, we must refer to tables of predicted tides to know exactly when to expect these unusually high tides.

The introduction to this guidebook has provided readers with a description of the topic at hand, DEO's involvement with Adaptation Action Areas, and useful information about the guidebook, including definitions. With this information, the reader may feel equipped to read and interpret the rest of the guidebook in a manner consistent with technical assistance provided by the state on coastal flooding. It is our hope that, once

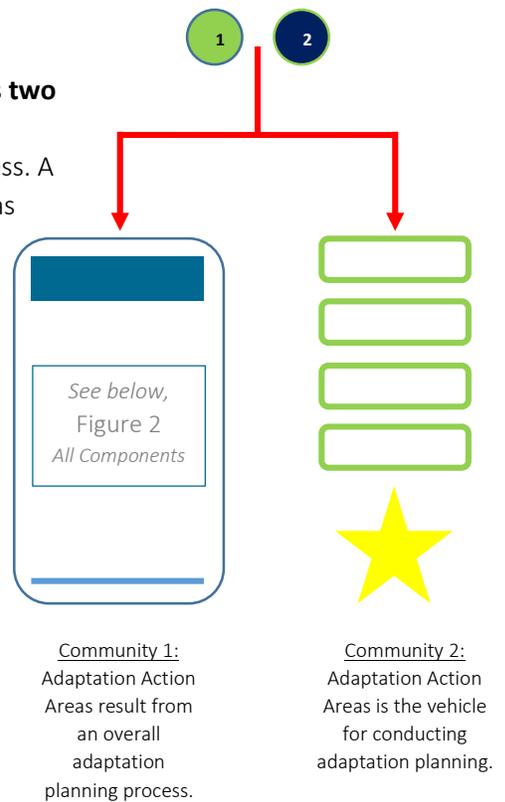
a community has engaged with all or part of this guide, it will be able to surmount its particular barriers to implementing Adaptation Action Areas. As Adaptation Action Areas represent a strong mechanism through which a community may prepare for potential future coastal flood hazards, this guide is highly recommended for municipalities who wish to increase their coastal flood capacity and resilience.

# Chapter 1: Adaptation Action Areas and the Adaptation Planning Process

In this chapter, the recommended components of an adaptation plan are described. Next, the relationship between Adaptation Action Areas and the Components of an Adaptation Plan are described. Examples from six Florida communities are used to explain this relationship. Communities have the option to consider using and approaching Adaptation Action Areas in many different ways, and therefore, it is important to discuss these different uses and approaches.

**In general, communities are likely to approach Adaptation Action Areas two different ways.** A first set of communities will consider the utilization of Adaptation Action Areas as part of their overall adaptation planning process. A second set of communities will use planning for Adaptation Action Areas as their primary adaptation planning activity. This guidebook illustrates the activities essential to Adaptation Action Area planning whether or not the Adaptation Area is the primary focus of the community’s future coastal flood hazard preparation.

The *Components of an Adaptation Plan* section (page 12) provides an organizational framework for discussing these uses and approaches, and how they might relate to a community’s overall adaptation planning process. By tying the use of Adaptation Action Areas more closely to the overall planning process, planners will be able to: better identify the interrelationship of Adaptation Action Areas to other adaptation efforts they are or could become involved with; tie lessons learned, guidance or staff responsibilities to the respective community’s adaptation planning process; and, identify through case studies, how Florida communities have already begun to approach and use Adaptation Action Areas.



## Components of an Adaptation Plan

Figure 2: Adaptation Plan Overview



There are four (4) essential components to be considered for inclusion in the adaptation planning process: Context, Vulnerability Assessment, Adaptation Strategies, and Implementation Strategies (see Figure 2 for a full listing of all components). Within each of these four main components are a number of supporting tasks (i.e., sub-components) that will assist each community plan for its own optimal sea-level rise adaptation. It is important to note that these components are not intended to be approached linearly, and communities are likely to take many different planning approaches to meet their individual adaptation needs. In Figure 2, the components that SFRPC and the City of Fort Lauderdale employed for the purpose of their Adaptation Action Areas pilot are **outlined in green**. The outcome, or designated Adaptation Action Areas, is aligned with sub-component 4.2 *Integrate into Existing Plans*, which is denoted by a gold star (★).

**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 sea-level rise adaptation. This 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.

**Context** refers to the preparatory activities taken by the planning team and the community to increase their understanding of the planning issue at hand, and to unite and fortify their efforts addressing the issue.

**1.1 Assemble a Steering Committee.** In order to write a sea-level rise adaptation plan that reflects the expertise and interests of the community's local stakeholders, a steering committee can be assembled. Steering committees have the ability to enhance all ensuing activities in the adaptation planning process.

**1.2 Set Guiding Principles and Motivations.** By deciding on guiding principles and motivations, the community can establish its compass for navigating through the following components. The principles and motivations are one of the plan's most inter-active sub-components, and may be recalled to assist decision-making activities in the second, third, and fourth components.

**1.3 Describe the Planning Context.** Describing the planning context offers an opportunity to analyze prior adaptation planning efforts that may have occurred within or near the community, information gaps related to adaptation planning, the available human capacity (such as coastal scientists and land-use planners), and the outside resources needed to conduct the locally desired planning effort. Essentially, this sub-component provides a chance to assess the scope of work and the resources applicable to the adaptation planning process.

**1.4 Identify Opportunities for Community Participation.** Within this sub-component, the planning team is encouraged to identify opportunities for community participation to discuss the resources created during the Vulnerability Assessment, Adaptation Strategies, and Implementation Strategies components.

**2. Vulnerability Assessment.** The Vulnerability Assessment represents the second component in the sea-level rise adaptation planning process, and consists of measuring the impact of sea-level rise and identifying the people, infrastructure, and land uses that may be affected. Vulnerability is often used interchangeably with risk when measuring hazard impacts.

The **Vulnerability Assessment** draws from the Risk Assessment framework described in the Code of Federal Regulations (Title 44 CFR 201.6 (c)(2)), which measures the hazard exposures a community is likely to experience, and the sensitivities – e.g., populations and land uses – that may be exposed to the identified hazards.

**2.1 Conduct an Exposure Analysis.** An exposure analysis utilizes a sea-level rise projection to answer the question “where” based on two choices – when (what horizon) and how much (which scenario). The “where” will depend on which computer model is used (e.g., SLAMM, SLOSH, ADCIRC etc.) to produce the sea-level rise projection. The analysis can depict which areas in the community are likely to be susceptible to the chosen sea-level rise scenario on a map.

**2.2 Conduct an Impact (Sensitivity) Analysis.** Conducting an impact (sensitivity) analysis helps the community to identify natural resources, structures, populations, and other entities located in areas that are at risk to the sea-level rise scenario projected during the Exposure Analysis.

**2.3 Assign Focus Areas.** With the assistance of the steering committee and community stakeholders, the planning team may assign focus areas. This sub-component responds to the sensitive entities identified in the previous step and assigns community preferences to areas that will receive the majority of adaptation strategy attention.

**3. Adaptation Strategies.** Adaptation Strategies represent the third component in the adaptation planning process, and are in effect a set of responses to the findings from the Vulnerability Assessment. Adaptation strategies are often classified according to their status as Protection, Accommodation, and Retreat (PAR) strategies. There are also a set of supporting activities that assist the development of the strategies themselves, which are described in this component. This component also identifies how adaptation strategies can be prioritized for each focus area, then applied through PAR and No Regrets interventions.

**Adaptation Strategies** refers to the toolkit of responses that communities can take to adapt to sea-level rise, as well as the steps taken to decide which adaptation strategies are the best fit based on the needs of individual communities.

**3.1 Assess Adaptive Capacities.** This sub-component encourages the community to measure the degree to which it is equipped to adapt to sea-level rise, through the existence of policies, structures, finances, and human resources that can assist or already are assisting to adapt to potential changes.

**3.2 Prioritize Adaptation Needs.** Component 3.2 takes into account the findings from the Vulnerability Assessment (namely focus areas), pairs the findings with the community's adaptive capacity assessment, and proposes priority needs – for example, top priority: wetland restoration in focus area X – according to the urgency and feasibility of each need.

### 3.3 Identify Adaptation Strategies by Focus Area

- Protection – Hard and soft structurally defensive measures to mitigate the impacts of rising seas (e.g., seawalls, bulkheads, rip-rap, and living shorelines).
- Accommodation – Physical design alterations allowing a structure or land use to remain in place (e.g., floodable development, floating structures, and bio-swales).
- Managed Retreat – Relocation of existing development / limitation of future development (e.g., rolling easements, transfer of development rights, and design for dis-assembly).
- No Regrets – Comprehensive and Targeted Strategies, such as incorporating sea-level rise scenarios into other plans and enhancing sea-level rise outreach.

**4. Implementation Strategies.** Once a set of adaptation strategies has been developed and analyzed, it is recommended that communities prepare for the supporting activities that can facilitate adaptation activities to be successfully undertaken. This includes locating, preparing for, and applying for potential funding opportunities; creating a schedule of adaptation actions for the future, and addressing monitoring and evaluation needs.

**Implementation Strategies** encourage communities to look into available funding for adaptation activities, describe which groups will complete which tasks, and create mechanisms to evaluate how the adaptation plan strategies are being accomplished.

**4.1 Survey Funding Options.** A systematic review of all known funding sources, as well as inquiry into new funding opportunities that may facilitate a successful implementation strategy.

**4.2 Integrate into Existing Plans.** In order to integrate the components of the sea-level rise adaptation plan into other plans, the planning team is encouraged to: identify all relevant documents, assess documents for potential inclusion points, and (if applicable) initiate collaboration with the responsible party to ensure that the applicable sea-level rise objective can be included at the time of the next update.

**4.3 Create a Schedule of Adaptation Activities and Actors.** Provide an impetus to the actions to be completed and the staff responsible for each action. This sub-component can serve to program different types of adaptation activities according to their prioritized need (see sub-component 3.2 above), and in pairing with funding opportunities, generate a concise and easy-to-follow plan.

**4.4 Monitor and Evaluate.** Monitoring and Evaluation extends throughout the horizon of the plan's implementation, which could extend decades. The ability to communicate the guiding goals of the plan across generations of implementing actors is essential. This is done through a Monitoring and Evaluation

plan that uses consistent language, such as “indicators” that can be tracked throughout the implementation horizon, and rated as to successfulness by different implementing actors.

## Approach and Use of Adaptation Action Areas: Relationship to Components

There have been at least five Florida communities that have used Adaptation Action Areas in their local adaptation planning processes. These communities include: Broward County, City of Fort Lauderdale (Broward County), Miami-Dade County, the City of Satellite Beach (Brevard County), Town of Yankeetown (Levy County), and the Town of Inglis (Levy County). Each of these communities have approached and used Adaptation Action Areas differently. As well as these completed efforts, the community Village of Pinecrest (Miami-Dade County) has proposed to add a new element to their comprehensive plan that includes designation of Adaptation Action Areas.

In addition to outright Adaptation Action Areas entering into community plans, other Florida communities have engaged in adaptation planning. In so doing, [Punta Gorda](#) and Palm Beach County have both considered the use of adaptation overlays or special designated areas to accomplish the goals of protecting local assets, similarly to an Adaptation Action Area. Each of these Florida communities have already demonstrated that Adaptation Action Areas can be used and approached in many different ways.

As a use, Adaptation Action Areas can be considered a *strategy and tool*. As a strategy, communities have used Adaptation Action Areas:

- As the focus of the adaptation planning process, whereby the end goal of the process was to adopt Adaptation Action Area language into policy and/or to assign focus areas;
- To spatially delineate areas subject to future Adaptation Action Areas policies; and,
- To spatially delineate areas subject to other adaptation planning and policy tools.

As a tool, Adaptation Action Areas have been used:

- As overlay areas; and,
- To prioritize areas for adaptation planning efforts.

How a community approaches and uses Adaptation Action Areas has a direct impact on the adaptation planning process that a community ultimately follows.

As highlighted above, communities are likely to consider many different approaches and uses for Adaptation Action Areas. The one continual similarity between all of the Adaptation Action Area planning processes observed to date is the similar language used by communities to describe the components of their local processes. Communities highlight actions such as “forming technical advisory committees”, “conducting vulnerability analysis”, “prioritization” and “identifying funding options.” The use of similar language and comparison of Adaptation Action Areas planning process outcomes suggests that there is a significant overlap between the two approaches.

In order to meet the needs of all Florida communities, this guidebook utilizes the *Components of an Adaptation Plan* as framework for discussing the Adaptation Action Area planning process. Although the six Florida communities that have already used Adaptation Action Areas may not have addressed all of the components, or have addressed components in different orders - the framework provided by the *Components* will allow for information, examples and comparisons to be organized and shared in an approachable format.

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## Adaptation Action Area Planning

As described above, adaptation planning is comprised of a series of steps that a community takes to become more resilient to the impacts of sea level rise. Planning for Adaptation Action Areas, a specific application of the adaptation process (with the end goal of adopting Adaptation Action Areas into policy), requires consideration on several distinct levels. There is a technical dimension, a social dimension, and a policy dimension. Each of these dimensions necessitates the identification of underlying principles, motivations and characteristics that are unique to each coastal community.

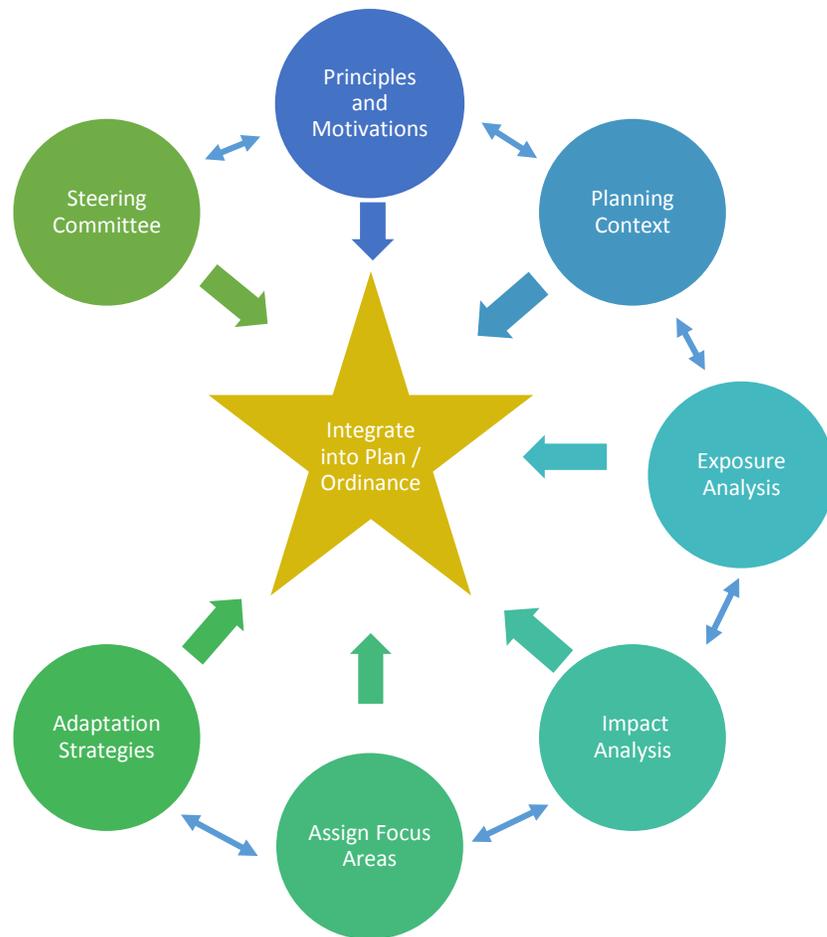
The points of consideration provided in this guidebook are meant to assist officials leading their communities to incorporate sea level change scenarios in local, state, and regional planning efforts. The following four chapters describe ways in which to:

- Assemble advisory support from local experts and officials;
- Design principles and motivations and provide opportunities for community input;
- Describe the planning context;
- Conduct an exposure analysis;
- Conduct an impact analysis;
- Prioritize adaptive needs;
- Develop adaptation strategies; and,
- Integrate these strategies into plans and an Adaptation Action Areas ordinance.

Figure 3 presents the sub-components highlighted as part of the Adaptation Action Area planning process in a graphic format. The following four chapters will group the sub-components according to their groups within the larger adaptation planning process and provide vignettes related to each chapter taken from the Florida communities who have already integrated Adaptation Action Areas into their planning efforts. As Figure 3 makes apparent, the activities are interactive, building upon one another as they engage with the end-goal of integrating the particular Adaptation Action Area policy into local plans. Communities may engage in several steps simultaneously, as flexibility often facilitates the strength of the overall product.

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Figure 3: The Adaptation Action Areas Planning process



As chapter 1 makes clear, the adaptation planning process incorporates aspects of planning from other disciplines and links them to the scientific undertakings needed to provide the most unbiased, accurate picture of future hazards possible. Adaptation Action Areas and the planning that this policy tool enables let communities work toward an end-goal of adopting overlay mappings and accompanying policies into municipal code (and other plans, when appropriate). In this way, Florida communities have an exciting opportunity to easily integrate novel coastal flood hazard knowledge and resilience preparations into their policy documents.

## Chapter 2: Contextualize the Adaptation Action Area Process

Most effective planning efforts begin with a pre-planning stage during which the community assembles personnel, puts-together a participation and outreach program, and connects to the relevant experts and pre-existing data that will assist them to complete the actual planning effort. The sections within this chapter guide users through considerations that are important for developing a steering committee, setting guiding principles, developing an understanding of the local planning context, and integrating opportunities for community participation.

### Establish a Steering Committee

Planners do not need to know how to do everything related to adaptation planning. But they should know where to look to find the talent for adaptation planning endeavors, such as to coastal biologists, geologists, engineers, public finance specialist, researchers, and residents with local knowledge. The Fort Lauderdale Adaptation Action Areas team were aware of the high degree of scientific and professional input needed to guide such an effort. In order to ensure that a refined conception of coastal flood hazards remained central to the effort, the team led outreach to create a Coastal Community Technical Advisory Committee (i.e., the steering committee for the project).

#### The Monroe County Steering Committee

The Monroe County Climate Advisory Committee (CCAC) collaborates with county staff, the University of Florida IFAS (Institute of Food and Agricultural Sciences) Monroe County Extension, and others on a strategy for moving forward with the development of criteria for Adaptation Action Areas in Monroe County.

<http://fl-monroecounty.civicplus.com/index.aspx?nid=386>



The following information box discusses characteristics and provides example roles of committee members. It also includes names and links to committees in Florida actively addressing adaptation planning.

### Creating and Managing a Coastal Community Technical Advisory Group

A coastal community can create a sea level rise technical advisory group made up of technical, planning, and budget staff, as well as interested or affected community businesses and residents to develop a plan for their community. Roles could include efforts such as:

- 1) Investigate federal, state and local funding assistance and grants;
- 2) Determine how collected funds (including those from any imposed Adaptation Action Area impact or concurrency fees that a community may associate with an Adaptation Action Area) will be prioritized; and,
- 3) Link desired capital improvement projects with other regional, infrastructure, public service, and/or emergency management and hazard plans the local government may have adopted or could benefit from partnering with.

In addition to funding, a technical advisory group can assist the community with understanding their priorities and assets. This technical advisory group can provide the link to the community for overall buy-in by all stakeholders in the community for a long-term plan. In addition to community staff, recommended members include individuals with experience in diverse backgrounds.

### Examples of state and local Adaptation Planning advisory groups:



[miamidade.gov/planning/boards-sea-level-rise.asp](http://miamidade.gov/planning/boards-sea-level-rise.asp)



[broward.org/NATURALRESOURCES/CLIMATECHANGE/Pages/Mission.aspx](http://broward.org/NATURALRESOURCES/CLIMATECHANGE/Pages/Mission.aspx)



[fl-monroecounty.civicplus.com/index.aspx?nid=386](http://fl-monroecounty.civicplus.com/index.aspx?nid=386)



[facebook.com/pages/Delray-Beach-Rising-Waters-Task-Force/751711674873636](https://facebook.com/pages/Delray-Beach-Rising-Waters-Task-Force/751711674873636)

## Identify Guiding Principles and Opportunities for Public Participation

For an Adaptation Action Area to be designed for a particular place and its distinctive population, input from a wide range of stakeholders is required. 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. When local concerns and preferences are considered, adaptation strategies can be tailored to meet community needs and desires. Plans and policy 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. Public participation may include: town hall meetings, home owner association meetings, workshops, targeted outreach efforts and other communal events.

Community conversations to identify goals may be centered on:

- 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; and,
- Steps residents can take to assist in community adaptation efforts.

In so doing, an informed set of stakeholders may be equipped to add great value to the critical thinking behind focus area prioritization described on page 43. The information box under the Outreach Strategies section (page 21) looks into the community conversations that may lead to successful adaptation efforts.

### Fort Lauderdale's Guiding Principles

"We are Ready" is an essential component of Fort Lauderdale's 2035 vision plan. This means being ready for extreme tides, flooding, and storm surge. The City's flood resiliency and natural resource protection goals include:

- Investing in infrastructure: drainage systems, bridges, roads;
- Protecting assets from inclement weather and high tides; and
- Managing increased water supply demands.

Adaptation Action Areas are an important tool that will assist the City reach its goals of staying prepared and safe.



## Outreach Strategies

The success of Adaptation Action Areas strategies largely depend upon **confidence** in the idea that reductions in long-term risk exposure, combined with present day mitigation efforts, will be sustained. To ensure that adaptation is well-received in your community, simple posting of information on the city's website is a first step, but it will likely not be enough. Positive public information efforts 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 very 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 a vulnerability analysis.

Outreach strategies that aim to increase confidence and buy-in for flood hazard planning currently exist in a number of guides. One such guide, the 2013 Community Rating System Manual, includes an entire series focusing on engaging the public. Activity 332.c "Program for Public Information"<sup>1</sup> focuses on the impacts that

<sup>1</sup> Find the entire Community Rating System Document at:  
[http://crsresources.org/files/300/developing\\_a\\_ppi\\_march\\_13.pdf](http://crsresources.org/files/300/developing_a_ppi_march_13.pdf)

a program for public outreach may have, with a focus on changing behavior. Other adaptation guides, such as NOAA's *Planning Guide for State Coastal Managers* (2010), provide suggestions for directing outreach. The Community Ratings System and NOAA guide recommendations are presented below for comparison:

<b>Engaging the Public – CRS Activity 332.c:</b>	<b>NOAA – Developing a general adaptation message:</b>
<p>Step 2: Assess the community's public information needs</p> <ul style="list-style-type: none"> <li>2.1 Delineate target areas</li> <li>2.2 Determine target audience</li> <li>2.4 Inventory other public information efforts</li> </ul> <p>Step 3: Formulate messages</p> <ul style="list-style-type: none"> <li>3.1 Six Priority topics<sup>2</sup></li> <li>3.3 Outcomes</li> </ul> <p>Step 4: Identify outreach projects to convey the messages</p> <p>Step 5: Examine other public information initiatives</p>	<ul style="list-style-type: none"> <li>▪ Describe changes that have already been observed.</li> <li>▪ Describe changes that are expected.</li> <li>▪ Describe potential impacts and consequences.</li> <li>▪ Convey need for action but balance the challenges with optimism.</li> <li>▪ Develop a course of action.</li> <li>▪ Acknowledge that questions remain.</li> </ul>

These two sources identify the importance of preparation for outreach and creation of specific content areas. A community with an outreach strategy developed beforehand that speaks to specific community social and political views will have greater chance of moving beyond “informing” to “prompting community members to act” on adaptation planning efforts.

### Fort Lauderdale and Stakeholder Participation

Informing Fort Lauderdale's Vision plan, priorities were explored via stakeholder interviews, town hall meetings with the Mayor and City Commissioners, Meetings-in-a-Box, and an interactive website ([OurVisionFTL.com](http://OurVisionFTL.com)). Feedback from these events helped to guide the Vision Plan in a way which integrated the Adaptation Action Areas process. As residents brought up issues such as flooding and resilience on their own, the concerns were considered accordingly. Communicating risk carefully and effectively, City staff enrolled stakeholders and decision makers into accepting Adaptation Action Areas as a means to a more resilient community.



In addition to the information contain in this section, Appendix 3: *The Adaptation Action Area Checklist*, contains a series of questions and prompts to consider prior to and during the public engagement process.

<sup>2</sup> Corresponds to: 1) Know your flood hazard, 2) Insure your property for your flood hazard, 3) Protect people from the hazard, 4) Protect your property from the hazard, 5) Build responsibly, and 6) Protect natural floodplain functions in the Community Rating System.

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## Community Conversations

Messages are the center of effective public outreach efforts. Messages are specific statements of directions that the community considers important for its audience. Messages need to be repeated many times before people absorb their meaning. Messages are more likely to be accepted if they are delivered from many different sources and supported by trusted stakeholders. Partnerships in message delivery are more effective than going it alone (and they can be less expensive when local governments combine resources). It is very important to recognize that different outreach and messaging approaches bring different results among different audiences, and therefore, outreach programs need to be monitored, evaluated, and revised to ensure that they will be effective.

This framework may be focused on the desired outcome, a changing behavior. Effective messages address why citizens should become knowledgeable and involved. They explain how impacts affect everyday life in order to cultivate a call to action.

## Communication and Engagement

Effective and engaging messages consider the target audience, not just systems for information distribution. Communication broadly categorizes how the issue affects people where they live, work, access key services such as health care, and conduct other necessary day-to-day activities. Combined with the other classifications, this underscores high consequence issues that managers and decision-makers should consider and prioritize. Factors considered during the development of messaging include:

- **Health:** The health impacts of sea level rise are diverse and Table 1 illustrates how they can be classified based on three sea level rise impacts: higher storm surge, flooding, and reduced groundwater capacity;
- **Safety:** Storm surge heightened by sea level rise can increase damage. Disruptions due to emergency response centers such as fire and police stations, emergency shelters, and health-care facilities being located in high risk areas could prevent effective response and recovery;
- **Where people live:** This includes damage to homes and entire neighborhoods as well as disruptions to key services that residential areas rely on, such as utilities;
- **People's livelihoods:** Impacts on employment centers as well as employees' access to jobs via roads and transit;
- **Socially vulnerable populations:** Populations such as renters, non-English speakers, persons with health or physical mobility constraints, and others who face greater barriers to planning for and responding to impacts; and,
- **Recreation areas:** Consequences to 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 co-benefits that will arise from addressing each issue. The linkages that exist tie together financial, socioeconomic, and environmental risks and corresponding opportunities for resilience.

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### The South Florida Regional Planning Council – Health Engagement

In partnership with the Florida Institute for Health Innovation (formerly known as the Florida Public Health Institute), SFRPC completed “Minimizing the Health Effects of Climate Change in the South Florida Region: A Health Impact Assessment”, a comprehensive assessment of the Southeast Florida Regional Climate Change Compact's adaptation and mitigation policy recommendations to determine the health effects of impacts such as sea-level rise and heat waves. The report can be found at:

[http://flhealthinnovation.org/wp-content/uploads/2014/10/REVISED-HIAFinal\\_Report\\_101514.pdf](http://flhealthinnovation.org/wp-content/uploads/2014/10/REVISED-HIAFinal_Report_101514.pdf)



Table 1: Health impacts of sea level rise compiled from Natural Resources Defense Council, Center for Disease Control, US Environmental Protection Agency, World Health Organization, National Institute of Environmental Health Sciences resources

PHYSICAL RISK	EXPOSURE OUTCOME	VULNERABLE POPULATIONS
HIGHER STORM SURGE	<ul style="list-style-type: none"> <li>Physical and social issues resulting from property damage, displacement, or injury and accidents</li> </ul>	<ul style="list-style-type: none"> <li>Coastal populations</li> <li>Elderly, handicapped, of children living in high rises</li> <li>Remote from emergency services</li> <li>Mobile home residents</li> </ul>
INCREASED FLOODING	<ul style="list-style-type: none"> <li>Waterborne disease vectors</li> <li>Housing displacement</li> <li>Limited health care access</li> <li>Nutrition/ food supply</li> <li>Exposure to mold</li> <li>Drowning</li> </ul>	<ul style="list-style-type: none"> <li>Low socioeconomic status</li> <li>Handicapped, elderly, children</li> <li>Residents of mobile homes</li> <li>People living in areas with outdated drainage</li> <li>People with respiratory illness</li> </ul>
RAISED WATER TABLE	<ul style="list-style-type: none"> <li>Contaminated water supply                             <ul style="list-style-type: none"> <li>Landfill/Brownfield seepage</li> <li>Sewage and toxic pollutants release</li> <li>Saltwater Intrusion</li> </ul> </li> <li>Unstable foundation from saturated soil</li> </ul>	<ul style="list-style-type: none"> <li>Low socioeconomic status</li> <li>Handicapped, elderly, children</li> <li>People living near impaired waters, septic tanks</li> <li>People who get water from wells near contaminated areas</li> </ul>

### Palm Beach County's Educational Website

Palm Beach County has a website dedicated to educate residents, with information on the Compact, the Go Green Initiative, the Countywide Vulnerability Analysis, and more:

[www.pbcgov.com/climate/](http://www.pbcgov.com/climate/)

There are several documents to inform residents on coastal impacts and ways to prepare for sea level rise, and including an annual report updating on Compact initiatives and accomplishments:

[www.pbcgov.com/climate/pdf/2013\\_Compact\\_Annual\\_Report\\_PBC.pdf](http://www.pbcgov.com/climate/pdf/2013_Compact_Annual_Report_PBC.pdf) 

## Describe the Planning Context

For many Florida communities, the planning process begins with the development and ongoing refinement of a local government's comprehensive plan, which lays out the blue print for developing a more resilient community. This Guidebook serves as a resource to provide guidance on the benefits of incorporating adaptation strategies into local plans and programs and to provide Florida's coastal communities with a series of approaches on how to develop and implement Adaptation Action Areas practices. This Guidebook presents ways of assessing community specific vulnerabilities and developing policies that increases resilience via sections on:

- Understanding, accessing, and utilizing risk assessment data and tools such as storm surge data and digital elevation models;
- An overview on the range of policy options to consider for implementing Adaptation Action Areas; and,
- A walkthrough of the process for submission and processing of Comprehensive Plan amendments, with a focus on adding Adaptation Action Areas language to the Coastal Management Element.

### Miami-Dade County's Adaptation Planning Context

Miami-Dade County, home to 15% of Florida's residents, is the State's most populous county. As a low-lying coastal community with an intricate water management system, the County has reduced its vulnerability by developing numerous ways of addressing flood risks. Methods include the development of the Stormwater Master Plan, the maintenance of stormwater infrastructure, Hazard Mitigation Planning, and preserving coastal habitat. With county leaders pushing implementation to increase resilience, Miami-Dade County has developed a Sea Level Rise Task Force and passed several resolutions related to addressing impacts of sea level rise, which can be explored here:

<http://www.miamidade.gov/planning/boards-sea-level-rise>

More recently, the County adopted Adaptation Action Areas language in their comprehensive plan.



Adaptation action areas can often be defined within areas that intersect multiple community jurisdictions. From the City of Fort Lauderdale Adaptation Action Areas pilot, one of the project best practices was fostering intergovernmental collaboration and communication. These activities make up a part of *describing the planning context*, since the organizers realized that in order to be implemented properly the Adaptation Action Area vulnerability assessment and overlays would involve coordination from more than one local or regional agency. Their findings are presented in the following graphic.

## Take a Regional Multi-layered Approach to Alignment of County and Municipal Planning

The Southeast Florida Regional Climate Compact's approach has shown that intergovernmental collaboration provides knowledge and diversifies perspectives. Within a region, local government can maximize resources, express a collective voice, and provides a partnership framework. Some local land development and public facilities policies and initiatives, such as a seawall or beach nourishment project, may have spillover effects that extend beyond the boundaries of the jurisdiction that implements them. Policies and projects that affect natural hazard vulnerability, both positively and negatively, may have such spillovers. The coordination and conflict resolution mechanisms included in the intergovernmental coordination element (ICE) of a community's Comprehensive Plan may address such spillovers. Neighboring jurisdictions can identify the appropriate local intergovernmental agencies and organizations in other jurisdictions with whom to collaborate, as well as environmental groups, Non-governmental organizations (NGOs), and the business community.

Examples of collaborators may include:

- City officials (elected & boards);
- Chamber of Commerce;
- Regional planning council;
- Public safety department director;
- Emergency management (local and county);
- Information officer/citizens response center;
- County board of commissioners;
- County planning and building department;
- Local United Way office representative;
- County public health department;
- County property appraiser;
- Florida Department of Transportation;
- FDOT local office and county roads department;
- County school board;
- County solid waste department;
- County sheriff's department;
- Local electric utility;
- Fire department;
- Economic Development Organization; and,
- Area chapter of the American Red Cross.

As this chapter suggests, the Adaptation Action Areas planning process cannot be carried out by an isolated team of planners. Input from the community and other experts can assist the planning team to develop consensus and spur action amongst constituents. In so doing, the goals and outcomes will have a higher likelihood of acceptance and support.

## Chapter 3: Conduct a Vulnerability Assessment

The vulnerability assessment fulfills the statutory requirement that Adaptation Action Areas respond to areas prone to coastal flooding. By integrating the best available scientific methods and developing a keen awareness of different structural and social assets that may be vulnerable to future coastal flooding, the community may ensure that the most useful Adaptation Areas are delineated.

This chapter will examine current trends in coastal flooding and flood response around the state, provide a brief overview of the way in which sea-level rise is expected to occur, and set readers on the path toward developing their own in-depth hazard assessments. It does not, however, provide precise instructions, since each community may adapt the exposure and impact analyses to suit their own priorities. Throughout the chapter, examples are provided from the communities who have already integrated Adaptation Action Area planning into their preparedness plans. This chapter is supplemented by Appendix 3: *The Adaptation Action Area Checklist*, which contains a series of questions and prompts to consider prior to conducting risk and vulnerability assessments.

### Florida's Coastal Hazards

Local government officials are responding and taking action to enhance community resilience when coastal flooding occurs. The history of hazards around the State relate to hurricanes, tropical storms, and severe weather. Currently, hazards have been increasingly unpredictable; Florida was directly impacted by twelve (12) named storms in 2004 and 2005, including Charley, Ivan, Frances, and Wilma. The record-breaking 2005 Atlantic hurricane season had four (4) category-5 hurricanes<sup>3</sup>. With possibly increasing irregularity in weather patterns and rising sea-levels, in addition to growing coastal populations and development, there is a need to amplify both the preparation and response to coastal hazards.

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The majority of Floridians live less than 60 miles from the Atlantic Ocean or Gulf of Mexico. Florida has 1,350 miles of coastline, 4,500 square miles of our estuaries and bays, and over 6,700 square miles of other coastal waters.

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Deyle, Bailey, and Matheny<sup>4</sup> reported that sea level rise may have the following four major impacts of concern related to the planning and management of coastal planning areas:

- Coastal inundation and shoreline recession;
- Increased flooding from severe weather events;
- Saltwater intrusion contaminating potable coastal well fields; and,
- Lifting of coastal aquifers closer to the ground surface, limiting storage and drainage capacity.

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<sup>3</sup> [http://www.cpc.ncep.noaa.gov/products/expert\\_assessment/hurrsummary\\_2005.pdf](http://www.cpc.ncep.noaa.gov/products/expert_assessment/hurrsummary_2005.pdf)

<sup>4</sup> Deyle, R. E., Bailey, K., & Matheny, A. (2007). Adaptive response planning to sea level rise in Florida and implications for comprehensive and public-facilities planning. Department of Urban and Regional Planning, Florida State University. [http://www.gulfofmexicoalliance.org/working/coastal\\_resil/slr\\_comm\\_response.pdf](http://www.gulfofmexicoalliance.org/working/coastal_resil/slr_comm_response.pdf)

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Flooding is a threat with many dimensions. There are four main kinds of flooding: tidal flooding, increased elevations of storm surge from tropical storm events, increased precipitation causing surface water to overtop stormwater management systems, and reduced soil storage capacity. Sea level rise heightens the foundation (base or starting sea level) which storm surge and extreme tides build upon (see Figure 4).

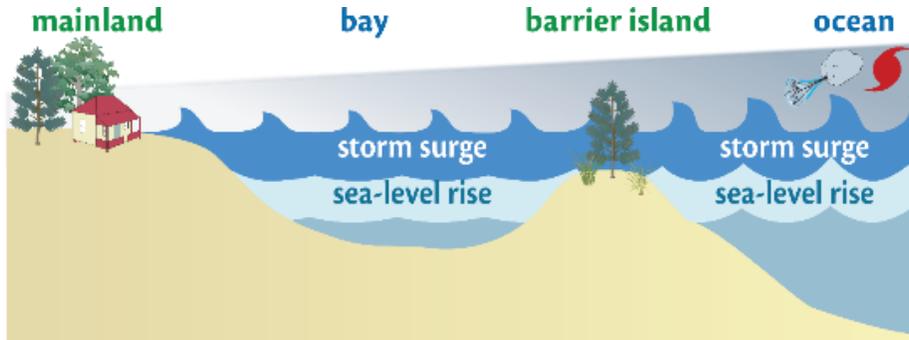


Figure 4: Sea-level Rise and Storm Surges on Barrier Islands: Conceptual diagram illustrating the effects of sea-level rise and storm surges on barrier islands

Global changes in sea-level vary in local effect. Figure 5 illustrates recent historic global sea-level change and future projections going to 2100. When sea-level rise combines with strong storms, barrier islands experience high storm surges which increases the effects of flooding and erosion. As part of a joint U.S.

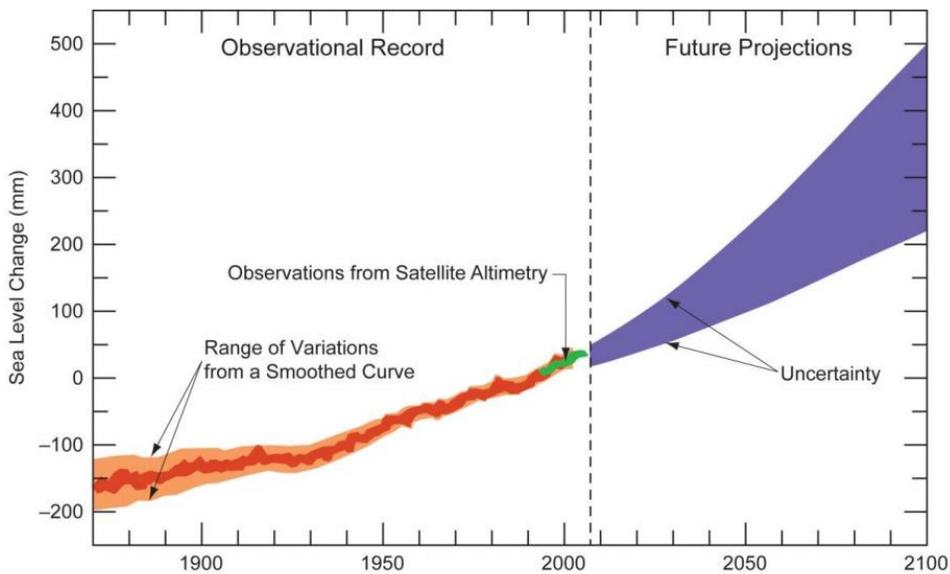


Figure 5 Illustration of GMSL (deviation from the 1980-1999 mean) as observed since 1870 and projected for the future. The future projections have been calculated independently from the observations

National Oceanic Atmospheric Administration (NOAA), U.S. Federal Emergency Management Agency (FEMA), and U.S. Army Corps of Engineers (USACE) project to assist in planning for future risks<sup>5</sup>, the USACE sea level rise calculator tool was modified to include the equations used for the NOAA scenarios and to allow for comparisons. Figure 6 shows the local, or relative sea level change in Key West, FL results from the calculator tool.

<sup>5</sup> <http://www.globalchange.gov/what-we-do/assessment/coastalresilience-resources>

## Key West, FL: 2.20 (mm/yr)

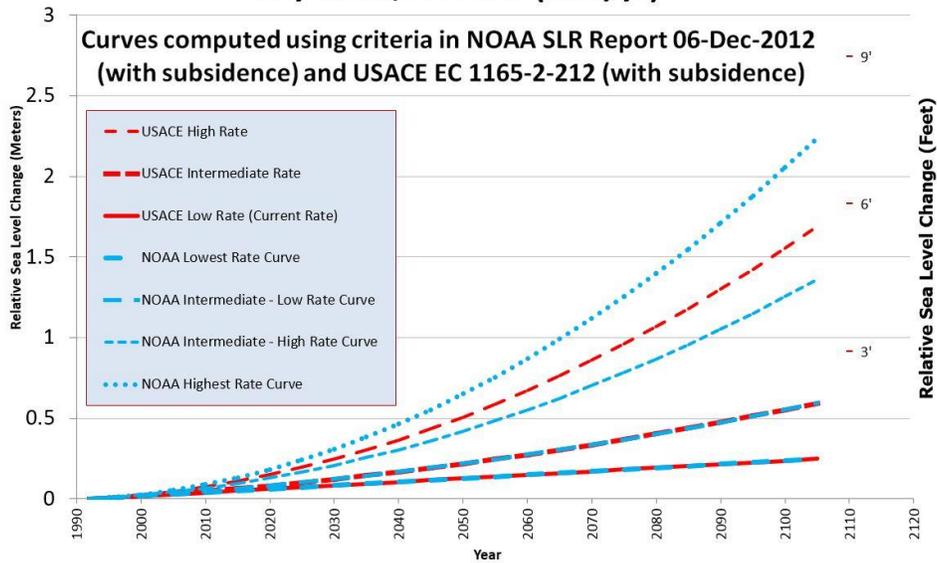


Figure 6: Graphical comparison of the USACE and NOAA Key West sea level rise scenario curves using the USACE sea level rise calculator

The impacts of sea level rise specified in the *Adaptation Action Areas* language are *high-tide events, storm surge, flash floods, and stormwater runoff* that result in *coastal flooding*. These coastal threats have great potential to be exacerbated by sea level rise and extreme weather. As storm surge is elevated by sea level rise, waves reach higher and move further inland.



Impacts defined in the Adaptation Action Areas key terms section (page 7) are described here, beginning with *high-tide events*. Currently, extreme tides in Florida tend to occur during the Perigean spring tides, or king tides. As the minor flood thresholds are surpassed in low-lying areas during these tide events, nuisance flooding occurs in the streets with limited property damage. Sea-level rise has the potential to force these extreme tides higher and further inland, and areas impacted by tidal flooding may grow in frequency and magnitude. In the future, these tides are likely to bring moderate to severe flooding.

According to the Florida Oceans and Coastal Council (2010):

Three-fourths of Florida's population resides in coastal counties that generate 79% of the State's total annual economy. These counties represent a built-environment and infrastructure whose replacement value in 2010 is \$2.0 trillion and which by 2030 is estimated to be \$3.0 trillion.

Coastal flooding and *storm surge risk* are also related to water below ground in terms of storage, drainage, and flow. For much of Florida's porous limestone geology, seawater intrudes into the bedrock along the coast. Sea level rise has the potential to exacerbate the landward advancement of a wedge of seawater that underlies a coastal aquifer. Groundwater is pushed higher towards the land surface as it floats above the denser and thus deeper saltwater. Sea level rise allows the existing wedge of seawater to further protrude

inland impacting the aquifer. The lens of freshwater is pushed inland, threatening coastal well fields with contamination from saltwater intrusion. In addition, groundwater elevations increase as the lens floats above the saltwater. Figure 7 illustrates this process of aquifer variability, which causes a threat of inland flooding as the capacity of the ground to absorb and store storm water is reduced.

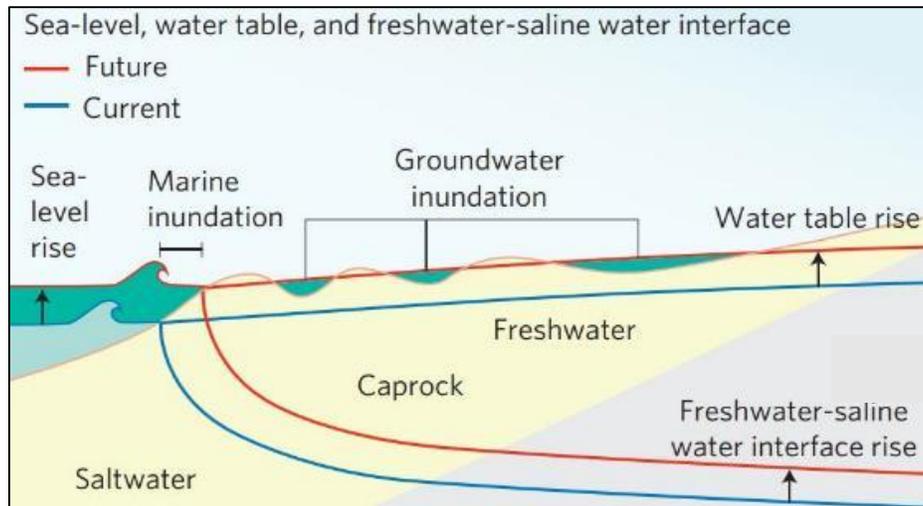


Figure 7: Conceptual diagram illustrating saltwater intrusion and ground water lifting

The Florida Peninsula is a porous plateau of karst limestone, known as the Florida Platform (Florida Geological Survey, 2001; USGS). In areas with coastal aquifers, the flow of water is intimately connected between surface and groundwater, between seawater and freshwater. The Florida Platform edge is defined as where the water depth is at 300ft, beyond which the sea floor plunges to depths which may exceed 10,000ft (Figure 8). On the west coast, the Platform extends 100 miles west of Tampa, while on the east, it drops off 3-5 miles seaward of Miami.

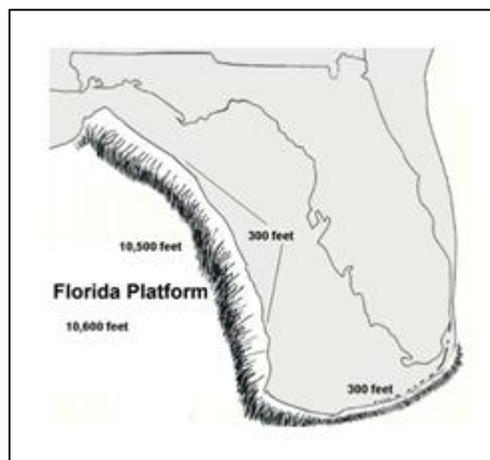


Figure 8: The Florida Platform

The multilayered Floridan aquifer system extends to four other states, and provides water for large cities including Jacksonville, Tallahassee, Orlando, and St. Petersburg (Figure 9).

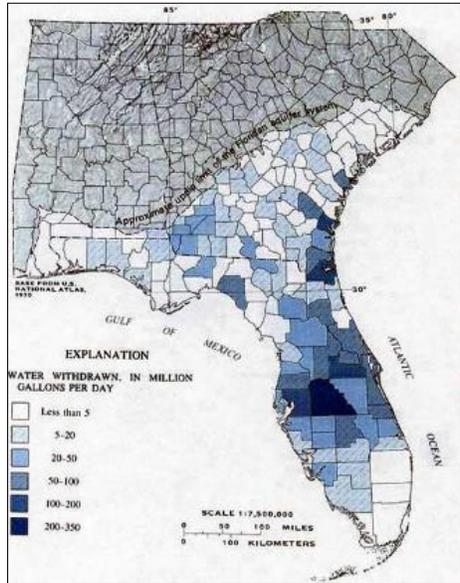


Figure 9: USGS Summary of the Hydrology of the Floridan Aquifer System in Florida and In Parts of Georgia, South Carolina, and Alabama

The Biscayne aquifer, overlying the Floridan Aquifer to the south supplies water to cities including Miami and Fort Lauderdale (Figure 10). The sponge-like limestone bedrock that underlays much of the Peninsula serves many beneficial purposes, particularly related to water supply and water quality. However, as explained, it also presents vulnerabilities related to rising seas.

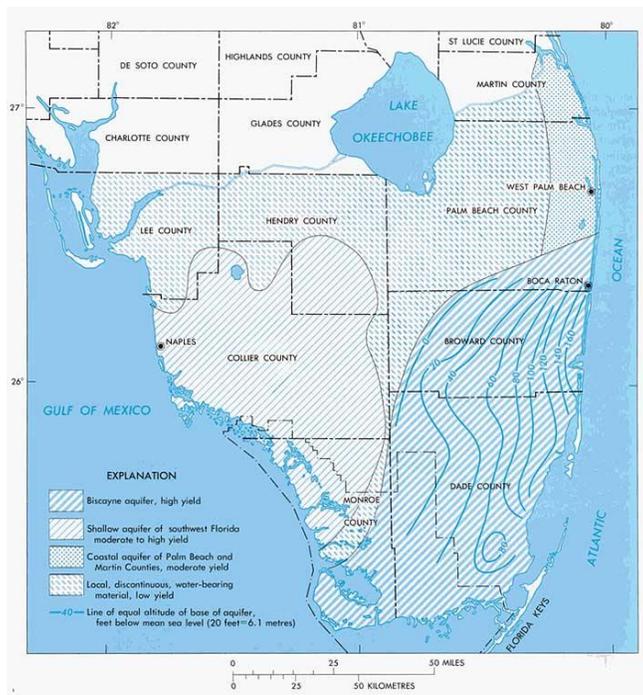


Figure 10: South Florida's hydrologic systems – with Biscayne Aquifer

Saltwater intrusion threatens coastal potable well fields and groundwater lifting increases the risk of seasonal flooding. Inland areas that are not hydrologically connected to the coastline are still vulnerable to the risk of increased groundwater flooding. Areas inland of gravity driven flood control structures are also vulnerable as drainage infrastructure experiences compromised functionality at higher ocean levels.

## Addressing Future Coastal Hazards

Florida's coastline is a transition zone for unique natural ecosystems: marine, coral reefs and oyster bars, shellfish beds, sea grass beds, barrier islands, bays, estuaries, lagoons, beaches, and wetland habitats. As shoreline habitats overlap with the human built environment, there are challenges to maintaining both of these competing coastal environments. Yet there are also opportunities to nurture the balance between the unique mosaic of ecosystems and the diverse population, public infrastructure, private property and economy in Florida. Many of the State's natural resources have historically served to buffer storm waves, filter pollutants, and facilitate habitat migration. There are innovative solutions to coastal hazards that both protect ecosystems and leverage ecosystem services for protection. When planning for sea level rise impacts, it is most beneficial to maintain a balance of both engineering and natural solutions. With these challenges have arisen opportunities; possibilities to help keep Florida resilient.

## Exposure Analysis: Identify Baseline Risk

It is crucial for a community to understand risk in terms of spatial extent and level of exposure. Baseline risk is a benchmark of the current state of vulnerability, upon which risk reduction actions can be monitored and progress can be measured. What may be a vulnerability or threat in one region may not be considered by a community in another region. Hazard maps have long been used to support planning and development policies, and new mapping may help to reduce future coastal hazard risk and facilitate sustainable development. The consideration of hazard maps may be integrated into planning procedures and periodically updated. As the best available data on flooding and storm surge risk develops, maps can be modified to best describe these risks.

### Yankeetown-Inglis Exposure Analysis

"A variety of inventory and analysis work was conducted in Yankeetown and Inglis prior to beginning work including collecting and reviewing the existing and future land use maps, regional conservation priorities, and information regarding water supply and wells. Additional data were collected including SLAMM model projects for the area, elevation data, and storm surge data. These were overlaid with conservation priorities, land use, and water supply data to assess potential impacts. These maps served as a basis for analyzing vulnerability to coastal change..." (Frank et al., 2013).



## Useful Data Sources and Tools

Communities have a large number of resources to which they may turn for assessing coastal flooding impacts. As such, communities are encouraged to research the available options with the same commitment that they would later use to survey available funding.

Due to the proliferation of data, tools, and services designed to assist a community assess coastal flood impacts, literature has emerged classifying these products and deciphering their functions. For a useful description of the ways in which coastal flood hazard tools serve different functions and capabilities, [Natureserve](#) provides one of the best explanatory reports. In their report, tools are defined as falling in one of three classes: visualizer, model, and decision-support. Based upon a tool's class and features, it can serve to assist planners to engage stakeholders, scoping/ inventory, assess/analyze, plan, and implement. This section presents an overview of data and tools in Table 2, and progresses into some greater detail via the following paragraphs.

Table 2: Coastal Flood Hazard Tools

<b>ONLINE SEA-LEVEL RISE VISUALIZERS</b>	
FDOT Sea Level Scenario Sketch Planning Tool	<a href="http://sls.geoplan.ufl.edu/">http://sls.geoplan.ufl.edu/</a>
CanVis, Digital Coast: Sea-Level Rise and Coastal Flooding Impacts Viewer	<a href="http://www.coast.noaa.gov/digitalcoast/tools/canvis">http://www.coast.noaa.gov/digitalcoast/tools/canvis</a>
NOAA Sea-Level Rise and Coastal Impacts Viewer	<a href="http://coast.noaa.gov/digitalcoast/tools/slr">http://coast.noaa.gov/digitalcoast/tools/slr</a>
Climate Central Surging Seas Viewer	<a href="http://sealevel.climatecentral.org/">http://sealevel.climatecentral.org/</a>
The Nature Conservancy Coastal Resilience Portal	<a href="http://maps.coastalresilience.org/network/">http://maps.coastalresilience.org/network/</a>
Geospatial Assessment Tool for Operations and Response (GATOR)	<a href="http://map.floridadisaster.org/GATOR/map.html">http://map.floridadisaster.org/GATOR/map.html</a>
NOAA C-CAP Coastal Land Change Tool	<a href="http://coast.noaa.gov/digitalcoast/tools/ccap-comparison">http://coast.noaa.gov/digitalcoast/tools/ccap-comparison</a>
<b>DATABASES OF RESOURCES</b>	
Adaptation Database for Planning Tool (ADAPT)	<a href="http://www.icleiusa.org/tools/adapt">http://www.icleiusa.org/tools/adapt</a>
Climate Adaptation Knowledge Exchange (CAKE)	<a href="http://www.cakex.org/">http://www.cakex.org/</a>
Georgetown Climate Center	<a href="http://www.georgetownclimate.org/">http://www.georgetownclimate.org/</a>
U.S. Climate Resilience Toolkit	<a href="http://toolkit.climate.gov/">http://toolkit.climate.gov/</a>
<b>ADD-INS FOR GIS PROGRAMS OR OTHER MODELS</b>	
HAZUS-MH	<a href="https://www.fema.gov/hazus">https://www.fema.gov/hazus</a>
SimCLIM	<a href="http://www.climsystems.com/simclim/">http://www.climsystems.com/simclim/</a>
Sea Levels Affecting Marshes Model (SLAMM)	<a href="http://www.slamview.org/slamview2/">http://www.slamview.org/slamview2/</a>
Community Viz	<a href="http://placeways.com/communityviz/productinfo.html">http://placeways.com/communityviz/productinfo.html</a>
NatureServe Vista	<a href="http://www.natureserve.org/conservation-tools/natureserve-vista">http://www.natureserve.org/conservation-tools/natureserve-vista</a>
Open-Source Nonpoint Source Pollution and Erosion Comparison Tool (OpenNSPECT)	<a href="http://coast.noaa.gov/digitalcoast/tools/openspect">http://coast.noaa.gov/digitalcoast/tools/openspect</a>

Land Use Portfolio Model (by U.S.G.S.)	<a href="http://geography.wr.usgs.gov/science/lupm.html">http://geography.wr.usgs.gov/science/lupm.html</a>
Integrated Valuation of Environmental Services and Tradeoffs (INVEST)	<a href="http://www.naturalcapitalproject.org/InVEST.html">http://www.naturalcapitalproject.org/InVEST.html</a>
U.S.A.C.E. Sea-Level Change Calculator	<a href="http://www.corpsclimate.us/ccaceslcurves.cfm">http://www.corpsclimate.us/ccaceslcurves.cfm</a>
Coastal Adaptation to Sea-Level Rise Tool (COAST)	<a href="https://www.blumarblegeo.com/products/COAST.php">https://www.blumarblegeo.com/products/COAST.php</a>
<b>OTHER ASSESSMENT TOOLS</b>	
The Social Vulnerability Index (SoVI)	<a href="http://webra.cas.sc.edu/hvri/products/sovi.aspx">http://webra.cas.sc.edu/hvri/products/sovi.aspx</a>
NatureServe Climate Change Vulnerability Index (CCVI)	<a href="https://connect.natureserve.org/science/climate-change/ccvi">https://connect.natureserve.org/science/climate-change/ccvi</a>
Community-based Risk Screening Tool (CRiSTAL)	<a href="https://www.iisd.org/cristaltool/">https://www.iisd.org/cristaltool/</a>

So as to convey a fuller understanding of some of the tools presented above, this section will provide greater detail on six of the tools. The tools surveyed in greater detail below were created by experts at national institutions such as NOAA, Universities such as the GeoPlan Center Sketch Planning Tool, or are exemplary efforts by non-profits, such as the Nature Conservancy visualizer. Readers may utilize these resources to develop a very good understanding of coastal flood hazards in their community either before or during outreach to stakeholders.

**NOAA's Tides & Currents** page plots long term mean sea level trends for the lifetime of tide gauges around the country. For example, the sea level trend at the Pensacola, Florida gauge station is illustrated below. NOAA's webpage also allows users to plot long-term and shorter term tide trends<sup>6</sup>, to explore trends through the creation of corresponding maps<sup>7</sup>, and to view future tide predictions<sup>8</sup>.

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<sup>6</sup> <http://tidesandcurrents.noaa.gov/sltrends>

<sup>7</sup> <http://tidesandcurrents.noaa.gov/map/>

<sup>8</sup> [http://tidesandcurrents.noaa.gov/tide\\_predictions](http://tidesandcurrents.noaa.gov/tide_predictions)

### Mean Sea Level Trend 8729840 Pensacola, Florida

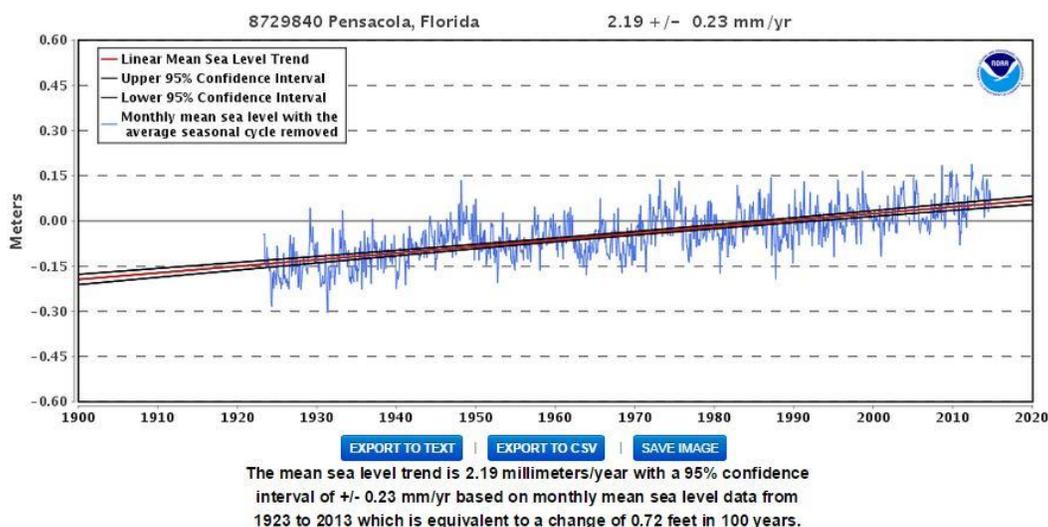


Figure 11: NOAA Tides and Currents

NOAA's Digital Coast<sup>9</sup> page provides data, tools, training, and stories. LIDAR Elevation data for Florida's entire coast is available to download, or it can be viewed using the **Sea Level Rise Viewer Tool**<sup>10</sup>. The tool is unique in that it distinguishes between inland and coastal low-lying areas, it can display confidence, flood frequency, socioeconomic vulnerability, and marsh impacts and potential migration.

Another NOAA tool is the **Coastal Change Analysis Program Coastal Comparison Tool**<sup>11</sup>, which allows users to compare land cover data (8 classes) for an individual county to the respective surrounding coastal region over a given period of time (1996, 2001, 2006, 2010).

A tool that is provided by the **Nature Conservancy** is the **Coastal Resilience**<sup>12</sup> mapping portal. While currently only available for some parts of Florida, the tool is continuously expanding the available spatial extent of coverage. There are a variety of layers that can be explored, such as FEMA repetitive loss properties, land-use, and habitat. The "Coastal Defense" application allows the user to visualize and quantify how coral reefs and mangroves can provide coastal protection in relation to increasing wave heights. Future habitats under various sea level rise scenarios may be graphed as well for a specified area.

The **University of Florida's GeoPlan Sea Level Rise Sketch Planning GIS tool**<sup>13</sup> is being developed in partnership with the Florida Department of Transportation (FDOT) Office of Policy Planning, to facilitate the identification of transportation infrastructure potentially at risk from projected sea level changes. The tool identifies transportation infrastructure vulnerable to sea level scenarios, which are based on the same methodology

<sup>9</sup> <http://coast.noaa.gov/digitalcoast/>

<sup>10</sup> <http://coast.noaa.gov/digitalcoast/tools/slr/>

<sup>11</sup> <http://coast.noaa.gov/digitalcoast/tools/ccap-comparison>

<sup>12</sup> <http://maps.coastalresilience.org/network/>

<sup>13</sup> <http://sls.geoplan.ufl.edu/>

used by the Southeast Florida Regional Climate Change Compact in developing its Unified Sea Level Rise Projection (U.S. Army Corps of Engineers). It provides data on affected transportation facilities and inundation surfaces for all roads and Strategic Intermodal System facilities and includes a map viewer, GIS data, and an inundation calculator.

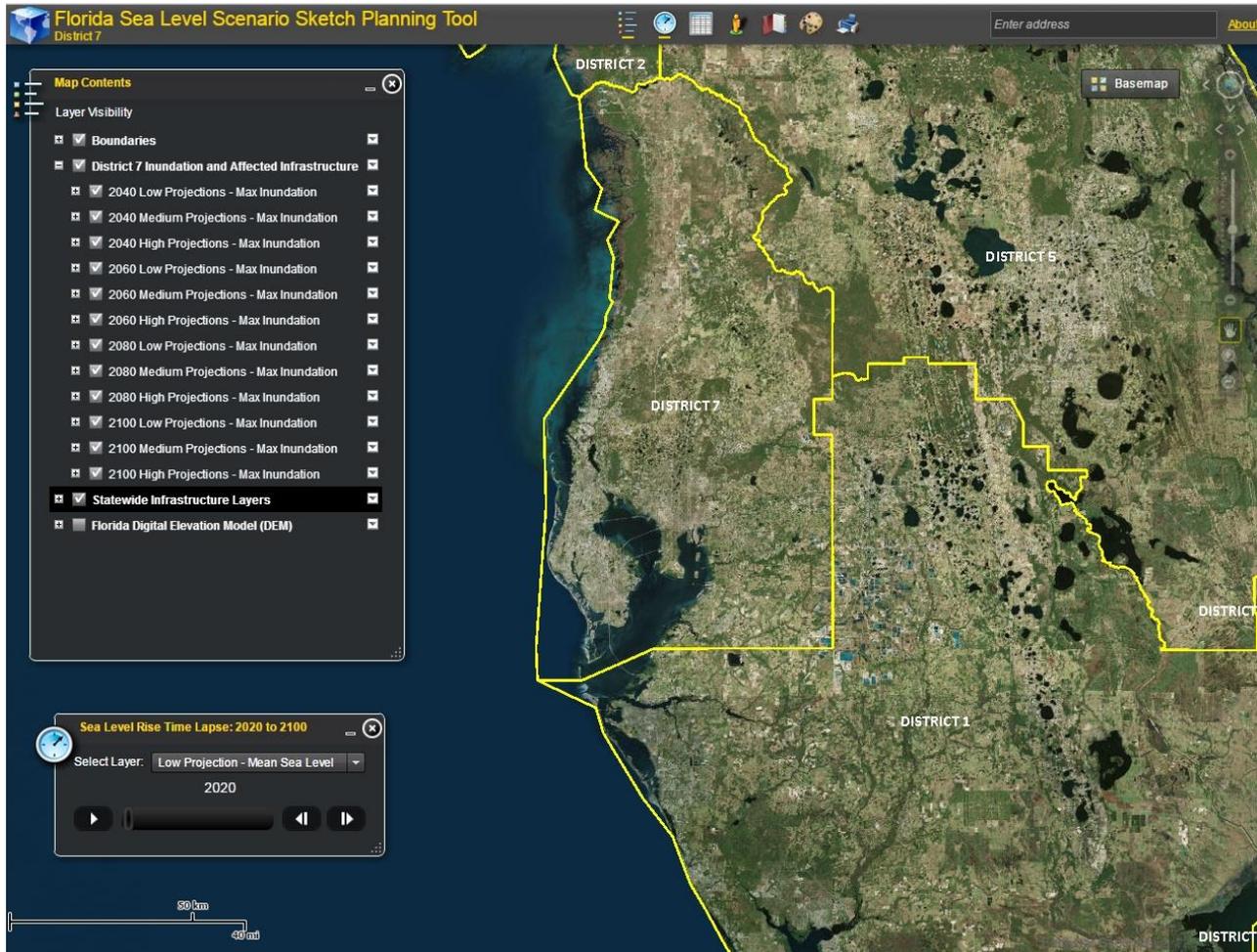


Figure 12: University of Florida GeoPlan Center & FDOT Sketch Planning Tool

### Working with Elevation Data

There are different methods of modeling and mapping coastal inundation. Still-water (or “bathtub”) models are coarse approaches that use water level and topographical data and apply sea level rise scenarios at constant elevations but do not include other factors such as erosion, tide, storm surge, wave dynamics, landform responses, or interaction with stormwater management systems. Maps generated from these models provide the basis for applying the sea level rise scenarios to assess potential extent and severity of flooding. While they have many limitations and should not be used for site-specific analysis, bathtub models are useful for visualizing potential extents of future high water levels for initial consideration of vulnerabilities.

## Working with Storm Surge Data

Storm surge occurs when a low pressure storm system moves over a body of water, pushing the water towards the shore with powerful winds. The highly elevated water levels that result as storm waves pile up and move inland can cause severe damage to both the natural and built environment. Sea, Lake, and Overland Surges from Hurricanes (SLOSH) is a model that integrates the effects of storm surge and accretion (i.e., sediment deposition). Figure 13 depicts storm surge exposure modelled for South Florida. As can be seen, much of the region is vulnerable, even to a Category 1 storm (shown in red).

Sea level rise permanently increases the average height of the ocean upon which surge builds. National Weather Service's SLOSH model can be applied to simulate the impact of projected changes in sea level on inundation. The linear method typically used adds sea level rise to SLOSH results (Frazier, Wood, Yarnal, & Bauer, 2010; Kleinosky, Yarnal, & Fisher, 2007; Shepard et al., 2012; Wu, Yarnal, & Fisher, 2002). The current designation for storm surge risk in Southeast Florida is the Coastal High-Hazard Area (CHHA), which is standardized as the category one storm surge zone modelled by SLOSH. In lieu of contracting to have sea level rise incorporated into existing SLOSH models for adaptation planning purposes, communities may consider choosing to use current (2014) higher storm surges (Category 3) as a best-available proxy for a Category 1 storm surge with 1 foot of sea level rise during future (2050) storm events.

By utilizing one of the tools and methods suggested in this section, a community may equip itself with the best available data for projecting sea-level rise and associated coastal flooding. The Adaptation Action Areas pilot (see Appendix 1: Case Studies) provides further detail on how a specific projection was selected for the City of Fort Lauderdale.

## Uncertainty in Projections

Uncertainty in projections refers to the assertion that, as models simulate scenarios further and further into the future, the range of values required to satisfy the same confidence that the projection is accurate must increase. This translates to a wider range of heights for projected sea level rise in 2100 compared to the range of heights projected for 2020. The Southeast Florida Regional Climate Change Compact Unified Projection (Figure 14) uses historic tidal information from Key West and was calculated by Kristopher Esterson from the USACE using USACE Guidance (USACE, 2009) intermediate and high curves to represent the lower and upper bound for projected sea level rise in Southeast Florida. As shown in Figure 14 below, there is increased uncertainty in projections as the planning horizon is extended.

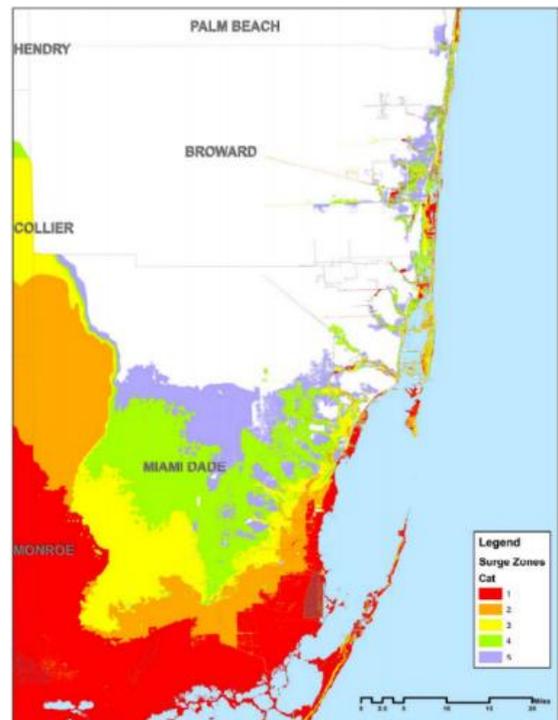


Figure 13: Storm Surge Exposures in South Florida

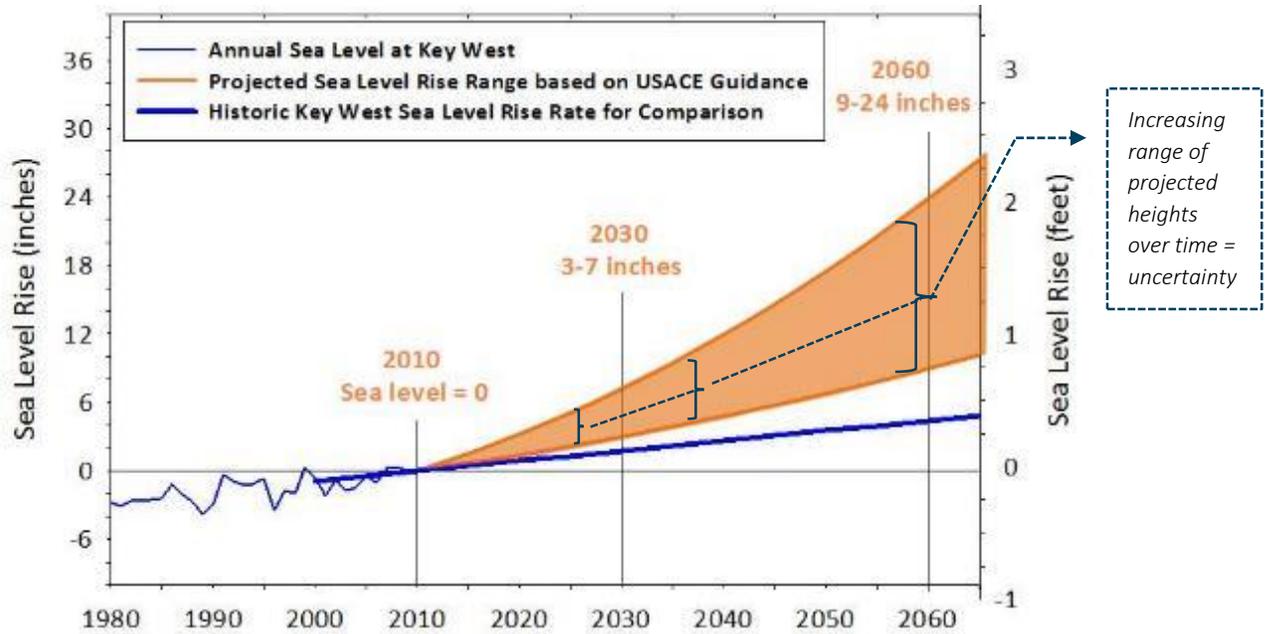


Figure 14: Key West USACE Sea-Level Rise Projection

Uncertainty is present in sea level change projections because of the uncertainty inherent in the forces that drive these systems (for example, rate and magnitude of sea level rise, changes in storminess, changes in daily tide range) and the future evolution of coastal landforms (examples include barrier island over wash, migration, and man-made alterations). In identifying and prioritizing areas for targeting infrastructure improvements, the Department of Transportation has found the need for establishing a planning horizon that exceeds the year 2060. The Compact is currently meeting to extent projections to 2100.

The key to progress among uncertainty is the collaborative agreement on the projections and the commitment to revisit projections as new scientific data develops. The Compact plans to meet in the next year (2015) to review and modify the unified projection, with the specific goal to set a planning horizon for 2100. Adaptive management is a two-step process of consideration of a variety of strategies and choosing the one that works most effectively across the largest range of scenarios.

## Impact Analysis: Inventory Assets

As recommended by the guide to adaptation planning in Chapter 1, the complementary follow-up to an exposure analysis is an impact analysis. In an impact analysis, the effects of coastal flooding are quantified and measured according to their impact on things such as populations, structures, and economic functions. An Adaptation Action Areas Checklist has been developed to help address the relevant questions for planning Adaptation Action Areas. This is a non-regulatory tool to assist local decision-makers in the identification of planning, mitigation, and adaptation opportunities that may reduce vulnerability to coastal storms and sea level rise.

## Impact Analysis Methods

This section outlines methods for assessing community specific vulnerabilities and integrating them into policy in a way that effectively increases resilience. The approach to adaptation planning for sea level rise described here is a series of steps a community takes, not just to adapt, but to holistically become more resilient to the impacts of sea level rise. Informed decision-making has the potential to lead to safer, more responsible, economically sound communities.

Regional or local asset inventories will be valuable in determining local impacts. Sea level rise scenario mapping can be used in conjunction with a key asset list developed by local experts and stakeholders to determine vulnerable assets of concerns. For example, Broward County was awarded a Coastal Zone Management Grant to conduct such an analysis, the Resilient Coastal Communities project<sup>14</sup>.

Community assets and vulnerabilities may be inventoried and mapped with the help of community experts such as residents, business owners and local non-profits. Southwest Florida Regional Planning Council's **Lee County Climate Change Resiliency Strategy** (CCRS) quantified the County assets in each of the flood zones and storm surge zones as part of the process for identifying resilience strategies to address vulnerabilities in each sector, from waste management to human health<sup>15</sup>.

An important reference point for Florida communities looking to catalogue and quantify future coastal flood hazard impacts is the [State Enhanced Hazard Mitigation Plan: Risk Assessment](#). The Florida Division of Emergency Management State Enhanced Hazard Mitigation Plan (2013) provides numerous categories and computations through which a hazard assessment can be developed. Section 3.2.2, *Hazard Profiling*, sets forth nine hazard impact areas. Impact categories 2, 6, 7, 8, and 9 are applicable to the one or more of the assessment projects proposed by this guide:

- **Impact on Public:** based on historical observation and demographic information and study, how the type or level of hazard would affect the general public and their daily lives.
- **Impact on property, facilities, and infrastructure:** based on historical observation, study and modelling, how the type or level of hazard would affect county facilities, critical infrastructure, and other structures.
- **Impact on delivery of services:** based on historical observation and study, how the type or level of hazard would affect the public or private delivery of essential services to the affected or neighboring population.
- **Impact on the environment:** based on historical observation, study and modeling, how the type or level of hazard would affect the environment, and associated affects that could cause (e.g., debris).
- **Impact on the economic condition:** based on historical observation, study and modeling, how the type or level of hazard would affect the economic success and viability of local, state and national enterprises, and longer-term impacts to supply chain, or commodity requirements.

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<sup>14</sup> [www.broward.org/NaturalResources/ClimateChange/Pages/ClimateResilience.aspx](http://www.broward.org/NaturalResources/ClimateChange/Pages/ClimateResilience.aspx)

<sup>15</sup> <http://www.floridaplanning.org/wp-content/uploads/2014/05/Lee-County-Climate-Change-Resiliency-Strategy.pdf>

Historical observations of flooding may inform the description of sea-level rise and storm surge prone areas according to earlier accounts of flood effects on people, property, facilities, the delivery of services, the environment, and economic changes in the area.

Beyond the categories into which potential vulnerabilities are divided, the State Enhanced Hazard Mitigation Plan reviews factors examined in the 67 Local Mitigation Strategies of Florida. The components of a Local Mitigation Strategy are mandated by 44 CFR 201.6, and include a risk assessment. Informed by Federal Regulations, the State Enhanced Hazard Mitigation Plan lists the following analyses conducted by Local Mitigation Strategies through their risk assessment (section 3.2.4 (II)):

- Probability of the hazard occurring in the jurisdiction;
- Potential magnitude and severity of the hazard in the area;
- Size of the population at risk in the jurisdiction;
- Growth and development trends for the jurisdictions, especially in areas that are affected by the hazard;
- Existence of large populations with special needs such as the elderly, the poor, and the non-English speaking communities; and,
- Critical facilities and infrastructure that are vulnerable to the hazard.

Akin to the hazard profiling bulleted list, the Local Mitigation Strategy bullets emphasize the importance of measuring special needs populations, growth trends, and critical infrastructure in hazard exposed areas.

### Southeast Florida's Vulnerability Assessment

The Compact has performed one of the most extensive asset impact and vulnerability analyses in the state. In it, they identify many of the structures suggested in this guide. The Analysis of the Vulnerability of Southeast Florida to Sea Level Rise to identify critical infrastructure vulnerable at 1, 2 and 3 foot scenarios can be found at:

<http://www.southeastfloridaclimatecompact.org/wp-content/uploads/2014/09/vulnerability-assessment.pdf>



California's *Adapting to Rising Tides* assessment contains a comprehensive list of assets divided into 12 categories, each with its own chapter describing the vulnerability and risk of these individual assets. Table 3 provides an overview of these categories which have been adapted for Florida<sup>16</sup>. For each asset type, examples are listed as well as factors for which an evaluation of exposure, sensitivity, adaptive capacity, and

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<sup>16</sup> <http://www.adaptingtorisingtides.org/vulnerability-and-risk-assessment-report/#categorychapters>

consequences should be considered. These categories were utilized in the Fort Lauderdale Adaptation Action Areas pilot.

Table 3: Asset Categories with Examples

ASSET CATEGORY	EXAMPLES OF ASSET	EXAMPLES OF HOW/WHAT TO EVALUATE
Community Land Use, Facilities and Services	Job centers, residences, schools, and hospitals	Residents, Employees, Property values, Community facilities and services
Structural & Natural Shorelines	Revetments, bulkheads, and wetlands	Percent & depth overtopped Assess by shoreline segments
Natural Shorelines	Estuarine flora and fauna	Habitat composition and thresholds to change
Parks & Recreation	Parks & golf courses	Quantify percent exposure for future tides & surge
Airport	Jet fuel storage, runways, maintenance, hangars	Quantify depth of inundation of tides & surge
Seaport	Shipping berths, container areas, and intermodal rail facilities	Economic cost of disruption and reduced capacity
Ground Transportation	Roads, buses, trains	Evacuation routes, exposed miles by road class
Wastewater Facilities	Onsite sewage disposal and wastewater treatment plants	Design capacity, pump stations, flow rates
Stormwater Infrastructure	Storm drains, ocean outfalls	Miles of pipes and number of pump stations at risk
Contaminated Lands	Federal superfund sites, Brownfields	Description of hazard and remediation aspects
Hazardous Materials Sites	Manufacturing facilities, gas stations	Human health risk
Energy, Pipelines & Telecommunication Infrastructure	Power plants, substations, and transmission lines	Quantify percent exposure for future scenarios of tides & surge

For each of the assets identified, the total quantity can be compared the quantity that are exposed at various sea level rise scenarios. There is an emphasis to identify critical of facilities responsible for emergency and disaster response, facilities that provide services to at-risk populations, and facilities with vulnerable, less mobile populations. Other ways in which to measure coastal flooding impacts include:

1. Monetary amount (such as property assessor's taxable value of property);
2. Size (such as acreage);
3. Count (such as absolute population or percent population living in vulnerable census tracts); and,
4. Change (such as population or development increase or decline in hazard areas).

Each community conducting an impact assessment as part of an Adaptation Action Areas planning process is encouraged to build upon these recommendations in order to quantify impacts in a locally meaningful way. For an example of how a completed impact assessment could look, an excerpt from the City of Satellite Beach's inventory of assets and quantification of impacts are provided in the box below.

### City of Satellite Beach, Inventory of Assets & Outcome from Impact Analysis

**Table 3** - List of critical infrastructure and other City assets utilized during vulnerability assessment. Location is shown in Figure 6 by reference to asset ID number (#). Impact elevation is height of rising sea level when asset centroid is submerged. CSB = City of Satellite Beach, ECFRPC = East Central Florida Regional Planning Council, Alt = data not readily available and ultimately acquired using alternate sources.

Type of Asset	ID #	Name	Source of File	Impact Elevation (ft)
City Services; security, social	1	Civic Center	CSB	5
	2	City Hall	CSB	5
	3	Satellite Beach Fire/Rescue	ECFRPC	5
	4	Public Works Complex	CSB	5
	5	Schechter Center	CSB	5
	6	Police Station	CSB	6
	7	Post Office	ECFRPC (Alt)	6
Public schools and libraries	8	Surfside Elementary	CSB	6
	9	Library	ECFRPC (Alt)	N/A
	10	Holland Elementary	CSB	N/A
	11	DeLaura Middle School	CSB	N/A
	12	Satellite High	CSB	N/A
	13	45th Space Wing Technical Library	ECFRPC	N/A
Parks and Recreation	14	Cinnamon Tot Lot	CSB	3
	15	Desoto Park	CSB	4
	16	Hedgecock Field	CSB	4
	17	Graboski Field	CSB	4
	18	Surfside Field	CSB	4
	19	Samsons Island	CSB	5
	20	Olson Field	CSB	6
	21	Stormwater Park	CSB	6
	22	Satellite Beach Sports and Recreation Park	ECFRPC	N/A
	23	Sunrise Park	CSB	N/A
	24	Pelican Beach Park	CSB	N/A
	25	Gemini Beach Park	CSB	N/A
	26	Hightower Beach Park	CSB	N/A
	Gas production, transportation, distribution	27	Fuel Facility (SR 513 & Jackson)	ECFRPC (Alt)
28		Fuel Facility (A1A & Ocean Spray)	ECFRPC (Alt)	N/A
29		Fuel Facility (A1A & Roosevelt)	ECFRPC (Alt)	N/A
Water supply; drinking water, waste water/sewage, surface/storm water (e.g. dikes, canals)	30	Sanitary Lift Station (Lansing Island)	CSB	4
	31	Sanitary Lift Station (SR 513 & Sherwood)	CSB	4
	32	Sanitary Lift Station (SR 513 north of Chevy Chase)	CSB	4
	33	Sanitary Lift Station (Jamaica & DeSoto)	CSB	5
	34	Sanitary Sewer Force Main Pump Station	ECFRPC (Alt)	N/A
	35	Sanitary Lift Station (Kale & Maple)	CSB	N/A
	36	Sanitary Lift Station (Grant & Orange)	CSB	N/A
	37	Sanitary Lift Station (A1A at Hightower Beach Park)	ECFRPC (Alt)	N/A
Electrical production, transmission and distribution	38	FPL Electric Substation	ECFRPC (Alt)	N/A

As developed by RWParkinson Consulting, Inc. (Parkinson, 2010, p. 25), this table assigns assets into categories, provides the corresponding map identification number, and identifies the depth of sea level rise at which the geospatial central point of each asset will be inundated.

### Broward Models Impacts on Groundwater

With direction from the Water Advisory Board, the Broward County Natural Resources Planning and Management Division is currently assessing climate/stormwater vulnerability with an Integrated Surface-Groundwater-Variable Density Model which will assess the potential effects of sea-level change on current surface water management and drainage systems via a range of possible scenarios and storm events. The adaptation scenarios include cost-benefit assessments of flood control and water supply projects such as:

- Hydrologic barriers to saltwater;
- Relocation of salinity control structures;
- Relocation of coastal well fields;
- Retrofit of gravity control structures;
- Increase pump capacity;
- Retrofit drainage wells; and,
- Increase sea wall height.



### Assign Focus Areas

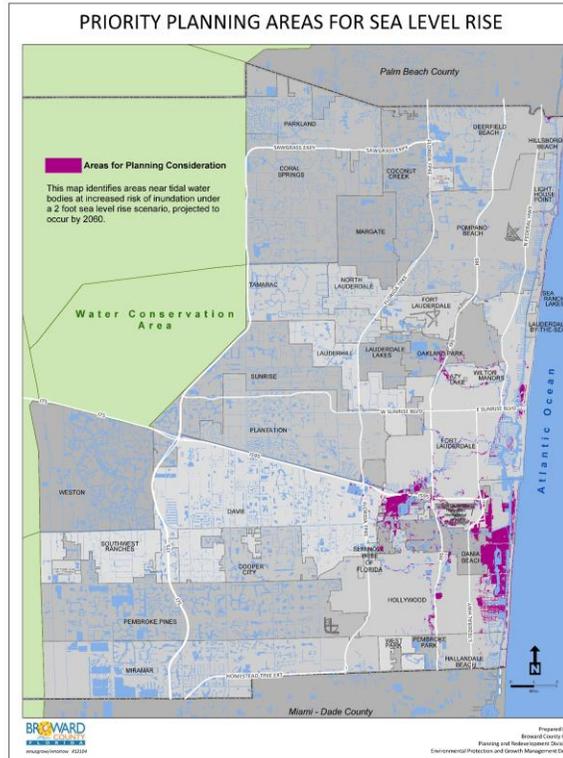
Once the exposure and impact are determined, a community may translate these findings into map-designated areas that constitute the boundaries of the focus areas, or overlays that can become Adaptation Action Areas once the ordinance goes into effect. Focus areas for adaptation planning should be based upon the findings generated during the exposure and impact analysis. Since focus areas may act as the precursor to the official Adaptation Action Area, they can be defined on a map according to the following characteristics:

- A specific geographic area (i.e., development along coastlines);
- Certain vulnerable populations or communities (i.e., the elderly and climate-related health risks);
- Natural and built systems (i.e., local stormwater drainage systems and infrastructure); and/or,
- Other assets identified and quantified during the Impact Analysis.

All of the options discussed here are possibilities for local government to consider during adaptation planning process. There is no one-size-fits-all solution, and as such Adaptation Action Areas are designed to be flexible in facilitating adaptation for any kind of community.

### Broward Focus Areas

Objective 19.3 in the Broward County Climate Change Element directs the County to “develop adaptation strategies for areas vulnerable to climate-related impacts”. Those vulnerable areas have been identified in the Broward County Land Use Plan’s “Priority Planning Areas for Sea Level Rise Map”, illustrating areas that are at increased risk of flooding due to, or exacerbated by, sea level rise over the next 50 years. The associated Priority Planning Areas policies direct the County to discourage land use plan amendments that would place additional residential and non-residential development at risk of flooding from sea level rise. Unlike all other counties in the state, it is important to note that Broward’s charter provides the County government countywide land use authority established with the passage of Chapter 59- 1154, Laws of Florida, Special Acts of 1959.



A vulnerability assessment can drive the scientific supporting analysis that enters into adaptation planning. The vulnerability assessment can help put future potential hazards into perspective so that community outreach may successfully address the problem at key places, or focus areas, rather than become entangled in speculative conversation about underlying causes. Utilizing the techniques broadly described above, and applying them locally, may help to develop consensus among community stakeholders about the areas in which adaptation strategies can be designed.

## Chapter 4: Develop Adaptation Strategies

Once a community has forged ties to its stakeholders and identified potentially vulnerable areas, the creative step in process may be undertaken. Developing adaptation strategies represents the community's attempt to maximize benefits to the affected assets by prioritizing and crafting interventions that will ensure the most beneficial planning outcome. As the following sections will explain, this may mean incorporating protection, accommodation, retreat, and avoidance strategies that are socially, technologically, administratively, politically, legally, economically, and environmentally appropriate for each focus area.

### Adaptation Strategy Concepts

Adaptation is fundamentally a risk management strategy; risk is a combination of the likelihood of sea level rise impacts and the magnitude of the potential consequences (The National Academies, 2010). Response options are evaluated for their feasibility and potential effectiveness at reducing the identified risk(s). Available academic research and case studies from practitioners pointedly acknowledges that adaptation planning may prove challenging due to adaptation barriers such as political impediments, institutional restrictions and resource limitations. However, resilience is becoming a necessary and sought after planning process for many coastal communities. Figure 15 supplements the text descriptions, and can be found on page 46.

The implementation of Adaptation Action Areas allows communities to gradually plan for adaptation to current and future sea level rise and other potential impacts. The four optional strategies (protection, accommodation, retreat and avoidance) of adaptation provide an avenue for communities to address the four major impacts of concern (refer to page 27).

**Protection strategies** may be targeted for areas of a community that are location-dependent and cannot be significantly altered or relocated, such as downtown centers, areas of historical significance, or water-dependent uses. Protection includes shoreline armoring that is either natural or man-made. Examples include: seawalls and bulkheads, beach nourishment, living shorelines, tide gates and saltwater intrusion barriers.

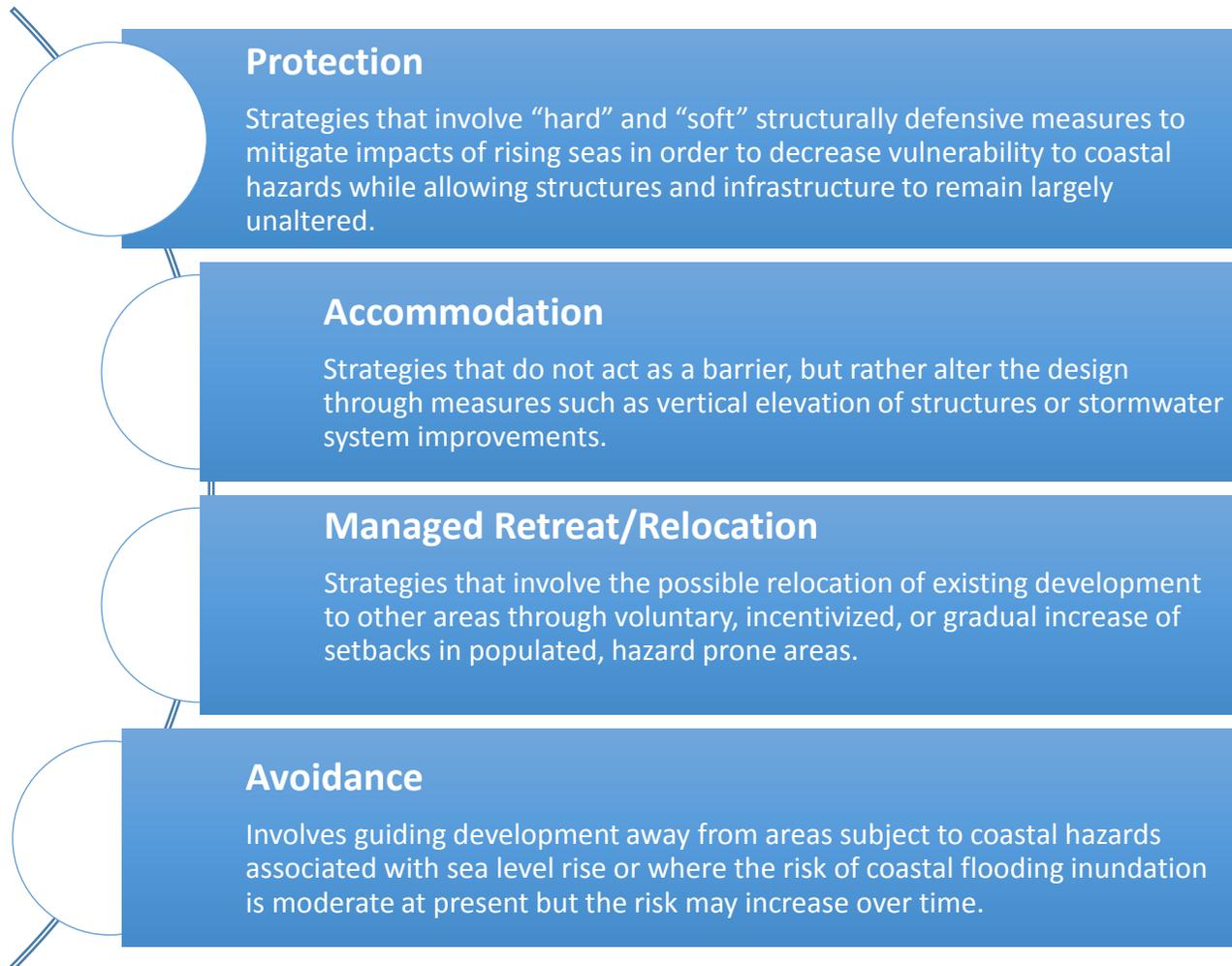
**Accommodation strategies** aim to reduce potential risks rather than seeking to prevent flooding or inundation entirely. Examples include: the flood proofing of nonresidential structures, vertical elevation of structures; using structural fill to raise grade elevations; build bridges to have higher vertical spans; limit development in projected hazard zones; planting salt water tolerant plant species, and, recommended increased setbacks for new or substantially improved development activities. If a critical facility in a high risk area requires substantial upgrades, it might be cost-effective in terms of hazard avoidance to relocate the facility.

**Managed Retreat or Relocation strategies** may involve the transition of vulnerable lands from private to public ownership, but may also include a combination other strategies such as transfer of development rights (TDRs), purchase of development rights, rolling and conservation easements. Examples include: publicly lead amendments to future land use plans; adoption of rolling easement policies; infrastructure

relocation/removal; and, transfer of development rights to upland sending areas that are characterized by lower vulnerabilities to coastal hazards.

**Avoidance strategies** may involve identifying opportunities for future conservation or low density development areas within local government planning documents. A wide range of planning tools may be identified, facilitating a local decision to limit development in areas subject to moderate to high risk. Regulatory tools may include the designation of lands for low density or passive uses. An avoidance strategy may include land acquisition or tools such as a land trusts, zoning codes, and overlay zones.

Figure 15: Protection, Accommodations, Managed Retreat, and Avoidance



These categories have numerous supporting options that can be applied in community-specific settings. Whereas one community may be able to implement more avoidance measures to protect people and property from future flooding, another may find greater benefit from soft structurally defensive measures. Table 4 illustrates supplementary examples used to provide guidance for U.S. Army Corps of Engineers (USACE) projects in the areas of navigation, coastal storm damage reduction, flood risk reduction, and ecosystems. Many of these activities tie into the others discussed in the section Adaptation Planning and Policy Tools.

Table 4: Potential Adaptation Approaches by Project Type

PROJECT TYPE	PROTECT	ACCOMMODATE	RETREAT
NAVIGATION	<ul style="list-style-type: none"> <li>• Upgrade and strengthen existing primary structures</li> <li>• Expand design footprint and cross section of existing structures (e.g., bridges), including raising for clearance and access</li> <li>• Add structures to protect backshore areas (e.g., dikes)</li> <li>• Improve resilience of backshore facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Upgrade drainage systems</li> <li>• Increase maintenance and dredging</li> <li>• Adjust channel location and dimensions</li> <li>• Modify operational windows</li> <li>• Flood proof interior infrastructure</li> <li>• Add sediment to shoreline or underwater morphology</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate interior harbor infrastructure due to relative sea level rise or fall</li> <li>• Abandon harbor/port</li> <li>• Re-purpose project area</li> </ul>
COASTAL STORM DAMAGE REDUCTION	<ul style="list-style-type: none"> <li>• Upgrade and strengthen existing structures</li> <li>• Expand design footprint and cross section of existing structures</li> <li>• Dune/beach restoration or enhancement</li> </ul>	<ul style="list-style-type: none"> <li>• Increase shoreline protection maintenance</li> <li>• Sediment management</li> <li>• Beach nourishment/ vegetation</li> <li>• Upgrade and modify drainage systems and infrastructure</li> <li>• Flood proof buildings, modify building codes, and implement building setbacks</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate buildings and infrastructure</li> <li>• Land-use planning and hazard mapping</li> <li>• Modify land use</li> </ul>
FLOOD RISK REDUCTION	<ul style="list-style-type: none"> <li>• Upgrade and strengthen existing structures</li> <li>• Expand design footprint and cross section of existing structures</li> <li>• Construct levees or implement flood-proofing measures</li> <li>• Add secondary structures</li> <li>• Dune/beach restoration or enhancement</li> </ul>	<ul style="list-style-type: none"> <li>• Increase maintenance of flood risk protection features</li> <li>• Upgrade and modify infrastructure</li> <li>• Improve natural shoreline resilience (vegetation)</li> <li>• Flood proof buildings</li> <li>• Implement building setbacks</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate buildings and infrastructure</li> <li>• Land-use planning and hazard mapping</li> <li>• Modify land use</li> </ul>
ECOSYSTEMS	<ul style="list-style-type: none"> <li>• Construct drainage systems</li> <li>• Construct shoreline protection structures, dikes or cells</li> <li>• Construct tidal gates, install salt water intrusion barriers</li> </ul>	<ul style="list-style-type: none"> <li>• Accept changes to ecosystems</li> <li>• Sediment management</li> <li>• Change water extraction</li> <li>• Freshwater injection /diversion</li> <li>• Modify land use</li> <li>• Migrate landward</li> </ul>	<ul style="list-style-type: none"> <li>• Allow/facilitate habitat conversion</li> <li>• Prohibit hard defenses</li> <li>• Ecosystem migration</li> <li>• Abandon ecosystem</li> </ul>

Determining suitable adaptation strategies to address rising seas in a community or region depends on the identification of vulnerabilities. The Center for Climate Strategies (2011) reports that an essential step in adaptation planning is to determine the areas that will receive priority focus when considering and developing adaptation policies. Those targeted impact areas should be prioritized based on projected timelines of impacts, risk level and type, consequence of risk, scope and range of impact, and frequency of impacts. As such, in addition to the assignment of focus areas (page 43), needs within each area can be prioritized according to considerations set forth in the next section.

## Prioritization of Needs

Once a community understands the essential concepts of adaptation planning contained within Protection, Accommodation, Retreat, and Avoidance strategies, it may prioritize actions within its focus areas. By prioritizing needs, the eventual Adaptation Action Areas ordinance can contain stronger policy language suited to the community's own recommended priorities for intervention and preservation.

NOAA (2010) proposes that communities consider the following categories (STAPLEE) in terms of the opportunities and constraints that each poses:

- **Social** – What are the socially acceptable adaptation strategies in the community?
- **Technical** – What are the technically feasible adaptation strategies within the community?
- **Administrative** – Which adaptation strategies are implementable by community leadership?
- **Political** – Which adaptation strategies are politically acceptable within the community?
- **Legal** – Which adaptation strategies are legally implementable by the community under state and municipal law?
- **Economic** – What are the cost-effective adaptation strategies available to the community?
- **Environmental** – Which adaptation strategies are most favorable to the environment, as determined by community conservation plans and statewide guidance?

Through the STAPLEE categories, a community may begin to develop adaptation strategies – the focus of the following section – that are pre-screened to meet local capacity and preferences. Prioritization enhances the impact of focus area-driven adaptation strategies by ensuring that the community adds additional aspects to the comprehension of coastal flooding in the greater context and functioning of the community.

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### Choosing the Adaptation Strategy that's Right for Your Community

Planning studies, such as risk assessments or data identifying current erosion or flooding problem areas, can serve as the data and analysis to develop and support a community's adopted adaptation measures. A community may designate high-risk areas with little existing development, and plan for limiting further development. For high-risk areas that are already developed, possibly with a high level of criticality, communities may plan to direct resilient infrastructure and prioritize funding for adaptation planning to increase resiliency capacities. These various adaptation options should be described in detail in the comprehensive plan.

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## Adaptation Strategies Tool-kit

An adaptation tool can refer to any specific intervention which a community employs to increase its resilience to coastal flooding hazards. The tools and initiatives discussed here summarize a previous report prepared by the SFRPC in collaboration with DEO, Broward County and the City of Fort Lauderdale (2013), that was produced for the Adaptation Action Areas set of resources. The full document is available at:

<https://southeastfloridaclimatecompact.files.wordpress.com/2014/07/final-report-aaa-11-6-13-1.pdf>

The *Policy Options for Adaptive Planning for Rising Sea Levels* describes the following 16 tools for consideration to implement Adaptation Action Areas policy:

- Transferable Development Rights;
- Incentives;
- Setbacks and Buffers;
- Building Codes and Design;
- Floodplain Regulations;
- Zoning and Overlay Zones;
- Hard- and Soft-Armoring Permits;
- Conditional Development;
- Rebuilding Restrictions;
- Stormwater Utility;
- Special Assessments;
- Impact Fees;
- Conservation Easements;
- Real Estate Disclosures;
- Coastal Land Acquisition Programs; and,
- Land Trusts.

In addition, a new legal instrument, land readjustment strategies, is presented here<sup>17</sup>.

## Adaptation Planning and Policy Tools

How can a local government determine the best adaptation strategies and how can it build these strategies into its budget? This section of the report outlines various adaptation planning strategies a coastal community could establish and implement through their local comprehensive plan or other strategic plans. The tool or initiative is identified, its benefit of use for adaptation planning discussed, and examples of policy strategies are provided.

### Transferable Development Rights (TDR)

The principal potential hazard mitigation application of TDR is to limit new development altogether or to reduce the allowed development density within hazardous areas. A Transfer of Development Rights (TDR) program is a market tool a community can use to achieve land preservation by allowing one landowner to

### Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels



<sup>17</sup> The concept of land readjustment strategies was introduced to SFRPC and other stakeholders by the Dutch attendees of Resilient Redesign workshop that took place in Miami on August 11, 2014.

sever development rights (the “sender” or sending lot or area) in exchange for compensation from another landowner who wants their development rights to increase (the “receiver” or receiving area). The receiving area is allowed to have increased intensity or density. The program shifts development from resource sensitive areas to locations with full municipal services.

A coastal community could establish a voluntary Adaptation Action Area TDR program to provide incentives to landowners to develop at higher densities in environmentally non-sensitive and low-risk areas upland with a mix of uses in very low risk areas outside a designated Adaptation Action Area. The efforts of such a program would be considered a retreat strategy as a community would be directing development away from the coastal, high-risk areas. Communities may wish to develop a statewide or regional sea level rise TDR program with a surplus of receiver site options to provide property owners more incentive to participate.

### Yankeetown Transfer of Development Rights

Yankeetown established a Transfer of Development Rights (TDR) program in the Town's Comprehensive Plan. This program has the opportunity to be expanded to include areas that are vulnerable to coastal change impacts, such as Adaptive Area One.



A TDR program is an incentive that can be used to compensate an owner for giving up the right to develop portions or all of a property. Incentives are often viewed by property owners as a fair way to limit development since he or she receive something in return for any lost privileges.

In order for these types of programs to work, development permits must be high demand and limited. If someone can more easily secure a permit through normal channels, there is no incentive to go through a TDR program to secure density bonuses.

TDR programs can be mandatory or voluntary. Mandatory TDRs have pre-designated sending and receiving areas and the sending area's development potential is automatically downsized. In voluntary TDRs, the landowner has the option to receive payment for their transferable development rights. Mandatory TDR programs can help avoid the constitutional takings constraints of down zoning, and possible claims under Florida's Bert Harris Act if the affected property owners in the sending area can be assured of an adequate compensation for their lost development rights through creation of a development credit bank or exchange. Transaction costs, however, can be substantial, especially when a development credit bank or exchange is established. In addition, the high value of some land in vulnerable areas (i.e., along the coast) makes trade-off to less vulnerable areas (perhaps inland) difficult because of a difference in land values as a function of aesthetics, amenities and demand.

**Florida Examples of Transferable Development Rights**

**Monroe County, Florida**, which includes the Florida Keys and large parts of Everglades National Park and the Big Cypress National Preserve, uses a TDR program to protect environmentally sensitive areas by retiring development rights on private vacant land. Most of the rights transferred to date have come from the middle and lower Keys and have gone to receiving areas in the middle and upper Keys where they are used to supplement allowable densities for single-family residential subdivisions and allowable floor-areas for commercial development.

**The City of Palmetto** uses density transfers to protect wetlands. Developers are allowed to increase development densities on the upland portions of their sites at the rate of one unit per acre for every four acres of wetlands that remain undeveloped.

**The City of Tallahassee’s** Environmental Management Ordinance encourages density transfers on sites situated within areas zoned as conservation and requires them in areas zoned as preservation. If there is no room for density transfer, development is allowed only at very low densities.

The benefits of a TDR program include the ability of a local government to decrease intensity and density standards while conserving and/or protecting threatened properties in areas vulnerable to sea level rise. In addition, TDRs may help governments avoid large expenditures on preservation by acquisition as a market for development rights opens up. The areas that are allowed additional intensity and density are usually infill development areas that have existing infrastructure.

Disadvantages of TDRs may include uncertainty. As discussed previously, because some TDR programs are inherently voluntary, one cannot be sure which landowners will participate and how many acres will be preserved. This is true for most land preservation programs to varying degrees—purchase of development rights programs can also be voluntary—but uncertainty seems especially salient for TDRs. More development may occur than there otherwise would have been. Some parcels that would have stayed undeveloped even without a TDR program may have their development rights transferred and used on another parcel. Programs can be complicated to design and implement, and may take a good deal of ongoing analysis and management to be successful. Despite all of these challenges, broad stakeholder participation throughout the TDR planning process has led to several successful examples across the state.

Advantages	Disadvantages
Although not currently widely used, this tool is within a local government's zoning authority.	This tool depends upon the assumption that every parcel of land has development potential that can be quantified and transferred to an alternative location.
This tool is market-based and could be structured so local government requirements are limited to administrative costs.	Density transfer has limited potential for small communities or ones with a static or declining population.

Transfer of density potential could be combined with land acquisition in which the local government acquires ownership of the land and transfers the development potential to the former owner elsewhere in the same municipality.	Owners of coastal properties may resent land use limitations or decreased densities if they perceive no imminent risk.
Density transfer may provide a less costly alternative to land acquisition.	As a voluntary undertaking, the transfer of development potential may not prevent the development of areas at risk from coastal hazards.
In addition to land value, owners may be compensated for previous construction that hold structural value.	There also may not be any viable sending areas if an entire community is going to be significantly impacted by sea level rise.

### Incentivize through Community Rating System

Within a designated Adaptation Action Area a community can take advantage of existing programs that offer incentives. For example, many coastal communities already require a freeboard for Community Rating System (CRS) purposes (i.e., a freeboard is a factor of safety usually expressed in feet above a flood level for purposes of floodplain management). In addition, the 2010 Florida Building Code, Building (see Chapter 16) requires a freeboard for most structures developed in a 100-year flood zone). This can provide incentives to homeowners and business owners who develop or redevelop structures above the minimum requirements of the National Flood Insurance Program (NFIP). When a CRS community requires a freeboard, all eligible community residents benefit through community-wide reduced insurance premiums. Flood insurance premiums are also reduced due to decreased risk from flood damage.

Other opportunities include:

- Making “sea level rise” a priority topic in the community’s Program for Public information (see CRS Activity 332.b).
- Furnishing information to persons looking to purchase property about the potential for future sea-level rise inundation hazards (see Activity 342.d).
- Maintaining a flood protection website that describes strategies property owners may take to improve the resilience of their structures (see Activity 352.c).
- Offering flood protection assistance through recommending retrofits to structures, site-specific protection advice, and financial assistance advice (see Activities 361.a – 362.c).
- Using sea level rise projections to map and develop policies to limit development in areas that are prone to future coastal erosion (see Activity 432.l.).
- Assign buffers to limit development in areas that are prone to future coastal erosion due to sea level rise (see Activity 432.l.).
- “Prohibit” the use of hardened structures in areas that are prone to future coastal erosion due to sea level rise (see Activity 430CE).
- Return previously developed areas to open space, and promote natural and beneficial floodplain functions (see Activity 422.c.).
- Removal of threatened structures (see Activity 430CE).
- Adoption of regulations that “prohibit” all new buildings and substantial improvement of existing buildings in the 30-year erosion area (see Activity 410CE).
- Setback regulations for accreting and rocky shorelines (see CRS Activity 430CE).

## Setbacks and Buffers

Setbacks and buffers are regulatory tools that can be established through zoning, subdivision and/or floodplain codes, or conservation easements. The use of setbacks and buffers not only serves to protect and extend the life of structures and their inhabitants, but can provide protection and preservation of coastal wetlands, estuaries, beach dunes and state beaches; allow for inland migration of habitats; and serve as alternatives to hard- and soft-armoring. They can be applied as short and mid-term solutions for sea level rise impacts.

A coastal community who wishes to use these regulatory tools may establish setbacks and/or buffer area policy based on a projected shoreline position that assumes specific increases in sea level or erosion rates over the life of the structure. Within a designated Adaptation Action Area, a community could create policy to:

- Establish mandatory construction setbacks to a specified distance from the seawall, mean high water line or applied to only those properties within the Coastal Construction Control Line (CCCL).
- Establish erosion-based setbacks requiring the structure be set back by the projected shoreline position over a specific time frame if appropriate (could either be based on a sea level rise projection or determined by the life expectancy of the structure).
- Establish a tiered setback system that would allow for varying setbacks based on the size and risk of a structure determined by the annual average rate erosion over a specified number of years.
- Limit the development on a property if sufficient setback requirements cannot be met.
- Designate coastal buffer zones in areas that have existing important natural resources and/or could be part of a mitigation corridor as shorelines erode or tidal habitats shift.
- Expand existing green buffer areas that are experiencing significant erosion or increased inundation.
- Reduce property exposure to erosion and storm damage through shoreline vegetative buffers. For example, a minimum of 25-foot vegetated buffer for all new beachfront development in the coastal zone; or 100-foot from existing natural resource assets like protected wetlands, shores, or streams.

Communities may implement this planning tool as soon as possible “in order to set property owners” expectations for the value of their property. Minimum lot sizes and “savings” clauses can also be used to avoid takings challenges. However, when structures are built seaward of the setback line due to a variance or permit, it should be clear that the owner takes on the financial risk and that no public funding will be provided for future relief or rebuilding (Siders, 2013).

*It is important to note that these and similar examples are for illustrative purposes only, and communities may experience or develop different scenarios throughout the state based on individual vulnerability assessments.*

## Building Codes and Site Design Standards

Building codes and design standards are regulatory tools that establish the minimum requirements for building construction to maximize their capacity for safety. Building codes generally include the standards for structure, placement size, usage, foundations, floor assemblies, roof structures, energy efficiency, mechanical, electrical, plumbing, site drainage and storage, fixture standards, occupancy rules, parking rules, traffic impacts, fire code, and requirements for resistance to extreme weather events in disaster prone areas such as earthquakes, hurricanes, tornados and flood events.

Under the Florida Building Code Act, the Florida Building Code officially replaced all local codes on March 1, 2002. However, local governments are permitted to adopt more stringent provisions where local conditions warrant. Other regulations governing building construction include flood protection regulations pursuant to the NFIP and the state Coastal Construction Control Line permitting standards (CCCL).

Applications of particular interest to hazard mitigation are provisions governing a structure's resistance to wind-borne debris and standards for elevation and flood-proofing. A coastal community could elect to establish a local amendment to the Florida Building Code to extend flood resistant building code standards to currently unregulated areas that may become vulnerable to flooding in the future, such as the 500-year floodplain discussed previously.

Within a designated Adaptation Action Area, a community could create policy to:

- Require two or more feet of freeboard for structures located in tidally influenced floodplain; foundations that are more resilient to erosion and wave impacts; and/or flood-resilient construction materials in new development and redevelopment projects.
- Encourage the use of strategies in new development and redevelopment projects to maintain the form and function of natural resources, such as incorporating vegetative buffers or natural water feature (wetlands).
- Delineate the minimum technical and safety requirements for the design and construction of residential and commercial structures that are vulnerable to sea level rise impacts.
- Require that all structures meet the flood resistant construction standards provided in the Florida Building Code (Building, Sec. 1612; Residential, Sec. 322).

In order to fund implementation of these actions, the local jurisdiction could develop policies to prioritize the pursuit of financial assistance, such as FEMA's Hazard Mitigation and Flood Mitigation Assistance grant programs: to 1) retrofit homes that have been repetitively damaged by flood, elevate structures, move structures, or demolish damaged homes; and, 2) retrofit structures to reduce or eliminate the long-term risk of flood damage.

The key advantage of this tool is its ability to deny approval of building permits or certificates of occupancy until the hazard risk has been addressed. However, permitting comes relatively late in the development process. This can be a concern if a property owner is not aware of any potential risk and only finds out when a building permit application is submitted. Outreach and education can alleviate this disadvantage.

Floodproofing strategies such as structural elevation (raising the habitable areas within a building; or raising the entire building by using stilts/piles/columns, foundation walls or similar elevating structures) and placement of fill have limitation within the building codes. The NFIP, ASCE-24 (Flood Resistant Design and Construction (2010)) and the 2010 Florida Building Code prohibit the placement of fill for structural support in V-zones (wave velocity zones). This practice should also be discouraged in Coastal A-Zones (wave heights less than 3 feet), and areas that are expected to receive stronger storm surges during the life of the proposed building.

### **Floodplain Regulations**

In order to participate in the NFIP, local governments are required to adopt and enforce local floodplain management regulations on all development activity in floodplains wherein structures in flood susceptible areas must be constructed with practices and materials which minimize flood damage. Such regulations

include elevating structures to or above the design flood levels and anchored to withstand wave action in 100-year floodplain areas (known as A-Zones and V-Zones). X-Zones represent the 500-year floodplain and adoption of minimum regulations for these zones is not mandatory for participation in the NFIP, but instead encouraged and incentivized for communities participating in the Community Rating System (CRS). FEMA, who administers the NFIP, is responsible for working with local communities to develop Flood Insurance Rate Maps (FIRMs). The maps are created using only historical flood data, and do not currently account for projected sea level rise impacts, which are expected to increase flood risks outside of existing coastal zones. However, under the Flood Insurance Reform Act of 2012, Congress directed FEMA to form a Technical Mapping Advisory Council that will provide recommendations for updating flood hazard mapping guidelines to incorporate future risk assessments, including the impacts of sea level rise.

Floodplain regulations are a regulatory tool that a coastal community could amend to impose additional limitations (i.e., higher standards) on development in floodplains above the NFIP minimum standards, such as “use” restrictions within the 100-year floodplain areas (only allow limited residential, recreational, or agricultural uses), and/or impose design requirements in the 500-year floodplain areas that are currently not required (elevation requirements).

Within a designated Adaptation Action Area a community could create policy to:

- Limit public expenditures to build or maintain infrastructure in the 100-year and 500-year floodplains.
- Limit public expenditures for certain types or categories of new or substantially improved infrastructure projects in the 100-year floodplain.
- For areas of the 500-year floodplain that are prone to future inundation by sea level rise, require that new development activity come into conformance with higher standards (e.g., be built vertically higher).

## Zoning Codes

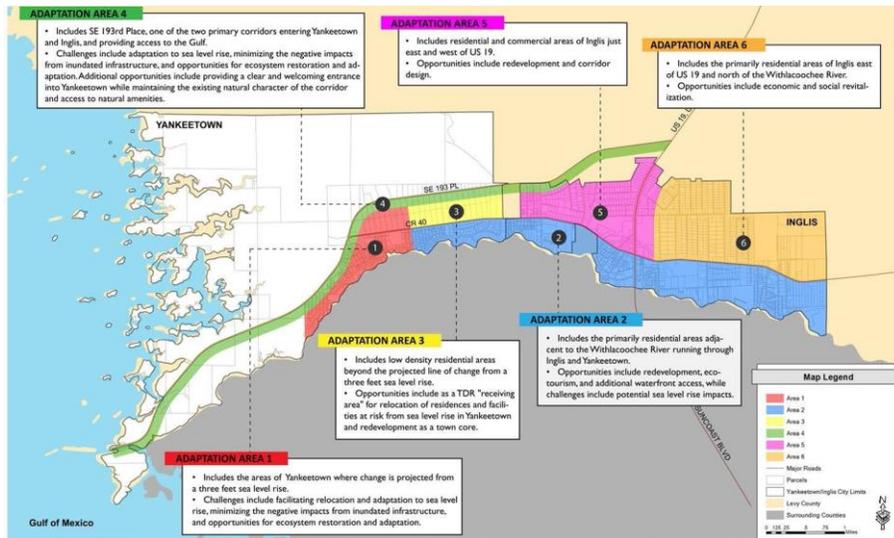
Zoning codes are typically the enforcement mechanism for policy, and are therefore a powerful tool by which local governments can preemptively mitigate hazards. Local governments can utilize compliance to fortify their framework of determining what is at risk what is safe to build, and where it is safe to build. By analyzing vulnerabilities and planning for impacts, local governments can shape landowner expectations and build political support for adaptive measures.

## Overlay Zones

An overlay zone is an area applied over one or more established land uses or zoning districts to establish additional, higher standards, or criteria for development in addition to those of the underlying land use or zoning district (American Planning Association, 2007).

## Yankeetown-Inglis Adaptation Action Areas Overlay Map

The Changing Levy Coast project undertaken by the University of Florida and Levy County produced the following *Adaptation Action Areas for conservation* overlay map. This map details six adaptation areas, each with a different set of conservation strategies. Based upon SLAMM model outputs for wetland and other natural area changes, each area can undertake appropriate adaptation strategies to conserve the assets within. For more information, see the case study section, page 10101.



### Decreased Intensity of Permitted Uses

In a *Conservation Zone* (designed to facilitate retreat, to protect natural resources) you may consider limiting development and redevelopment to low-density and low-intensity uses, such as agricultural, recreational, or open space uses.

### Yankeetown Addresses Density and Intensity

“Density increases greater than 4 or more units an acre are illegal in Yankeetown without a central sewer system. This rigid framework in Yankeetown's allowed dwelling units per acre could become problematic in light of coastal change...Adaptation strategies may call for spatial shifts that marginally increase residential densities in the town. Yankeetown needs policies that are more flexible to accommodate redevelopment in areas suitable for relocation, a greater variety of housing types ... [are needed] to accommodate redevelopment... Thoughtfully designed redevelopment can accommodate relatively small increases in dwelling units per acre that allow for adaptation, while preserving the quality of life the people of Yankeetown desire” (Frank et al., 2013).

In an *Accommodation Zone* (designed to allow for continued development) you may consider limitations to new development of critical facilities, or for those which require more intense uses, require they obtain special use permits.

### Limit Rebuilding and Utilization of Rebuilding Standards

Limit redevelopment of storm-damaged structures in highly vulnerable areas or limit redevelopment of repetitive loss structures. The most drastic risk responses result from short-term, costly disasters. Preemptive policy such as rebuilding regulations can lead to “pre-covery” in which a system is in place so that it is ensured that damage is mitigated throughout the redevelopment process in a timely manner as residents start to repair their homes.

Rebuilding standards are regulatory tools a community can use to limit, or even in some cases prohibit, what is allowed to be rebuilt on a property that has been damaged or destroyed by natural hazards. Rebuilding standards already exist federally, in the Florida Building Code, and in local floodplain management ordinances. The Florida Building Code and FEMA’s “50 Percent Rule” (as adopted in local floodplain management ordinances) states that a structure is considered “substantially damaged” when the total cost of repairing the structure to its pre-disaster condition is equal or greater than 50 percent of the market value of the structure (not including the value of the land) before the damage occurred. With the exception of Historic Structures that are listed on the National Register (and can handled by variances or exemptions), all structures in a community that are substantially damaged must come into full compliance with the Florida Building Code (and the NFIP if located in a floodplain).

#### **FEMA’s “50 Percent Rule”**

FEMA’s Substantial Damage Rule, or 50% rule, states that a building must be elevated and brought into compliance if damaged by any cause for which the repair costs are 50% or more of the value of any structures in a designated special flood hazard area (FEMA Region VII 04/21/97). This is a very constructive regulation, because it allows communities to use the authority of the Florida Building Code to require non-resilient structures to come into full conformance with the code. Over time, this will allow a community’s existing building stock to gradually become more resilient to hazards.

When homeowners avoid the 50 percent threshold (i.e., the cost of repairs is only 49.9 percent of the market value of the structure), they are potentially investing more money in their non-conforming structures, and end up with more expensive structures (sunken cost) that continue to have a higher risk to impacts from hazards. And over the long term, increasing the cost to repair (and cost to the nationwide insurance pool) the structure if damaged occurs again at a later date.

### Hard- and Soft-Armoring Permits

The protection of property and structures from flooding and erosion through shoreline armoring has been practiced for years. Armoring includes both hard-engineered (hard-armoring) structures such as onshore or offshore bulkheads, breakwaters, sea walls, dikes, tide gates, storm surge barriers, often used in cities or historic districts; or soft-armoring techniques which are man-made barriers that replenish or mimic natural

buffers such as living shorelines, or elevate land, such as beach renourishment, dune creation, or wetlands restoration often used in rural areas or parks.

A coastal community who wishes to protect property in areas vulnerable to the impacts of sea level rise may want to investigate the best options for shoreline armoring over the short and long-term. A community may wish to pursue policies which limit all hard-armoring in new development, or encourage the use of soft-armoring through development incentives.

### **Conditional Development**

Special conditions are regulatory tools a community can impose on a landowner, to be collected on a one-time basis as a condition of approval being granted for new development or redevelopment in order to mitigate the impacts of development. Examples of conditions include:

- Dedications – require landowners to dedicate lands for public purposes.
- Impact Fees and Exactions – proportionate fees imposed to help recover related public infrastructure costs (streets, water and sewer systems, fire, and police services).
- Land-Use Limitations – limit land to be developed to a specified use.

### **Stormwater Utility**

A stormwater utility ordinance establishes a flat stormwater fee for developed residential and non-residential parcels. The stormwater utility fee may be billed annually via tax roll as a non-ad valorem charge collected through the City or County Tax Collector's Office. Under Florida Statute 403.0893, local governments may establish a stormwater utility to address construction, operation or maintenance of the stormwater management system. Stormwater management fees are a potential source of revenue to fund drainage infrastructure improvements in coastal areas. Policies in the comprehensive plan can set the stage for introducing the topic to stakeholders. Adaptation action areas may provide boundaries for instituting the stormwater utility or for establishing a differential rate structure commensurate with the potential benefits to reduce flooding. An example can be seen in Bay County, whose website lists the related ordinances and lists frequently asked questions. See <http://www.baycountyfl.gov/engineering/sw-utility.php>.

### **Special Assessments**

Ad valorem and non-ad valorem assessments can be made on local property tax bills to meet specific public purposes. These may be in the form of a "capital project assessment." Policies which contemplate special assessment in Adaptation Action Areas could be used to help fund specific improvements that aid in adaptation and protection of targeted locations.

### **Impact Fees**

An impact fee is a development tool imposed on developers to help pay for the expansion of public infrastructure by requiring that developers pay their proportionate share of costs associated with servicing said development.

A coastal community may consider developing an appropriate methodology of calculation and impose an “Adaptation Action Area” impact fee for all residential and non-residential development (office, retail, commercial) to help cover the costs of various capital improvement projects related to the protection of coastal infrastructure within a designated “Adaptation Action Area”. Since the fee would only apply to new development and redevelopment within vulnerable areas, it would be considered both a protection and accommodation strategy.

### **Conservation Easements**

A conservation easement is a market tool used by local governments for the permanent conservation of private lands by placing a limitation on the uses and/or allowable amount of development on a property to protect its associated resources while still allowing the owner to live, retain and develop the property with limited use. The easement can apply to all or a portion of a property. The property must have significant conservation values. Usually, a conservation easement preserves a portion of property in its natural state. Easements are recorded legally, binding all future property owners. Landowners receive tax deductions and relief in return for the reduction in value associated with the donated easement.

Conservation easements can serve as natural flood buffers, open space or wildlife migration corridors in areas vulnerable to the impacts of sea level rise. To qualify for an easement in vulnerable areas, a property is likely to have significant conservation values (coastal wetlands, beaches with natural berms and/or dunes, endangered species habitats, and historic or archaeological resources).

### **Real Estate Disclosures**

When selling a property, a seller is required to disclose certain information such as special property taxes, the presence of lead-based paints, and natural hazards that can put a property at risk (flooding). The intent of disclosure laws is to fully inform the buyer of the conditions of a property prior to its purchase.

Disclosure laws could be enacted to require alerting potential buyers of any property within a designated Adaptation Action Area of the property’s vulnerability to flooding and future increases in vulnerability due to the impacts from sea level rise. The disclosure could identify the current and projected erosion rates, projected rate of sea level rise based inundation, and any statutory setback or buffer limitations.

### **Coastal Land Acquisition Programs and Land Trusts**

An acquisition program is a tool a local government can establish to purchase lands using public or private funds for the purpose of conserving land for its natural, recreational, scenic, productive and/or historic value. The state of Florida already has a long, successful purchase history dating back to the 1960s and currently has almost 10 million acres of managed conservation land. The focus of the state’s conservation has been to halt the destruction of natural resources that was occurring in conjunction with rapid population growth; preserve the tourist economy, which relies on the state’s natural resources; and contain urban sprawl.

A designated Adaptation Action Area can be the property base for which a community focuses its acquisition efforts. Then a community can develop criteria for the prioritization of lands to be purchased, such as those lands severely damaged by recent storms, at highest risk of being damaged in the future, or are currently undeveloped and ideal to serve as a buffer to rising sea levels.

## Land Readjustment Strategies

Land readjustment strategies are similar to TDR, but they occur on a larger scale. They may have potential as a new planning tool that facilitates value capturing (der Krabben & Needham, 2008). Land Readjustment Strategies are assemblages of platted lands from which private owners voluntarily contribute property in exchange for equal or greater value in compensation or in share of the community's urban re-design outcome, allocating modified land parcels located as close to the original sites as possible. Compared to eminent domain, land readjustment may be considered a more friendly approach to adjusting property relations in land assembly (Hong, 2007).

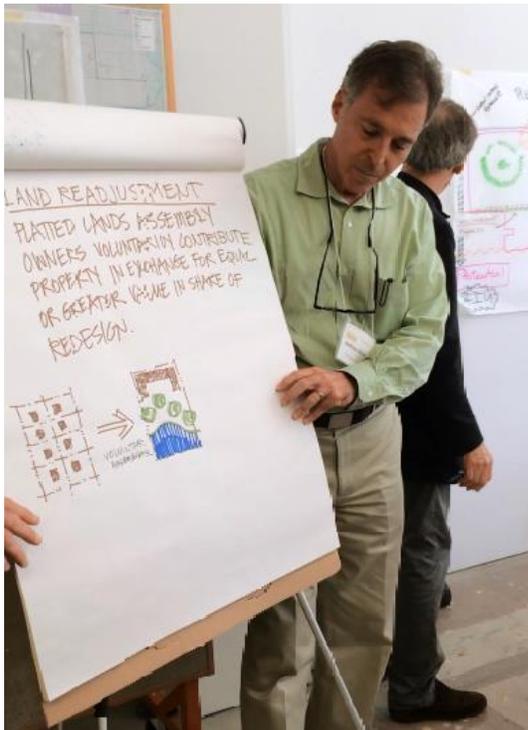


Figure 16: At the Resilient Redesign workshop, Tony Abbate explains land readjustment strategies and their potential application in the case study for an unincorporated section of Miami Dade County

For Florida, the strategy may be applied to rearrange communities in a way that enhances flow, ensures drainage, and reduces flooding. One disadvantage of this strategy is that for a community wide redesign, all residents must be willing to accept adoption of the full redesign plan. All residents will also likely need to be both temporarily (during transition) and permanently relocated as the community is reconstructed in a resilient way.

To ease the process of land readjustment, Hong & Needham (2007) recommend three conditions:

1. **Have a consensus** on the exchange value of property before assembling land. This could avert holdouts.
2. The land readjustment agency should **avoid making the exchange value** (the value at which the property is taken into the pool) **negotiable**. Instigated property change through land readjustment may reduce, though not totally mediate, the problem of compensating owners for the loss of sentimental value of the property.
3. When owners return to newly modified property, they may **build new houses that resemble the old ones**.

Regarding private property protection, Hong (2007) states that “land readjustment will most likely be adopted in a property rights regime in which protection of private property is strong and, although transformation of property relations always conflicts, to a certain extent, with private property protection.”

## Applying the Adaptation Strategies to Different Management Categories

The strategies presented above provide readers with a diverse set of interventions that a community may use to confront coastal flooding hazards, but they are not explicitly connected to the management categories that would incite any particular use. For a quick reference by which communities may connect a particular tool to a management issue, Table 5 addresses four management categories and matches flood management tools to those categories. This list is not meant to be exhaustive. For additional tips and tools related to adaptation strategies, see the table in Appendix 4: Additional Materials.

Table 5: Adaptation Strategies by Management Category

MANAGEMENT CATEGORY	POSSIBLE TOOL
PROTECTION / ACCOMMODATION / RETREAT / AVOIDANCE OF STRUCTURES AND POPULATIONS	Building Codes (e.g., freeboard, V zone Standards in A Zones)
	Coastal Land Acquisition Program
	Zoning
	Overlay Zones
	Incentives
	Transferable Development Rights
	Conditional Development
	Real Estate Disclosures
	Rebuilding Restrictions
	Land Readjustment Strategies
CONSERVATION / PROTECTION OF SHORE AND COASTAL AREAS	Hard Armor Permits
	Soft-Armor Permits
	Set-backs and Buffers
	Land acquisition (e.g., for tidal marsh migration)
	Conservation Easements (e.g., for tidal marsh migration)
TRANSPORTATION AND STORMWATER INFRASTRUCTURE	Floodplain Regulations
	Zoning
	Set-backs and Buffers
	Stormwater Utility
	Hard and Soft Armor Permits
	Overlay Zones
	Impact Fees
	Special Assessments
WATER AND SEPTIC INFRASTRUCTURE	Real Estate Disclosures
	Special Assessments
	Floodplain Regulations
	Overlay Zones
	Land Trust
	Conservation Easements
	Impact Fees



As mentioned, the assortment of adaptation strategies available to communities is numerous, and their application is unique to each situation. Those communities who think creatively and collaboratively are sure to design no regrets strategies that will be cost feasible and benefit the community for generations to come. As a means to consolidate the options presented above and to connect those options to planning scenarios that a community may be facing, Table 5 in this section links tools to categories of intervention as a quick way to access strategies.



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## Chapter 5: Integrate Adaptation Action Areas into Existing Plans

This chapter advances the information presented in the “Describe the Planning Context” section in Chapter 2 about the Comprehensive Plan and Adaptation Action Areas. It explains the relationship between the two in greater detail, and utilizes the Adaptation Planning Process “Implementation” component to suggest activities for the final step – adoption of Adaptation Action Areas into municipal plans, ordinances and land development codes.

### Adaptation Action Areas and the Comprehensive Plan

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#### Florida’s Comprehensive Plans: Guiding Resilience

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While the Adaptation Action Areas implementation is optional, once it is in place there are many options that come with the insertion of the language into a comprehensive plan. Planning begins with a local government’s comprehensive plan, which “provides the principles, guidelines, standards, and strategies for the orderly and balanced future economic, social, physical, environmental, and fiscal development...” of the community for which it is written and adopted (§163.3177, Fla Stat.).

A comprehensive plan reflects community commitments to implement the plan and its elements. Comprehensive plans guide local decision-making with regard to land development, economic growth, protection of resources and the delivery of public services. As a guide for future decisions, a comprehensive plan lays the policy groundwork for developing a more resilient community. In the context of sea level rise, planning today improves the preparedness and resilience of coastal communities for the potential rising tides of tomorrow.

In 1972, there were limited planning codes and developmental regulations in Florida. Many large scale developments were being built without looking at impacts on the environment, water quality, transportation, and population densities. Occasionally, such developments were so large that their impacts crossed county boundaries and had regional implications. A series of growth management acts were adopted as the State recognized these issues and the need to standardize local government planning procedures and to align them at the regional and state level.

#### What Do Comprehensive Plans Consist of?

Pursuant to Florida’s Community Planning Act (§163.3177, Fla. Stat. (2011)), all counties and municipalities in the State are provided the authority to adopt a comprehensive plan and procedures to implement the plan. The Community Planning Act provides great latitude as to the content of the comprehensive plan and how the local government chooses to address the various issues raised in the comprehensive plan.

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Comprehensive plans are generally comprised of goals, objectives, and policies that are intended to guide the future development of a community covering at least the first 5-year and 10-year period occurring after the plan's adoption.



There are minimum and optional elements which are subject to specific state statutory requirements and guidance. Required elements of each plan include: Future Land Use, Housing, Transportation, Recreation and Open Space, Infrastructure (sanitary sewer, solid waste, drainage, potable water and natural groundwater aquifer recharge), Conservation, Capital Improvements, and Intergovernmental Coordination. Additionally, those local governments abutting (and some non-ocean abutting municipalities) the Gulf of Mexico or the Atlantic Ocean are required to adopt a Coastal Management Element (*see* § 380.24, Fla. Stat.). While a comprehensive plan is composed of these elements, the issues addressed in the elements are often interrelated; therefore, allowing the comprehensive plan to be read as a singular document. A community may also include optional elements, such as Economic Development, Historic Preservation, or Community Design. In addition, coastal municipalities and counties have a Coastal Management Element.

### What Is a Coastal Management Element?

The Coastal Management Element's overall purpose is to (§163 Part II, Fla. Stat.):

- **Maintain, restore, and enhance** the overall quality of the coastal zone environment;
- **Protect** the orderly and balanced utilization and preservation ... of all living and nonliving coastal zone resources;
- **Protect** human life against the effects of natural disasters; and,
- **Limit public expenditures** that subsidize development in coastal high-hazard areas.



Local governments that adopt Adaptation Action Areas may consider a range of policies to improve resilience to coastal flooding. Florida Statutes (§163.3177(6)(g)) further provides strategies to guide local governments:

1. Maintain, restore, and enhance the overall quality of the coastal zone environment, including, but not limited to, its amenities and aesthetic values.
2. Preserve the continued existence of viable populations of all species of wildlife and marine life.
3. Protect the orderly and balanced utilization and preservation, consistent with sound conservation principles, of all living and nonliving coastal zone resources.
4. Avoid irreversible and irretrievable loss of coastal zone resources.

5. Use ecological planning principles and assumptions in the determination of the suitability of permitted development.
6. Limit public expenditures that subsidize development in coastal high-hazard areas.
7. Protect human life against the effects of natural disasters.
8. Direct the orderly development, maintenance, and use of ports identified in s. 403.021(9) to facilitate deepwater commercial navigation and other related activities.
9. Preserve historic and archaeological resources, which include the sensitive adaptive use of these resources.

The State of Florida's "coastal zone" includes the area encompassed by the state's 67 counties and its territorial seas, and therefore the Coastal Management Element is critical. Communities that prepare a coastal management element address the Coastal High-Hazard Area, an area particularly vulnerable to the effects of coastal flooding from disasters (the area below the elevation of Category 1 Hurricane Storm Surge Line). Florida Statutes (§163.3178(2)(d)) provides further criteria for addressing hazard mitigation and safe population evacuation. These planning requirements are supported by the integration of Hazard Mitigation Planning and the Regional Evacuation Studies.<sup>18</sup>

The comprehensive plan is an important planning tool for communities, as it is an advantageous place to incorporate adaptive strategies into a community's land-use decision-making framework. The associated implementation procedures established in a comprehensive plan may relate to land development regulations, environmental permitting requirements, and government funding protocols [or priorities]. All proposed and approved development in the community is reviewed for consistency with the comprehensive plan and its procedures. Florida statute also enables citizens to challenge local development decisions approved through local development review processes (e.g., zoning hearing boards).

## Identify Policy and Funding to Accomplish Goals

Adaptation Action Areas are about protecting existing infrastructure in the short term while using other mechanisms to reduce vulnerabilities and evolve communities in the long term. Funding can be prioritized for Adaptation Action Areas, reducing risk in the most cost efficient way. It is important to maintain a balance between the urgency of current risks and the foresight to plan for future impacts. Adaptation planning and action is incremental and relies on using the best available data at the time and on understanding the useful life of the investment. Consideration of all possible options and the related costs and benefits for each will allow for a "no-regrets strategy" to be designed.

Local governments wishing to designate Adaptation Action Areas, can consider creating the policy framework within the Coastal Management Element of their comprehensive plan. In order to set the stage for designating Adaptation Action Areas, local governments may consider policy language which:

- Recognizes the value of, and states the intent to, designate Adaptation Action Areas to improve the resilience of built and natural areas to coastal flooding and related impacts of sea-level rise;
- Provides the criteria to consider when identifying areas of concern for potential designation;
- Describes mechanisms the local jurisdiction may use to create the actual designation; and,

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<sup>18</sup> <http://www.floridajobs.org/hazardmitigationplanning>

- Possibly identifies potential funding mechanisms to implement the adaptation action needed.

### Fort Lauderdale's Funding Considerations

The Fiscal Year Budget for Fort Lauderdale is designed to prioritize annual resources in a way that will incrementally and efficiently guide the City towards the 2035 Vision. The five-year Community Investment Plan considers current and future improvement projects. The plan has been aligned in the context of the 2035 Vision priorities. These tools and plans can be supplemented with Foundation, State, and Federal Grants. For some ideas specific to Florida, Broward County has compiled a database of funding sources:

<http://www.broward.org/GOGREEN/MUNICIPALITIES/Pages/CommunityWideInitiativesandGrants.aspx>

The challenge for coastal communities is going to be: (1) how to tailor traditional planning tools to the impacts and timeframe of sea level rise; and, (2) how these tools can be used to support the development of new, creative ways to also tackle sea level rise as a complex multi-faceted issue.

It is also beneficial to design plans and tools in alignment with other local governments within the region. Local governments may consider infusing adaptation policies universally to all of their planning documents beyond the Coastal Management Element (CME) of a comprehensive plan. Policies can be linked to any or all of a plan's elements. For example, adaptation projects could be identified in the Five-Year Schedule of Capital Improvements within the Capital Improvements Element, or policies outlining specific coordination efforts can be adopted within the Intergovernmental Coordination Element.

In addition, a coastal community's efforts to adapt the built environment to climate related impacts can be written to supplement the Florida Building Code, land development and zoning regulation, emergency management plans, local mitigation and post-redevelopment plans, water resource management plans, transportation plans, flood control and stormwater management plans, community redevelopment plans, and future visioning plans. Coastal communities may consider coordinating efforts with their respective regional Water Management District's plans, Metropolitan Planning Organization's Long Range Transportation Plan, applicable public school district's adopted five-year work plan, and applicable local and regional natural systems and park management plans, such as the Comprehensive Everglades Restoration Plan.

## Folding Results into Comprehensive Plan Amendments

Criteria for Adaptation Action Areas may reference the state statute for Adaptation Action Areas and identify more specific local concerns that fall within the state guidelines. Once the local government adopts a comprehensive plan policy to use Adaptation Action Areas to improve community resilience, mechanisms for designating the geographical borders of an Adaptation Action Areas may vary based on internal procedures. The options may include, but are not limited to:

- Designation in the comprehensive plan through narrative description of the location on maps;
- Use of the capital improvement plan;

- Adoption of a resolution or an ordinance; and,
- Review and support by a jurisdiction’s sustainability board.

### Miami-Dade incorporates Adaptation Action Areas into its Comprehensive Plan

Miami-Dade County’s Comprehensive Development Master Plan’s (CDMP) Evaluation and Appraisal Report, adopted in 2011, has incorporated Adaptation Action Areas in a 2013 update. These policies now form a sound foundation for Miami-Dade County to begin actively incorporating these considerations into existing capital investment and infrastructure planning processes. CDMP language on Adaptation Action Areas includes the following wording:

(LU-3K). By 2017, Miami-Dade County shall determine the feasibility of designating areas in the unincorporated area of the County as Adaptation Action Areas as provided by Section 163.3177(6)(g)(10), Florida Statute, in order to determine those areas vulnerable to coastal storm surge and sea level rise impacts for the purpose of developing policies for adaptation and enhance the funding potential of infrastructure adaptation projects.



## Submission and Processing of Amendments

DEO’s Bureau of Community Planning website<sup>19</sup> has a page that outlines an expedited state review process that applies to all comprehensive plan amendments. There are several documents which provide instructions for the submittal process, including a flowchart (Figure 17 and Figure 18), guidelines for amendment preparation, and citizen challenge procedures. As illustrated in the flowchart, the “Proposed Phase” is centered on the review process, and the subsequent “Adopted Phase” relates to compliance checks.

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<sup>19</sup> <http://www.floridajobs.org/community-planning-and-development/programs/comprehensive-planning/amendment-submittal-and-processing-guidelines/expedited-state-review>

Figure 17: Comprehensive Plan Amendment, Proposed Phase Process

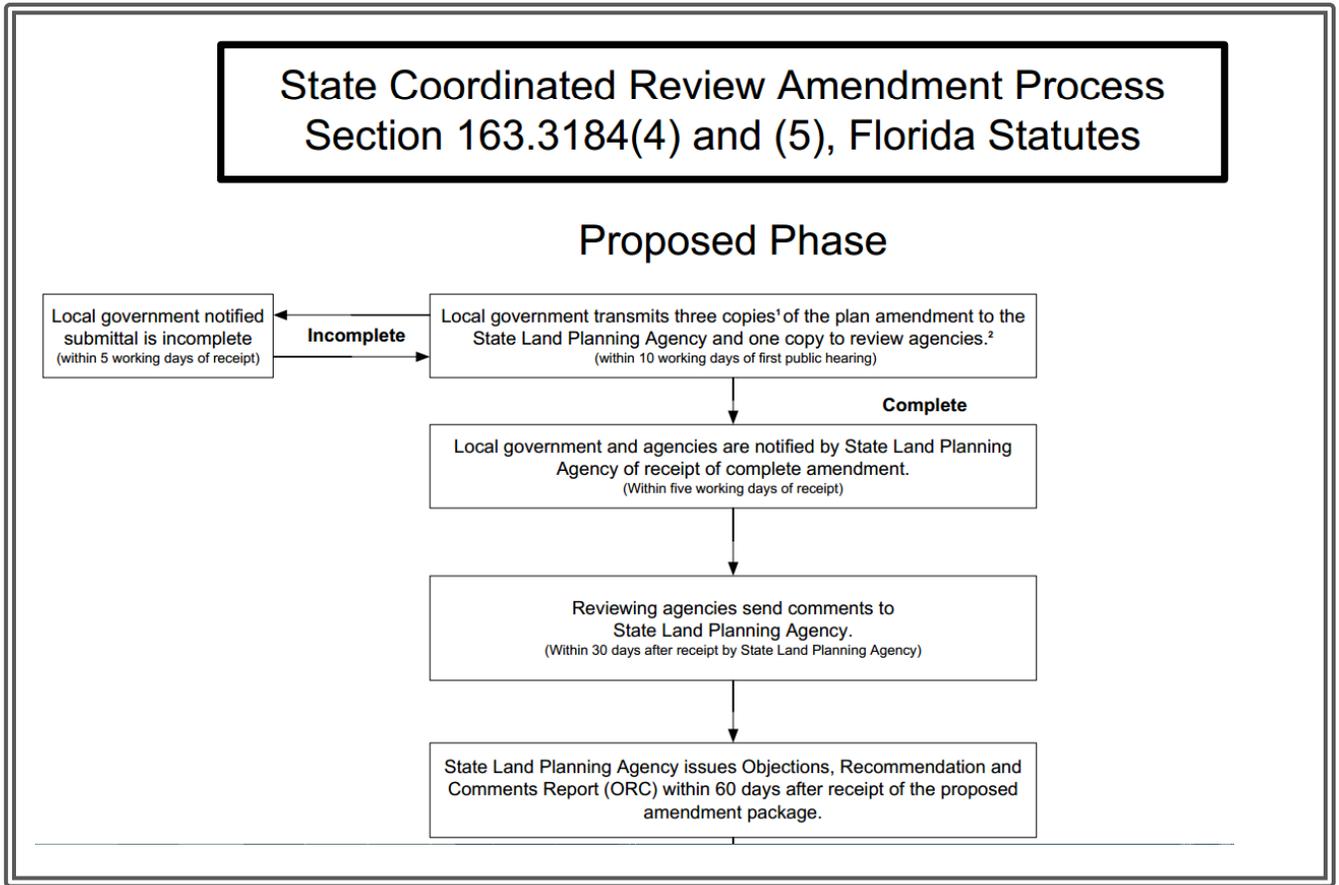
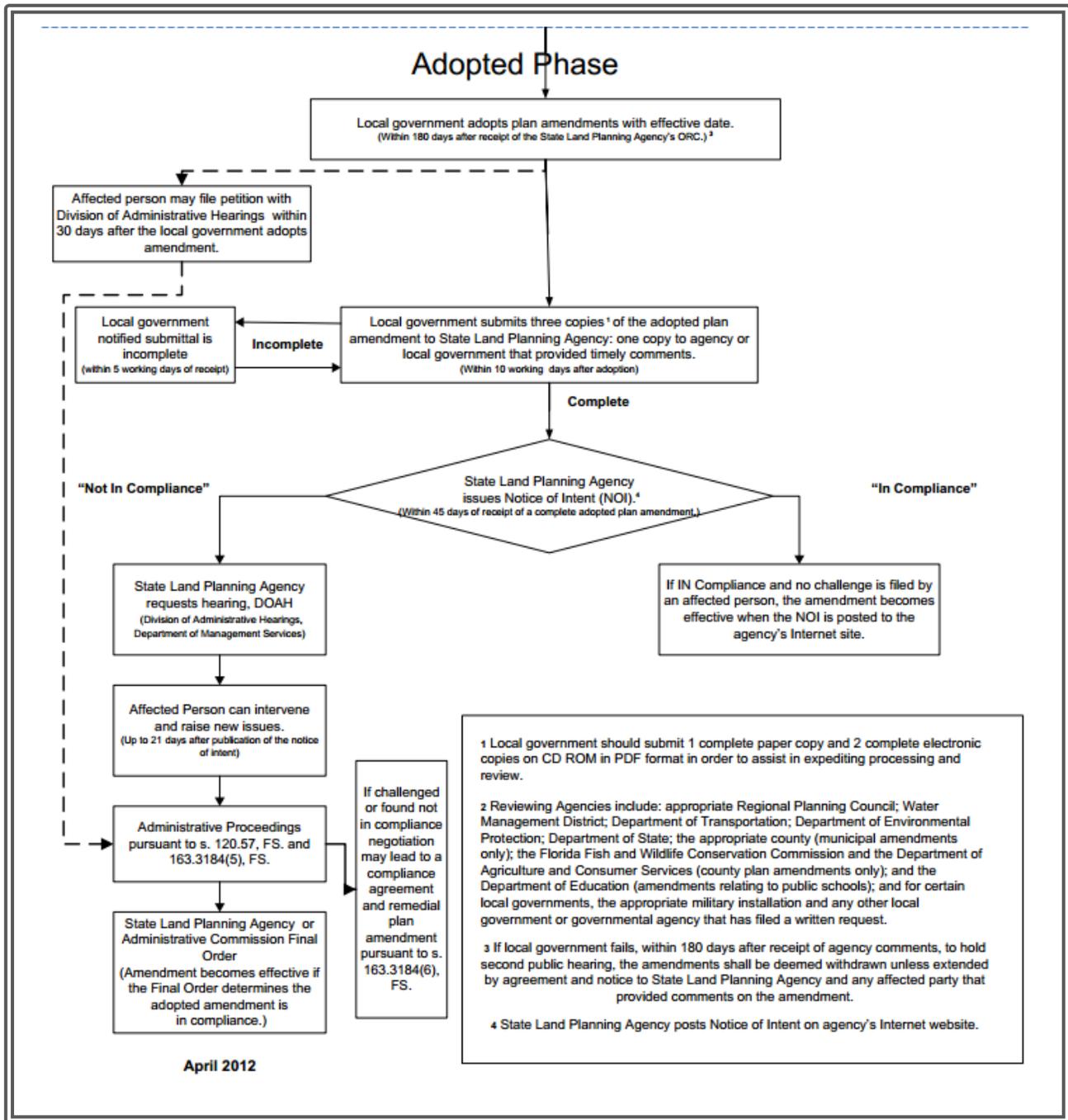


Figure 18: Comprehensive Plan Amendment Process, Adopted Phase



The comprehensive plan amendment process has been streamlined at the state level to assist communities who wish to plan proactively for adaptation planning, amongst other activities. As such, an Adaptation Action Area may be easily integrated into the Coastal Management element after a community has engaged with the other activities suggested by this guide. Once a hydrologic connection to the coast and vulnerability to storm surge, high tides, and potential sea-level rise impacts have been considered by the community (see §163.3164, Fla. Stat. (2014)), the community may designate areas for resilient responses (more on Adaptation Action Areas in the Introduction, page 7). If a community would like more information about the

process through which they may adopt an Adaptation Action Area into municipal ordinance, they are encouraged to contact the State Plan and Amendment Processing Office at the following link: <http://www.floridajobs.org/community-planning-and-development/programs/comprehensive-planning/amendment-submittal-and-processing-guidelines>

When drafting your community's amendment it is important to consider all assets, as listed in the textbox, *Recommendations for Increasing Granularity of Plan Amendments*, on page 70. This textbox lists some tips for addressing a wide range of issues, including transportation, facilities, and collaboration.

### **Considerations for Increasing Clarity of Plan Amendments**

- Consider referencing all transportation resources/facilities instead of listing examples (roads, bridges, transit infrastructure).
- Consider structuring policy to provide for the designation, modification, or removal of Adaptation Action Areas solely through comprehensive plan amendments. This approach would, among other things, ensure that the public, reviewing agencies, and others are able to find information on Adaptation Action Areas designated in the community in one document.
- Consider expanding policy to incorporate collaboration relating to consideration of Adaptation Action Areas designations, possibly with reference to partners.
- Consider addressing saltwater intrusion impacts that may occur when elevating roads and modifying conveyance structures.
- Consider addressing legal issues of who is responsible.
- Consider impacts associate with different designations. How can your community address off-site impacts?
- Consider the design life of affected transportation facilities and consider the planning horizon used, sea level scenarios, and adaptation strategies (i.e., 2060 may be sufficient for roads but 2100 is more in line with the design life of bridges, which is about 80 years).

## Integration into other Municipal Documents

The comprehensive plan was addressed first in this chapter because comprehensive plans often serve as a community's primary blue print, laying out community goals and aspirations. Alongside this focal document, other community visioning processes and strategic planning efforts may welcome the inclusion of Adaptation

Action Areas designation. This section discusses a number of other documents into which Adaptation Action Areas can be integrated.

Integration of Adaptation Action Areas into other municipal plans, ordinances and land development codes can be approached in an incremental fashion, meaning the community and the planning team may integrate one Adaptation Action Area strategy or all strategies relative to a specific aspect of sea-level rise (e.g., infrastructure; open space), and then return to the integration process when convenient.

In approaching the integration process, this guidebook recommends that communities consider the completion of a checklist of regulatory documents and update times so that Adaptation Action Area strategies may be adopted on a schedule that conforms to the community's existing or projected schedule of adoption and implementation activities. An example checklist is illustrated in Table 6 below and more extensively in Appendix 3: *The Adaptation Action Area Checklist*, on page 110.

Table 6: Community Plan Checklist (excerpt) – See Appendix 3: *The Adaptation Action Area Checklist*

EXAMPLE DOCUMENTS	ADOPTION YEAR	DO INTEGRATION OPPORTUNITIES EXIST?
Municipal Comprehensive Plan		
All-Hazards Mitigation Plan		
Floodplain Management Plan		
Evacuation Plan		
Emergency Response Plan		
Continuity of Operations Plan		
Disaster Recovery Plan		
Post-Disaster Redevelopment Plan		
Capital Improvements Plan		
Economic Development Plan/Strategy		
Coastal Plan or Element		
Shoreline Restoration Plan		
Open Space Plan		
Stormwater Management Plan		
Historic Preservation Plan		
Zoning Ordinance		
Flood Damage Prevention Ordinance		
Subdivision Ordinance		
Building Code		

As shown by Table 6, options abound for a community to integrate Adaptation Action Area language and maps into other documents. Of the nineteen shown here, the Capital Improvements Plan (CIP) often draws

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its influence on project scheduling directly from the comprehensive plan, and may be the first place in which a community who wishes to integrate Adaptation Action Areas into the comprehensive plan will see strategies being addressed by monetary allocations. Readers will also recall zoning ordinances, building codes, and floodplain management from the Adaptation Strategies Toolkit section (see page 49). Because the designation of an Adaptation Action Area is flexibly written in Florida Statute, the benefits the Areas may confer relate to numerous mitigation and growth management tools already in existence to protect the welfare of community residents.

Like the larger checklist in Appendix 3, this table acts as a management tool whereby community officials may keep track of the assortment of policy documents whose uses intersect along Adaptation Action Area lines. Although readers are encouraged to keep in mind the recommendations made in the “Considerations for Increasing Clarity of Plan Amendments” box on page 70, the authority of different plans to direct areas that the comprehensive plan may not address could entail several final integrations of the local Adaptation Action Area language.

From the Fort Lauderdale Pilot integration activities, the community created an initiative to designate Adaptation Action Areas in the City’s Strategic Plan: *Press Play Fort Lauderdale*. Then, upon conducting the adaptation planning activities set forth earlier in this guide, and having adopted it into the comprehensive plan, the language appears forty times in reference to infrastructure projects programmed in the City’s Community Investment Plan. The box on page 73 illustrates further description of Fort Lauderdale’s multiple-plan coordination. The City’s efforts provides an excellent example of how integration activities can produce a trickle-down or diffusion effect.

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**City of Fort Lauderdale’s  
Integration of Adaptation into Strategic Plan &  
Community Investment Plan (CIP)**

“In the next five years, the City will focus on continuing our progress by proactively lining pipes, inspecting and cleaning water lines, and creating Adaptation Action Areas and traditional gray and natural green infrastructure, such as water retention parks and bio-swales. Roads, sidewalks, and bridges need smart investments and maintenance in ways that meet resiliency and daily transportation needs. While prior generations made significant investments to ensure that we have sound infrastructure, we are now responsible for maintaining and preparing for future challenges and demands” (p. 22).



**02 OBJECTIVE 2:**  
Reduce flooding and adapt to sea level rise

STRATEGIC INITIATIVES:	LEAD:	PARTNERS:
1. <b>» Incorporate sea level rise and resiliency projections into the Stormwater Management Plan and the Flood Hazard Mitigation program</b>	PWD	FLFR, BC, Compact, Seven50, SFWMD
2. Implement the Stormwater Management Plan and examine funding rate structures based on vulnerability	PWD	BC, Compact
3. Implement the Flood Hazard Mitigation Program for residents	PWD	CMO-BDGT, DSD, FLFR, BC, FDEM, FEMA
4. Utilize a multi-agency advisory group to evaluate and implement solutions to address flooding concerns	PWD	BC, Consultant
5. Identify potential Adaptation Action Areas (AAA) and develop AAA policies	PWD	DSD, FLFR, T&M, PNZ, CA, DEO, DEP, NOAA, SFRPC
6. Examine and update the Save Our Swales program to include bio-swale options	PWD	Neighbors

» indicates an idea from the Vision Plan. For more information on strategic initiative partners, see [Cylinders of Excellence Community Partners](#)

As shown above, the City of Fort Lauderdale integrated resiliency and adaptation into the Infrastructure section of the City’s Strategic Plan. In the Objectives section, the City also identified a lead department responsible for action, as well as partners that that will be available for support during implementation. Objective # 2 from the Strategic Plan has since been incorporated into the City’s Community Investment Plan (CIP) for 40 infrastructure projects.

**City of Fort Lauderdale  
Community Investment Plan (CIP)**

FY 2015 - FY 2019

**CITYWIDE STORMWATER MODEL**

**PROJECT#: 11869**

**Description:** This project is for a Citywide Hydraulic Stormwater Model that will determine and prioritize areas needing future infrastructure improvements.

**Justification:** A Stormwater Model incorporating sea level rise, climate change and higher groundwater elevations is necessary to determine high-risk areas, impacts to properties, and the improvements required to address the issues.

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As different groups may be assigned Adaptation Action Area strategies to implement, they may also work toward a strategy's adoption into a regulatory document as part of the schedule of activities so that the strategy's implementation is multifaceted and reaches across the range of local policy frameworks.



The implementation phase of Adaptation Action Area planning provides planning teams with exciting and immediate results: the integration of the Adaptation Action Area ordinance into municipal plans, codes or land development ordinances. This chapter recommends that a community optimize its Adaptation Action Area language to be adopted into a variety of plans and codes, and examines the comprehensive plan amendment process as it currently is handled by the state land planning agency (DEO). By referring to this section, a community may have a roadmap to guide them through the process of enshrining their multifaceted effort to integrate future coastal flood hazard resilience into their plans and ordinances.

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## Chapter 6: Conclusion

Adaptation planning will serve to enhance the resilience of Florida communities by prompting them to consider future potential coastal flooding hazards and creatively develop responses to those hazards. Adaptation Action Areas, a subset of that planning effort, can represent the end product of, or engine behind, numerous component activities that support adaptation planning. This guidebook has endeavored to provide readers with a panorama of the adaptation planning process currently developed by the Community Resiliency Initiative at DEO, and to then hone in on the particular sub-components that have proven most relevant to Adaptation Action Area planning, as tested through the South Florida Regional Planning Council, Broward County, and City of Fort Lauderdale pilot project.

In the Appendices to the guidebook, full details of the Fort Lauderdale pilot, including the Adaptation Action Areas ordinance language, are provided, as well as case studies from some other communities at the cutting edge of adaptation planning. Appendix 3: The *Adaptation Action Area Checklist*. This *checklist* provides prompts and discussion points to consider, including:

- Municipal documents that may be considered during the integration process;
- Risk and vulnerability assessments;
- Public engagement opportunities;
- Planning integration;
- Disaster preparedness and recovery processes; and,
- Hazard mitigation implementation.

By developing this guidebook, it is our hope that readers will be able to serve themselves and their communities better once they have explored the resources herein.

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#### City of Fort Lauderdale

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## Appendix 1: Case Studies



CITY OF FORT LAUDERDALE

### Fort Lauderdale, Broward County Pilot

The City of Fort Lauderdale has successfully created a policy framework for designating Adaptation Action Areas. In addition, the City has developed a suite of aligned plans to ensure that the goals and long range aspirations of the Comprehensive Land Use Plan are met: the updated Sustainability Action Plan, the Strategic plan entitled, “Press Play Fort Lauderdale: Our City, Our Strategic Plan 2018,” and a community vision plan for the city, entitled, “Fast Forward Fort Lauderdale: Our City, Our Vision 2035.” As part of the vision, Fort Lauderdale encourages Adaptation Action Areas to be viewed as a tool that contributes to enhance resilience, maintaining property values and allowing for business opportunities. The City has weaved Adaptation Action Areas into the fabric of local government by taking the policy language and inserting it into these and other existing plans. The City of Fort Lauderdale has extensive involvement in the Southeast Florida Regional Climate Change Compact in their work on adaptation.

#### *Introduction*

Anchored in the central coastal area of Broward County, Fort Lauderdale is a bridge between the City of Miami metro area and West Palm Beach. The tri-county area makes up the Southeast Florida Metropolitan Statistical Area (MSA), the sixth largest in the United States. With over 170,000 residents, Fort Lauderdale is a destination location for over 10 million tourists that visit Broward County annually and spend close to \$10 billion.

In 2013, The City of Fort Lauderdale embarked on a journey of creating a policy framework for the designation of Adaptation Action Areas. On June 17, 2014, the City Commissioners voted unanimously to transmit a comprehensive plan text amendment to the Coastal Management Element which included a goal, objective and fourteen policies related to Adaptation Action Areas to the Florida Department of Economic Opportunity (DEO), for review. As the state’s primary land planning agency, DEO is a key player in guiding and approving land use plans and amendments.

The South Florida Regional Planning Council (SFRPC) was also a key player in facilitating the process. SFRPC is the planning and public policy agency which works with public and private leadership in the South Florida region to achieve a vision of the future.

Fort Lauderdale’s success is due largely to the City’s approach, which consisted of a uniquely designed combination of:

- **Partnerships and Support** - Fort Lauderdale and Broward County were engaged by DEO, in partnership with the Florida Department of Environmental Protection (FDEP) and the National Oceanic and Atmospheric Administration (NOAA). The SFRPC has documented the process through a wide variety of resources including videos, a Guidebook, and a Case Study for the pilot community of Fort Lauderdale;
- **Community Engagement** – Continuous outreach via a diverse range of avenues allowed the City to gauge community concerns and ideas, as well as to inform residents about resilience opportunities;

- **Integration** – The alignment of Adaptation Action Areas with the City’s vision, strategy, budget, and planning fortifies all components; and,
- **Capacity Building** – The City organized numerous staff training events to introduce new language and designs. A NOAA staff training event engaged staff in the importance these issues (for more information, see: <http://collaborate.coast.noaa.gov/climateadaptation/Ft%20Lauderdale%20Florida%20Training>).

Throughout the process, the majority of residents and city staff were already aware of coastal challenges, as they have been experiencing tidal flooding, erosion, and other issues related to drainage and water management.



Figure 19: NOAA staff training January 14-16, 2014

### *Sea Level Rise and Coastal Challenges in Fort Lauderdale*

The immediate sea level rise impacts that Fort Lauderdale is currently experiencing include higher storm surge, higher tides, reduced storm water capacity, increased flooding, and saltwater intrusion. Over time, sea level rise vertically raises the foundation (or base water depth) which storm surge and extreme tides build upon. Fort Lauderdale has a significant amount of land that is at low elevations and already vulnerable to tidal flooding and storm surge (Figure 20 and Figure 21).

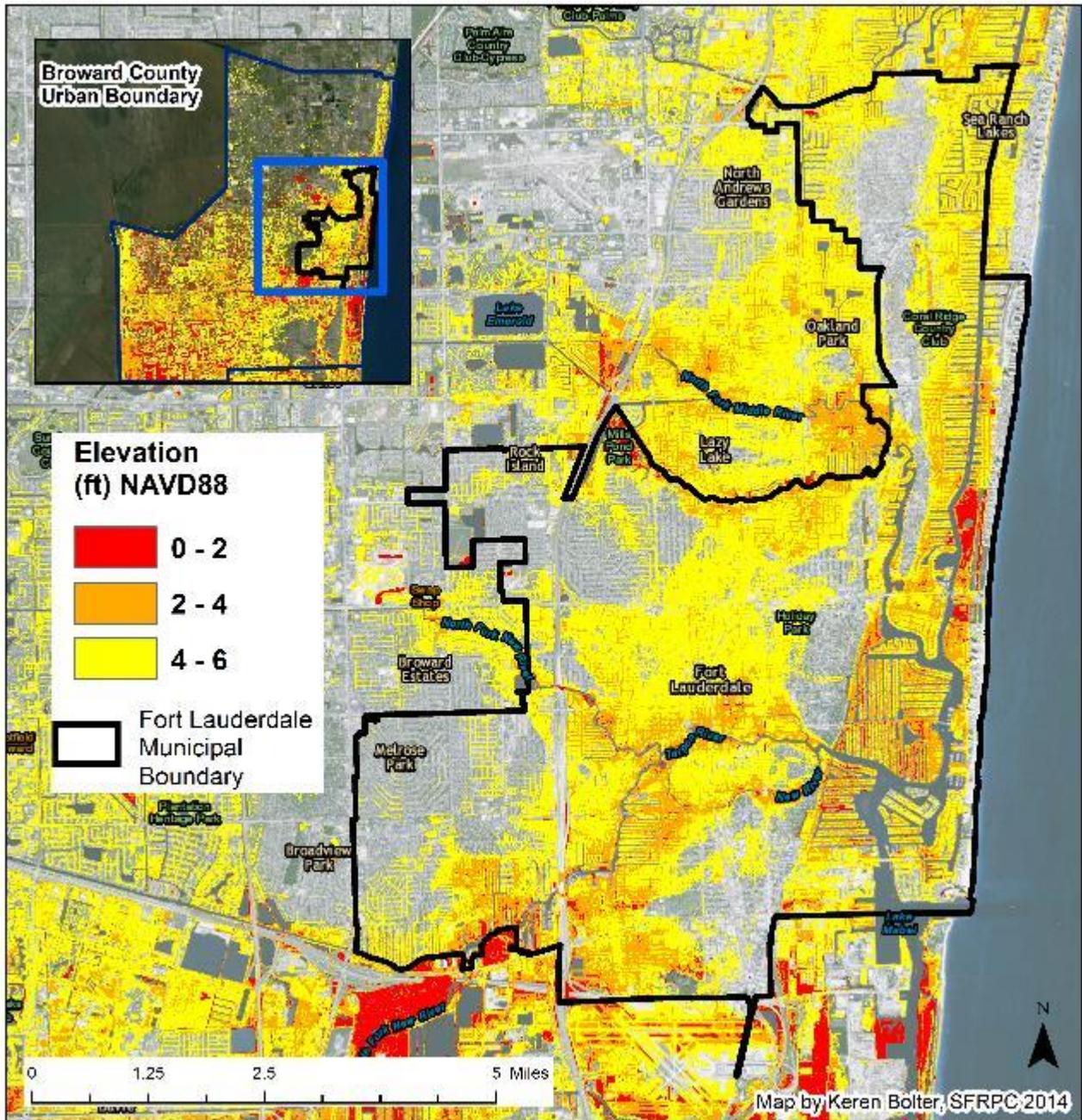


Figure 20: Broward County Inundation Areas

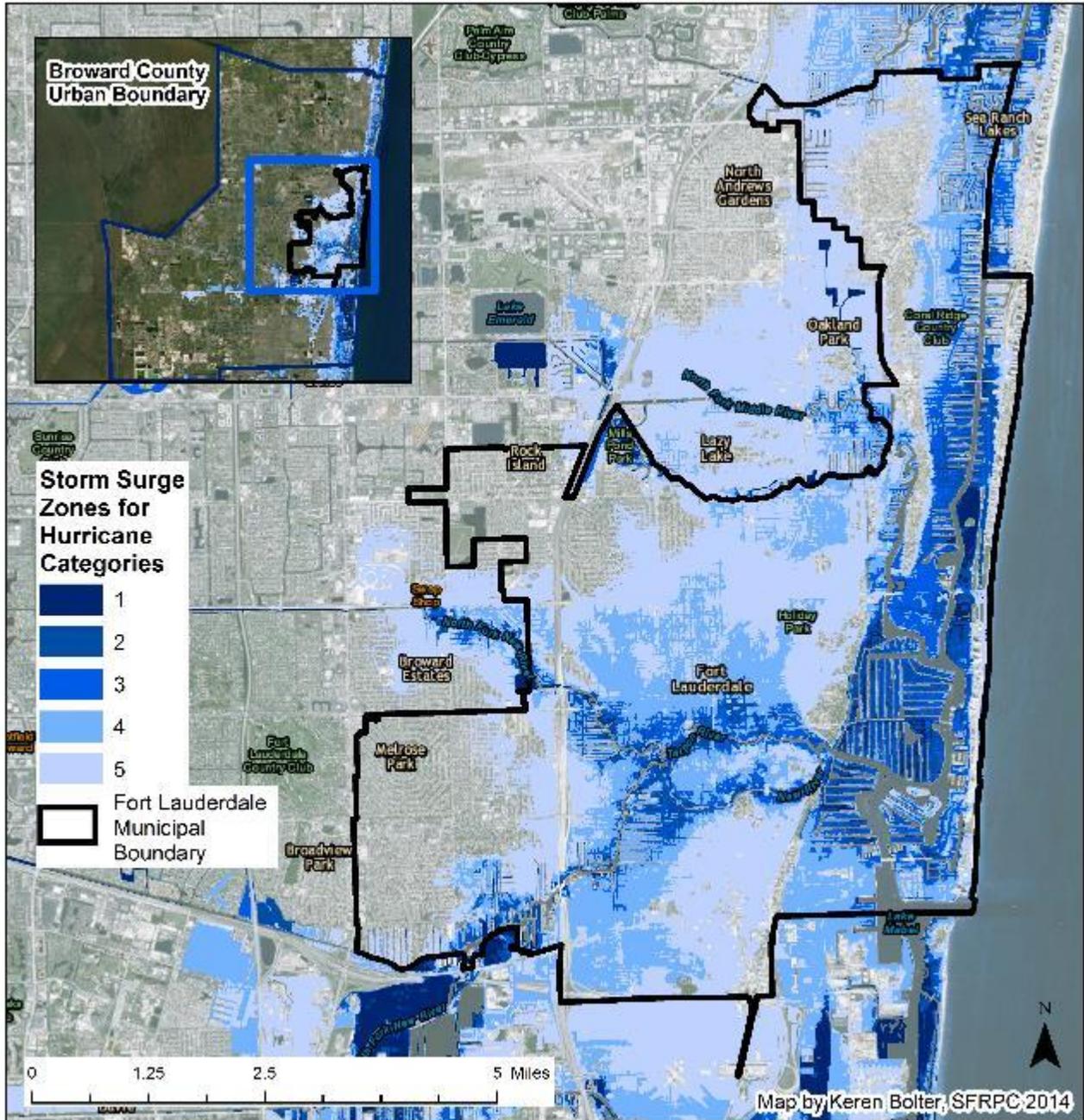


Figure 21: Broward County Storm Surge Zones<sup>20</sup>

Saltwater intrusion is also a threat due to potential contamination of fresh water aquifers, deterioration of structural materials, and groundwater lifting. Sea level rise exacerbates the landward advancement of an intrusion of seawater that underlies the Biscayne Aquifer. The groundwater is pushed higher towards the land surface increasing the threat of inland flooding. As water seeps up from below the ground and saturates the soil, storage capacity is reduced. This is a unique threat that cannot be solved by traditional methods of shoreline protection. Saltwater intrusion can also contaminate coastal potable well fields.

<sup>20</sup> Source: National Hurricane Center SLOSH Model – description at [http://www.sfrpc.com/SRESP%20Web/Vol7-11\\_Broward.pdf](http://www.sfrpc.com/SRESP%20Web/Vol7-11_Broward.pdf)

In the fall of 2012, Hurricane Sandy weakened natural and built coastal armory (i.e., seawalls) in the off-shore Atlantic Ocean areas of Fort Lauderdale, and one month later high seasonal tides coupled with a strong onshore wind resulted in severe erosion of the remaining beach. Man-made losses connected to the beach erosion included the collapse of a four blocks of State Road A1A, a seawall, sidewalk and a traffic signal mast arm. Fort Lauderdale shut down two lanes of traffic on the road as the Florida Department of Transportation (FDOT) began emergency repairs. The process for repairing A1A and restoring the beach both in the short-term as well as the long-term was a collaboration among FDOT, the City of Fort Lauderdale, and Broward County.

That same month, Fort Lauderdale hosted a community meeting attended by over 200 residents that came to voice their concerns and recommendations on next steps. Public opinion was considered during the design process, resulting in a new long-term design that was engineered to be resilient to a wide range of foreseeable coastal hazards. The four lanes were reduced to three, the setbacks were increased, and dunes were included. A new fortified seawall made of metal sheet pilings was driven 40 feet into the ground. The final design for the road was actually adopted by FDOT as a resilient prototype to use for all future repairs and updates to the entire length of State Road A1A, which hugs Florida's east coast.



Figure 22: A1A November 2012

While the City has been well aware of the increasing threat of erosion as sea levels rise, this event prompted many city residents to consider balancing prioritization of shoreline protection against traffic and scenic vista concerns. With the City's distinctive vulnerability to coastal hazards, the City was also characterized by a number of well-developed capacities that made it an exemplary candidate

for being a pioneer in adaptation.

- Fort Lauderdale has engaged staff and elected officials that are committed to infusing sustainability into all aspects of the City;
- Breaking down silos is crucial for success. The City participates in countywide and regional efforts to address adaptation opportunities; and,
- Adaptation Action Areas have the potential to expand the range of policy options, funding opportunities, and support at the state and federal level.

As mentioned in the balloon on page 20, “We are Ready” is an emphasized section of Fort Lauderdale’s vision plan. This means being prepared for extreme tides, flooding, and storm surge. The City’s resiliency, sea level rise, and natural resource protection goals include:

- Strategically investing in infrastructure, drainage systems, bridges, and roads;
- Protecting assets from inclement weather and high tides; and,
- Managing increased water supply demands.



Figure 23: SFRPC Director Jim Murley at the Climate Adaptation Open House on January 21, 2014

Fort Lauderdale has been carefully folding resiliency and adaptation into their Strategic Plan, Vision Plan, and Sustainability Action Plan. The City capital budget prioritization methods have shifted towards supporting the stated goals. The City’s outreach includes an annual “Neighbor Survey”, stakeholder interviews, town hall meetings with the Mayor and City Commissioners, Meetings-in-a-Box, and an interactive website ([OurVisionFTL.com](http://OurVisionFTL.com)) complete with social ideation in the development of vision plan. There were also two key events during the Vision process, the *Big Ideas Fort Lauderdale* and the *Neighborhood Summit* in 2012, in which residents’ advocated for the need to improve the city’s infrastructure to protect against inclement weather and high tides. The annual Neighbor Survey results showed that most of the residents surveyed have observed coastal water levels rise or increased flooding since they have established residency in the city.

This understanding of resident concerns, coupled with a strategic approach, gives Fort Lauderdale an advantage for proactive planning. Feedback from these events helped to feed into the Adaptation Action Areas process. Building from these interactions, a “Climate Adaptation” Open House took place during the development of the Adaptation Action Areas comprehensive plan amendment.



Figure 24: Mayor Jack Seiler at the Open House

As residents brought up issues such as flooding and resilience on their own, this direct feedback was the basis for establishing a need for the evolution of related information and education. The results provided the foundation upon which to recommend Adaptation Action Areas to the community and the commission as a tool for improving community resilience.

### *Identifying Adaptation Action Areas Opportunities*

The City continues to find ways to connect priorities. On June 24<sup>th</sup> and 25<sup>th</sup>, 2014, Fort Lauderdale hosted a Riverwalk Activation and Climate Adaptation Technical Assistance Panel (Technical Assistance Panel), which was facilitated and organized in collaboration with the Urban Land Institute. The Panel focus on the Riverwalk, a highly valuable, pedestrian friendly amenity located downtown.

The City of Fort Lauderdale Riverwalk Technical Assistance Panel process highlights included:

Riverwalk Activation and Climate Adaptation  
**Technical Assistance Panel**  
 for the City of Fort Lauderdale, Florida



- Representatives from the Urban Land Institute (ULI) Southeast Florida/Caribbean District Council met with city staff to discuss issues related to developing long-term strategies for the Riverwalk District's resiliency; and,
- ULI Southeast Florida/Caribbean District Council staff researched the City's goals for the Technical Assistance Panel and, based on that research, selected the Technical Assistance Panel members who had the expertise most tailored to addressing the issues raised by city staff.

The Technical Assistance Panel received a complete set of pre-meeting briefing materials about the Riverwalk and its planning history. The final report listed considerations to implement recommendations, one of which stated, “Consider pursuit of Adaptation Action Areas designation for the Riverwalk to leverage sea level rise adaptation funds and connect those funds to public [space] improvements,” and went on to discuss adaptation planning laws in Florida Statute.



Figure 25: The October 2010 high tides along the Riverwalk

As a theme to move forward, the report suggested that Fort Lauderdale embrace living with the water as a new mantra. That means accommodating it where possible and fortifying the city against it where appropriate. It also means designing for the transitional edge where the water meets the built environment. Solutions for the surrounding properties focus on using elevations where parts of structures are raised to higher elevations and lower levels are designed for more passive uses that can be flooded and still retain value. For example, structures may be moved to higher topographical elevations in the Adaptation Action Areas while low lying, flood prone areas are left open (see *Design with Nature* - Ian McHarg, 1969).



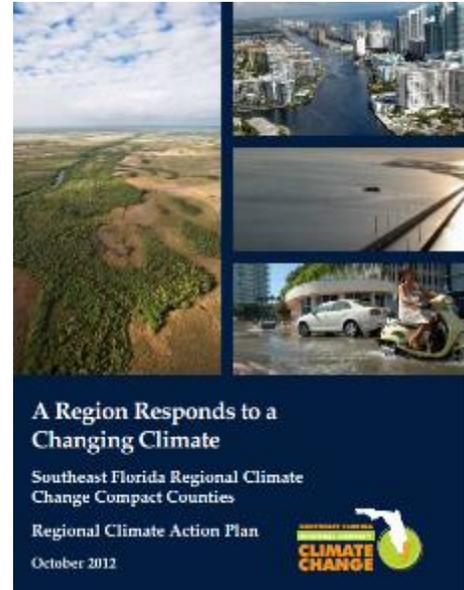
Figure 26: Extreme tides at the Historic Stranahan House

### *Outcomes and Achievements*

In following the 3-step process outlined in this section of the case study, the City has three main outcomes that will support the newly adopted policy:

- 1) **Understanding baseline risk** using the extensive vulnerability assessments, guides and tools created by the Southeast Florida Regional Climate Compact (SFRCC) and Broward County. These documents are tailored to the specific characteristics of the Southeast Florida Region:

- a) Regional Climate Action Plan & Implementation Guide (SFRCC);
  - b) A Unified Sea Level Rise Projections for Southeast Florida (Broward County);<sup>21</sup>
  - c) Analysis of the Vulnerability of Southeast Florida to Sea Level Rise (SFRCC); and,
  - d) Health Impact Assessment (Broward County & Florida Institute for Health Innovation (formerly known as the Florida Public Health Institute).
- 2) **Identifying community goals via conversations** with various audiences ensured that the public and decision-makers were actively engaged throughout the development process. Both wide-spread and targeted outreach efforts offer many advantages to gain support and understand concerns early in the process. In Fort Lauderdale, the majority of residents that participated in outreach efforts had characterized themselves as being concerned and insistent that the government move forward to identify adaptation opportunities and take action.
- 3) **Identifying planning tools and initiatives** to implement Adaptation Action Areas. The Administration and Implementation Element of the Fort Lauderdale Comprehensive plan contains definitions for each of the strategies for Adaptation Action Areas as defined in this Guidebook. See the full language of the [Coastal Management Element](#) and the [Administration and Implementation Element](#) for more details.



One of the Fort Lauderdale Coastal Management Element’s goals is to “increase the City’s resiliency to the impacts of climate change and rising sea levels by developing and implementing adaptation strategies and measures in order to protect human life, natural systems and resources and adapt public infrastructure, services, and public and private property.” As an evaluation measure, the City plans to identify public investments, infrastructure and assets at risk from rising sea levels by 2018. Thereafter, this assessment will be performed every five years. Adaptation strategies to achieve this planning goal may include, but not be limited to:



Figure 27: High tide flooding in Fort Lauderdale

<sup>21</sup> Regional Climate Action Plan Available at:

<http://southeastfloridacompact.org/pdf/Regional%20Climate%20Action%20Plan%20FINAL%20ADA%20Compliant.pdf>

- a. Public infrastructure planning, siting, construction, replacement, operation and maintenance;
- b. Emergency management;
- c. Stormwater management;
- d. Land development regulations;
- e. Building codes;
- f. Comprehensive planning; and/or,
- g. Other strategies.



## Broward County Partnerships

Broward County is home to approximately 1.8 million residents. The county contains 431 square miles of urban area in the eastern portion and 796 square miles of conservation area in the west, mostly comprised of Water Conservation Areas, which are integral to Florida’s Everglades ecosystems.

Broward County has earned numerous awards for their collaborative work on climate impacts and planning, including the National Planning Excellence Award from the American Planning Association (APA). This award recognized the County’s efforts to address climate change today by being the first to add a Climate Change Element as part of their Comprehensive Plan, which specifically describes and sets goals for Adaptation Action Areas. Broward County was recently recognized by the Southeast Florida Clean Cities Coalition as one of five organizations that made outstanding contributions in support of the Coalition's goal of reducing dependence on imported oil and improving the environment by creating a sustainable fuel market.

Broward County, a leader in adaptation and coastal hazard planning, has developed an extensive suite of plans and tools:

- Broward County provided an early foundation for Action Area guidance as it was the first community to integrate Adaptation Action Area language into its comprehensive plan, through their nationally recognized Climate Change Element, which establishes a framework for integrating the economic, environmental, and social factors of changes to the climate into future planning and land use decisions. The County is the first local government to adopt such detailed policy direction focused on planning for climate related impacts.
- Broward County's Enhanced Local Mitigation Strategy has comprehensive sections which focus on sea level rise in the context of risk assessment and economic vulnerability, including a loss estimation and mapping impacts of 1, 2, and 3 foot sea level rise scenarios.
- Broward County is committed to supporting and assisting the County's 31 incorporated municipalities designate Adaptation Action Areas, as needed, in order to prepare and strengthen the community's resilience.
- Using the Priority Planning Areas for Sea Level Rise Map as a basis for identifying areas especially vulnerable to sea level rise, Broward County and its municipalities will use the Adaptation Action Areas designation to develop policies for adaptation and enhance the funding potential of infrastructure adaptation projects.

The Broward County Climate Change Element represents an important milestone in adaptation planning in Florida as the County is the first local government to adopt such detailed policy direction focused on planning for climate related impacts. The Climate Change Element establishes a framework for integrating the economic, environmental, and social factors of changes to the climate into future planning and land use decisions. Objective 19.3 directs the County to "develop adaptation strategies for areas vulnerable to climate-related impacts". Those vulnerable areas have been identified in the Broward County Land Use Plan's "Priority Planning Areas for Sea Level Rise Map", illustrating areas that are at increased risk of flooding due to, or exacerbated by, sea level rise over the next 50 years.

The associated Priority Planning Areas policies direct the County to discourage land use plan amendments that would place additional residential and non-residential development at risk of flooding from sea level rise. Unlike all other counties in the state, it is important to note that Broward's charter provides the County government countywide land use authority established with the passage of Chapter 59- 1154, Laws of Florida, Special Acts of 1959. The County has also committed itself to coordinate with its local municipalities to help designate Adaptation Action Areas, using the Priority Planning Areas in order to identify vulnerable areas and to enhance funding opportunities for adaptation projects.

Broward County is holding itself accountable through Policies 19.3.4 and 19.3.7, requiring the County to update its "Priority Planning Area for Sea Level Rise Map" and infrastructure vulnerability assessments, every five years, so that decisions regarding adaptation planning and investments can be based on best available data.

## Southeast Florida Regional Recognition

The Southeast Florida Regional Climate Change Compact (The Compact) has been given global attention for its local adaptation planning achievements. The Compact's efforts are recognized internationally as a pathway to a long-term solution. Fort Lauderdale, Broward County, and SFRPC have been key players in the ongoing efforts of the Compact. The Compact has been acknowledged by ICLEI and the National Association

of Counties, receiving multiple awards of excellence. The Compact's activities were highlighted as a model for regional collaboration in the 2014 National climate assessment. The Compact has been asked to lend support and resources by the White House Domestic Policy Council, the White House-Interagency Adaptation Task Force, and it is referenced within the Task Force's Final Report and Council on Environmental Quality (CEQ) progress reports to the President. The Compact, a partnership of Broward, Miami-Dade, Monroe, and Palm Beach Counties, represents regional cooperative framework designed to set the agenda for adaptation planning in the region. In addition, the Compact provides a means for state and federal agencies to engage with technical assistance and support.

The Compact has been successful in amending Florida planning legislation to incorporate efforts to address sea level rise, and prioritize funding for this purpose. The Compact hosts an annual summit to bring key partners together to learn about new projects, ideas, and research relating to regional impacts for the Four County Regional Climate Action Plan. In addition to this plan, the Compact has produced several key documents to guide local governments including:

- Mayors' Climate Action Pledge;
- Southeast Florida Regional Climate Action Plan;
- Southeast Florida Regional Climate Action Plan Implementation Guide;
- A Unified Sea Level Rise Projection for Southeast Florida;
- Regional Greenhouse Gas Emissions Inventory: Baseline Period 2005 -2009; and,
- Analysis of the Vulnerability of Southeast Florida to Sea Level Rise.

With 109 municipalities and nearly one-third of Florida's population, the Compact has not been alone in this effort. The compact works with government agencies, such as the South Florida Water Management District, the Florida Department of Transportation (FDOT), the Florida Department of Economic Opportunity (DEO), National Oceanic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), and the U.S. Army Corps of Engineers to reinforce the technical and science-based aspects of adaptation; as well as with international non-profits, such as Institute for Sustainable Communities (ISC) to build up local and national partnerships. ISC has actively supported the Compacts efforts to involve the community and to bolster regional governance and local initiatives.

The State of Florida, primarily via Florida Department of Economic Opportunity (DEO), sees its role as providing technical assistance, funding, and other kinds of support to local governments working with their region and state to create the best opportunities for merging growth with resilience. DEO recognizes the need to modify approaches accordingly as new information is available. While local governments take lead, the State will support them by providing updates on the latest tools and data and by suggesting optional guidelines and how they may be utilized.

In Year 2 of its Community Resiliency Initiative, DEO worked with South Florida Regional Planning Council to incorporate a local community in a pilot project to development and implement Adaptation Action Area policy. Adaptation Action Areas policy has so much potential because it comes from State Legislation. The policy acknowledges that issues exist and it offers the state-wide availability of a framework and a common point of reference to address them. The policy is flexible and optional, and it is possible to tailor the range of tools, strategies, and plan modifications to any community.

The City of Fort Lauderdale Adaptation Action work is part of a Project of Special Merit funded by NOAA and coordinated through the Community Resiliency Initiative, focused on developing and implementing Adaptation Action Area policy, advancing partnership between the City of Fort Lauderdale, Broward County, South Florida Regional Planning Council and the Southeast Florida Regional Climate Compact. The collaboration in support of this initiative is to serve as an example to create guidance for statewide dissemination.

## Lessons Learned in Fort Lauderdale Pilot

Adaptation Action Areas are an excellent opportunity for resilience planning. Many existing and potential plans can be leveraged to ensure that Adaptation Action Areas wording is so ingrained in policy that it will sustain turnover of managers and elected officials. The key pieces of advice that the Fort Lauderdale staff unanimously agreed upon were:

- Make your policy language broad and flexible. Use adaptive management to keep short-term solutions flexible for a wide range of long-term scenarios;
- As alignment with other plans is being organized, this gives room to address the intent of the policies;
- If something doesn't work, the policies allow space to step back and try something new;
- Be methodical and strategic about your choice of words in terms of jumping too far ahead; and,
- When communicating about increased vulnerability, provide factual information and avoid negative language that may alarm constituents. Gradually progress from short-term solutions to long-term solutions over time. These incremental steps will ease the process and make goals more attainable.

The extensive consideration of public opinion is advantageous, when presenting funding requests, as the request directly relates to priorities identified by engaged community members. Susanne M. Torriente, Assistant City Manager, says her best advice to other cities is to integrate Adaptation Action Areas into fabric of local government and the budget process. Take the new language and put it into existing government lingo. Susanne highlighted that integration is an ongoing process. In 2015, the City plans to revise their design standards for infrastructure to integrate climate resiliency and sustainability into planning, designing and construction. Susanne says, "We aren't having the climate change debate – We see sea level rise happening now and we are dealing with it. We are local government. We are at the front line. We have to deal with these issues in a practical manner. We are creating the local government of the future to deal with the City of the future."

## Satellite Beach

Over one-half of the barrier island of Satellite Beach is below 6 feet (1.8 m), and the city is already planning for seasonal flooding (Parkinson & McCue, 2010). Much of the Atlantic shoreline in this Brevard County area is classified as “Critically Eroded” by the Florida Department of Environmental Protection. A 2009 study found that based on the topography, there was a tipping point at 2 feet of sea level rise, beyond which the flooding will create a hazard for many of the City’s assets. The city has a volunteer citizen committee serving on the Comprehensive Planning Advisory Board which recommends plan revisions and updates. All of the efforts and research have brought Satellite Beach much closer to resilience.

Satellite Beach is part of the Florida Department of Protection Grant Program’s Coastal Partnership Initiative. There are a wide variety of partners involved on the project team and the technical advisory team, from county officials to universities, and the Florida Department of Economic Opportunity. These efforts have supported with the development and application of Adaptation Action Area criteria and resiliency strategies for Satellite Beach. In 2013, Adaptation Action Area Policy was implemented, stating:

Objective 1.12A – Development and redevelopment within the City shall be permitted only when consistent with sound planning practices that shall protect life and property from the effects of coastal erosion, flooding, sea level rise, or damage to environmental systems.

Policy 1.12A.2 – The City of Satellite Beach designates the Adaptation Action Area (AAA) as that area which includes the Coastal High Hazard Area (CHHA) and other areas of the City as may be identified by the City Council in the future as being subject to coastal erosion, flooding, sea level rise, or damage to environmental systems



Figure 28: Inundation Areas in Satellite Beach

For more information, please visit:

<http://www.satellitebeachfl.org/Documents/CPAB%2010-28-13%20Agenda%20Packet.pdf>

<https://southeastfloridaclimatecompact.files.wordpress.com/2014/08/mccue-protecting-paradise-v2.pptx>

## The City of Punta Gorda

The City of Punta Gorda's Adaptation Plan is a local initiative, with regional support, that addresses the same issues identified in Adaptation Action Areas legislation. The Plan is the result of a cooperative decision-making process that was used within the Charlotte Harbor National Estuary Program to address diverse resource management concerns in the 4,400 square mile study area. Led by the Southwest Florida Regional Planning Council (SWFRPC), the partnership engaged citizens, elected officials, resource managers, and commercial and recreational resource users, all committed to maintain and protect the watershed.

The 2008-2009 plan used a vulnerability assessment to guide intensive and creatively coordinated communication with stakeholders and decision-makers. The resulting components led to specific implementation actions that were both effective and preferred by the community. The actions focused on facilitating natural habitats to increase resilience. The region was already building capacity by actions such as planning for hurricanes. The community opted for planned relocation in some places, and to build future infrastructure further inland. They also thought about which areas to armor, and whether armoring would be natural or artificial. SWFRPC's James Beever describes other changes, "Today's mangroves become sea grass, and flatwood becomes salt marsh." The region plans to maintain productive through these changes via restoration and the building of corridors for habitat migration along this gradient. James has been a leader for the region's climate readiness planning and has led many projects that stemmed in part from the plan. These include several Comprehensive Plan amendments, mapping/modelling efforts, and resiliency strategies for nearby counties. Other cities have done similar work utilizing Adaptation Action Areas.

### City of Punta Gorda Adaptation Plan



Southwest Florida Regional Planning Council  
Charlotte Harbor National Estuary Program  
Technical Report 09-4  
11/18/2009

James W. Beever III, Whitney Gray, Daniel Truscott, Don Cobb, Jason Ufey, David Hutchinson,  
John Gibbons, Tim Walker, Matt Stenshoel, SWFRPC  
April-Lisa H. Beever, PhD, ONC C1031P



Figure 29: Top and bottom right: Salt marsh and SWFRPC meeting; Below Left: Sunset view from Laisley Crab House in Punta Gorda

## The Towns of Yankeetown and Inglis

Levy County and the Towns of Yankeetown and Inglis have taken on resilience by using Adaptation Action Areas. Their project used a unique approach to planning for coastal change. The social, economic, policy and geographic attributes of the urbanized areas were inventoried, and to analyze predicted coastal change, Sea Level Affecting Marshes Model (SLAMM) model output for the area was provided courtesy of the Nature Conservancy. The results identify areas that are likely to experience the most intense coastal change due to future sea level rise. In response to the information produced by SLAMM analysis, the six proposed Adaptation Action Areas cover a variety of land-uses, each with a specific vulnerability, as shown in Figure 30. This includes the designation of Natural Resource Adaptation Action Areas, for which an ecological assessment was conducted and environmental monitoring continues to take place.

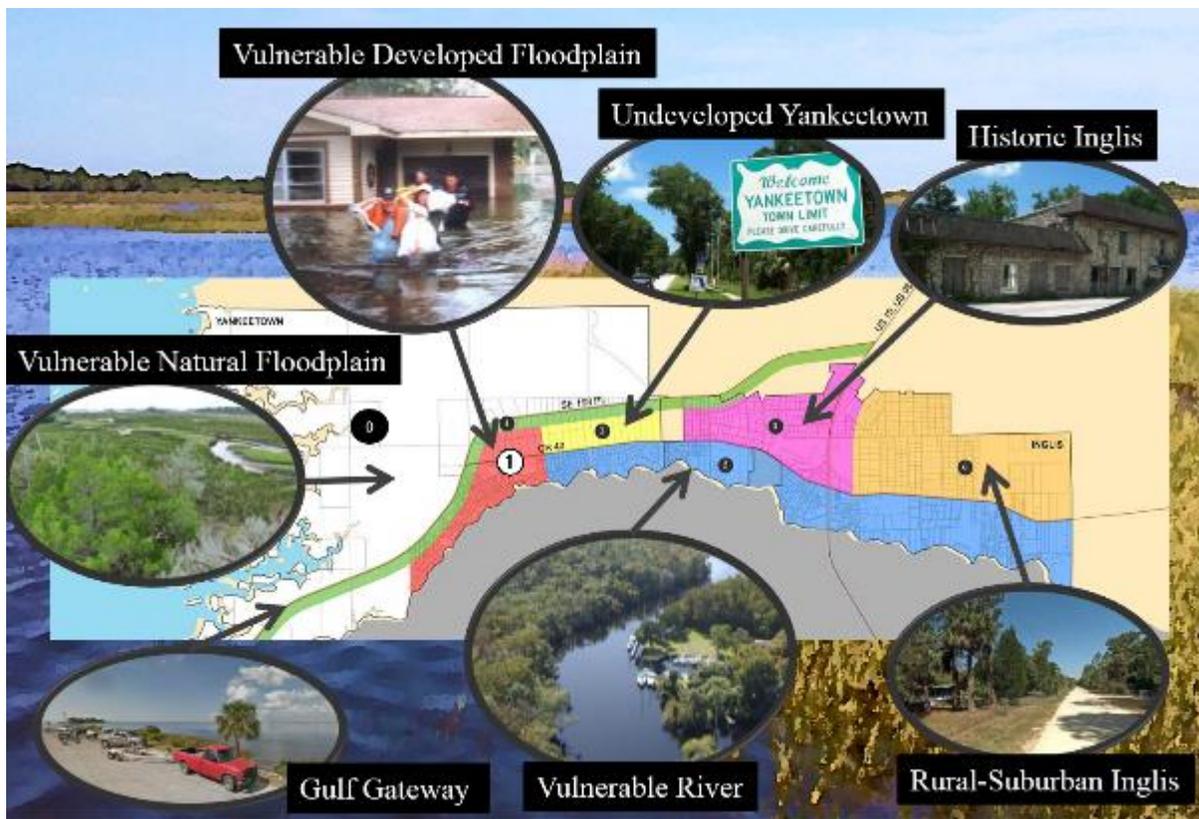


Figure 30: Yankeetown-Inglis Designated Areas

Next steps included site visits and community workshops to consider various adaptive design strategies. These allowed for the establishment of project goals and objectives. A SWOT analysis was conducted to identify strengths, weaknesses, opportunities, and threats, and to consider how these traits could be best addressed for reaching goals effectively. The spatial asset analysis results were merged with the vulnerability analysis and the local vision to produce recommendations and planning options for each Adaptation Action Areas.

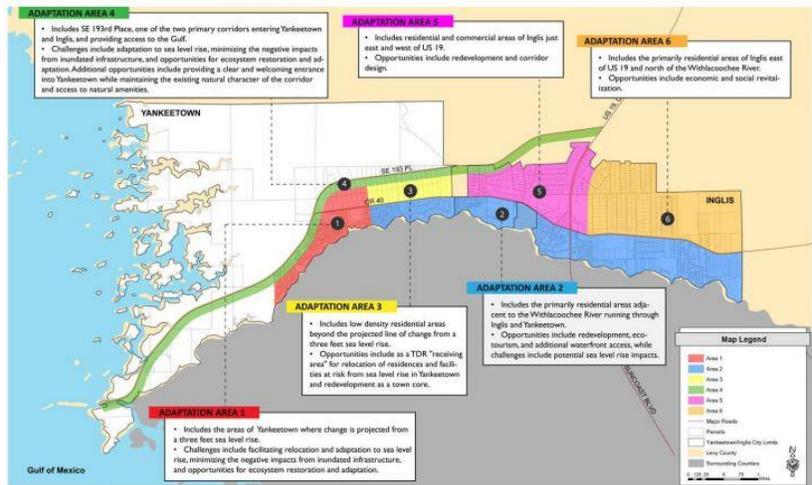


Figure 31: Additional Information: Yankeetown Designated Areas

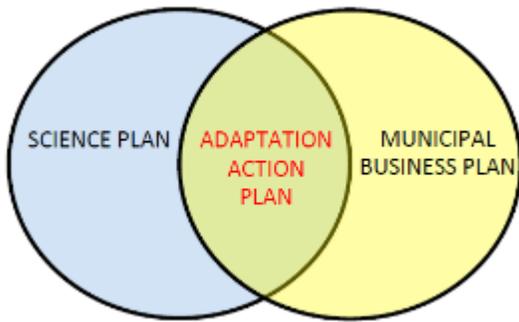


Figure 32: Intersections between Plans affecting the Adaptation Action Area Plan

Long-term adaptation strategies were considered based on both best available data and municipal considerations. The towns are considering implementation measures such as floodplain management, FEMA’s Community Rating System, and changes in the comprehensive plan and land development code. For specific adaptation strategies, protection, accommodation, and retreat were considered, as shown in Table 7. For more information see [www.ChangingLevyCoast.org](http://www.ChangingLevyCoast.org).

Table 7: Yankeetown Natural Resource Adaptation Action Areas (NRAAA) Adaptation Plan

PROTECTION	ACCOMMODATION	RETREAT
Living shorelines	Sea grass preservation	Buffer for habitat migration
Oyster reef creation /restoration	Saltmarsh preservation	Setback lines
	Species habitat creation	Rolling easements on the Withlacoochee Gulf Preserve

## The City of Satellite Beach

Over one-half of the barrier island community of Satellite Beach is below 6 feet (1.8 m), and the city is already planning for seasonal flooding (Parkinson & McCue, 2010). Much of the Atlantic shoreline in this Brevard County area is classified as “Critically Eroded” by the Florida Department of Environmental Protection. A 2009 study found that based on the topography, there was a tipping point at 2 feet of sea level rise (see Figure 33), beyond which the flooding will create a hazard for many of the City’s assets. The city has a volunteer citizen committee serving on the Comprehensive Planning Advisory Board which recommends plan revisions and updates. All of the efforts and research have brought Satellite Beach much closer to resilience.

Satellite Beach is part of the Florida Department of Environmental Protection Grant Program’s Coastal Partnership Initiative. There are a wide variety of partners involved on the project team and the technical advisory team, from county officials to universities, and the Florida Department of Economic Opportunity. These efforts have supported the development and application of Adaptation Action Areas criteria and resiliency strategies for Satellite Beach. In 2013, Adaptation Action Areas Policy was implemented, stating:

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<https://southeastfloridaclimatecompact.files.wordpress.com/2014/08/mccue-protecting-paradise-v2.pptx>



Figure 33: Inundation Areas of Satellite Beach

## How These Lessons Can Be Applied in Other Areas

For Adaptation Action Areas strategies to be successful and sustainable, each strategy must be both well-established and well-received. The scientific fundamentals of sea level change can be difficult to understand; this is compounded with the delicate ways in which the conversation can be politically charged. To address these issues, it is important to choose messages carefully. A coastal community may create and manage a sea level rise outreach campaign (see also, page 20) to inform community residents and business owners of:

- The potential impacts of sea level rise;
- The initiatives and programs the community will be or has implemented to address said impacts (such as Adaptation Action Areas designations); and,
- Develop a relationship and understanding of the community needs, including addressing vulnerable populations and health risks associated with sea level rise.

It is essential to tell people what they can do with the information they receive. Education campaigns prove much more useful when linked with targeted action or behavior change. It's the "why" that then relates to the change that is aimed for. Thus, in addition to the scientific planning techniques discussed above (Chapter 3: Conduct a Vulnerability Assessment, page 27), the community case studies emphasize the importance of stakeholder outreach and participation.

In 2012, The Federal Transit Administration, in collaboration with the American Public Transportation Association organized its third climate change adaptation workshop entitled: **Getting on the Right Track: Real-world Approaches to Climate Change Adaptation** ([http://www.fta.dot.gov/sitemap\\_14677.html](http://www.fta.dot.gov/sitemap_14677.html)). Some objectives of this workshop were to shape ongoing and future transit adaptation assessments by exploring successful approaches, to develop strategies for mainstreaming climate considerations as part of a transit agency's standard operating procedures and to gather ideas to inform adaptation planning.

Becky Lupes, from the Federal Highway Administration's Sustainable Transport and Climate Change Team, presented on "Lessons Learned from Climate Change Vulnerability Assessment Pilots" ([http://www.fta.dot.gov/documents/Lupes\\_FHWA.pdf](http://www.fta.dot.gov/documents/Lupes_FHWA.pdf)). The information box below (page 105) summarizes and adapts these findings to the present guidebook recommendations for adaptation planning.

While sound science is integral to the adaptation planning process, the outreach and inter-group coordination aspects may prove to be the most difficult to organize. Through these case studies, the guidebook has endeavored to show that committees, task forces, and other groups have aligned with community officials and planning teams to build consensus and buy-in for Adaptation Action Areas and associated planning efforts. Communities just embarking on the process are encouraged to reach out to DEO or one of the case studies described above for additional information and support.

### TIMING AND PLANNING CONSIDERATIONS

- Allocate more than one year for community outreach and planning.
- Define study objectives and scope up front.
- Who is the target audience? What products are needed? What level of detail is required?
- Select and characterize relevant assets- so you don't spend time collecting data on assets you aren't going to study.

### DESIGNING YOUR APPROACH

- Identify impacts of concern, and identify thresholds for impacts:
  - There are multiple approaches (see pages 32, 38).
- Depending on specific objectives, geographies, available funding:
  - It's an iterative process.
- Findings in one area influence data gathering or analysis in another.
- It is not a linear, step by step process.
- Increase emphasis on vulnerability rather than criticality.
- Consider political factors.
- Consider your objectives.
- Consider how to piece together networks (e.g. transportation) in differing formats.

### MESSAGING

- Focus on extreme events now and those being more common in the future:
  - "What keeps you up at night?"
- Focus on solutions and asset management:
  - Emphasize strategies that work rather than always "disaster".
- Use maps and pictures to share results.

## Appendix 2: City of Ft. Lauderdale Comprehensive Plan



CITY OF FORT LAUDERDALE

# CITY OF FORT LAUDERDALE COMPREHENSIVE PLAN

## PROPOSED GOAL, OBJECTIVE AND POLICIES LANGUAGE ADAPTATION ACTION AREAS

### CITY OF FORT LAUDERDALE COASTAL MANAGEMENT ELEMENT

#### GOAL 3:

Increase the City's resiliency to the impacts of climate change and rising sea levels by developing and implementing adaptation strategies and measures in order to protect human life, natural systems and resources and adapt public infrastructure, services, and public and private property.

#### OBJECTIVE 3.1:

Develop and implement adaptation strategies for areas vulnerable to coastal flooding, tidal events, storm surge, flash floods, stormwater runoff, salt water intrusion and other impacts related to climate change or exacerbated by sea level rise, with the intent to increase the community's comprehensive adaptability and resiliency capacities.

*Evaluation Measure: Collaborating with regional partners, City shall identify public investments, infrastructure and assets at risk from rising sea levels by 2018. Thereafter, this assessment will be performed every five (5) years.*

#### Policy 3.1.1:

Identify public investments and infrastructure at risk to sea level rise and other climate related impacts. Assess the vulnerability to public facilities and services, including but not limited to water and wastewater facilities, stormwater systems, roads, bridges, governmental buildings, hospitals, transit infrastructure and other assets.

#### Policy 3.1.2:

Adaptation strategies may include, but not be limited to:

- a. Public infrastructure planning, siting, construction, replacement, operation and maintenance
- b. Emergency management
- c. Stormwater management
- d. Land development regulations
- e. Building codes
- f. Comprehensive planning

g. Other strategies

Policy 3.1.3:

Adaptation strategy options may include the designation of Adaptation Action Areas (Adaptation Action Areas). As per Section 163.3164(1), Florida Statutes, an Adaptation Action Area is an optional designation within the coastal management element of a local government's comprehensive plan which identifies 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 and adaptation planning.

Policy 3.1.4:

Adaptation Action Areas' adaptation strategy options may include, but not be limited to:

- a. Protection
- b. Accommodation
- c. Managed retreat
- d. Avoidance
- e. Other options

Policy 3.1.5:

Considerations for Adaptation Action Areas designation may include, but not be limited to:

- a. Areas which experience tidal flooding
- b. Areas which have an hydrological connection to coastal waters
- c. Locations which are within areas designated as evacuation zones for storm surge
- d. Other areas impacted by stormwater/flood control issues

Policy 3.1.6:

As a basis for the designation of Adaptation Action Areas, the City will utilize the best available data and resources, such as the Unified Sea Level Rise Projection for Southeast Florida and Broward County's Priority Planning Areas for Sea Level Rise Map, in order to identify and understand the risks, vulnerabilities and opportunities to formulate timely and effective adaptation strategies.

Policy 3.1.7:

As deemed to be in the best interest of the City, the City Commission may designate or remove designation by means of, but not limited to, the following mechanisms:

- a. Community Investment Program (Capital Improvement Plan)
- b. City Commission Resolution or Ordinance
- c. Comprehensive Plan via location description or map
- d. Other mechanisms as appropriate

Policy 3.1.8:

Potential funding sources for the implementation of Adaptation Action Area's associated adaptation strategies include, but are not limited to:

- a. Federal and State grants and technical expertise assistance (in-kind)
- b. Local Stormwater Utility Fees and Community Investment Program (Capital Improvement Plan) prioritization
- c. Public/Private Partnerships

d. Other sources

Policy 3.1.9:

Integrate Adaptation Action Areas into existing and future City processes and City-wide plans and documents which may include, but not be limited to:

- a. Community Investment Program
- b. Local Mitigation Strategy
- c. Strategic Plan
- d. Sustainability Action Plan
- e. Stormwater Master Plan
- f. Comprehensive Emergency Management Plan
- g. Unified Land Development Regulations
- h. Other related processes, plans and documents.

Policy 3.1.10:

Align and be consistent with, to the extent possible, relevant and current national, state, and regional adaptation strategy documents such as the Broward County Climate Action Plan, Southeast Florida Regional Climate Action Plan and The President's Climate Action Plan as well as other regional strategic plans, disaster mitigation plans, water management plans, transportation/transit plans, and climate change plans.

Policy 3.1.11:

Participate in, when appropriate, coordinated governmental, non-governmental and other appropriate agencies' proposed application requests for funding adaptation implementation projects.

Policy 3.1.12:

Collaborate and coordinate with appropriate local, regional and state governmental agencies, to the extent possible, toward the implementation of Adaptation Action Area adaptation strategies.

Policy 3.1.13:

Based on evolving rising seas data and associated vulnerabilities, to allow for flexible adjustments, preserve future strategic adaptation implementation options to maintain maximum resiliency in response to new risks and vulnerabilities. The City will take advantage of new emerging data and technological opportunities.

Policy 3.1.14:

Continue to foster effective collaborations, partnerships and coordination with national, state, regional and local partners to identify risks, vulnerabilities and opportunities associated with coastal hazards and the impacts from sea level rise.

CITY OF FORT LAUDERDALE ADMINISTRATION AND IMPLEMENTATION ELEMENT

Add/Amend Comp Plan Administration and Implementation Element (VII. Definitions):

- a. Priority Planning Areas for Sea Level Rise Map, Broward County: Map which identifies and illustrates vulnerable areas within Broward County that are at increased risk of flooding due to, or exacerbated by, sea level rise over the next fifty (50) years. Broward County generated this map in partnership with the South Florida Water Management District and the National Oceanographic and Atmospheric Administration.

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- b. Protection: Strategies that involve “hard” and “soft” structurally defensive measures to mitigate impacts of rising seas in order to decrease vulnerability while allowing structures and infrastructure to remain unaltered. Two examples are shoreline armoring and beach renourishment. Protection strategies may be targeted for areas of a community that are location-dependent and cannot be significantly altered or relocated, such as downtown centers, areas of historical significance, or water-dependent uses. (Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels, South Florida Regional Planning Council, 2013)
  - c. Accommodation: Strategies that do not act as a barrier, but rather alter the design through measures such as elevation or stormwater improvements, to allow the structure of infrastructure system to stay intact. Rather than preventing flooding or inundation, these strategies aim to reduce potential risks. (Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels, South Florida Regional Planning Council, 2013)
  - d. Managed Retreat: Strategies that involve the actual removal of existing development, their possible relocation to other areas, and/or prevention of further development in high-risk areas. (Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels, South Florida Regional Planning Council, 2013)
  - e. Avoidance: Strategies that involve ensuring development does not take place in areas subject to coastal hazards associated with sea level rise or where the risk is low at present but will increase over time. (Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels, South Florida Regional Planning Council, 2013)
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## Appendix 3: The Adaptation Action Area Checklist

### COMMUNITY PLAN CHECKLIST

Documents	Adoption Year	Do Opportunities Exist to Integrate AAA Planning?
Municipal Comprehensive Plan		
All-Hazards Mitigation Plan		
Floodplain Management Plan		
Evacuation Plan		
Emergency Response Plan		
Continuity of Operations Plan		
Disaster Recovery Plan		
Post-Disaster Redevelopment Plan		
Capital Improvements Plan		
Economic Development Plan/Strategy		
Coastal Plan or Element		
Shoreline Restoration Plan		
Open Space Plan		
Stormwater Management Plan		
Historic Preservation Plan		
Zoning Ordinance		
Flood Damage Prevention Ordinance		
Subdivision Ordinance		
Building Code		

## RISK AND VULNERABILITY ASSESSMENTS

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Are previous coastal hazards and disasters identified and mapped through historical information, existing plans and reports, scientific knowledge, and local knowledge?		
Are hazard probability, frequency, magnitude, and duration defined?		
Are coastal erosion and/or shoreline change identified as a hazard?		
Is sea level rise identified as a hazard?		
Are <a href="#">historic rates of sea level</a> defined?		
Are conditions identified that could amplify the impact of a hazard, like storm surge inundation at a high tide or erosion rates on stabilized shorelines?		
Are maps used to define the spatial extent of coastal hazards? Such as:		
<ul style="list-style-type: none"> <li>• Flooding, e.g., <a href="#">Flood Insurance Rate Maps</a></li> </ul>		
<ul style="list-style-type: none"> <li>• Storm Surge: <a href="#">Sea, Lake and Overland Surges from Hurricanes (SLOSH)</a></li> </ul>		
<ul style="list-style-type: none"> <li>• Erosion, e.g., <a href="#">Shoreline Change Analysis</a></li> </ul>		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
<ul style="list-style-type: none"> <li>Cumulative Risk Assessments, e.g., <a href="#">Risk and Vulnerability Assessment</a></li> </ul>		
<ul style="list-style-type: none"> <li><a href="#">Sea Level Rise Inundation Maps</a></li> </ul>		
<ul style="list-style-type: none"> <li>Other:</li> </ul>		
<p>Are municipal planners or emergency managers trained in mapping the following risk mapping tools?</p>		
<ul style="list-style-type: none"> <li><a href="#">Flood Insurance Rate Maps (FIRMs)</a></li> </ul>		
<ul style="list-style-type: none"> <li><a href="#">Sea, Lake and Overland Surges from Hurricanes (SLOSH)</a></li> </ul>		
<ul style="list-style-type: none"> <li><a href="#">Shoreline Change Analysis</a></li> </ul>		
<ul style="list-style-type: none"> <li><a href="#">Cumulative Risk Assessment</a></li> </ul>		
<ul style="list-style-type: none"> <li><a href="#">Sea Level Rise Inundation Maps</a></li> </ul>		
<ul style="list-style-type: none"> <li>Other:</li> </ul>		
<p>Are emergency managers and planners aware of potential flooding extents in their community and risks related to sea level rise?</p>		
<p>Are emergency managers and planners aware of potential storm surge heights in their community?</p>		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Are local planners, emergency managers, and public works officials aware of the location of repetitive loss properties?		
Do the municipality track repetitive loss properties within the NFIP?		
Are maps used to spatially define vulnerabilities in relationship to risks?		
<ul style="list-style-type: none"> <li>• Populations, e.g., elderly, children, poor, disabled</li> </ul>		
<ul style="list-style-type: none"> <li>• Buildings, e.g., business and residential</li> </ul>		
<ul style="list-style-type: none"> <li>• Infrastructure, e.g., roads, schools, wastewater treatment facilities, hospitals, public works</li> </ul>		
<ul style="list-style-type: none"> <li>• Natural Resources, e.g., freshwater wetlands, forests, beaches</li> </ul>		
<ul style="list-style-type: none"> <li>• Historical Resources, e.g., historic districts, properties, and landmarks</li> </ul>		
<ul style="list-style-type: none"> <li>• Cultural Resources, e.g., libraries, museums</li> </ul>		
<ul style="list-style-type: none"> <li>• Economic Resources, e.g., major employers</li> </ul>		
Is the majority of the community in a V or A-zone?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Does the community contain lands within the Coastal Barrier Resource System?		
Has the municipality developed a build-out analysis using existing zoning ordinances?		
<ul style="list-style-type: none"> <li>If so, has the build-out analysis been compared to the extent of storm surge scenarios?</li> </ul>		
<ul style="list-style-type: none"> <li>Has the build-out analysis been compared to various sea level rise scenarios?</li> </ul>		
Have municipal employees utilized any of the following vulnerability assessment methodologies?		
<ul style="list-style-type: none"> <li><a href="#">Community Vulnerability Assessment Tool (CVAT)</a></li> </ul>		
<ul style="list-style-type: none"> <li><a href="#">Risk and Vulnerability Assessment Tool</a></li> </ul>		
<ul style="list-style-type: none"> <li>Hazard Assessment Tool</li> </ul>		
<ul style="list-style-type: none"> <li><a href="#">HAZUS-MH</a></li> </ul>		
<ul style="list-style-type: none"> <li>Other:</li> </ul>		
Are municipal employees trained in the use of FEMA's <a href="#">HAZUS-MH</a> ?		
Do any plans describe the damage and cost of previous storms, floods, or erosion?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Do any plans estimate future financial losses that may result from flooding?		
Do any plans estimate future financial losses that may result from sea level rise?		
Have risk and vulnerability assessments been shared with municipal planners, public works officials, transportation planners, and other appropriate municipal, county, or state officials?		
<ul style="list-style-type: none"> <li>• Direct Communication, e.g., email, mailer</li> </ul>		
<ul style="list-style-type: none"> <li>• Newspaper or Newsletter</li> </ul>		
<ul style="list-style-type: none"> <li>• Website</li> </ul>		
<ul style="list-style-type: none"> <li>• Public Presentations</li> </ul>		
<ul style="list-style-type: none"> <li>• Other:</li> </ul>		

## PUBLIC ENGAGEMENT ACTIONS

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Has the public been involved in the identification of historic storm impacts, such as storm surge elevations, flood-prone streets, beach erosion and overwash, or property loss?		
<ul style="list-style-type: none"> <li>• <a href="#">Participatory Mapping</a></li> </ul>		
<ul style="list-style-type: none"> <li>• Surveying</li> </ul>		
<ul style="list-style-type: none"> <li>• Focus Groups</li> </ul>		
Does the municipality have publicly visible <a href="#">high water mark signs</a> , storm surge elevation or projected sea level rise signs?		
Does the municipality provide the public with information on the natural and beneficial functions of floodplains?		
Does the municipality provide access to floodplain maps?		
Does the municipality publicize the availability of floodplain information to property owners and businesses?		
Does the municipality publicize the availability of floodplain information to insurance agents, real estate agents, and lenders?		
Does the municipality have a local hazard disclosure policy?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Does the municipality conduct outreach to floodplain residents at least once a year?		
<ul style="list-style-type: none"> <li>• Website</li> </ul>		
<ul style="list-style-type: none"> <li>• Brochures/Newsletters</li> </ul>		
<ul style="list-style-type: none"> <li>• Community Meetings</li> </ul>		
<ul style="list-style-type: none"> <li>• Television or Radio</li> </ul>		
<ul style="list-style-type: none"> <li>• Other:</li> </ul>		
Has the public been involved in defining an overall acceptable level of natural hazard vulnerability?		
Does the municipality provide residents with guidance on the development of Personal or Family Evacuation Plans?		
Does the municipality provide the public with <a href="#">flood mitigation information</a> ?		
Does the municipality refer homebuilders to FEMA's Coastal Construction Manual?		

**PLANNING INTEGRATION**

<b>Questions to Ask</b>	<b>How is this Information Useful in Planning for AAAs?</b>	<b>How Can This Be Implemented?</b>
Does the municipality have an adopted municipal comprehensive plan?		
Does the comprehensive plan explain the support and involvement of emergency managers, floodplain managers, coastal managers, and public works officials?		
Does the planning process documentation describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information, e.g., the All-Hazards Mitigation Plan, the Stormwater Management Plan, Capital Improvement Plan, etc.?		
Did the preparation of the comp plan involve a broad base of the community, such as public officials, civic organizations, businesses, and citizens?		
Does the comp plan provide a clear explanation of participation techniques used in its development?		
Does the municipal master plan identify resilience within its mission, vision, or goals?		
Are hazards addressed in the comp plan as individual elements?		
Are hazards addressed among the elements of the comp plan?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Does the plan identify potential coastal hazard impacts on infrastructure, land uses, housing, and community facilities?		
Does the plan make recommendations to reduce hazard vulnerability through land use planning?		
Does the plan identify how often it should be updated (6 years)?		
Are land uses compatible with coastal hazards?		
Are floodways and other frequently flooded areas zoned for open space or recreation?		
Does the community use subdivision regulations to ensure low densities within the floodplain?		
Does the community have a local ordinance to protect dunes, bluffs, or eroding cliffs from development or disturbance?		
Does the community have a local ordinance to protect wetlands?		
Does the community have an open space management plan?		
If so, does the plan identify floodplain management as a priority?		
Are managed lands maintained in a manner that provides flood protection?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Is the plan adopted as part of the municipal master plan?		
Is the plan updated in coordination with the municipal master plan?		
Does the municipality have a FEMA-approved All-Hazards Mitigation Plan?		
Is the plan multi-jurisdictional?		
Does the plan include multiple counties?		
Is the plan locally adopted?		
Was a Certified Floodplain Manager included in the hazard mitigation planning process?		
Does the All-Hazards Mitigation Plan identify the involvement of a broad base of your community, such as public officials, civic organizations, businesses, and citizens?		
Does the All-Hazards Mitigation Plan describe the support and involvement of local government departments and offices?		
Does the All-Hazard Mitigation Plan describe past mitigation efforts (i.e., shoreline stabilization, land acquisition, etc.), along with their costs and effectiveness?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Does the hazard mitigation plan provide a general explanation of the environmental, social, and economic consequences of failing to address natural hazards?		
Does the plan include municipal maps that indicate local hazard risks, such as flood zones, storm surge inundation, and erosion rates?		
Does the plan identify shoreline erosion as a hazard?		
Does the plan identify sea-level rise as a hazard?		
Does the hazard mitigation plan specify timelines for completing projects and achieving goals?		
Do mitigation goals correspond with measurable mitigation objectives?		
Is a process for intergovernmental coordination explained for mitigating natural hazards?		
Does the plan identify opportunities to incorporate hazard mitigation into existing planning mechanisms, e.g., land use planning, capital investments, shoreline restoration projects?		
Does the plan identify the federally required update frequency (5 years)?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Does the municipality have an adopted floodplain management plan?		
Is it incorporated as an element of the municipal master plan?		
Is it incorporated in the stormwater management plan?		
Is it incorporated in the All-Hazard Mitigation Plan?		
Does the municipality have a certified floodplain manager (CFM®) on staff?		
Does the municipality participate in NFIP?		
Does the municipality have a flood damage prevention ordinance?		
Does the municipality have a stormwater management plan?		
Was a certified floodplain manager included in the planning process?		
Does the plan identify low-impact regulatory options to decrease runoff, such as tree protection ordinances, impervious cover limits, riparian buffers, vegetated drainage channels, and cluster development?		
Does the plan identify runoff and drainage problems due to impervious surface?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Does the plan identify constraints if the municipality reaches impervious coverage levels allowed by land use and zoning designations?		
Does the plan describe the municipal responsibilities for inspection and maintenance of stormwater facilities?		
Does the plan identify how often it should be updated (6 years)?		
Does the community have a capital improvements plan?		
Does the plan consider the threat of coastal hazards when upgrading existing municipal infrastructure?		
Does the plan identify the threat of sea level rise on municipal infrastructure?		
Does the plan consider the threat of coastal hazards on proposed infrastructure projects?		
Were a licensed professional planner, engineer, and a certified floodplain manager involved in the planning process?		
Does the municipality have an Economic Development Plan or Strategy?		
Does the plan describe the stratification of existing job sectors?		

<b>Questions to Ask</b>	<b>How is this Information Useful in Planning for AAAs?</b>	<b>How Can This Be Implemented?</b>
Is the community's economic base diversified outside of tourism, maritime industries, and fisheries?		
Does the plan identify economic vulnerabilities due to coastal hazards?		
Does the municipality have a special area management plan, beachfront management plan, or shoreline management plan?		
Does the plan identify the threat of coastal storms and erosion?		
Does the plan identify the threat of sea level rise?		
Does the plan identify the vulnerability of wildlife and habitat to coastal hazards?		

**DISASTER PREPAREDNESS AND RECOVERY**

<b>Questions to Ask</b>	<b>How is this Information Useful in Planning for AAAs?</b>	<b>How Can This Be Implemented?</b>
Is the municipality recognized as a <a href="#">Storm Ready Community</a> ?		
Does the community have an emergency warning system?		
If the AAA is located along a river, does it have an <a href="#">early flood warning system</a> ?		
Does the community relay weather related threats to the public in at least two forms of communication?		
Does the community have an <a href="#">emergency operations plan</a> and /or a flood response plan?		
Does the plan describe a hierarchy of authority during emergencies?		
Does the plan identify first responders?		
Does the plan include a list of contacts for operators of municipal facilities?		
Is the plan a municipal plan?		
Is the plan a county or state plan?		
Does the plan indicate the required update frequency (3 years)?		
Does the community have a designated emergency operations center?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
If so, is it located outside of flood-hazard (AAA) areas?		
Does the community have a designated storm shelter either in or outside of its municipal boundaries?		
If the community does not have a designated storm shelter within the community, is there an established memorandum of agreement with a neighboring community or county to provide your constituents shelter?		
Does the AAA have an evacuation plan?		
Are responsibilities for municipal evacuation clearly defined?		
Does the plan identify the necessary time frame to evacuate residents and vacationers outside of storm hazard areas?		
Does the plan identify where evacuation routes are prone to flooding?		
Is there more than one route identified to evacuate the AAA?		
Does the plan identify the conditions that would spur a lane reversal?		
Does the plan identify local and state evacuation assistance programs for the following special needs?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
<ul style="list-style-type: none"> <li>Hospitals</li> </ul>		
<ul style="list-style-type: none"> <li>Nursing Homes</li> </ul>		
<ul style="list-style-type: none"> <li>Prisons</li> </ul>		
<ul style="list-style-type: none"> <li>Residents without Personal Transportation</li> </ul>		
<ul style="list-style-type: none"> <li>Elderly</li> </ul>		
<ul style="list-style-type: none"> <li>Disabled</li> </ul>		
Does the municipality have a volunteer Community Emergency Response Team (CERT)?		
Does the community have a portable communications system that can operate under poor weather conditions and when electrical power is not available?		
Does the AAA have Continuity of Operations Plan?		
In the event of a disaster, are procedures defined to conduct habitability and substantial damage assessments?		
Does the municipality store elevation certificates outside of flood-hazard areas?		
Does the community have a Post-Disaster Redevelopment Plan?		
Does the plan identify redevelopment opportunities outside of flood hazard and AA areas?		

<b>Questions to Ask</b>	<b>How is this Information Useful in Planning for AAAs?</b>	<b>How Can This Be Implemented?</b>
Does the plan advocate the use of Advisory Flood Maps to define post-disaster redevelopment building elevations?		
Does the plan identify opportunities to retrofit or relocate existing structures or infrastructure in hazard prone areas?		
Does the plan utilize risk and vulnerability mapping to determine the location of future development?		

## HAZARD MITIGATION IMPLEMENTATION

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Is the municipality active in the NFIP's <a href="#">Community Rating System</a> ?		
Does the municipality have a score of 8 or better? (1 being the best ranking)		
Has the municipality proposed the relocation of public buildings, critical facilities, or infrastructure out of flood hazard areas as a result of the All-Hazard Mitigation Plan or other planning tools?		
Has the municipality used its All-Hazard Mitigation Plan to propose retrofitting public buildings, critical facilities, and other infrastructure to withstand flood damage?		
Have building and permitting officials completed <a href="#">training</a> in <a href="#">FEMA's Coastal Construction Manual</a> ?		
Does the municipality provide property owners with <a href="#">guidelines to retrofit existing development for flood and wind risks</a> ?		
Have building and permitting officials completed <a href="#">training</a> on <a href="#">retrofitting flood-prone residential buildings</a> ?		
Does the municipality utilize any of the following tools to manage development in hazard prone areas?		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
<ul style="list-style-type: none"> <li>• Transfer of development rights or purchase of development rights</li> </ul>		
<ul style="list-style-type: none"> <li>• Conservation overlay districts or cluster development</li> </ul>		
<ul style="list-style-type: none"> <li>• Zoning for open or recreational space</li> </ul>		
<ul style="list-style-type: none"> <li>• Riparian and/or wetland buffer ordinances</li> </ul>		
<p>Does the municipality use land acquisition programs to buy-out or purchase land conservation easements in hazard prone areas?</p>		
<ul style="list-style-type: none"> <li>• <a href="#">Coastal and Estuarine Land Conservation Program (CELCP)</a></li> </ul>		
<ul style="list-style-type: none"> <li>• <a href="#">The Nature Conservancy</a></li> </ul>		
<ul style="list-style-type: none"> <li>• <a href="#">The Trust for Public Lands</a></li> </ul>		
<ul style="list-style-type: none"> <li>• Other:</li> </ul>		
<p>Does the community utilize impact fees, accommodation taxes or user fees to acquire properties in hazard areas?</p>		
<p>Does the municipality engage in dune and/or wetland restoration?</p>		
<p>Does the community utilize impact fees, accommodation taxes or user fees to pay for shoreline stabilization/restoration?</p>		

Questions to Ask	How is this Information Useful in Planning for AAAs?	How Can This Be Implemented?
Has the community used any of the following grant programs to implement mitigation projects?		
<a href="#">Hazard Mitigation Grant Program</a>		
<a href="#">Pre-Disaster Mitigation</a>		
<a href="#">Flood Mitigation Assistance</a>		
<a href="#">Repetitive Loss Claims</a>		
<a href="#">Severe Repetitive Loss</a>		
Community Development Block Grants		
Other:		

## Appendix 4: Additional Materials

### Table of Additional Adaptation Strategies, Applied by Management Category

The following table was originally published in a Guilford, Connecticut Community Coastal Resilience Plan and modified for application in Florida. It expands on the tools set forth in Table 5: Adaptation Strategies by Management Category, on page 61, introducing new strategies fitting the targeted asset for adaptation assistance.

Table 8: Adaptation Tools linked to Management Categories

MANAGEMENT CATEGORY	POSSIBLE TOOL
Management of coastal real estate and structures	Building Codes (freeboard, V zone Standards in A Zones)
	Acquisition of damaged properties
	Zoning Overlays
	Zoning Amendments
	Land Acquisition
	Coastal realignments through any of the above
Shoreline protection and management or coastal and near-shore lands	Hard shoreline protection
	Living shorelines
	Buffers for flood protection
	Land acquisition for tidal marsh migration
	Land conservation for tidal marsh migration
Roadway alterations and drainage considerations  (for more information, see Bloetscher et al., 2012)	Elevation of roadways/roadbeds
	Create/update/improve stormwater master plan
	Abandonment of certain roads (based on vulnerability and criticality assessment)
	Re-evaluation of emergency routes
	Increase stormwater pumping
	Improve drainage capacity with
	Added stormwater retention particularly along high priority roads
	Install new coastal salinity structures and retrofit existing ones
Protection of replacement of water supply wells and septic systems  (for more information, see Heimlich et al., 2009)	On-site retrofits of septic systems/sealing sewer system
	Community wastewater systems
	Extension of sewer system to eliminate onsite sewage treatment
	Individual water treatment systems
	Consideration of alternate water supplies
	Extension of water mains
	Water conservation

Source: <http://www.ci.guilford.ct.us/pdf/community-coastal-resilience-plan.pdf#page=9>