Hallandale Beach
PROGRESS. INNOVATION. OPPORTUNITY.

FLOODPLAIN MANAGEMENT PLAN

2021 Update

CRS MAX
CONSULTANTS, INC.

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Section One - Purpose and Introduction

Purpose of the Floodplain Management Plan

Of all natural hazards, the one that consistently has the greatest impact on local communities is flooding. Of all of the states in the nation, none is impacted more by flooding than Florida. For these reasons alone, it is prudent for members of a community to join together to study the hazard of flooding and to develop a plan to reduce (or mitigate) its impact. This is precisely what the City of Hallandale Beach has done.

Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. Flood mitigation entails taking action prior to flood events in order to reduce human and financial consequences resulting from the events. Floodplain Management Planning can lead to activities that lessen the impacts of disasters and reduce the loss of life and property for residents, governments and businesses in a community.

Accordingly, the purpose of the *City of Hallandale Beach Floodplain Management Plan* (FMP) is to produce a program of activities that will best address the community's vulnerability to the flood hazard and to:

- help to reduce flood losses
- improve local flood hazard mitigation capability
- increase public and private sector awareness by education about the flood hazard, loss reduction measures, flood insurance, and the natural and beneficial functions of floodplains
- address and protect cultural, economic and natural resources
- provide a basis for justifying the solicitation and use of local, state, federal and other funds to support hazard mitigation projects and initiatives

This Floodplain Management Plan may also serve to enhance economic development initiatives. The fact that the City of Hallandale Beach and its residents are involved in this type of mitigation planning is a selling point to potential residents, businesspeople and developers when they consider moving into the City.

The City of Hallandale Beach

The City of Hallandale Beach was incorporated as the Town of Hallandale on May 14, 1927. At that time, the City had 1,500 residents. Hallandale was reincorporated as a City in 1947 and reincorporated as Hallandale Beach in August 1999.

With a 2019 population estimate of 39,847, it is the seventh oldest city in a county of 31 incorporated cities. The area of Broward County is 1,322.8 square miles, of which Hallandale Beach comprises 4.55 square miles. The land area of the City of Hallandale Beach is 4.21 square miles and the surface water area is 0.34 square miles.

The city is situated at the southeasternmost corner of Broward County, bordered on the east by the Atlantic Ocean and on the South by Miami-Dade County. It is located approximately 20 miles north of Miami and 13 miles south of Fort Lauderdale. This positions the City in the heart of southeast Florida's tri-county Miami-Dade/Broward/Palm Beach metropolitan area. Hallandale Beach is conveniently located, with access to the Fort Lauderdale / Hollywood and Miami International airports, Port Everglades, and Port of Miami, as well as the Tri-Rail commuter rail system. The city has direct access to I-95, the Intracoastal Waterway and the Atlantic Ocean. Visitors as well as residents can enjoy beautiful beaches, exciting parimutuel wagering, and comfortable hotels.

The City is divided into four quadrants: northwest, northeast, southwest and southeast. The Florida East Coast Railroad sets the City's boundaries east from west, and Hallandale Beach Boulevard north from south. Avenues extend north and south, and streets east and west.

The industries with the highest share of the employment in the city are retail services and accommodation (hospitality/ food service). Those are followed by administration, manufacturing, arts and health.

Hallandale Beach has a City Commission-City Manager form of government. There are five elected officials: four City commissioners and an independently elected mayor. Each member is elected to a four-year term. The Mayor and City Commission set policy while the City Manager manages the day-to-day operations.

The City strives to provide its residents with courteous, helpful and responsive service through its various departments and offices typical to municipalities in South Florida. Additionally, the City prioritizes personalized service, and as such, maintains a Human Services Department to ensure the City's seniors, low-income residents, children and students receive the services they need. These services include, but are not limited to, job training, senior services, after school tutorial programs, and food distribution.

Section Two – Compliance with Flood Mitigation Programs & Plans

During the development of this Floodplain Management Plan (FMP), all necessary steps required to satisfy the National Flood Insurance Program's Community Rating System Floodplain Management Planning Process, and the Disaster Mitigation Act of 2000 were purposefully followed.

The Disaster Mitigation Act of 2000

Among its main features, the Disaster Mitigation Act of 2000 (DMA 2000) authorized the creation of a pre-disaster mitigation program that makes mitigation grants available to states, as well as to local and tribal governments, provided they have a FEMA approved hazard mitigation plan in effect prior to the time of the disaster. In accordance with the DMA 2000, Broward County developed the *Broward County Enhanced Local Mitigation Strategy*, which covers all the hazards that affect the county. The planning regulations for the DMA are consistent with the CRS process and this hazard mitigation plan enables the county, and the municipalities within the county that adopted it, to receive Hazard Mitigation Grant Program (HMGP) awards. The 2017 *Broward County ELMS* was adopted by the City on December 6th, 2017.

Broward County Local Mitigation Strategy (LMS) History

First adopted in March 2000, a follow-up revision was then adopted by the Broward County Board of County Commissioners (BOCC) in April 2005 (Resolution #2005-344), and a subsequent update was submitted to FEMA and adopted by the BOCC on January 5, 2010 (Resolution 2010-015).

The latest update to the Broward County LMS, dated 2017 and titled *Enhanced Local Mitigation Strategy* (ELMS), was reviewed by the Florida Division of Emergency Management for compliance and consistency with the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended by Section 322 of the Disaster Mitigation Act of 2000 (P.L. 106-390); the National Flood Insurance Act of 1968, as amended by the National Flood Insurance Reform Act of 2004 (P.L. 108-264); and 44 Code of Federal Regulations (CFR) Part 201 – Mitigation Planning.

The City of Hallandale Beach has been an active participant in the development and implementation of the Broward County Local Mitigation Strategy (LMS). At one time, this plan had also served as the community's floodplain management plan. Though the City had been able to make significant progress using this plan, in 2006 the City decided to formulate its own Floodplain Management Plan. On November 20, 2006, the City Commission officially authorized the formation of a Floodplain Management Plan Committee to develop a plan formulated specifically for this community.

Flood Mitigation Assistance Program Grants

The Federal Emergency Management Agency's (FEMA's) Flood Mitigation Assistance Program (FMA) provides funding to states and communities for implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP). The Program provides grants for mitigation planning, projects and technical assistance, with a goal of reducing flood insurance claims under the NFIP.

There are certain guidelines that must be followed to take advantage of FEMA's FMA grants, which are only available to NFIP-participating communities for the purpose of implementing measures to reduce flood losses. Communities receiving FMA project funds must have FEMA-approved Floodplain Management Plans, Flood Mitigation Plans or multi-hazard plans which address flood hazards in place to receive FMA Project Grant funds. This Floodplain Management Plan is specifically intended to comply with this requirement. Using this plan, the City can be better prepared to provide the necessary grant application materials required to seek state and federal funding. Applicable projects can be included in the Broward County ELMS Priority Project List in order to qualify for grant funding.

National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) to help provide a means for property owners to financially protect themselves, to minimize response and recovery costs and to reduce the loss of life and damage to property caused by flooding. The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. In order to qualify for flood insurance, a community must join the NFIP and agree to enforce sound floodplain management standards. Floodplain management regulations that meet minimum NFIP standards have been adopted by over 20,000 communities nationwide. Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements designed to protect new and existing buildings from anticipated flooding and prevent new developments from increasing the flood threat to existing properties.

The NFIP is administered by the Federal Emergency Management Agency (FEMA), which works closely with nearly 90 private property and casualty insurance companies to offer flood insurance to property owners and renters. Rates are set and do not differ from company to company or agent to agent. These rates depend on many factors, which include the date and type of construction of a building, together with the building's level of risk.

The primary benefits of the NFIP are to:

- ✓ Provide flood insurance coverage not as readily available in the private market;
- ✓ Stimulate local floodplain management to guide future development;
- ✓ Emphasize less costly nonstructural flood control regulatory measures over structural measures; and

- ✓ Reduce costs to the federal and state governments by shifting the burden from the general taxpayer to floodplain occupants.

The City of Hallandale Beach is a participant in the National Flood Insurance Program (NFIP) and will maintain compliance with the program by continuing to:

- ✓ require permits for all new development in the SFHA;
- ✓ elevate the lowest floor of all residential buildings in the SFHA to or above the Base Flood Elevation (BFE);
- ✓ restrict development in the regulatory floodway;
- ✓ ensure that construction materials and methods used will minimize future flood damage; and
- ✓ treat substantially improved structures as new buildings that must meet the minimum NFIP standards.

The success of the NFIP depends on communities ensuring that buildings and other development within their jurisdictions are constructed and maintained according to these standards so that flood losses will be minimized.

The Community Rating System Program

This document has been prepared to qualify as a "floodplain management plan" under the Community Rating System (CRS). The National Flood Insurance Program's CRS was first implemented in 1990 as a program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards. Community participation in the CRS program is voluntary. When communities surpass the NFIP's minimum standards for floodplain management, CRS can provide discounts of up to 45% off flood insurance premiums for residents and businesses in those communities. Communities apply for a CRS classification and are given credit points that reflect the impact of their activities on the three goals of the CRS:

1. Reduce and avoid flood damage to insurable property,
2. Strengthen and support the insurance aspects of the NFIP, and
3. Foster comprehensive floodplain management.

To obtain the necessary credit points to achieve lower CRS class ratings, communities implement a broad range of programs aimed at addressing the three goals of the CRS program. There are nineteen

activities by which communities can accumulate points toward their class ratings. These activities, designated in the FEMA Community Rating System Coordinator's Manual are:

Activity Number		Maximum Points Available
310	Elevation Certificates	116
320	Map Information Service	90
330	Outreach Projects	350
340	Hazard Disclosure	80
350	Flood Protection Information	125
360	Flood Protection Assistance	110
370	Flood Insurance Promotion	110
410	Flood Hazard Mapping	850
420	Open Space Preservation	2,870
430	Higher Regulatory Standards	2,462
440	Flood Data Maintenance	222
450	Stormwater Management	755
510	Floodplain Management Planning	762
520	Acquisition and Relocation	2,250
530	Flood Protection	1,600
540	Drainage System Maintenance	470
610	Flood Warning and Response	395
620	Levees	235
630	Dams	160

The activities above, credited by the CRS, provide direct benefits to the community, including:

- Enhanced public safety
- Reduction in flood damage
- Environmental protection
- Public awareness of community efforts to protect residents from flood losses
- Public information activities that build a knowledgeable constituency interested in supporting flood protection measures
- Public outreach that educates residents about the dangers of flooding and promotes behaviors that result in a reduction in the loss of life and property
- Savings that can then be spent in the community instead of on insurance premiums.

Participating jurisdictions are classified into CRS classes. These classes range from Class 1, which requires the most credit points and provides the largest reduction in insurance premiums, to Class 10, which receives no reduction in insurance premiums. A community applies for the program using

the CRS Application. The Insurance Services Office's (ISO) CRS Specialist reviews the community's program and verifies the CRS credit.

In October 1994, Hallandale Beach qualified for the CRS Program. Each year the City must recertify that it is continuing to perform the activities for which it is receiving CRS credit. If a community is not properly or fully implementing the credited activities, its credit points, and possibly its CRS classification, will be revised.

Typically, a "cycle verification visit" takes place every three to five years and is conducted in the form of an in-person verification visit. At this verification visit, the ISO/CRS Specialist reviews all the community's activities that may deserve credit. ISO will report the credit points and CRS Class to the community in a verification report. As of October 1, 2008, the City of Hallandale Beach became the first city in Broward County to earn a CRS rating of Class 6. This classification results in a 20% reduction in flood insurance premiums for residents that purchase flood insurance for their properties located in Special Flood Hazard Areas (SFHA), and a 10% premium reduction for policies outside of the SFHA.

Credit Points	CRS Class	Flood Insurance Premium Discount
4500 +	1	45%
4000 – 4499	2	40%
3500 – 3999	3	35%
3000 – 3499	4	30 %
2500 – 2999	5	25%
2000 – 2499	**6**	**20%**
1500 – 1999	7	15%
1000 – 1499	8	10%
500 – 999	9	5%
0 – 499	10	0

Although the City has found great value in the flood mitigation sections of the Broward County LMS, in 2006, the City determined there was a need to develop its own Floodplain Management Plan in order to strengthen the flood component of the strategy specific to Hallandale Beach and incorporate increased public input as part of the plan development process. Approximately once every five years, Floodplain Management Plans in the CRS program are required to be updated. This plan fulfills that requirement and is purposefully developed to optimize points in the CRS program.

The City of Hallandale Beach adopted its first Floodplain Management Plan in 2007. This plan has enabled the City not only to implement more comprehensive and focused flood mitigation activities, but it has also served as a major factor for the City's improved CRS classification. At the time, it was the highest scoring Floodplain Management Plan in Florida. The plan was then updated in 2013. In 2018, revisions were made to the plan's action items.

In conjunction with the development of this Floodplain Management Plan, Hallandale Beach will continue to implement other CRS activities that go beyond the minimum NFIP requirements. It is a goal of the City to maintain or improve its current CRS rating. As a CRS program participant, the City actively pursues a broad range of flood mitigation and management activities, including:

- Implementing outreach projects through a Program for Public Information, which includes information about the availability and value of flood insurance
- Maintaining and providing mapping information, which includes furnishing inquirers with flood zone information and making digitized maps available on the City's website
- Enforcing regulations and ordinances such as stormwater management regulations and regulations prohibiting dumping in the drainage system, as well as regulations that promote erosion control and safeguard water quality

- Providing flood protection information on the Hallandale Beach website and in the City's library

- Preserving floodplain as open space and promoting the natural and beneficial functions of the floodplain

While the CRS program does not dictate exactly what details are to be in a Floodplain Management Plan, it will credit this Plan according to standards outlined in the *FEMA CRS Coordinator's Manual*. This *City of Hallandale Beach Floodplain Management Plan* has been prepared in accordance with the following CRS 10-step planning process:

1. Organize to prepare the plan (15 points maximum)
2. Involve the public (120 points max)
3. Coordinate with other agencies (35 points max)
4. Assess the hazard (35 points max)
5. Assess the problem (52 points max)
6. Set goals (2 points max)
7. Review possible activities (35 points max)
8. Draft an Action Plan (60 points max)
9. Adopt the Plan (2 points)
10. Implement, evaluate and revise (26 points max)

Section Three – Organize to Prepare the Plan

"Organize to Prepare the Plan" is the first step in FEMA's 10-step planning process. The credit for this step is based on how the community organizes to prepare its floodplain management plan. It is important that the office responsible for land use and comprehensive planning is actively involved in the planning process to ensure that the FMP is incorporated into the community's planning activities; staff from departments that implement or have expertise in flood mitigation activities are also included in the planning process.

The City of Hallandale Beach staff utilized the 10-step process to update this plan. The City's CRS Coordinator, Chris Van Vliet, who is also a Project Manager in the Public Works Department, led the *City of Hallandale Beach Floodplain Management Plan* update project. The City retained CRS Max Consultants, Inc., of Coconut Creek, Florida to provide guidance throughout the planning process and to draft the plan.

Floodplain Management Planning Committee

A Floodplain Management Planning Committee, composed of both City staff and stakeholders from the public, was formed and titled the Ad Hoc CRS Committee. The Hallandale Beach staff was already familiar with the existing Floodplain Management Plan (2013) and the planning process.

Staff from the following City departments, divisions and specialties served as members in this planning committee:

- Planning and Zoning
- Building
- Engineering
- Emergency Management
- Public Information
- Sustainability

Stakeholders who served as members of the Floodplain Management Committee represented a robust contingency of the community and provided expertise in several key professions, including:

- Insurance
- Utilities
- Sustainability
- Business

Several committee members also serve on the City's Sustainability and Flood Mitigation Advisory Board, making them particularly well qualified.

Ad Hoc CRS Committee - City of Hallandale Beach Stakeholders & Residents

Alegria Bensimon, a long-time citizen of the City of Hallandale Beach, is a fiber engineer with Crown Castle Fiber. Alegria serves as secretary on the City's **Sustainability and Flood Mitigation Advisory Board**.

Irina Cotler has been a resident of Hallandale Beach for five years and has volunteered for several City Committees during the past two years. By trade, Irina is a **business and IT consultant** as well as an experienced Yoga Teacher.

Lakitsia Gaines is the Agency Owner with Kitsia Gaines - State Farm Insurance, which serves Hallandale Beach. She has been in the **insurance** industry for over 25 years.

Howard Garson has been a **resident** of Hallandale Beach for 43 years, during which time he has been a very active **volunteer** with the City. He has served in key positions on the City's Planning and Zoning Board, Charter Review Committee, Parks and Recreation Advisory Board and Three Islands Safe Neighborhood District Advisory Board.

Robert McColgan, whose professional experience includes **public works, utilities and environmental health**, has been a resident of Hallandale Beach for 48 years. He has served as a volunteer on several City and County boards.

Ad Hoc CRS Committee - City of Hallandale Beach Staff

Christy Dominguez is the Planning and Zoning Manager for the City of Hallandale Beach. A longtime member of City staff, Ms. Dominguez is responsible for overseeing current as well as long-range **planning** programs related to development for the City of Hallandale Beach.

Miguel Nunez has served as Building Official for several municipalities, including the City of Hallandale Beach. In that capacity he is also the municipality's **floodplain administrator**.

Jeffrey Odoms serves the City as Director of Public Works. He has been a professional in **utilities management** for 26 years and a professional in **emergency management** for three years.

Chris Van Vliet, Project Manager for the City of Hallandale Beach's Public Works Department is a certified project manager (PMP), focusing on **engineering**, and a **certified floodplain manager** (CFM) with approximately 20 years of Florida governmental experience at both the municipal and county levels. He is also the CRS Coordinator for the City of Hallandale Beach.

Alyssa Jones Wood has been a public servant at the City of Hallandale Beach for three years. As the City's Sustainability & Resiliency Officer she is focused on **environmental sustainability** and climate change resilience. Alyssa also assists with **public information** and outreach as part of the City's Digital Engagement Team.

The Committee provided invaluable input needed to identify problems, set goals and objectives, and select mitigation actions and strategies for the plan. Members of the Committee were able to supplement the flood data that was obtained for this report with their personal knowledge and experiences concerning the flood hazard in the city.

Ad Hoc CRS Committee Meetings

In order to update the Floodplain Management Plan, the Committee reviewed recent data, identifying the characteristics and potential consequences of the current flood hazard in Hallandale Beach. Armed with an understanding of the risks posed by flooding, the Committee determined what priorities should be considered and potential activities to avoid or minimize the hazard. The result is a Floodplain Management Plan, including a strategy for implementation.

To optimize its effectiveness, the Floodplain Management Plan must be implemented through an Action Plan that includes a variety of activities, ranging from implementing specific mitigation projects to advocating code requirements. To ensure the success of the ongoing program, it is critical that the plan remains relevant. Thus, it is important to conduct periodic evaluations and make revisions as needed.

These key periodic plan evaluation steps were individually presented and discussed at the Committee meetings. The breakdown of specific steps undertaken at each Committee meeting follows:

Meetings held during FMP Update Process (2020-2021):

The first Community Outreach meeting, held virtually by Zoom at the beginning of the planning process, was advertised on the City's website, by email and through social media. All Committee meetings were held by Zoom and attended virtually. The final Action Plan review and drafting steps were completed by email. A second Community Outreach meeting was again held virtually by Zoom at the end of the process to solicit public input on the updated Action Plan draft.

Meeting Date	Plan Evaluation Step(s)	Topics Covered
3/17/2021	Organize to Prepare the Plan PPI Update	• Define purpose & goals of the Committee • Description of 10-Step planning process • PPI Review and Update
4/22/2021	PPI Update	• PPI Review and Update
05/17/2021	Assess the Hazard Assess the Problem	• Review of 10-Step planning process • Assessment of the Flood Hazard • Assessment of the Problem

Meeting Date	Plan Evaluation Step(s)	Topics Covered
06/07/2021	Assess the Problem Set Goals	• Assessment of the Problem • Define Problem Areas • Establish Goals
6-8-2021	Community Outreach Meeting	• Held virtually via Zoom • Inform the community • Explain the 10-step planning process • Gather Input
6/28/2021	Review of Possible Activities	• 2013 Action Plan: Item Review • Review of additional Possible Activities
7/1/2021	Review of Possible Activities	• Review of additional Possible Activities
7/1/2021 – 7/9/2021 (by email)	Review of Possible Activities	• Finalize Review of Possible Activities • Draft Action Plan

7/16/2021 - 7/23/2021 (by email)	Update & Approve Action Plan Draft	• Draft Action Plan
		• Finalize Action Items
		  ○ Prioritize,
		  ○ Assign responsibilities
		  ○ Identify possible funding
		• Approval of Action Plan by Committee

08/12/2021	Community Outreach Meeting	• Held virtually via Zoom • Collected public input on the updated Action Plan draft

Exhibit 1 includes documentation of the agendas and handouts from the Floodplain Management Committee meetings.

Involve the Public in the Planning Process

The Floodplain Management planning process is most effective when the citizens and stakeholders within the community are actively engaged. Community involvement was encouraged throughout the development of this plan update with opportunities provided to the citizens of Hallandale Beach to participate in the planning process. The direct community representation on the Committee and the participation of residents in public outreach meetings allowed the Committee to gain insight into current and past neighborhood-specific flood issues and possible mitigation actions.

Including Hallandale Beach citizens on the planning committee has the following advantages:

- ✓ The participants recognize that they are involved and will be more willing to commit themselves to the process.
- ✓ A Committee can be an effective forum for discussing alternatives, debating goals and objectives, and matching the technical requirements of a program to local situations.
- ✓ It gives the participants a feeling of "ownership" of the plan and its recommendations, which helps build public support for it.
- ✓ Committee members form a constituency that will have a stake in ensuring that the plan is implemented.

Community Outreach Meetings

The first community outreach meeting of the FMP Update planning process was held on June 8th, 2021. To maximize safety and accessibility, the meeting was held virtually by Zoom. Among other things, the planning process was described both on the City's website and in the meeting, specifically outlining the ten steps of the Floodplain Management Plan.

A second community meeting was held on August 12th, 2021 by Zoom, to solicit input on the updated Action Plan draft. A copy of the Action Plan was sent to members of the public that have shown an interest in Floodplain Management planning and was placed on the City's website. The community meeting was advertised on the City's website, social media, and by email. Copies of, the agenda, presentation, and the attendance are included in Exhibit 1. Exhibit 2 includes documentation demonstrating how the Community Outreach meetings were advertised to the public.

Solicitation of Comments and Recommendations

In an effort to communicate and coordinate with the public and local stakeholders, letters were sent to a number of agencies and stakeholders in the affected areas seeking their input, comments and recommendations, and soliciting their support of the City's Floodplain Management efforts. These included the following:

- ❑ Neighborhood advisory groups
- ❑ Homeowners' associations
- ❑ Parent-teacher organizations
- ❑ Chamber of Commerce
- ❑ Neighboring communities
- ❑ Agencies involved in hazard mitigation
- ❑ Agencies that regulate development
- ❑ Businesses
- ❑ Academia
- ❑ State NFIP Coordinator
- ❑ State water resources agency
- ❑ FEMA regional office
- ❑ National Weather Service
- ❑ Red Cross
- ❑ Homebuilders' Associations
- ❑ Environmental Groups

See Exhibit 3, which includes a list of stakeholders that represent the public in the affected areas from which comments and recommendations were solicited, and a copy of the letter that they received. Information and feedback obtained from the responses and follow-up phone calls were incorporated into the planning process.

Other Information Activities to Encourage Public Input

The following activities were implemented to encourage public input in the month during which the draft plan was under review.

- Post a draft of the Action Plan and advertise a request for FMP draft input on the City's website
- Hold the Community Outreach meeting by Zoom seeking input on the draft FMP.
- Implement media releases on various City social media platforms, explaining the process, requesting input, participation, etc.
- Include an article in the City's *Green Initiatives Newsletter*, explaining the process, requesting input, participation, etc.
- Email sent to HOAs and other groups explaining the process, requesting input, participation, etc.

Exhibit 4 includes documentation demonstrating how the public was invited to participate in the planning process and review the Action Plan draft.

Section Four – Coordination with Other Organizations & Plans

Coordination

Hazard mitigation planning is most successful when it results in actions that also support other important community goals and objectives, so it is important that the development of a floodplain management plan includes involvement and coordination with government agencies and private organizations for two reasons:

1. Other agencies may be implementing or planning to implement activities that could affect flood damage, the hazards, or other local interests and concerns. The Committee needs to ensure to the greatest extent possible that its efforts and plans will not conflict with other essential government programs. Equally important is the need to avoid duplication of efforts and resources.

2. Involvement of outside agencies and organizations may secure valued assistance. This assistance may be in the form of hazard data, technical information on various measures, guidance on regulatory requirements, advice in the planning effort, implementation of a recommended measure, and/or financial participation to help implement a recommended measure.

Review of Existing Studies, Reports, & Plans for the Area

The planning Committee has access to a wide variety of information. Members, local government offices, and many other sources allow for the group to bring information together for planning purposes. This information has been compiled to address mitigation issues and establish mitigation initiatives for incorporation into this FMP.

The City's community development goals and floodplain management / mitigation goals may be mutually supportive or they may conflict, but they must be acknowledged. Therefore, the development of this FMP has included a concerted effort to assure it is in conformance with the City's other plans, studies and reports, many of which were used for reference or informational purposes.

This FMP conforms with the principles and guidance offered by the *City of Hallandale Beach Comprehensive Plan*, ensuring that it is consistent with and supportive of the Comprehensive Plan. The FMP also takes into consideration the related plans of neighboring municipalities and other governmental entities. It is the intent of the Committee that the FMP be consistent with and

supportive of the City's Comprehensive, Emergency Management, and Post-Disaster Redevelopment Plans as well as other studies, reports and technical information.

The FMP Committee utilizes the *City of Hallandale Beach Comprehensive Plan*, Intergovernmental Coordination Element for guidance on how intergovernmental coordination will be conducted and managed in the City of Hallandale Beach. The following goals, objectives, and policies of this element are particularly relevant to the planning process of the FMP:

> ***Goal 1:*** *To maintain and/or improve existing mechanisms and to establish new ones as required to ensure coordination and cooperation between the City of Hallandale Beach and other units of local, County, Regional, State, and Federal governments regarding planning and development matters.*

- ***Objective 1.1:*** *The City shall use existing and establish new procedures as needed to ensure consistency and coordination between the City Comprehensive Plan, the State of Florida Comprehensive Plan, the Strategic Regional Policy Plan (SRPP) for South Florida, plans of adjacent municipalities, and plans of other units of local government which provide services within the City, but do not have regulatory authority..*
    - ***Policy 1.1.3*** *The City shall continue to coordinate and cooperate with the Broward County Planning Council, South Florida Regional Planning Council, South Florida Water Management District, Florida Department of Community Affairs, Florida Department of Transportation and other Federal, state, regional agencies through formal and informal means to carry out the goals, objectives and policies of the Comprehensive Plan.*
- ***Objective 1.5*** *Coordinate with state, regional and local governments to plan for sea level rise and other issues unique to coastal cities.*
    - ***Policy 1.5.1*** *Pursuant to Coastal Management Policy 1.2.4, the City shall continue to coordinate with representatives of all local coastal governments which are within at least two miles of the boundaries of the Hallandale Beach Coastal area, including Dania Beach, Hollywood, Aventura, Golden Beach, and Sunny Isles, to discuss plans and strategies and the implementation of specific programs to ensure (1) adequate sites for water-dependent uses, (2) prevent estuarine pollution, (3) control surface water runoff, (4) protect living marine resources, (5) reduce exposure to natural hazards, and (6) ensure public access to the Intracoastal Waterway and Atlantic beaches.*
    - ***Policy 1.5.2*** *Pursuant to Coastal Management Policy 2.3.2, in designating adaptation action areas, the City should coordinate with Broward County, adjacent municipalities where applicable, Florida Department of Transportation, and other agencies that plan for or own, operate, and maintain public facilities/infrastructure within or crossing proposed adaptation action areas.*

Coordination Efforts

On June 3rd, 2021, a letter was sent to 28 recipients, including neighboring communities; local, regional, state, and federal agencies; businesses; academia and other private and non-profit organizations that may be affected by the flood hazard or involved in flood mitigation or floodplain management. A copy of the letter and a list of recipients are included in Exhibit 3. Any responses received can also be found in Exhibit 3.

Coordinating with other Plans and Studies

Plans, flood studies, reports and technical information from state agencies and neighboring counties and municipalities were reviewed in the planning process. Most of these documents can be found in their entirety on the Internet. Below is a list of the documents that have been examined during the development of this plan to collect helpful information and to assure conformance with goals and objectives. This listing should prove helpful to the FMP Committee in future planning efforts, especially for annual evaluations and five-year updates of this FMP:

- ✓ **National Risk Index (NRI) Data**
- ✓ **Florida Statewide Regional Evacuation Study Program (2016 Updates)**
- ✓ **Broward County Enhanced Local Mitigation Strategy 2017**
- ✓ **Broward County Comprehensive Emergency Management Plan**
- ✓ **Hallandale Beach Comprehensive Emergency Management Plan**
- ✓ **Broward County Hurricane Preparedness Guide**
- ✓ **NOAA Storm Event Database**
- ✓ **National Hurricane Center and NOAA Historical Hurricane Track**
- ✓ **Florida Building Code Cost and Loss Reduction Benefit Comparison Study**
- ✓ **Impact of Hurricanes on Housing and Economic Activity: A Case Study for Florida 2006 produced by the NATIONAL ASSOCIATION OF REALTORS**
- ✓ **Division of Emergency Management State of Florida Enhanced Hazard Mitigation Plan**
- ✓ **South Florida Transportation Analysis Hurricane Evacuation Study Update**
- ✓ **2020 Statewide Emergency Shelter Plan**
- ✓ **A Region Responds to a Changing Climate, Regional Climate Action Plan, October 2012**
- ✓ **NOAA Technical Report NOS CO-OPS 073; Sea Level Rise and Nuisance Flood Frequency Changes around the United States**
- ✓ **Southeast Florida Regional Climate Change Compact report titled Analysis of the Vulnerability of Southeast Florida to Sea Level Rise, August 2012**
- ✓ **2019 Unified Sea Level Rise Projection for Southeast Florida prepared by the Southeast Florida Regional Climate Change Compact**

- ✓ **Saltwater Interface Monitoring and Mapping Program Technical Publication WS-58 (December 2020)**
- ✓ **The CDC's Mold Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes and Major Floods; Recommendations and Reports June 9, 2006**
- ✓ **City of Hallandale Beach Vulnerability and Adaptation Plan, 2020**
- ✓ **City of Hallandale Beach Sustainability Action Plan, 2019**
- ✓ **City of Hallandale Beach Dune Protection and Management Plan, 2020**
- ✓ **City of Hallandale Beach Post-disaster Redevelopment Plan, 2020**
- ✓ **Hallandale Beach Citywide Master Plan and Implementation Strategy**
- ✓ **Hallandale Beach Citywide Parks Master Plan**

Appendix A includes a more detailed list of referenced documents with the website addresses and/or locations of each, along with a table explaining where they are cited or referenced throughout the FMP.

Solicitation of Input on the Draft Action Plan

In August, a draft of the *City of Hallandale Beach Floodplain Management Plan* Action Plan was also sent to the agencies, organizations and stakeholders that were contacted at the beginning of the planning process, as well as to any members of the public that have shown an interest in flood mitigation planning, asking them to comment by a certain date. The Action Plan was also posted on the City's website, along with an invitation to the community outreach meeting.

Section Five - Assess the Flood Hazard

Section Contents

Flood Hazards and Risks

Flood or flooding refers to the general or temporary conditions of partial or complete inundation of normally dry land areas from the overflow of inland or tidal water and of surface water runoff from any source. Floodplains are defined as any land areas susceptible to being inundated by water from any flooding source.

Flooding can be divided into two major categories: Coastal and Inland/Riverine. While there are no rivers in the City of Hallandale Beach, its low-lying topography combined with its subtropical climate makes it highly vulnerable to inland flooding. Those areas lying east of Federal Highway are particularly vulnerable to coastal flooding from storm surges, and residents living in those areas should be prepared if a major storm threatens.

In the City of Hallandale Beach intense or prolonged, concentrated rain is the primary cause of localized flooding. Major rainfall events occur in association with hurricanes, tropical storms, and thunderstorms associated with frontal systems. This overabundance of rainfall creates saturated soil conditions, after which additional rain causes surface ponding or an overflow of catchment canals and ponds. This can result in street and yard flooding, which is regarded as nuisance flooding. Because most buildings are elevated above the base flood elevation, there is typically protection from flooding. The hazard of flooding, however, has impacted the city substantially.

Flooding in can occur as a result of one, or a combination of two or more of the following events:

- ✓ **Tropical Cyclone**
- ✓ **Storm Surge**
- ✓ **Thunderstorms**
- ✓ **Dam/Dike Failure**
- ✓ **Sea Level Rise**
- ✓ **Tsunami**
- ✓ **Rogue Wave**

Risk, or the probability of loss, depends on three elements:

Frequency – How frequently does a known hazard produce an impact within the community?

Vulnerability – How vulnerable is a community to the impacts produced by a known hazard?

Exposure – What is the community's exposure in terms of life and property to the impacts produced by a specific hazard?

Risk Measurement

Where applicable, the publicly available *National Risk Index (NRI)* was used to define the flood related risk of each of the census blocks within Hallandale Beach. The *National Risk Index* rates community exposure to 18 Natural Hazards, of which four (highlighted) are flood related:

- Avalanche	- Coastal Flooding	- Cold Wave
- Drought	- Earthquake	- Hail
- Heat Wave	- Hurricane	- Ice Storm
- Landslide	- Lightning	- Riverine Flooding
- Strong Wind	- Tornado	- Tsunami
- Volcanic Activity	- Wildfire	- Winter Weather

The NRI is available to the public through https://www.fema.gov/nri. FEMA provides access to the NRI data and information through multiple venues, including a website, an interactive map and data exploration tool, tabular and spatial dataset files, and GIS-based REST services.

FEMA describes the NRI as follows:

> Briefly stated, the NRI is a first-of-its-kind, nationwide, holistic assessment of baseline risk to natural hazards. Although it is based on extensive research and best practices in the risk assessment fields, the NRI's methodology is unique and carefully constructed [to meet] the specific needs of natural hazard risk assessment at both small and large geographic scales.

A detailed overview of the risk calculation is available in the *National Risk Index Primer, December 2020*, a document published by FEMA. In summary, the risk equation behind the National Risk Index includes three components:

- **Expected Annual Loss:** a natural hazards component
  - the dollar loss from building value, population and/or agriculture exposure each year due to natural hazards.
- **Social Vulnerability:** a consequence enhancing component
  - the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood.
- **Community Resilience:** a consequence reduction component
  - the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.

The following excerpts from the *National Risk Index Primer* give a more detailed explanation of some of the methodologies and calculations:

Data & Methodologies

> The NRI's most important and central component, Expected Annual Loss (EAL), is a robust measurement that quantifies the anticipated economic damage resulting from natural hazards each year. EAL consists of the best-available datasets for 18 natural hazards of national and regional significance, with source data being processed to match the unique

nature of each natural hazard. Full processing details for each hazard are available in the NRI Technical Documentation. Per the direction established at initiation, the dataset also includes measurements of social vulnerability and community resilience to quantify overall risk. These key components are detailed fully in the Social Vulnerability and Community Resilience sections.

Risk Analysis Overview

Risk, in the most general terms, is often defined as the likelihood (or probability) of a natural hazard event happening multiplied by the expected consequence if a natural hazard event occurs. The generalized form of a risk equation is given in Equation 1.

Equation 1: Generalized Risk Equation

$$Risk = Likelihood \times Consequence$$

Risk Calculation

In the National Risk Index, risk is defined as the potential for negative impacts as a result of a natural hazard. The risk equation behind the NRI includes three components: a natural hazards component, a consequence enhancing component, and a consequence reduction component. EAL is the natural hazards risk component, measuring the expected loss of building value, population, and/or agricultural value each year due to natural hazards. Social vulnerability is the consequence enhancing component and analyzes demographic characteristics to measure a community's susceptibility of social groups to the adverse impacts of natural hazards. Community resilience is the consequence reduction component and uses demographic characteristics to measure a community's ability to prepare for, adapt to, withstand, and recover from the effects of natural hazards. These three risk components are combined into one risk value using Equation 2.

Equation 2: NRI Risk Equation

$$Risk = Expected\ Annual\ Loss \times Social\ Vulnerability \times \frac{1}{Community\ Resilience}$$

An overall composite Risk Index score and individual hazard Risk Index scores are calculated for each county and Census tract included in the NRI. A composite Risk Index score measures the relative risk of a location considering all 18 natural hazards included in the index. An individual hazard Risk Index score measures the relative natural hazard risk of a location for a single natural hazard. All scores are relative as each Census tract or county's score is evaluated in comparison with all other Census tracts or counties.

Scores and Ratings

In this NRI Risk Equation, each component is represented by a unitless index value, representing a community's score relative to all other communities. From the three indices, the Risk Index score is calculated to measure a community's risk to all 18 natural hazards. The Risk Index is also a unitless index and represents a community's risk relative to all other communities. The Risk Index and EAL are provided as both composite scores from the summation of all 18 natural hazards, as well as individual-hazard scores where each hazard is considered separately.

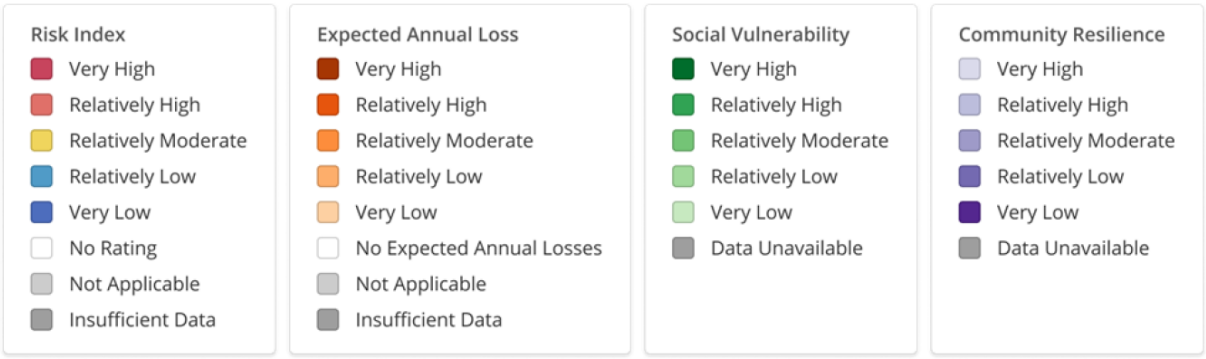
All calculations are performed separately at two levels-of-detail—county and Census tract—so scores are relative only within their level-of-detail. It must be stressed that scores are relative, representing a community's relative position among all other communities for a given component and level-of-detail. Scores are not absolute measurements and should be expected to change over time either by their own changing measurements or changes in other communities.

All scores are constrained to a range of 0 (lowest possible value) to 100 (highest possible value).

For every score there is also a qualitative rating that describes the nature of a community's score in comparison to all other communities, ranging from "Very Low" to "Very High." The rating is intended to classify a community for a specific component in relation to all other communities.

In the NRI application's maps and data visualizations, standard color schemes have been applied to the qualitative ratings. Risk Index ratings are represented using a diverging blue (Very Low) to red (Very High) color scheme. The NRI's standard color schemes are shown [in the figure below].

National Risk Index Qualitative Rating Legend



The NRI scale was used to assess the risk potential to people, property, and agriculture within the selected census blocks using the following relative descriptors, and, although they are not further described by FEMA, an explanation of each has been provided below for clarification based on the expected frequency and scope of damage:

Very Low: A hazard with a "Very Low" risk rating indicates that it is not likely to affect the community, or if it does occur, it is not likely to cause measurable damage. A risk of "Very Low" indicates a risk that is above zero, but quantitatively small.

Relatively Low: A hazard with a "Relatively Low" risk rating indicates that it is not likely to have any measurable or lasting detrimental impact and will likely be rectified promptly with locally available resources, thus not considered a threat to the whole community.

Relatively Moderate: A hazard with a "Relatively Moderate" risk rating indicates that it has a moderate chance of occurring (frequency) but will likely cause a "Major Disaster" level loss when it does occur. As such, the hazard is considered a major threat to the whole community.

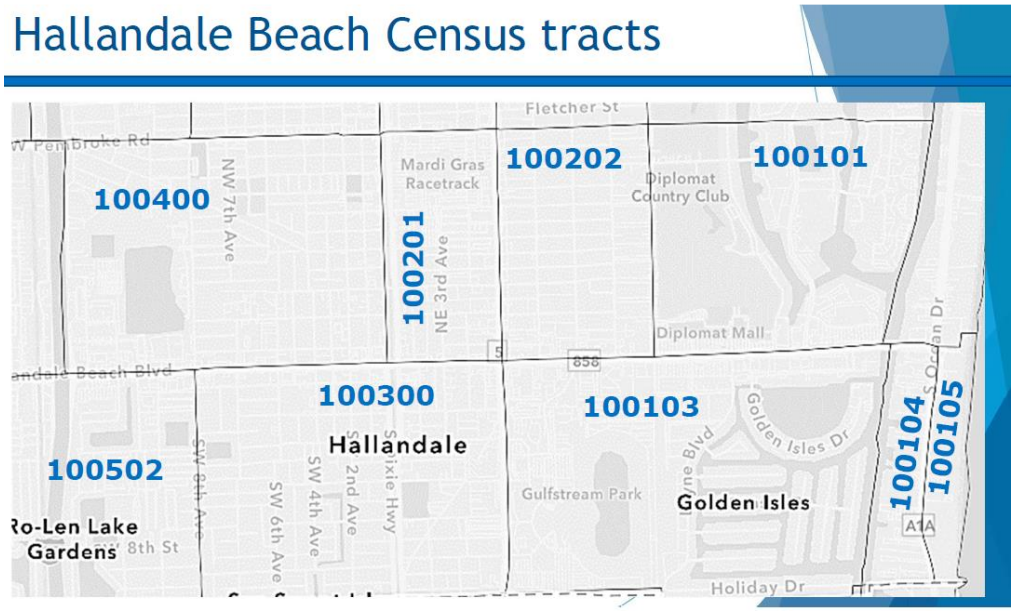
Relatively High: The hazard with a "Relatively High" risk rating indicates that it has a significant chance of occurring in any given year and will likely cause a catastrophic disaster. Detrimental impacts from the hazard will require substantial time, resources, and/or outside assistance to rectify damages. More than likely, there will be long-term effects on the general economy, the private sector, and public confidence in the jurisdiction's governance.

Very High: The hazard with a "Very High" risk rating indicates that there is a high likelihood of this hazard occurring and it will likely cause a catastrophic disaster with significant loss of life, property and/or agriculture. Detrimental impacts from the hazard will require substantial time, resources, and/or outside assistance to rectify damages. More than likely, there will be long-term effects on the general economy, the private sector, and public confidence in the jurisdiction's governance. Because of the high likelihood of occurrence, these are the hazards for which communities should focus mitigation efforts first.

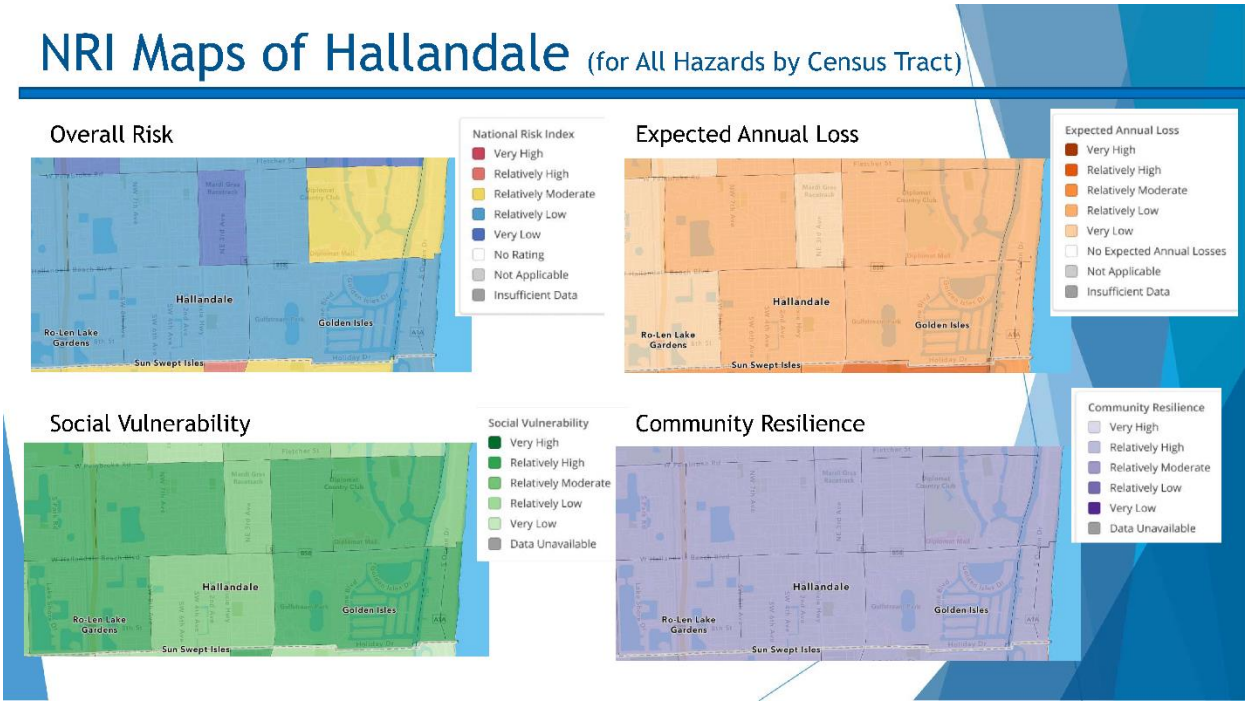
Note: Historical loss (as a ratio of historical value at risk) is a significant variable in the NRI calculations for Expected Annual Loss (EAL). Although updated calculations using the current values for properties and lives at risk are used in the final calculations, circumstances (such as low insured rates) can result in 'reported' historical loss ratios being less than 'actual incurred' historical losses. This can in turn result in risk values that appear lower than expected. In such situations, a note will be made of this discrepancy based on historical experience or unique local conditions.

In the *Assess the Problem* section of this document, possible or expected qualitative (non-monetary) risks and problems, such as interruption of services, environmental impact and indirect health risks will also be discussed. These factors cannot always be adequately captured in a strictly quantitative assessment but are worth noting during the consideration and prioritization of hazard mitigation efforts.

The NRI provides risk assessments for Counties and census tracts. In order for this plan to be as specific to Hallandale Beach as possible, the NRI data from Hallandale's nine census tracts (seen below) were used.



Census tract level risk maps from the *October 2020 NRI* can be seen below:



Summary of Overall Risk

For each census tract, the NRI provides an overall risk rating. Below is a risk summary from the 2020 NRI for all 18 natural hazards (across all 9 Hallandale Beach census tracts):

- **Expected Annual Loss:** Relatively Low
- **Social Vulnerability:** Relatively High
- **Community Resilience:** Relatively Moderate

- **Overall Relative Risk: RELATIVELY LOW**

Summary of Flood Risk

The NRI does not summarize flood risk as an overall category for each community, but it does provide a risk analysis for four specific forms of flooding (Hurricane, Coastal, Riverine, Tsunami). Those assessments will be included at the end of their respective subsections. The available NRI Data tables covering those hazards for Hallandale Beach can be found in Appendix B.

Below is a general flood risk summary using averages from the *October 2020 NRI* data for the three most common forms of flooding that were analyzed (Coastal, Riverine, Hurricane) across all 9 census tracts:

- **Frequency:** >1% likelihood per year
- **Vulnerability:** VERY LOW
- **Exposure:** Building Value: $4.6 Billion
  Population: 37,770
- **Relative Expected Annual Losses:** Moderate-High

- **Flooding Relative Risk: HIGH**

Tropical Cyclones

In general terms, a hurricane is a cyclone. A cyclone is any closed circulation developing around a low-pressure center in which the wind rotates counterclockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. They act as safety valves that limit the build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the poleward latitudes.

As a developing center moves over warm water, pressure drops (measured in millibars or inches) in the center of the storm. As the pressure drops, the system becomes better organized and the winds begin to rotate around the low pressure, pulling the warm and moist ocean air. It is this cycle that causes the wind (and rain) associated with a tropical cyclone. If all the conditions are right (warm ocean water and favorable high-altitude winds), the system could build to a point at which it has winds in excess of 155 miles per hour and could become catastrophic if it makes landfall in populated areas.

Tropical cyclones with a maximum sustained wind speed of less than 39 mph are called tropical depressions. When the maximum sustained wind speed ranges between 40-73 mph they are tropical storms. When the maximum sustained wind speed reaches or exceeds 74 mph, they are called hurricanes.

Hurricanes vary greatly in size, intensity, behavior, and movement. All hurricanes are dangerous, but some are more so than others. The way storm surge, wind and other factors combine determine the hurricane's destructive power. Hurricanes are destructive because they produce damage due to high winds, large amounts of rainfall and storm surge. Storm surge is simply water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge can combine with the normal tides to create the storm tide. An intense hurricane can send a dome of water more than 18 feet deep ashore as the storm hits land. Coastal flooding can be difficult to predict. Flooding may be worse from a direct hit by a lesser category hurricane, in comparison to a glancing hit by a larger category storm. In the City of Hallandale Beach, storm surge flooding that could occur during a hurricane or major storm would be on the Atlantic coastline, along the Intracoastal Waterway and the finger canals off the Intracoastal Waterway, west to Federal Highway and possibly to the railroad tracks at Dixie Highway. A further discussion of the storm surge hazard in the City follows in the "Storm Surge and Storm Tide" section of this Flood Mitigation Plan.

In the City of Hallandale Beach, damage during hurricanes may be exacerbated by inland flooding and heavy rainfall that usually accompanies these storms. In some areas of Hallandale Beach, the drainage issues further exacerbate the problem.

To make comparisons easier and to make the predicted hazards of approaching hurricanes clearer, the National Oceanic and Atmospheric Administration's hurricane forecasters use a disaster-potential scale that assigns storms to five categories. This can be used to give an estimate of the potential property damage and flooding expected along the coast with a hurricane. The scale was formulated in 1969 by Herbert Saffir, a structural consulting engineer, and Dr. Bob Simpson, director of the National Hurricane Center. The World Meteorological Organization was preparing a report on structural damage to dwellings due to windstorms, and Dr. Simpson added information about storm surge heights that accompany hurricanes to each category.

The Saffir-Simpson Hurricane Scale is a 1-5 rating based on the hurricane's present intensity. This is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf and the shape of the coastline in the landfall region. A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water in close proximity to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. This is the situation along most of the Atlantic Ocean side of the state of Florida.

SAFFIR-SIMPSON HURRICANE DAMAGE POTENTIAL SCALE

Category	Central Pressure inches	Central Pressure millibars	Winds (mph)	Surge (ft.)	Damage
1	>28.94	>980	74-95	4-5	Minimal
2	28.50-28.91	965-979	96-110	6-8	Moderate
3	27.91-28.47	945-964	111-130	9-12	Extensive
4	27.17-27.88	920-944	131-155	13-18	Extreme
5	<27.17	<920	>155	>18	Catastrophic

Category 1 Winds 74-95 mph
Storm surge is generally 4 to 5 feet above normal; no real damage to building structures; damage primarily to unanchored mobile homes, shrubbery, and trees; some damage to poorly constructed signs; some coastal road flooding and minor pier damage.

Category 2 Winds 96-110 mph
Storm surge is generally 6 to 8 feet above normal; some roofing material, door and window damage to buildings; considerable damage to shrubbery and trees blown down; considerable damage to mobile homes, poorly constructed signs, and piers; coastal and low-lying escape routes flood 2-4 hours before arrival of the hurricane's center; risk to small crafts in unprotected anchorages break moorings.

Category 3 Winds 111-130 mph
Storm surge is generally 9 to 12 feet above normal; some structural damage to small buildings and utility buildings with a minor amount of curtain wall failures; damage to shrubbery and trees with foliage blown off trees and large trees blown down; mobile homes and poorly constructed signs destroyed; low-lying escape routes cut by rising water 3-5 hours before arrival of the center of the hurricane; flooding near the coast destroys smaller structures with larger structures damaged by battering from floating debris; terrain lower than 5 feet

above mean sea level may be flooded inland 8 miles or more; evacuation of low-lying residences within several blocks of the shoreline may be required.

Category 4 Winds 131-155 mph
Storm surge is generally 13 to 18 feet above normal; more extensive curtain wall failures with some complete roof structure failure on small buildings; shrubs, trees, and all signs are blown down; complete destruction of mobile homes; extensive damage to doors and windows; low-lying escape routes cut by rising water 3-5 hours before arrival of the center of the hurricane; major damage to lower floors of structures near the shore; terrain lower than 10 feet above sea level may be flooded, requiring massive evacuation of residential areas as far inland as 6 miles.

Category 5 Winds greater than 155 mph
Storm surge is generally greater than 18 feet above normal; complete roof failure on many residences and industrial buildings; some complete building failures with small utility buildings blown over or away; all shrubs, trees, and signs blown down; complete destruction of mobile homes; severe and extensive window and door damage; low-lying escape routes are cut by rising water 3-5 hours before arrival of the center of the hurricane; major damage to lower floors of all structures located less than 15 feet above sea level and within 500 yards of the shoreline; massive evacuation of residential areas on low ground within 5-10 miles of the shoreline may be required.

Only four Category Five Hurricanes have made landfall in the United States since records began: the "Labor Day" hurricane which hit the Florida Keys in 1935, Hurricane Camille which hit Louisiana and Mississippi in 1969, Hurricane Andrew which hit Homestead Florida in 1992, and Hurricane Michael which hit the Florida Panhandle in 2018.

Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane watch is issued by the National Weather Service 48 hours in advance of the anticipated onset of tropical-storm-force winds. A hurricane warning is issued when hurricane conditions (sustained winds of 74 mph or higher) are expected somewhere within the specified area.

In the event that a major hurricane were to impact Broward County, many low-lying coastal areas would be inundated to varying depths by the storm surge and exceptionally high tides which accompany the storm. Tides 3-4' above normal could occur 24-36 hours before the eye of the hurricane reaches the coastline. Many of the causeways, as well as mainland coastal roads, could be inundated well in advance of the storm's arrival, thus restricting, or denying their use as evacuation routes. Some areas in the City of Hallandale Beach that would possibly be subject to flooding by storm tides are:

- PLAN A Evacuation - Areas east of Intracoastal Waterway
  - Typically a Category 1-2 hurricane
- PLAN B Evacuation - Areas east of U.S. 1 (Federal Highway)
  - Typically a Category 3 or higher hurricane

Flood watches (when conditions are right for flooding) and flood warnings (when flooding is imminent) will be issued by local television and radio stations. Residents in flood prone areas of Hallandale Beach will also be warned of an actual emergency condition by the sounding of a steady

siren tone provided by fire and law enforcement mobile units. When these signals are sounded, residents should turn to their local television and radio stations for information.

According to NOAA historical storm track records, 111 hurricane or tropical storm tracks have affected Broward County from 1850 - 2020. This includes:

	Category 1	Category 2	Category 3	Category 4	Category 5
Within 75 miles of Broward County	18	15	14	9	3
Direct hits on Broward County	3	4	3	1	1
Direct hit on Hallandale Beach	1	2	0	0	0

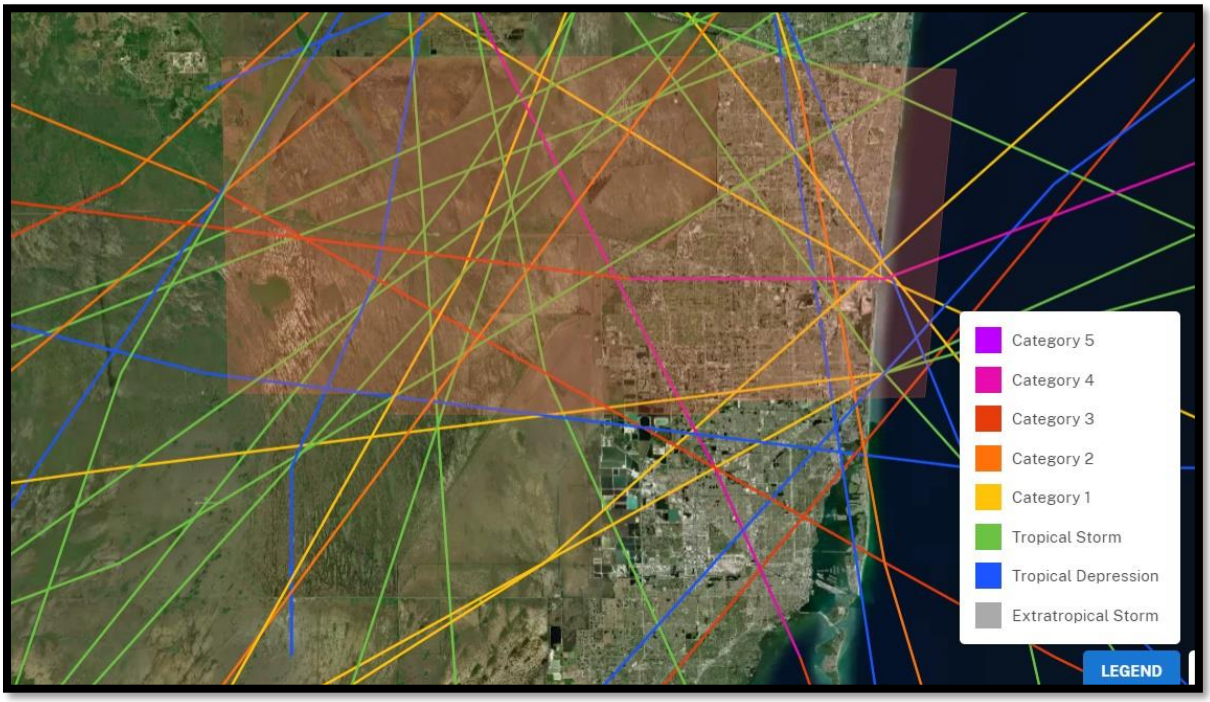
The table below lists storms that have affected the City of Hallandale Beach over the past 30 years, including the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of Broward County), and Category of the storm based on the Saffir-Simpson Scale. Appendix C contains more details about major historic storm events that caused flooding in Hallandale Beach.

Historical Storm Tracks within 75 Miles of Broward County (1850 - 2020)

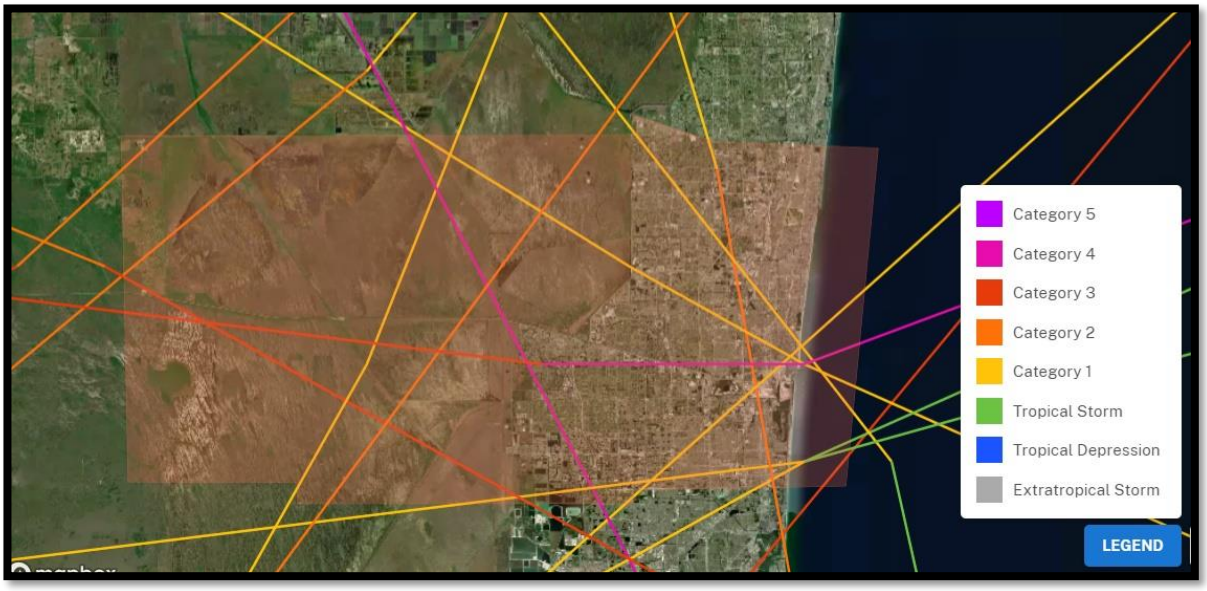
Date of Occurrence	Storm Name	Maximum Wind Speed (MPH)	Storm Category
8/24/1992	Andrew	160	Category 5 Hurricane
11/16/1994	Gordon	50	Tropical Storm
8/2/1995	Erin	85	Category 1 Hurricane
8/24/1995	Jerry	40	Tropical Storm
11/5/1998	Mitch	65	Tropical Storm
9/21/1999	Harvey	60	Tropical Storm*
10/15/1999	**Irene**	**75**	**Category 1 Hurricane***
8/13/2004	Charley	145	Category 4 Hurricane
9/5/2004	Frances	110	Category 2 Hurricane
9/26/2004	Jeanne	120	Category 3 Hurricane
8/25/2005	**Katrina**	**80**	**Category 1 Hurricane***
10/24/2005	**Wilma**	**105**	**Category 2 Hurricane ***
8/30/2006	Ernesto	70	Tropical Storm
8/20/2008	Fay	80	Tropical Storm
7/24/2008	Bonnie	45	Tropical Storm
8/2/2013	Dorian	39	Tropical Storm
10/7/2016	Mathew	132	Category 4 Hurricane
9/10/2017	Irma	115	Category 3 Hurricane
9/3/2018	Gordon	58	Tropical Storm
8/2/2020	Isaias	69	Tropical Storm
9/12/2020	Sally	40	Tropical Storm

**** Storm track traversed through Broward County.***
Storm track traversed directly through Hallandale Beach
Sources: National Hurricane Center and NOAA Historical Hurricane Track Visualizer

Shown below are the storm tracks of tropical systems that have impacted Broward County since 1851 (from NOAA historic storm track data):



The following image shows the storm tracks of Hurricanes (Category 1-5) that have impacted Broward County since 1851(from NOAA historic storm track data):



The following image shows the storm tracks of Tropical Systems that have passed directly through Hallandale Beach since 1851(from NOAA historic storm track data):

This table below from the *Statewide Regional Evacuation Study* shows hurricane strikes by category and state. It can be noted that the state of Florida has been impacted by more hurricanes than any other state.

Table II-6
U.S. Mainland Hurricane Strikes by State (1851-2006)

Area	Category					All (1-5)	Major (3-5)
	1	2	3	4	5		
U.S. (Texas to Maine)	110	73	75	18	3	279	96
Texas	23	18	12	7	0	60	19
Louisiana	18	14	15	4	1	52	20
Mississippi	2	5	8	0	1	16	9
Alabama	16	4	6	0	0	26	6
Florida	43	33	29	6	2	113	37
(Northwest)	26	17	14	0	0	57	14
(Northeast)	12	8	1	0	0	21	1
(Southwest)	18	10	8	4	1	41	13
(Southeast)	13	13	11	3	1	41	15
Georgia	15	5	2	1	0	23	3
South Carolina	18	6	4	2	0	30	6
North Carolina	24	14	11	1	0	50	12
Virginia	7	2	1	0	0	10	1
Maryland	1	1	0	0	0	2	0
Delaware	2	0	0	0	0	2	0
New Jersey	2	0	0	0	0	2	0
Pennsylvania	1	0	0	0	0	1	0
New York	6	1	5	0	0	12	5
Connecticut	5	3	3	0	0	11	3
Rhode Island	3	2	4	0	0	9	4
Massachusetts	6	2	3	0	0	11	3
New Hampshire	1	1	0	0	0	2	0
Maine	5	1	0	0	0	6	0

Notes: State totals will not necessarily equal U.S. totals, and Florida totals will not necessarily equal sum of sectional totals.

More recently, from 2006-2016 Florida experienced a record-breaking "hurricane drought" during which time, out of the 66 that formed in the Atlantic, zero hurricanes made landfall in the state. Additionally, between Hurricane Wilma striking Florida in 2005 and Hurricane Harvey hitting Texas in 2017 no major hurricanes (Cat 3 or higher) made landfall in the US. This was also record breaking, surpassing the previous record of 9 years between 1860 and 1869.

However, the Tropical activity since the end of the Hurricane Drought has been intense. 2016 was the first above-average hurricane season since 2012. In 2016 Hurricane Mathew, a major hurricane, ran up the East Coast of Florida triggering massive evacuations and extensive storm surges from Miami to Jacksonville but ultimately staying just east of the shores of Florida.

In 2017, three notable Category 4 Hurricanes made landfall in the US. Hurricane Harvey in Texas brought record-breaking rainfall to the City of Houston. Hurricane Irma caused substantial damage in the Florida Keys, triggered extensive state-wide evacuations, and resulted in school closure for all of Florida's 67 counties. Although it ended up making landfall on the West Coast of Florida, its expanse was still wide enough to cause a substantial storm surge on the East Coast of the state as it made its way up the Gulf Coast. Hurricane Maria was another notable 2017 Category 4 storm that decimated Puerto Rico.

The following year, in 2018, an extremely wide Category 5 Hurricane Michael caused widespread destruction in the Panhandle of Florida and remained hurricane strength well into the state of Georgia. Michael was only the fourth Category 5 storm to make landfall in the US and the first since Andrew, which made landfall in South Florida in 1992.

The 2019 season was also extremely active with Hurricane Barry making landfall along the US Gulf Coast and Hurricane Dorian causing catastrophic destruction in the Bahamas.

The 2020 Atlantic hurricane season was the fifth above-average season in a row, with more named storms than any other Atlantic hurricane season on record. The season also had the highest accumulated cyclone energy (ACE) since 2017. The season saw 30 named storms, 14 of which were hurricanes, and a record-tying seven major hurricanes. Of the 30 named storms, 11 of them made landfall in the contiguous United States, breaking the record of nine set in 1916. During the season, 27 tropical storms established a new record for the earliest formation by storm number. This season also featured a record 10 tropical cyclones that underwent rapid intensification, tying the record set in 1995. This unprecedented activity was fueled by a La Niña that developed in the summer months of 2020. Despite the extreme activity, this was the first season since 2015 in which no Category 5 hurricane formed.

Out of the seven Atlantic hurricane seasons during which two category five storms formed in the same year: 1932, 1933, 1961, 2005, 2007, 2017, 2019, four have occurred within the last 20 years. Of those years, 2017 and 2007 each recorded two Category 5 landfalls.

Dr. Randall Dole at the NOAA Climate Prediction Center states that when it comes to forecasting climate in the months, years, and decades ahead, there are many challenges in accurately predicting what the future holds. When an ENSO event – whether the warm pulse of El Nino or cool pulse of La Nina is identified, certain general predictions based on probability can be made at a regional level.

The state, county and local emergency management personnel look to El Nino/La Nina studies and advisories to help predict the future storm seasons. An explanation of the El Nino/La Nina phenomena and the latest predictions of the El Nino/La Nina patterns are as follows:

El Nino is a term originally used to describe the appearance of warm (surface) water from time to time in the eastern equatorial Pacific region along the coasts of Peru and Ecuador.

Florida El Nino Effects:

- ✓ Rainfall – above average rainfall
- ✓ Severe Weather – During El Nino the jet stream is oriented from west to east over the northern Gulf of Mexico and Northern Florida. Accordingly, this region is most susceptible to severe weather.
- ✓ Temperatures – below normal temperatures
- ✓ Winter Storms – increased cyclogenesis (low pressure, tropical cyclone formation systems) in the Gulf of Mexico
- ✓ Hurricanes – El Nino almost always reduces the frequency of tropical storms.

La Nina is defined as cooler than normal sea-surface temperatures in the central and eastern tropical Pacific Ocean that impact global weather patterns. La Nina conditions recur every few years and can persist for as long as two years.

Florida La Nina Effects:

- ✓ Rainfall – Generally dry conditions prevail in late fall, winter, and early spring.
- ✓ Hurricanes – According to research, the chances for the continental U.S. and the Caribbean Islands to experience hurricane activity increases substantially.

Understanding current and future ENSO conditions can help local emergency managers better plan for the upcoming season. The latest ENSO forecast and diagnostic discussion can be found at www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ . Additionally, NOAA data indicates human cased climate change is predicted to increase the intensity and rainfall of hurricanes. The City is preparing for these possible future conditions, which are explored more in the *Assess the Problem* section,

Tropical Cyclone Summary of Risk

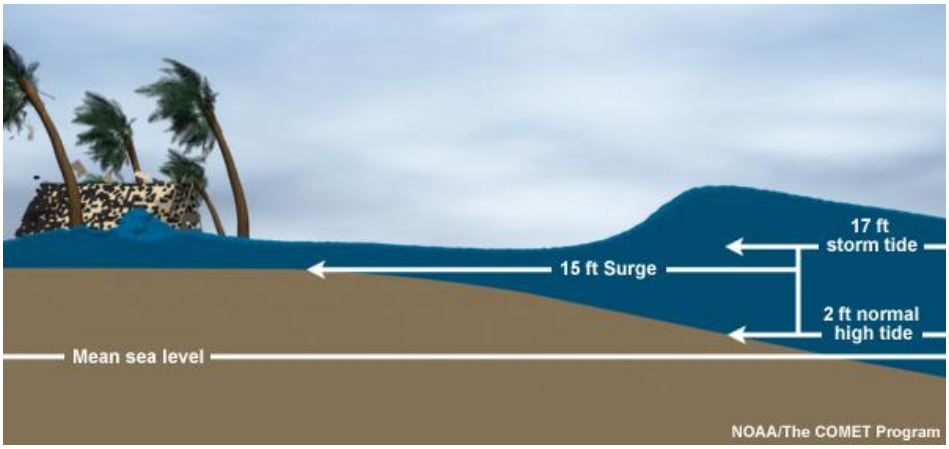
The following summary of tropical cyclone flooding risk uses data from the *October 2020 NRI* (using all 9 Census Tracts):

- ❖ **Frequency:** >1% likelihood per year
- ❖ **Vulnerability:** VERY LOW
- ❖ **Exposure:** Building Value: $4.6 Billion
  Population: 37,770
- ❖ **Relative Expected Annual Losses:** Moderate-High
- ❖ **Relative Risk: HIGH**

A complete data table from the NRI Risk assessment can be found in Appendix B.

Storm Surge and Storm Tide

The City of Hallandale Beach's coastal areas are susceptible to storm surge flooding: The abnormal rise of water levels is generated by the force of onshore winds produced by tropical storms, hurricanes, and northeasterners. It is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane to 20 feet in a Category 5 storm. The storm surge arrives ahead of the storm's actual landfall; the more intense the storm is, the sooner the surge arrives. Water rise can be very rapid, posing a serious threat to those who have waited to evacuate flood prone areas. Following the storm surge, the water rushes back into the ocean (negative tide) as tsunamis do, often with an even stronger force. A storm surge is a wave that has outrun its generating source and become a long period swell. The surge is always highest in the right-front quadrant of the direction the hurricane is moving in. As the storm approaches shore the greatest storm surge will be to the north of the hurricane eye.



Such a surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions. The severity of flooding can vary significantly based on a variety of factors such as storm intensity, forward speed, angle of attack, the slope of the continental shelf and tidal conditions. The southern coastal areas of Broward County, where Hallandale Beach is located, are somewhat more susceptible to surge flooding than northernmost areas. Storm surge heights, wind speed, fetch length, pressure and associated waves, are dependent upon the configuration of the continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water in close proximity to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. The stronger the hurricane and the shallower the offshore water, the higher the surge will be.

Hallandale Beach is particularly vulnerable to storm surge because of shallow water offshore. About 2 miles offshore of Hallandale Beach, the water is only around 100' deep. When the water is that shallow, it is more likely to be forced up into storm surge.

The principal tool utilized for analyzing the expected hazards from potential hurricanes is the Sea, Lake and Overland Surges from Hurricane (SLOSH) numerical storm surge prediction model. The SLOSH computerized model predicts the tidal surge heights that result from hypothetical hurricanes with selected various combinations of pressure, size, forward speed, track and winds. Originally developed for use by the National Hurricane Center (NHC) as a tool to give geographically specific

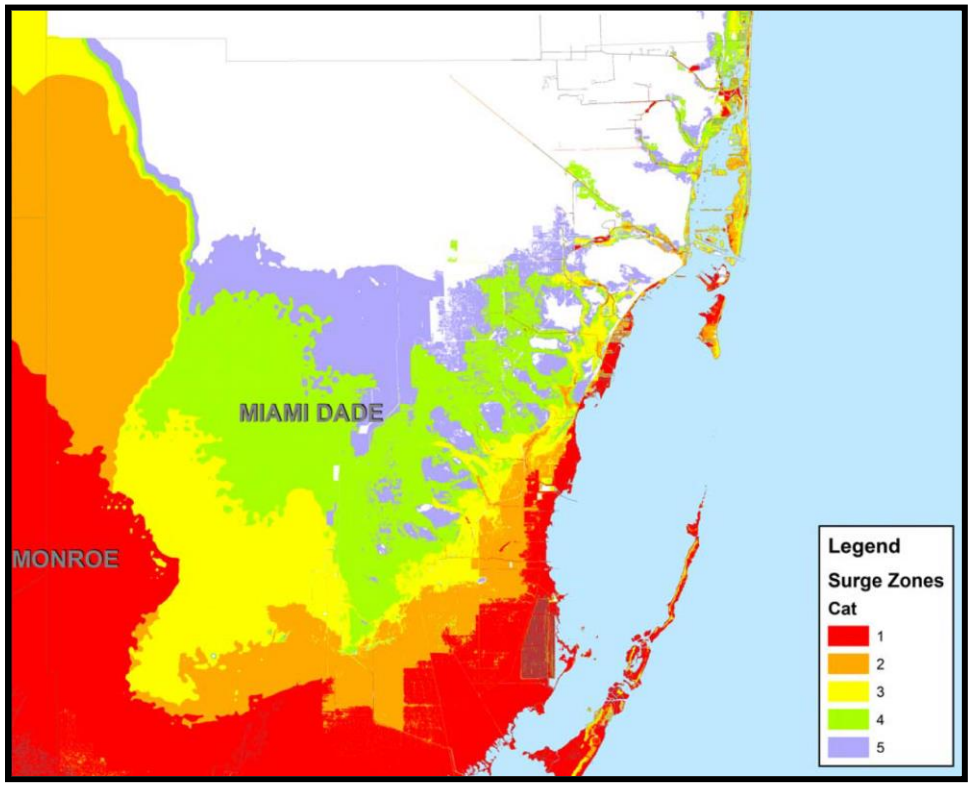
warnings of expected surge heights during the approach of hurricanes, the SLOSH model is utilized in regional studies for several key hazard and vulnerability analyses.

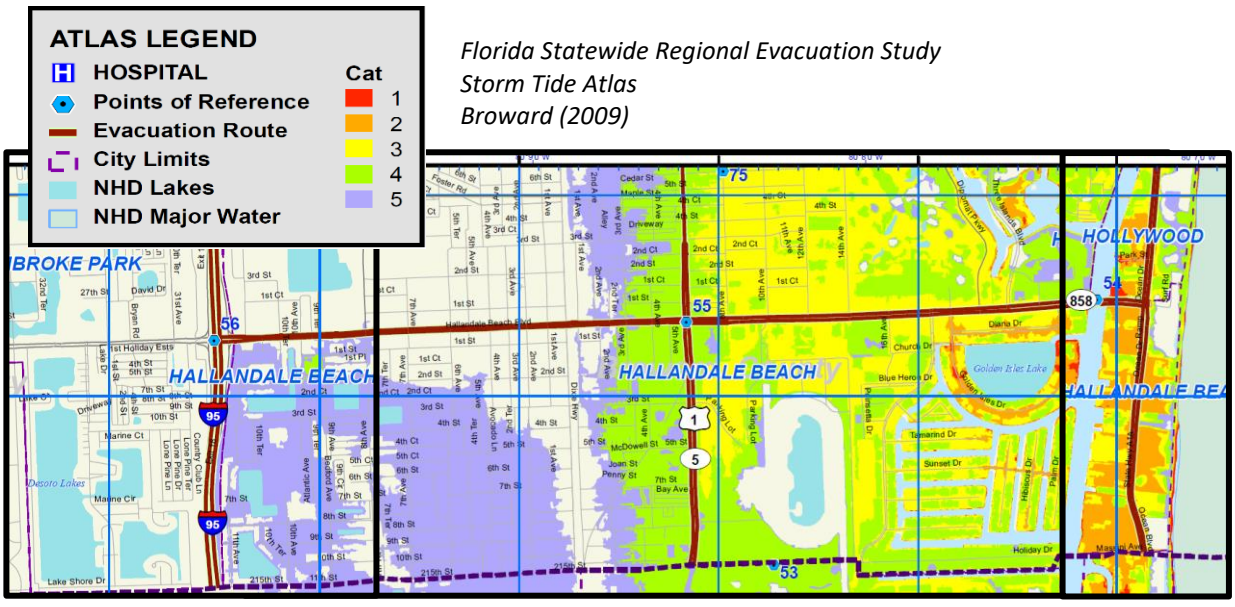
The SLOSH model must be developed for each specific geographic coastal area individually incorporating the unique local bay and river configuration, water depths, bridges, roads and other physical features. In addition to open coastline heights, one of the most valuable outputs of the SLOSH model for evacuation planning is its predictions of surge heights over land which predicts the degree of propagation or run-up of the surge into inland areas.

A Sea, Lakes and Overland Surge from Hurricane (SLOSH) Model was run in 2010 on the Biscayne Bay. More recently in 2017, SLOSH models of the South Florida Superbasin were developed for use as a storm surge modeling tool. This tidal inundation information can be used to help communities prepare for possible storm surge. Maps created from the use of the SLOSH modeling tool depend on storm and scenario specific inputs entered by emergency management professionals. As each scenario would be specific to the storm parameters entered, there is no longer a standard publicly available map illustrating these new SLOSH models. However, NOAA does offer an interactive Storm Surge Map viewer based on SLOSH models, allowing the user to see storm surge maps for each category storm category. Examples from https://www.nhc.noaa.gov/nationalsurge/#map are provided below:

If the storm surge arrives at the same time as the high tide, the water height will be even greater. The storm tide is the water level rise during a storm due to the combination of storm surge and the normal astronomical tide.

Storm Tide maps produced by a Statewide Regional Evacuation Study, showing the threat to the City of Hallandale Beach are included in Appendix C of this Food Mitigation Plan. Examples of these maps can be seen below:





Florida Statewide Regional Evacuation Study
Storm Tide Atlas
Broward (2009)

The table below from *the Statewide Regional Evacuation Study* predicts both the storm surge and depth expected at six Hallandale Beach locations. During a Category 5 hurricane, the storm surge is predicted to be above seven feet for each of the five coastal locations.

Volume 7-11 South Florida — **Statewide Regional Evacuation Studies Program**

Map ID	Name	Elevation	C1 DPTH[5]	C2 DPTH	C3 DPTH	C4 DPTH	C5 DPTH	C1 SURGE[6]	C2 SURGE	C3 SURGE	C4 SURGE	C5 SURGE
	LINE.											
53	GULFSTREAM PARK (DADE LINE).	1.943	0.000	0.238	1.211	3.919	5.255	1.333	2.181	3.154	5.863	7.198
54	HALLANDALE BEACH BLVD & INTRA. WTRWY.	0.000	2.332	3.534	4.637	6.449	7.638	2.332	3.534	4.637	6.449	7.638
55	HALLANDALE BEACH BLVD & US 1.	5.442	0.000	0.000	0.000	0.844	1.964	1.338	2.188	3.551	6.286	7.406
56	HALLANDALE BEACH BLVD & I-95.	7.449	0.000	0.000	0.000	0.000	0.000	1.340	2.190	2.860	3.614	3.245
57	PEMBROKE RD & I-95.	9.156	0.000	0.000	0.000	0.000	0.000	1.340	2.190	2.860	3.620	2.890
58	PEMBROKE RD & US 1.	9.273	0.000	0.000	0.000	0.000	0.000	1.340	2.190	2.944	4.307	7.096
59	GRIFFIN RD & US 441.	6.938	0.000	0.000	0.000	0.000	0.000	1.517	2.443	3.130	3.979	5.603
60	UNIVERSITY DRIVE & SR 84.	29.323	0.000	0.000	0.000	0.000	0.000	1.700	2.900	4.000	4.700	4.901
61	US 1 & Green Rd (NE 48 St) Pompano Beach	8.300	0.000	0.000	0.000	0.000	0.000	1.561	2.548	3.486	4.952	5.729
62	US 1 & NE 10 St: Pompano Beach	8.667	0.000	0.000	0.000	0.000	0.000	1.955	3.225	4.220	6.026	6.668
63	N Dixie Hwy & Atlantic Blvd: Pompano Beach	12.318	0.000	0.000	0.000	0.000	0.000	1.340	2.195	2.850	3.833	5.996
64	N Dixie Hwy & McNab Rd: Pompano Beach	5.995	0.000	0.000	0.000	0.000	0.915	1.340	2.185	2.856	4.537	6.909
65	Andrews Av & Prospect Rd: Oakland Pk	5.921	0.000	0.000	0.000	0.000	0.000	1.340	2.190	2.860	3.620	4.114
66	NE 6 AV & 56 St: Oakland Pk	4.712	0.000	0.000	0.000	0.000	0.000	1.340	2.190	2.860	3.614	4.249
67	Broward Blvd & SW 4 Av: Ft Lauderdale	4.996	0.000	0.000	0.000	0.509	2.756	1.770	2.835	3.848	5.505	7.752
68	NE 15 AV & 13 St; Ft Lauderdale	8.544	0.000	0.000	0.000	0.000	0.000	1.344	2.216	3.097	5.139	7.825
69	Oakland Pk Blvd & NW 27 AV: Oakland Pk	4.075	0.000	0.000	0.000	0.000	0.000	1.340	2.191	2.860	3.620	3.739
70	NW 27 AV & 6 St: Ft Lauderdale	5.813	0.000	0.000	0.000	0.000	1.454	2.050	3.304	4.180	4.944	7.267
71	SW 17 ST & 9 AVE: Ft Lauderdale	4.121	0.000	0.000	0.000	1.406	3.505	1.606	2.557	3.251	5.526	7.625
72	NW 1 ST & Bryan Rd: Dania Beach	3.514	0.000	0.000	0.000	2.160	2.200	1.624	2.466	3.207	5.674	5.714
73	Tyler St & 9 AV: Hollywood	0.576	1.763	2.819	3.824	6.158	7.289	2.339	3.395	4.400	6.734	7.865
74	Moffett St & NE 14 AV: Hallandale	1.113	0.446	1.343	3.229	5.604	6.533	1.559	2.456	4.342	6.716	7.646
75	NE 6 ST & 8 AV: Hallandale	3.579	0.000	0.000	0.458	2.938	3.987	1.337	2.187	4.037	6.517	7.566

Storm Surge Summary of Risk

The *NRI* does not specifically address the risk that storm surge poses to the City of Hallandale Beach. However, the *NRI* provides a risk assessment for coastal flooding. The following summary of coastal flooding risk uses data from the *October 2020 NRI Risk Assessment* (using all 9 Census Tracts):

- **Frequency:** 0.01-4.77% likelihood per year (varies by tract)
- **Vulnerability:** VERY LOW
- **Exposure:** Building Value: $4.1 Billion
  Population: 32,415
- **Relative Expected Annual Losses:** Low - Moderate

- **Relative Risk: LOW – MODERATE** (varies by tract)

A complete data table from the NRI Risk Assessment can be found in Appendix B.

Thunderstorms

Thunderstorms are a frequent part of Florida life. They occur in all seasons of the year in Florida, but they are more numerous during the warm season when the wind off the sea flows inland during the afternoon. Communities in Florida typically experience thunderstorms 75 to 105 days per year, with Hallandale Beach receiving 70-80 per year. In fact, Florida leads the United States annually in the number of thunderstorm days. Out of 100,000 thunderstorms that occur within the United States each year, approximately 1 out of every 10 storms can become severe, causing damage or posing a threat to life.

Average Rainfall for Broward County (30 YEAR: 1991-2020):

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Inches	2.51	2.28	2.60	3.35	5.47	8.60	6.73	7.89	8.37	6.48	3.64	2.38	59.23

Information from the South Florida Water Management District website

The average annual rainfall in the City of Hallandale Beach is 59.23", with August usually being the wettest month. The annual average in the United States is 29.94".

The following table from the National Oceanic and Atmospheric Administration summarizes the daytime and nighttime likelihood of precipitation during each month of the year for South Florida:

Climatological Probabilities of Precipitation for
South Florida from 1985-1997

Nighttime Probabilities of Precipitation*

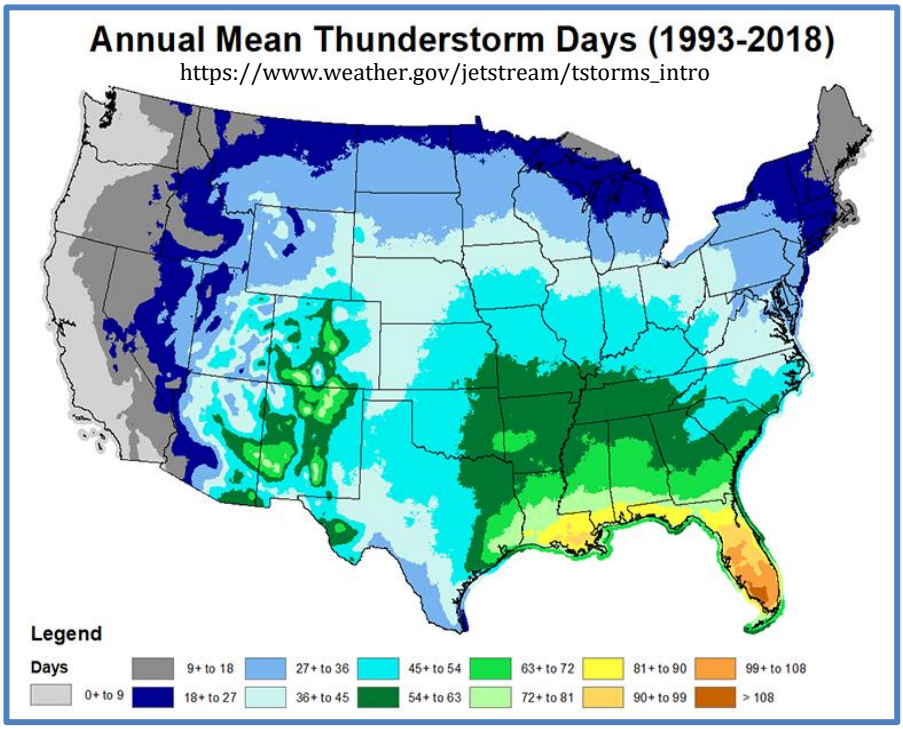
STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Palm Bch.	20%	15%	22%	17%	21%	30%	22%	31%	39%	25%	19%	13%
Miami	16%	12%	15%	13%	18%	29%	24%	24%	33%	26%	19%	11%
Key West	14%	10%	13%	11%	17%	23%	21%	25%	35%	26%	13%	13%

Daytime Probabilities of Precipitation*

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Palm Bch.	24%	19%	26%	22%	22%	43%	37%	40%	42%	29%	21%	15%
Miami	17%	14%	17%	18%	22%	44%	42%	46%	42%	31%	19%	13%
Key West	13%	9%	12%	12%	13%	24%	27%	31%	38%	25%	15%	11%

* From (1985-1997) for Miami and (October 1986-1997) for Palm Beach and Key West

Three factors must be present in the atmosphere for a thunderstorm to form. First, the atmosphere needs to be unstable. An unstable atmosphere is essentially one in which warmer air near the ground will rise higher in the sky, much like a hot air balloon. Second, there needs to be a source of lift to cause the air to rise. This lifting mechanism can be a cold front, winds from another nearby thunderstorm, or even a cooler breeze off the nearby sea, known as a sea breeze boundary. The sea breeze is the most common trigger for thunderstorms during the summer months in Florida. The lifting mechanism acts much like a large plow or shovel that forces the air upwards. Once the lift causes the air to move upwards, the instability in the atmosphere accelerates the air upwards. Third, there needs to be enough moisture in the atmosphere to help make clouds as the air rises. Without moisture, no clouds will form, even in the presence of lift and an unstable atmosphere.



Florida experiences more thunderstorms than other states because:

1. Florida is located close to large bodies of water that provide moisture. Evaporation of the warm ocean waters from the Atlantic and Gulf of Mexico contribute to Florida's humid climate and provide the necessary moisture for thunderstorms to form.
2. Florida receives plenty of sunlight, which warms the air near the ground and causes unstable air; and
3. Florida has frequent sea breezes that provide lift for the thunderstorms.

Without any one of these three elements, Florida would not have such a high frequency of thunderstorms.

Thunderstorms affect a relatively small area when compared to hurricanes. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Despite their small size, all thunderstorms are dangerous. According to the NOAA publication titled *Thunderstorms, Tornadoes, Lightning... ...Nature's Most Violent Storms: A PREPAREDNESS GUIDE*, more than 90 fatalities each year are attributed to the flooding caused by thunderstorms, making flash flooding the leading cause of thunderstorm-related deaths. Heavy rainfalls, capable of dropping significant rain in a short period of time, may occur without warning and may not be associated with any named tropical storm.

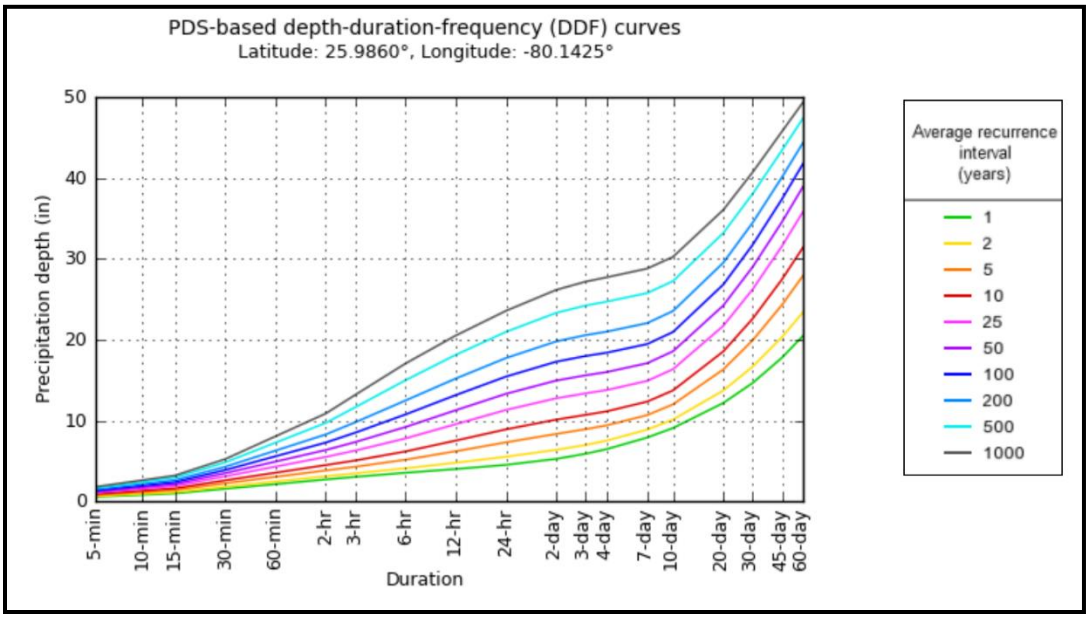
The following data from the *2016 Broward County Flood Insurance Study* highlights the likelihood of excessive amounts of rainfall due to thunderstorms:

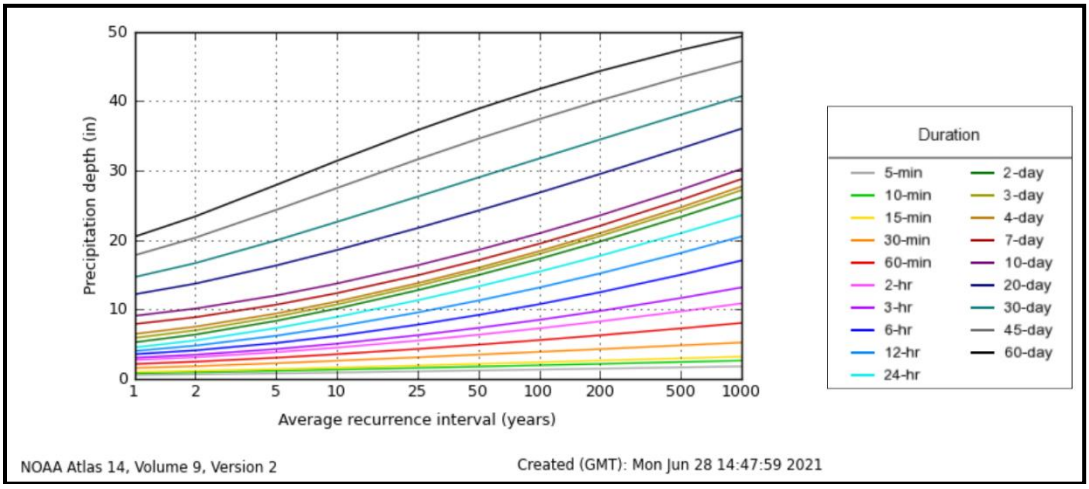
Expected Broward County Rainfall Totals (for select Storm Frequencies)

10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
10.0 inches	14.0 inches	16.0 inches	20.1 inches

Storms severe enough to cause flooding and damage occur frequently in Florida during the summer. For the safety of the public, severe thunderstorm watches and warnings are issued by the National Weather Service, as well as flood watches and warnings due to heavy rainfall that may accompany the storms.

The following NOAA images illustrate the estimated depth and frequency of precipitation events for Hallandale Beach.





(images from https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html)

Severe thunderstorm watches and warnings are issued by the National Weather Service, as well as flood watches and warnings due to heavy rainfall that may accompany the storms.

According to the NOAA Storm Events Database, between 1950 and 2020 there were 22 flash flood events, 46 flood events, and 21 heavy rain events reported in Broward County. One in each category was specific to Hallandale Beach.

Severe Thunderstorm Summary of Risk

The *NRI* does not specifically address the risk that thunderstorm related rainfall poses to the City of Hallandale Beach. However, the *NRI* provides a risk assessment for riverine (freshwater) flooding. The following summary of riverine flooding risk uses data from the *October 2020 NRI Risk Assessment* (using all 9 Census Tracts):

- **Frequency:** 1.18% likelihood per year
- **Vulnerability:** VERY LOW
- **Exposure:** Building Value: $3.8 Billion
  Population: 30,622
- **Relative Expected Annual Losses:** Moderate

- **Relative Risk: MODERATE-HIGH**

A complete data table from the NRI Risk Assessment can be found in Appendix B.

Sea Level Rise

Sea Level Rise is a long-term increase in mean sea level occurring in response to global climate and global tectonic changes as measured using scientific horizontal control points and benchmarks, or simply measured rises in the sea. Increasing concentration of greenhouse gases and rising global air and oceanic water temperatures precede and contribute to sea level rise.

Florida is considered one of the most vulnerable areas of the country to the consequences of global climate change, with Southeast Florida being at the frontline to experience the impacts of a changing climate, especially sea level rise. In 2010, the counties of Palm Beach, Broward, Miami-Dade and Monroe entered into the Southeast Florida Regional Climate Change Compact in response to the need for immediate, coordinated and visionary action to address the impacts of a changing climate and provide for economic and environmental resilience in Southeast Florida.

The City of Hallandale Beach is an active participant in the Southeast Florida Regional Climate Change Compact. The Compact, ratified on January 10, 2010, recognizes the heightened vulnerability of Southeast Florida to the impacts of climate change and calls for the identification of specific areas of the participating counties that are uniquely vulnerable to the impacts of climate change, especially sea level rise. In January 2011, the Compact Counties adopted state and federal policies related to the creation of Adaptation Action Areas and jointly advocated to the Florida Legislature for the definition of Adaptation Action Areas in Florida law.

The *Southeast Florida Regional Climate Change Action Plan* (RCAP) resulted from the Compact and details many of the potential impacts and needed mitigation strategies. Among the data generated by this group, the Unified Sea Level Rise Projections provided Southeast Florida governments with a baseline for their own planning efforts. The Compact first produced a Regionally Unified Sea Level Rise Projection for Southeast Florida in 2011. The Projection was updated in 2015. In 2019, the Compact again convened an ad hoc Sea Level Rise Work Group, composed of scientific experts within the academic community, as well as local, regional, and federal government, to update the Projection. The Climate Compact's Regionally Unified Sea Level Rise Projection and accompanying Guidance Report are adopted for use by each of the four-counties' Boards of County Commissioners. The Compact's 2019 Projection was completed in 2020 and released with a Guidance Report supporting the Projection, containing directions and specific examples of how the projection can be used by local governments, planners, designers, engineers, and developers. The Projection is reviewed and updated every five years, or sooner, as a result of ongoing advances in scientific knowledge and modeling via the peer-reviewed literature related to global climate change.

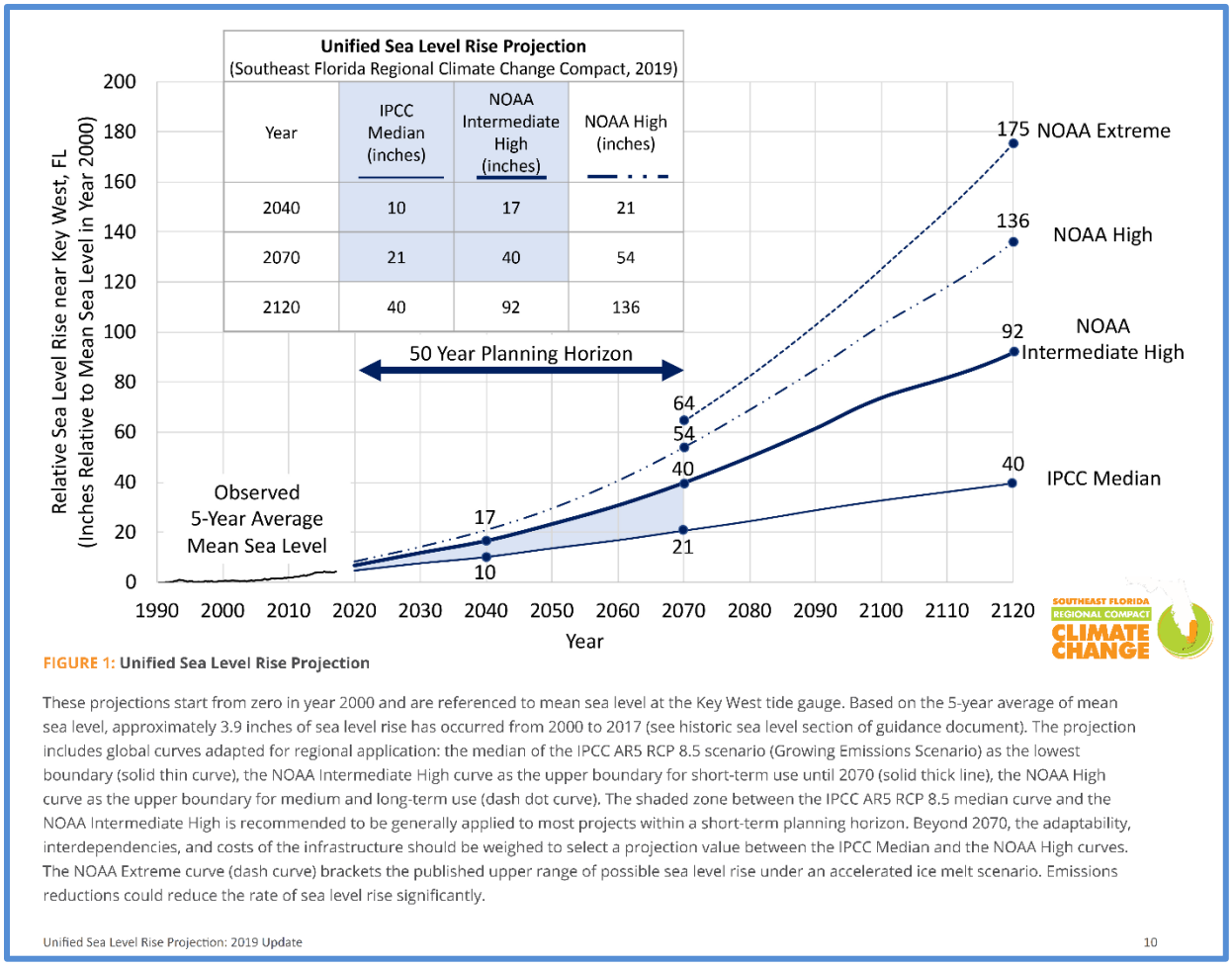


FIGURE 1: **Unified Sea Level Rise Projection**

These projections start from zero in year 2000 and are referenced to mean sea level at the Key West tide gauge. Based on the 5-year average of mean sea level, approximately 3.9 inches of sea level rise has occurred from 2000 to 2017 (see historic sea level section of guidance document). The projection includes global curves adapted for regional application: the median of the IPCC AR5 RCP 8.5 scenario (Growing Emissions Scenario) as the lowest boundary (solid thin curve), the NOAA Intermediate High curve as the upper boundary for short-term use until 2070 (solid thick line), the NOAA High curve as the upper boundary for medium and long-term use (dash dot curve). The shaded zone between the IPCC AR5 RCP 8.5 median curve and the NOAA Intermediate High is recommended to be generally applied to most projects within a short-term planning horizon. Beyond 2070, the adaptability, interdependencies, and costs of the infrastructure should be weighed to select a projection value between the IPCC Median and the NOAA High curves. The NOAA Extreme curve (dash curve) brackets the published upper range of possible sea level rise under an accelerated ice melt scenario. Emissions reductions could reduce the rate of sea level rise significantly.

Unified Sea Level Rise Projection: 2019 Update 10

The Southeast Florida Regional Climate Change Compact Counties have concluded that the sea level will continue to rise even if mitigation efforts to reduce greenhouse gas emissions are successful at stabilizing or reducing atmospheric CO_2 concentrations. A substantial increase in sea level rise within this century is likely and may occur in rapid pulses rather than gradually.

In 2011, Hallandale Beach completed a *Vulnerability to Sea Level Rise Assessment Report*. Then, again in 2020, the City created the *City of Hallandale Beach Vulnerability and Adaptation Plan* (included as Appendix E) which is contains the following sections:

1. Flood Hazard Mapping
2. Flood Vulnerability / Loss Assessments
3. Future Precipitation Analysis
4. Qualitative Assessment of Groundwater Changes
5. Projected Changes in Shoreline
6. Initial Strategy Development and Evaluation

The following table shows Sea Level rise modeling performed as part of the Plan:

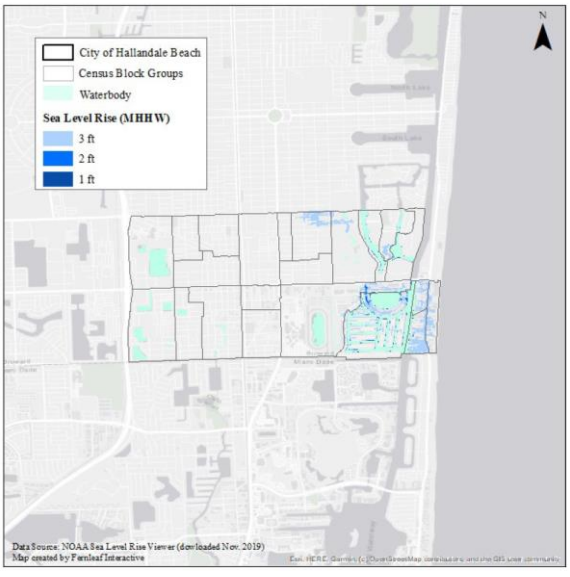
1.6.4 Sea Level Rise

Sea level rise flooding was modeled for two scenarios, near-term and mid/long-term. Table 3shows area inundated in acres and percent of total City area for each depth range of flooding under each sea level rise scenario.

TABLE 3: CITY AREA INNUNDATED BY SEA LEVEL RISE, NEAR-TERM AND MID/LONG-TERM

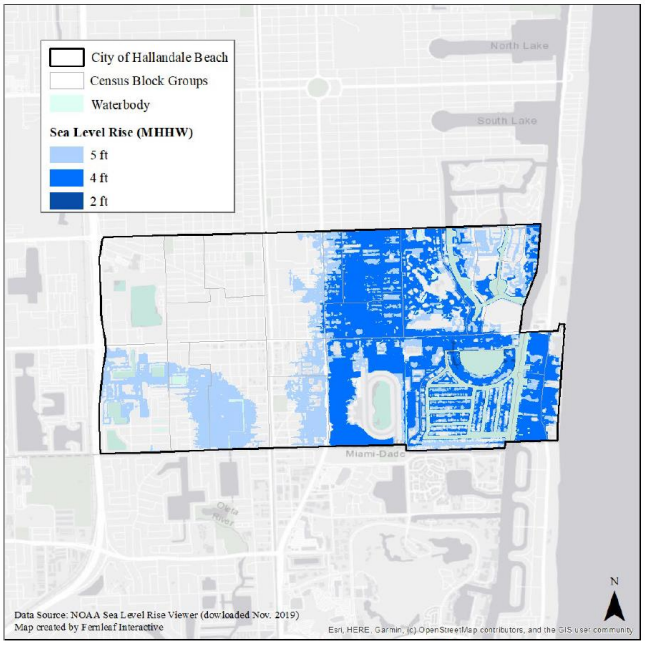
Type of Flooding	Depth of inundation (Feet)	Area Inundated (Acres)	Percent of Total City Area
Sea Level Rise, Near Term	0-1'	116.5	4.14%
	1-2'	11.9	0.42%
	2-3'	154.1	5.48%
Sea Level Rise, Mid/Long Term	0-1'	594.7	21.14%
	1-2'	658.6	23.41%
	2-3'	165.1	5.87%

The plan also included maps showing projected inundation. Examples are included below:



Near Term (1-3ft) SLR Estimate

From: City of Hallandale Beach Vulnerability & Adaptation Plan, 2020

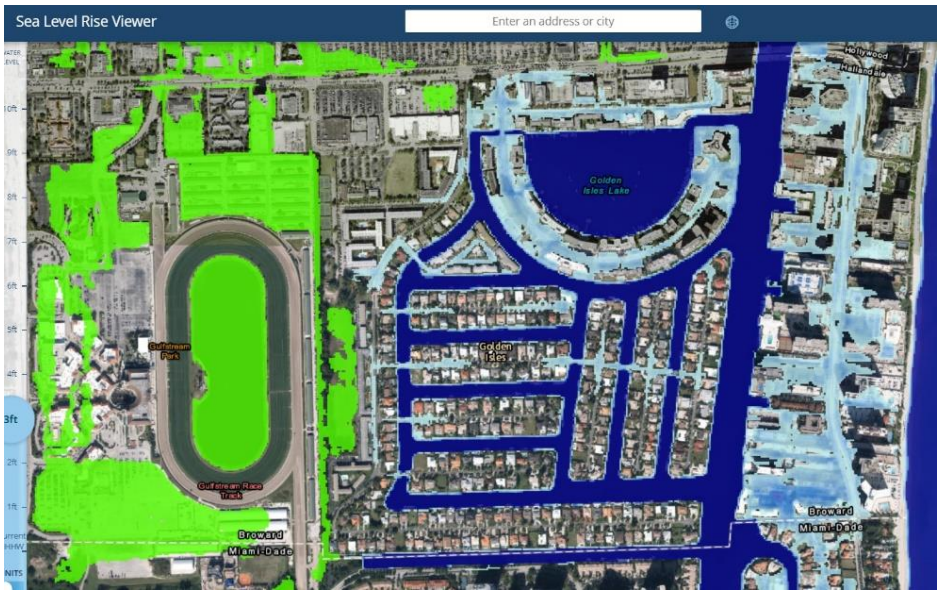


Mid-Long Term (4-5ft) SLR Estimate

From: City of Hallandale Beach Vulnerability & Adaptation Plan, 2020

The vulnerability and adaptation plan, which is referenced in more detail as part of *Section Six – Assess the Problem*, concludes with ten action items and recommendations that the City can implement over both the short term (1-5 years) and the long term (6-20 years) in order to adapt to and mitigate some of the effects of sea level rise.

In addition to the internally produced sea level rise maps, NOAA's Seal Level Rise visualizer allows communities and their residents view community maps showing projected inundation under various levels of seal level rise. Examples of the resulting images are included below:



3ft SLR Visualization
From: https://coast.noaa.gov/slr

6ft SLR Visualization
From: https://coast.noaa.gov/slr

Sea Level Rise Summary of Risk

The NRI, does not specifically describe the risk of the City to sea level rise. However, based on the City's coastal flood risk, it can be estimated that:

- **Frequency:** 0.01-4.77% likelihood per year (varies by tract)
- **Vulnerability:** VERY LOW
- **Exposure:** Building Value: $4.1 Billion
  Population: 32,415
- **Relative Expected Annual Losses:** Low - Moderate

- **Relative Risk: LOW – MODERATE** (varies by tract)

A complete data table from the NRI Risk Assessment can be found in Appendix B.

Less Frequent Floods

In addition to the common flooding hazards, such as thunderstorms, tropical systems and sea level rise, as discussed on the previous pages, Hallandale Beach is also vulnerable to several forms of less frequent flooding. These potential sources of less frequent flooding include:

- Dam/Dike Failure,
- Tsunamis, and
- Rogue Waves

Assessing the extent of exposure to these hazards can be difficult due to the absence of robust historical data, however every effort has been made to assess these hazards based on any available historical data, geological and geographical studies as well as the most recent available hazard models.

Additionally, infrequent extreme rainfall events are detailed in the last few pages of *Section Six: Assess the Problem* under the *Future Flooding Conditions* sub-heading. In that section, there is a detailed assessment of historical data trends that indicate a recent acceleration in the frequency of record-breaking extreme rainfall events, highlighting the possibility that these extreme events may one day become more frequent.

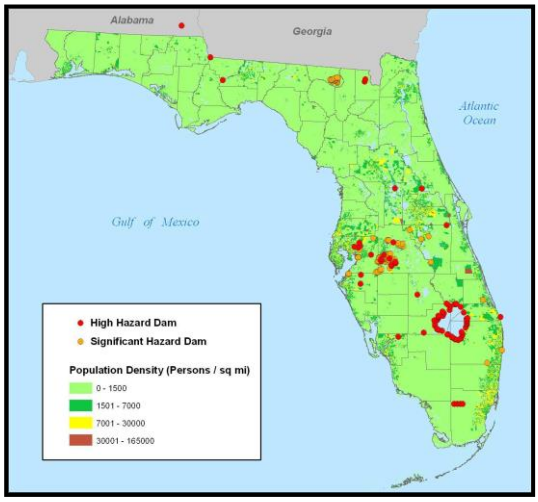
Dam/Dike Failure

Dike failure is defined as an unintended, potentially catastrophic release or surge of impounded water through or over a dike onto adjacent lands.

The failure of a dam or dike can result in a flood event. The most significant risk related to dam/levee failure is flooding due to substantial rainfall. Structural and non-structural techniques to slow and contain this runoff incorporate several drainage systems, some dating back to 1919. Rainfall in excess

of designed capacities could cause erosion of constructed drainage facilities and flooding of many areas, including primary roadway evacuation routes.

According to the U.S. Army Corps of Engineers and the FEMA National Dam Safety Program, there are no identified dams or levees which pose a high or intermediate hazard to Broward County.



Dam/ Dike Failure Summary of Risk

As stated in the *Broward County Emergency Management Enhanced Local Mitigation Strategy, September 2017* there are no identified dams or levees which pose a high or intermediate hazard to the City.

- **Frequency:** not applicable
- **Vulnerability:** not applicable
- **Exposure:** not applicable
- **Relative Expected Annual Losses:** not applicable

- **Relative Risk: NONE - VERY LOW**

Tsunami

A tsunami is a series of waves created when a body of water, such as an ocean, is rapidly displaced. A tsunami has a much smaller amplitude (wave height) offshore, and an extremely long wavelength (often hundreds of kilometers long); this explains why it generally passes unnoticed at sea, forming only a passing "hump" in the ocean. Tsunamis have historically been referred to as tidal waves because, as they approach land, they take on the characteristics of a violent onrushing tide rather than the typical cresting waves that are formed by wind action upon the ocean. Since they are not actually related to tides, the term “tidal wave” is considered misleading, and its usage is discouraged by oceanographers.

Earthquakes are frequently the cause for tsunami events. Earthquakes and earthquake-generated landslides have caused more than 90% of the tsunamis reported in the United States. Tsunamis are formed as the displaced water mass moves under the influence of gravity and radiates across the ocean like ripples on a pond. This phenomenon rapidly displaces large volumes of water, as energy from falling debris, such as a landslide or energy expansion is transferred to the water into which the debris falls. Tsunami caused by these mechanisms, unlike the ocean-wide tsunami caused by some earthquakes, generally dissipate quickly and rarely affect coastlines distant from the source, due to the small area of sea affected. However, an extremely large landslide could generate a mega-tsunami that might have ocean-wide impacts.

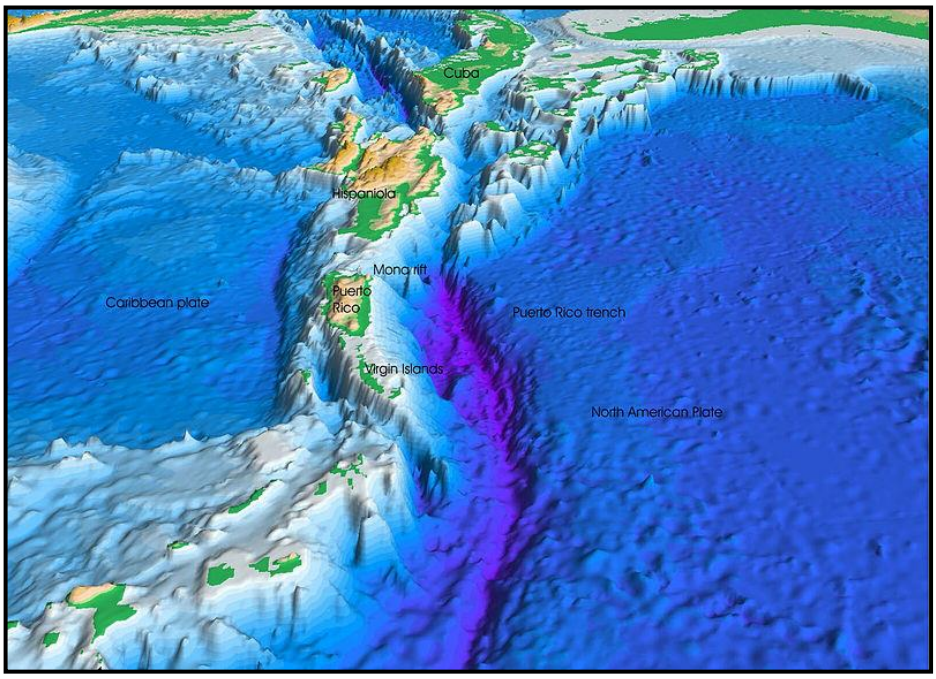
The first part of a tsunami to reach land is a trough rather than a crest of the wave. The water along the shoreline may recede dramatically, exposing areas that are normally submerged. This can serve as a warning of the approaching crest of the tsunami, although the warning is very short, as the crest typically arrives seconds to minutes later.

Tsunamis are infrequent high-impact events that have the potential to cause fatalities and damage on the coast. Since the beginning of the 19th century, tsunamis have caused more than 700 deaths and approximately $2 billion in damage to U.S. coastal states and territories.

Tsunami events occur most frequently in the Pacific Ocean, but they are a global phenomenon. Major tsunamis occur approximately once per decade. Based on historical data, approximately 59% of the world's tsunamis have occurred in the Pacific Ocean, 25% in the Mediterranean Sea, 12% in the Atlantic Ocean, and 4% in the Indian Ocean. All tsunamis are potentially dangerous, even though they may not damage every coastline they strike. An analysis of the past 150 years of tsunami records shows that the most frequent and destructive tsunamis to affect the U.S. have occurred along the coasts of California, Oregon, Washington, Alaska, and Hawaii. However, the state of Florida is located within the Caribbean area, and over the past 156 years, the Caribbean has experienced tsunami events. Florida has experienced few destructive tsunami or rogue wave events, but there have been several small events.

There is often no advance warning of an approaching tsunami. However, since earthquakes are often a cause of tsunamis, an earthquake felt near a body of water may be considered an indication that a tsunami will shortly follow.

The National Weather Service and NOAA report that the most likely source of earthquake or landslide-triggered tsunami that would affect the Atlantic coast of Florida is the Puerto Rican Trench, the deepest point in the Atlantic Ocean, which is an earthquake prone area north of Puerto Rico. In the past, tsunamis have caused fatalities in Puerto Rico as well as the U.S. Virgin Islands.



The picture to the left is a perspective view of the sea floor of the Atlantic Ocean and the Caribbean Sea. The Lesser Antilles are on the lower left side of the view and Florida is on the upper right. The purple sea floor at the center of the view is the Puerto Rican trench, the deepest part of the Atlantic Ocean and the Caribbean Sea.

A 2019 NOAA fact sheet titled *U.S. Tsunami Hazard* defines the risk to the Atlantic Coast as follows:

U.S. Atlantic Coast Risk: Very Low to Low

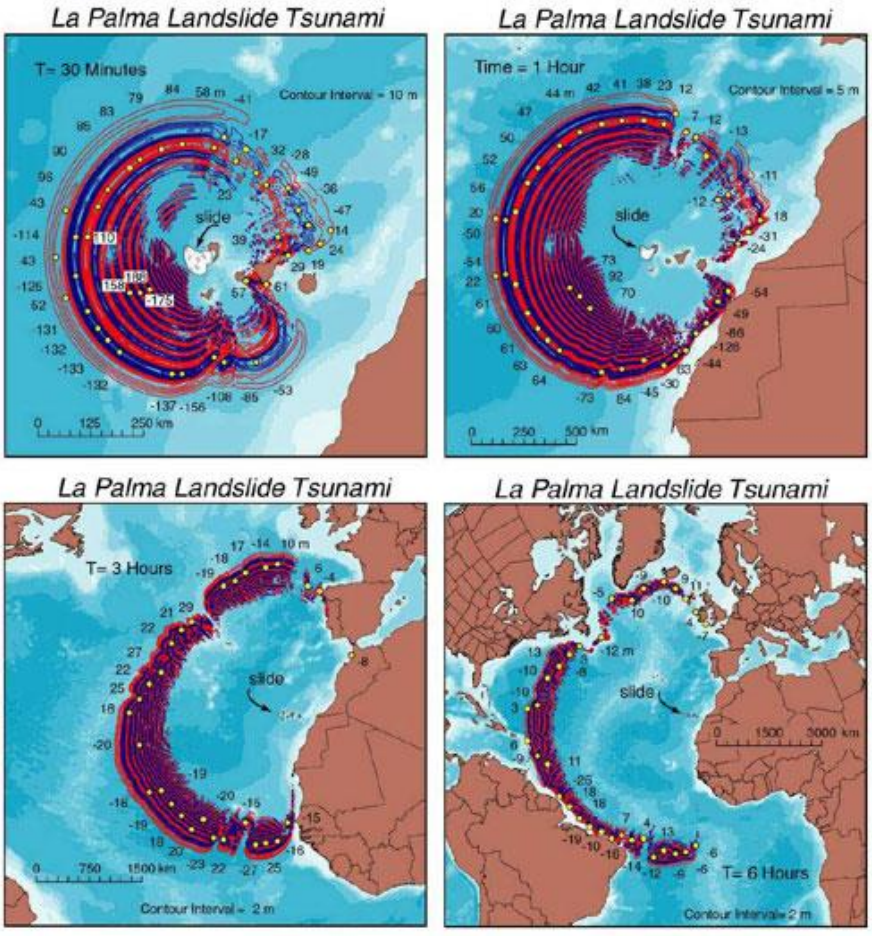
The history of U.S. Atlantic Coast tsunamis is short but shows that tsunamis can happen in the region. Key events include an earthquake (1886) and an underwater landslide (1964) that both produced small local tsunamis. Also, a tsunami produced by an earthquake-generated landslide off Newfoundland, Canada (1929) recorded as small waves along the U.S. coast, but caused death and destruction near its source. There is no subduction zone along the U.S. Atlantic Coast, and earthquakes are not as strong or as frequent as in other regions or the country. Underwater landslides and meteotsunamis (large waves caused by storms) are the most likely source of tsunami waves in the region. Unlike tsunamis triggered by seismic activity, NOAA states that meteotsunamis are driven by air-pressure disturbances often associated with fast-moving weather events, such as severe thunderstorms, squalls, and other storm fronts. More distant tsunami threats come from the Puerto Rico trench, the Canary Islands, and the Azores–Gibraltar fault zone.

Reported tsunamis on US Atlantic Coast: Earliest: 1886 | Total events: 8

Another potential cause would be the eruption of a volcano on the island of La Palma in Spain's Canary Islands, which could generate a huge landslide and trigger a tsunami that would impact the U.S. east coast.

La Palma is not only the steepest island in the world but has also been the most volcanically active of the Canary Isles in the past 500 years. If this event were to take place, it is expected that the eastern coastline of the state of Florida could suffer extensive damage and loss of life.

An image illustrating the path and timing of such a Tsunami can be seen to the right.



Tsunami Summary of Risk

The *2017 Broward County ELMS* excluded Tsunami from the hazards assessment with the following explanation: Extremely rare, small events are possible along the eastern shoreline of Broward County but the impact would likely be minimal. Further, the vulnerability of coastal assets to tsunami inundation is lessened through ongoing hurricane storm surge mitigation practices.

In the absence of historic tsunami data, the *October 2020 NRI* determined that calculating the tsunami risk to all 9 Census Tracts in Hallandale Beach is not applicable:

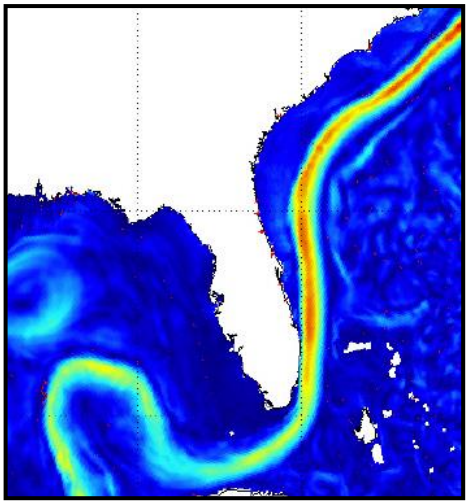
- **Frequency:** Not available
- **Vulnerability:** NOT APPLICABLE
- **Exposure:** Not available
- **Relative Expected Annual Losses:** NOT APPLICABLE

- **Relative Risk: NOT APPLICABLE**

A complete data table from the NRI Risk assessment can be found in Appendix B.

Rogue Wave

A rogue wave event that occurred in Daytona Beach on July 7, 1992 resulted in the injury of over 20 people, one death, and damage to many cars parked and driving in the area close to the coastline. A senior seismologist for the U.S. Geological Survey advised that the freak wave, estimated at 27 miles long and 250 feet wide, apparently was caused by shifting sands from an underwater landslide. It was estimated the wave peaked at 18 feet high. The National Weather Service said seas otherwise were 1 to 2 feet at the time. Undersea landslides are common off Daytona Beach but rarely cause waves of that size. Authorities ruled out a tidal wave, and no seismic activity was recorded in the Atlantic Ocean at the time. A weather service meteorologist said it was not weather-related.



While scientists have gained a greater understanding of rogue waves in the last decade, they are still quite enigmatic. No one has ever filmed the formation of a rogue wave in the ocean or followed one through its entire life cycle. There are very few photographs of rogue waves. For centuries, the best evidence for their existence was anecdotal -- the many stories told by sailors who had survived one.

Rogue waves frequently occur in areas known for strong ocean currents. The Gulf Stream (pictured) which runs up the east coast of Florida, very close to the City of Hallandale Beach and further up the coast of United States, is another potential rogue wave source. Rogues originating in the Gulf Stream could be responsible for some of the legends of the Bermuda Triangle.

Due to the nature of rogue waves, it is unlikely that there would be warning to the City of this phenomenon.

Rogue Wave Summary of Risk

Neither the 2017 Broward County ELMS nor the NRI address the risk rogue waves pose to the City of Hallandale Beach. However, due to the historical rarity of rogue waves, as well as the localized effects and limited impacts attributed to the few confirmed rogue waves, the City's risk can be described as follows:

- **Frequency:** Very Low
- **Vulnerability:** Very Low
- **Exposure:** Very Low
- **Relative Expected Annual Losses:** Very Low

- **Relative Risk: VERY LOW**

Sources of Floodwaters in the City of Hallandale Beach

Sources of flood waters in the City of Hallandale Beach include:

- **The Atlantic Ocean**
- **The Intracoastal Waterway**
- **Water Management Canals**
- **Chaves Lake**
- **Various Other Lakes (minor sources)**

Hallandale Beach's low-lying topography combined with its subtropical climate makes it highly vulnerable to inland flooding, and the areas lying east of Federal Highway are particularly vulnerable to coastal flooding from storm surges.

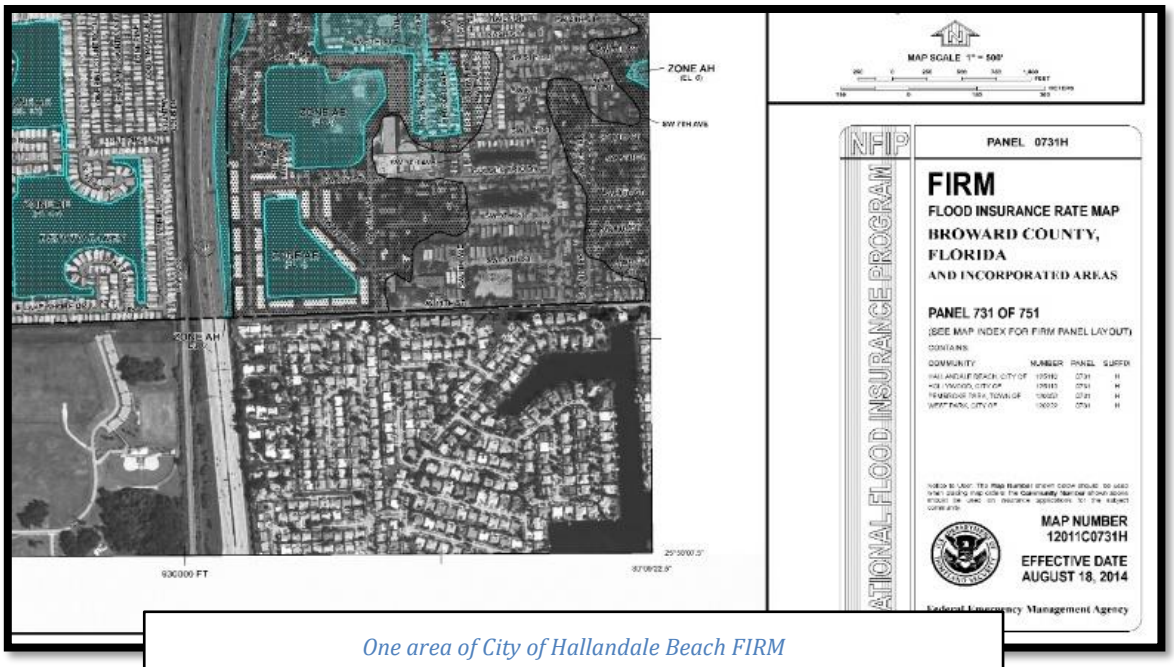
The City of Broward County Flood Insurance Study (FIS) covering Hallandale Beach was most recently revised in August 18, 2014 and was reprinted with corrections on August 9, 2016. The FIS provides information about the sources of flooding in the County, and can be found in Appendix F.

There are two drainage canals located within the city: Schaffer Canal and SE 14th Avenue Canal. Rights-of-way, culverts, and bridges must be inspected and cleared quickly of any blockage so there is continuous free flow of water through these canals.

Flood Zones and Flood Insurance Rate Maps

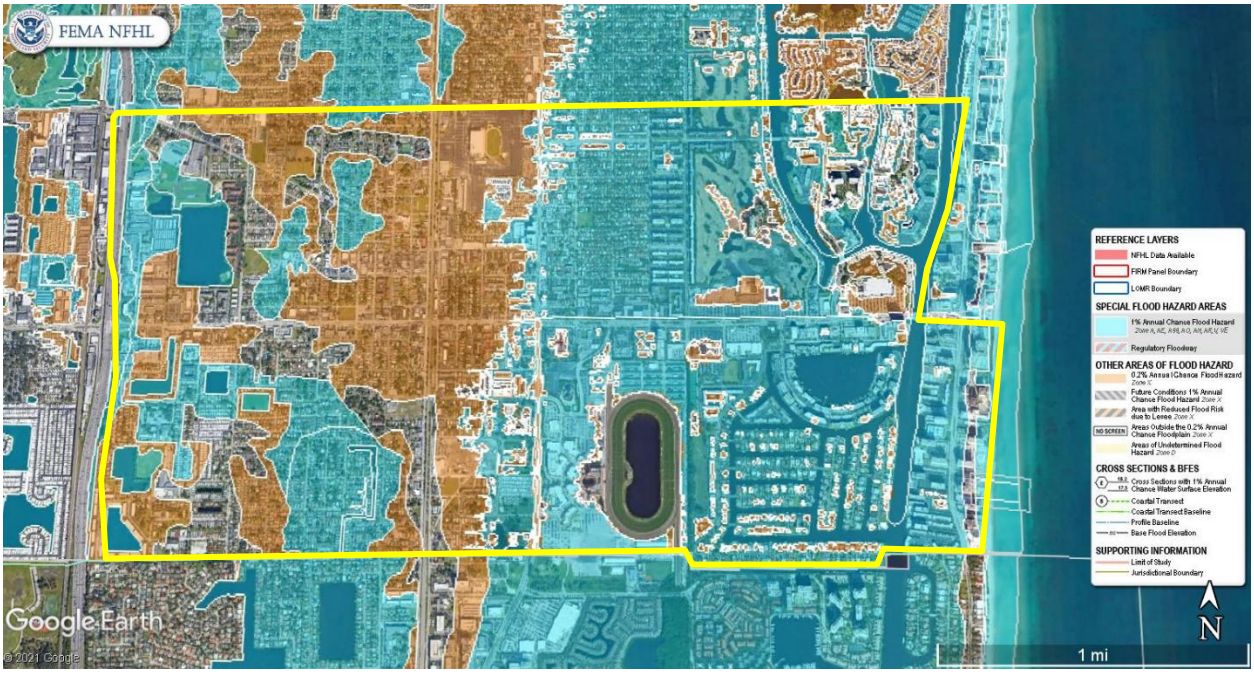
In response to mounting losses from flooding nationwide, the United States Congress initiated the National Flood Insurance Program (NFIP) in 1968. The program is administered through FEMA. Under this program, FEMA produces FIRMs (Flood Insurance Rate Maps), which show areas subject to various levels of flooding under different conditions. This flood risk information is based on historic, meteorological, hydrologic, and hydraulic data, as well as open-space conditions, flood control works, LIDAR (Light Detection and Ranging) and development. The FIRMs are regulatory documents that identify the Special Flood Hazard Areas (SFHAs) where land use and building requirements of the NFIP need to be enforced in order for a community to participate in the NFIP. The SFHAs identify areas of possible inundation due to both riverine flooding and coastal flooding. The FIRMs establish flood zones that are used for floodplain management regulations, to set flood insurance rates, and to identify where flood insurance is required as a condition of a federally insured mortgage.

Flood inundation areas shown on the FIRMs for coastal areas are based on the storm surge and wave action (where applicable) from the flood that has a 1% chance of being equaled or exceeded in a given year (also known as the 100-year flood or base flood). The regulatory and insurance requirements of the NFIP are based on the flood data shown on the FIRM. The maps may also show the extent of stillwater inundation (without consideration of wave height) from the flood that has a 0.2% chance of being equaled or exceeded in a given year (also known as the 500-year flood).



One area of City of Hallandale Beach FIRM

The FIRMs for the City of Hallandale Beach have an effective date of August 18, 2014, and residents can access them through FEMA's online map service center or by contacting the City. Floodplains designated on the FIRM are based on the 1% annual flood chance or the 100-year flood event. The 500-year flood event with a 0.2 % annual chance of occurrence is used to designate other areas of the community, which may have some vulnerability to flooding. The FIRMs for the City of Hallandale Beach can be seen in Appendix F.



Hallandale Beach Flood Zones

The various flood zones are indicated on the Hallandale Beach map. The first four Flood Zones defined below apply to the City of Hallandale Beach and are in the Special Flood Hazard Area (SFHA). There is a mandatory purchase of flood insurance that applies for federally backed mortgages in the SFHA. The requirement also extends to private mortgage companies backed by the FDIC or other federal agencies. Therefore, many private mortgage companies also require flood insurance on properties in the SFHA (as defined by the following Flood Zones):

- **AE Zone** – Areas subject to inundation by the 1-percent-annual chance (also known as the 100-year flood) flood event determined in a Flood Insurance Study by detailed methods. Base Flood Elevations (BFEs) are shown within these zones. Mandatory flood insurance purchase requirements and floodplain management standards apply.

- **AH Zone -** Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30 - year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

- **VE Zone** – SFHAs along coasts subject to inundation by the 1% annual chance (100-year) flood event with the additional hazards due to storm-induced velocity wave action. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown. The V Zone generally extends inland to the point where the 100-year flood depth is insufficient to support a 3-foot breaking wave. Mandatory flood insurance purchase requirements and floodplain management standards apply.

There are two flood zones in the City that are moderate flood hazard areas and are also shown on the FIRM but are not considered part of the Special Flood Hazard Area. They are:

- **X Zone** – An area of minimal flood hazard that is determined to be outside the SFHA and higher than the elevation of the 0.2% annual chance (or 500-year) flood. Shown on some flood maps as the "C" Zone or the "X" unshaded zone.

- **X500 Zone** – An area of moderate flood hazard that is determined to be outside the SFHA between the limits of the 1% flood and the 0.2% annual chance (or 500-year flood). Shown on some flood maps as the "B" Zone or the "X" shaded zone.

In addition to the FIRM maps there is a numerical model, which predicts the effects of storm surge in Broward County. Developed by the National Oceanic and Atmospheric Administration (NOAA), it is called the Sea, Lake and Overland Surges from Hurricanes (SLOSH) model. In Appendix G, a map illustrates the areas of Broward County vulnerable to this type of flooding.

FEMA uses the most accurate flood hazard information available and applies rigorous standards in developing the FIRMs. However, for some small areas, earthen fill may have been placed during construction, thereby elevating a small area within the SFHA to an elevation that is at or above the BFE. This construction may have taken place during the time the engineering study was being performed or subsequent to that study. Because of the limited extent of the elevated area and the limitations of the map scale, it may not have been possible for FEMA to show this area as being outside the SFHA and so these areas have been incorrectly included in the SFHA on the FIRM.

Recognizing that these situations do occur, FEMA established administrative procedures to change the designation for these properties on the FIRM. These processes are referred to as the Letter of Map Amendment, or LOMA process and the Letter of Map Revision Based on Fill, or LOMR-F, process (see Appendix F for an example LOMR). Through these processes, an individual who owns, rents, or leases property may submit certain mapping and survey information to FEMA and request that FEMA issue a document that officially removes a property and/or structure from the SFHA. In most cases, the applicant will need to hire a Licensed Land Surveyor or Registered Professional Engineer to prepare an Elevation Certificate for the property. Upon receiving a complete application forms package, FEMA will normally complete its review and issue its determination in 4 to 6 weeks.

The City of Hallandale Beach's FIRM, *Flood Insurance Study,* and Letters of Map Amendment are available to the public by contacting the Building Department. These documents can also be viewed on FEMA's Map Service Center website.

Flood Prone Areas in Hallandale Beach

In the course of developing this Flood Mitigation Plan, the City of Hallandale Beach submitted the following list of areas most often reported as being prone to flooding:

- **Southwest Quadrant**

  Over the past ten years, the City of Hallandale Beach has both planned and implemented many capital improvement projects in the southwest quadrant designed to mitigate flooding. Over $3 million has been spent over the past eleven years to enhance stormwater drainage in the area. Most recently, a major drainage project has been funded through the Hazard Mitigation Grant Program, costing approximately $12,000,000. As a result of capital improvement

efforts, the major flooding problems that characterized the area in previous years have been substantially improved.

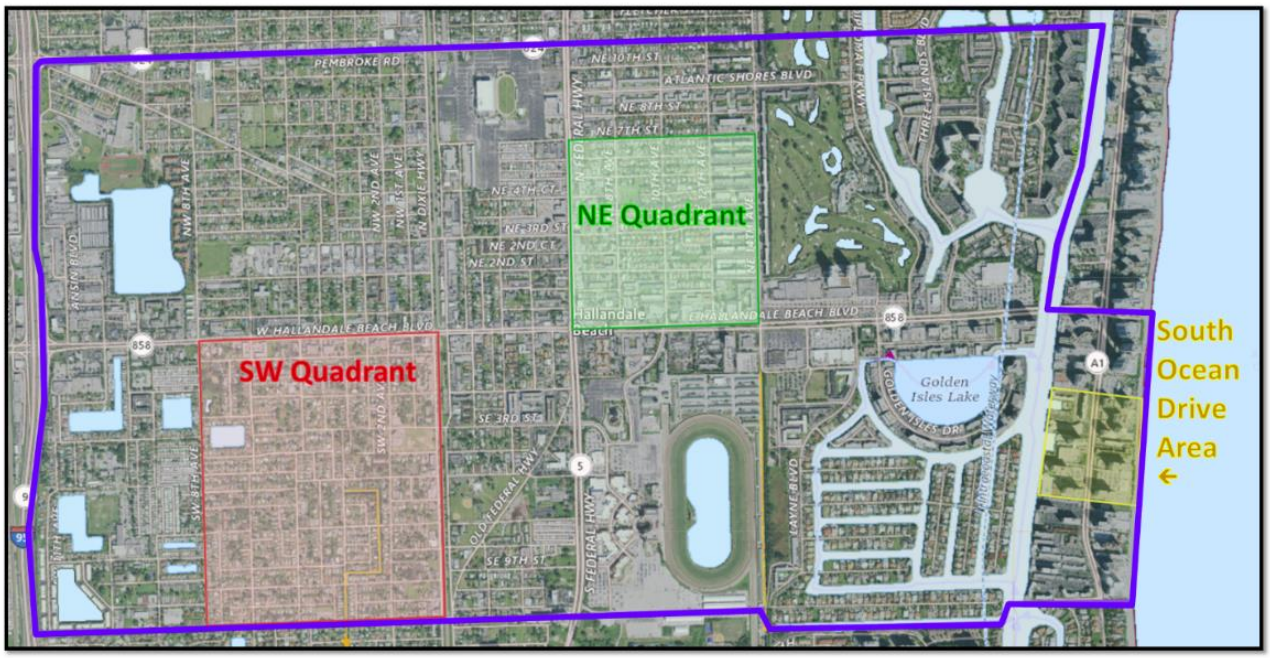
- **Northeast Quadrant**

  Of all areas in the City of Hallandale Beach, none have a greater number of repetitive loss properties than the northeast quadrant. Not only are there many low-lying areas, but there are very few bodies of water in the area to which stormwater can flow.The City secured a Hazard Mitigation Grant for $6 million to complete an $8 million drainage improvement project that will further reduce the flooding hazard in the Northeast Quadrant. This project was completed in 2015. The City continues to prioritize this area for future drainage improvements.

- **South Ocean Drive Area**

  One of the two repetitive loss properties has recently been demolished and rebuilt. Its new elevation provides considerably more protection from flooding than its previous elevation. The other property has not had a property loss in several years.

See below, and in Appendix H, for map of the City indicating the areas listed above, which are highlighted as flood prone.



2021 Hallandale Beach Flood Prone Areas

The City has been actively addressing flooding issues in the community. Several areas that had nuisance flooding problems as recently as the previous 2013 flood mitigation plan have since been mitigated. Recently completed projects implemented within these areas include:

- **NE Quadrant Drainage Improvement Project (completed in 2015)**
  - Area bounded by Federal Highway, NE 14th Avenue, Hallandale Beach Blvd. and NE 8th Street.
  - Work included installation of stormwater pumping stations, injection wells, stormwater force main, removal and upgrade of existing gravity systems, new sanitary sewer force main and restoration of all disturbed areas.

- **SW Drainage Project (completed in 2020)**
  - Located within portions of the right-of-way defined by South Dixie Highway to the east, SE 11th Street to the south, SW 6th Avenue to the west and SW 5th Street to the north.
  - Work included the construction of a stormwater pump station that discharges stormwater from the Schaeffer Canal into 17 stormwater injection wells via a force main network. Work also included dredging, electrical equipment, water main relocation, sanitary gravity sewer reconstruction, seawall construction, sheet piling, generator for alternate power supply, asphalt milling and overlay and landscaping.

- **42nd Year CDBG Project (completed in 2018)**
  - Intersection of SW 10th Avenue and SW 8th Street.
  - Along SW 9th Street between SW 10th Avenue and SW 8th Avenue.
  - Along SW 8th Street between SW 9th Avenue and SW 8th Avenue.
  - Storm drainage improvements focused on installing four (4) drainage structures and two hundred seventy (270) linear feet of french drains (15”). Also included was asphalt pavement restoration and markings, sidewalk replacement, new ADA compliant ramps and speed hump reconstruction within the SW quadrant of the city.

- **43rd Year CDBG Project (completed in 2019)**
  - NW 2nd Avenue from NW 5th Street and NW 4th Street.
  - Storm drainage improvements focused on installing three (3) drainage structures and one hundred one (101) linear feet of French drains (18”). Also included was asphalt pavement restoration and markings, sidewalk replacement, and new ADA compliant ramps within the NW quadrant of the city. All work was within the City’s right-of-way.

- **44th Year CDBG Project (completed 2020)**
  - NW 8th Avenue from NW 9th Street to Pembroke Road.
  - storm drainage improvements focused on installing four (4) drainage structures and one thousand (1000) linear feet of french drains. Also included was asphalt pavement restoration and markings, sidewalk replacement, new ADA compliant ramps and speed hump reconstruction within the NW quadrant of the city. All work was within the City’s right-of-way.

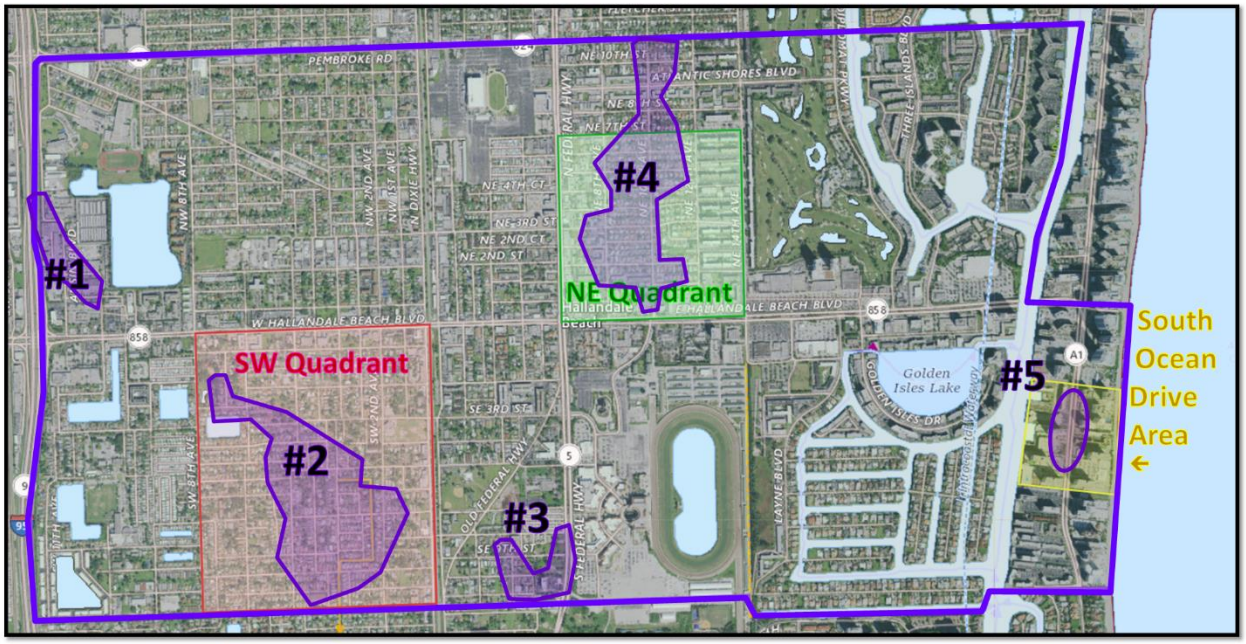
Projects currently, or soon to be, underway within these areas include:

- **45th Year CDBG Project (In progress) in the NW quadrant**
  - Area bounded by the intersection of NW 7th Avenue and NW 3rd Court.
  - Project scope will include street resurfacing, construction of new stormwater facilities, regrading and sodding of swales and construction/restoration.
  - Notice to Proceed - May 10,2021.
  - Currently in construction.
  - Expected completion date September 6, 2021.
- **46th Year CDBG Project (hasn't started yet) in the NW quadrant**
  - Along NW 2nd Avenue (between NW 7th Street and NW 9th Street).
  - Along NW 7th Court (between NW 2nd Avenue and NW 3rd Avenue).
  - Along NW 8th Street (between NW 2nd Terrace and NW 2nd Avenue).
  - Project scope will include street resurfacing, construction of new storm drainage, regrading and sodding of swales, sidewalk replacement and new ADA compliant ramps.
  - Anticipated Construction Start - September 7, 2021
  - Anticipated Construction Completion - February 7, 2022.
- **Citywide Stormwater Master Plan (not yet underway)**
  - The City has plans to design and develop a citywide stormwater master plan that will help identify and prioritize projects in order to improve conditions in the problem areas.
- **Lift Station #8 (In Progress) as mentioned in Broward County Enhanced LMS Project List (2017)**
  - SE 5th Street and SE 4th Avenue.
  - Replace Lift Station and install improved generator built to account for sea-level rise.
  - Currently in the construction phase.
  - Anticipated wet well installation date - July 21, 2021.
  - Generator to be shipped by the end of July 2021.
  - Anticipated Construction Completion - February 1, 2022.

Repetitive Loss Areas

In addition to nuisance flooding, which affects streets, driveways, and yards, flooding also impacts buildings. FEMA has developed a classification to highlight those buildings that have been especially vulnerable to flooding, as quantified by the flood insurance claims that have been paid. If two or more flood insurance claims of more than $1,000 have been paid within any 10-year period since 1978 the property is considered a "repetitive loss property." In 2018, the City had 142 unmitigated repetitive loss properties. Concurrent with its development of this flood mitigation plan, the City undertook an analysis of the areas in which the repetitive loss properties are located to help determine the extent

of the hazard. The repetitive loss information and analysis is included in Appendix I and discussed in more detail in *Section Six – Assess the Problem*.



2013 Hallandale Beach Repetitive Loss Areas

Future Flood Hazards

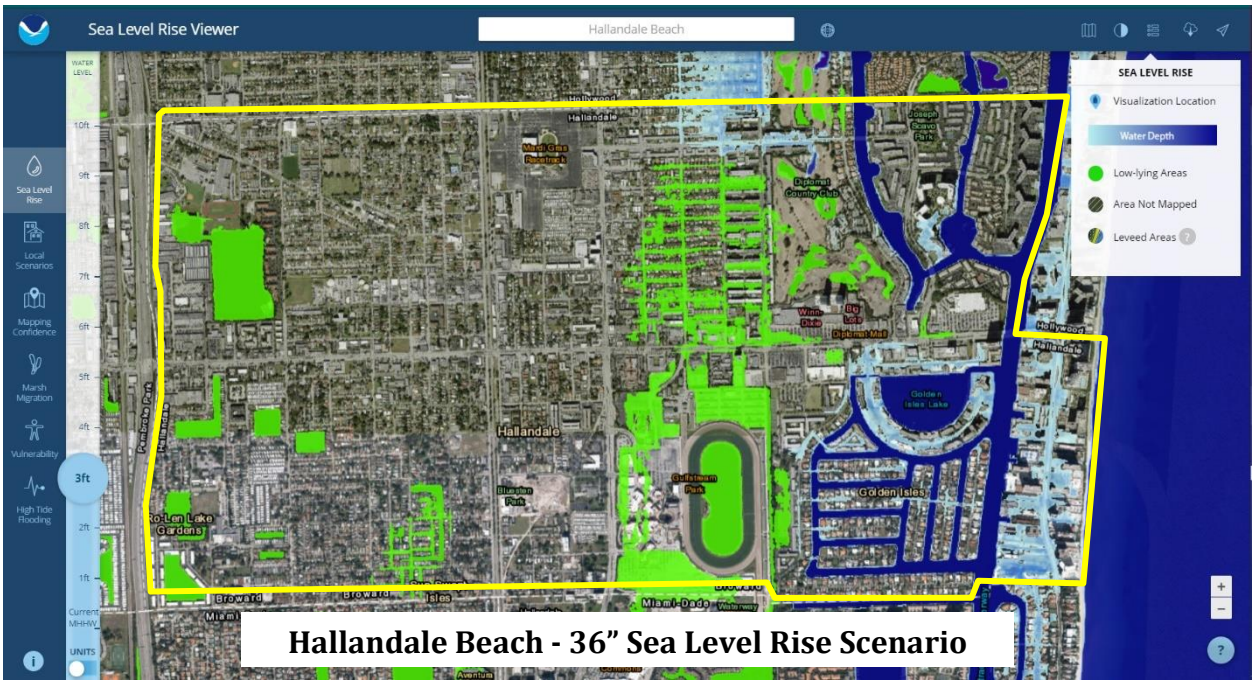
As the City of Hallandale Beach is already largely built out according to current and future land use designations, there is very little land available for new development. Therefore, with the exception of the areas that are projected to be affected by sea level rise (discussed further on the following page), it is not expected that any areas (that do not already flood) will become additional flood hazards in the future.

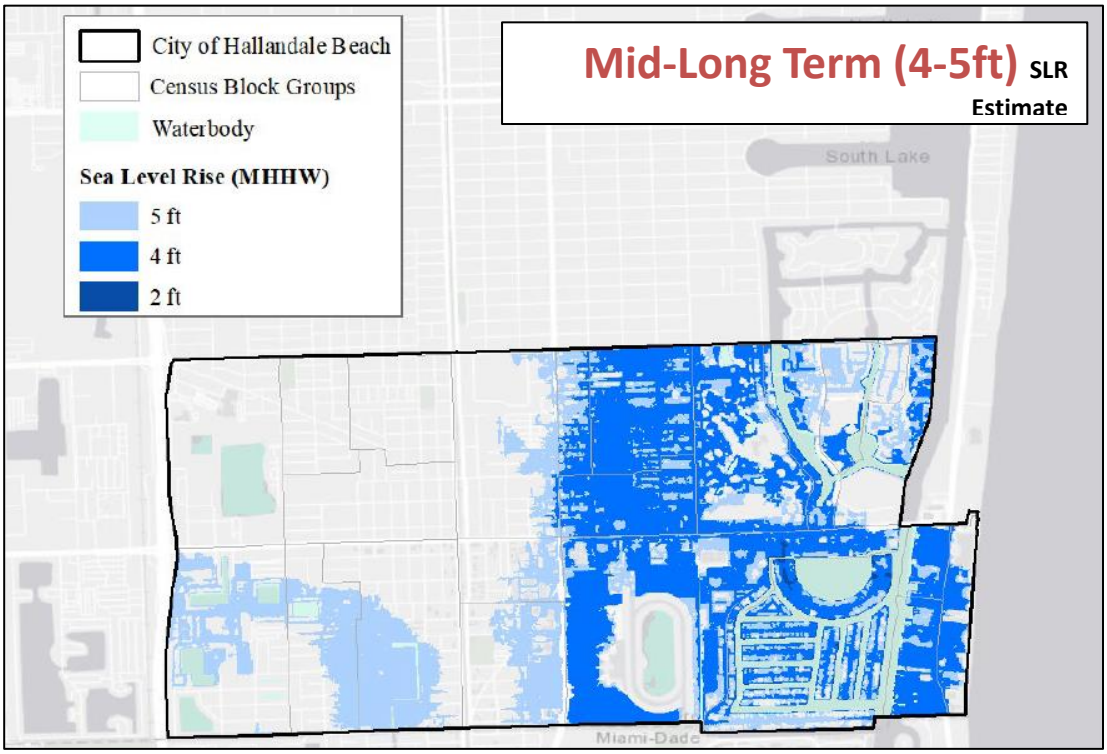
It is the hope of City staff and this Committee that the flood hazard (and the ensuing problems) will actually be reduced in the future as a result of the following:

- substantial improvement of old buildings,
- advancements in science and technology,
- enforcement of increasingly robust building practices and standards,
- implementation of resiliency focused community planning (utilizing green infrastructure),
- restoration of natural and beneficial areas (including dunes and coral reefs),
- demolition, mitigation, or acquisition of frequently flooded buildings,
- and completion of stormwater capital improvement projects.

Unfortunately, despite the City's best efforts to mitigate and reduce the flood hazard, it is expected that sea levels will continue to rise. This will, in turn, expand the flood hazard to areas that have not yet experienced historic flooding or increase the duration and number of flood days for properties

that currently only experience infrequent flooding. The South Florida Climate Change Compact encourages communities to use the NOAA Intermediate Seal Level Rise Forecast for 2070 (which is 40") for planning. Below is an image from NOAA's interactive online Seal Level Rise Viewer showing area of the City that can be expected to flood under a 36" sea level rise scenario and the Mid – Long Term outlook from the *2020 City of Hallandale Beach Vulnerability & Adaptation Plan*.





The areas expected to experience flooding in the above sea level rise scenario are already in the SFHA and therefore may already be subject to infrequent flooding. However, should these sea level rise projections occur, the highlighted areas may become permanently inundated or experience frequent tidal inundation. This City is incorporating this possibility into long-term planning efforts. A more detailed map of areas likely to flood in the future is included in Appendix H.

Population growth estimates and future severity projections for many of the hazards are explored in more detail as part of the *Assess the Problem* section of this document.

Past Flood Events in Hallandale Beach and Broward County

In addition to considering possible future flood hazards, the City also incorporates historical experience into planning efforts. Lessons learned from previous floods are applied to forward looking prevention efforts in order to improve outcomes and mitigate known hazards.

A detailed list and description of notable flood events that have affected Hallandale Beach and Broward County can be found in Appendix C

Section Six - Assess the Flood Problem

Section Contents

Overall Vulnerability to Flooding & Impact on Community

A flood hazard area may or may not produce flood problems. In and of itself, flooding is viewed as a natural and even beneficial occurrence. Flooding does, however, become a problem when it negatively impacts people, and floodplains can be problematic when development exacerbates the detrimental effects of floods.

Public safety is of paramount concern for the City of Hallandale Beach. The City has made it a priority to educate its citizens on the dangers and impacts of flooding. The City implements a Program for Public Information that provides information on flood warnings, property protection, flood safety, and flood insurance. Furthermore, the City has developed a comprehensive flood warning program that can deliver real-time data to citizens and emergency management personnel through television, radio, social media, mobile apps, and the Internet. The goal of the City's approach is an educated and well-informed constituency.

As Hallandale Beach's population has rapidly increased since 1960, so has rapid water runoff associated with the vast areas of impervious surfaces such as asphalt roads, concrete areas, sidewalks, and structures created by new development. Impervious surfaces often create flood prone areas where they did not previously exist. A recent assessment of the City found that it is 55% impervious surface.

The Stormwater Division of the City of Hallandale Beach is responsible for managing the stormwater runoff on City streets and City-owned property. The Division inspects and maintains open channels, stormwater pipes, catch basins, storm drains, swales, wet and dry stormwater ponds, and outfalls within the City limits to ensure that stormwater runoff is managed properly after storms and rain events. The performance of the stormwater system is continually monitored, and improvements are made as necessary.

Flood damage is proportional to the volume and the velocity of the water. With a storm surge, for example, high volumes of water can move heavy objects and undermine roads and bridges. Urban and residential flooding, even non-destructive nuisance flooding, can impede traffic and adversely affect commerce by delaying and discouraging residents, customers and employees.

This section of the Flood Mitigation Plan evaluates the potential impact of flooding on Hallandale Beach with respect to the following:

- ✓ Life, safety, and health of Hallandale Beach residents and incident responders
- ✓ Existing structures at risk
- ✓ Natural and beneficial floodplain functions
- ✓ Economy
- ✓ Repetitive flood loss properties
- ✓ Development and redevelopment

Impact on Life, Safety, Health

Although there has not been a recent flood-related fatality in the City of Hallandale Beach, the deadly hazard associated with coastal flooding is ever present. Generally, the inland flood hazard in the City is not considered to pose a serious risk to life, however some risk does exist. During the rainfall flooding of January 2014, in unrelated incidents, both a driver and a pedestrian lost their lives to roadway flooding in nearby Delray Beach, illustrating the potential for loss of life and the importance of flood mitigation efforts.

Beyond loss of life, floods, can bring a variety of health problems: disease and pollutants in the water; mold, mildew, and sediment left by the flood; and psychological impacts on flood victims.

Illness from Floodwater

Three general types of health problems accompany floods. The first comes from the water itself. Floodwaters carry whatever objects and pollutants the stormwater runoff carries, including dirt, oil, farm and industrial chemicals, fertilizers, animal waste, trash, etc. The ground can become saturated with flood waters, and this contaminated water eventually makes its way into the stormwater and sanitary sewer lines. Boil water orders may be instituted by the City if the potable water supply has been or is thought to have been contaminated. Furthermore, during floods the overloaded sewer system can back up into homes and low-lying areas, creating a breeding ground for bacteria. All materials that are or have come in contact with floodwaters should be considered contaminated. Until the water recedes, the public is at immediate risk due to these unsanitary and unhealthy conditions.

The second type of health problem comes after the waters have receded. Stagnant pools of water become breeding grounds for mosquitoes, while mold and mildew can develop in parts of buildings that have not been cleaned and/or dried out.

Mosquitoes

Mosquitoes in Florida have been known to carry the following diseases:

- ✓ Eastern Equine Encephalitis
- ✓ West Nile Virus
- ✓ St. Louis Encephalitis
- ✓ Zika Virus

That list may become longer in the future due to the tropical climate and international tourism that characterize Florida's beaches. The possibility of the re-emergence or introduction of mosquito-borne diseases that had either been eradicated or previously unreported in the United States is ever-present. In addition to recent reports by The Florida Department of Health announcing confirmed cases of dengue fever and chikungunya among people who had traveled overseas, there were over 1200 Zika cases reported in 2016. These findings have experts concerned about the possibility that Florida mosquitoes are now spreading what were previously considered foreign illnesses, which

could, under the right conditions, lead to a potential outbreak of locally acquired mosquito-borne infections. Vector borne diseases are also projected to spread further as a result of climate change.

Below is a table from the Florida Department of Health's Mosquito-Borne Disease Surveillance System listing confirmed cases of mosquito-borne illnesses reported from 2014 - 2020:

Mosquito-Borne Illness, Confirmed Cases	2014	2015	2016	2017	2018	2019	2020
West Nile virus illness	15	11	6	4	33	3	79
St. Louis encephalitis (neuroinvasive)	2	0	0	0	0	0	0
Eastern equine encephalitis	0	0	0	1	3	0	0
Dengue fever (local)	6	1	2	0	1	16	71
Dengue fever (imported)	80	82	43	18	73	295	49
Chikungunya fever (local)	11	0	0	0	1	0	0
Chikungunya fever (imported)	452	73	6	4	5	8	0
Zika (imported)	Not Tracked	Not Tracked	1,016	207	97	36	0
Zika (local)	Not Tracked	Not Tracked	256	2	97	0	0

Source: Florida Department of Health's Mosquito-Borne Disease Surveillance System

Surveillance conducted by the CDC's Division of Vector-Borne Infectious Diseases indicates that in the absence of pre-storm epidemics, the risk of mosquito-borne illness does not usually increase after a flood or natural disaster. However, citing evidence of increased illness after the Red River Flood of 1975 the CDC states:

> *"The three viruses of primary concern (EEE, SLE, WEE) overlap in their distribution, but each has a distinct ecology, involving different mosquito species and avian amplifier hosts. Despite these differences, populations of primary or secondary vector species of each virus may increase significantly in response to heavy rainfall or flooding. Therefore, under certain circumstances, disasters might produce increases in disease risk."*

The Broward County Office of Mosquito Control recommends the following measures to reduce the health risks associated with mosquitoes:

- ✓ Repair leaky pipes and outside faucets.
- ✓ Move house cooler drain hoses frequently.
- ✓ Install screens on rain barrels and openings to water tanks or cisterns.
- ✓ Empty water from boats.
- ✓ Change water and scrub vases holding flowers or cuttings twice each week or grow cuttings in soil.
- ✓ Eliminate old tires, tin cans, bottles, jars, buckets, drums and other outside containers.
- ✓ Clean clogged roof gutters and drain flat roofs that collect water.
- ✓ Scrub and change water in bird baths twice weekly
- ✓ Empty watering areas of pets and chickens daily.

- ✓ Fill holes in trees with sand or mortar, or drain or spray them as required.
- ✓ Empty your plastic wading pool weekly and store it under shelter when not in use.
- ✓ Stock fish pools or lily ponds with minnows. These fish eat mosquito larvae.

The Broward County Mosquito Control department is tasked with providing countywide mosquito control and is available to respond to residents' mosquito-related concerns. After a flood or natural disaster, the department will evaluate whether additional methods or more frequent pesticide applications would be required to safeguard public health.

Mold and Mildew

Unless confined to a Natural and Beneficial area, or removed by canals and storm drains, the standing water left after a flood can be hazardous. While standing water outdoors can encourage mosquito breeding, standing water inside of a building can also cause problems. A building that is not thoroughly and properly cleaned and dried becomes a health hazard, especially for small children and the elderly. There are two prerequisites to mold growth:

- ✓ Moisture
- ✓ Nutrients

Both of these are present in homes following a flood. The CDC's *Mold Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes and Major Floods; Recommendations and Reports June 9, 2006* states:

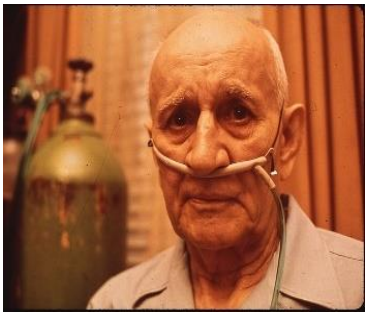
> *"Although molds can be found almost anywhere, they need moisture and nutrients to grow. The exact specifications for optimal mold growth vary by the species of mold. However, mold grows best in damp, warm environments. The availability of nutrients in indoor environments rarely limits mold growth because wood, wallboard, wallpaper, upholstery, and dust can be nutrient sources. Similarly, the temperature of indoor environments, above freezing and below the temperature for denaturing proteins, can support mold growth, even if the actual temperature is not optimal.*
>
> *The primary factor that limits the growth of mold indoors is lack of moisture. Substantial indoor mold growth is virtually synonymous with the presence of moisture inside the building envelope. This intrusion of moisture might be from rainwater leaking through faulty gutters or a roof in disrepair, from a foundation leak, from condensation at an interface (e.g., windows or pipes), or between a cold and a warm environment. Water also can come from leaks in the plumbing or sewage system inside the structure. Studies of mold growth on building materials, such as plywood, have found that mold grows on materials that remain wet for 48-72 hours. Flooding, particularly when floodwaters remain for days or weeks, provides an almost optimal opportunity for mold growth."*

In the warm, humid climate of Florida, any moisture that is not properly removed from walls, furniture, carpets and other absorbent surfaces after a flood can quickly begin harboring irritating, if not dangerous, strains of mold and mildew. Although proper remediation is recommended after a storm, many homeowners forgo the option. Some who are unaware of the potential hazards and

others who are deterred by the expense or the inconvenience, opt for superficial fixes thereby compromising the long-term indoor air quality of their homes or businesses.

The CDC further emphasizes the potentially detrimental health effects of mold exposure when it summarizes the results of a study in which post-Katrina homes, residents and remediation workers were tested for mold exposure and related illnesses:

> *"In 2004, the Institute of Medicine (IOM) reviewed the literature regarding health outcomes related to damp indoor spaces. In addition to the risk for opportunistic fungal infections in immunocompromised persons, IOM found sufficient evidence for an association between both damp indoor spaces and mold and upper respiratory symptoms (nasal congestion and throat irritation) and lower respiratory symptoms (cough, wheeze, and exacerbation of asthma). The findings of this report indicate that, in the New Orleans area post-hurricane, indoor environmental conditions and personal practices provided exposures that potentially put residents and remediation workers at risk for these negative health effects."*



Finally, residents with asthma, the elderly and those with compromised immune systems are more susceptible to mold-related breathing problems. Considering the fact that the 2019 Census Estimates calculated 24.3% of the residents of Hallandale Beach are over the age of 65 (significantly higher than the US average of 16.5%), and Florida Health Charts indicates 6.2% of Broward's adults currently have asthma (2.2% being below the age of 65), there is a significant percentage of the population (approximately 10,560 residents) at increased risk from mold exposure.

In 2013-2018, there were 117 flood claims paid out for damage to 103 properties. That represents only 0.68% of the 17,103 policies currently in force. But those are only the insured properties. There were no doubt uninsured properties which may have been exposed to flooding but not remediated, resulting in possible mold damage. Consequently, it is possible that a significant number of residents may currently be exposed to mold growth as a result of previous floods. The City's efforts to educate the public about the dangers of flooding, including mold growth, and the importance of having flood insurance should help to reduce these numbers.

Psychological Impacts

In addition to the possibility of physical illness, there is the potential for long-term psychological impacts due to experiencing damage caused by a flood to one's home, business, personal belongings, etc. Unprepared and uninsured persons can often feel increased pressures due to all that accompanies the aftermath of a flood. There is also a long-term sense of insecurity for those who know that their homes can be flooded again. The resulting strain on floodplain residents takes its toll in the form of aggravated health and mental health problems. As a result of recent flash floods in the city, there was even an attempted suicide-by-cop incident involving an elderly gentleman who was

devastated about the flood damages to his home and his inability to fund repairs with his fixed income.

The cost and labor needed to repair a flooded home puts a severe strain on people, especially the unprepared, uninsured, displaced or temporarily unemployed. Additionally, the cost allocated to re-building may reduce resources for other important needs, such as, healthcare, personal maintenance and mental health. This psychological impact can be exacerbated when the flooding was the result of a community-wide or region-wide event that disrupts the local economy, interrupts the supply chain, upends normal schedules, cuts off lines of communication and suspends necessary or helpful social services.

While adults who experience these traumatic events can suffer from post-traumatic stress disorder (PTSD) for years afterward, children are particularly susceptible to this post-traumatic stress. The psychological impacts can endure long after the actual event. Considered adverse childhood experiences (ACEs), natural disasters, like floods and hurricanes, can have lifelong effects on the health and wellbeing of children.

Secondary Safety Risks

The aforementioned health hazards associated with a flood may not become apparent until days or even months after the event. More immediate dangers include the risk of injury from electricity and the increased likelihood of being involved in an automobile or other storm-related accident.

When people ignore basic safety precautions such as evacuations and warnings, injuries and/or accidents are more common. A major potential for injuries from flooding results from people walking or playing in or near flooded areas. During or after any flood event, care must be taken when entering the waters, whether in a vehicle or by foot.

Roads running through low-lying areas, or areas with poor drainage, as in some of the older sections of Hallandale Beach, can pose a serious threat. Roads covered with water may cause confusion to drivers and may affect vehicles' braking systems or leave a car disabled. Canals near roadways may be obstructed from view by flood waters on roadways, where the canal may look like a road to a driver not familiar with the area. For instance, during the flooding of January 2014 two residents of Palm Beach County lost their lives in Delray Beach. One of these residents was a motorist whose car left the road and became submerged in a roadside lake. The other was a pedestrian, wading through flood waters, who fell into a canal that was not visible through the flood water.

In the case of storm surge flooding, motorists may attempt to drive through barricaded or flooded roadways. Because only 18 to 24 inches of water moving quickly across a roadway can carry away most vehicles, floods can present significant potential safety risks. Emergency rescue assistance may be required to remove an individual from a vehicle disabled by high flood waters, putting emergency responders at risk.

In addition to dangerous road conditions that may be hidden by the flood waters, power lines may be down and obscured by the flood waters, putting people at risk of electrocution. The combination of electricity and water can prove deadly. Snakes, poisonous insects, and fire ant colonies can also be present in the water, posing a serious threat.

Other secondary effects on safety resulting from flooding, include damage to gas lines, structures, and bridges that may make it unsafe for emergency operations.

As Hurricane Dennis moved through south Florida in 2005, there was one known direct death... a man who drowned in a likely rip current at Hollywood Beach. An indirect death occurred in Fort Lauderdale when a man was electrocuted after stepping on a downed power line. In 2017, of the 32 deaths attributed to Hurricane Irma in southern Florida, all but one were indirect. The only direct death was an 86-year-old man who was knocked down by a gust of wind while opening the front door of his home in Broward County. Most of the deaths occurred during cleanup after the storm or from carbon monoxide poisoning, a result of the improper use of generators.

Following are several actions that residents of flood hazard areas can take to decrease the potential of injury due to flooding. It is wise to be overly cautious:

- ✓ Know the flood warning procedures.
- ✓ Do not attempt to cross a flowing stream where water is above your knees.
- ✓ Keep children away from floodwaters, ditches, culverts and storm drains.
- ✓ If your vehicle stalls in high water, abandon it immediately and seek higher ground.
- ✓ Evacuate the flood hazard area in times of impending flood or when advised to do so by the police and fire departments.
- ✓ Cut off all electric circuits at the fuse panel or disconnect switches. If this is not possible, turn off or disconnect all electrical appliances.
- ✓ Shut off the water services and gas valves in your home
- ✓ Be aware of outdoor hazards. Watch out for loose or dangling power lines and report them immediately to proper authorities. It is not unusual in a disaster such as a flood for more people to be killed by carelessness in the aftermath than were killed by the event itself.
- ✓ Be sure all electric and gas services are turned off before entering buildings for the first time after a flood.
- ✓ Remove covers from all outlets and fuses or multi-breaker boxes and flush with clean water. Let dry and spray with contact cleaner/ lubricant.
- ✓ Watch for electrical shorts or live wires.
- ✓ Don't turn on any lights or appliances until an electrician has checked the system for short circuits.
- ✓ Electric motors in appliances that have been flooded should be thoroughly cleaned and reconditioned before they are put back into service.

Sea level rise (covered in more detail later in this section), is also an issue that will exacerbate flood risk, increase storm surge and affect drainage throughout most of South Florida. Knowing that scientific studies indicate a continuation and/or acceleration of the recently-observed increase in sea levels, it is becoming clear that it is no longer sufficient for communities to plan for flood risk based solely on historical flood events. Now, communities must also plan for an expected increase in risk that could exceed any previously recorded or measured events. Following recommendations of the Southeast Florida Regional Climate Change Compact, the City is using the "NOAA Extreme" sea level rise projections for 2070, as defined in the 2019 Unified Sea Level Projections to inform critical infrastructure planning and mitigation efforts.

Warning and Evacuation of Residents and Visitors

National Weather Service flood watches (when conditions are right for flooding) and flood warnings (when flooding is imminent) will be issued by local television, The Weather Channel, and radio stations. Residents in flood-prone areas will also be warned of an actual emergency condition by the sounding of a steady siren tone provided by fire and law enforcement mobile units. When these signals are sounded, residents should turn to their local television and radio stations for information. To get updated information on storm preparations, residents can call the Broward County Emergency Hotline at 311 or 954-831-4000, or additional telephone numbers announced through news outlets.

Broward County is the lead agency in this county for hurricane responses and is responsible for ordering evacuations when required.

County Emergency Operations

Broward County Emergency Management Division (EMD) coordinates disaster planning, preparedness, response, recovery and mitigation activities for the County. Because the City of Hallandale Beach has contracted with Broward County for many of its emergency management needs, the County's emergency response is of particular significance to the Hallandale Beach community. A detailed description of County's emergency response procedures can be found in the Broward County Comprehensive Emergency Management Plan (CEMP).

The primary emergency response is housed at the Broward County Emergency Operations Center (CEOC) in Plantation, Florida. The CEOC will be activated upon the direction of the Director of EMD with concurrence from the County Administrator. The CEOC may continue to be activated on a 24 hour a day basis throughout the emergency response period until such time a reduced working schedule is deemed appropriate, and the Demobilization Plan is completed. It is from this EOC that County emergency operations encompassing the Hallandale Beach area will be directed during and following the storm or event.

The County operates according to the following activation levels:

Level 1 – Full-scale Activation.

In a full-scale activation, the CEOC is completely activated on a 24-hour schedule due to an imminent threat or actual occurrence of a significant disaster. All Emergency Management Division staff, Incident Command System (ICS) components and all Emergency Support Functions (ESFs) are activated and required to report to the CEOC. Additionally, all logistical and finance/admin support elements are activated. At this level response, relief, and recovery operations are expected to last for an extended period of time. Additional support or back-up staff, including representatives from the FDEM and/or the FEMA, is notified and available to assist should the response escalate and exceed local capability.

Level 2 - Partial Activation.

Level II activation is a limited agency activation. EMD staff, required ICS components and appropriate ESF lead agencies with a role in the incident response are activated and required to report to the CEOC. All other ICS component members and ESFs are alerted of the event and are on standby. The purpose of Level II activation is to initiate preparations due to a significant threat of a disaster or to coordinate response due to the occurrence of a minor disaster. During Level II activation, the CEOC may be operational 24-hours per day or a lesser period of time. During Level II activation, EMD disseminates information to, and begins to coordinate preparation and response actions with, external agencies, municipalities, and Broward County departments tasked in emergency response.

Level 3 - Monitoring & Assessment.

Level III is typically a monitoring and assessment phase where a specific threat, unusual event, or situation, is actively monitored by EMD. A Level III activation is an internal process for EMD and involves little, if any, inter-agency direction or coordination. The threat, unusual event, or situation simply warrants observation, verification of appropriate action, and follow-up by EMD staff. Events or incidents that occur during Level III activation can generally be resolved in a brief period of time by using a very small number of resources.

Not Activated - Routine Monitoring.

EMD is constantly monitoring the entire County for threats, unusual events, and situations that may warrant further action or intervention. EMD has a 24-hour Duty Officer that monitors various information sources such as the Miami National Weather Service Office, National Hurricane Center (during hurricane season), Ft. Lauderdale Sun-Sentinel, local TV channels, traffic information (FHP/FDOT traffic websites) in order to maintain awareness of actual or potential events that may require EMD intervention.

City Emergency Operations

As a hurricane approaches, or some other foreseeable disaster threatens, the City of Hallandale Beach takes steps to weather the storm and to assist the community with recovery. During the hurricane season, departments are given updates on any threatening tropical storms in the Atlantic Ocean or the Gulf of Mexico. City workers go on alert when a hurricane or other potential disaster threatens Hallandale Beach. Before a storm impacts Hallandale Beach, the City will activate an Emergency Operations Center (EOC) located at Fire Station 7. It is from the EOC that City emergency operations will be directed during and following the storm.

Storm Tides and Evacuation

Some areas that would possibly be evacuated due to flooding by storm tides are:

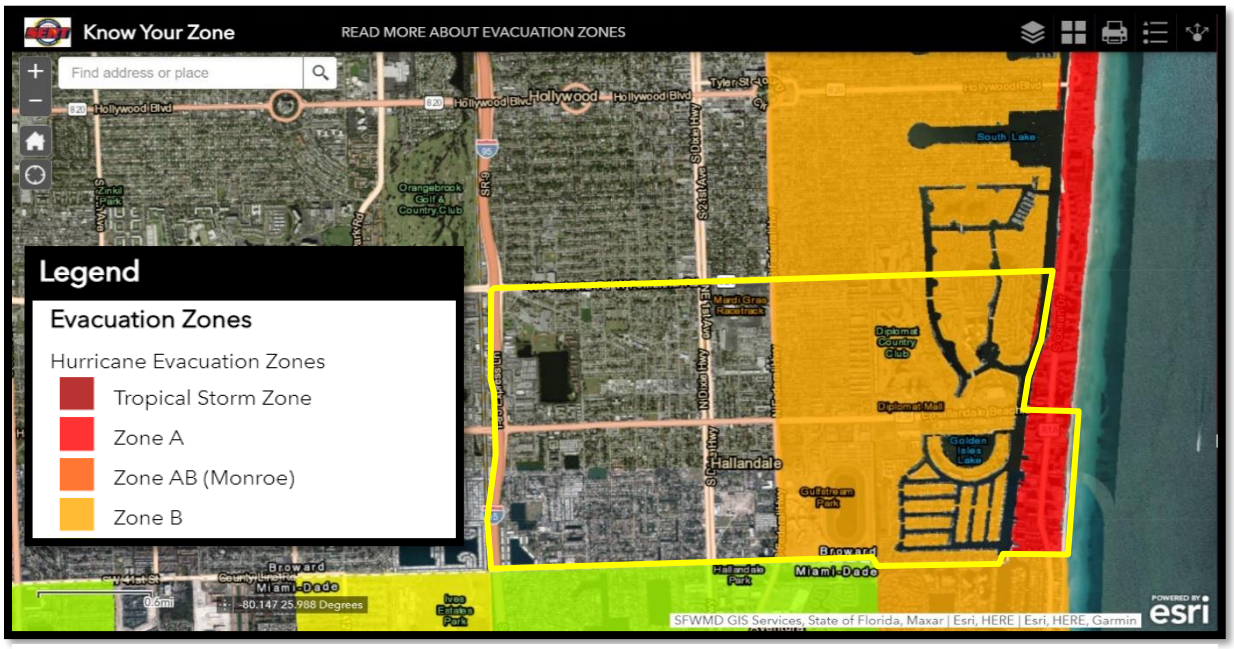
Stage 1: Minor Hurricane

- All coastal barrier islands.
- All mobile & manufactured homes anywhere in the city.
- All properties within one block of a coastal/tidal body of water.
- All areas prone to flooding.

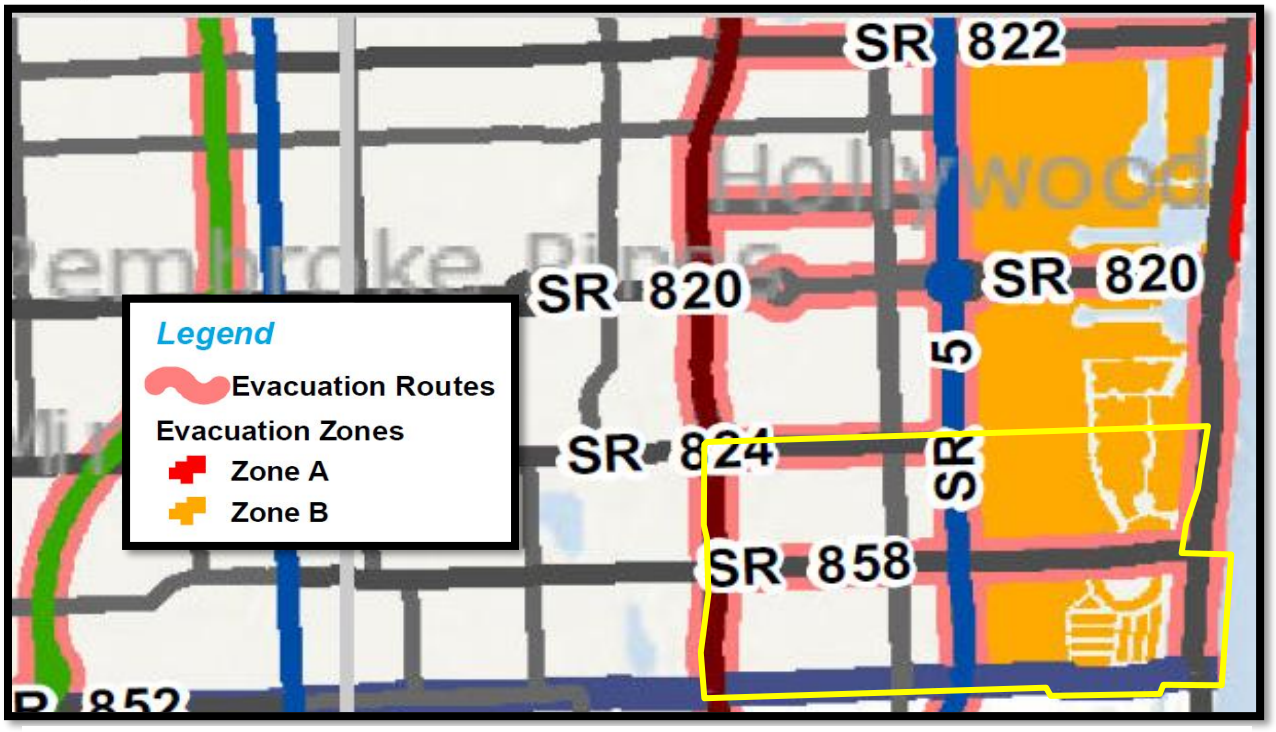
Stage 2: Major Hurricane

- All areas in Stage 1, plus all areas eastward of U.S. 1

Residents and visitors can enter their addresses into the interactive "Know Your Zone" tool at https://floridadisaster.maps.arcgis.com/apps/webappviewer/index.html?id=c788060028cb43809a25744ead39c0d6 or use the Broward County Evacuation Map at https://www.broward.org/Hurricane/pages/evacuationroutes.aspx to see if they are in an evacuation area. The maps are displayed below and detailed maps showing the evacuation zones and routes are included in Appendix J.



Hallandale Beach Evacuation Zones



Hallandale Beach Evacuation Routes

The City's Comprehensive Plan addresses evacuations as follows:

GOAL 2: The City of Hallandale Beach shall protect human health and safety in the coastal area.

> ***OBJECTIVE 2.1:*** *The City shall adopt the hurricane evacuation times developed by the South Florida Regional Planning Council listed in SFRPC's Regional Hurricane Evacuation Model Traffic Study. All Scenarios 4-8 Hours*
>
> > ***POLICY 2.1.1:*** *The City shall participate with Broward County in the development of evacuation plans and strategies to provide adequate public transportation for residents during evacuation, with particular emphasis towards senior citizens and handicapped residents.*
> >
> > ***POLICY 2.1.2:*** *The City shall request participation in the development of schedules for major construction and maintenance activities conducted by the State, County or Municipal transportation departments along primary evacuation routes. This is to avoid scheduling of major work during seasons of highest hurricane incidents which would hamper evacuation of the coastal area.*
> >
> > ***POLICY 2.1.3:*** *The City will assist in the development and implementation of local public information programs to annually advise residents of high risk areas of evacuation routes and evacuation schedules.*

POLICY 2.1.4: *The City shall participate in regular reviews and revisions to Broward County's adopted Emergency Preparedness Plan.*

POLICY 2.1.5: *The City shall provide data regarding City evacuation facilities to the County to be used in the County's evacuation efforts for South Broward and North Miami-Dade County areas.*

POLICY 2.1.6: *The City shall require that proposed developments, which would result in a concentration of elderly and/or handicapped residents, provide plans and methods of evacuation as part of their development planning.*

POLICY 2.1.7: *The City shall require that development within the coastal area not impede traffic flow along the primary evacuation routes.*

POLICY 2.1.8: *The City shall follow the recommendations included in the hazard mitigation annex of the local peacetime emergency plan and applicable existing interagency hazard mitigation reports to reduce the exposure of human life and public and private property to natural hazards.*

Persons living or working in these areas should be prepared to evacuate as soon as hurricane warnings are announced and seek shelter in hotels or motels west of the railroad tracks, in an American Red Cross shelter, or in a friend's or relative's home. Evacuation should be completed early to avoid gale-force winds and heavy rains that precede the storm's arrival. Broward County registers individuals who will need special help during evacuations because of medical conditions or disabilities. Those residents can receive information about how to pre-register at https://www.broward.org/AtRisk/Pages/SpecialNeeds.aspx or obtain an application by calling Broward County Emergency Management at 954-831-3902 (TTY 954-831-3940). At the direction of the County, the Red Cross will open local shelters. The City will also assist with any evacuations ordered by Broward County. The City has an EverBridge system to notify citizens of critical evacuation announcements.

The following information from City-Data (http://www.city-data.com/city/Hallandale-Beach-Florida.html) lists potentially vulnerable populations living in group quarters that may need assistance during evacuations (2010 data):

# of Residents	Facility Type
15	Residential Treatment (Adult)
62	Emergency/Transitional Shelters with beds for People Experiencing Homelessness
14	Adult Group Homes
10	Workers' Group Homes

Source: *City-Data (http://www.city-data.com/city/Hallandale-Beach-Florida.html) retrieved 2021*

Additionally, the Statewide Regional Evacuation Study lists the percentage of households having someone with a disability or medical condition requiring assistance in order to evacuate (by evacuation zone and housing) as follows:

Percentage of Florida households having someone with a disability or medical condition requiring assistance in order to evacuate (by evacuation zone and housing)

	Evacuation Zone						
Type of Housing	Cat 1	Cat 2	Cat 3	Cat 4-5	Coastal Non-Surge	Non-Coastal	All Zones
Site Built Homes	4.4%	6.3%	6.0%	6.1%	5.9%	6.5%	**5.6%**
Mobile Homes	8.7%	6.3%	13.9%	8.1%	8.1%	8.2%	**8.6%**
All Housing	5.0%	5.8%	7.4%	6.3%	6.3%	6.9%	**6.1%**

Source: Statewide Regional Evacuation Study, Volume 1-11, South Florida Region Technical Data Report, CHAPTER V 2015 Update, Retrieved in 2021 from https://sfregionalcouncil.org/portfolio-items/hurricane-evacuation-sresp/

Below is a breakdown of vulnerable Populations in each Broward County evacuation area:

Table VI-5 – Vulnerable Population in South Florida for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Broward County*					
Site-built Homes	50,715		100,357	45,901	91,994
Mobile/Manuf. Homes	30		1,055	827	3,008
TOTAL	50,745		101,413	46,728	95,002

Table VI-7 Vulnerable Population by Destination for 2020

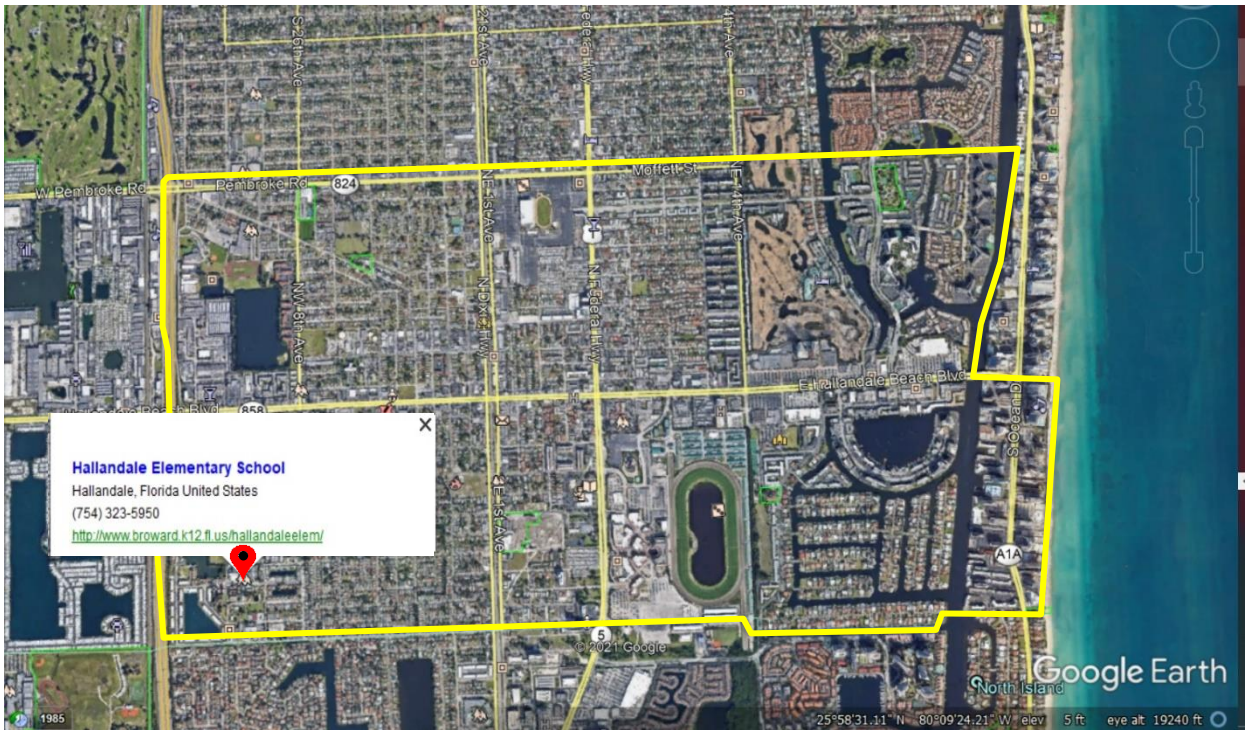
	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Broward County*					
To Friends and Family	38,056		75,954	34,963	70,951
To Hotel/ Motel	7,612		15,212	7,009	14,250
To Public Shelter	1,017		5,123	2,378	4,901
To Other Destination	4,060		5,123	2,378	4,901

Note: Vulnerable population determined using SRESP small area data and county-provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.
** For the purposes of this study, Broward County has a combined A/B zone and all of Monroe County is considered vulnerable.*

Source: *Statewide Regional Evacuation Study, Volume 1-10, South Florida Region Technical Data Report, CHAPTER VI 2015 Update, Retrieved in 2021 from https://sfregionalcouncil.org/portfolio-items/hurricane-evacuation-sresp/*

Radio and television broadcasts will announce the opening of shelters by the Red Cross for Hallandale Beach residents. Most Hallandale Beach residents who want to use public shelters are asked by Broward County to report to primary evacuation shelters in the County and should remember that space is limited to 20 ft² per person. Broward County is responsible for ordering evacuations. A hurricane evacuation typically is intended to remove residents from the most dangerous areas: the barrier islands, mobile homes, and low-lying areas. All other residents are encouraged to shelter in place if they live in a well-built structure outside of storm surge inundation areas, evacuate to a community that is not under storm warnings or shelter in place with family and friends who live in well-built structures outside of the storm surge inundation area.

Public shelters are provided for residents who are unable to find shelter elsewhere. When a primary shelter is full, newcomers will be directed to another facility that has been opened by the Red Cross to handle the overflow. According to the 2020 Statewide Emergency Shelter Plan shelter list for Broward County (retrieved 2021 from https://hallandalebeachfl.gov/DocumentCenter/View/21685/Broward-Shelter-List-2020pdf and included in Appendix J), county-wide there is an estimated general population demand of 28,299 shelter spaces. The 37,830 shelter spaces available at designated Broward County shelters would provide an excess of 39,531 spaces. The same report lists Gulf Stream Academy (formerly Hallandale Elementary School as seen on map below), as the only Emergency Shelter in Hallandale. Gulf Stream Academy has a maximal capacity of 1,697 spaces, with an expected utilization of 309 spaces. A map of all Broward County shelter locations can be found in Appendix J.



Hallandale Beach Emergency Shelter Location

In the *Hallandale Beach Comprehensive Plan, Coastal Management Element* shelter capacity is addressed as follows:

> ***GOAL 3: The City shall discourage or limit development in areas subject to destruction by natural disasters.***
>
> ***OBJECTIVE 3.1:*** *The City shall continue to monitor established limits on levels of service and areas of service for infrastructure systems to existing levels of service within the high hazard area. The City on an on-going basis shall continue to monitor coastal infrastructure to ensure that coastal infrastructure capacities are not expanded beyond existing capacities.*
>
> ***6.3.1.8 Measures to Maintain Evacuation Capability***
>
> *… As populations increase, improved or maintained evacuation capability will require provision of additional refuge facilities. The County should identify additional shelters for Hallandale Beach evacuees.*

The table below from the Statewide Regional Evacuation Study shows the estimated evacuation times for the county and region. These are only estimates provided to emphasize the importance of early preparedness. Residents and visitors should not wait until the last minute to make an evacuation decision.

Broward County Evacuation Clearance Times (in Hours)

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
2010 estimates					
Clearance time to shelter	**12.5**	**12.5**	**13.0**	**19.0**	**30.0**
In-County Clearance Time	**12.5**	**12.5**	**13.5**	**20.0**	**31.0**
Out of County Clearance Time	**26.0**	**27.5**	**32.0**	**32.0**	**39.5**
Regional Clearance Time	**26.0**	**27.5**	**32.0**	**32.0**	**39.5**
2015 estimates					
Clearance time to shelter	**12.5**	**12.5**	**13.0**	**21.0**	**45.0**
In-County Clearance Time	**12.5**	**12.5**	**13.0**	**21.0**	**45.0**
Out of County Clearance Time	**26.5**	**28.0**	**33.5**	**33.5**	**46.0**
Regional Clearance Time	**26.5**	**28.0**	**33.5**	**33.5**	**46.0**

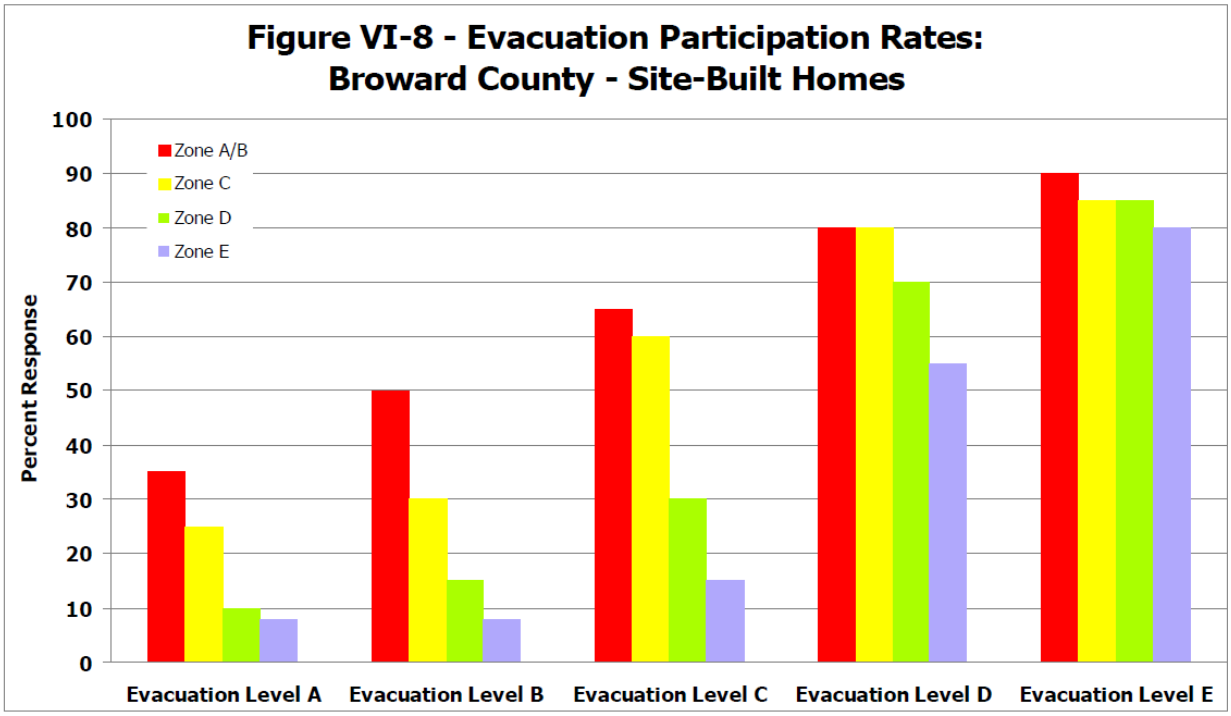
Source: *Statewide Regional Evacuation Study, Volume 4-11, South Florida Region Evacuation Transportation Analysis2015 Update, Retrieved in 2021 from https://sfregionalcouncil.org/wp-content/uploads/2019/08/Vol4-11.pdf*

Mutual Aid agreements are in place with Broward County and neighboring municipalities to ensure additional assistance as needed.

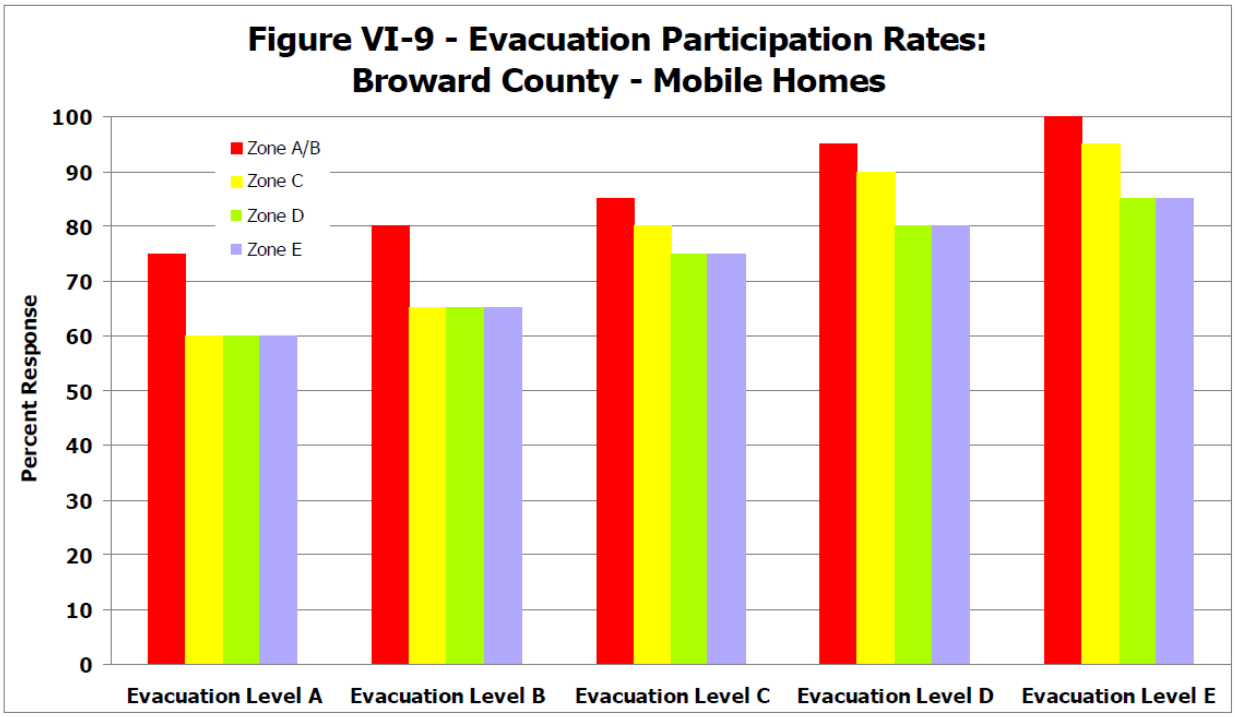
Florida experienced a record-breaking 11-year span between Wilma in 2005 and Hermine in 2016, during which time no hurricanes made landfall in the state. Due to this reduced hurricane frequency, the risk to the population may have been exacerbated by some complacency in the general populace, and an influx of hurricane naïve residents during this time period. However, the last few years have included some significant hurricane activity for the state including the following:

- A record-breaking 2020 Hurricane season that saw the formation of 30 named storms
- Category 5 Hurricane Michael in 2018, which made landfall in the Florida panhandle
- Hurricane Irma in 2017, which caused significant damage in the Florida Keys and disruption and damage throughout the entire state. Extensive urban evacuations were ordered for South Florida in anticipation of both Mathew and Irma, resulting in extreme state-wide traffic congestion, a shortage of hotel/ motel accommodations as far up the coast as South Carolina and in some cases region-wide gas shortages. With Mathew eventually veering offshore from its forecast path and Irma changing course from Florida's east coast to Florida's west coast, there may be a dangerous hesitancy among some to follow future evacuation orders.
- Hurricane Mathew in 2016, which skirted the East Coast

The following charts from the 2016 update of the *State-wide Regional Evacuation Study Program - Regional Transportation Analysis* show expected evacuation rates for Broward County residents in both site-built and mobile homes:



Source: *Statewide Regional Evacuation Study, Volume 1-10, South Florida Region Technical Data Report, CHAPTER VI 2015 Update, Retrieved in 2021 from https://sfregionalcouncil.org/portfolio-items/hurricane-evacuation-sresp/*



Source: *Statewide Regional Evacuation Study, Volume 1-10, South Florida Region Technical Data Report, CHAPTER VI 2015 Update, Retrieved in 2021 from https://sfregionalcouncil.org/portfolio-items/hurricane-evacuation-sresp/*

Evacuation Study Table VI-16 – Maximum Evacuating Population by Time Interval (County)					
	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Broward County 2020					
12-Hour	96,224	88,063	87,986	85,499	88,756
18-Hour	144,336	132,095	131,979	128,248	133,133
24-Hour	192,448	176,126	175,972	170,997	177,511
36-Hour	216,504	223,827	311,617	452,430	266,267
Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.					

Source: *Statewide Regional Evacuation Study, Volume 1-10, South Florida Region Technical Data Report, CHAPTER VI 2015 Update, Retrieved in 2021 from https://sfregionalcouncil.org/portfolio-items/hurricane-evacuation-sresp/*

By applying a standard multiple of 0.0204 to the County estimates (because according to 2018 population estimates the 39,847 residents of Hallandale Beach represent 2.04% of the 1,952,778 County residents) a general estimate of the maximum number of Hallandale Beach residents that may evacuate during the timeframes is included below:

Maximum Evacuating CITY Population by Time Interval (Calculated based on County data)					
	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Hallandale Beach **2020**					
12-Hour	1963	1797	1795	1745	1811
18-Hour	2945	2695	2693	2617	2717
24-Hour	3927	3594	3591	3489	3622
36-Hour	4418	4567	6359	9232	5433

As the City of Hallandale Beach is a community that is subject to sea level rise, future impacts may include higher storms surge, increased evacuation areas and increased evacuation time frames. In addition to planning based on historical flood risk, the expectation of a possible increase in risk due to sea level rise is being factored into the City's planning and preparation efforts.

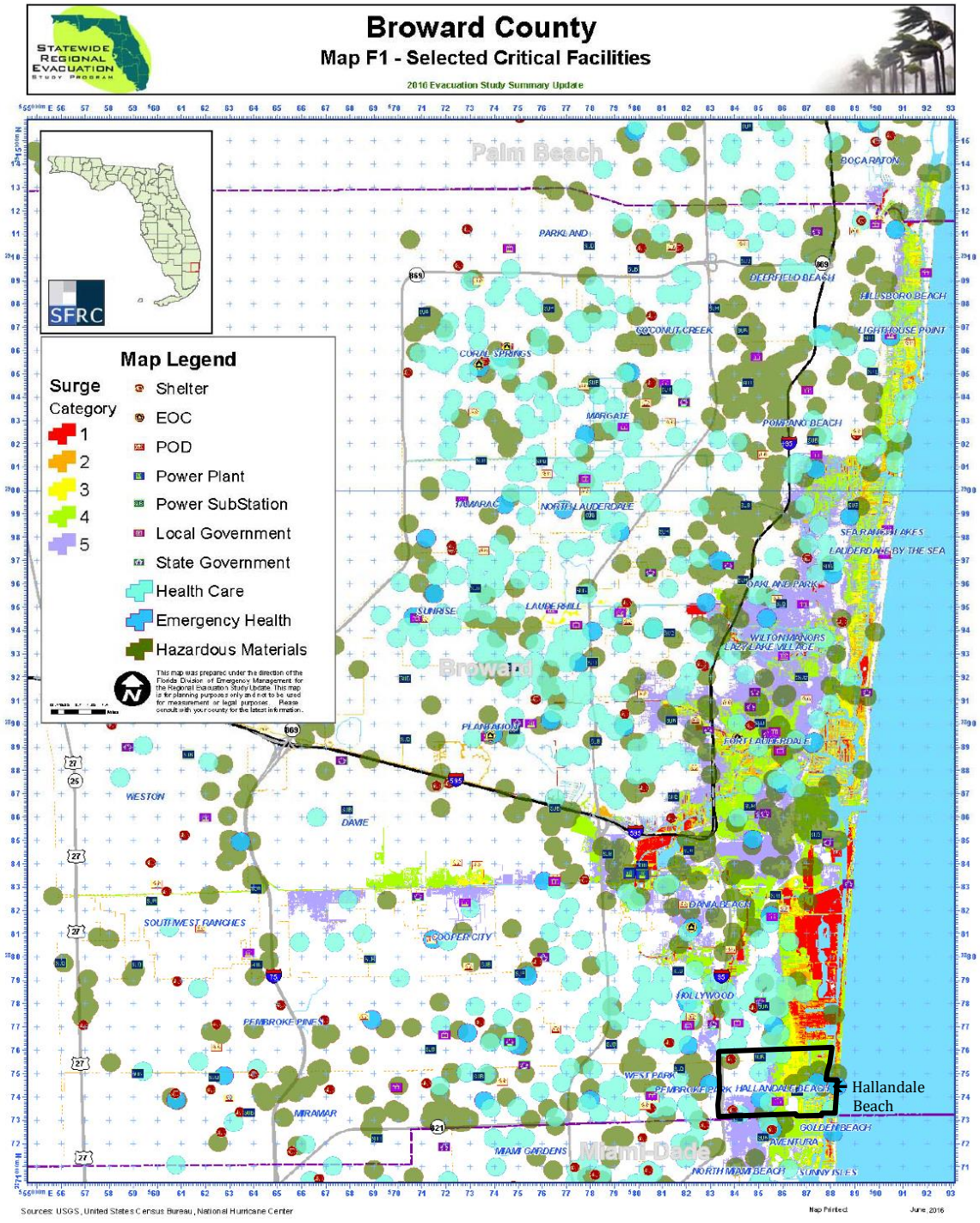
Impact on Critical Facilities

The City's comprehensive plan states that "The City shall discourage or limit development in areas subject to destruction by natural disasters." It also states, "As part of the City's Post-Disaster Plan, the City will develop a plan for the replacement of infrastructure in the Coastal high hazard Area (CHHA) that integrates additional innovative climate adaptation and mitigation to the extent financially feasible." and "the City shall begin retrofitting and/or relocating public facilities out of flood zones and the CHHA following damage or destruction from natural disasters, tidal flooding, and/or sea-level rise with the exception of water dependent uses such as beach access corridors." Additionally, the City plans to reduce the exposure of all critical facilities through hardening and relocation whenever feasible.

In the City of Hallandale Beach, a list of critical facilities is maintained. They are required by the State, County and the City to have an emergency plan in place. This is verified annually, and all contact information is updated annually.

Critical facilities include but are not limited to law enforcement and fire rescue facilities, schools, government facilities, utility facilities, hospitals and other critical medical facilities, shelters, adult living facilities, etc.

Appendix K (portion not released to the public), contains a list of Hallandale Beach's critical facilities. For security reasons and their sensitive nature, complete critical facility listings are excluded from publicly distributed copies of this Floodplain Management Plan and the *Broward County Enhanced Local Mitigation Strategy*. As required by the State, a list is maintained by the County's Division of Emergency Management (DEM) and made available to authorized personnel. A County map with approximate critical facility locations can be seen below:



Critical facilities in Hallandale Beach fall into two categories and include the following:

Buildings or locations that, if damaged could create secondary disasters, such as

- Gulf Stream Academy (Hallandale Elementary School)
- Hallandale High School
- Gulfstream Middle School
- Hallandale Adult Community Center
- Private Schools
- Hazardous Material sites. The City of Hallandale Beach maintains a list of buildings that have acquired a "Hazardous Material Permit".

Buildings or locations vital to the emergency response effort, such as

- Municipal Complex
- City of Hallandale Beach Public Works Compound
    - As the City's former EOC, the water treatment plant meets and exceeds current and future standards and requirements for water treatment and capacity and the building has been hardened to be able to withstand a Category 5 hurricane.
- Bell South Transfer Station
- Florida Power and Light substation
- Intracoastal Waterway Bridge
    - In the event of an emergency, Broward County will interface with the bridge tender to determine when the bridge will be opened or closed to vehicles and marine traffic. The bridge tender is notified to instruct EOC when bridge is locked in closed position.
- Three fire stations in the City
    - **Station 7 (also serves as City EOC)**
      111 Foster Road, Hallandale Beach, FL 33009
    - **Station 60**
      2801 E Hallandale Beach Blvd, Hallandale Beach, FL 33009
    - **Station 90**
      101 Three Islands Blvd, Hallandale Beach, Florida 3300

The Fire Station 7, which serves as the City's EOC is a 25,000 SF, three-story complex with an emergency operations center, four apparatus bays and living quarters for up to 16 firefighters. This station hosts both on-duty fire rescue staff and the Fire Prevention Bureau, including office space for fire inspectors, plans review and public education. The new EOC complex serves as fire rescue administrative headquarters, as well as the City's main emergency operations center. The building, built in 2017, is hardened to withstand a Category 5 Hurricane. The fire station is located outside the SFHA and storm surge zones.

It is the responsibility of the City of Hallandale Beach, working together with Broward County, to annually update a critical facilities phone list and review any flood response plans of privately-owned critical facilities. It is required by the State, County and the City that all assisted living facilities have an emergency plan in place. This is verified annually, and the required contact information is updated.

Without listing all of the facilities individually (for security reasons), the publicly available version of Appendix K contains the best estimate of the 2021 value of all critical facilities in Hallandale Beach. Of those, the value of flood exposed critical facilities (located in zones AE and VE) is also estimated.

Impact on Infrastructure

Flooding can produce a widespread direct and indirect danger to large segments of the community as a result of the loss or incapacity of such critical infrastructure elements as roads, Florida Turnpike, I-95, bridges, rail beds, stormwater drainage systems, potable water and wastewater treatment and collection systems and private infrastructure, such as utilities and power companies. The Public Works Department of the City of Hallandale Beach works diligently to maintain and improve the public infrastructure in the City and has procedures in place in the event of a flood emergency.

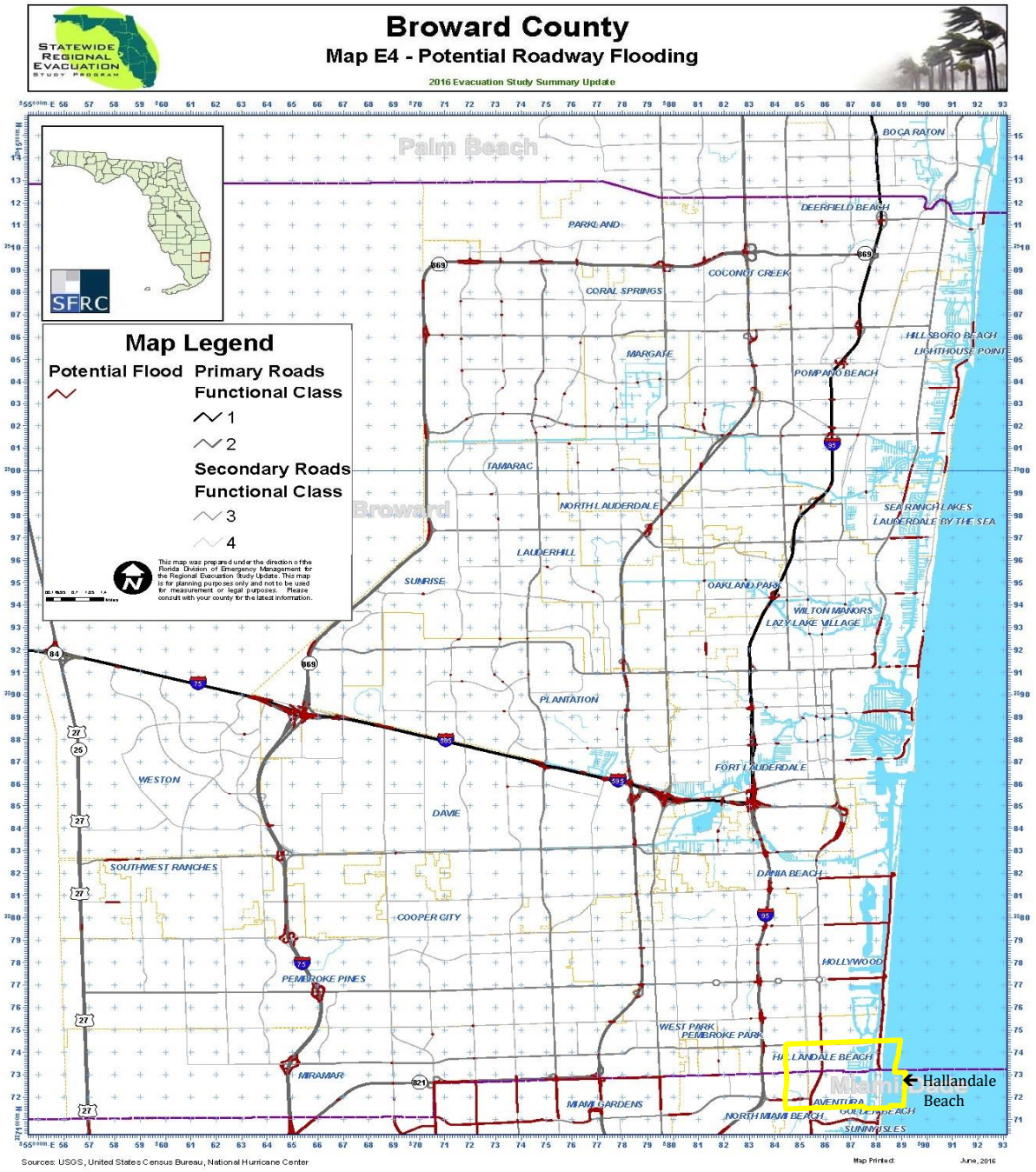
Infrastructure Assessment

Infrastructure	Risk Level	Assessment
Roads	Moderate	Area Specific Risk, Evacuation Routes and main roads are susceptible to substantial flooding. Many smaller roads may be affected by mild flooding.
Highways	Low	Elevated
Bridges	Low	Elevated, but approaches may be compromised
Rail beds	Low	Elevated
Stormwater Drainage Systems	Moderate Short Term	Reduced performance during floods but should not result in long term damage
Potable Water	Moderate Short Term	Saltwater Intrusion is likely during coastal flooding
Wastewater Treatment & Collection Systems	Moderate Short Term	Water Treatment Facility is hardened for a Cat 5 Hurricane. Floodwater may enter and temporarily overwhelm wastewater system but should not result in long term damage
Private Utilities & Power Companies	Low	Two FP&L Substations are located in Hallandale Beach, one of which is in an AE Flood Zone and Cat 5 storm surge area. Although one substation is located in a flood hazard area, exposure to flood water should not result in long term damage

Impact on Railroads, Roadways & Bridges

The eastern railroads in Southeast Florida were built on the coastal ridge with elevated beds. Because of this, most of the rails are not vulnerable to typical flooding in the City.

Below is a map of Broward County in the Statewide Evacuation Study showing roads at risk of flooding:



During mild to moderate flooding, because the main high traffic roads are elevated above surrounding grade, the local moderate speed or low volume roads and parking areas are more likely to be affected by flooding. Unfortunately, during substantial flood events, even the main evacuation routes in Hallandale Beach are considered to be at risk of being inundated. These include:

- A1A heading north along the coast,
- US 1 heading north (located inland between the Intracoastal and I-95),
- Hallandale Beach Blvd. from US1 eastward to the coastline,
- I-95 entrance ramps

Bridges are also important elements of infrastructure that can be affected by flooding. For barrier island communities in Hallandale Beach, evacuation routes are served by a bridge which provides access across the Intracoastal Waterway. This bridge that connects residents from coastal areas to the mainland may be of concern for residents trying to move inland during an evacuation as the approach to the bridge may be of concern during flooding events. However, the evacuation routes heading *out* of Hallandale Beach do not include any such high-profile bridges. The evacuation routes leaving Hallandale Beach include only small bridges that cross canals. These small crossings are not expected to sustain significant damage during a storm.

Impacts of Saltwater Intrusion

Saltwater intrusion can put public water utilities at risk following coastal flooding. The impacts would not be immediately evidenced but could impact water supply in the long term. The risk of saltwater intrusion is expected to increase as sea levels rise. The saltwater interface separates the saltwater from the freshwater of the Biscayne Aquifer, which provides potable water to about 6.7 million residents in South Florida.

A Sun Sentinel article written by And Reid in 2011, titled *South Florida Drinking Water Faces Saltwater Threat,* describes the problem of saltwater intrusion in South Florida:

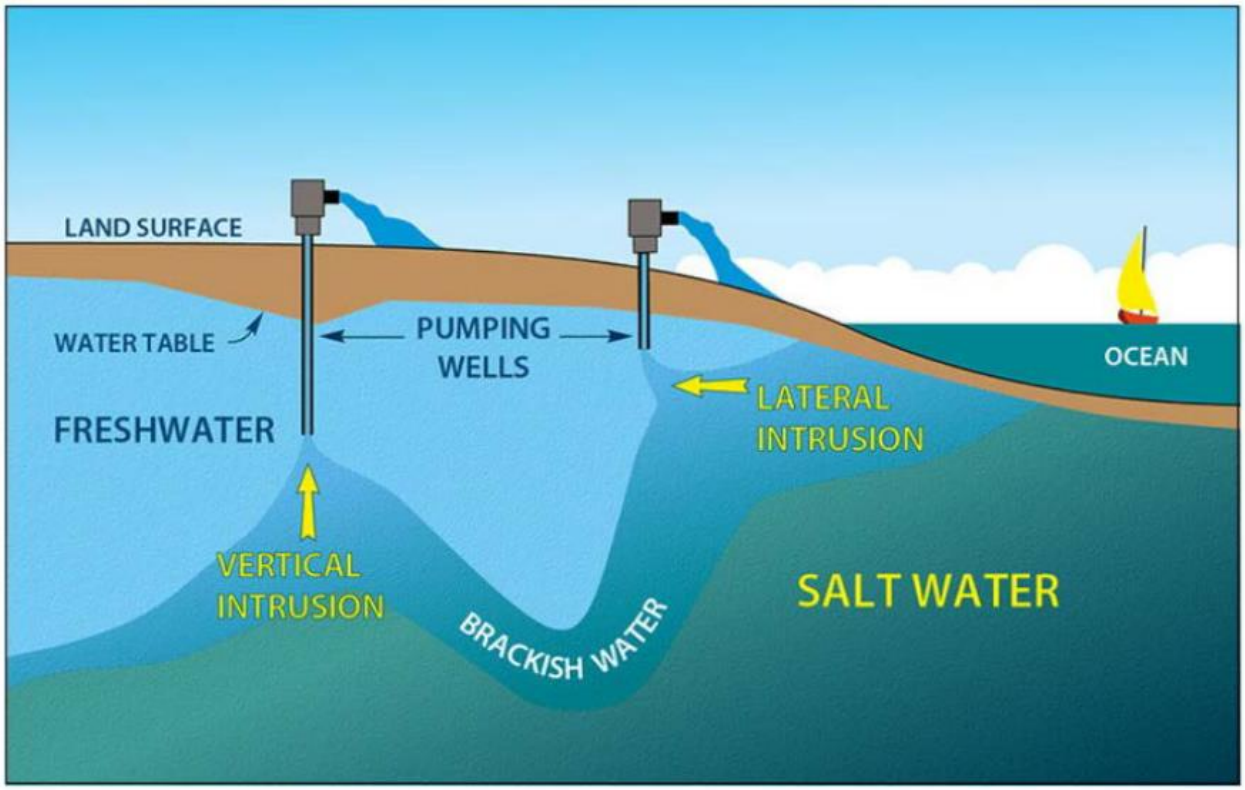
> *Saltwater seeping in from the ocean keeps spreading farther west, threatening to foul underground freshwater supplies that provide most of South Florida's drinking water. "Saltwater intrusion" in South Florida has worsened through the decades as providing water and flood control for a growing population siphons away freshwater and allows more saltwater to seep into aquifers and well fields. Ninety percent of South Florida gets its drinking water from underground supplies, most from the Biscayne aquifer. Pumping too much water from underground supplies can allow saltwater to push in from the coast.*
>
> *"It [saltwater intrusion] is still progressing westward," Hector Castro, Hallandale Beach public works and utilities director, said. "Eventually all coastal communities will deal with this in some way, shape or form." Hallandale Beach, Pompano Beach, Dania Beach, Lantana and Lake Worth are among local cities that in recent years have been most at risk from saltwater intrusion.*

The article goes on to further describe the challenges faced by Hallandale Beach:

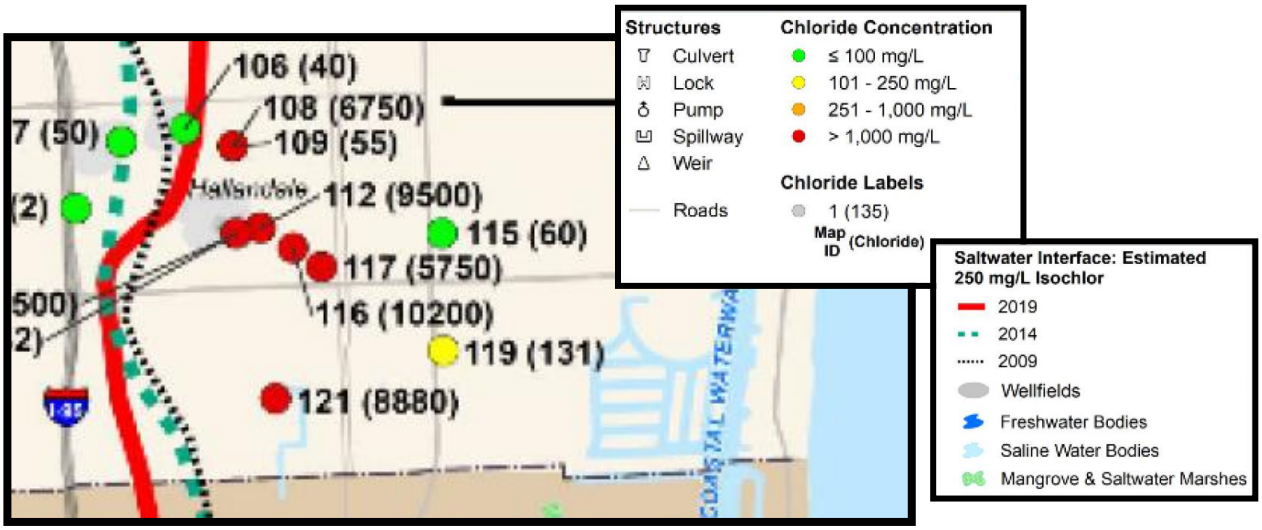
> *Six of the eight wells that Hallandale Beach relies on have been closed through the years due to saltwater intrusion. That's because 85 percent of the city is within the area where*

saltwater has seeped in, Castro said. As a result, the city pays to get half of its water from Broward County's western well fields.

The image below from *Saltwater Interface Monitoring and Mapping Program Technical Publication WS-58 (December 2020)* illustrates how saltwater intrusion affects drinking water wells:



The map below from the same technical report shows the location of Hallandale Beach wells in relation to the 2019 saltwater interface (red line) as determined using USGS data:



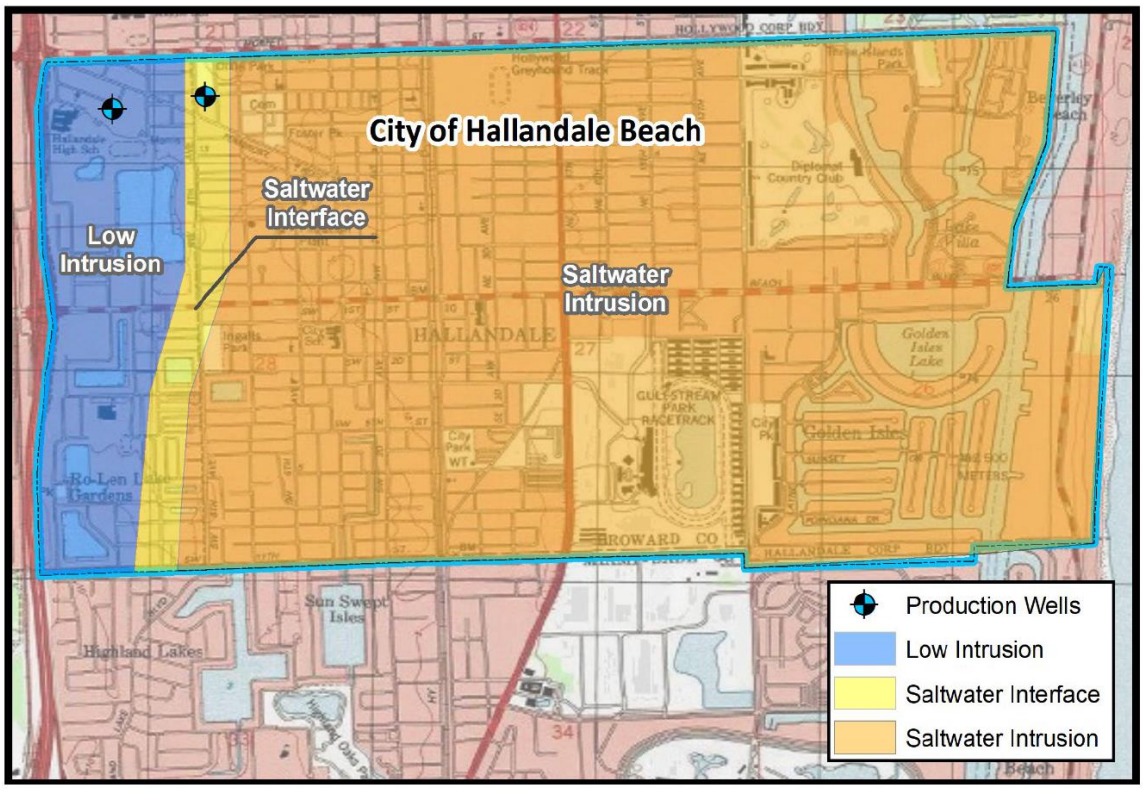
As stated in the City's 2020 Vulnerability Assessment and Adaptation plan:

The City's wellfield is located in the northwest quadrant, within City limits. Groundwater is sourced from three wells approximately 100 feet deep. The City also sources water from Broward County's South Regional Well Field, located in Brian Piccolo Park in southwestern Broward County. The City has a purchase agreement with the City of North Miami Beach to purchase water during emergencies. The two cities have interconnected water mains.

The South Florida Water Management District (SFWMD) permits the City of Hallandale Beach to withdraw water from the Biscayne aquifer to supply its public water system. The City's Water Use Permit (WUP) is No. 06-00138-W. One of the conditions of the City's WUP requires the City to cease pumping if chloride concentrations exceed 150 mg/l in production wells and notify the SFWMD.

Excessive withdrawal of the groundwater resource to serve the City's water system could increase the rate at which the saltwater interface migrates westward. The SFWMD originally limited the City's wellfield pumping rate to 3.5 million gallons per day (MGD). Since 2007, SFWMD has limited capacity to 3.0 million gallons per day. The City is able to source another 6.2 MGD through an agreement with Broward County.

[The figure below] shows the location of the saltwater interface near the City's remaining production wells. By 2012, groundwater had become salty in about 83% of the City's area. The saltwater interface made up 4% of the City's area, and the area of lowest saltwater intrusion, located west of 8th Avenue, was about 12% of the City.



Impact on the Economy

Business interruptions and failures stemming from disaster events deal a severe blow to local economies in terms of lost productivity and employment. Research from a variety of sources, including the US Department of Labor Statistics, consistently reports that 50% to 70% of businesses either never reopen after a major disaster or fail after reopening. Small businesses are represented disproportionately higher among the business casualties. In Broward County, approximately 96.9% of businesses have fewer than 500 employees.

Because Broward and Miami-Dade Counties include a dense concentration of municipalities, where customers and employees often cross from one town or city to another on a daily basis while infrastructure such as roads and public transportation span many municipalities without discernable distinction, businesses in the County are more inclined to see their problems as cutting across jurisdictional boundaries. Local businesses know their customers and employees often reside in neighboring cities and towns and may be impacted by regional flooding.

According to Hallandale Beach's *FY 2020-21 Adopted Budget* the top ten taxpayers and top nine employers in the City are listed below:

Principal Taxpayers/taxable value

1. Gulfstream Park Racing/$232M
2. Hallandale Land Ventures LLLP/$70M
3. 17070 Collins Ave. Shopping Ctr. /$52.9M
4. Florida Power & Light Co. /$48.5M
5. Three Islands Assoc. Residential /$42.9M
6. 831 Federal Hwy Acquisition LLC/$28M
7. Maltese Diplomat Owner LLC/$25.4
8. Hallandale Group Limited Partnership /$24.5M
9. 2500 Hallandale Beach LLC /$20.2M
10. Romagnole Investment Properties LLC/$18.4M

Principal Employers/Number of Employees

1. Gulfstream Park / 826
2. City of Hallandale Beach / 545
3. Wal-Mart Stores, Inc. / 427
4. The Big Easy Casino / 375
5. School Board of Broward County / 280
6. Publix Supermarket / 208
7. Winn Dixie Supermarkets / 168
8. Burlington Coat Factory / 121
9. US Post Office / 104

These businesses may have multiple locations and may not be physically located in a Special Flood Hazard Area, but their operations may still be adversely affected by regional flooding. Even if the business remains undamaged, its operations may be adversely affected if a large number of its employees or customers experience flood damage to their homes. Alternately, employees or customers, even ones that live outside the flood hazard area, may be affected if their places of employment, commerce or critical services are affected by flooding.

City Data (http://www.city-data.com/business/econ-Hallandale-Beach-Florida.html) lists the most common industries in Hallandale Beach as follows:

Percentage of Establishments:

1. Retail (15%)
2. Health (14%)
3. Professional (13%)
4. Wholesale (12%)

Percentage of Employees

1. Retail (22%)
2. Accommodation (20%)
3. Administration (11%)
4. Manufacturing (7%), Arts (7%), Health (7%)

Not only may current industry be affected by flooding, but industries that are being recruited to locate in the City and County may also be impacted. The eight industries identified below are targeted by the Broward County and the Greater Fort Lauderdale [Economic Development] Alliance. These industries are encouraged to relocate entirely to or open a facility in Broward County; or if presently located in Broward County, to remain and expand in order to create jobs and to strengthen and diversify the local economy:

- ✓ Aviation/ Aerospace
- ✓ Financial Services
- ✓ Global Logistics
- ✓ Business & Corporate Headquarters
- ✓ Life Sciences
- ✓ Manufacturing
- ✓ Marine Industries
- ✓ Technology

As seen in the table below from the *City of Hallandale Beach Vulnerability and Adaptation Plan (2020)*, 96% of commercial property value, 96% of commercial sales, and 7,033 employees are located in the Special Flood Hazard Area. Additionally, 70% of the commercial properties and 66% of commercial sales are at risk due to storm surge, along with the 5,180 employees tasked with generating those sales. The City-owned facilities at risk in the bottom half of the table are also worth noting as the City is the second largest employer in Hallandale Beach.

Asset Type	Vulnerability/ Loss Metric	Total Citywide Assets	FEMA Flood Zones (floodplain inundation)	Storm Surge	Sea Level Rise (short-term)	Sea Level Rise (mid/long-term)	Tidal Flooding (current)
Commercial	No. of Properties	585	474 (81%)	273 (47%)	12 (2%)	128 (22%)	5 (1%)
	Total property value	$1.63B	$1.57B (96%)	$1.14B (70%)	$486M (30%)	$1.24B (76%)	$160M (10%)
	Annual Sales Volume	1,420M	1,363M (96%)	933M (66%)	92M (6%)	540M (38%)	50M (4%)
	Employees	7,868	7,033	5,180	472	3,180	186
City-Owned Facilities	No. of Properties	68	21 (31%)	14 (21%)	0	11 (16%)	0
	Total property value	$102M	$78M (77%)	$57M (56%)	0	$48M (48%)	0

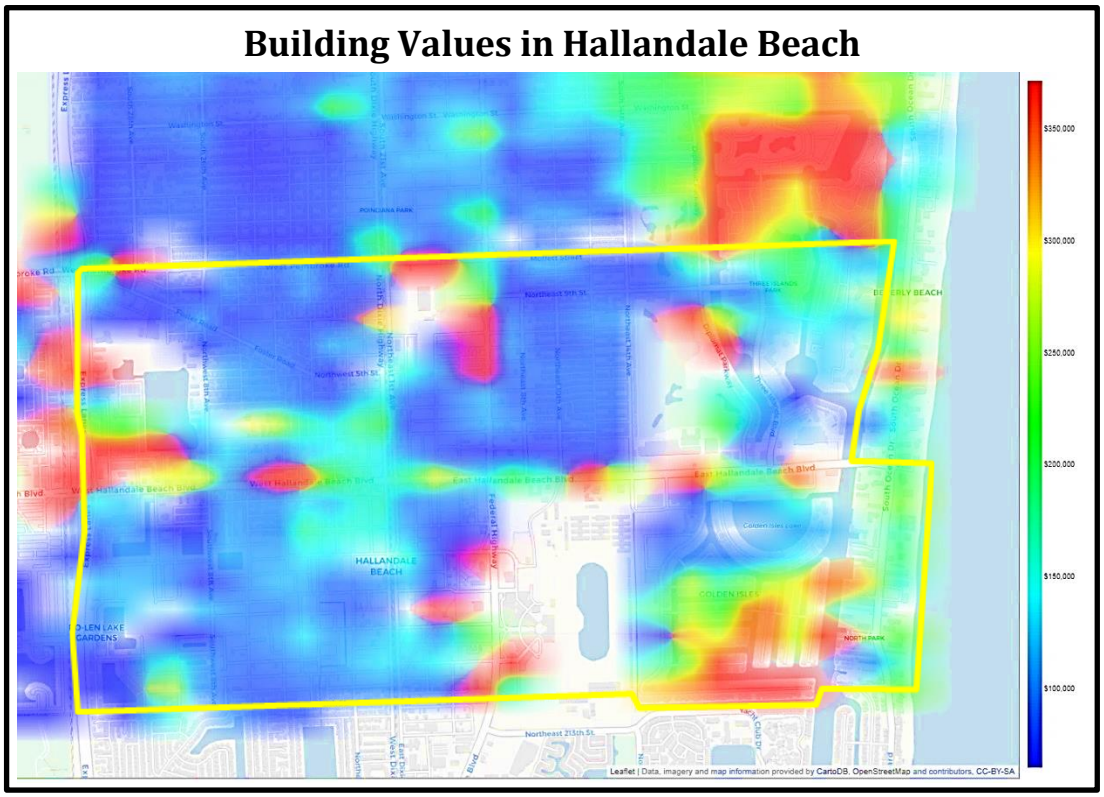
Hurricanes and flooding can affect more than just employment. According to the *Impact of Hurricanes on Housing and Economic Activity: A Case Study for Florida, 2006* produced by the NATIONAL ASSOCIATION OF REALTORS®, the housing industry took an average of three to four months to return to normal levels of growth in areas affected by Hurricane Andrew and the Hurricanes of 2004 and 2005.

In some areas the housing industry remained depressed for much longer periods of time due to several factors, including potential buyers being deterred by the perceived risk and the rapid escalation of insurance rates that resulted from the storms.

Potential developers and homebuyers may have second thoughts about buying in the community after learning of or seeing the typical types of nuisance flooding or the potential of sea level rise that can affect a business's traffic or access to a home. Local realtors have stated that, after seeing flooded streets in front of a house, potential buyers have decided they were not going to buy a particular house, regardless of the updated kitchen or spacious backyard.

In South Florida communities, the greater property values reflected in the financial impacts of flooding are typically the expensive irregular residential properties proximate to the water. These coastal residential properties are generally waterfront with ocean or Intracoastal access and therefore have high taxable value. Additionally, the roads that access these residential areas may be lower than the finished floor elevation of the homes and therefore subject to inundation prior to impacts to the homes.

As seen in the graphic below from City-Data.com, although there are some high value homes along the Intracoastal Waterway and adjoining canals, many of the high value properties in Hallandale Beach are located inland along major roadways and in golf course and country club communities. They are therefore buffered from the effects of coastal flooding that originates in the ocean, such as storm surges and King tides. Unfortunately, of the high value properties identified on the image below, many of them are located within the SFHA, and are therefore vulnerable to the rainfall and freshwater flooding that is more common inland.

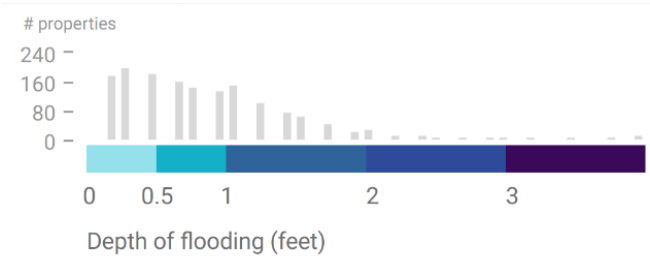


Buildings Subject to Flooding

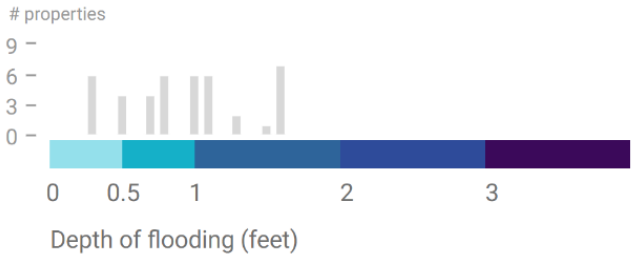
Because the National Flood Insurance Program insures buildings, the impact of flooding on buildings is a prime concern of the Community Rating System. A count of the number of buildings affected by each type of flooding informs planners of the magnitude of the problem. The building count should be done by use or type of building, if possible, because flooding affects different types of buildings in different ways. For example, a commercial or industrial building is likely to suffer more financial damage than a residential house. A commercial or industrial building is also likely to have a greater impact on the community if it is required to close as a result of flooding or flood damage.

Building counts from historic events can serve as a basis for assessing current and future risk. FloodFactor.com calculated the number of properties impacted by two recent storms, Hurricane Wilma and Hurricane Irma, using First Street Foundation's modeled recreation of each storm surge. The results can be seen below:

Hurricane Wilma's storm surge in October 2005



Hurricane Irma's storm surge in September 2017



# of Hallandale Beach Properties Impacted by Storm Surge (historic)

Flood Depth (feet)	0' - 0.5'	0.6' - 1.0'	1.1' - 1.5'	1.6' - 2.0'	2.1' - 2.5'	2.6' - 3.0'	3.4' - 3.5'	3.6' +	Total:
Hurricane Wilma's storm surge in October, 2005	570	450	338	145	63	19	11	17	1613
Hurricane Irma's storm surge in September, 2017	10	16	9	7	0	0	0	0	42

Source: *Retrieved in 2021 from https://floodfactor.com/city/hallandale-beach-florida/1228452_fsid*

Number, Types, Age & Value of Buildings

The following 2021 Data from the Broward County Property Appraiser Summarizes the types, age and values of properties within Hallandale Beach. Unfortunately, the property appraiser database does not contain any parcel level data about building materials such as concrete block or wood frame.

	# of parcels	# of buildings	Total Building Value	Average Building Value	# of Vacant Parcels	Average Year Built
Residential	23677	23431	$ 5,090,917,110	$ 217,273	250	1975
Commercial	916	808	$ 585,461,880	$ 724,582	120	1991
Industrial	185	193	$ 116,950,750	$ 605,962	4	1970
Agriculture	6	3	$ 7,768,550	$ 2,589,517	3	1970
Institutional	60	80	$ 80,879,710	$ 1,010,996	6	1970
Government	82	42	$ 87,616,040	$ 2,086,096	57	1989
Utilities	5	15	$ 3,122,550	$ 208,170	0	1967
Total	**24931**	**24572**	**$ 5,972,716,590.00**	**$ 7,442,595.92**	**440**	

Source: Retrieved in 2021 from Broward County Property Appraiser Database

The following table (from https://data.census.gov/) contains slightly different 2019 residential housing numbers for Hallandale Beach, which are further broken down by useful subcategories:

	Estimate	Percentage
HOUSING OCCUPANCY		
Total housing units	27977	100
Occupied housing units	17573	62.8
Vacant housing units	10404	37.2
Homeowner vacancy rate	3.1	(X)
Rental vacancy rate	8.5	(X)
UNITS IN STRUCTURE		
1-unit, detached	2782	9.9
1-unit, attached	731	2.6
2 units	1637	5.9
3 or 4 units	800	2.9
5 to 9 units	966	3.5
10 to 19 units	1274	4.6
20 or more units	19013	68
Mobile home	774	2.8
HOUSING TENURE		
Occupied housing units	17573	100
Owner-occupied	8944	50.9
Renter-occupied	8629	49.1
Boat, RV, van, etc.	0	0

	Estimate	Percentage
YEAR STRUCTURE BUILT		
Built 2014 or later	152	0.5
Built 2010 to 2013	314	1.1
Built 2000 to 2009	2782	9.9
Built 1990 to 1999	1015	3.6
Built 1980 to 1989	3423	12.2
Built 1970 to 1979	11835	42.3
Built 1960 to 1969	5462	19.5
Built 1950 to 1959	2638	9.4
Built 1940 to 1949	286	1
Built 1939 or earlier	70	0.3
ROOMS		
1 room	857	3.1
2 rooms	2646	9.5
3 rooms	9277	33.2
4 rooms	10018	35.8
5 rooms	3225	11.5
6 rooms	1232	4.4
7 rooms	514	1.8
8 rooms	69	0.2
9 rooms or more	139	0.5
Median rooms	3.6	(X)
BEDROOMS		
No bedroom	943	3.4
1 bedroom	10536	37.7
2 bedrooms	12725	45.5
3 bedrooms	3213	11.5
4 bedrooms	473	1.7
5 or more bedrooms	87	0.3
VALUE		
Owner-occupied units	8944	100
Less than $50,000	373	4.2
$50,000 to $99,999	725	8.1
$100,000 to $149,999	1487	16.6
$150,000 to $199,999	1527	17.1
$200,000 to $299,999	1989	22.2
$300,000 to $499,999	1954	21.8
$500,000 to $999,999	607	6.8
$1,000,000 or more	282	3.2
Median (dollars)	215600	(X)

Dollar Value of Buildings at Risk from Various Hazards

One of the useful publicly available data sources for building values at risk from flood hazards is the Nation Risk Index (NRI). FEMA recently instituted the NRI database to provide census tract level risk assessment data to all communities. An introduction to the NRI and an explanation of NRI methodology is discussed in more detail at the beginning of the *Assess the Hazard* section.

In addition to other non-flood related hazards, the NRI assess risk for "Coastal Flooding", "Riverine Flooding", "Hurricane" and "Tsunami". Although included in the NRI, tsunami risk is not discussed below. The NRI lists tsunami risk to Hallandale Beach as "N/A" meaning it is either too small to quantify, not applicable and/or without enough historical data to assess.

For ease of reading, the NRI data for Hallandale Beach has been aggregated and summarize in the tables below. The values listed for Hallandale Beach are a result of data that has been averaged (or, if more appropriate, totaled) across all Hallandale Beach census tracts. Tables providing more detailed assessment data for each individual census tract can be found in Appendix B.

Below is a summary of the 2020 NRI data quantifying Hallandale Beach's exposure to the following three hazards:

Building & Population Exposure

Hallandale Beach NRI Risk Data for all census tracts	Riverine Flooding (freshwater)	Coastal Flooding (ocean water)	Hurricane
Building Value Exposed ($ Billions)	$ 3.79	$ 4.08	$ 4.63
Population Exposed	30,622	32,415	37,770
Dollar Value of exposed Population ($ Billions)	$ 226.61	$ 239.87	$ 279.50
Total Exposure ($ Billions)	$ 230.39	$ 243.96	$ 284.12

As can be seen in the table above, 3-5 billion dollars' worth of Hallandale Beach buildings are currently exposed to flooding from each of the three flooding sources assessed. But not every exposed building will flood in every year. Based on historic flood losses, the NRI calculates how many of the exposed buildings and people are expected to be lost in any given year. The table on the following page quantifies these expected annual losses. Fortunately, flood deaths are rare in Hallandale Beach, and accordingly, the data indicates that no losses of life are expected from any flooding source in any given year. Unfortunately, the data indicates that although only $411 dollars' worth of building loss are expected each year due to coastal flooding, almost $400,000 in losses are expected each year from freshwater flooding and over $1,000,000 in losses are expected each year from hurricanes.

Building & Population Expected Annual Loss

Hallandale Beach NRI Risk Data for all census tracts	Riverine Flooding (freshwater)	Coastal Flooding (ocean water)	Hurricane
Number of Historical Events	N/A	N/A	25 - 26
Annualized Frequency (average number of events per year)	1.2	1.7	0.3
Expected Annual **Building Value** Loss ($ Dollars)	$ 391,116	$ 411	$ 1,391,852
Expected Annual Population Loss	0.0014	0.0136	0.0028
Dollar Value of Expected Annual Population Loss ($ Dollars)	$ 10,503	$ 100,329	$ 20,957
Total	**$ 401,638.16**	**$ 100,739.67**	**$ 1,412,808.72**
Rating (range across all census tracts)	Very Low - Relatively High	Very Low - Relatively Moderate	Relatively Moderate - Relatively High

The table below from the *City of Hallandale Beach Vulnerability and Adaptation Plan (2020)*, calculates City-owned and commercial properties at risk during a 100-year and 500-year flood event:

Asset Type	100-year flood			500-year flood event		
	No. of Properties	Potential Total Loss (Building Value)	Potential Annualized Loss (Building Value)	No. of Properties	Potential Total Loss (Building Value)	Potential Annualized Loss (Building Value)
Commercial	215	$1356.2M	$135.6M	474	$1574.6M	$31.5M
City-owned	12	$33.3M	$3.3M	19	$61.1M	$1.2M

Buildings in the Special Flood Hazard Area

The following table (and map in Appendix S) contains a breakdown of buildings within the City's different Flood Zones. It is worth noting that there are far fewer buildings than flood insurance policies, as many buildings in Hallandale Beach are multi-unit condominiums or multi-unit commercial buildings.

Buildings & Flood Insurance Policies by Flood Zone

Flood Zone	AE	AH	VE	Outside SFHA	TOTAL
# of Policies	16,016	795	7	292	**17,110**
# of Buildings	1,402	943	9	3,508	**5,862**
% of all buildings	23.92%	16.09%	0.15%	59.84%	**100%**

Source: 2016 data from Hallandale Beach GIS Department & 2021 CRS "What If" Statement for Hallandale Beach

City-owned Buildings in the Special Flood Hazard Area

As seen in the table below from the *City of Hallandale Beach Vulnerability and Adaptation Plan (2020)*, 31% of City properties, representing 77% of City property values, are located in the Special Flood Hazard Area. Additionally, 21% of the City properties, representing 56% of City property values are at risk due to storm surge. Currently there are no City facilities at risk due to tidal flooding, and City facilities are not expected to be directly affected by Sea Level Rise until 2060. An inventory of City owned properties can be found in Appendix K.

Flood Hazard	Time Horizon
FEMA Flood Zones (floodplain inundation)	Current
Storm Surge	Current
Sea Level Rise (short-term)	2040-2050s
Sea Level Rise (mid/long-term)	2060-2070s
Tidal Flooding	Current

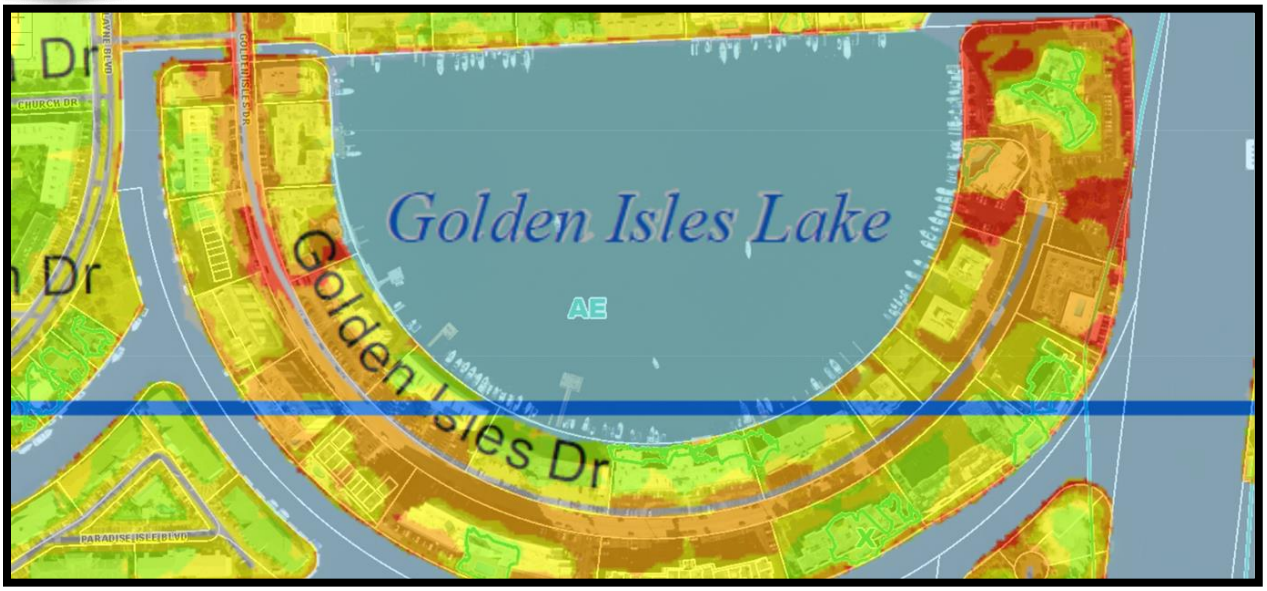
Asset Type	Vulnerability/ Loss Metric	Total Citywide Assets	FEMA Flood Zones (floodplain inundation)	Storm Surge	Sea Level Rise (short-term)	Sea Level Rise (mid/long-term)	Tidal Flooding (current)
City-Owned Facilities	No. of Properties	68	21 (31%)	14 (21%)	0	11 (16%)	0
	Total property value	$102M	$78M (77%)	$57M (56%)	0	$48M (48%)	0

Buildings in the Coastal High Hazard Area

The City of Hallandale Beach Comprehensive Plan, Policy 2.2.2 states "The Coastal High-Hazard Area (CHHA) is defined by Chapter 163.3178(2)(h) F.S. as the area below the elevation of the category 1 storm surge line as established by Sea, Lake, and Overland Surges from Hurricanes (SLOSH) computerized storm surge model."

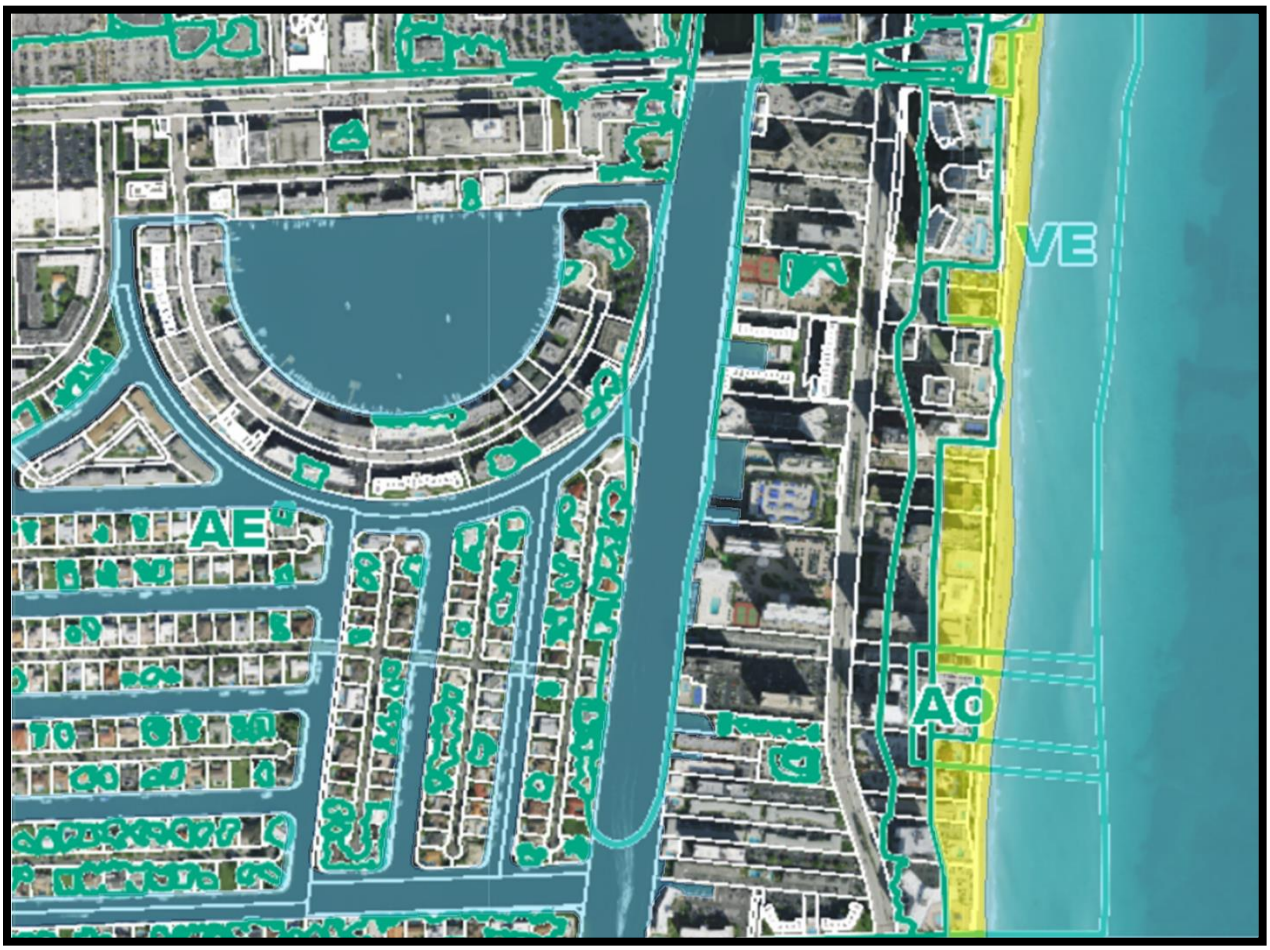
According to this definition, some waterfront properties in the Golden Isles neighborhood of Hallandale Beach have parking lots, landscaping and right of ways located within the Coastal High Hazard Area (Category 1 Storm Surge Zone), but none of the residential buildings are located within the CHHA. Using the VE Flood Zone as the definition of the CHHA would add 9 condo buildings to the list of buildings in the CHHA, excluding the few that have been removed from the beachfront VE Flood Zones by effective LoMRs. The buildings in both the Golden Isles neighborhood and the VE Zone were built mostly in the early 1970's to mid-1980's, before the establishment of the CHHA.

Should future development projects be proposed within the CHHA, the Hallandale Beach Comprehensive Plan Coastal Element policy 2.2.4 states: "New development and infrastructure in areas modeled to be within the CHHA and/or FEMA flood zones will be encouraged to use best practices to address sea-level rise."



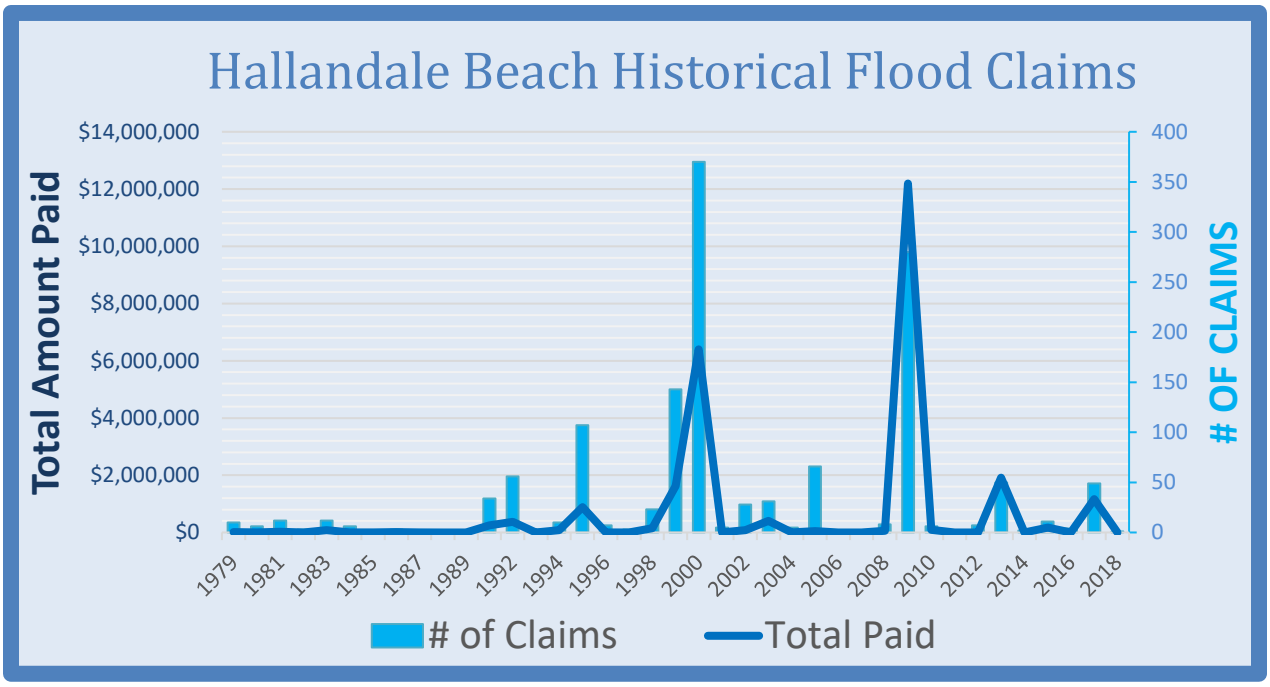
Coastal High Hazard Areas

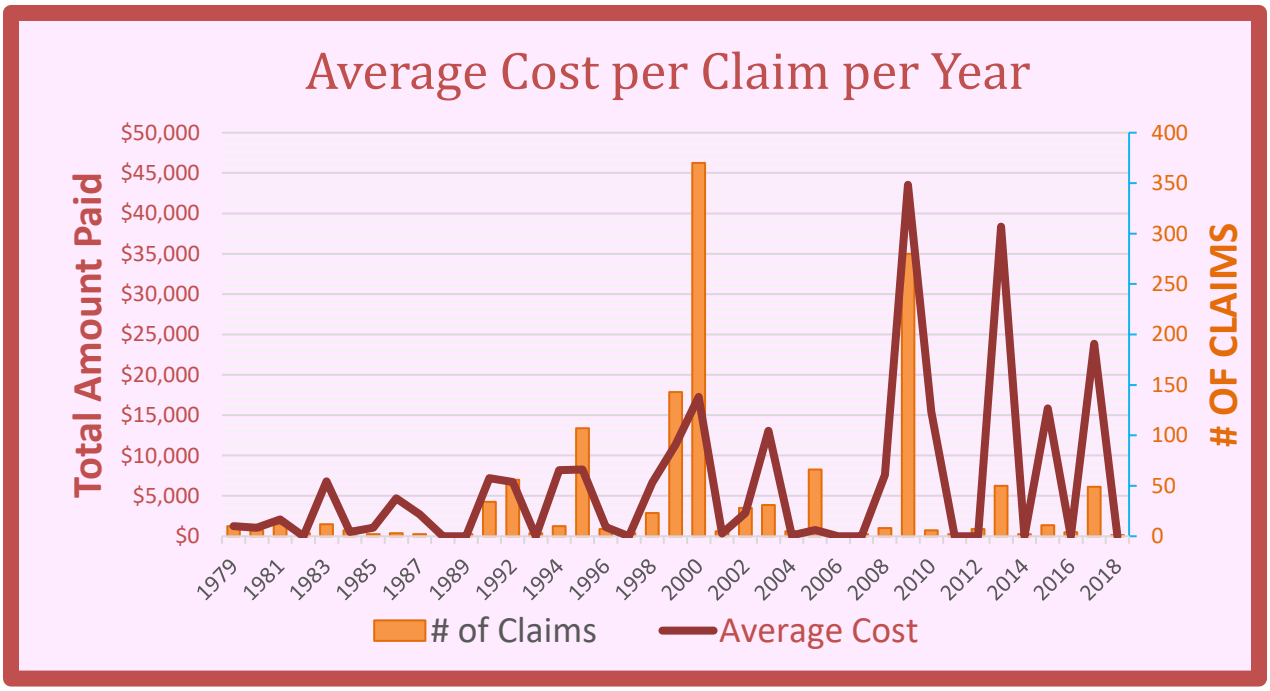
Category 1 Storm Surge Zone (red in image above), VE Flood Zone (yellow in image below)



Historical Flood Insurance Claims

FEMA has historically provided every community that participates in the Community Rating System (CRS) with a list of flood insurance claims filed on properties in its jurisdiction, with dates of the claims filed and claim payment amounts. This information is analyzed in the following tables and on a spreadsheet in Appendix I.





There are 17,103 flood insurance policies in force in the City of Hallandale Beach, with total annual premiums of $3.9 million. The average annual premium paid is $228. Because the City exceeds the requirements of the NFIP and has earned a Class 6 in the Community Rating System program, policyholders in the Special Flood Hazard Area (SFHA) can receive up to a 20% discount on their annual flood insurance premiums. The total savings for the residents in premium discounts is $918,617 (data retrieved 2021 from the CRS Program).

Repetitive Loss Properties

As seen above, in any given year the number of flood claims is only a very small percentage of the total number of policies. Nevertheless, the City has 142 structures listed by FEMA as unmitigated repetitive flood loss properties. These are properties that have had two or more insured flood losses of more than $1000 during a rolling ten-year period since 1978. FEMA has historically provided every community that participates in the Community Rating System (CRS) with a list of Repetitive Loss (RL) properties in its jurisdiction with dates of the claims filed. The most recent data received for Hallandale Beach is for claims filed up until May 2018.

Use of flood insurance claim data is subject to the Privacy Act of 1974, which prohibits public release of the names of policy holders, the addresses, and the amount of the claim payments. Averages or totals and maps showing *areas* where claims have been paid can be made public. Therefore, the addresses and ownership of these properties will not be discussed here. A Repetitive Loss Claim Analysis was conducted on the repetitive loss properties. In order to protect confidential information, each property was referred to only by a randomly assigned property ID #. The claim analysis can be found in Appendix I.

Preserving Open Space, Promoting Natural & Beneficial Functions of Flood-Prone Areas

Photos from https://www.usgs.gov/products/multimedia-gallery/images

Using flood–prone areas for parks and conservation purposes is a strong flood mitigation strategy since development can be limited in these areas. Existing vacant land allows the City an opportunity to regulate or limit development before it occurs. Open and natural areas absorb much more rain and floodwaters than do urbanized areas, reducing flood flows on downstream properties, and recharging the drinking water supply. These open spaces also serve as filters of stormwater runoff as it seeps through the ground and into the aquifer. This aquifer is the only source of drinking water for many of the surrounding communities. This filtering helps contain pollution before it reaches the aquifer. It is important that we appreciate our open spaces and try to maintain, preserve and keep these areas clean. Protecting and preserving these natural and beneficial floodplain functions provides the major benefits of protecting development from natural disasters and helping integrate floodplain management efforts with other community goals and objectives.

In addition to storing and filtering stormwater, which allows for the natural recharge of ground water aquifers and surface water reservoirs, preserving natural and beneficial open space provides numerous advantages to a community. Among them are the economic benefits that result from an influx of people who are endeavoring to relocate from barren and congested urban centers to areas with healthy ecosystems, outdoor recreation and scenic landscapes.

Communities such as the City of Hallandale Beach can help mitigate the environmentally damaging effects of development on the Natural and Beneficial ecosystems by integrating conservation and preservation into its comprehensive and future land use plans. The City further addresses the importance, restoration, preservation and acquisition of Natural and Beneficial Spaces in the following plans:

- *City of Hallandale Beach Sustainability Action Plan*
- *City of Hallandale Beach Dune Protection and Management Plan (2020)*
- *City of Hallandale Beach Vulnerability and Adaptation Plan (2020)*
- *Citywide Master Plan and Implementation Strategy,*
- *City Wide Parks Master Plan*

Specifically, the *City of Hallandale Beach Vulnerability and Adaptation Plan (2020)* includes the follow action item:

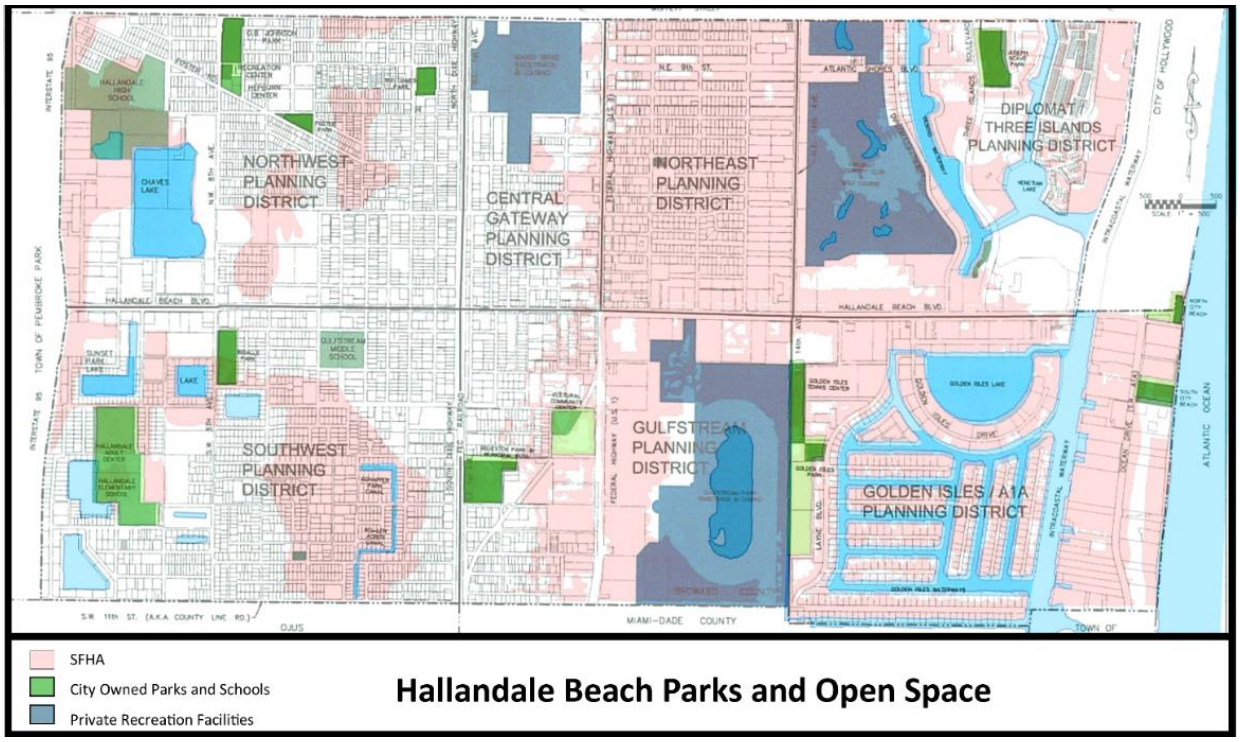
> *Use flood prone areas for open spaces, parks, parking lots, or other uses that can be designed to flood in a storm and provide temporary storage for excess runoff. By designing certain areas to flood, stormwater can be diverted from the overall system so it can effectively deal with an extreme precipitation event.*

Open Spaces, Parks and Recreation

Hallandale Beach has approximately 108 acres of public parks and open space, and approximately 143 acres of public waterways. Broward County's Land Use Plan requires a level of service (LOS) standard of 3 acres of parks/open space per 1,000 residents. Including public waterways, Hallandale

Beach's parks and open space exceed this standard by 144%. The City's Comprehensive Plan acknowledges that parks and open space are not uniformly distributed, limiting some citizens access. In addition, public waterways are not generally accessible. As a result, the City continues to look for opportunities to both enhance existing facilities and to add to its inventory. A proposal to increase the City's LOS to 4 acres/1000 residents and reduce the acreage of waterways that contribute towards this goal is currently before the City Commission. The goal is to develop an impact fee that will help the City purchase land for open space.

The City manages open spaces, parks and recreation according to its City Wide Parks Master Plan, which identified recreational needs, maximized use of current assets, and improved access to facilities. The plan guides investment of a $58.5 million general obligation bond approved by the voters to improve existing parks and develop new facilities.



Natural Area Preservation

The City of Hallandale Beach does not have extensive areas of undeveloped land or natural areas. However, the City does have extensive marine and aquatic ecosystems, including lakes, estuarine areas, and the Intracoastal Waterway. The Coastal Management and Conservation elements of the City's Comprehensive Plan establish objectives, goals and policies designed to protect natural resources. Notable objectives include preserving the hazard mitigation system of dunes with native coastal vegetation, reducing stormwater pollutants, protecting manatees, and encouraging drought resistant/native vegetation through landscaping guidelines.

Hallandale Beach has been a certified Tree City USA, through the Arbor Day Foundation, for 31 years. Tree canopy is limited due to the intensive development throughout most of the City. There is a tree

canopy goal set by Broward County aiming for 40% citywide coverage by 2040. However, according to a recent tree canopy assessment the maximum coverage Hallandale Beach can only achieve is 35% by 2040. The current tree canopy percentage is 14%, which the 2008 Citywide Masterplan and Implementation Strategy indicated was very low. The City has a Street Tree Planting program, which should receive additional funding, and a Tree Preservation Ordinance.

Hallandale Beach is working towards achieving certification as a Community Wildlife Habitat by the National Wildlife Federation. This program requires cities to establish wildlife habitats at homes, schools and common areas; establish sustainable gardening practices; and educate citizens.

Due to the intensive development of the area, there are no federally threatened or endangered species habitats in Hallandale Beach; however, manatees, bald eagles, and/or loggerhead turtles could potentially utilize aquatic/marine/coastal environments in the City. The City's municipal code includes provisions to protect nesting sea turtles from artificial light sources on new coastal construction. In 2020, the City was home to 24 turtle nests (22 loggerhead, 2 green turtle), down from the 31 turtle nests found during the 2017 season. There have also been burrowing owls found nesting in the City. Although not federally protected, burrowing owls are protected by the state as a threatened species.

Dunes and Critical Coastal Areas

In addition to serving as the one of the coast's first lines of defense against storm surge flooding, coastal dunes also serve as habitats for wildlife and support a high biodiversity of flora and fauna. Hallandale Beach provides critical nesting grounds for threatened and endangered sea turtles and serves as an important habitat for shorebirds and other wildlife. Functional dune systems keep beaches healthy by accreting sand and minimizing beach erosion rates. Established dunes protect coastal infrastructure and upland properties from storm damage by blocking storm surge and absorbing wave energy. In Broward County, beaches provide protection for more than $4 billion dollars of shoreline property, structures and infrastructure.

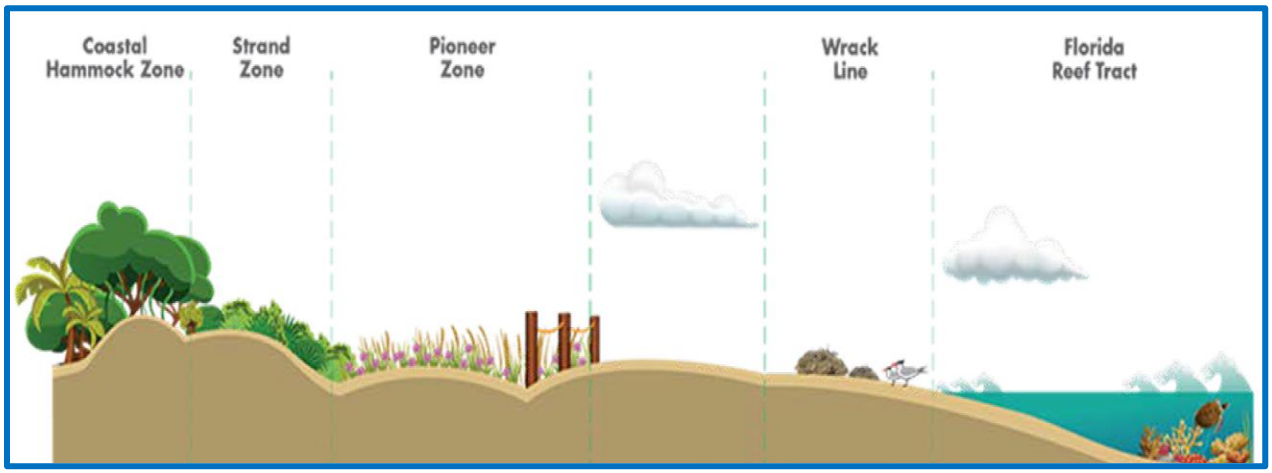
In addition to the environmental benefits of dunes, dunes also provide economic and recreational co-benefits to the community. Hallandale beaches are a significant employment center for the City. Broward County beaches, including Hallandale Beach, attract more than 12.8 million visitors annually and contribute more than $6 billion to the local economy each year. A healthy dune system is an invaluable asset to coastal communities like Hallandale Beach.

In 2020 the City of Hallandale Beach developed a *Dune Protection & Management Plan (DPMP)* to outline the framework and specifications that the City will use to foster and maintain healthy, stable, and natural dune system that is appropriate for its location and reduces public safety and maintenance concerns. The Plan, which can be found in Appendix L, shall guide the City's efforts in managing the urban, man-made dune as close to a natural system as possible and ensuring the dune provides storm protection, erosion control, and a biologically-rich habitat for local species.

This DPMP plan was developed by the City and reviewed with the help of stakeholders, as well as local experts to meet the following primary objectives:

- Restore and expand the existing dune system;
- Prevent dune loss and beach erosion;
- Create a long-term maintenance plan for the dune system;
- Engage coastal property owners to improve the dune system;
- Increase public education and awareness of the importance of dune restoration and maintenance.
- Identify funding for dune restoration projects; and
- Plan for the impacts of sea level rise.

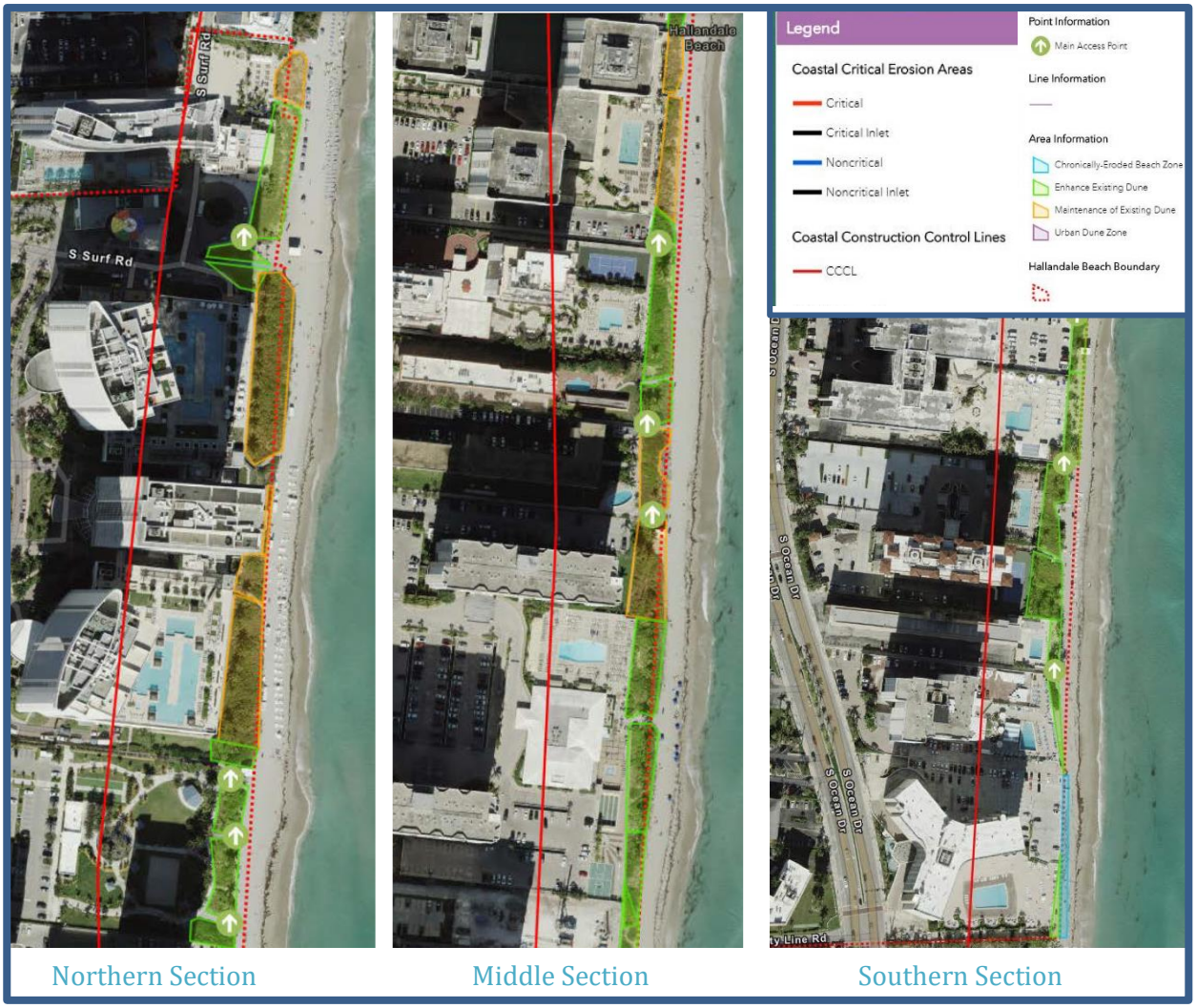
The illustration below (from the DPMP) shows a cross section of different dune zones:



Except for a few locations, most of the City's existing dunes are narrow and only consist of a Pioneer Zone where sea oats (Uniola paniculate) are the preferred species. There is little to no Strand Zone, and no existing Coastal Hammock Zone in Hallandale Beach's dune and coastal system.

Most of Hallandale Beach has some vegetation along the Atlantic Shoreline, except for the Southern Section. Vegetation in the City's dune system is either native dune vegetation or exotic invasive plants. Existing beach has been assessed and categorized via an online GIS tool. Categories include the following goals and descriptors for each area "enhance existing dune," "maintenance of existing dune," or "chronically eroded beach zone"

The following figures from the DPMP illustrate the areas Hallandale Beach Coastline identified for Dune maintenance and restoration:



Sections of Hallandale Beach Dune System

It is worth noting that the city has received four grants from Broward County in the past two years to carry out invasive removal and restoration of dunes with in the City and is working on entering an agreement with the County to restore dunes as part of the upcoming army corps beach renourishment project

Native versus Invasive Vegetation

Vegetation should be selected based on appropriateness for the proposed location, both within the State of Florida and within the cross-section of the dune. The DPMP's lists "Recommended Plant Palette" for each cross-section of the dune system and includes species native to the region which are salt-tolerant, drought tolerant, and are naturally found in coastal dune habitats. The recommended species do not preclude other native salt tolerant species from being proposed or allowed to grow within the dune. For instance, sea purslane (Halimoine portlacoides) may seed itself in a functional

dune despite being unavailable from nurseries. Rather, the list serves as a starting place for residents, developers and City staff tasked with dune restoration and maintenance. For privately maintained dunes, a planting plan should be submitted for review/approval by City staff and FDEP under the Coastal Construction Control Line permitting program.

The City's beaches and dune systems currently contain coconut palms, a Category II invasive species. As these palms serve the religious purpose to uphold the Eruv (a traditional Jewish boundary), they are permitted to remain in existing dunes. However, all other Category I and II invasive plant species, as classified by the Florida Exotic Pest Plant Council, are not permitted within the dune system and should be removed. If the Eruv is damaged by a storm event, the supporting trees should be replaced with trees of a species listed in the Recommended Plant Palette. By selecting native plants which also provide habitat value, critical habitat which has largely been destroyed and/or displaced by development is reestablished.

Non-native/exotic, or invasive plant species can have adverse effects on native plant communities, including loss of native plants due to non-native plant infestations and alteration of endangered species habitat. Non-native plant species can destabilize a dune community, resulting in reduced storm resilience. Non-native species should be removed and disposed of off-site when observed in the dunes. No on-site shredding or chipping will be allowed. Mechanized equipment may be used for removal when it is possible to gain access without impacting the existing dune. Post and rope barriers may be temporarily removed for mechanical invasive removal, but the post and rope must be replaced upon completion of each section.

Non-native species observed in Hallandale Beach dunes include:

- Scaevola taccada (Hawaiian half-flower or beach naupaka)
- Sphagneticola trilobata (wedelia or creeping oxeye daisy)

Other non-native species commonly found within South Florida's dune system include:

- Casuarina equisetifolia (Australian pine)
- Schinus terebinthifolius (Brazilian pepper)

All invasive removal should be done manually either by hand or by machine. The use of herbicides, such as glyphosate, is prohibited.

Impacts on Wildlife and Endangered Species

In South Florida, many threatened, endangered, and endemic species depend on a healthy beach and dune system. The Southeast Beach Mouse (*Peromyscus polionotus* niveiventris), the Piping Plover (*Charadrium melodus*), the Least Tern (*Sternula antillarum*), the Rim Rock Crowned Snake (*Tantilla oolitica*), Loggerhead Turtle *(Caretta caretta*), Green Sea Turtle (*Chelonia mydas mydas*), and Leatherback Turtle (*Dermochelys coriacea*) are examples of State and/or federally listed threatened or endangered animal species which depend on our beach and/or dune habitat. Likewise, Sea Lavender (*Tournefortia gnaphalodes*), one of the plants listed in the Recommended Palette, is an endangered plant species native to the dunes. In addition to those threatened or endangered species, many other species depend on the beach environment, especially the Strand and Coastal Hammock Zones for food, cover, nectar, and/or larval resources.

Many species in the DRMP's "Recommended Palette" provide significant food and cover resources for wildlife including: Saw Palmettos, Cocoplum, Cabbage Palm, White Stopper, Marlberry, Blolly, Wild Coffee, & White Indigo Berry. Other species in the Recommended Palette provide moderate amounts of food and cover resources for wildlife including: Sea Grape & Gumbo Limbo.

Additionally, many of the species in the Recommended Palette are either larval or nectar sources for moths and butterflies including: Saw Palmettos, Sea Lavender, Sea Grape, Cabbage Palm, White Stopper, Wild Coffee, White Indigo Berry, and Buttonwood. Those moths and butterflies, which could be brought to Hallandale Beach's dunes by following this Plan, can provide biodiversity and environmental benefit to the ecosystem.

Beyond the coastal storm surge area, the Florida Manatee depends on the health of the Intracoastal Waterway to complete yearly migrations, and the American Bald Eagle range extends through all of Hallandale Beach. Although it is unlikely that the eagles would nest or hunt in such an urban environment, preserving floodplains in their natural and beneficial state while safeguarding the water quality, makes valuable habitat available to species, like the eagles, which have otherwise been displaced due to development.

Conservation and Open Space (as addressed in the Comprehensive Plan)

The Conservation Element of the City's *Comp Plan* states:

> ***7.1 INTRODUCTION***
>
> *The purpose of the Conservation Element is to describe the natural resources within the City of Hallandale Beach, and to establish policy direction for consideration of these natural resources in future environmental management activities. The policies contained in this element are designed to enhance the existing natural and physical environment.*

Objective 1.13 of the Future Land Use Element of the *Comp Plan* further addresses the City's commitment to conservation:

> ***Objective 1.13*** *The City shall continue to protect native habitat and preserve wetlands.*
>
> > ***Policy 1.14.1*** *The City shall continue to enforce regulations requiring the preservation of 25% of the area occupied by "A" rated native plants on sites classified "Conservation Overlay" and shall require that these standards are placed as conditions of approval for development orders and permits where applicable.*

The City further defines its conservation goals, objectives and policies in the Conservation Element of its *Comprehensive Plan*. The following goals are specific to the conservation of Natural & Beneficial areas:

> ***Goal 2:*** *The City shall encourage natural areas, where they exist, to be improved in larger scale developments or redevelopment situations (5 acres or more).*

Goal 3: *The City shall protect, by regulation, acquisition and/or restoration, existing natural areas.*

Goal 4: *The City shall preserve and enhance a beach dune and vegetation system for beaches within the City.*

Goal 5: *The City shall require restoration and protection of native coastal vegetation.*

Goal 6: *The City shall seek to lessen the degradation of habitats conducive to endangered or threatened species.*

Goal 7: *The City shall preserve and expand natural environments within the City.*

Through the use of a variety of funding sources such as the General Fund, developer commitments, County, State and Federal grants, bonds, user fees and impact fees, the City intends to continue to fund the acquisition and development of parks, open space, recreational facilities, native habitat and habitat of endangered, threatened and species of special concern. The City works in conjunction with the State of Florida, the South Florida Water Management District, the Nature Conservancy, the Trust for Public Lands, and other appropriate agencies involved in conservation lands to create a citywide open space system and a greenways/trails/blueways system. Some sources of possible funding to support these efforts include:

- Broward County's Dune Restoration Grant Program
- Community Foundation of Broward ECO Broward Grant
- Florida Department of Economic Opportunities Small Cities Community Development Block Grant
- Florida Resilient Coastlines Grant
- Funders Network for Smart Growth and Livable Communities Partners for Places Grant
- Infrastructure General Obligation Bond
- Sustainability Revolving Fund (yet to be created)
- Budget allocation

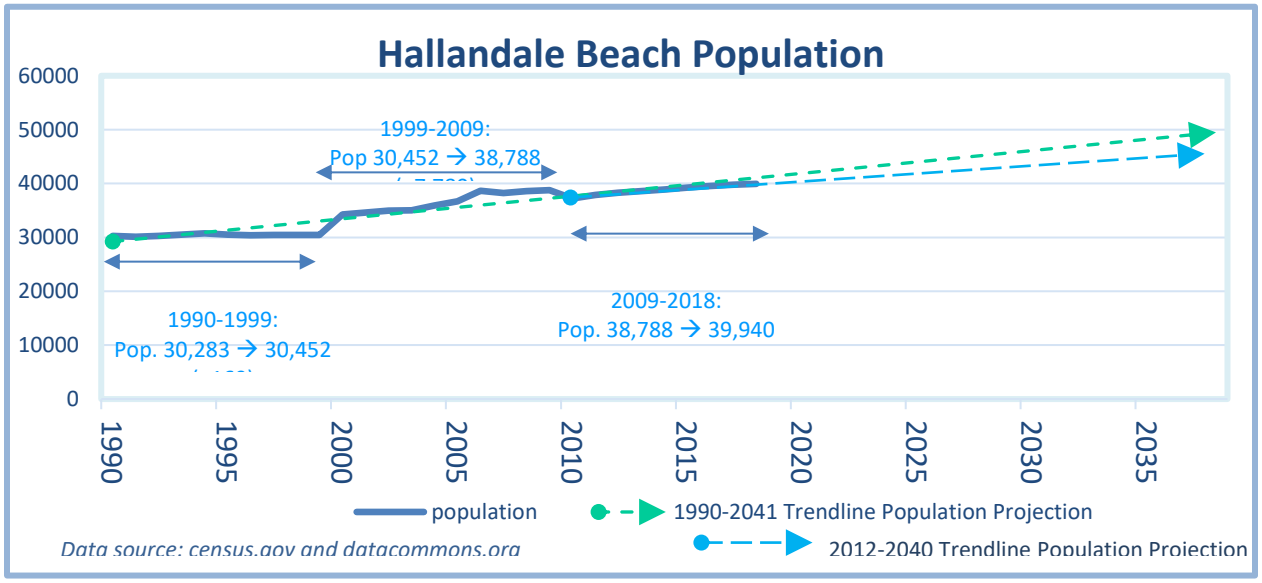
Future Development

The population experienced an annual average growth of 1.5% between 1990 and 2007 followed by a negative growth rate of -1.2% per year between 2008 and 2010. Hallandale Beach, like many other US cities, saw population growth slow during the economic downturn that occurred between 2007-2010. The growth rate from 2010 until 2018 has rebounded to 0.6% per year, which is about half of the pre-recession growth rate. Overall Hallandale Beach has experienced a 32% increase in population between 1990 and 2018 averaging 1.1% growth per year.

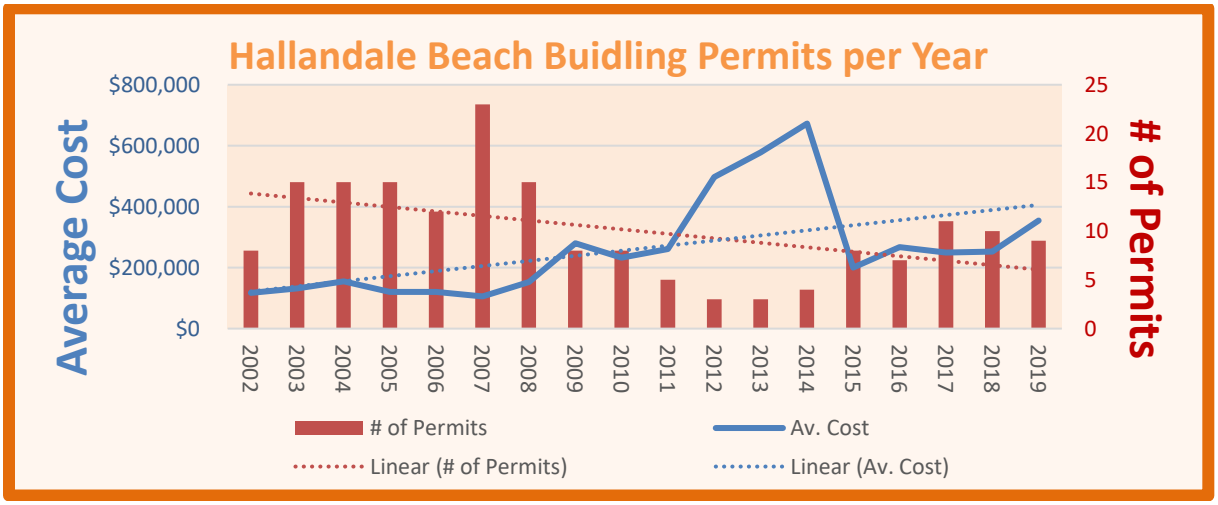
Any estimates of future growth and development in Hallandale Beach are difficult to project. Growth over the last 20 years has been characterized by extremes with slow growth between 1990 and 1999, a building and population boom (1999-2007), followed by a recession (2008-2010) with a subsequent contraction of both the number of people moving into the area and the value of the properties. Currently (2010-2021), the county is witnessing a slow recovery. The City's population

growth since 2010, is generating an ongoing mix of development and redevelopment activities. This is an indication that the economic outlook remains bright. The City of Hallandale Beach continues to make sustained development, in accordance with the Comprehensive Plan, and the Future Land Use Maps a top priority. The Future Land Use Maps can be found in Appendix P.

Extending trend lines out based on recent growth, it can be expected that the population will reach 45,000-50,000 by 2040. It is generally understood that increases in population necessitate increased development due to higher demand for housing, services, employment, and commercial/ retail items. The chart below illustrates the population trends since 1990:



Following the trendlines from yearly permits as provided by City-data.com, it appears that the number of building permits per year has been trending down, while the value of each building permit has been trending up. This lines up with local efforts to recruit commercial and multi-unit residential development.



Source: U.S. Census Bureau, City-Data.com

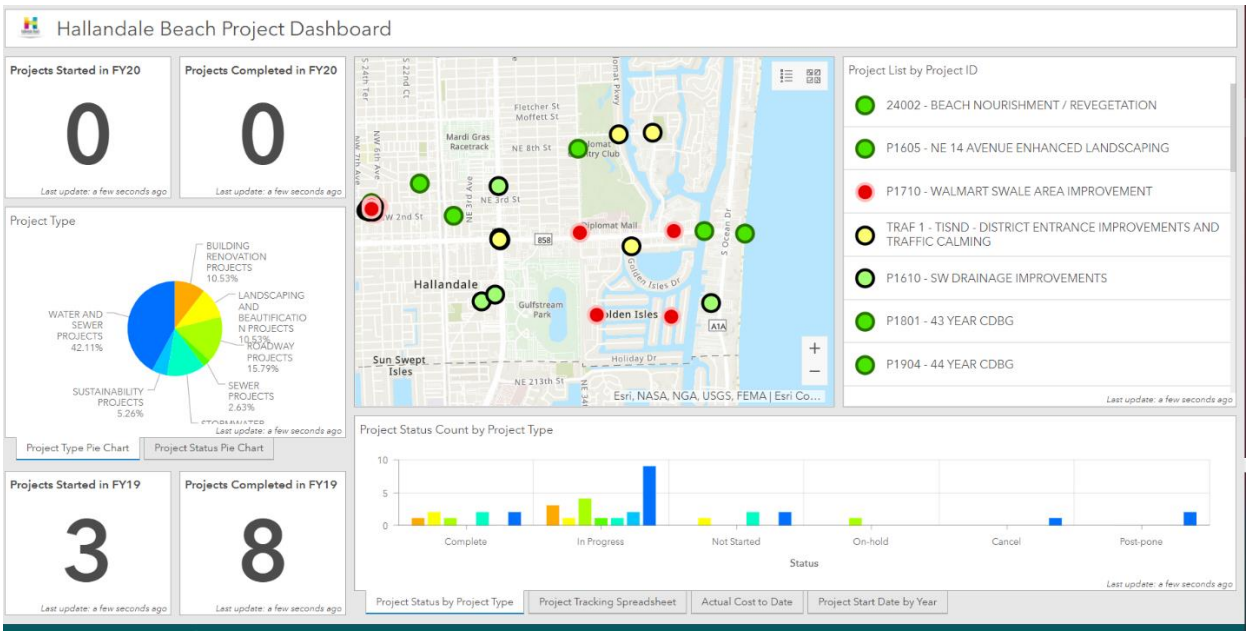
Although the City prioritizes the preservation of open space, the City is almost completely built out according to the land use designations outlined in the Future Land Use element of the City's comprehensive plan. Other than focusing new development and redevelopment on increasing the sustainability of the community, becoming more environmentally efficient, meeting increases in demands for residential and commercial space, and utilizing new technologies and aesthetics to increase the quality of life for its residents, there are no major expansions planned for the City.

Following the City's *Sustainability Action Plan* (Appendix M), the City is committed to encouraging development that enhances the quality of life in Hallandale Beach without increasing risks to the residents or the environment. Each new development project is reviewed by City staff and the SFWMD to be sure that it will not pose a risk to the environmentally sensitive lands, degrade water quality (both drinking and estuarial), alter the character of the community, compromise residents' safety or place undue burdens on the City's stormwater and utility service capacity. Some of the recent and upcoming development projects can be found in Appendix N.

Future development projections are accompanied by planned infrastructure improvements, including the City's stormwater conveyance system. Some of the impending Capital Improvement Projects related to utilities and stormwater are listed below, in Appendix N, and on the City's, Public Utilities Page (https://cohb.org/1173/Public-Works-Projects):

- Atlantic Shores Boulevard
- Foster Road Water Main
- Historic Village
- Lift Station #8
- Raw Water Well #9
- Raw Water Well #9 Pipeline
- SW Drainage Improvements Project
- Sunrise Park
- Three Islands Reuse Irrigation Project
- Transfer Pump Replacement
- Wastewater Lift Station #8
- 45th Year CDBG Drainage Improvements

Additionally, residents can keep track of the status of projects on the City's Project Dashboard Page:



In addition to referencing the City's expected growth and development trends, it is noteworthy that the City also has specific guidelines governing redevelopment after exceptional events such as floods or other natural disasters. This is addressed in detail in the City's *2020 Post-disaster Redevelopment Plan* which can be found in Appendix 0.

Future Flooding Conditions

In light of the data from the previous section on future development it is clear that, even with minimal growth and development, in an urban area such as Hallandale Beach, flood risk can be expected to increase, regardless of trends in climatology or building practices. The four most prominent aspects of increased flood problem risks include an increase in the number of people at risk, an increase in the dollar value of individual properties at risk, an increase in the age of structures and critical facilities, and an increase in the number and value of flood insurance claims.

- **Increase in the number of people at risk**: This increase refers to welcome and healthy population growth trends. If the City continues to be developed according to the comprehensive plan, such increases will be handled with little impact to the environment or character of the community, without over-burdening critical facilities and available shelters, or significantly increasing evacuation times. Knowing that flood water is the number one danger during a storm, and with advances in storm and storm surge prediction, emergency managers are now able to focus on more precise groups of people at risk from storm water. Being able to evacuate and relocate smaller numbers of people while still protecting the life and safety of residents in the storm's path, helps to reduce the impact of, and risk to, ever increasing populations.

- **Increase in the dollar value of individual properties at risk:** Although property values are determined by market forces, and therefore the dollar value of individual properties is outside the City's scope of control, Hallandale Beach strives through regulation, to make sure that the highest value (and newest) developments are constructed to the most rigorous and up-to-date flood resilience standards. In addition to requiring all new developments to retain a level of storm water onsite, thereby reducing the possibility that new development will increase the flood risk of existing properties (whose values are most likely increasing as well), new building standards, stricter water quality and conservation requirements, access to superior flood resistant materials, and state-wide freeboard elevation requirements, all serve to protect the new structures from an increase in the risk of future flood losses.

- **Increase in the age of structures and critical facilities:** With the exception of historic properties, development projects are slowly replacing the oldest structures in the city with more resilient structures and the City's substantial improvement regulations require properties that are undergoing significant renovations to be brought up to current building codes. The City's Engineering and Public Works department is also actively maintaining and replacing infrastructure and making investments in public utilities. New City-owned critical facilities, are being built to withstand hurricane force winds and are being located outside of the floodplain.

- **Increase in the number and value of flood insurance claims:** When it comes to evaluating flood insurance claim trends to forecast future flooding, it should also be noted that the City's aggressive efforts to inform residents about the benefits of flood insurance may result in a net increase in the number of insured buildings. A net increase in the number and total value of

claims may also result. Graphs that show a year over year increase in the number of claims filed and amounts paid can be misinterpreted to indicate an increase in future risk. These increased numbers do not necessarily indicate reduced NFIP solvency, as there will also be a marked increase in the value of premiums collected and a corresponding increase in the number of policies written to cover buildings that will not sustain losses. In fact, the larger the pool of policies and the fewer uninsured buildings sustaining loss, the healthier and more resilient the community, the NFIP, and FEMA will be.

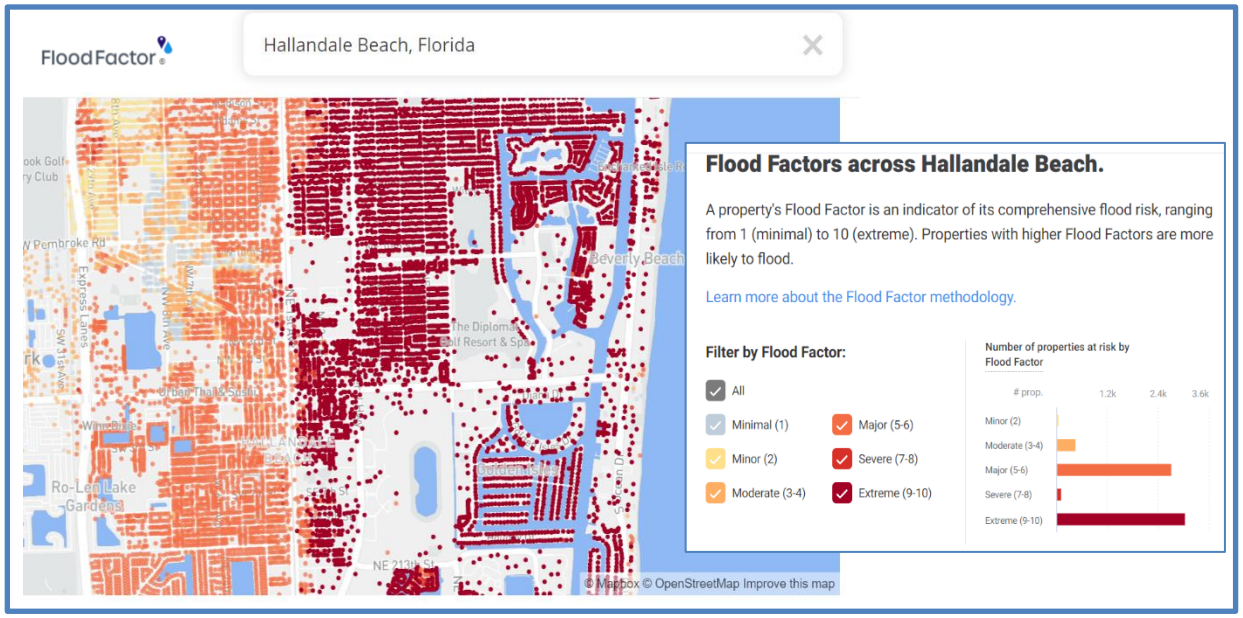
In 2020 the City completed a *Vulnerability Assessment and Adaptation Plan*, which has become the best source of data related to future flood conditions in Hallandale Beach. The plan is included in Appendix E and was summarized as follows:

> *This document provides an inventory of the hazard data gathered for the vulnerability assessment. Four types of flooding-related hazards are considered in the vulnerability assessment: Federal Emergency Management Agency (FEMA) flood zones, storm surge, sea level rise and high tide flooding. For each of these hazards, we use the most up-to-date nationally available datasets from federal sources. No additional modeling is performed by FernLeaf Interactive.*

The *Vulnerability Assessment and Adaptation Plan contains the following sections:*

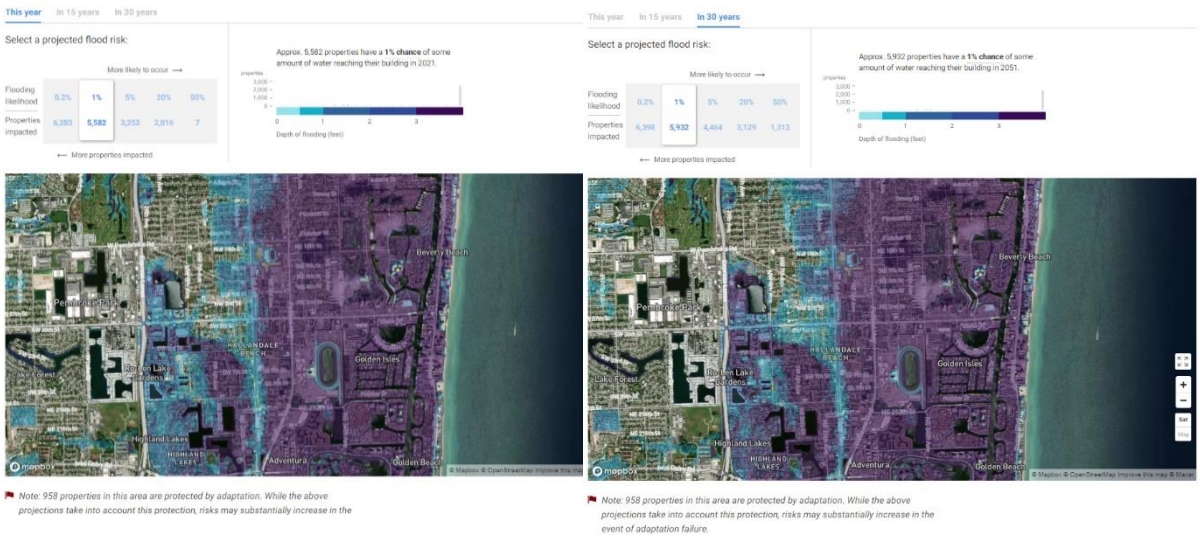
- Flood Hazard
- Flood Vulnerability / Loss Assessments
- Future Precipitation Analysis
- Qualitative Assessment of Groundwater Changes
- Projected Changes in Shoreline
- Initial Strategy Development and Evaluation

There are also outside sources with available assessment data related to Hallandale Beach. One of those is FloodFactor.com. According to FloodFactor.com, as sea levels rise and weather patterns



change, flood risks for Hallandale Beach will increase. Approximately 6,283 properties are already at risk in Hallandale Beach, and within 30 years, about 6,398 will be at risk.

FloodFactor.com also provides maps illustrating projected 1% flood risks for 2021 and 2051:



FloodFactor.com then goes on to apply values to the properties at risk for each timepoint:

Total annual flood damages in Hallandale Beach

$32.5M	$54.2M +67%
This year	In 30 years

▼ Damage breakdown by Flood Factor

	This year ($)	In 30y ($)	Change
Minor (2)	0	400	–
Moderate (3-4)	4,200	21.8K	+419%
Major (5-6)	2.2M	5.6M	+152%
Severe (7-8)	135K	222.6K	+65%
Extreme (9-10)	30.1M	48.3M	+60%

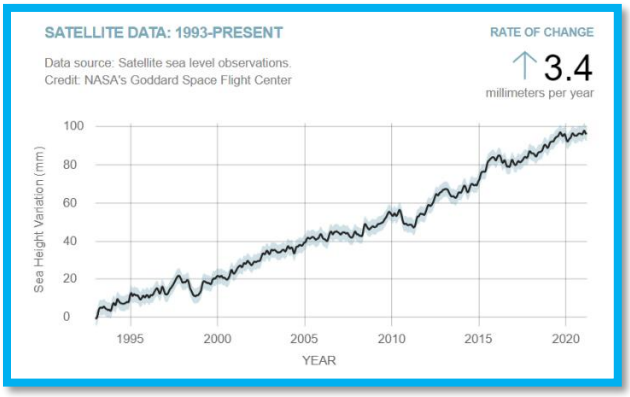
Future Sea Level Rise Projections

When considering an increase in risk from climatological sources, sea level rise presents the greatest potential for increased risk. Sea level rise, considered a nearly inevitable possibility, is a flood risk that is expected to continually increase in years to come. Although the increase is expected to be slow enough to allow the City to respond with mitigation and prevention efforts aimed at protecting existing property and preventing new developments from being constructed in potentially affected areas, the rise in sea level will most likely exacerbate rapidly occurring events such as storm surge, King Tides and coastal erosion.

Communities such as Hallandale Beach that are particularly subject to sea level rise may experience an increase in coastal vulnerability. Impacts to communities may include:

- ✓ Increased flooding and drainage problems
- ✓ Destruction of natural resource habitats
- ✓ Higher storm surges, increased evacuation areas and evacuation time frames
- ✓ Increased shoreline erosion
- ✓ Saltwater intrusion
- ✓ Loss of infrastructure and existing development

The following chart obtained on 8/4/2019 from https://climate.nasa.gov/vital-signs/sea-level/ shows historical satellite sea level data from January 1993 to July 2020 illustrating the rate of increase in sea level rise:



The *2019 Unified Sea Level Rise Projection for Southeast Florida* prepared by the Southeast Florida Regional Climate Change Compact, provides projections that South Florida Communities can use as part of their long-term planning efforts:

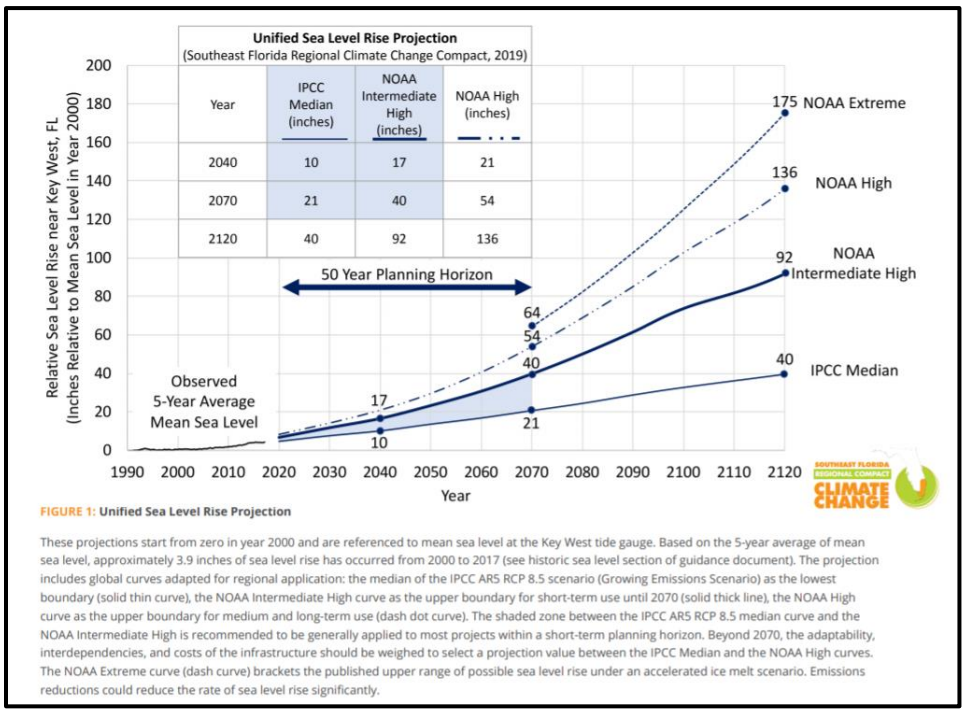
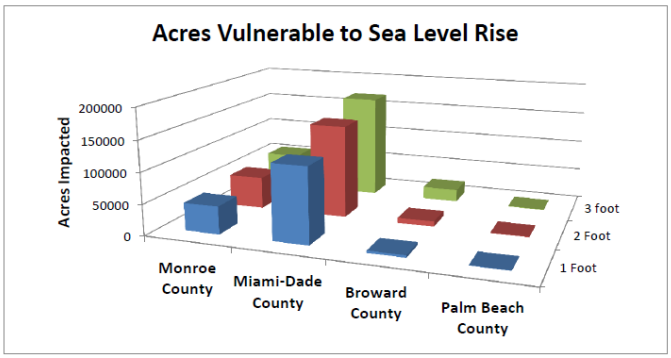


FIGURE 1: **Unified Sea Level Rise Projection**

These projections start from zero in year 2000 and are referenced to mean sea level at the Key West tide gauge. Based on the 5-year average of mean sea level, approximately 3.9 inches of sea level rise has occurred from 2000 to 2017 (see historic sea level section of guidance document). The projection includes global curves adapted for regional application: the median of the IPCC AR5 RCP 8.5 scenario (Growing Emissions Scenario) as the lowest boundary (solid thin curve), the NOAA Intermediate High curve as the upper boundary for short-term use until 2070 (solid thick line), the NOAA High curve as the upper boundary for medium and long-term use (dash dot curve). The shaded zone between the IPCC AR5 RCP 8.5 median curve and the NOAA Intermediate High is recommended to be generally applied to most projects within a short-term planning horizon. Beyond 2070, the adaptability, interdependencies, and costs of the infrastructure should be weighed to select a projection value between the IPCC Median and the NOAA High curves. The NOAA Extreme curve (dash curve) brackets the published upper range of possible sea level rise under an accelerated ice melt scenario. Emissions reductions could reduce the rate of sea level rise significantly.

The following figure from the Southeast Florida Regional Climate Change Compact report titled *Analysis of the Vulnerability of Southeast Florida to Sea Level Rise, August 2012* illustrates the sea vulnerability of several southeast Florida counties to each of three different sea level rise scenarios (1 foot, 2 foot and 3 foot). The report indicates that although Broward County is less vulnerable to sea level rise that Miami-Dade County to the south, "Broward County's inland waterways provide for pathways by which sea level rise may extend inland. Saltwater intrusion barriers along these waterways may slow but cannot prevent inland impacts especially associated with drainage issues."



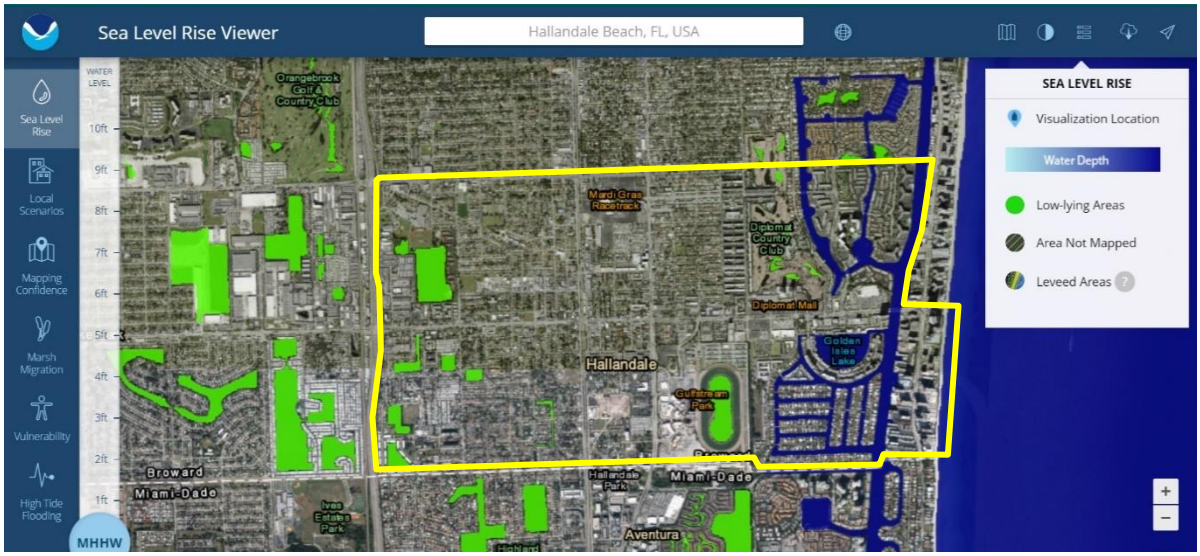
The same study indicates that, only at the three-foot scenario, would two hospitals, and one school, out of 26 hospitals and 239 schools, in Broward County be affected by future sea level rise projections. Fortunately, none of these are located within Hallandale Beach. No emergency shelter structures are affected at any of the sea level rise scenarios.

In 2019 & 2020, FEMA conducted an in-depth study of the Broward County coastline and released preliminary coastal FIRM maps that define areas at heightened risk for flooding as a result of sea level rise. It is anticipated that after a review period, these maps will be adopted, thereby limiting high risk development and re-development in the areas most at risk. Once the maps become effective, all development and re-development within the newly defined SFHA will have to meet strict standards and be constructed at elevations that will help to mitigate the risk of future losses. With these new maps, coastal communities like Hallandale Beach will also be better equipped to incorporate expected sea level rise into their long-term planning efforts and avoid the construction of critical facilities and infrastructure within the areas that are expected to experience sea level rise. Appendix F contains Hallandale Beach's preliminary FIRM panels and excerpts from the preliminary Flood Insurance Study.

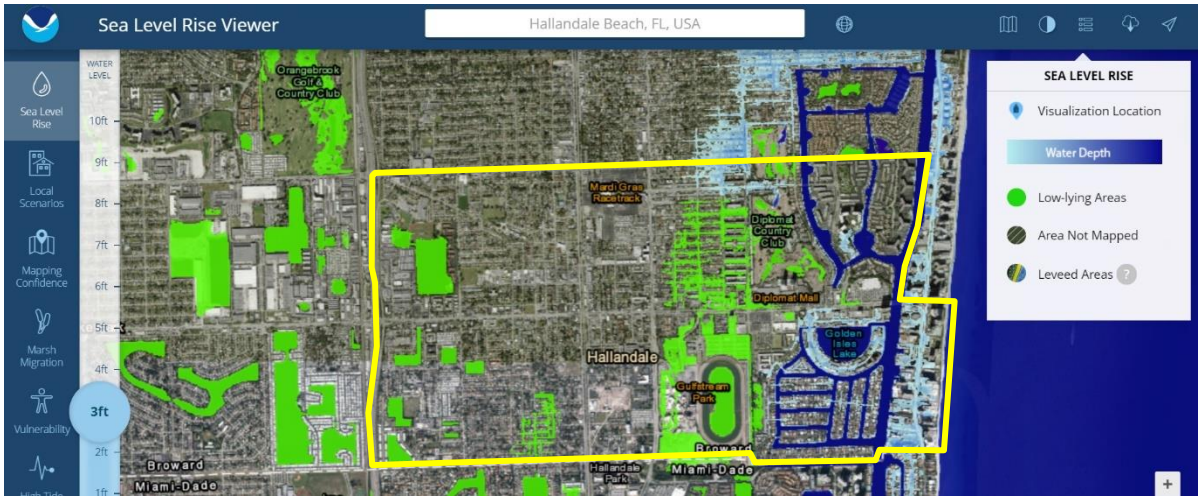
In coordination with the work FEMA is doing, NOAA has produced a Sea Level Rise Visualization tool (https://coast.noaa.gov/slr/) allowing communities and individuals to visualize the effects that sea level rise would have in their areas. The user can adjust the slider to see the predicted effects of various sea levels. Unfortunately for Hallandale Beach, barrier island and intracoastal properties are eventually expected to see widespread flooding as a result of sea level rise.

The maps below, taken from the NOAA Sea Level Rise Viewer which can be found at https://coast.noaa.gov/slr, show areas forecast to become completely submerged in light blue. Low lying areas that are forecast to see an increase in periodic flooding are shown in bright green. The maps can be adjusted to show inundation areas for various possible sea level rise scenarios. Each scenario includes an estimate for the earliest timeframe those conditions might be expected, based on the Climate Change Compact's *Unified Sea Level Projections (*using *NOAA High* and *NOAA Extreme* as seen in a chart on the previous page).

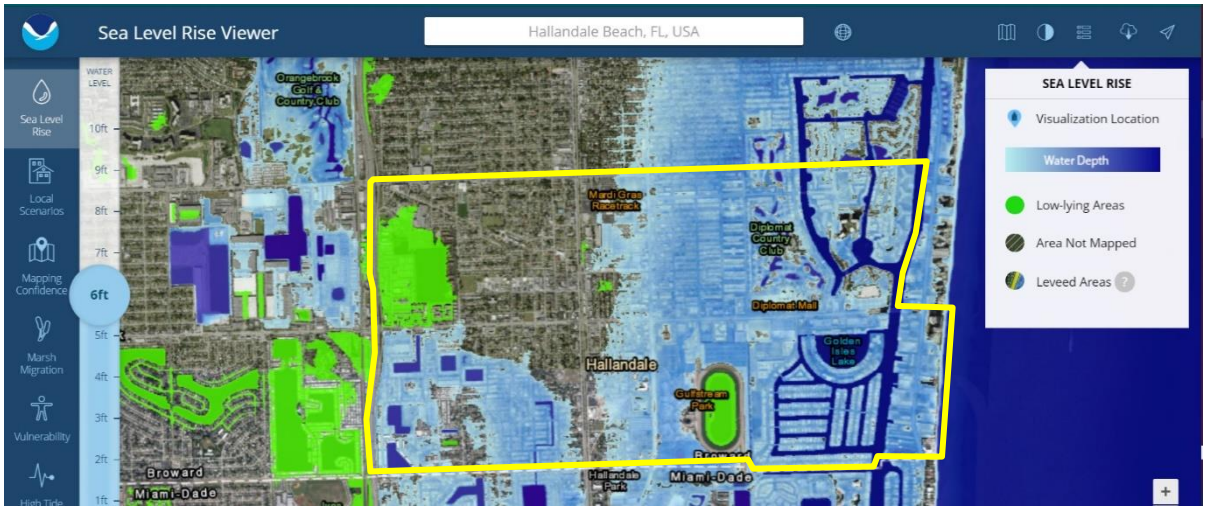
Hallandale Beach Today:



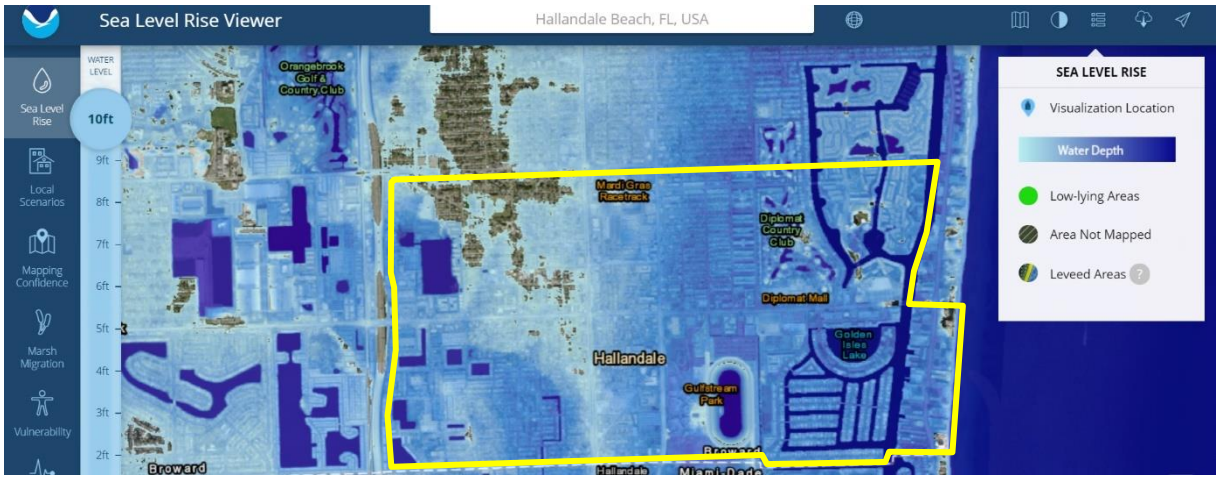
With 3 feet of Sea Level Rise (2050-2055):



With 6 feet of Sea Level Rise (2075-2085):

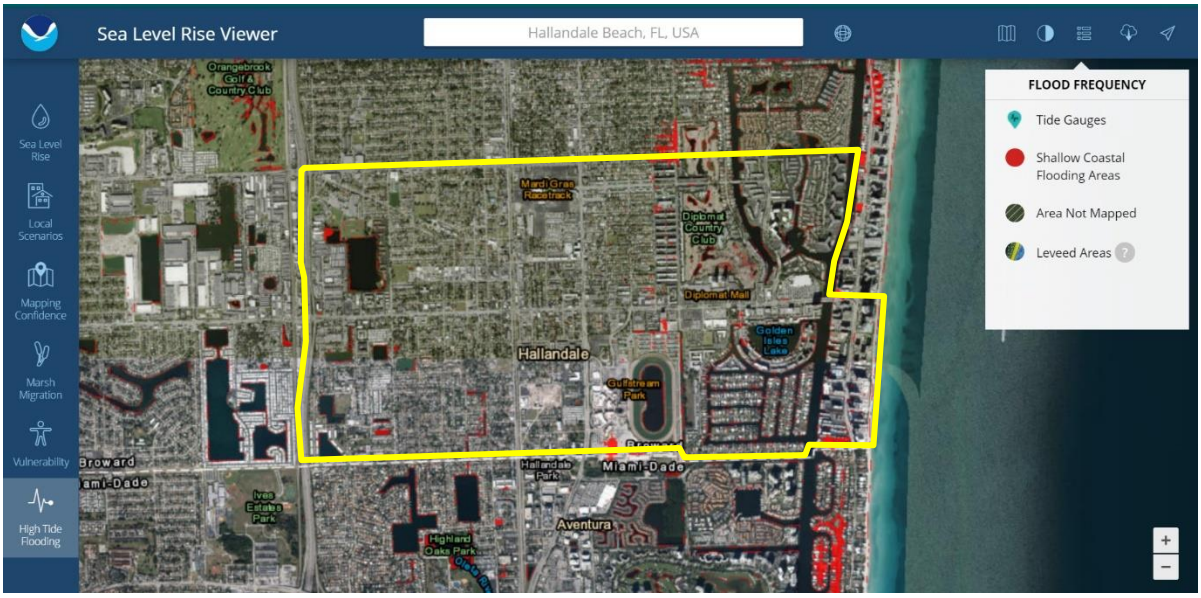


With 10 feet of Sea Level Rise (2095-2110):

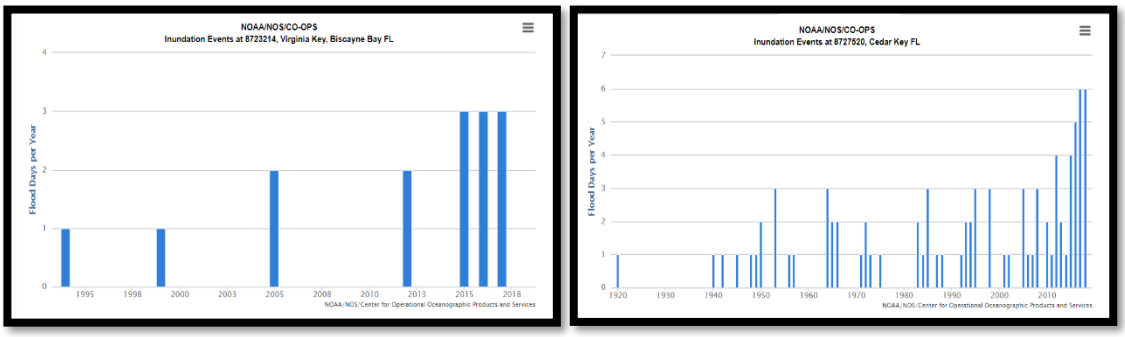


Exacerbated by sea level rise, King Tides have also been an increasing problem. According to *NOAA Technical Report NOS CO-OPS 073; Sea Level Rise and Nuisance Flood Frequency Changes around the United States*, recent research indicates an increase in the number of nuisance coastal floods per year attributed to King Tide events. Although not a scientific term, the seasonal high tides referred to as King Tides occur a few times a year when lunar and solar positions influence, and increase, a normal high tide. Due to Florida's low and level elevation, high density development along the coast and increase in sea levels, South Florida is among the regions that has already experienced a significant increase in the number of coastal "sunny day" nuisance floods since 1960. Some King Tides have equaled or surpassed storm-related surge levels. Fortunately, Florida is expected to experience a smaller increase in flood frequency than other coastal regions like the central east coast, where there is a simultaneous rise in sea level and subsidence of the coastal land.

The following shows the areas of Hallandale Beach most vulnerable to high tide flooding:

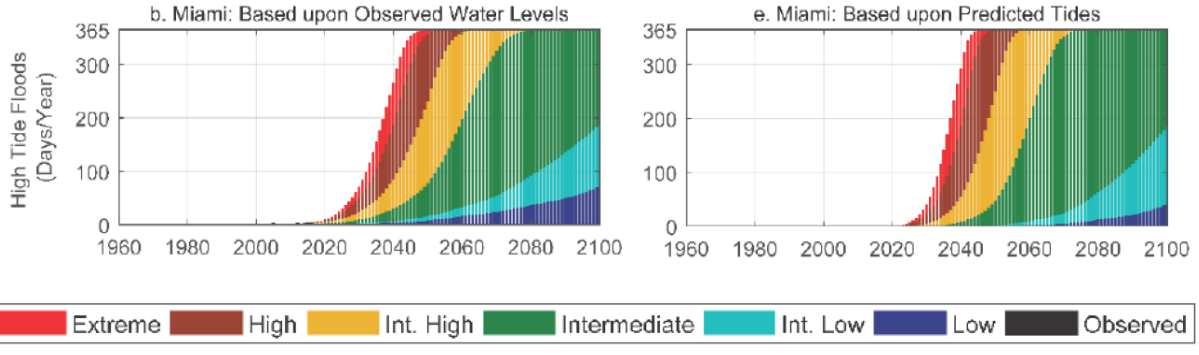


Currently, the only areas noticeably affected by heightened sea levels are the areas of the City whose streets are inundated by nuisance flooding during "King Tides". Notable high tides occurred in the fall of 2015, 2016, 2017, 2019 and 2020 accompanying the monthly full moons in late September, October and November. So far, the only problems caused by these exceptionally high tides have been confined to roadway flooding and saltwater intrusion into the stormwater system. Locally, inundation tidal events are increasing in frequency; the following charts show number of inundation events per year in Biscayne Bay (closest tidal gauge to Hallandale Beach that has been operating for more than 5 years) and Cedar Key (older tidal gauge across the state provided for extended historical context):



NOAA projects that the nearby Virginia Key tidal gauge will experience about 30 days of tidal flooding per year by 2100, based on a low emissions scenario and a derived high tide level of 0.53 meters. (NOAA Technical Report NOS CO-OPS 086: Patterns and Projections of High Tide Flooding along the U.S. Coastline Using a Common Impact Threshold, NOAA Center for Operational Oceanographic Products and Services, February 2018).

However, under an intermediate-low scenario, tidal flooding would be nearly 200 days per year by 2100, while intermediate, intermediate high, and high scenarios would see 200 days of flooding per year by 2055, 2045 and 2035, respectively. At intermediate scenarios and above, the location is flooded year round from 2070 onwards. The figure below from the City's *Vulnerability Assessment and Adaptation Plan* shows projected number of days per year for tidal flooding at Virginia Key for various emissions scenarios.



In light of the scientific studies indicating a continuation and/or acceleration of the recently observed increase in sea levels, it is becoming clear that it is no longer sufficient for communities to plan for flood risk based solely on historical flood events. Now communities must also plan for an expected *increase* in risk that could exceed any previously recorded or measured events.

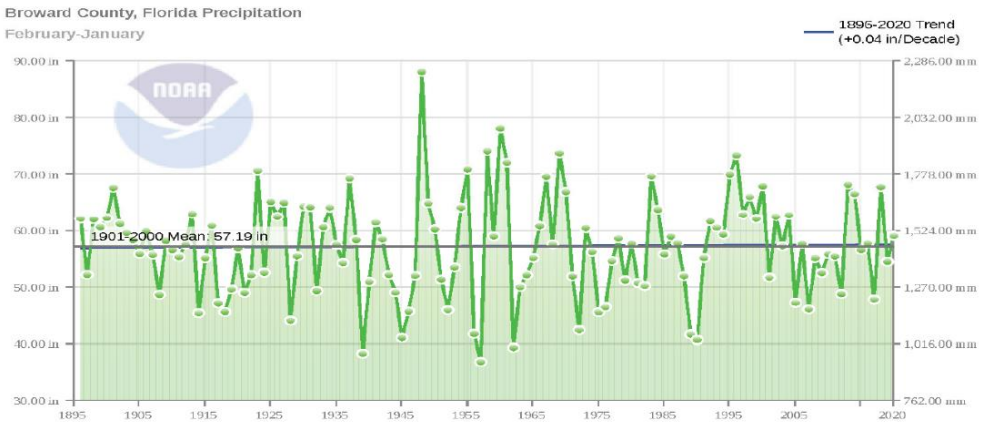
Future Rainfall Projections

Rainwater flooding also poses a future flood risk. However, profiling the future possibility of rainwater flooding is virtually impossible as the entire city is exposed to the unpredictable hazards of rainstorms and rainwater flooding. Unlike storm surge and sea level rise, whose risk can be anticipated and mapped, rainwater flooding is not confined to any specific area on the map. The City is currently preparing for future occurrences of rainwater flood hazards by maintaining the stormwater systems, regulating building projects so that rainwater runoff is handled on site, designing for increases in peak stormwater flows as population density and impervious surface areas increase, and educating residents about the ways in which they can protect their properties from rainwater flooding. In order to minimize the risk of future rainwater flooding, the City of Hallandale Beach is committed to maintaining a stormwater system that is designed to handle the peak capacity of a 100-year three-day event with 100% of the City built out according to Future Land Use designations. Because the City is remarkably close to being 100% built out, the peak demands of such a scenario are not expected to vary largely from current demands.

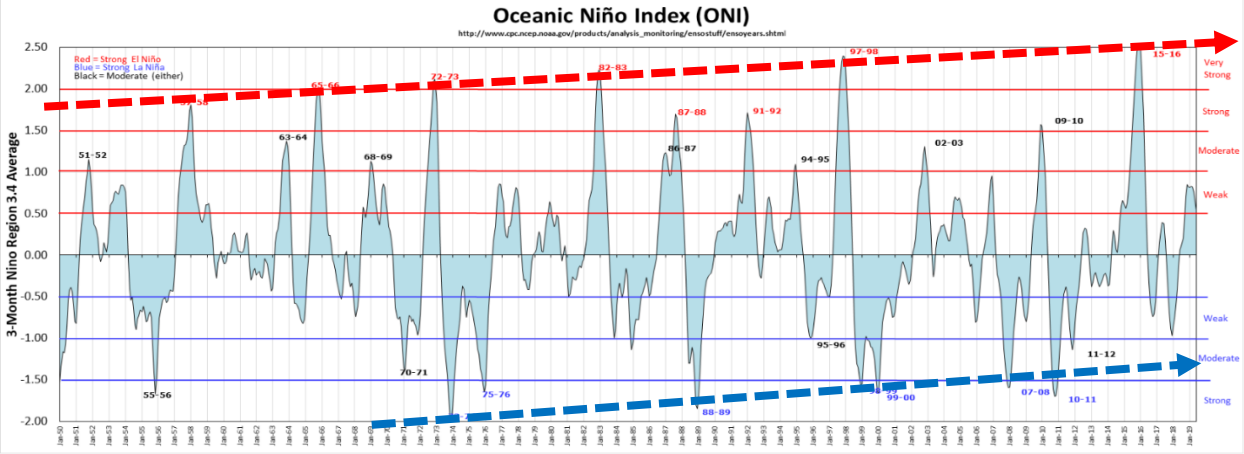
There is some debate as to whether changes in climate patterns are causing an increase in the frequency and severity of heavy rainfall events. As highlighted in the Vulnerability assessment, a few notable record rainfall events have occurred over the last few decades:

Date	Location Affected	Description of Event	Cause
6/7/2013	Portions of Hallandale Beach near the Intracoastal Waterway	Severe Flooding	Heavy rain up to 9 inches associated with Tropical Storm Andrea
04/30/2012	Hallandale Beach, specific location not recorded	Roof collapsed on a home, resulting in injury to resident	Heavy rain (2 inches in 12 hour period) and winds to 40 mph
12/17/2009	Hallandale Beach, specific location not recorded	Streets and parking lots under several feet of water	Heavy rain associated with a warm front, up to 14 inches

Total annual precipitation is projected to increase in Hallandale Beach and has been increasing in recent decades. Broward County averaged slightly higher annual rainfall than Florida as a whole with about 57.19 inches from 1895 to 2000 (seen in chart below) NOAA data shows a very slight increasing trend of 0.04 inches per decade for the county during that period. Annual precipitation in Broward is highly variable with more than 88 inches recorded in 1948 and as little as 37 inches in 1957.



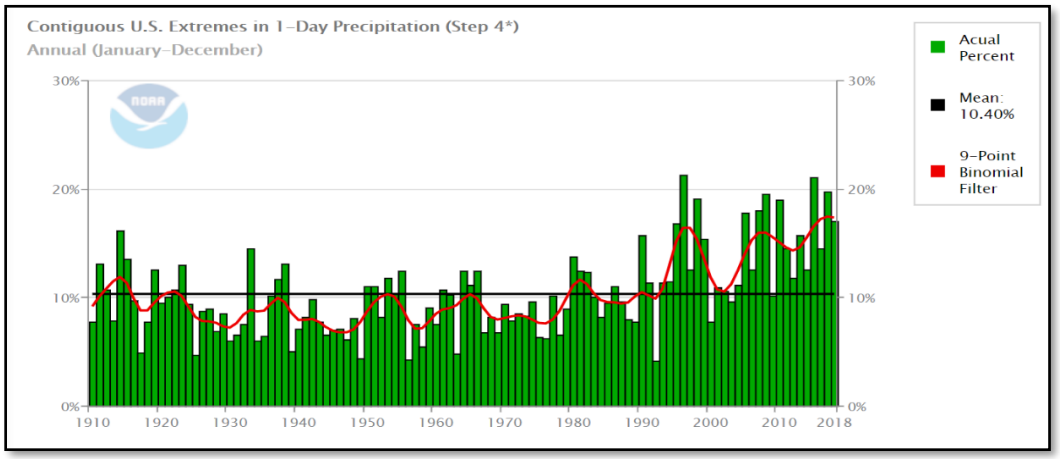
Some climatologists theorize that strong El Nino events may be contributing to increases in precipitation. Regionally, higher than average total precipitation levels were observed during the three strongest El Ninos, (1982-1983, 1997-1998, and 2015-2016). The chart below indicates that the strength of the strongest El Ninos (red trendline) appears to be trending up while the strength of the strongest La Ninas (blue trendline) appears to be gradually becoming weaker.



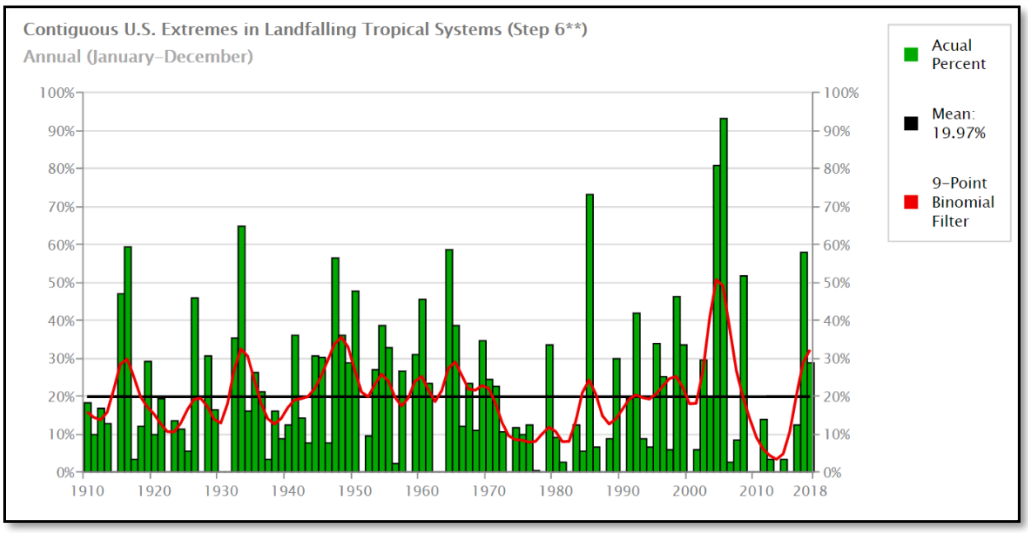
The two wettest years in recorded US history took place within the last 4 years. From May 1, 2018 to April 30, 2019, the contiguous U.S. averaged 36.20 inches of precipitation, more than half an inch higher than the previous record-setting year (April 2015 to March 2016), and the most in 124 years of modern record-keeping. Additionally, ten states ranked record wettest year with another seven states ranking among the top three.

In June 2019, the record for 12-month average rainfall was broken again when wet conditions from July 2018 through June 2019 resulted in a new 12-month precipitation record in the U.S., with an average of 37.86 inches (7.90 inches above average), according to NOAA's National Centers for Environmental Information.

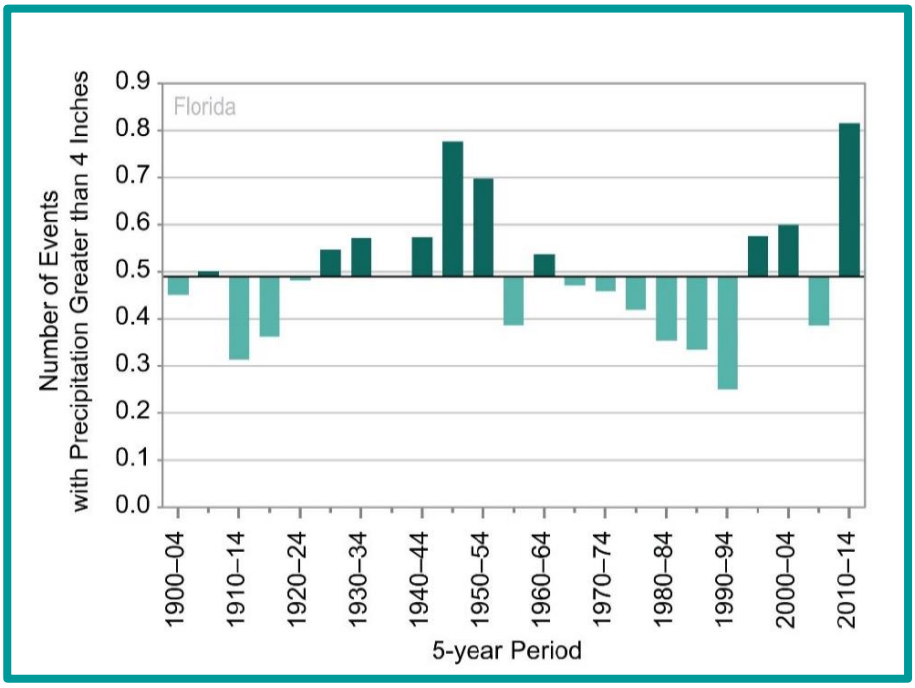
The following chart illustrates the gradual increase in extreme 1-day precipitation events affecting the contiguous United States:



The following chart also illustrates the increasing extremes of tropical activity experienced during the last 20 years. Not only did 2004-2005 bring the most extreme landfalling tropical systems in recorded history, but the ten years following recorded the most profound drop in tropical activity in recorded history.



The chart below, from NOAA's state climate summary for Florida, shows "the observed number of extreme precipitation events (annual number of events with greater than 4 inches divided by the number of long-term stations) for 1950–2014, averaged over 5-year periods; these values are averages from 12 long-term reporting stations. The dark horizontal lines represent the long-term average. Significant variability is observed over the recorded 5-year periods. A record number of such



events occurred during the most recent 5-year period (2010–2014) with an average of about 0.8 events per station per year. "

For most forms of flooding, with the exception of the possible scenarios involving sea level rise and increased rainfall, as noted above, modeling based on historical occurrences of flooding has proven sufficient for proper planning and preparation. While there is no expectation of a major increase in future flood risk beyond those already described, the City is ready and willing to stay abreast of the latest climatological data and respond to new threats as they are discovered. In fact, with improved building codes, diligent growth management, more detailed mapping, a more educated populace, the return of natural and beneficial areas to their original state, advances in water treatment, improvement of storm water quality, more accurate storm predictions and advances in flood proofing techniques, it is possible that the future risk from flooding will be better mitigated and result in less of a problem than is currently the case.

The City of Hallandale Beach is, by geography and climate, exposed to several flood hazards which may cause flood-related damages (problems) within the City. For the benefit of its residents, for the health of the local economy, and for the financial solvency of FEMA and the NFIP, the City of Hallandale Beach is actively identifying flood-related problems within the City, attempting to ascertain causes, mitigating losses and legislating toward a future with minimal flood related damages. From preparing for rising sea levels, to preserving open space, to completing structural capital improvement projects, to educating citizens about the local flood related hazards and problems, the City of Hallandale Beach continues to address the problem of the community's flood hazard and to pursue activities to reduce flood losses.

Identifying the problems is only part of the process. The following sections of this Flood Mitigation Plan will expand upon the progression of steps that include identifying goals, discussing possible solutions, developing an action plan, adopting the plan, implementing improvements and evaluating progress.

Section Seven – Set Goals

Goal 1

Enhance protection of people from the dangers and health hazards caused by flooding.*

Objective 1.1 Ensure that residents are given adequate warning of floods, hurricanes, and storm surges.

Objective 1.2 Reduce the hazardous effects of flooding.

Objective 1.3 Provide appropriate instruction and assistance before, during and after major flooding events.

Goal 2

Enhance the protection of public and private property from flood damage.

Objective 2.1 Prioritize the flood protection of buildings in the following areas:

1. Southwest Quadrant Area
2. Northeast Quadrant Area
3. South Ocean Drive Area

Objective 2.2. Mandate that new development reduces the possibility of flood-related property damage, by requiring the retention and management of stormwater and by enforcing all NFIP regulations.

Objective 2.3. Reduce flood-related problems through strategic planning and implementations.

Goal 3

Contribute to the improvement of the quality of life in Hallandale Beach, by prioritizing the maintenance, restoration, and expansion of natural & beneficial areas.

Objective 3.1. Prioritize the protection of existing natural areas, particularly in the floodplain, by regulation, acquisition and/or restoration.

Objective 3.2. Ensure preservation and restoration of existing open space.

Objective 3.3. Seek expansion or addition of open space.

** Flooding includes inundation of water exacerbated by King Tides and sea level rise.*

Section Eight – Review of Possible Activities

In the process of the developing earlier updates of the Floodplain Management Plan, adopted in 2007 and 2013, the Planning Committee performed a review of possible activities in order to develop an action plan. During this 2021 update of the Floodplain Management Plan, the Committee reviewed the Action Items from the 2013 Floodplain Management Plan Action Plan, as well as additional possible action items. The review process took place during four meetings in June and July of 2021 with final edits being made by email in early July using a shared online document.

Some previous and possible activities were removed from the list because they had been completed, were determined to be too vague, were already required, or were not considered a priority. Other possible activities were either accepted as stated, combined with other activities, revised or removed from the list. Additional action items were proposed at the beginning of each meeting and new ones arose during the meetings as a result of Committee suggestions and group discussion. Many of the new action items pertain to the City's recent effort to prioritize sustainability.

The Committee reviewed possible activities for each of the following categories:

- Preventive measures (including floodplain management regulatory)
- Property protection
- Natural resource protection
- Emergency services
- Structural flood control projects
- Public Information

The following tables summarize the review of the Committee. The table lists the action plan items, states the results of the review and explains why the decision was made. It also identifies the goals and addresses whether or not the ongoing activities are achieving expectations. For each action item that will be included in the Action Plan, possible funding, responsible parties, timeframes, and priority ranking are identified. All excluded items are highlighted pink.

In addition to specific proposed Action Items, the Committee reviewed relevant components of the City's Comprehensive Plan, building codes, zoning ordinances and floodplain regulations. Action items that resulted from this discussion are highlighted yellow in the following tables. The referenced tables can be found on the following pages:

Tables

Action Items Reviewed from 2013 ACTION PLAN

2013 Action Plan Action Items	2013 Ranking	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Acquire more property for parks.	**6**	N/A	• Natural Resource Protection	Incorporated into related action item.	Combined with other action item related to acquisition and preservation of open space.	N/A	N/A	N/A	N/A
Prioritize addressing of flooding issues in repetitive loss areas and implement capital projects to mitigate flooding.	**1**	N/A	• Preventive • Structural Projects • Property Protection	Incorporated into related action item.	Incorporated into new action item that includes the development of a Stormwater Master Plan to determine and prioritize capital improvement priorities.	N/A	N/A	N/A	N/A
Continue to encourage percolation-oriented drainage.	**2**	N/A	• Preventive	Excluded	Still an ongoing policy, but too finite to be include as an action item.	N/A	N/A	N/A	N/A
Implement increased utilization of stormwater injection technology.	**3**	N/A	• Structural Projects • Preventive	Excluded.	Completed. Implemented and incorporated into City practices.	N/A	N/A	N/A	N/A
Install lightning prediction system at all restored City parks.	**23**	N/A	N/A	Excluded	Other Hazard. Not related to flooding.	N/A	N/A	N/A	N/A
Update repetitive loss forms and remove properties from Repetitive Loss List.	**4**	N/A	• Floodplain Management Regulatory	Excluded	Required part of CRS Program Participation. No need to include as an action item.	N/A	N/A	N/A	N/A

2013 Action Plan Action Items	2013 Ranking	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Enhance the City's Community Rating System classification through pursuit of credit under Activity 530 Flood Protection.	**5**	N/A	• Floodplain Management Regulatory • Property Protection	Excluded	Previously pursued and deemed to be unfeasible.	N/A	N/A	N/A	N/A
Enforce responsible redevelopment.	**7**	N/A	• Floodplain Management Regulatory • Property Protection • Preventive	Excluded	Too vague. Covered more specifically by other related action items.	N/A	N/A	N/A	N/A
Continue to enforce the City's Code of Ordinance by conducting inspection of all newspaper rack to ensure compliance with the code.	**21**	N/A	N/A	Excluded	Other Hazard. Not related to flooding.	N/A	N/A	N/A	N/A
Ensure the preservation of City-owned open space in the SFHA (floodplain).	**8**	N/A	• Natural Resource Protection • Floodplain Management Regulatory	Excluded	Open space was mentioned as part of other action items.	N/A	N/A	N/A	N/A
Assure dissemination of location of local hurricane shelters.	**22**	**1** 1.1	• Emergency Services • Public information	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Note/ edits:** Edit to read "Advertise evacuation routes and shelter locations."	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	28

2013 Action Plan Action Items	2013 Ranking	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Maintain strong enforcement of South Florida Water Management District (SFWMD) regulations, especially in times of drought.	**13**	N/A	• Floodplain Management Regulatory • Preventive	Excluded	Already Required. Refers to non-flood hazard as written.	N/A	N/A	N/A	N/A
Modify the existing permit card to include a signature line for contractor/sub-contractor to acknowledge the requirements of securing site, equipment and materials from high wind events.	**20**	N/A	N/A	Excluded	Other Hazard. Not related to flooding.	N/A	N/A	N/A	N/A
Include flood-related information in all Building Division Community Education Forums.	**11**	N/A	• Public Information	Excluded	Part of PPI. Included in action item referencing implementation of PPI.	N/A	N/A	N/A	N/A
Enhance training for Structural Inspectors and Plan Reviewers to include basic training pertaining to the National Flood Insurance Program	**12**		• Floodplain Management Regulatory	Excluded	Current staff are trained. Ongoing training already incorporated into City practices.	N/A	N/A	N/A	N/A

2013 Action Plan Action Items	2013 Ranking	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Ensure that flood-related provisions in the 2010 Florida Building Code are incorporated in the City of Hallandale Beach Code of Ordinances.	**9**	N/A	• Floodplain Management Regulatory	Excluded	Already completed.	N/A	N/A	N/A	N/A
Ensure emergency management plans of condominiums are in place.	**14**	N/A	• Emergency Services	Excluded	Emergency Plans are only required of Critical Facilities. Critical facility plans are covered by another action item.	N/A	N/A	N/A	N/A
Encourage frequent use of Code Red. Encourage citizens to register for Code Red with an active phone number.	**15, 16**	N/A	• Emergency Services • Public information	Excluded	The City is no longer utilizing CodeRed. Use of Everbridge (CodeRed alternative) is already included in other action items and PPI.	N/A	N/A	N/A	N/A
Ensure that City's Public Relations Official continually updates information pertaining to natural disasters, including hurricane and flood warnings.	**17**	N/A	• Emergency Services • Public information	Incorporated into related action item.	Incorporated into related action item with more comprehensive wording.	N/A	N/A	N/A	N/A
Continue to require City staff to follow the City's Comprehensive Emergency Management Plan.	**10**	N/A	• Emergency Services	Excluded.	CEMP adherence is required and understood. No need to include as action item.	N/A	N/A	N/A	N/A

2013 Action Plan Action Items	2013 Ranking	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Continue to maintain the Vulnerable Population Registry.	**19**	**1** 1.1	• Emergency Services	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Note/ edits:** Edit to read "Maintain and update vulnerable population list annually in May before the beginning of hurricane season. Recruit eligible residents to register their request for assistance prior to a disaster."	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	31
Conduct the following emergency management meetings, in addition to the meetings held immediately prior to, during and following a major storm event: a. Briefing at least 2 days prior to event b. Post disaster meeting following the event	**18**	N/A	• Emergency Services	Excluded.	Staff are directed to defer to and follow CEMP during emergency response.	N/A	N/A	N/A	N/A

NEW Possible Action Items Reviewed for Inclusion

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Pursue appropriate grants to enhance Floodplain Management, including one or more of the following: • Floodplain Management Assistance Grant • Hazard Mitigation Grant • Pre-Disaster Mitigation Grant • Repetitive Flood Claims • Severe Repetitive Loss	**2** 2.3	• Preventive	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Note/ edits:** Could add "BRIC Grant"?	Staff time (operating budget)	Director, Public Works Department	Ongoing policy.	15
Review City Code of Ordinances to strengthen maintenance requirements of private stormwater management facilities, including structures controlling flow.	**2** 2.2	• Floodplain Management Regulatory • Preventive	Included with edits.	**Notes/ Edits:** Remove "including structures controlling flow" as that is implied part of stormwater management facilities. Staff must determine feasibility of possible ordinance changes and present proposed changes to governing board.	Staff time (operating budget)	Director, Public Works Department	Ongoing policy.	16
Continue to require new commercial development to incorporate historical drainage patterns in the analysis of the required stormwater storage.	N/A	• Floodplain Management Regulatory • Preventive	Excluded.	Too vague to be actionable. Requirements are governed by regulations.	N/A	N/A	N/A	N/A

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Continue practice of correcting localized drainage problems so that the Level of Service standards are maintained.	**2** 2.1	• Preventive	Included with edits.	**Notes/ Edits:** Edit to read "Continue correcting localized drainage problems, including the following: •The intersection of NW 7th Ave. & NW 3rd Ct. •NW 2nd Avenue (between NW 7th St. & NW 9th St.) •NW 7th Court (between NW 2nd Ave. & NW 3rd Ave) •NW 8th Street (between NW 2nd Terr. & NW 2nd Ave)"	Community Block Development Grants	Director, Public Works Department	September 2022	17
Identify City parks that could be for permanent open space and encourage such designation where possible.	N/A	• Preventive	Excluded	Repetitious and vague. Open space was mentioned as part of other action items.	N/A	N/A	N/A	N/A
Look for areas that can be used for storage of floodwaters, such as public rights of way, parks, ball fields in locations that have flooding problems.	N/A	• Property Protection • Natural Resource Protection • Structural Projects • Preventive	Excluded.	Too vague to be actionable.	N/A	N/A	N/A	N/A

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Encourage the use of flood prone areas as open space.	N/A	• Natural Resource Protection • Preventive	Excluded	Repetitious and vague. Open space is mentioned as part of other action items.	N/A	N/A	N/A	N/A
Require designation of open space property for all major development.	**3** 3.1, 3.3	• Floodplain Management Regulatory • Natural Resource Protection • Preventive	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Note/ edits:** Edit to read "Continue requiring open space standards for all development as specified by City ordinances. Requirement varies by development type and size but is required at some level for every type of development."	Staff time (operating budget)	Director, Development Services Department	Ongoing policy.	18
Encourage developing provisions for stormwater design management practices in low-impact development.	**2** 2.3	• Preventive • Floodplain Management Regulatory	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Note/ edits:** Edit to read "Continue developing provisions that require or encourage low impact development."	Staff time (operating budget)	Director, Development Services Department	Ongoing policy.	19

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
As part of the City's NPDES program, continue sediment control to prevent clogged drainage systems such as street sweeping, curb and gutter cleaning and planting vegetation on bare ground.	N/A	• Preventive	Excluded	NPDES standards are already enforced and are outside the control of City staff. No need to include as an action item.	N/A	N/A	N/A	N/A
Maintain the City's strong regulatory flood prevention standards.	**1** 1.2	• Preventive • Floodplain Management Regulatory	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Note/ edits:** Edit to read "Maintain the City's regulatory flood prevention standards. The Building Official/ Floodplain Administrator will be responsible for identifying any proposed ordinance that could weaken the City's standards and will coordinate with other City staff and follow up as needed to assure the standards are not weakened."	Staff time (operating budget)	Building Official, Development Services Department	Ongoing policy	3

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Continue to require that installation of stormwater management facilities made necessary by new development is the responsibility of the developer.	**2** 2.2	• Preventive • Floodplain Management Regulatory	Included.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Director, Development Services Department	Ongoing policy	9
Collaborate with Florida Communities' Trust to assist with funds in acquiring properties in the SFHA.	**2** 2.3 **3** 3.3	• Property Protection	Included as worded.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Director, Development Services Department	Ongoing policy	12
Encourage all property owners to purchase flood insurance.	**1** 1.2	• Property Protection • Public Information	Included as worded.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	CRS Coordinator, Public Works Department	Ongoing policy	13

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Consider the relocation, mitigation or replacement of infrastructure currently present within the Coastal High Hazard Area (and soon to be designated Priority Planning Areas and Adaptation Action Areas), where state funding is anticipated to be needed, as identified in the Broward County Enhanced Local Mitigation Strategy Priority Project List.	**2** 2.3	• Preventive • Floodplain Management Regulatory	Included with edits.	**Note/ edits:** Edit to read "Consider the relocation, mitigation or replacement of infrastructure currently present within the Coastal High Hazard Area, including Coastal A zones (and soon to be designated Priority Planning Areas and Adaptation Action Areas), where state funding is anticipated to be needed, as identified in the Broward County Enhanced Local Mitigation Strategy Priority Project List."	State funding, as identified in the *Broward County Enhanced Local Mitigation Strategy* Priority Project List	Director, Public Works Department	Within six months following designation of Priority Planning Areas and Adaptation Action Areas.	5
Collaborate with the Southeast Florida Regional Climate Change Compact as they make recommendations for land development standards with respect to low-lying coastal areas and Adaptation Action areas.	**3** 3.1	• Preventive • Floodplain Management Regulatory	Included.	Already Being Done. Will Continue this important collaboration. Achieving Results As expected.	Staff time (operating budget)	Sustainability & Resiliency Officer	Ongoing policy	6

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Maintain the City's practice of denying development permits for projects that do not meet the design criteria for correcting existing deficiencies, or do not meet future drainage requirement.	**2** 2.2	• Preventive • Floodplain Management Regulatory	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Note/ edits:** Edit to read "Maintain the City's practice of denying development permits for projects that do not meet the design criteria for correcting existing drainage deficiencies, or do not meet future drainage requirements."	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	7
Incorporate into the City's review process for infrastructure planning an assessment of the appropriateness of public capital improvements in coastal high hazard areas as identified in the Coastal Management Element of the Comprehensive Plan.	**2** 2.3	• Preventive • Floodplain Management Regulatory	Included as worded.	Included as worded. Strengthening of current policy.	Staff time (operating budget)	Director, Development Services Department	Ongoing policy	8
Continue the City's policy of encouraging designation, protection and maintenance of wetlands, mangroves and environmental sensitive lands.	**3** 3.1, 3.3	• Natural Resource Protection	Included as worded.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Sustainability & Resiliency Officer	Ongoing policy	21

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Implement strict enforcement of best management practices for reducing erosion during development activity.	**2** 2.3	• Natural Resource Protection	Included as worded.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Director, Development Services Department	Ongoing Policy	23
Research the benefits of including base flood finished floor elevations on Certificates of Occupancy. Implement within one year if deemed beneficial.	**2** 2.3	• Floodplain Management Regulatory • Property Protection	Included with edits.	**Note/ edits:** Edit to read "Research the benefits of including base flood and finished floor elevations on Certificates of Occupancy utilizing Broward County's new future flood maps to determine finished floor elevations for new construction to account for sea level rise and future flooding."	Staff time (operating budget)	Director, Development Services Department	Sep. 2022	10
Include notification of grants, loans and service availability on all appropriate City media publications, seminars and websites that addressed Floodplain Management.	**1** 1.3	• Property Protection • Public Information	Included as worded.	New policy.	Staff time (operating budget)	CRS Coordinator, Public Works Department	Will be ongoing policy.	11

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Encourage flood proofing techniques in order to preserve and revitalize neighborhoods by considering the following forms of retrofitting for areas or buildings with major flooding issues: • Elevation of structures by piers, posts and columns, and pilings • Elevation of the lowest floor above the Florida Building Code elevation requirements • Wet flood proofing (allowing water to enter uninhabited areas of the structure) • Dry flood proofing (sealing the structure to prevent floodwaters from entering) • Installation of flood walls (constructing a barrier around the structure to keep out floodwaters) • Demolition (tearing down the structure and rebuilding with appropriate flood proof techniques or relocating the structure) • Elevation of the main breaker or fuse box and other critical appliances • Installation of flood resistant landscaping	**2** 2.3	• Property Protection	Included as worded.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Building Official, Development Services Department	Ongoing policy	14

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Pursue dune restoration programs.	**3** 3.1, 3.2	• Natural Resource Protection	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Notes/ Edits:** Edit to add clarity and context "Continue to pursue dune and coral reef restoration programs in order to maintain and enhance the natural buffers which help protect the city from coastal flooding and storm surge."	Staff time (operating budget)	Sustainability & Resiliency Officer	Ongoing policy	20
Ensure that citizens know how to contact FEMA post-flood.	**1** 1.3	• Public Information	Included as worded.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	36
Based on availability and prioritized needs, provide knowledgeable staff to assist citizens before, during and after a flood event to help them understand their repair/ rebuilding/ flooding/ mitigation options.	**1** 1.3	• Public Information	Included as worded.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Building Official, Development Services Department	Ongoing policy	37

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Identify privately-owned and public natural and beneficial areas in the City and consider expansion of the City's properties that are designated natural and beneficial areas.	**3** 3.2, 3.3	• Natural Resource Protection	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Notes/ Edits:** Edit to provide clarity and context "Identify privately-owned and public natural and beneficial areas in the City and consider expansion of the City's properties that are designated natural and beneficial areas which provide enhanced drainage capacity, recharge the aquifer, and help provide natural habitats and other ecosystem services for residents."	Staff time (operating budget)	Director, Development Services Department	Ongoing Policy	22
Explore funding opportunities to retrofit critical facilities to be more flood and wind resistant.	**2** 2.3	• Emergency Services	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Notes/Edits:** Reword to emphasize that this is a continuation of an ongoing policy. "Continue exploring…"	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	30

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Immediately prior to, during and after a hurricane or flood event, post pertinent information concerning major points of interest, such as bridge and road closures, evacuation orders, emergency shelter locations and electrical outages, utilizing the following media: • City website • Email advertisements • Television Government Access Channel • Electronic message boards • Code Red telephone system • e-breaking news • Public Service Announcements through local media • Brochure handouts at PODs • Department of Health Emergency Health Inoculations	**1** 1.1	• Emergency Services • Public Information	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Notes/Edits:** Replace "• Code Red telephone system • e-breaking news" with "• Social media posts • Everbridge telephone contact system"	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	26
Integrate response to flooded homes with appropriate response organizations (Red Cross, faith-based organizations, other non-profit entities, CERT etc.)	**1** 1.3	• Emergency Services • Public Information	Included as worded.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	27

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Identify all critical facilities located within SFHAs and make contingency plans for each, in the event of flooding.	**1** 1.2	• Emergency Services	Included with edits.	**Notes/Edits:** Add "…including nursing homes and smaller (Type 1) home centers,…Confirm that all critical facilities have an up-to-date emergency plan that has been submitted annually to the State."	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	29
Annually update the list of nursing homes and smaller home centers (Type 1 group homes) in the City and the priority list of critical facilities. Confirm that all nursing homes have an emergency plan.	N/A	• Emergency Services	Incorporated into action item above.	Repetitious. Incorporated into action item above.	N/A	N/A	N/A	N/A
Implement the following project listed in the Broward County Enhanced LMS Project List (2017): • Replace Lift Station and install improved generator built to account for sea-level rise.	**2** 2.3	• Structural Projects	Included as worded.	Already underway. Anticipated wet well installation date – July 21, 2021; Generator to be shipped by end of July 2021; Anticipated Completion – February 1, 2022	City capital funds	Director, Public Works Department	March 2022	34
Develop and implement a swale maintenance program.	**2** 2.3	• Structural Projects	Included with edits.	**Notes/Edits:** Edit to read "Investigate feasibility of developing a swale maintenance program"	Staff time (operating budget)	Director, Public Works Department	September 2022	35

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Monitor conditions in the two problem areas [define areas] that have recently undergone extensive capital improvement and drainage improvement projects. After assessing outcomes, determine if additional capital improvement projects are needed, or if completed projects are achieving satisfactory results.	**2** 2.1	• Structural Projects	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected. **Notes/Edits:** Add description of two problem areas "• NE quadrant • SW quadrant"	Staff time (operating budget)	Director, Public Works Department	September 2021	33
Educate residents on the care and proper use of swales.	**2** 2.3	• Public Information	Included with edits.	**Notes/Edits:** Add additional sentence for clarity and context "Undertake public outreach efforts to educate residents on benefits of swale maintenance and negative consequences of poor swale conditions."	Staff time (operating budget)	Director of Utilities, Public Works Department	Ongoing policy	44
Assure annual distribution of Broward County Hurricane Survival Guide in multiple languages. Post the Broward County Hurricane Survival Guide on the City website in a location that is easily accessed by the community.	**1** 1.3	• Public Information	Included. Both were combined as one action item.	**Note/ edits:** Edit to read "Assure online access to *Broward County Hurricane Survival Guide* in multiple languages by posting the Broward County Hurricane Survival Guide on the City website in a location that is easily accessed by the community"	Staff time (operating budget)	Director, Public Works Department	Ongoing policy	38

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Implement the City's Program for Public Information, including Flood Insurance Promotion.	**1** 1.3	• Public Information	Included as worded.	PPI implementation will guide Public information efforts	Staff time (operating budget)	CRS Coordinator, Public Works Department	Ongoing policy	39
Develop early warning systems and social media applications to both inform residents and visitors of extreme high-tied events and raise overall awareness of sea level rise and climate change issues. Also consider roadway signage for tidal flooding zones.	**1** 1.1, 1.2	• Public Information	Included as worded.	Will help residents and visitors prepare for current and future flood conditions.	Staff time (operating budget)	Sustainability & Resiliency Officer	September 2022	40
Initiate a regional public education campaign to educate residents, business owners, policymakers on the merits of preserving open land as an "insurance policy" for adaptation to sea level rise in South Florida.	**3** 3.2	• Public Information	Included with edits.	**Note/ edits:** Eliminated the word "regional" because regional and State efforts are already underway independent of City efforts and "regional" is too wide of a scope to implement effectively	Staff time (operating budget)	Sustainability & Resiliency Officer	Ongoing policy	41

NEW Action Items Resulting from Meeting Discussion

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Revise City ordinance to bring in line with CRS Class 8 prerequisites for residential freeboard to include a freeboard requirement for manufactured homes.	**2** 2.3	• Floodplain Management Regulatory • Property Protection	Included.	Suggested and accepted by committee members during meeting.	Staff time (operating budget)	CRS Coordinator, Public Works Department	December 2021	1
Undertake a public information campaign to educate residents and buyers about City SI/SD ordinances	**2** 2.3	• Public Information	Included.	Suggested and accepted by committee members during meeting.	Staff time (operating budget)	Building Official, Development Services Department	September 2022	42
Revise City ordinance to enhance freeboard requirements for commercial property and critical facilities.	**2** 2.3	• Floodplain Management Regulatory • Property Protection	Included.	Suggested and accepted by committee members during meeting.	Staff time (operating budget)	Building Official, Development Services Department	December 2021	2
Consider determination of a standard timeframe for cumulative substantial improvement and development of an SOP for assuring its ongoing implementation.	**2** 2.3	• Floodplain Management Regulatory	Included.	Suggested and accepted by committee members during meeting.	Staff time (operating budget)	Building Official, Development Services Department	December 2022	4

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Develop a Stormwater Master Plan for the City that will identify, prioritize, and recommend funding for stormwater capital improvements.	**2** 2.3	• Structural Projects • Preventive	Included.	Having a SWMP will help identify, prioritize, and secure funding for stormwater capital improvements.	City capital funds	Director, Public Works Department	September 2023	32
Prioritize climate change adaptation and mitigation, including the City's participation in the Southeast Florida Regional Climate Change Compact by: • exchanging data & knowledge • participating in planning and implementation of regional action items • leveraging collaborative Compact efforts	**2** 2.3	• Natural Resource Protection • Preventive	Included.	Suggested and accepted by committee members during meeting.	Staff time (operating budget)	Sustainability & Resiliency Officer	Ongoing policy	24
Continue implementation of Vulnerability Assessment and Adaptation Action Plan which includes: - Flood Hazard Mapping with best available data, - Flood Vulnerability and Loss Assessment, - Flood Exposure Assessment, - Flood Economic Loss Assessment, - Future Precipitation Analysis,	**2** 2.3	• Floodplain Management Regulatory • Property Protection • Natural Resource Protection • Preventive	Included.	This Plan was developed in 2020 and implementation is critical to preparing for and adapting to future flood conditions.	Staff time (operating budget)	Sustainability & Resiliency Officer	Ongoing policy	25

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
- Qualitative Assessment of Groundwater Changes, - Projected changes in shoreline, - Strategy development and a cost benefit analysis.								
Require realtors to provide written notification (to be signed by home buyers) about sea wall height requirements and sea level rise and other flood hazards.	**2** 2.3	• Preventive • Property Protection • Public Information	Included	Suggested and accepted by committee members during meeting.	Staff time (operating budget)	Sustainability & Resiliency Officer	December 2022	43

NEW Action Items related to Post Disaster Planning

Proposed Action Items	Goal/ Objective	Category	Determination	Reason for Determination	Possible Funding	Responsible Party	Timeframe	2021 Ranking
Maintain and update the City's 2020 Post-Disaster Redevelopment Plan by: • Integrating key long-term recovery roles and responsibilities into job descriptions. • Requiring review of this plan as part of the process of onboarding new employees. • Providing a copy of this plan to current key staff. • Offering an annual training on long-term recovery. • Appointing Disaster Recovery Team Coordinators at the start of hurricane season each year. • Reviewing plan annually and updating plan to reflect program evolution as needed.	**2** 2.3	• Preventive	Included with edits.	Already Being Done. Will Continue. Achieving Results As expected.	Staff time (operating budget)	Sustainability & Resiliency Officer	Will be ongoing policy	45

Section Nine – Action Plan

The Floodplain Management Plan Committee reviewed numerous flood mitigation activities in Section 8 that could prevent or reduce the severity of the problems described in the hazard assessment of Sections 5 and the problem assessment of Section 6. Based upon the activities review documented in Section 8, the Action Items listed and described below were recommended and prioritized by the Committee.

These Action Items incorporate the following six categories of activities reviewed:

- ✓ Preventive measures
- ✓ Property protection
- ✓ Natural resource protection
- ✓ Emergency services
- ✓ Structural flood control projects
- ✓ Public information

Prioritized Action Items

1. Revise City ordinance to bring in line with CRS Class 8 prerequisites for residential freeboard to include a freeboard requirement for manufactured homes.

Responsible Office: CRS Coordinator, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: December 2021

2. Revise City ordinance to enhance freeboard requirements for commercial property and critical facilities.

Responsible Office: Building Official, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: December 2021

3. Maintain the City's regulatory flood prevention standards. The building Official/ Floodplain Administrator will be responsible for identifying any proposed ordinance that could weaken the City's standards and will coordinate with other City staff and follow up as needed to assure the standards are not weakened.

Responsible Office: Building Official, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This will be an ongoing policy.

4. Consider determination of a standard timeframe for cumulative substantial improvement and development of an SOP for assuring its ongoing implementation.

Responsible Office: Building Official, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: December 2022.

5. Consider the relocation, mitigation or replacement of infrastructure currently present within the Coastal High Hazard Area, including Coastal A zones (and soon to be designated Priority Planning Areas and Adaptation Action Areas), where state funding is anticipated to be needed, as identified in the *Broward County Enhanced Local Mitigation Strategy* Priority Project List.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: State funding, as identified in the *Broward County Enhanced Local Mitigation Strategy* Priority Project List.

Timeframe: Within six months following designation of Priority Planning Areas and Adaptation Action Areas.

6. Collaborate with the Southeast Florida Regional Climate Change Compact as it makes recommendations for land development standards with respect to low-lying coastal areas and Adaptation Action areas.

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This will be an ongoing policy.

7. Maintain the City's practice of denying development permits for projects that do not meet the design criteria for correcting existing drainage deficiencies, or do not meet future drainage requirements.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

8. Incorporate into the City's review process for infrastructure planning an assessment of the appropriateness of public capital improvements in coastal high hazard areas as identified in the Coastal Management Element of the Comprehensive Plan.

   Responsible Office: Director, Development Services Department, City of Hallandale Beach

   Possible Funding: Staff time (operating budget)

   Timeframe: This is an ongoing policy, and the City will continue its current approach.

9. Continue to require that installation of stormwater management facilities made necessary by new development is the responsibility of the developer.

   Responsible Office: Director, Development Services Department, City of Hallandale Beach

   Possible Funding: Staff time (operating budget)

   Timeframe: This is an ongoing policy, and the City will continue its current approach.

10. Research the benefits of including base flood and finished floor elevations on Certificates of Occupancy utilizing Broward County's new future flood maps to determine finished floor elevations for new construction to account for sea level rise and future flooding.

    Responsible Office: Director, Development Services Department, City of Hallandale Beach

    Possible Funding: Staff time (operating budget)

    Timeframe: September 2022

11. Include notification of grants, loans and service availability on all appropriate City media publications, seminars and websites that addressed flood mitigation.

    Responsible Office: CRS Coordinator, Public Works Department, City of Hallandale Beach

    Possible Funding: Staff time (operating budget)

    Timeframe: This will be an ongoing policy.

12. Collaborate with Florida Communities' Trust to assist with funds in acquiring properties in the SFHA.

    Responsible Office: Director, Development Services Department, City of Hallandale Beach

    Possible Funding: Staff time (operating budget)

    Timeframe: This is an ongoing policy, and the City will continue its current approach.

13. Encourage all property owners to purchase flood insurance.

    Responsible Office: CRS Coordinator, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

14. Encourage flood proofing techniques in order to preserve and revitalize neighborhoods by considering the following forms of retrofitting for areas or buildings with major flooding issues:

- Elevation of structures by piers, posts and columns, and pilings
- Elevation of the lowest floor above the Florida Building Code elevation requirements
- Wet flood proofing (allowing water to enter uninhabited areas of the structure)
- Dry flood proofing (sealing the structure to prevent floodwaters from entering)
- Installation of flood walls (constructing a barrier around the structure to keep out floodwaters)
- Demolition (tearing down the structure and rebuilding with appropriate flood proof techniques or relocating the structure)
- Elevation of the main breaker or fuse box and other critical appliances
- Installation of flood resistant landscaping

Responsible Office: Building Official, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

15. Continue pursuing appropriate grants to enhance flood mitigation, including one or more of the following:

- Flood Mitigation Assistance Grant
- Hazard Mitigation Grant
- Pre-Disaster Mitigation Grant
- Repetitive Flood Claims
- BRIC Grants

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

16. Review City Code of Ordinances to assure sufficient strength of maintenance requirements for private stormwater management facilities.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

17. Continue correcting localized drainage problems, including the following:

- The intersection of NW 7th Avenue and NW 3rd Court
- NW 2nd Avenue (between NW 7th Street and NW 9th Street)
- NW 7th Court (between NW 2nd Avenue and NW 3rd Avenue)
- NW 8th Street (between NW 2nd Terrace and NW 2nd Avenue)

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Community Block Development Grants

Timeframe: September 2022

18. Continue requiring open space standards for all development as specified by City ordinances. Requirement varies by development type and size but is required at some level for every type of development.

Responsible Office: Director, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

19. Continue developing provisions that require or encourage low impact development.

Responsible Office: Director, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: September 2022

20. Continue to pursue dune and coral reef restoration programs in order to maintain and enhance the natural buffers which help protect the city from coastal flooding and storm surge.

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

21. Continue the City's policy of encouraging designation, protection and maintenance of wetlands, mangroves and environmentally sensitive lands.

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

22. Identify privately-owned and public natural and beneficial areas in the City and consider expansion of the City's properties that are designated natural and beneficial areas which

provide enhanced drainage capacity, recharge the aquifer, and help provide natural habitats and other ecosystem services for residents.

Responsible Office: Director, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

23. Implement strict enforcement of best management practices for reducing erosion during development activity.

Responsible Office: Director, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

24. Prioritize climate change adaptation and mitigation, including the City's participation in the Southeast Florida Regional Climate Change Compact by:

- exchanging data & knowledge
- participating in planning and implementation of regional action items
- leveraging collaborative Compact efforts

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

25. Continue implementation of Vulnerability Assessment and Adaptation Action Plan which includes:

- Flood Hazard Mapping with best available data,
- Flood Vulnerability and Loss Assessment,
- Flood Exposure Assessment,
- Flood Economic Loss Assessment,
- Future Precipitation Analysis,
- Qualitative Assessment of Groundwater Changes,
- Projected changes in shoreline,
- Strategy development and a cost benefit analysis.

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

26. Immediately prior to, during and after a hurricane or flood event, post pertinent information concerning major points of interest, such as bridge and road closures, evacuation orders, emergency shelter locations and electrical outages, utilizing the following media:

- City website
- Email notifications
- Television Government Access Channel
- Electronic message boards
- Social media posts
- Everbridge telephone contact system
- Public Service Announcements through local media
- Brochure handouts at Points of Distributions (PODs)
- Department of Health Emergency Health Inoculations

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

27. Integrate response to flooded homes with appropriate response organizations (County, State, Red Cross, faith-based organizations, other non-profit entities, CERT etc.)

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

28. Advertise evacuation routes and shelter locations

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

29. Identify all critical facilities, including nursing homes and smaller (Type 1) home centers, located within SFHAs and make contingency plans for each, in the event of flooding. Confirm that all critical facilities have an up-to-date emergency plan that has been submitted annually to the State.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

30. Continue exploring funding opportunities to retrofit critical facilities to be more flood and wind resistant.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

31. Maintain and update vulnerable population list annually in May before the beginning of hurricane season. Recruit eligible residents to register their request for assistance prior to a disaster.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

32. Develop a Stormwater Master Plan for the City that will identify, prioritize, and recommend funding for stormwater capital improvements.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: City capital funds

Timeframe: September 2023

33. Continue to monitor conditions in the two problem areas that have recently undergone extensive capital improvement and drainage improvement projects. After assessing outcomes, determine if additional capital improvement projects are needed, or if completed projects are achieving satisfactory results. Incorporate observations into Stormwater Master Planning.

- NE quadrant
- SW quadrant

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: September 2021

34. Implement the following project listed in the Broward County Enhanced LMS Project List (2017):

- Replace Lift Station and install improved generator built to account for sea-level rise.

Responsible Office: Director of Utilities, Public Works Department, City of Hallandale Beach

Possible Funding: City capital funds

Timeframe: March 2022. Anticipated wet well installation date – July 21, 2021; Generator to be shipped by end of July 2021; Anticipated Construction Completion – February 1, 2022

35. Investigate feasibility of developing a swale maintenance program.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: September 2022

36. Ensure that citizens know how to contact FEMA post-flood.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

37. Based on availability and prioritized needs, provide knowledgeable staff to assist citizens before, during and after a flood event to help them understand their repair/rebuilding/flooding/mitigation options.

Responsible Office: Building Official, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

38. Assure annual distribution of *Broward County Hurricane Survival Guide* in multiple languages by posting the *Broward County Hurricane Survival Guide* on the City website in a location that is easily accessed by the community.

Responsible Office: Director, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

39. Implement the City's Program for Public Information (PPI), including Flood Insurance Promotion.

Responsible Office: CRS Coordinator, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

40. Develop early warning systems and social media applications to both inform residents and visitors of extreme high-tide events and raise overall awareness of sea level rise and climate change issues. Also consider roadway signage for tidal flooding zones.

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: September 2022

41. Initiate a public education campaign to educate residents, business owners, and policymakers on the merits of preserving open land as an "insurance policy" for adaptation to sea level rise in South Florida.

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: September 2022.

42. Undertake a public information campaign to educate residents and buyers about City SI/SD ordinances.

Responsible Office: Building Official, Development Services Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: September 2022

43. Require realtors to provide written notification (to be signed by home buyers) about sea wall height requirements and sea level rise and other flood hazards.

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: December 2022

44. Educate residents on the care and proper use of swales. Undertake public outreach efforts to educate residents on benefits of swale maintenance and negative consequences of poor swale conditions.

Responsible Office: Director of Utilities, Public Works Department, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This is an ongoing policy, and the City will continue its current approach.

Post Disaster Planning

45. Maintain and update the City's recently completed *2020 Post-Disaster Redevelopment Plan* by:

- Integrating key long-term recovery roles and responsibilities into job descriptions
- Requiring review of this plan as part of the process of onboarding new employees
- Providing a copy of this plan to current key staff
- Offering an annual training on long-term recovery
- Appointing Disaster Recovery Team Coordinators at the start of hurricane season each year
- Reviewing plan annually and updating plan to reflect program evolution as needed

Responsible Office: Sustainability & Resiliency Officer, City of Hallandale Beach

Possible Funding: Staff time (operating budget)

Timeframe: This will be an ongoing policy, and the City will continue its current approach.

Section Ten – Implement, Evaluate & Revise

As implementation of the *City of Hallandale Beach Floodplain Management Plan* proceeds, it is important that it be periodically evaluated and updated. Not only does this assure that the plan remains current and relevant, but it also assures the implementation of the Action Plan. To ensure that there is a continuing and responsive planning process, the following procedures are included in the *City of Hallandale Beach Floodplain Management Plan* (FMP):

Quarterly Meetings & Annual Evaluation

The Floodplain Management Plan Committee responsible for the development of this plan, or a successor committee similar in membership that is created to replace the original committee, shall meet quarterly to review the progress of the plan. The Committee will complete an annual evaluation. Because the Committee is composed of both staff members as well as community stakeholders, the quarterly reviews and annual evaluation will include community input. The meetings will typically take place in March, June, September, and December, with the annual review taking place during the September meeting. The documentation of these meetings, including advertisements inviting the public, minutes, and sign-in sheets will be collected by the Committee Chair for submission to the CRS program. The FMP Committee Chair is responsible for overseeing and monitoring implementation of the Plan and may call meetings or contact members more often as necessary.

Prior to the annual meeting, the Committee Chair is responsible to prepare a draft FMP Evaluation Report (progress report) that will be presented at the meeting. The Committee will review and discuss the report, after which it may be revised before the Committee approves it. The report shall include:

- ✓ How the reader can obtain a copy of the original plan.
- ✓ A description of how the evaluation report was prepared and how it will be submitted to the Commission, released to the media, and made available to the public.
- ✓ A review of each action item in the action plan, including a statement on how much was accomplished during the previous year, or why implementation is behind schedule.
- ✓ A discussion of why any objectives were not reached or why implementation is behind schedule.
- ✓ Recommendations for new projects or revised action items. Such recommendations shall be subject to approval by the City Commission as amendments to the adopted plan.

Following approval of the annual FMP Evaluation Report by the committee, it will be submitted to the City Commission, released to the media, and made available to the public. The CRS Coordinator must submit a copy of the annual evaluation report with the City's CRS recertification by May 1st of each year.

The Committee Chair will assure that the Floodplain Management Plan Committee continues to be comprised of high-level staff that will likely be responsible for implementing the plan, and at a minimum, an equal number of members of the public, i.e., stakeholders.

Five-Year Update

An update to the FMP must be prepared every five years. This time frame may be extended in accordance with ISO/CRS guidelines. As with the annual evaluations, the Committee chairperson will be responsible to conduct the five-year update. The process for the update will commence no less than 12 months prior to the five-year anniversary date. The Committee chairperson will have the descriptive elements of the plan updated in accordance with current information, studies, etc. Following the preliminary approval by the Committee, the Plan update will be presented to the community for its input and the Action Plan will be sent by email to stakeholders and appropriate agencies both within the community and outside the community.

The 5-year update must include the following steps:

- ✓ The Update must include a review of new studies, reports and technical information and of the community's needs, goals and plans for the City that have been published since the plan was originally prepared.
- ✓ The hazard and problem assessments must be reviewed and brought up to date. The assessments must account for:
  - New floodplain or hazard mapping
  - Annexation of flood prone areas
  - Additional repetitive loss properties
  - Increased development in the floodplain or watershed
  - New flood control projects
  - Evaluation of maintenance of flood control projects
  - Major floods or other disasters that occurred since the plan was adopted
  - Any other change in flooding conditions and/or development exposed to flooding
- ✓ The original plan's goals must be reviewed to determine if they are still appropriate.
- ✓ The Action Plan must be revised to account for items that have been completed, dropped, or changed.
- ✓ The Update must be adopted by the City Commission.

Integration into Other Plans and Documents

The Floodplain Management Plan Committee Chair and CRS Coordinator will interface with appropriate governmental and nongovernmental agencies and offices to ensure that the Floodplain Management goals, objectives, and priorities are consistent with and cross-referenced with those articulated in other existing plans, such as the *City of Hallandale Beach Comprehensive Plan*, the C*omprehensive Emergency Management Plan*, the *Broward County Enhanced Local Mitigation Strategy*, and the City's *Capital Improvement Plan*.

In addition, the Committee Chairperson will seek opportunities, including in the committee meetings and staff meetings, to communicate the importance of:

- ✓ updating plans, policies, regulations and other directives to include flood hazard mitigation priorities
- ✓ encouraging the adoption of mitigation priorities within capital and operational budgets and grant applications
- ✓ sharing information on grant funding opportunities
- ✓ offering guidance for carrying out mitigation actions
- ✓ exploring opportunities for collaborative mitigation projects and initiatives among City departments.

Section Eleven – Adoption of the Plan

The City of Hallandale Beach City Commission adopted the *City of Hallandale Beach Floodplain Management Plan Update 2021* on _____ renewing its dedication to the safety and well-being of the citizens and businesses of Hallandale Beach. Exhibit 5 includes a copy of the resolution to adopt the Plan.