MIAMI SPRINGS

CITY OF MIAMI SPRINGS
VULNERABILITY AND RESILIENCY ASSESSMENT AND ADAPTATION ACTION PLAN

FUNDED BY

Florida Department of Environmental Protection

Sea Grant Florida

PREPARED BY

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Coastal & Marine Engineering

EXECUTIVE SUMMARY

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1. PROJECT BACKGROUND

Most of the City of Miami Springs is located in low-lying areas connected by the Miami Canal to Biscayne Bay and coastal waters, thus subjected to the perils of sea-level rise and the associated impacts to the City's critical infrastructure. Although the City of Miami Springs can be considered an inland municipality due to its location, it is vulnerable to the impacts of future storm surges and sea-level rise. The Flooding Vulnerability Map developed by Miami-Dade County shown in Appendix A, shows the areas of the City of Miami Springs that is vulnerable to storm surges and sea-level rise. Located close to the Miami International Airport and main communication lines like SR 27- W Okeechobee Road, Hialeah Express and SR-112 with connections to I-95 and SR-836 and the Palmetto SR-826, the City of Miami Springs plays a vital role in the local economy of South Florida.

Recent studies indicate that critical public infrastructure in Miami Springs, including access roads, bridges, utilities, parks, and conveyance systems, have already begun to show vulnerabilities to the current rising sea level, extreme rainfall, and seasonal high tides.

City of Miami Springs is taking a proactive approach to future flood resilience by performing a Sea Level Rise Vulnerability Assessment and Adaptation Study. The City has received funding by the Florida Department of Environmental Protection (FDEP) under the Resilient Florida Program to prepare a Vulnerability Assessment and Adaptation Plan to ensure compliance with the 2015 Peril of Flood legislation following the 2020 State of Florida Mitigation Action Plan guidelines.

Based on the Unified Sea Level Rise Projection for Southeast Florida updated in 2019 projects, the anticipated range of sea-level rise for the region from 2000 to 2120 is projected to rise 10 to 17 inches by 2040, 21 to 54 inches by 2070, and 40 to 136 inches by 2120. Specifically, the National Oceanic and Atmospheric Association (NOAA) intermediate-high projections are adopted for this study, and the King Tide elevations are mapped as a function of flood depth within the City's limits.

Upon completion of the collection of the background information on GIS and LIDAR available from the Miami-Dade County database, this report completes a vulnerability assessment to understand potential impacts of sea level rise hazards to the City's critical assets and operations through 2070 by addressing the following questions:

- **What areas of the City are most vulnerable to sea level rise impacts?**
- **What sea level conditions create critical scenarios that may result in widespread flooding that could affect the City operations?**
- **How does sea level rise affect critical assets?**
- **What are the potential next steps to prepare the City for sea level rise resilience?**

Upon completion of the Vulnerability Assessment exposure and sensitivity analysis this report provides a toolbox of potential adaptation strategies to address flood risks to the City's built infrastructure. This report includes planning and design guidance to provide a framework for considering sea level rise within the city's capital planning process. By preparing for future sea levels, the City of Miami Springs will become more resilient to future flood and storm events and remain a strong economic engine in the region.

Understanding the City's potential vulnerabilities is an essential first step to development of potential adaptation strategies that will protect infrastructure, maintain operational continuity, and increase the long-term resilience of the City.

2. GOALS AND OBJECTIVES

The main objective of this study is to conduct a vulnerability assessment, a resiliency evaluation and the development and assessment of several adaptation alternatives and strategies to reduce flood risk and economic impacts within the City due to sea-level rise, storm surge, rainfall events and other compound scenarios.

The ultimate goal is to provide a framework for resiliency that can benefit the City of Miami Springs for decades.

3. MIAMI SPRINGS INFORMATION AND MAPS

Miami Springs is located northwest of downtown Miami at 25°49'11"N 80°17'28"W.[6] It is bordered to the northeast by the City of Hialeah and to the southwest by the Village of Virginia Gardens. U.S. Route 27 runs parallel to the Miami Springs/Hialeah border. It leads east 6 miles (10 km) to its southern terminus at U.S. Route 1 in Wynwood, Miami, and northwest 4 miles (6 km) to Hialeah Gardens. To the south, Miami Springs is bordered by Miami International Airport.

According to the July 2022 United States Census Bureau, Miami Springs has a total area of 3.0 square miles (7.8 km2). 2.9 square miles (7.5 km2) is land and 0.1 square miles (0.26 km2) of it (3.55%) is water, and a population of approximately 14,000. Residential areas are made mostly of single-family dwellings with a limited number of apartments. Miami Springs also has a historic downtown area that includes professional offices, restaurants and small retail stores.

The core of Miami Springs (excluding the more recently annexed areas) is roughly shaped as a triangle with three definable sides. Northwest 36th Street forms most of the southern boundary, while the Miami River canal forms the northern/eastern boundary. Finally, the Ludlam Canal and Florida East Coast Railroad Yard delimit the western boundary.

The City of Miami Springs is vulnerable to Sea Level Rise (SLR) and storms due to its proximity to the coastline and connection to Biscayne Bay through the C-6 Miami Canal. The City contains diverse critical assets, including roadways, utilities, security facilities, public buildings and community centers. The vulnerability analysis focuses on the importance for the City to maintain the functional services it provides following a storm event on the critical assets identified in Table 1.

Table 1. List of critical assets.

Miami Springs Senior Center	
Miami Springs Community Center	
Miami Springs City Hall	Miami Springs City Hall, Police Department and Miami-Dade County Fire Rescue personnel are located at 201 Westward Dr.,
Miami Springs Fire 35	
Miami Springs Police Department	
Miami Springs Police Department- Substation	
Miami Springs Public Works	
Miami Springs Branch Library	
East Drive Park Debris Stating Area	
Miami Springs Elementary Schools	
FMAF & GEN. Geiger Memorial	
Glenn Curtis Residence	The City is home of several significant historical landmarks like Curtiss Mansion, a Pueblo style home that belonged to city founder Glenn Curtiss and Fair Haven Nursing Home one of the oldest buildings in the City
South Bass Park	
Miami Springs Golf and Country Club	
Peavy-Dove Field Park	
Charles B Stafford Park	
Ludlam Drive Boat Ramp	
Ragan Park	
Circle Park	
Deleon Park Triangle	
Prince Field	
Miami Springs Aquatic Center	
Miami Springs Tennis / Raquetball Facility	
Melrose Canal	

References

Critical Community and Emergency Facilities

Critical Infrastructure

Natural, Cultural, Historic Resources

4. SCOPE OF WORK

This scope of the study includes a vulnerability assessment with a comprehensive look at the City's critical infrastructure assets. The study assessed historic damage patterns, current and future risks to the critical infrastructure, provide risk analysis, and assess unmet mitigation needs in response to identified current and future events. The study then evaluates several adaptation alternatives and mitigation strategies to reduce flood risks and economic impacts to residents and businesses, including death, injuries, and property losses due to sea-level rise, high tides, and storm events. Very important to the study is to develop a public awareness/educational campaign which would include scheduling public meetings, preparing the materials, and surveys to raise awareness of the impacts of sea level rise and resiliency. Social media is used as one of the venues to provide information to the public an interested stakeholders.

During the vulnerability study background information is collected, including analysis of historical water level data and relationship to sea-level rise, historical groundwater levels, future projection of King Tide, assessment of vulnerable areas, and mapping of Miami Spring's elevations with available LiDAR data for vulnerability analyses. The study then models the impact of current and projected climate hazards, identify and assess the vulnerability and risks of the City's critical assets associated with these impacts, and selects and prioritizes a dashboard of alternative strategies for critical infrastructures to coordinate with stakeholders following a communication plan.

The study conducts a King Tide elevation mapping combined into a Geographical Information System (GIS) database in a format suitable for input into the Florida Department of Environmental Protection (FDEP) mapping tool. The created GIS database has been utilized to aid in developing a vulnerability plan to identify potential flooding, drainage, and infrastructure problems, along with vulnerable areas within the City to be submitted using standards prescribed by FDEP.

Once the projections and the extent of sea-level rise inundation are identified during the collection of the background information, the report models the impact of sea-level rise. Based on the model, the report evaluates the impacts on critical assets as hardships to the local economy and tourism. This report assesses the principal risks and vulnerabilities, including the loss of power, environmental impacts, flooding, and sea-level rise.

Once these principal adaptation vulnerabilities, risks, and impacts to the City are identified, specific and realistic adaptation strategies are defined. The adaptation strategies are potential actions to address the vulnerabilities identified. The actions can range from natural options, often referred to as "soft" or "green" actions, to more complex structural intervention options considered "hard" or "grey" alternatives. The "hard" alternatives may include utility relocation, raising infrastructure, elevating roads, flood control pump station, floodproofing, managed retreat/redirect development, and policy recommendations for future improvements.

SOW OUTPUTS

1. An engineering report including an analysis of historical water level data and relationship to sea-level rise, historical groundwater levels, future Projection of King Tide and assessment of vulnerable areas, mapping of Miami Spring elevations with available LiDAR data for vulnerability analyses, and an SLR storm surge vulnerability assessment for critical and potential impacts due to SLR / Storm Surge.
2. Two model runs for 2040 and 2070 based on sea-level rise scenarios adopted for project purposes and a DTM/DEM terrain model, elevation analysis, depicting flooding from tidal events, storm surge, and sea-level rise.
3. A resiliency study is provided to evaluate and prevent any adverse environmental conditions (such as fatalities and property damage) due to SLRs, high-tide flooding, storm event or a combination of these risks.
4. Following the resiliency study, the planning team has identified four focus areas in the city that concentrates several of the critical assets in a close area.
5. An outreach plan is also provided including agendas, meeting minutes and, educational materials.

5. METHODOLOGY

Sea-level rise and resiliency are critical for the safeguarding of the City's infrastructure. As previously mentioned, most of the City area is located in low-lying areas connected to coastal areas by the Miami Canal.

The study methodology follows a nine step process following state guidelines as summarized in Figure 1 to be completed within 12 months. The focus of Steps 1 through 7 is to provide the necessary background information, prioritization process, and plan necessary to develop subsequent adaptation strategy, implementation and monitoring. This plan is included in Steps 8 and 9 are completed upon completion of the first seven steps.

Table 2. Methodology steps

STEP	DESCRIPTION
Step 1	Kick off meeting
Step 2	Steering Committee
Step 3	Background Information
Step 4	Flood Scenarios
Step 5	Vulnerability Assessment
Step 6	Public meeting
Step 7	Final Vulnerability Assessment
Step 8	Adaptation Action Plan
Step 9	Prepare and Submit Final Report with Recommendations

STEP 1 – KICK OFF MEETING

The first step in the process is to organize a kick off meeting to introduce the team members, discuss the project scope and goals, schedule, present the Work Plan with deliverables and present a plan for project outreach.

During the Kick off meeting, the City identified individuals that would serve as a Steering Committee as noted in Step 2. Exhibit B includes the meeting minutes, Work Plan and additional information discussed during the meeting.

STEP 2 - STEERING COMMITTEE

During the kick off meeting the planning team, in coordination with the City staff, a group of community champions, elected officials, key decision makers, and technical experts that have been identified are confirmed. The Steering Committee provides additional project oversight, contribute subject matter expertise, aid in identifying gaps in testing assumptions, propose refinements, review and respond to primary deliverables.

Table 3 shows a list of suggested Steering Committee members that include a blend of key individuals with strong ties to the community and technical experts that were selected based on their expertise, The Steering Committee is composed of elected officials and community members representing local businesses like developers and insurance agents, academia, as well as residents.

Table 3. List of Steering Committee members

AGENCY	POSITION	NAME
BA	Project Manager	Jose Lopez
BA	Outreach specialist	Tere C. Garcia
PUBLIC OFFICIALS		
Miami Springs	City Mayor	Maria Puente Mitchell
BUSINESS COMMUNITY		
Real Estate developer	The Leonard Real Estate Group	Charlie Leonard
Insurance agency	Coastal Insurance Group Vice President	Douglas Matthew Webb
TECHNICAL EXPERTS/ACADEMIA		
UF	Department of Environmental Engineering Sciences Research Professor	William Cooper
COASTAL SCIENTISTS		
SFWMD	Resiliency Officer	Ana Carolina Coelho Maran
SPECIAL INTEREST GROUPS		
Local residents	Woolpert Program Director	Alfredo C. Sanchez
Non-governmental organizations		Rick Householder
MIAMI DADE COUNTY		
Miami-Dade LMS	EM Planner	Robin Yang
Miami - Dade Water Management	Engineer	Amy M. Cook
Miami - Dade Water Management	Engineer	Alberto Pisani
OTHER MEMBERS		
BA	Public Information Officer	Maria Luisa Murillo
BA	Jr. Engineer	Alejandro Marinucci
Cummins Cederberg	Engineer	Leonard Barrera Allen
Miami Springs	City Manager	William Alonso
Miami Springs	Assistance City Manager	Tammy Romero
Miami Springs	PW	Lizette Fuentes
Miami Springs	PW	Lazaro Garaboa

STEP 3 - BACKGROUND INFORMATION

The planning team in coordination with City has researched and compiled existing background data including existing water levels, critical assets and GIS information.

SEA LEVEL RISE SCIENCE

In 2019, the Southeast Florida Regional Climate Change Compact (Compact) released an update of the Unified Sea Level Rise Projections Guidance Report (Compact 2020), which describes a summary of observed sea level rise trends and recommended regional sea level rise projections through the year 2120. This update is intended to support local governments and regional entities in the development of science-based adaptation strategies, policies, and infrastructure design.

EXISTING WATER LEVEL CONDITIONS

To understand the City's vulnerability to sea level rise, it is important to first establish existing baseline water levels upon which sea level rise is evaluated.

Storm surge levels, displayed in Table 3, were taken from the United States Army Corps of Engineers (USACE) Coastal Hazard Systems (CHS), which is based on high-resolution numerical modeling of coastal storms. The City of Miami Spings is approximately 5 miles upland from the Biscayne Bay. While the daily tide range is only approximately two feet, hurricane-driven storm surge can increase local water levels up to approximately seven feet above the daily high tide level and should be considered for future planning purposes. The ADCIRC save point 31944 from the CHS was selected, as it was located within Miami Springs. The storm surge values selected are shown in Table 4.

Table 4. Peak Storm Surge Elevations (USACE Coastal Hazards Systems)

STORM RETURN PERIOD	
20-year	4.05
100-year	5.46

An analysis of rainfall impacts was included within the Vulnerability Assessment. The precipitation analysis conducted included flood depth mapping for the 100-year and 500-year rainfall event. Additionally, the 100-year rainfall event was combined with projected sea level rise and storm surge values for future planning purposes.

Rainfall depths were obtained from NOAA's Atlas 14 Rainfall Data for both the 100-year and 500-year event. The 2-hour duration rainfall distribution curve, from the Intensity-Duration-Frequency (IDF) curves given in the FDOT Drainage Manual, was multipied by the rainfall depth to yield the storm intensity over time. The 100-year and 500-year rainfall intensity curves developed were specific to the City of Miami Springs and used in the flood depth mapping scenarios.

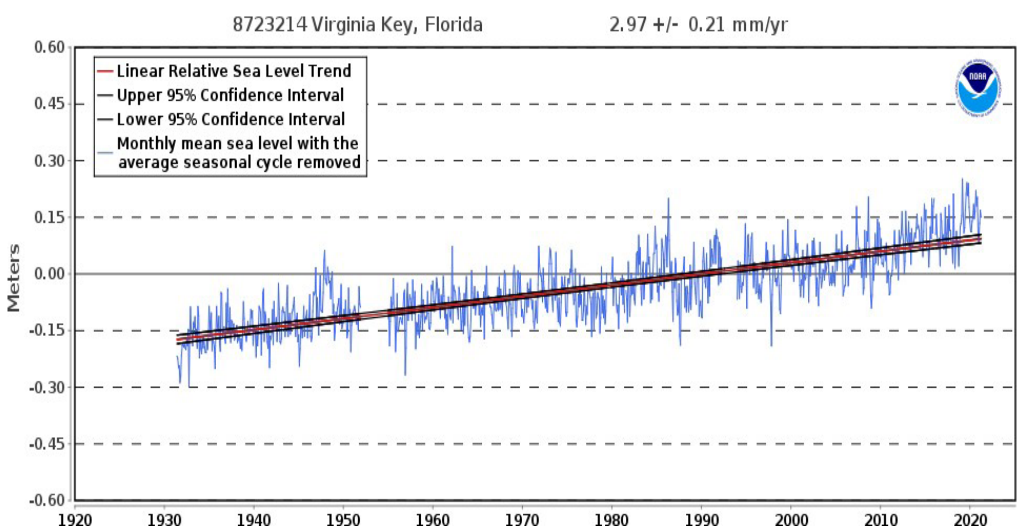
OBSERVED SEA LEVEL RISE

Since its installation in 1931, tide measurements from the Virginia Key tide station (NOAA #8723214), located in Biscayne Bay, show that sea levels have increased by 0.9 feet (NOAA 2021) (approximately 3 mm/year) (see Figure 4 below). Recent observations indicate that regional sea level rise rates are accelerating. Since 2006, local sea level rise has been approximately 4 millimeters per year, which is almost twice the global rate (NOAA/NESDIS/STAR 2019) due to localized effects (such as changes in the speed and thermodynamics of the Florida Current and Gulf Stream (Domingues et al. 2018; Sweet et al. 2018; Volkov et al. 2019).

Rising sea levels represent new challenges for the City. As water levels rise, the frequency and extent of flooding increase. Areas once considered to be outside the floodplain begin to experience periodic storm flooding or permanent inundation by daily or king tides.

Figure 1. Observed sea level rise measurements and calculated trend in Biscayne Bay

Source: NOAA Sea Level Rise Trends (Station #8723214)



SEA LEVEL RISE PROJECTIONS

The Compact guidance includes sea level rise projections from the International Panel on Climate Change (IPCC)'s 5th Annual Report (IPCC 2013) and the National Oceanic and Atmospheric Administration's (NOAA) Global and Regional Sea Level Rise (SLR) Scenarios for the United States (Sweet at al. 2017) to represent a range of sea level possibilities based on current and modeled greenhouse gas (GHG) emission trends. The Compact guidance presents three (3) curves for potential application to projects, depending on factors such as project lifespan, adaptability, and risk tolerance [see Table 3 below]: (1) IPCC Median, (2) NOAA Intermediate High, and (3) NOAA High (see Figure 2 below). A fourth curve, NOAA Extreme is also included for informational purposes (this curve is not intended for design), representing the upper limit of sea level rise in response to a potential massive Antarctic ice sheet collapse by the end of the century.

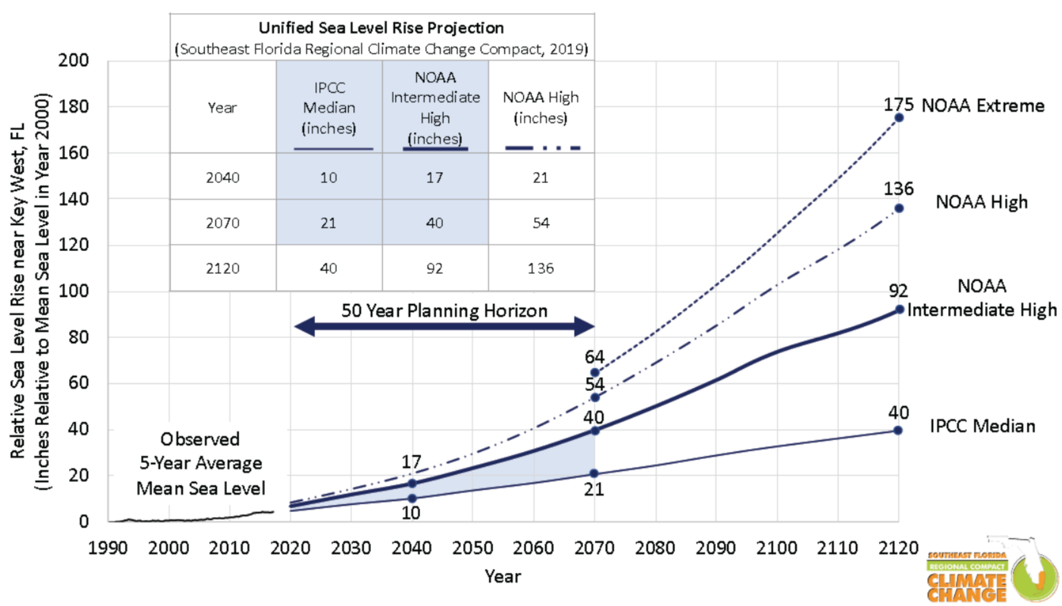
Based on these projections, sea levels may range between 1.3 and 5.0 feet higher over the next 50 years, and 2.9 to 14.2 feet higher over the next century (see Figure 2 below). Long term projections (2070-2120) have a significant range of variability due to uncertainty in climate dynamics and future GHG emission reduction efforts.

Florida Statute 380.093 states a minimum of two local sea level rise scenarios must be conducted including the 2017 NOAA intermediate-low and intermediate-high sea level rise projections. The NOAA intermediate-low and intermediate-high curve sea level rise projections, given in Table 5, were added to storm surge values to project the storm surge values at different planning horizons.

Table 5. NOAA Sea-Level Rise Projections for Virgina Key

VIRGINIA KEY SLR (FT)			
	2000	2040	2070
Intermediate Low	0	0.69	1.25
Intermediate High	0	1.41	3.28

Figure 2. Sea level rise projections



CRITICAL ASSETS INVENTORY

A critical part of the vulnerability assessment is categorizing and locating the City's assets that may be exposed to sea level rise hazards. Categorizing assets helps to organize the findings of the vulnerability assessment based on asset function as the City responsible for their maintenance and management. This section describes the asset inventory organization, data sources, and inventoried assets considered in the vulnerability assessment.

DATA COLLECTION

An inventory was developed to identify and organize the City's assets that were assessed for their vulnerabilities to sea level rise and storm tides. It is not practical, or necessary, to evaluate the sea level rise vulnerability of all the City's individual assets. Therefore, assets included in the inventory were selected based on their significance to maintaining uninterrupted City operations and services, as well as for critical City-related services.

Inventoried assets were evaluated for exposure, sensitivity, and adaptive capacity during the vulnerability assessment, discussed in Section 0.

The inventory was developed considering a combination of the following:

- City-maintained facility locations documented on the City address map,
- CAD drawings of utility features,
- Asset locations identified by the City as part of a concurrent asset management data collection effort,
- Asset locations identified by BA and other consultant staff currently support City projects, and
- Review and discussions between consultants and City staff.

The inventory is organized by the asset categories as outlined in **s. 380.093, F.S**., a **vulnerability assessment** performed through the Resilient Florida Grant Program must analyze all critical assets, including regionally significant assets, owned or maintained by the City.

ASSET INVENTORY

A list of inventoried City assets that were evaluated as a part of the vulnerability and risk assessment is presented in Table 6 below, and in Figure 2 (List of Critical Assets) / Figure 4 (Critical Assets Owned or Operated by the City of Miami Springs)

Table 6. Assets evaluated in the vulnerability assessment

ASSET CATEGORY	CRITICAL ASSET	QUANTITY	CITY OWNED
TRANSPORTATION	Bridge	4	
	Bus Terminals	50	
	Major Roads	306	
	Evacuation Routes	9	
CRITICAL INFRASTRUCTURE	Drinking Water	20	
	Electricity	7	
	Solid Waste Facilities	3	1
	Stormwater Facilities	404	
	Communications Facilities	19	
		1	
	Sewer	12	
		18	
CRITICAL COMMUNITY AND EMERGENCY FACILITIES	Community Centers	6	2
	Health Care Facilities	12	
	Schools	18	1
	Daycare Facilities	13	
	Local Government Facilities	4	4
	Fire Station	1	1
	Gas Station	7	
	Elderly Home	2	
		4	
NATURAL, CULTURAL, HISTORIC RESOURCES	Parks	12	
	Historical Assets	28	
	Water	49	

Figure 3. Location of critical assets within the City of Miami Springs

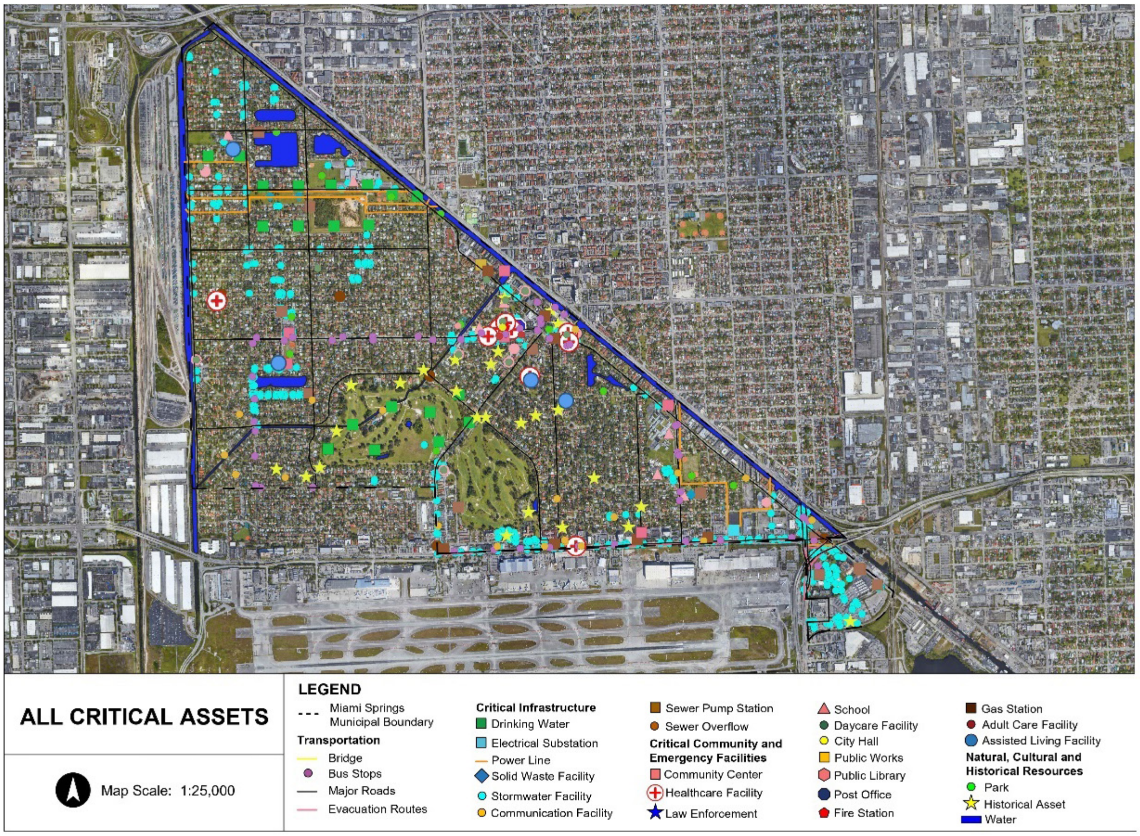
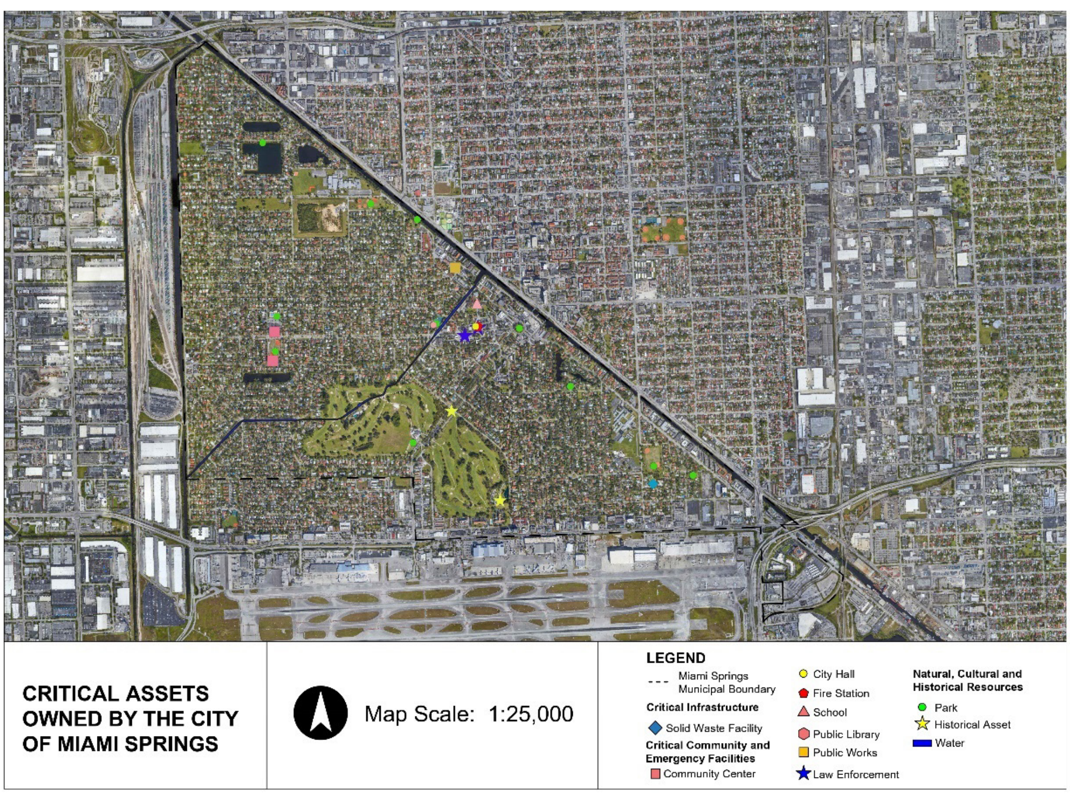


Figure 4. Location of critical assets owned or operated by the City of Miami Springs.



GIS DATABASE

An asset inventory was compiled to document key City assets and operations that may be impacted by sea level rise based on requirements as defined in s.380.093.F.S.

TOPO GRAPHIC DATA

The latest climate science was reviewed to select sea level rise scenarios that could affect the City over a planning timeframe through the year 2120.

STEP 4- FLOOD SCENARIOS

Flood scenarios were developed based on existing conditions, the 2040 planning horizon and the 2070 planning horizon. The flood scenarios analyzed included precipitation events, tidal events, storm surge and sea level rise. Kings tides were analyzed during the flood scenario development. However, the City of Miami Springs is only connected to Biscayne Bay through the C-6 Canal and within the C-6 canal, the S-26 structure controls the headwater. Therefore, the City of Miami Springs is not directly affect by king tides and is dependent on the water fluctuations produced by the canal structures.

The flood depth mapping included the following scenarios considering existing conditions, the 2040 planning horizon, and the 2070 planning horizon:

Existing Water Level Conditions:

1. 20-year storm surge
2. 100-year storm surge
3. 100-year rainfall event
4. 500-year rainfall event

2040 Planning Horizon:

1. 20-year storm-surge + NOAA SLR Intermediate-Low
2. 20-year storm-surge + NOAA SLR Intermediate-High
3. 100-year storm-surge + NOAA SLR Intermediate-Low
4. 100-year storm-surge + NOAA SLR Intermediate-High
5. 100-year rainfall event + 20 year storm-surge + NOAA SLR Intermediate-Low

2070 Planning Horizon:

1. 20-year storm-surge + NOAA SLR Intermediate-Low
2. 20-year storm-surge + NOAA SLR Intermediate-High
3. 100-year storm-surge + NOAA SLR Intermediate-Low
4. 100-year storm-surge + NOAA SLR Intermediate-High
5. 100-year rainfall event + 100 year storm-surge + NOAA SLR Intermediate-Low

STORM SURGE MAPPING

Storm surge scenarios were evaluated using the stillwater elevations from the USACE CHS and the Digital Elevation Model (DEM) for Miami Springs. A stillwater raster corresponding to the stillwater elevation being evaluated was created and used as input to conduct a mathematical operation on the DEM. The operation involved the subtraction of the DEM values from the stillwater level raster. Areas that are not flooded corresponded to negative values and were excluded from the resulting raster. The resulting values from the mathematical operation represent the flood depths in feet.

RAINFALL + STORM SURGE MAPPING

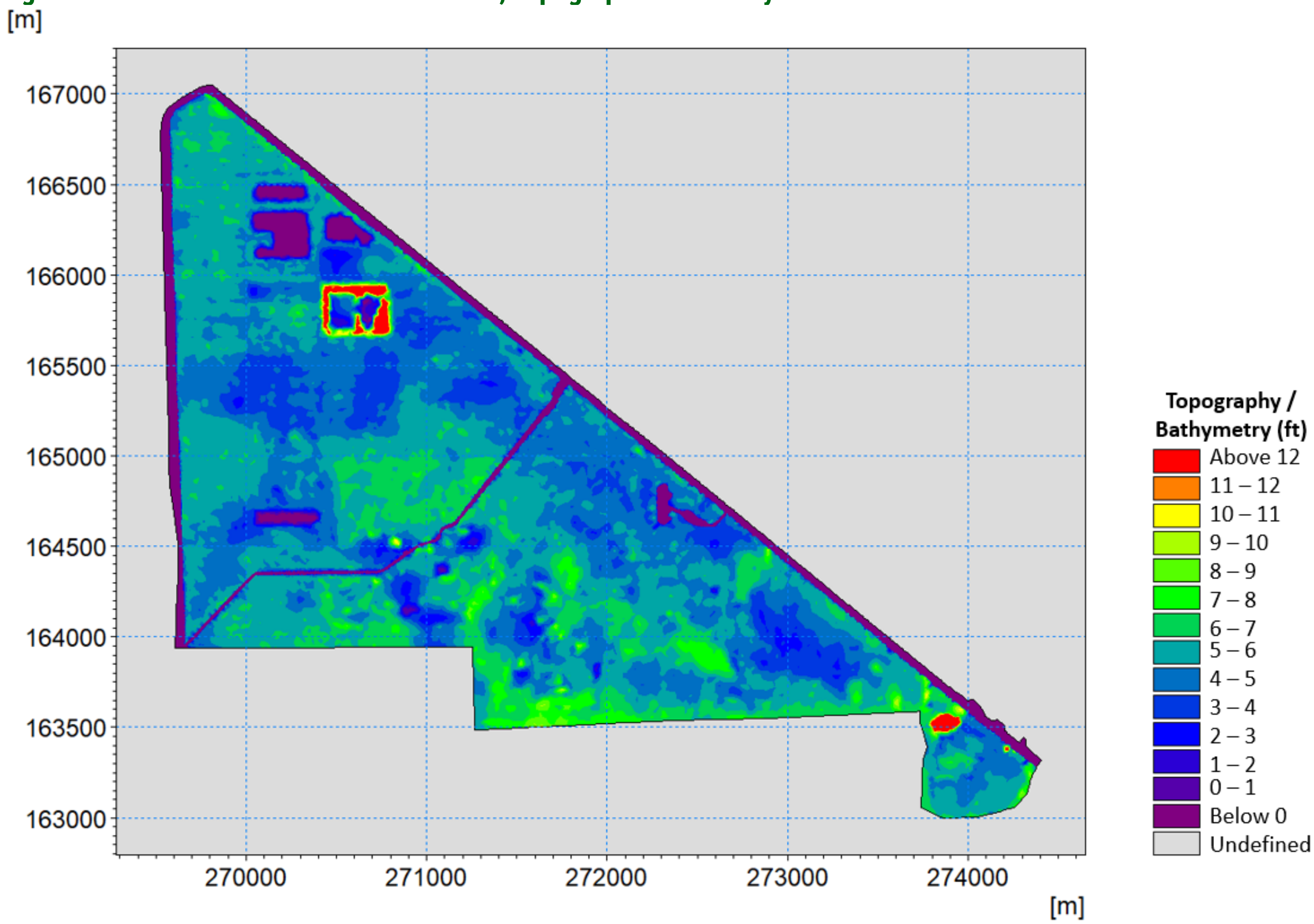
The rainfall with coastal inundation mapping was developed utilizing the hydrodynamic (HD) module within the MIKE 21 Flow Model (FM) engineering software package. The model was created to evaluate the coastal flooding and to provide dynamic inundation mapping illustrating which areas are flooded for various scenarios, the flooding pathways, and the flood depth. Utilizing the MIKE 21 HD numerical model adds temporal variability to inundation mapping as opposed to the traditional “bathtub” models which only consider spatial variability.

To develop flood inundation maps, a computational domain was adopted for the hydrodynamic analysis which followed the City of Miami Springs boundary. Topographic data within the model area was acquired from Miami-Dade County Digital Elevation Model data from 2021.The computational domain, topographic data and bathymetric data for the numerical model is shown in Figure 5. The hydraulic roughness in the numerical model is described by Manning’s bed resistance number and varied over the model domain to accurately depict different surface materials including open green space, residential areas and roadways, and water.

Inputs for the model were dependent on the flood depth scenario. The University of Florida report titled “Design Storm Surge Hydrographs for the Florida Coast” outlines the design storm surge hydrographs for various coastal Florida locations (2003). The storm surge hydrograph provided for Key Biscayne was the basis for the storm surge hydrograph used in the storm surge model set. The hydrograph was linearly scaled such that the peak surge elevation equaled the peak storm surge elevations given by USACE CHS presented in Table 4. Therefore, all points on the storm surge hydrograph were scaled to reflect the storm surge elevations given by USACE CHS.

The storm surge hydrographs were inputted into the model as initial water conditions and boundary conditions, as shown in Figure 5 below. The intensity curves developed for the City of Miami Springs was used as a precipitation input. The sea level rise projections were added to the storm surge hydrographs to achieve the projected storm surge values. The maximum water depths outputted from the numerical model, were used to conduct the flood depth mapping for each of the flood scenarios.

Figure 5. Coastal Inundation Model Domain, Topographic and Bathymetric Data



STEP 5- VULNERABILITY ASSESSMENT- DRAFT

A Vulnerability Analysis assist stakeholders to determine what structural and social assets are likely to be impacted by flooding due to high tides, storm events and sea level rise.

In the past years, the City of Miami Springs has worked closely with Miami-Dade Office of Resilience, the Southeast Florida Regional Climate Change Compact, Florida Resilient Coastline Program and a network of community, academic and government partners to promote and enhance the resiliency of critical infrastructure within the City boundaries.

The purpose of this section is to identify the vulnerability of the public critical infrastructure by determining the depth of water caused by each sea level rise, storm surge, rainfall, and/or compound flood scenario and identify the impact of these future hazards to critical assets in the City.

Following Chapter 2 of the Florida Adaptation Planning Guidebook, Vulnerability for each asset category is based on evaluation through three Vulnerability Assessment key factors: exposure, sensitivity, and resiliency to sea level rise impacts, as follows:

EXPOSURE ANALYSIS

An Exposure Analysis assess the extent that an asset is exposed to flooding due to storm surges, King Tides, future storm events and/or sea level rise that are likely to occur in the future.

Once the Sea Level Rise Model to determine the future water level conditions for existing, 2040 and 2070 planning horizons is chosen in Step 3, and the impacts on critical assets determined based on a GIS overlay of inventoried assets described in Step 4, a Exposure analysis is conducted.

The exposure summary table below indicate the impact pf SLR at each public critical assets as exposed to king tides (KT) and 100 and 500-year stormwater events (ST).

SENSITIVITY ANALYSIS

Using the data from the Exposure Analysis phase, a sensitivity and resiliency can be conducted following guidelines 380.093 F.S. and Chapter 2 of the FL Adaptation Planning Guidelines.

Sensitivity analysis can be defined as the responsiveness of a critical asset to hazardous impacts and evaluates the degree to which the physical condition and functionality of the critical asset is affected by flooding and/or inundation.

RESILIENCY

In concurrence with the sensitive analysis, a resiliency analysis provides information on the existing critical asset redundancy or the asset's ability to be modified to accommodate future sea level rise.

Both sensitivity and resiliency are evaluated qualitatively based on the adaptive capacity of the asset to respond to direct, operational, environmental or social impacts to the community. The planning team evaluated the City assets and assigned a rating of low, moderate, high or extreme as described in Table 8.

Table 7. Exposure Analysis

Asset_Name	Asset_Type	Flood Depth 100 year rainfall (feet)	Flood Depth 500 year rainfall (feet)	Flood Depth - 100 year storm surge (feet)	Flood Depth - 2040 Intermediate Low SLR + 20 year storm surge (feet)	Flood Depth - 2040 Intermediate Low SLR + 100 year storm surge (feet)	Flood Depth - 2040 Intermediate High SLR + 20 year storm surge (feet)	Flood Depth - 2040 Intermediate High SLR + 100 year storm surge (feet)	Flood Depth - 2070 Intermediate Low SLR + 20 year storm surge (feet)	Flood Depth - 2070 Intermediate Low SLR + 100 year storm surge (feet)	Flood Depth - 2070 Intermediate High SLR + 20 year storm surge (feet)	Flood Depth - 2070 Intermediate High SLR + 100 year storm surge (feet)
Miami Springs Senior Center	Community Center	0.3	0.6	1.3	0.5	2.0	1.3	2.7	1.1	2.5	3.1	4.5
Miami Springs Community Center	Community Center	0.3	0.4	0.5		1.2	0.5	1.9	0.3	1.7	2.3	3.8
Miami Springs City Hall	Local Government Facilities	0.5	0.7	1.1	0.4	1.8	1.1	2.5	1.0	2.4	3.0	4.4
Miami Springs Fire 35	Local Government Facilities	0.5	0.7	1.1	0.4	1.8	1.1	2.5	1.0	2.4	3.0	4.4
MIAMI Springs Police Department	Local Government Facilities	0.5	0.7	1.1	0.4	1.8	1.1	2.5	1.0	2.4	3.0	4.4
Miami Springs Police Department - Substation	Local Government Facilities	0.6	0.8	1.2	0.5	1.9	1.3	2.7	1.1	2.5	3.1	4.5
Miami Springs Public Works	Local Government Facilities	0.3	0.3	0.1		0.6	0.1	1.3		1.2	1.8	3.2
Miami Springs Branch Library	Library	0.5	0.5	0.9	0.2	1.6	0.9	2.3	0.7	2.2	2.8	4.2
East Drive Park Debris Staging Area	Solid Waste Facility	1.8	2.4	3.2	2.5	3.9	3.2	4.6	3.0	4.4	5.0	6.4
Miami Springs Elementary School	Historical Assets	0.5	0.6	1.8	1.1	2.5	1.9	3.3	1.7	3.1	3.7	5.1
FMAF & Gen. Geiger Memorial	Historical Assets	0.3	0.5	0.4		1.1	0.5	1.9	0.3	1.7	2.3	3.7
Glenn Curtis Residence	Historical Assets	0.3	0.4			0.5		1.2		1.1	1.7	3.1
South Bass Park	Parks	2.8	3.3	7.9	7.2	8.6	7.9	9.3	7.7	9.1	9.8	11.2
Miami Springs Golf and Country Club	Parks	12.2	13.3	6.5	5.8	7.2	6.5	7.9	6.3	7.7	8.4	9.8
Peavy-Dove Field Park	Parks	1.3	1.5	4.9	4.2	5.7	5.0	6.4	4.8	6.2	6.8	8.2
Charles B Stafford Park	Parks	2.1	2.7	3.6	2.8	4.3	3.6	5.0	3.4	4.8	5.4	6.8
Ludlam Drive Boat Ramp	Parks	2.9	4.0	3.0	2.2	3.7	3.0	4.4	2.8	4.2	4.8	6.2
Ragan Park	Parks	1.3	1.8	2.5	1.8	3.2	2.5	3.9	2.3	3.7	4.3	5.8
Circle Park	Parks	1.0	1.2	1.9	1.2	2.6	2.0	3.4	1.8	3.2	3.8	5.2
Deleon Park Triangle	Parks	0.5	0.6	1.9	1.2	2.6	1.9	3.3	1.7	3.1	3.8	5.2
Prince Field	Parks	0.7	0.8	1.7	1.0	2.4	1.7	3.1	1.6	3.0	3.6	5.0
Miami Springs Aquatic Center	Parks	0.6	0.9	1.1	0.4	1.8	1.1	2.5	0.9	2.3	3.0	4.4
Miami Springs Tennis / Raquetball Facility	Parks	0.5	0.5	0.9	0.2	1.6	0.9	2.3	0.7	2.2	2.8	4.2
Melrose Canal	Water	0.5	0.5	0.9	0.2	1.6	0.9	2.3	0.7	2.2	2.8	4.2

Table 8. Sensitivity and resiliency rating descriptions

SENSITIVITY RATING	DESCRIPTION	ADAPTIVE CAPACITY RATING	DESCRIPTION
Low	Minimum impact	High	Ability to adapt asset to fully mitigate impacts; full mitigation is possible at reasonable cost and effort
Moderate	Short-term, minor, or reversible damage to asset or function	Moderate	Ability to adapt asset with moderate level of effort or advanced budget planning
High	Significant but reversible damage to asset or function	Very Low	Ability to adapt asset to partially mitigate impacts; or full mitigation is possible, but extremely costly or difficult
Extreme	Irreversible damage to asset and permanent loss of function	None	No ability to adapt asset or possible adaptations; do not mitigate impacts

Table 9. Number of Critical Assets inundated at each of the Flood Scenarios 2040 Intermediate low SLR

NUMBER OF CRITICAL FACILITIES INUNDATED AT EACH OF THE FLOOD SCENARIOS						
2040 Intermediate - Low SLR						
Asset Type	Total of Critical Facilities Evaluated	ST (years)	+2 - ft	+3 -ft	+4 - ft	>4 - ft
CRITICAL INFRASTRUCTURE	1	20	-	1	-	-
		100	-	-	1	-
CRITICAL COMMUNITY & EMERGENCY FACILITIES	8	20	6	-	-	-
		100	8	-	-	-
NATURAL, CULTURAL & HISTORICAL RESOURCES	15	20	8	2	-	3
		100	5	4	2	4

Table 10. Number of Critical Assets inundated at each of the Flood Scenarios 2040 Intermediate High SLR

NUMBER OF CRITICAL FACILITIES INUNDATED AT EACH OF THE FLOOD SCENARIOS						
2040 Intermediate - High SLR						
Asset Type	Total of Critical Facilities Evaluated	ST (years)	+2 - ft	+3 -ft	+4 - ft	>4 - ft
CRITICAL INFRASTRUCTURE	1	20	-	-	1	-
		100	-	-	-	1
CRITICAL COMMUNITY & EMERGENCY FACILITIES	8	20	8	-	-	-
		100	2	6	-	-
NATURAL, CULTURAL & HISTORICAL RESOURCES	15	20	8	2	1	3
		100	2	3	5	5

Table 11. Number of Critical Assets inundated at each of the Flood Scenarios 2070 Intermediate low SLR

NUMBER OF CRITICAL FACILITIES INUNDATED AT EACH OF THE FLOOD SCENARIOS						
2070 Intermediate - Low SLR						
Asset Type	Total of Critical Facilities Evaluated	ST (years)	+2 - ft	+3 -ft	+4 - ft	>4 - ft
CRITICAL INFRASTRUCTURE	1	20	-	1	-	-
		100	-	-	-	1
CRITICAL COMMUNITY & EMERGENCY FACILITIES	8	20	7	-	-	-
		100	2	6	-	-
NATURAL, CULTURAL & HISTORICAL RESOURCES	15	20	8	2	1	3
		100	2	4	4	5

Table 12. Number of Critical Assets inundated at each of the Flood Scenarios 2070 Intermediate High SLR

NUMBER OF CRITICAL FACILITIES INUNDATED AT EACH OF THE FLOOD SCENARIOS						
2070 Intermediate - High SLR						
Asset Type	Total of Critical Facilities Evaluated	ST (years)	+2 - ft	+3 -ft	+4 - ft	>4 - ft
CRITICAL INFRASTRUCTURE	1	20	-	-	-	1
		100	-	-	-	1
CRITICAL COMMUNITY & EMERGENCY FACILITIES	8	20	1	5	2	-
		100	-	-	2	6
NATURAL, CULTURAL & HISTORICAL RESOURCES	15	20	1	4	4	6
		100	-	-	2	13

Although exposure is the primary driver of an asset's vulnerability, evaluating sensitivity and adaptive capacity provides additional information on the degree to which an asset would be impaired once exposed to flooding and considers inherent characteristics that allow an asset to be modified to adapt to future sea level rise. Assets are considered most vulnerable if they are exposed to flooding, have high sensitivity, and low adaptive capacity.

Table 13. Sensitivity analysis of Critical Assets, showing inundation levels.

	0 to 1 ft	1 to 2 ft	2 to 2 ft	3 to 2 ft	2 to 3 ft	3 to 4 ft	4 to 5 ft	5 to 6 ft	6 to 7 ft	More than 7 ft
Miami Springs Senior Center										
Miami Springs Community Center										
Miami Springs Town Hall Complex										
Miami Springs Police Department-Substation										
Miami Springs Public Works										
Miami Springs Branch Library										
East Drive Park Debris Staging Area										
Miami Springs Elementary School										
FMAF & GEN. Geager Memorial										
Glenn Curtis Residence										
South Bass Park										
Miami Springs Golf and Country Club										
Peavy-Dove Field Park										
Charles B Stafford Park										
Ludlam Drive Boat Ramp										
Ragan Park										
Circle Park										
Deleon Park Triangle										
Prince Field										
Miami Springs Aquatic Center										
Miami Springs Tennis / Raquetball Facility										
Melrose Canal										

FOCUS AREAS

Once the vulnerability, sensitivity and adaptation assessments have been completed, the findings are translated into a map with designated areas that constitute the boundaries of the focus areas. Focus areas are defined according to the specific geographic area, population or communities, natural or built systems and other assets identified and quantified during the Sensitivity Analysis.

Much of the data developed from the modeling step that is used for vulnerability analysis and the sensitivity assessment is useful for the evaluation of the focus areas. In this phase BA utilizes DOR codes to identify priority properties in tiers. Higher priority concerns should be those properties or assets that are considered essential and need to be kept in service. The reason they are more important is that their failure presents a greater consequence to the watershed – police, fire, hospitals, water and wastewater plants and major pumping facilities. To establish guidelines for assigning a risk factor associated with potential consequences of failure, it is suggested to create categories for properties and infrastructure, as follows:

1. **Tier 1. Critical facility protection (water, sewer, public safety, hospitals, schools, power).** These essential service facilities are required to respond to emergencies and protect public health, safety, and welfare. Areas that include these facilities should be rated the highest.
2. **Tier 2. Essential services (groceries, pharmacies, roadways).** These facilities are needed to sustain people – food, medications, and mobility access. These receive the second highest priority. Most are located along major roadways that act as access routes. Most roads are state or county owned.
3. **Tier 3. Economic centers.** These facilities are rated high to protect jobs so the community can keep the local economy flowing while minimizing disruption to daily life.
4. **Tier 4. At risk communities.** The highest rated residential communities involve at risk populations who have limited ability, financially or otherwise, to escape the impacts of flooding. These may include high density developments, so flooding impacts a larger number of people that may have health, food, age, and other limitations to adaptation to flood conditions.
5. **Tier 5. Other urban/suburban property.** Note that for residential property, identifying at-risk communities (income, age, disability, health) requires a further drilldown to the neighborhood level (i.e. wealthy neighborhoods with few older, poor health individuals would have a lower priority than at risk communities, which generally have lower value housing and denser development).
6. **Tier 6. Agriculture/public property/vacant/undeveloped.** These types of properties have less flooding impacts on populations.

Table 14. Outlines the US Department of Revenue (DOR) codes from the property appraiser's office and assigns an associated priority. Note that for residential property, identifying at-risk communities (income, age, disability, health) requires a further drilldown to the neighborhood level (i.e. wealthy neighborhoods with few older, poor health individuals would have a lower priority than at risk communities, which generally have lower value housing and denser development). In the latter case, more people are impacted, and those people have less ability to mitigate risk. Based on these priorities, the relative risk priority of DOR land use codes were evaluated based on a scale of 1 to 6, where 1 is most vulnerable and 6 is least vulnerable

Table 14. Department of Revenue land use codes

DOR (USE CODE)	DESCRIPTION	PRIORITY	DELINEATOR
000	Vacant Residential	6	
001	Single Family Residential	Depends	Value, Age, Income
002	Mobile Homes	4	
003	Multi-Family >9 units	4	
004	Residential Condo	Depends	Value, Age, Income
007	Misc. Residential	5	
008	Multi-Family <10	4	
009	Residential Common Area	6	
010	Vacant Commercial	6	
011	One-Story Stores	3	
012	Mixed Use Store	4	
013	Department Store	3	
014	Supermarket	2	
015	Regional Shopping Center	3	
016	Community Shopping Center	3	
017	Office Non Professional	3	
018	Service Multi-Story	3	
019	Professional Services Building	3	
020	Terminals	3	
021	Restaurant	3	
022	Drive-in	5	
023	Financial	2	
026	Laundry	3	
027	Service Station	3	
028	Mobile Home Sales, Parking Lot, Mobile Home Parks	5	
031	Drive-in Theater	5	

Table 14. Department of Revenue land use codes

DOR (USE CODE)	DESCRIPTION	PRIORITY	DELINEATOR
032	Auditoriums/Indoor Theaters	5	
033	Bar	5	
034	Skating Rinks, Poolhalls, Bowling Alleys	5	
035	Tourist Attractions	5	
038	Golf Course	6	Miami Springs Golf Course
039	Hotel	3	
040	Vacant Industrial	6	
041	Light Manufacturing	4	
048	Warehouse Distribution	5	
049	Open Storage	6	
052	Cropland	6	
063	Grazing Land	6	
066	Orchard	6	
067	Poultry	6	
069	Ornamentals	6	
070	Vacant without Features	6	
071	Church	5	
072	Private School	3	
073	Private Hospital	2	
074	Home for the Aged	4	
075	Orphanage	4	
076	Cemetery	6	
077	Club, Hall	5	
078	Convalescent Homes	4	
080	Vacant Government	6	
082	Military, Forest, Parks	6	
083	Public School	2	

Table 14. Department of Revenue land use codes

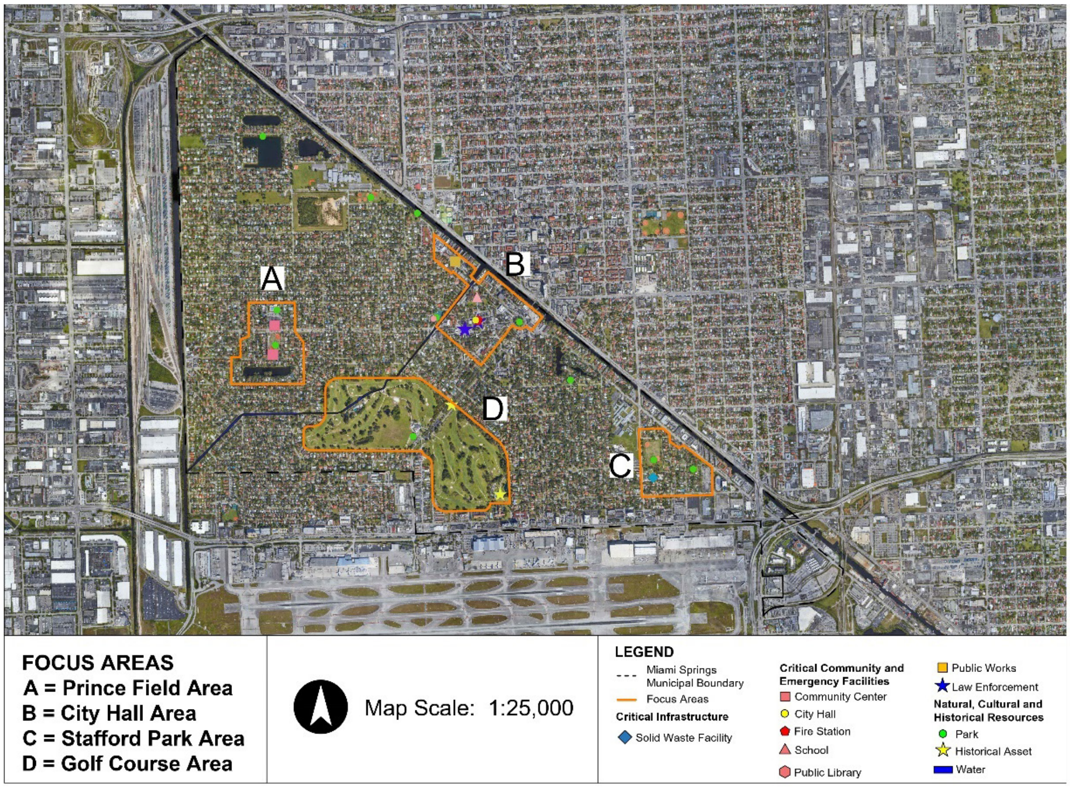
DOR (USE CODE)	DESCRIPTION	PRIORITY	DELINEATOR
084	Public College	2	
086	County	Depends	Utilities, Arterial =1
087	State	Depends	Arterial = 1
088	Federal	6	
089	Municipal	1	
091	Utility	Depends	Water/Wastewater Treatment Plants, Public Safety = 1
094	Right of Way	Depends	Florida Department of Transportation (FDOT), Arterial = 1
095	Submerged, lakes	6	
096	Sewage Disposal	1	
099	Other Non-Agricultural Acreage	6	

Having identified the vulnerable properties and determined the risk priority from 1 to 6 in the DOR codes, properties that are more critical to the community can be identified. Those higher priority properties are where the mitigation strategies and financial resources should focus first. An example of priority properties overlaid on flood prone areas is shown in Figure 6.

Table 15. Critical Assets listed by Focus Area with address and DOR ratings.

CRITICAL ASSET	ADDRESS	FOCUS AREA	RATING
MIAMI SPRINGS SENIOR CENTER	101 Apache St	A	4
MIAMI SPRINGS COMMUNITY CENTER	1401 WESTWARD DR	A	4
Prince Field	101 Apache St	A	5
Miami Springs Aquatic Center	501 Payne Dr	A	5
Miami Springs Elementary School	51 PARK ST	B	1
Miami Springs Branch Library	401 Westward Dr	B	1
Miami Springs City Hall	201 Westward Dr	B	1
Miami Springs Fire 35	201 WESTWARD DR	B	1
Miami Springs Police Department	201 WESTWARD DR	B	1
Miami Springs Police Department- Substation	274 WESTWARD DR	B	1
Miami Springs Public Works	345 N Royal Poinciana Blvd	B	1
Circle Park	CURTISS PKWY & WESTWARD DR,	B	5
Miami Springs Tennis / Raquetball Facility	401 Westward Dr	B	5
Melrose Canal	Explanade Dr. N and S	B	3
Charles B Stafford Park	489 East Dr	C	5
Ragan Park	La Baron Dr / Ragan Dr	C	5
Stafford Park Debris Staging Area	501 EAST DRIVE	C	3
FMAF & GEN. Geiger Memorial	650 Curtiss Pkwy	D	5
Glen Curtis Residence	500 DEER RUN	D	5
Miami Springs Golf and Country Club	650 Curtiss Pkwy	D	5

Figure 6. Location of Focus Areas in the City of Miami Springs



STEP 6- PUBLIC INVOLVEMENT

The proposed project includes a Public Involvement Plan that includes interagency coordination with the South Florida Water Management District and other organizations (e.g. Florida International University's Sea Level Solutions Center, SFRPC) to train citizen scientists to identify and assess areas impacted by flooding and the to understand how sea level rise impacts flood risks related to our regional canal network and identify climate change impacts.

Many businesses and institutions are working with architects and developers to determine their vulnerabilities and build higher and stronger in anticipation of future water levels. The insurance and reinsurance industries are leading the field in the preparation of better forecasts of the potential impacts, and in the creation of financial mechanisms to support economic resilience. The County assists these industries and individual property owners through Building Efficiency 305. In 2018, the County assessed the feasibility of creating a sea level rise checklist and plans to create a checklist in the future.

In support of consensus building and to to promote an inclusive process for stakeholders' better understanding of the local issues our approach of engagement is focused on getting input from stakeholders throughout the City. In addition to one-on-one and open house meetings, the team would conduct public meetings at key locations experiencing adverse effects including flooding from increased sea levels, to better understand the dynamics and expectations at these select locations. This process not only provides a more thorough understanding of the community's concerns but also helps to build trust and consensus on proposed strategies.

As indicated in the Vulnerability Assessment Approach, once all collected data is analyzed and modeling is completed, the first step in the public involvement process is to assemble a Steering Committee that would assist the planning team as noted above.

The design concept(s) are been considered by the appropriate City staff, presented to the Steering Committee and eventually to the public and may consider additional public comment at the appropriate time. The most important aspect of these methods is that the data collected is completely quantifiable, eliminates any misinterpretations and confirms consensus.

The main methods used by the planning team approach include:

Public information tools

The planning team has considered the following public participation activities, as deemed appropriate:

1. Printing materials such as Project newsletters, maps, brochures, renderings, postcards or flyers, door hangers, and display boards among other alternatives.
2. Website and social media postings.
3. Meeting agendas including location, sing-in sheet, information on presenters, meeting objectives and presentation materials.
4. Project website.
5. Public meeting materials including agendas, public notices, meeting minutes, public comments, plans and documents, meeting recordings.
6. Public Service announcements.
7. Kiosks and signs.
8. Workshops and community meetings including one-on-one as well as large group public meetings and/or hearings. Organize small group briefings upon request (e.g Monroe County public elected officials and staff, other local government officials, business, residents, Homeowner Associations (HOA), and other interested parties.
9. Surveys.
10. Other innovative tools like real time polling or visualization.

Because many stakeholders cannot attend public meetings in person or virtually, additional tools to provide input can be used such as:

- On-line surveys (eg SurveyMonkey)
- Comments on the webpage
- Blogs
- Electronic news outlets
- Discussion boards

Table 16. Proposed Outreach Plan

WORK PLAN STEPS	DESCRIPTION
Step 1: Planning	Set up Steering Committee, identify key stakeholders, community outreach locations, frequency, methodology, etc. for outreach program. Include internal County staff and leadership sessions to inform them on the project development.
Step 2: Listening	Conduct and coordinate meetings with the Steering Committee as well as first round of public outreach events to describe program and solicit input on issues/concerns/desires. Publish summary of findings to validate what we heard.
Step 3: Evaluating and coordinating with modeling and vulnerability assessment staff.	Perform scenario analysis and inundation mapping to identify and prioritize asset vulnerabilities. Develop toolbox of strategies (possible matrix) for application in different situations to meet various issues/needs.
Step 4: Strategy Presentations and Steering Committee presentations	Hold second round of public outreach events to present findings from public outreach #1, hazard evaluations and draft strategies for consideration. Solicit feedback and develop consensus for need to act.
Step 5: Coordination and program validation	Analyze strategies, perform cost benefit. And select strategies and approach for each stakeholder issue for County review and approval. Organize design review meeting with stakeholders and decision makers to garner support, preempt issues and address in draft plan.
Step 6: Documenting	Prepare draft plan and recommendations and make available for public comment on project website. Address comments and finalize/ publish on project website.

Figure 7. Outreach Plan

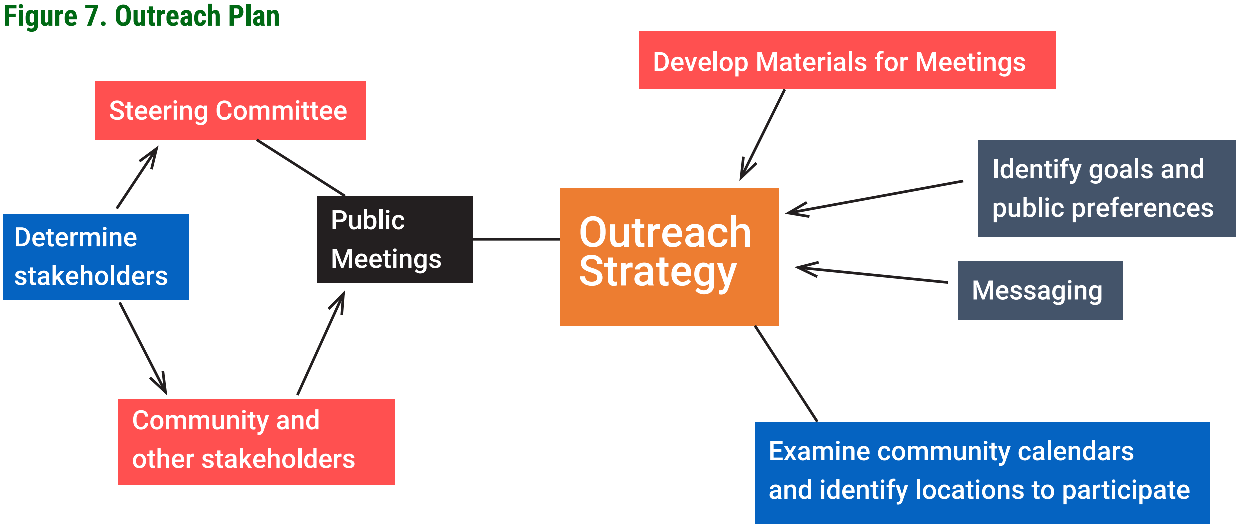


Table 17. Public Meeting #1

ACTIVITY	PUBLIC AWARENESS MEETING TO OBTAIN INPUT
Pre- Activity description	Prepare links with information on the project and subject Choose data to be presented. Get familiar with the community and "talking points" about the upcoming process. Optional: site visits
Format	Open House; informational meeting Remote/Zoom meeting
City staff	E-mail distribution Public Notice/Invitation City website; spread word
Meeting Facilitators	Meeting agenda Power Point presentation/visualization Handouts Motivate participants
Length	60-90 minutes
Approach	Give community members an opportunity for input One-on-one meetings with attendants Engage residents and obtain their input in person Use a theme; "This is happening, let's do something about it".
Outcome	Evaluate potential gaps in the data Meeting minutes Recommendations/input to include in final reports Set agenda for future meetings
Constraints	Poor attendance of event; low participation Low interest of community members Some residents can be very vocal and combative to debate existence and cause of SLR Low by-in to proposed planning effort No information on costs, budget or funding alternatives Results are citywide only, need to coordinate with Miami-Dade, SFWMD
Overcoming Constraints	Ensure that event advertising is widespread and obtain RSVP; set meeting in advance. Publicize the meetings using proven methods, like posting in social media. Constructive dialog; acknowledge comments and re-orient dialog Transparency Focus on values; not their positions Plan for multiple group meeting at different locations, if needed.
Techniques to engage by-in	Making assets and population more equipped to deal with SLR flooding Sustainability principles Use the Latest technology (e.g. surveys, audience polling) Plan for flood-based resiliency planning Apply good meeting facilitation techniques.

Table 18. Steering Committee Strategy

STEERING COMMITTEE MEETING	
ACTIVITY	MEETING WITH STEERING COMMITTEE TO OBTAIN THEIR INPUT
Activity description	Share information on modeling results and vulnerability assessment. Obtain steering committee comments
Format	Meeting in person; small group Remote/Zoom meeting
Participant preparation	Steering committee members to familiarize with results
City staff	Meeting location
Meeting Facilitators	Meeting agenda Distribute Handouts ahead of the meeting Power point presentation
Length	60-90 minutes
Approach	The planning team presents results and obtain comments and input form steering committee members Group provide input and direction for next phase; what they would like to see in the Adaptation Action Plan. Input on how to address public meetings.
Outcome	Evaluate potential gaps in the data Meeting minutes Recommendations/input to include in draft report ahead of the public meeting Revise draft VA to final VA
Constraints	Personal believes or opinions might be controversial. Results might be controversial
Overcoming Constraints	Ensure the members participation, share preliminary information and follow up

Outreach is an important activity that can help communities to build confidence and trust. The planning team is confident that the above described Public Involvement Strategy which has been used in other similar neighborhood improvement projects successfuly is flexible, responsive and will yield the best results for Miami Springs amenable to flexibility, adjustments and modifications as deemed most suitable by Miami Springs.

STEP 7- FINAL VULNERABILITY ASSESSMENT

Includes visual presentation of the data via maps and tables, based on the statuary scenarios and standards.

STEP 8- ADAPTATION ACTION PLAN

During this step, a set of adaptation strategies and capital planning design guidance are developed to address sea level rise in future City planning and design initiatives.

The vulnerability assessment includes the evaluation of infrastructure improvements such as raising roads, installing pump stations, protecting existing buildings and building new infrastructures higher. Saltwater intrusion is also addressed. Salt water is pushing further landward into the fresh water Biscayne Aquifer, which is increasing the vulnerability of the region's drinking water. Rising sea levels also push salt water further into the City infrastructure, potentially causing loss of habitat. Salinity control structures have been built at the entrances of major canals to separate fresh water and salt water and canals have been restored through plug barriers. Explore the Sea Level Rise story map to learn more.

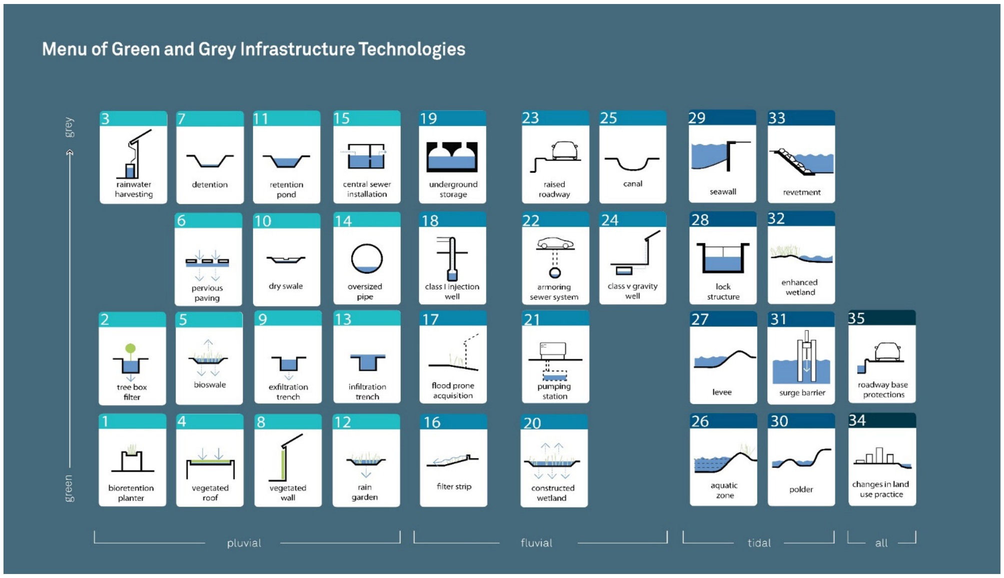
- Areas experiencing coastal flooding;
- Areas experiencing or projected to be experiencing tidal flooding;
- Areas with hydrological connections to coastal waters;
- Areas below, at, or near mean higher high water;
- Storm surge evacuation zones;
- Areas with other related impacts of sea level rise.

The process of identifying potential mitigation measures to implement begins with narrowing down the feasible engineering alternatives using threshold criteria and quantifiable selection criteria that include measures of effectiveness, cost, and added benefit to the community. The toolbox describes a variety of strategies that could be used to improve potential flood management conditions. They are community-specific and most require significant engineering and planning to determine the most efficient configuration to achieve the community's goals. Hard infrastructure systems are usually the first systems to be impacted because they are built at lower elevations than the finished floor of structures.

The vulnerability of infrastructure requires the design of more resistant and adaptive infrastructure and network systems. This will, in turn, involve the development of new performance measures to assess the ability of infrastructure systems to withstand flood events, and to enhance resilience standards and guidelines for design and construction of facilities. Specifically, considerations include retrofitting, material protective measures, rehabilitation and, in some cases, the relocation of facilities to accommodate sea-level rise impacts.

For this document, 35 solutions referred to as the "Periodic Table" menu of green and grey infrastructure technologies (Figure 8) are presented. Each of these options, their benefits, and limitations are included.

Figure 8. “Periodic table” menu of green and grey infrastructure technology options



The menu is organized to address various flooding types, from pluvial (rainfall and runoff mitigation in upland areas), fluvial (runoff, high ground water, and surface water management in low-lying flood prone areas), tidal (flooding associated with storm surge, high ground water, and tidally influenced), and all (applies across the spectrum).

STEP 9- RECOMMENDATIONS

Adaptation strategies outlined in Step 8 are prioritized for implementation through City policies and project design. Larger-scale interventions identified will be phased in over longer time frames as major capital project occur.

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