EXHIBIT "A"

Floodplain Mitigation Plan

Town of Cutler Bay, FL

FEMA

SERT

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EXECUTIVE SUMMARY

The purpose of this Floodplain Mitigation Plan is to reduce or eliminate risk to people and property from flood hazards. Every community faces different hazards and every community has different resources to draw upon in combating problems along with different interests that influence the solutions to those problems. Because there are many ways to deal with flood hazards and many agencies that can help, there is no one solution for managing or mitigating their effects. Planning is one of the best ways to develop a customized program that will mitigate the impacts of flood hazards while taking into account the unique character of a community. The plan provides a framework for all interested parties to work together and reach consensus on how to move forward. A well prepared flood mitigation plan will ensure that all possible activities are reviewed and implemented so that the problem is addressed by the most appropriate and efficient solutions. It can also ensure that activities are coordinated with each other and with other goals and activities, preventing conflicts and reducing the costs of implementing each individual activity.

The Town of Cutler Bay (Town) followed the planning process prescribed by the Federal Emergency Management Agency (FEMA), and this plan was developed under the guidance of a Floodplain Mitigation Planning Committee (FMPC) comprised of representatives of Cutler Bay Departments, citizens and other stakeholders. The FMPC conducted a risk assessment that identified and profiled flood hazards that pose a risk to the Town, assessed the Town's vulnerability to these hazards, and examined the capabilities in place to mitigate them. The flood hazards profiled in this plan include:

- Climate Change and Sea Level Rise
- Coastal/Canal Bank Erosion
- Dam/Levee Failure
- Flood: 100/500 year
- Flood: Stormwater/ Localized Flooding
- Hurricane and Tropical Storms (including Storm Surge)

This plan identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by floods. Based on the risk assessment developed for each of the flood hazards identified above, the FMPC identified goals and objectives for reducing the Town's vulnerability to the hazards. The goals and objectives are summarized as follows:

Goal 1 – Protect the health, safety and welfare of the citizens of Cutler Bay from the effects of flooding

- Objective 1.1: Reduce flood damage to insurable buildings and public infrastructure through stormwater improvement projects
- Objective 1.2: Preserve open space areas, especially where there are sensitive natural areas
- Objective 1.3: Promote higher development and design standards to protect new buildings from flood damage

Goal 2 – Promote a public education program to encourage residents to undertake mitigation measures that reduce the effects of flood damage on private property

- Objective 2.1: Encourage residents to assume an appropriate level of responsibility for their own flood protection

- Objective 2.2: Promote flood insurance as a property protection measure against potential flood damage

- Objective 2.3: Develop a public education program for the local schools

Goal 3 – Protect critical and essential facilities from flood damage

- Objective 3.1: Seek county, state and federal support for mitigation projects

- Objective 3.2: Prioritize critical and essential facilities in need of protection from potential flood damage

Goal 4 – Reduce the number of repetitively flooded structures

- Objective 4.1: Leverage local, state and federal grant funding to facilitate mitigation actions such as elevation, acquisition, or floodproofing

- Objective 4.2: Target repetitive loss properties for implementation of mitigation projects

In order to meet the identified goals, this plan recommends 17 mitigation actions, which are summarized in the table that follows.

This plan has been formally adopted by the Town and will be updated every five years at a minimum.

Summary of Cutler Bay Mitigation Actions					
Action	**Related to Goal**	**Address Current Development**	**Address Future Development**	**Continued Compliance with NFIP**	**Mitigation Category**
Identify segments of canals where erosion is causing banks to collapse and prepare a prioritized list for improvements	1 & 4	Y	Y	N	Property Protection and Natural Resource Protection
Cleanout all storm drains on a bi-annual basis	1, 3 & 4	Y	Y	Y	Preventative and Property Protection
Improve drainage along the C-100 canal through a dredging project	1, 3 & 4	Y	Y	Y	Preventative, Property Protection and Structural Projects
Improve drainage in the Saga Bay sub basin through upgraded stormwater piping	1 & 4	Y	Y	Y	Preventative, Property Protection, and Structural Projects
Implement program to identify all catch basins located on private streets in gated communities	1 & 4	Y	N	N	Preventative
Continue implementation of drainage system maintenance on all surface water channels, canals and ditches	1, 3 & 4	Y	Y	Y	Preventative and Property Protection
Improve drainage along SW 212th Street with construction of a new outfall	1, 3 & 4	Y	Y	Y	Preventative, Property Protection, and Structural Projects
Promote an Enviro-Scape model to elementary school students	2	N	N	N	Public Information and Outreach
Work with local, state and federal partners to target repetitive loss properties for acquisition or elevation	2 & 4	Y	N	Y	Property Protection
Promote retrofitting techniques for floodproofing of residential structures	2 & 4	Y	N	Y	Property Protection
Revise local codes to require landscapers to obtain licenses	1 & 2	Y	Y	N	Preventative and Public Information and Outreach
Work with the Miami-Dade Association of Realtors to require flood zones to be included in a MLS	1 & 2	Y	Y	N	Public Information and Outreach

Summary of Cutler Bay Mitigation Actions					
Action	**Related to Goal**	**Address Current Development**	**Address Future Development**	**Continued Compliance with NFIP**	**Mitigation Category**
Promote the purchase of flood insurance to residents and businesses	1, 2 & 3	Y	Y	Y	Property Protection and Public Information and Outreach
Protect the natural floodplain functions within the Town including the Cutler Wetlands	1, 2, 4	Y	Y	Y	Natural Resource Protection
Increase awareness of the flood hazard through development of a Program for Public Information PPI	1 and 2	Y	N	Y	Public Information and Outreach
Work with Miami-Dade County Emergency Management on identifying vulnerable populations for evacuations	1 and 2	Y	N	N	Emergency Services and Public Information and Outreach
Work with Miami-Dade County Emergency Management, state and federal governments, to protect vulnerable critical facilities	1 and 3	Y	N	N	Emergency Services

This plan fulfills the requirements of Section 104 of the Disaster Mitigation Act of 2000 and qualifies for CRS credit. The following table provides the 10-step CRS planning credit activity checklist and the section/page number within this plan that describes the completion of each planning step in more detail.

CRS Planning Credit Activity Checklist

CRS Step	Section/Page
1. Organize to prepare the plan.	
a. Involvement of office responsible for community planning	Section 2.1 / page 8
b. Planning committee of department staff	Section 2.1 / page 8
c. Process formally created by the community's governing board	Section 2.2.1 / page 9
2. Involve the public.	
a. Planning process conducted through a planning committee	Section 2.1 / page 8; Section 2.2.1 / Table 2.3
b. Public meetings held at the beginning of the planning process	Section 2.2.1 / Table 2.4
c. Public meeting held on draft plan	Section 2.2.1 / Table 2.4
d. Other public information activities to encourage input	Section 2.2.1 / Table 2.5
3. Coordinate with other agencies.	
a. Review of existing studies and plans	Section 2.2.1 / page 16
b. Coordinating with communities and other agencies	Section 2.2.1 / page 15
4. Assess the hazard.	
a. Plan includes an assessment of the flood hazard with:	Sections 3.1 – 3.2
(1) A map of known flood hazards	Sections 3.1 – 3.2
(2) A description of known flood hazard	Sections 3.1 – 3.2
(3) A discussion of past floods	Sections 3.1 – 3.2
b. Plan includes assessment of less frequent floods	Sections 3.1 – 3.2
c. Plan includes assessment of areas likely to flood	Section 3.2.7
d. The plan describes other natural hazards	----
5. Assess the problem.	
a. Summary of each hazard identified in the hazard assessment and their community impact	Section 3.3
b. Description of the impact of the hazards on:	Section 3.3
(1) Life, safety, health, procedures for warning and evacuation	Section 3.3
(2) Public health including health hazards to floodwaters/mold	Section 3.2.4
(3) Critical facilities and infrastructure	Section 3.3
(4) The community's economy and tax base	Section 1.3.4
(5) Number and type of affected buildings	Section 3.3
c. Review of all damaged buildings/flood insurance claims	Section 3.3
d. Areas that provide natural floodplain functions	Section 3.3
e. Development/redevelopment/Population Trends	Section 3.3
f. Impact of future flooding conditions outline in Step 4, item c	Section 3.3
6. Set goals.	Section 4.2
7. Review possible activities.	
a. Preventive activities	Section 4.3 / Appendix B
b. Floodplain Management Regulatory/current & future conditions	Section 4.3 / Appendix B

CRS Step	Section/Page
c. Property protection activities	Section 4.3 / Appendix B
d. Natural resource protection activities	Section 4.3 / Appendix B
e. Emergency services activities	Section 4.3 / Appendix B
f. Structural projects	Section 4.3 / Appendix B
g. Public information activities	Section 4.3 / Appendix B
8. Draft an action plan.	
a. Actions must be prioritized	Sections 4.4 – 4.5 / Appendix B
(1) Recommendations for activities from two of the six categories	Sections 4.4 – 4.5 / Appendix B
(2) Recommendations for activities from three of the six categories	Sections 4.4 – 4.5 / Appendix B
(3) Recommendations for activities from four of the six categories	Sections 4.4 – 4.5 / Appendix B
(4) Recommendations for activities from five of the six categories	Sections 4.4 – 4.5 / Appendix B
b. Post-disaster mitigation policies and procedures	Sections 4.4 – 4.5 / Appendix B
c. Action items for mitigation of other hazards	Sections 4.4 – 4.5 / Appendix B
9. Adopt the plan.	Section 5
10. Implement, evaluate and revise.	
a. Procedures to monitor and recommend revisions	Sections 6.1.1 – 6.2.2
b. Same planning committee or successor committee that qualifies under Section 511.a.2 (a) does the evaluation	Section 6.1.1

TABLE OF CONTENTS

Sections

List of Appendices

List of Tables

List of Figures

1 INTRODUCTION

1.1 Purpose

The purpose of this plan is to identify, assess and mitigate flood risk in order to better protect the people and property of the Town of Cutler Bay from the effects of flood hazards. Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. The planning area has been affected by hazards in the past and is thus committed to reducing future impacts from hazard events and maintaining eligibility for mitigation-related federal funding.

The Plan was developed in a joint and cooperative venture by members of the Cutler Bay Planning Team to ensure Cutler Bay's continued eligibility for federal disaster assistance including the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA). Completion of this plan also earns credits for the National Flood Insurance Program's Community Rating System (CRS) which allows for discounted flood insurance premiums for citizens residing within the Town. Furthermore, the Plan has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act or the Act), 42 U.S.C. 5165, enacted under Section 104 of the Disaster Mitigation Act of 2000, (DMA 2000) Public Law 106-390 of October 30, 2000, as implemented at CFR 201.6 and 201.7 dated October 2007.

1.2 Background and Scope

The Town is a participant in both the National Flood Insurance Program (NFIP) and the CRS Program. As part of the CRS program, the Town is classified as a repetitive loss category "C" community which requires the development of a Floodplain Mitigation Plan. The Town must accurately identify flood hazards, analyze their impacts on people and property, and identify ways to reduce those impacts through hazard mitigation.

As defined by FEMA, "hazard mitigation" means any sustained action taken to reduce or eliminate the long-term risk to life and property for a hazard event. Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. This plan documents Cutler Bay's hazard mitigation planning process and identifies relevant flood hazards and vulnerabilities and strategies the Town will use to decrease vulnerability and increase resiliency and sustainability.

1.3 Community Profile

1.3.1 Overview of the Community

The Town of Cutler Bay, Florida, is located along Biscayne Bay in southern Miami-Dade County. The Town comprises approximately 10 square miles and is home to over 40,000 residents. The Town was incorporated on November 8, 2005, making it the youngest municipality in the State of Florida. The Town was substantially built-out at the time of its incorporation. **Due to its recent incorporation as a municipality, Miami-Dade County remains an extensive source of data and historic information for**

the Town. Cutler Bay is currently an active participant in the Miami-Dade County Local Mitigation Strategy (LMS).

The boundaries of the Town are approximately as follows: on the North by SW 184 Street (Eureka Drive) from the Florida Turnpike to Biscayne Bay; on the West from SW 184 Street following US 1 to SW 112 (Allapattah Road) and then along SW 126 (Hanlin Mills Drive); on the South by SW 216 Avenue and along historic Old Cutler Road, taking a right on SW 224 Street (up to SW 47th Avenue heading south and left of SW 232 Street) going east to Biscayne Bay. The Eastern Border follows the coastline of Biscayne Bay from SW 184 Street to SW 224 Street. The Town of Cutler Bay is shown in Figures 1.1 and 1.2.

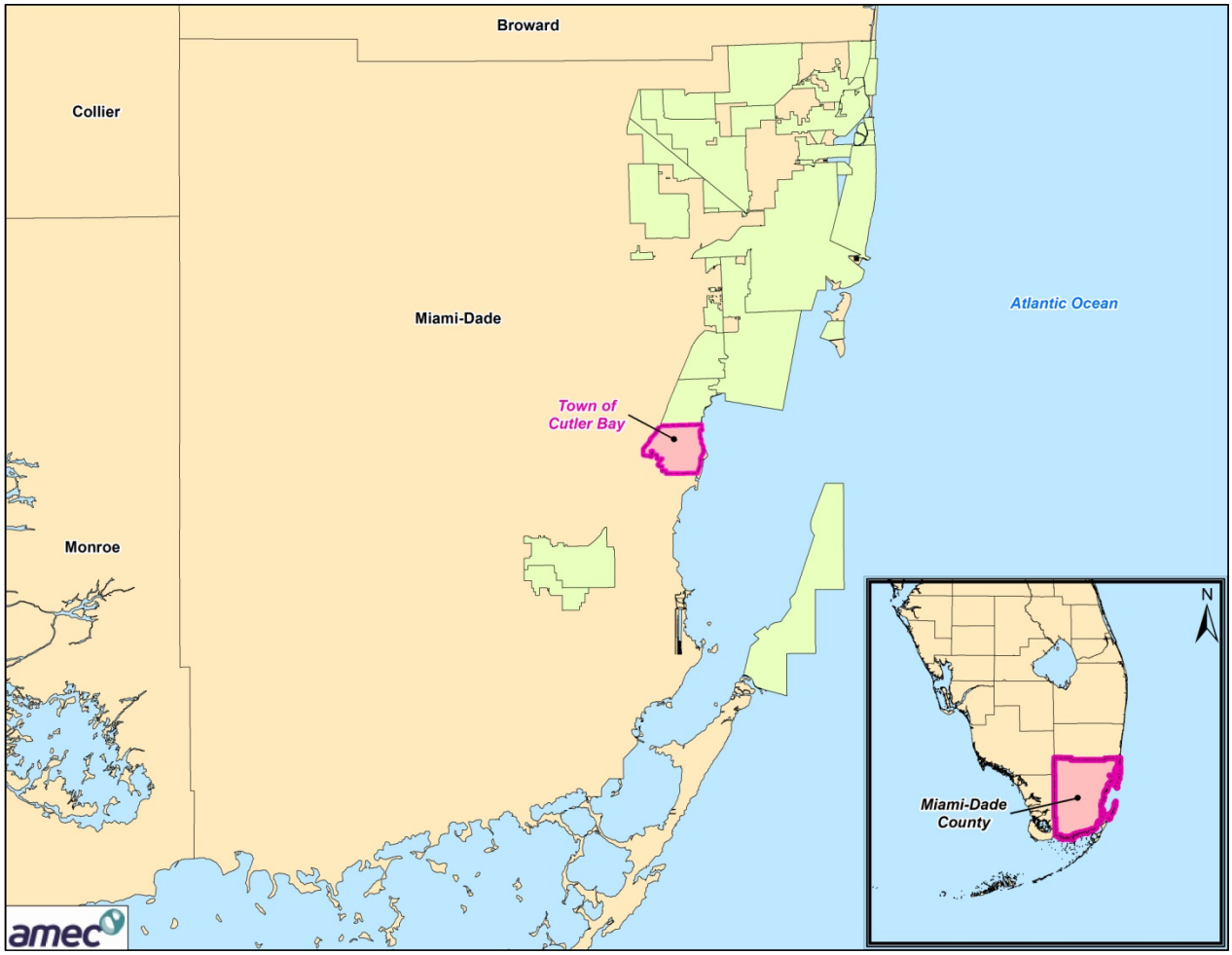


Figure 1.1 - Cutler Bay Location Map

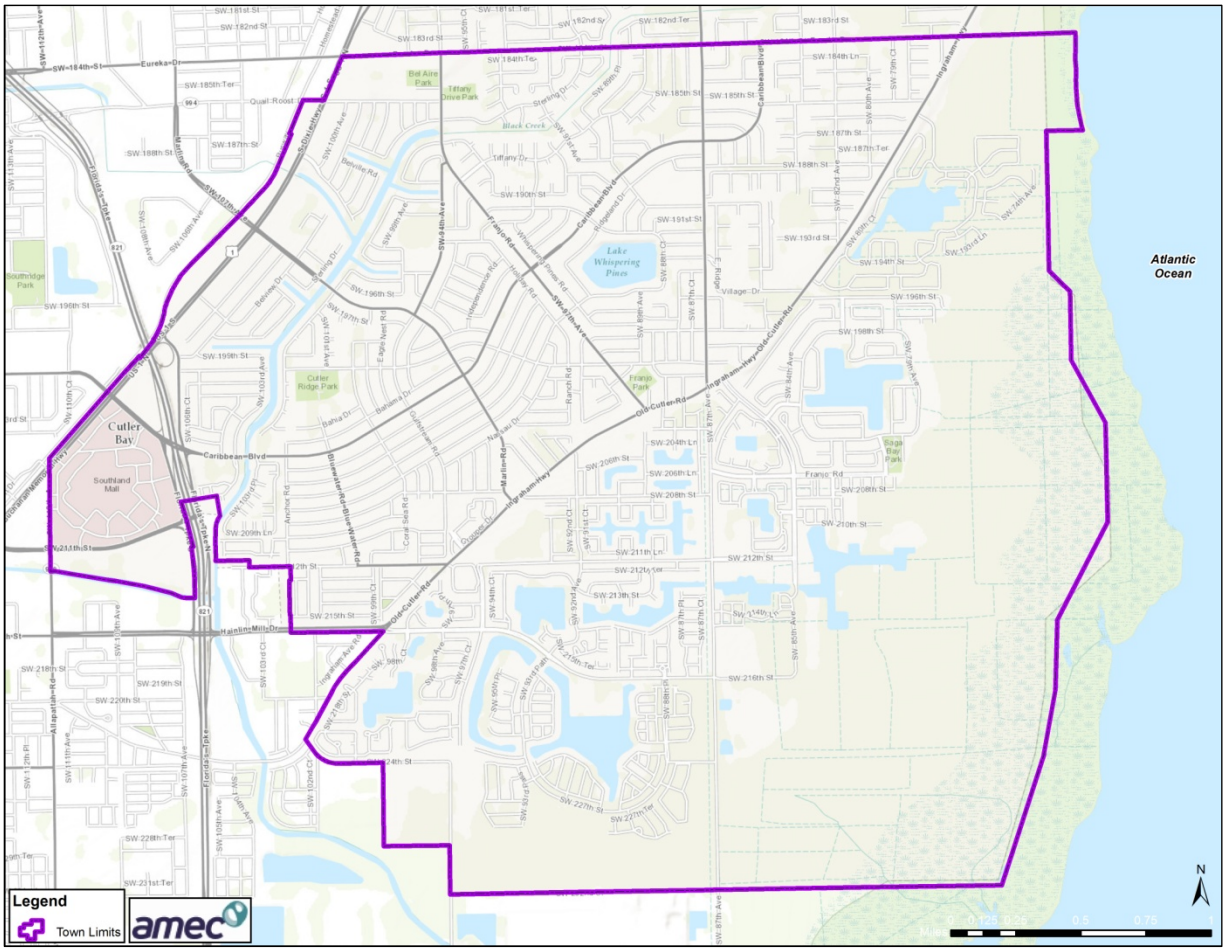


Figure 1.2 – Cutler Bay Base Map

1.3.2 Topography and Climate

Cutler Bay is flat and low with elevations generally below 10 feet National Geodetic Vertical Datum of 1929 (NGVD). The Town is traversed by a canal system that directs drainage into Biscayne Bay and the Atlantic Ocean. The topography of the Town can be seen in Figure 1.3.

The climate is subtropical marine, characterized by a long, warm summer with abundant rainfall followed by a mild, dry winter. The wet season begins in May, ending in mid-October. The average annual temperature is 76 degrees Fahrenheit. The average annual precipitation for Cutler Bay is 59 inches.

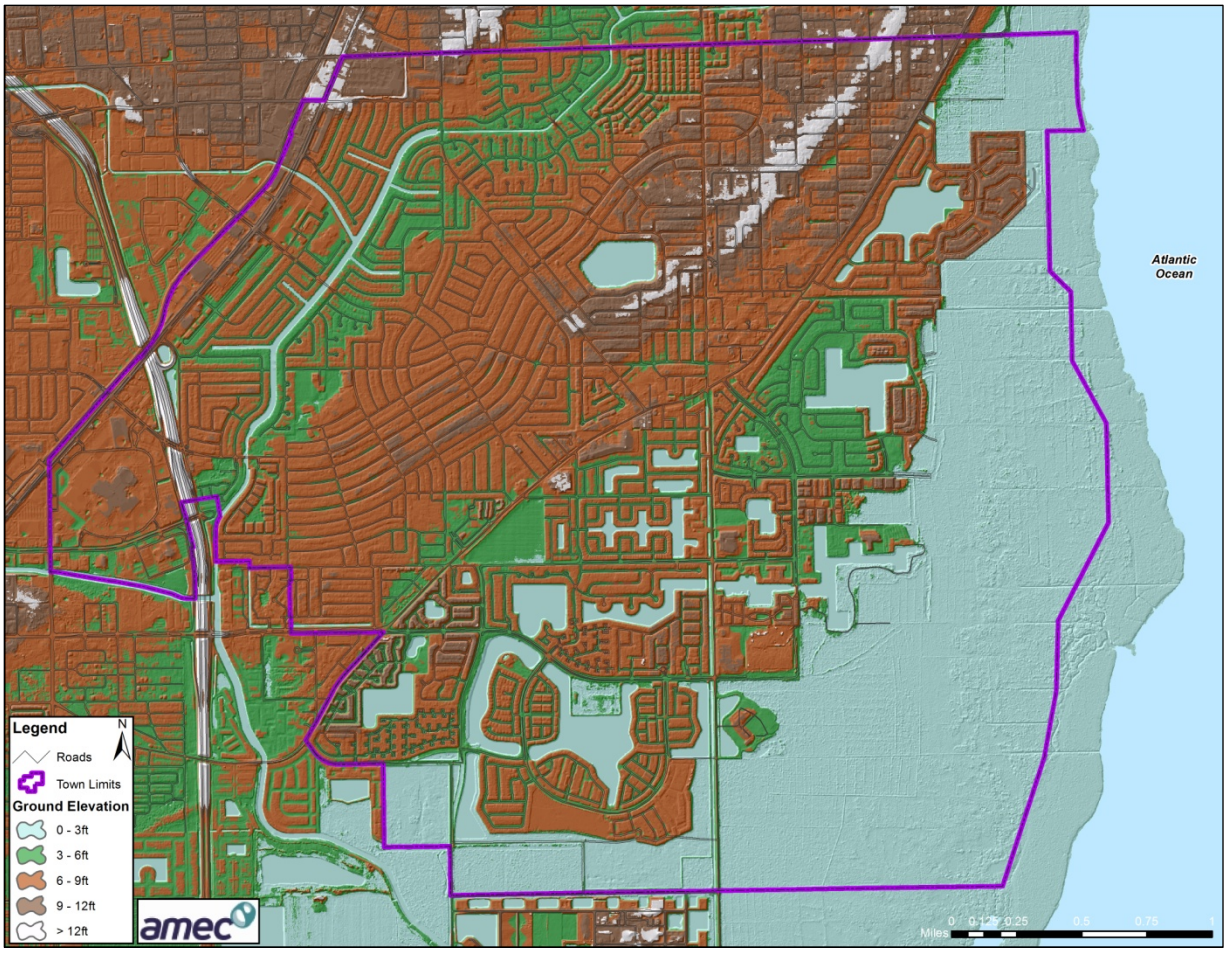


Figure 1.3 - Cutler Bay Topography

1.3.3 History

Cutler Ridge's history began in the 1870's when William C. Cutler visited the area and fell in love with it. Dr. William C. Cutler was the leading practitioner of medicine and surgery in Chelsea, Massachusetts.

Native Americans living in South Florida then referred to the area as the Big Hunting Grounds. It was officially part of the Perrine Grant awarded to Dr. Henry Perrine, in 1838. Dr. Cutler bought a 600-acre tract of this land for $1.25 per acre and wanted to establish a fruit and vegetable plantation.

The only one of Dr. Cutler's friends who became a permanent resident was William Fuzzard. On his first trip to the area in 1882, twenty-year-old William stayed in Coconut Grove while he explored the area. He returned in 1883, setting up a tent before building a wooden two-story home. One of Mr. Fuzzard's greatest contributions to the Cutler area was the path he cut through the wilderness. The road, which was eventually widened to a wagon trail, went from Coconut Grove to his home. This trail was the beginning of what is now called Old Cutler Road. It ran north from Fuzzard's home, went east and joined what is now Coral Reef Drive; Fuzzard's path was declared a public road in 1895. What was once the path traveled by Fuzzard's white mule, Samson, became the beginning of what is now the State Historic Highway of Old Cutler Road. The present Cutler Road, which follows a somewhat altered course, was declared a State Historic Highway in May, 1974, by the Florida Legislature.

It was really not until Mr. David Blumberg began developing the land that Cutler Ridge became an organized community. In the early 1950's Blumberg and his partner, Joe Segal, convinced owner Walter Blumberg to sell him 1,400 acres of undeveloped land. Blumberg actually named the area after Dr. Cutler and the limestone ridge on which the land sits. The first housing development went up in 1954, and the Cutler Ridge Mall opened in 1960. Street names in Cutler Ridge came from holidays and the ports of call Mr. Blumberg visited as a sailor. The area around the mall was called Seminole Plains. What is now Lakes by the Bay was called Lincoln City as the streets and parks were laid out. Black Point was the first post office south of Cutler, opening on February 15, 1904.

More About the Stories Behind the Area and its Names

In the winter of 1904-05, Wilford B. Focht arrived in Cutler and stayed at the Richmond Inn. He was a cousin of Mr. John H. Earhart, who owned 2,000 acres, which included a small farming community called Franjo, after John Earhart and his brother, Francis. Franjo Road (SW 97 Avenue) gets its name from this community.

1.3.4 Economy

According to the U.S. Census Bureau, the median household income for Cutler Bay from 2008-2012 was $63,681. 11.3% of the population is considered to be living below the poverty level. Table 1.1 shows employment and unemployment rates along with industry employment by major classification for the Town. The economy in Cutler Bay is focused primarily on educational services, health care, and social assistance which makes up 25% of the local economy. That is followed closely by waste management services (13.4%) and retail services (12.3%). Much of the population in Miami-Dade County, as well as, Cutler Bay, commute from their place of residence to another nearby community or to another county. As a result many businesses in Cutler Bay employ workers from outside of the Town. Based on 2009 estimates, the number of owner-occupied housing units in Cutler Bay in the price range of $200,000 to $299,999 totaled 2,453 and the number of owner-occupied units in the price range of $300,000 to $399,999 totaled 2,609. As a result, 5,062 owner-occupied units out of a total of 13,338 were in a price range between $200,000 and $399,999. Since the Town of Cutler Bay is primarily a residential community, much of the tax base comes from residential structures. Major employers for Cutler Bay are listed in Table 1.2.

Table 1.1 - Employment and Occupation Statistics for Cutler Bay

Employment Status	Percentage
Employed	60.3
Unemployed	5.7
Not in Labor Force	34.0
Occupation	
Management, business, science and arts	38.5
Service	16.0
Sales and office	30.5
Natural resources, construction and maintenance	9.5
Production, transportation and material moving	5.5

Source: U.S. Census Bureau, 2008-2012 American Community Survey 5-Year Estimates

Table 1.2 - Major Employers in Cutler Bay, FL

Corporation/Organization	Service/Product by SIC Code	# of Employees
Alorica, Inc.	Telemarketing	919
Healthsouth Rehabilitation Hospital of Miami	Medical Services	180
Mercedes Benz	Car Dealership	140

Corporation/Organization	Service/Product by SIC Code	# of Employees
Eastridge Retirement Village, Inc.	Retirement Hotel	225
Southland Mall	Shopping Center	500

Source: Town of Cutler Bay

1.3.5 Population

The Town of Cutler Bay has an estimated 42,221 residents, according to the U.S. Census Bureau 2012 estimates. Table 1.3 provides detail for Cutler Bay's demographics.

Table 1.3 - Cutler Bay Demographic and Social Characteristics, 2010

Demographic	Percentage
Gender/Age	
Male	48.0
Female	52.0
Median Age	35.5
Under 5 Years	7.4
65 Years and Over	11.8
Race/Ethnicity	
White	77.3
Asian	2.3
Black or African American	14.2
American Indian/Alaska Native	0.2
Hispanic or Latino	54.5[1]
Education	
High School Graduate or Higher	87.7
Bachelor's Degree or Higher	30.7

Source: U.S. Census Bureau, 2010, www.census.gov

[1]Hispanics may be of any race, so also are included in applicable race categories.

1.4 Plan Organization

The Cutler Bay Floodplain Mitigation Plan is organized as follows:

- Section 2: Planning Process
- Section 3: Flood Risk Assessment
- Section 4: Mitigation Strategy
- Section 5: Plan Adoption
- Section 6: Plan Implementation and Maintenance
- Appendix A: Planning Process
- Appendix B: Mitigation Strategy
- Appendix C: References

2 PLANNING PROCESS

Requirement §201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and
3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
Requirement §201.6(c)(1): The plan shall include the following:
1) Documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

This Floodplain Mitigation Plan was developed under the guidance of a Floodplain Mitigation Planning Committee (FMPC). The Committee's representatives included representatives of Cutler Bay Departments, citizens and other stakeholders.

This plan identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by floods. The Plan fulfills the requirements of Section 104 of the Disaster Mitigation Act of 2000, qualifies for CRS credit, and most importantly provides Cutler Bay with effective actions for reducing flood hazard impacts on people and property.

2.1 Local Government Participation

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the FMPC;
- Detail where within the planning area the risk differs from that facing the entire area;
- Identify potential mitigation actions; and
- Formally adopt the plan.

For the Cutler Bay FMPC, "participation" meant the following:

- Providing facilities for meetings;
- Attending and participating in the FMPC meetings;
- Completing and returning the AMEC Data Collection Guide;
- Collecting and providing other requested data (as available);
- Managing administrative details;
- Making decisions on plan process and content;
- Identifying mitigation actions for the plan;

- Reviewing and providing comments on plan drafts;
- Informing the public, local officials, and other interested parties about the planning process and providing opportunity for them to comment on the plan;
- Coordinating, and participating in the public input process; and
- Coordinating the formal adoption of the plan by the governing board of the Town.

The Town met all of these participation requirements. Key representatives from the Town of Cutler Bay included the Town Manager, Department of Community Development, Public Works Department and the GIS consultant. The FMPC also included representatives from the insurance and real estate industries as well as Town residents. The participants comprising the Cutler Bay FMPC included the following:

1. Rafael Casals – Cutler Bay Town Manager
2. Sandra Cuervo, CFM – Cutler Bay Department of Community Development*
3. Alfredo Quintero – Cutler Bay Public Works Department
4. Yenier Vega – Cutler Bay Public Works Department
5. Mary Ann Mixon – Council Liaison to the FMPC
6. Janice Rowton – Cutler Bay Resident and Insurance Industry Representative (State Farm)
7. Luis Badillo – Cutler Bay Resident and Real Estate Industry Representative (Keller Williams)
8. Jorge Acevedo, P.E. – Cutler Bay Resident
9. Dan Vesce – Cutler Bay Resident
10. Paul Mauriello, AICP – Cutler Bay Resident

***Note: Department of Community Development is the office responsible for community planning.**

The Town representatives participating in the FMPC and guiding the development of this plan are experienced in the following areas of expertise as related to the CRS mitigation categories as detailed in Table 2.1.

Table 2.1 - Cutler Bay Staff Capability with Six Mitigation Categories

Community Department	Prevention	Property Protection	Natural Resource Protection	Emergency Services	Structural Flood Control Projects	Public Information	Other
Town Management	X	X	X	X		X	X
Community Development	X	X	X			X	X
Public Works	X	X	X	X	X	X	X

This Section 2 and Appendix A provide additional information and documentation of the planning process that was implemented for the development of this FMP.

2.2 The 10-Step Planning Process

The planning process for preparing the Cutler Bay Floodplain Mitigation Plan was based on DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

1) Planning Process;
2) Risk Assessment;
3) Mitigation Strategy; and
4) Plan Maintenance.

Into this process, Cutler Bay integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA's Hazard Mitigation Grant Program; Pre-Disaster Mitigation Program; Community Rating System; Flood Mitigation Assistance Program; Severe Repetitive Loss Program; and new flood control projects authorized by the U.S. Army Corps of Engineers.

Table 2.2 shows how the 10-step CRS planning process aligns with the four phases of hazard mitigation planning pursuant to the Disaster Mitigation Act of 2000.

Table 2.2 - Mitigation Planning and CRS 10-Step Process Reference Table

DMA Process	CRS Process
Phase I – Planning Process	
§201.6(c)(1)	Step 1. Organize to Prepare the Plan
§201.6(b)(1)	Step 2. Involve the Public
§201.6(b)(2) & (3)	Step 3. Coordinate
Phase II – Risk Assessment	
§201.6(c)(2)(i)	Step 4. Assess the Hazard
§201.6(c)(2)(ii) & (iii)	Step 5. Assess the Problem
Phase III – Mitigation Strategy	
§201.6(c)(3)(i)	Step 6. Set Goals
§201.6(c)(3)(ii)	Step 7. Review Possible Activities
§201.6(c)(3)(iii)	Step 8. Draft an Action Plan
Phase IV – Plan Maintenance	
§201.6(c)(5)	Step 9. Adopt the Plan
§201.6(c)(4)	Step 10. Implement, Evaluate and Revise the Plan

The development of this FMP involved a comprehensive review of all flood hazards specific to the Town of Cutler Bay. Also to be noted, this plan provides an analysis of climate change impacts to the Town.

2.2.1 Phase I – Planning Process

Planning Step 1: Organize to Prepare the Plan

With Cutler Bay's commitment to participate in the DMA planning process and the Community Rating System (CRS), Town officials worked to establish the framework and organization for development of the plan. An initial meeting was held with key community representatives to discuss the organizational aspects of the plan development process. At the beginning of this planning process, the Town of Cutler Bay passed a resolution establishing the planning process and the FMPC. This resolution is included in Appendix A.

The initial kick-off meeting was held on October 24, 2013. Invitations to this kickoff meeting were extended to Town officials, citizens, and federal, state, and local stakeholders that might have an interest in participating in the planning process. The list of initial invitees is included in Appendix A. A notice was also posted in two local newspapers inviting members of the public to attend this kickoff meeting.

The FMPC was comprised of representatives from key Town Departments, key stakeholders and the public. The following were invited to participate on the FMPC:

Town of Cutler Bay
Mayor's Office
Town Manager's Office
Police Department
Department of Community Development (Planning and Zoning and Building)
Public Works
Parks and Recreation
Council Liaison to the FMPC

Neighboring Communities
Miami-Dade County
City of Coral Gables
City of Homestead
City of Miami
Village of Palmetto Bay
Village of Pinecrest

Other Government and Stakeholder Representatives
Florida Division of Emergency Management
FEMA Region IV
Miami-Dade County Regulatory and Economic Development Agency
Miami-Dade County Regulatory and Economic Resources Department
South Florida Water Management District
American Red Cross, South Florida Region
National Weather Service
Miami-Dade County Office of Emergency Management
US Army Corps of Engineers
Miami-Dade Public Schools
Key Biscayne National Park
Fortis College
CBT College
US Fish and Wildlife Service
NOAA Southeast Fisheries Science Center
Florida Department of Environmental Protection
City of Miami Public Works and Waste Management
Florida Department of Transportation
South Florida Regional Planning Council

A list of participating FMPC representatives is included in Section 2.1. This list details all FMPC members that attended one or more FMPC meetings detailed in Table 2.3. Note that the above list of FMPC members also includes citizens and other stakeholder representatives that contributed to the planning process.

Based on the area of expertise of each FMPC member, Table 2.1 demonstrates each member's expertise in the six mitigation categories (Prevention, Property Protection, Natural Resource Protection, Emergency Services, Structural Flood Control Projects and Public Information). The Town of Cutler Bay

Department of Community Development which is responsible for community land use and comprehensive planning was an active participant on the FMPC and provided data and information to support development of the plan.

The planning process officially began with a kick-off meeting held on October 24, 2013 at 5:30 pm in the Town Council Chambers, followed by a public kick-off meeting held the same day at 6:30 pm at the Town Hall. The meetings covered the scope of work and an introduction to the DMA, CRS, and FMA requirements. The final piece of the presentation dealt with the NFIP and the Biggert-Waters 2012 National Flood Insurance Reform Act (BW-12).

During the planning process, the FMPC communicated through face-to-face meetings, email, telephone conversations, and a file transfer protocol (ftp) website. Draft documents were posted on the Town's website so that the FMPC members could easily access and review them. Agendas and sign in sheets for FMPC meetings are included in Appendix A. The formal meetings held and topics discussed are detailed in Table 2.3. All FMPC meetings covered the CRS Planning Steps and were open to the public.

Table 2.3 - FMPC Meetings

Meeting Type	Meeting Topic	Meeting Date	Meeting Location
FMPC #1 (Kick-off)	1) Introduction to DMA, CRS and the planning process 2) Organize resources: the role of the FMPC, planning for public involvement, and coordinating with other agencies and stakeholders 3) Introduction to hazard identification	October 24, 2013	Town Council Chambers
FMPC #2	1) Program overview/history of project 2) Discussion of Florida Sunshine Law 3) Discussion of the FMPC 's functions and responsibilities 4) Development of flood mitigation plan (four phases of DMA) 5) Overview of Program for Public Information (PPI) 6) Project schedule	December 11, 2013	Town Center Community Room
FMPC #3	1) Local flooding concerns 2) Flood protection and flood safety publications and outreach materials 3) Coordination with other plans, ordinances and studies 4) Public information needs 5) Coordination letter for other agencies and stakeholders and the distribution list for letter	January 16, 2014	Town Center Community Room
FMPC #4	1) Review of public survey results 2) Documentation of coordination with other agencies 3) Identification of local flooding areas 4) Additional assessment of public information needs	February 20, 2014	Town Center Community Room

Meeting Type	Meeting Topic	Meeting Date	Meeting Location
	5) Target audiences and stakeholders for PPI		
FMPC #5	1) Discussion of Flood Risk Assessment (Assess the Hazard) 2) Discussion of Vulnerability Assessment (Assess the Problem) 3) Preliminary results from the PPI	April 22, 2014	Town Center Community Room
FMPC #6	1) Development of Goals for FMP 2) Development of Mitigation Strategies for FMP	July 17, 2014	Town Center Community Room
FMPC #7	1) Review "Draft" Floodplain Mitigation Plan 2) Solicit comments and feedback from the FMPC	September 25, 2014	Town Council Chambers

Planning Step 2: Involve the Public

Early discussions with Cutler Bay personnel established the initial plan for public involvement. Public outreach for the plan development began during the initial plan development process with an informational press release placed in the local paper inviting the public to the early public meeting held on October 24, 2013 as shown in Appendix A. As part of the early outreach efforts, the public was also invited to attend the kickoff meeting. At the kick-off meeting, the FMPC discussed additional options for public involvement and agreed to an approach using established public information mechanisms and resources within the community.

Public involvement activities for this plan update included press releases, stakeholder and public meetings, public surveys, and the collection of public and stakeholder comments on the draft plan through a variety of mechanisms as further described below. The formal public meetings for this project are summarized in Table 2.4.

Table 2.4 - Public Meetings

Meeting Type	Meeting Topic	Meeting Date	Meeting Locations
Public Meeting #1	1) Introduction to DMA, CRS and the planning process 2) Overview of BW-12 and NFIP	October 24, 2013	Town Council Chambers
Public Meeting #2	1) Overview of purpose of risk assessment 2) Presentation of risk assessment 3) Presentation of vulnerability assessment	April 23, 2014	Cutler Ridge Park
Public Meeting #3	1) Review "Draft" Floodplain Mitigation Plan 2) Solicit comments and feedback from the public	September 25, 2014	Town Council Chambers
Public Meeting # 4	1) Review "Draft" Floodplain Mitigation Plan 2) Solicit comments and feedback from the public	October 1, 2014	Town Council Chambers

The complete draft of the plan was provided to the FMPC in September 2014. A preliminary public meeting was conducted on September 25th and a final public meeting was held on October 1, 2014. The public meeting was advertised in the local newspaper, indicating where the plan could be accessed on the Town website. Documentation to support the final public meeting can be found in Appendix A

Involving the Public Beyond Attending Public Meetings

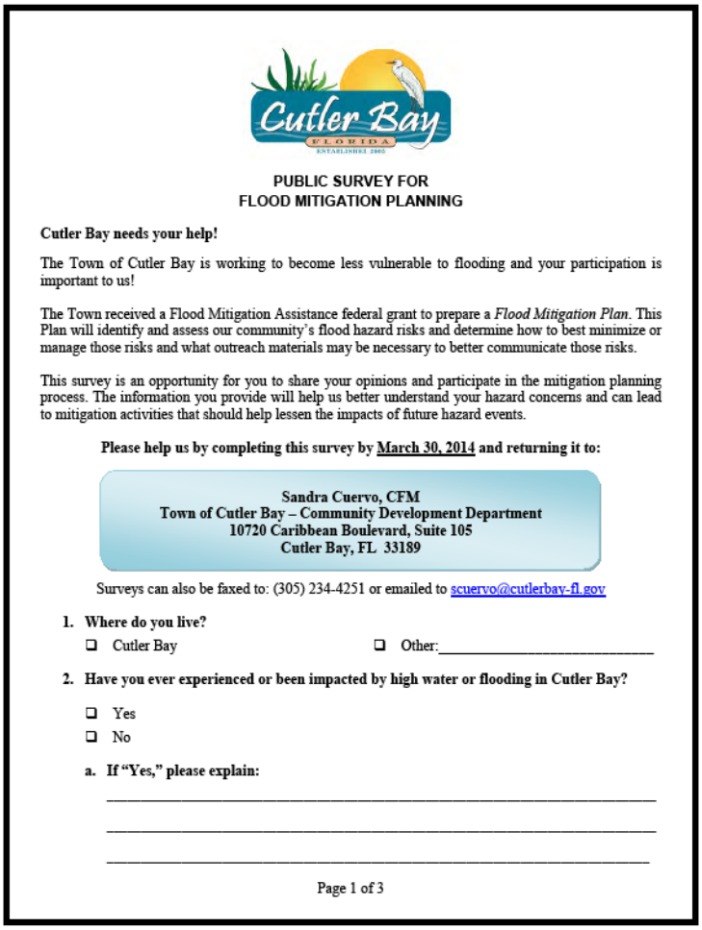
Beyond the formal public meetings, the plan development process included additional public outreach activities as show below in Table 2.5. The Town of Cutler Bay found 10 different ways to involve the public beyond attending public meetings.

Table 2.5 - Public Outreach Efforts

Project/Event	Message	Frequency	Other Ways to Involve the Public/CRS Step 2
Project Kick-off – Public Meeting	Presentation, Informational Brochures and Flyers	One-time	N/A
Flood Mitigation Meeting	Presentation, Informational Brochures and Flyers	One-time	N/A
Miami Herald	Article and meeting announcement	One-time	N/A
South Dade News Leader	Article on 1st Public Meeting	One-time	Yes
Cutler Bay News	Committee Meeting Announcement	One-time	N/A
Movie Night	Public Service Announcement	One-time	N/A
Caribbean Blvd Holiday – Work Zone Open	Presentation, Informational Brochures and Flyers	One-time	N/A
Chili Cook-Off	Surveys and Information Materials on Floodplain Mitigation Plan	One-time	Yes
Roadway Resurfacing Phase III + Flood Flyers	Presentation, Informational Brochures and Flyers	One-time	N/A
Tree Trimming & Canopy Uplifting Project – Bel Aire Section 9 & 10	Informational Brochures and Flyers	One-time	N/A
Tree Trimming & Canopy Uplifting Project – Bel Aire Section 1	Informational Brochures and Flyers	One-time	N/A
Councilmember Loyzelle's Newsletter	Meeting Announcement	One-time	N/A
Concerned Citizen's Meeting (2/4/14)	Presentation, Informational Brochures and Flyers	One-time	N/A
Sidewalk Repairs	Presentation, Informational Brochures and Flyers	One-time	N/A
Alina-School	Presentation, Informational Brochures and Flyers	One-time	N/A
Taste of the Bay	Surveys and Informational Materials on Floodplain Mitigation Plan	One-time	Yes
Old Cutler Glenn HOA Meeting	Presentation, Informational Brochures, Flyers, and information	One-time	Yes
Movie Night at the Park	PSA, Informational Materials and Surveys	One-time	N/A
Relay for Life	Charity Event, Outreach	One-time	N/A
Marlin MOT	Informational Brochures and Flyers	One-time	N/A
Concerned Citizens Meeting (3/4/14)	Presentation, Surveys and Informational Materials on	One-time	Yes

Project/Event	Message	Frequency	Other Ways to Involve the Public/CRS Step 2
	Floodplain Mitigation Plan		
OCR Grand Re-Opening	Presentation, Surveys and Informational Materials	One-time	N/A
Make Mitigation Happen – Repetitive Loss Properties	Surveys and Informational Materials	One-time	N/A
CBBA Luncheon	Informational Materials and Surveys	One-time	N/A
CBBA Meeting	Presentation, Surveys and Informational Materials	One-time	N/A
Seagrape HOA Meeting	Information Materials	One-time	N/A
Concerned Citizens Meeting (4/1/14)	Presentation, Informational Brochures and Flyers	One-time	Yes
Flood Surveys for Repetitive Loss Properties	Informational Brochures and Flyers	One-time	N/A
Enclave Fair at Enclave Club House	Informational Materials and Surveys on Floodplain Mitigation Plan	One-time	Yes
Centennial (Chanterelle) HOA Meeting	Information Materials	One-time	N/A
CBBA/EDC Luncheon	Informational Materials and Surveys	One-time	N/A
Cutler Bay Press Release	Announcing April 2014 Committee and Public Meeting	One-time	N/A
MOT Work Zone 2 Detour	Informational Brochure and Flyers	One-time	N/A
South Dade News Leader	Meeting Announcement	One-time	N/A
Miami Herald Neighbors Section	Meeting Announcement	One-time	N/A
Flood Mitigation Meeting	Presentation, Surveys and Informational Materials	One-time	N/A
Cutler Bay Website	Survey	Continuous/4 months	Yes
Councilmember Mixon	Meeting Announcement at Council Meetings	Monthly	N/A
Cutler Bay Website	Meeting Announcement	Monthly	N/A
Cutler Bay Announcement Board	Meeting Announcement	Monthly	N/A
Risk Assessment for the Floodplain Mitigation Plan	Posted on Website for Review	One-time	Yes
Draft Floodplain Mitigation Plan	Posted on Website for Review	One-time	Yes

Furthermore, the Town of Cutler Bay distributed a public survey (Figure 2.1) requesting public input into the flood mitigation plan planning process and the identification of mitigation activities that could lessen the risk and impact of future flood hazard events. The survey was provided on the Town website as well as distributed at community events. A summary of the completed survey results has been included in Appendix A.



PUBLIC SURVEY FOR
FLOOD MITIGATION PLANNING

Cutler Bay needs your help!

The Town of Cutler Bay is working to become less vulnerable to flooding and your participation is important to us!

The Town received a Flood Mitigation Assistance federal grant to prepare a *Flood Mitigation Plan*. This Plan will identify and assess our community's flood hazard risks and determine how to best minimize or manage those risks and what outreach materials may be necessary to better communicate those risks.

This survey is an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impacts of future hazard events.

Please help us by completing this survey by March 30, 2014 and returning it to:

Sandra Cuervo, CFM
Town of Cutler Bay – Community Development Department
10720 Caribbean Boulevard, Suite 105
Cutler Bay, FL 33189

Surveys can also be faxed to: (305) 234-4251 or emailed to scuervo@cutlerbay-fl.gov

1. **Where do you live?**
   - ❑ Cutler Bay
   - ❑ Other:_____
2. **Have you ever experienced or been impacted by high water or flooding in Cutler Bay?**
   - ❑ Yes
   - ❑ No
   - a. **If "Yes," please explain:**

_____
_____
_____

Page 1 of 3

Figure 2.1- Public Survey

Cutler Bay Academy high school students assisted the Town at the "5th Annual Chili Day" in January 2014 by volunteering at the flood hazard information both and distributing flood mitigation public surveys to event attendees. The Survey was also available at public meetings, homeowner association meetings, and other special events. The survey was available in both English and Spanish as a significant number of residents primarily speak Spanish.

Flood Hazard Information Booth provided by the Town of Cutler Bay at Chili Day 2014

Public Survey for Flood Mitigation Planning at Chili Day 2014

Planning Step 3: Coordinate

Early in the planning process, the FMPC determined that the risk assessment, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Representatives from the following agencies were invited to participate on the FMPC:

- Florida Division of Emergency Management
- FEMA Region IV
- Miami-Dade County Regulatory and Economic Development Agency
- Miami-Dade County Regulatory and Economic Resources Department
- South Florida Water Management District
- American Red Cross, South Florida Region
- National Weather Service
- Miami-Dade County Office of Emergency Management
- US Army Corps of Engineers
- Miami-Dade Public Schools
- Key Biscayne National Park
- Fortis College
- CBT College
- US Fish and Wildlife Service
- NOAA Southeast Fisheries Science Center
- Florida Department of Environmental Protection
- City of Miami Public Works and Waste Management
- Florida Department of Transportation
- South Florida Regional Planning Council

Coordination involved contacting these agencies through a variety of mechanisms and informing them on how to participate in the plan development process. Coordination with these groups included, holding face-to-face meetings, sending outreach letters, some with follow up phone calls; and making phone calls alone to out of area agencies. All of these groups and agencies were solicited asking for their assistance and input and telling them how to become involved in the plan development process. A copy of each coordination letter can be found in Appendix A.

Coordination with Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is also paramount to the success of this plan. Mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability to hazards. Cutler Bay uses a variety of comprehensive planning mechanisms, such as Growth Management Plan, land development regulations and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions.

- Miami-Dade County Local Mitigation Strategy, 2013
- Cutler Bay Repetitive Loss Areas Analysis, 2012
- Cutler Bay Stormwater Master Plan, 2008
- Cutler Bay Growth Management Plan, 2008

- Cutler Bay Capital Improvement Plan, 2013
- Miami-Dade County Flood Insurance Study, 2009
- Cutler Bay Flood Damage Prevention Ordinance
- Cutler Bay Land Development Regulations (2012)
- Cutler Bay Building Code Ordinance
- Cutler Bay Basin or Sub-basin flood studies
- Cutler Bay Community Rating System Annual Reports
- Building Code Ordinance
- State of Florida Hazard Mitigation Plan, August 2013
- State of Florida Critical Erosion Report, June 2012
- Miami-Dade Sea Level Rise Task Force Report and Recommendations, July 2014

These and other documents were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment. Data from these plans and ordinances were incorporated into the risk assessment and hazard vulnerability sections of the plan. The source document is referenced where the data from the existing studies and reports is used in this plan. The data was also used in determining the capability of the community in being able to implement certain mitigation strategies. The Capability Assessment can be found in Section 3.4.

2.2.2 Phase II – Risk Assessment

Planning Steps 4 and 5: Identify/Assess the Hazard and Assess the Problem

The FMPC completed a comprehensive effort to identify, document, and profile all flood hazards that have, or could have, an impact on the planning area including an evaluation of climate change and sea level rise. Data collection worksheets were developed and used in this effort to aid in determining hazards and vulnerabilities and where the risk varies across the planning area. Geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities.

The FMPC also conducted a capability assessment to review and document the planning area's current capabilities to mitigate risk from and vulnerability to hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the FMPC could assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. A more detailed description of the risk assessment process and the results are included in Section 3 Risk Assessment.

2.2.3 Phase III – Mitigation Strategy

Planning Steps 6 and 7: Set Goals and Review Possible Activities

AMEC facilitated brainstorming and discussion sessions with the FMPC that described the purpose and process of developing planning goals and objectives, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This information is included in Section 4 Mitigation Strategy. Additional documentation on the process the FMPC used to develop the goals and strategy has been included in Appendix B.

Planning Step 8: Draft an Action Plan

A complete first draft of the plan was prepared based on input from the FMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7. This complete draft was

posted for FMPC review and comment on the Town's website. Other agencies were invited to comment on this draft as well. FMPC and agency comments were integrated into the second public review draft, which was advertised and distributed to collect public input and comments. AMEC integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the FDEM and FEMA Region IV to review and approve, contingent upon final adoption by the Town of Cutler Bay.

2.2.4 Phase IV – Plan Maintenance

Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was reviewed and adopted by the Town Council on the date(s) included in the corresponding resolution in Section 5 Plan Adoption.

Planning Step 10: Implement, Evaluate and Revise the Plan

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. Up to this point in the planning process, all of the FMPC's efforts have been directed at researching data, coordinating input from participating entities, and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. Section 6 Plan Implementation and Maintenance provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The Section also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

3 FLOOD RISK ASSESSMENT

Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

This section describes the Risk Assessment process for the development of the Town of Cutler Bay Floodplain Mitigation Plan. It describes how the Town met the following requirements from the 10-step planning process:

- Planning Step 4: Assess the Hazard
- Planning Step 5: Assess the Problem

As defined by FEMA, risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

This flood risk assessment covers the entire geographical area of the Town of Cutler Bay. The risk assessment identifies and profiles the relevant flood hazards for Cutler Bay and assesses the exposure of lives, property, and infrastructure to these hazards. This process allows for a better understanding of Cutler Bay's potential risk to flood hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events. This risk assessment process followed the methodology described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses (FEMA 386-2, 2002), which breaks the assessment down to a four-step process:

1) Identify Hazards;

2) Profile Hazard Events;

3) Inventory Assets; and

4) Estimate Losses.

Data collected through this process has been incorporated into the following subsections of this chapter:

Section 3.1: **Hazard Identification** identifies the natural flood hazards that threaten the Cutler Bay planning area.

Section 3.2: **Hazard Profiles** discusses the threat to the Cutler Bay planning area and describes previous occurrences of flood hazard events and the likelihood of future occurrences.

Section 3.3: Vulnerability Assessment assesses the Cutler Bay planning area's exposure to natural flood hazards; considering assets at risk, critical facilities, and future development trends.

Section 3.4: Capability Assessment inventories existing mitigation activities and policies, regulations, and plans that pertain to mitigation and can affect net vulnerability.

3.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The Town of Cutler Bay's FMPC conducted a hazard identification study to determine the natural flood hazards that threaten the planning area.

3.1.1 Results and Methodology

Using existing flood hazard data and input gained through planning meetings, the FMPC agreed upon a list of natural flood hazards that could affect the Town of Cutler Bay. Flood hazard data from the Miami-Dade County Local Mitigation Strategy (LMS), FEMA, the Florida Division of Emergency Management (FDEM), the National Oceanic and Atmospheric Administration (NOAA), the National Hurricane Center (NHC), National Climatic Data Center (NCDC), the Spatial Hazards Events and Losses Database for the United States (SHELDUS™) and many other sources were examined to assess the significance of these hazards to the Cutler Bay planning area. Significance was measured in general terms and focused on key criteria such as frequency and resulting damage, which includes deaths and injuries, as well as property and economic damage.

The flood hazards identified in Table 3.1 were evaluated as part of this plan. Only the more significant hazards with the potential to cause significant human and/or monetary losses in the future have a more detailed hazard profile and are analyzed further in Section 3.3 Vulnerability Assessment.

Table 3.1- Flood Hazard Summary

Hazard	Frequency of Occurrence	Spatial Extent	Potential Magnitude	Significance
Climate Change and Sea Level Rise	Occasional	Limited	Limited	Low
Coastal/Canal Bank Erosion	Likely	Limited	Limited	Low
Dam/Levee Failure	Unlikely	Limited	Negligible	Low
Flood: 100-/500-year	Likely	Extensive	Catastrophic	High
Flood: Stormwater/Localized Flooding	Highly Likely	Significant	Limited	Medium
Hurricane and Tropical Storms (including Storm Surge)	Likely	Extensive	Catastrophic	High

Guidelines:
Frequency of Occurrence:
Highly Likely: Nearly 100% probability within the next year.
Likely: Between 10 and 100% probability within the next year.
Occasional: Between 1 and 10% probability within the next year.
Unlikely: Less than 1% probability within the next year.

Potential Magnitude:
Catastrophic: More than 50% of the area affected.
Critical: 25 to 50% of the area affected.
Limited: 10 to 25% of the area affected.
Negligible: Less than 10% of the area affected.

Spatial Extent:
Limited: Less than 10% of planning area.
Significant: 10-50% of planning area.
Extensive: 50-100% of planning area.

Significance:
Low
Medium
High

Source: AMEC Data Collection Guide

The following hazard was evaluated by the FMPC and determined to be a non-prevalent hazard that should not be included in the plan. Following is a brief description of the hazard and the reason for its exclusion:

- **Tsunamis** - Defined as a long-term (generally 15 to 60 minutes) wave caused by a large scale movement of the sea floor due to volcanic eruption, marine earthquake or landslide. Barely noticeable at sea, the wave velocity may be as high as 400 knots so that it travels great distances and in shoal water reaches heights up to 15 meters. NOAA indicates that the risk of a tsunami in the Cutler Bay planning area is relatively low due to the absence of subduction zones at the edges of plate boundaries to spawn such waves except small subduction zones under the Caribbean and Scotia arcs. Based on historical data, 12% of the world's tsunamis have occurred in the Atlantic Ocean with the majority occurring in the northeast.

3.1.2 Disaster Declaration History

The FMPC researched past events that resulted in a federal and/or state emergency or disaster declaration in the planning area for Cutler Bay in order to identify known flood hazards. Federal and/or state disaster declarations may be granted when the Governor certifies that the combined local, county and state resources are insufficient and that the situation is beyond their recovery capabilities. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state government capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

Details on federal and state disaster declarations were obtained by the FMPC from FEMA and FDEM, and compiled chronologically in Tables 3.2 and 3.3. Table 3.2 displays flood related major disaster declarations that State of Florida has received from FEMA since 2002. This table reflects the vulnerability and historic patterns of flood hazards within the State of Florida.

Table 3.2 - FEMA Major Disaster Declarations for Florida, 2002-2014

Hazard Type	Disaster #	Date
Severe Storms, Flooding, Tornadoes and Straight-line Winds	DR-4177	05/06/2014
Severe Storms and Flooding	DR-4138	08/02/2013
Hurricane Isaac	DR-4084	10/18/2012
Tropical Storm Debby	DR-4068	07/03/2012
Severe Storms, Flooding, Tornadoes and Straight-line Winds	DR-1840	05/27/2009
Severe Storms, Flooding, Tornadoes and Straight-line Winds	DR-1831	04/21/2009
Hurricane Gustav	DR-1806	10/27/2008
Tropical Storm Fay	DR-1785	08/24/2008
Severe Storms, Tornadoes and Flooding	DR-1680	02/08/2007
Severe Storms and Tornadoes	DR-1679	02/03/2007
Hurricane Wilma	DR-1609	10/24/2005
Hurricane Katrina	DR-1602	08/28/2005
Hurricane Dennis	DR-1595	07/10/2005
Hurricane Jeanne	DR-1561	09/26/2004
Hurricane Ivan	DR-1551	09/16/2004
Hurricane Frances	DR-1545	09/04/2004
Hurricane Charley and Tropical Storm Bonnie	DR-1539	08/13/2004
Severe Storms and Flooding	DR-1481	07/29/2003

Source: Florida State Hazard Mitigation Plan (August 2013), FEMA

A more in-depth review of the state and federal declared disasters for the State of Florida indicated that Miami-Dade County was impacted by five flood related federal disaster declarations between 1960 and 2014. The disaster-related damage to people and property resulted from wind and flood damage associated with hurricanes and tropical storms.

Table 3.3 - FEMA Major Disaster Declarations for Miami-Dade County, 1960 - 2014

Hazard Type	Disaster #	Date	IA Dollars Obligated[1]	PA Dollars Obligated[1]
Hurricane Wilma	DR-1609	10/24/2005	$191,472,426.07	$1,483,085,540.62
Hurricane Katrina	DR-1602	08/28/2005	--	$194,516,321.23
Hurricane Jeanne	DR-1561	09/26/2004	$398,624,417.44	$521,496,151.88
Hurricane Frances	DR-1545	09/04/2004	$411,862,738.49	$667,164,433.62
Hurricane Charley and Tropical Storm Bonnie	DR-1539	08/13/2004	$208,970,753.97	$613,442,592.07
		Total:	**$1,210,930,335.97**	**$3,479,705,039.42**

Source: FEMA, FDEM

[1]Dollar damage values are for all Counties included in the disaster declaration.

3.2 Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The hazards identified in Section 3.1 Hazard Identification, are profiled individually in this section. Information provided by members of the FMPC has been integrated into this section with information from other data sources.

Each hazard is profiled in the following format:

Hazard/Problem Description

This section provides a description of the hazard followed by details specific to the Cutler Bay planning area. Where available, this section also includes information on the hazard extent, seasonal patterns, speed of onset/duration, magnitude and any secondary effects.

Past Occurrences

This section contains information on historical events, including the extent or location of the hazard within or near the Cutler Bay planning area.

Frequency/Likelihood of Future Occurrence

This section gauges the likelihood of future occurrences based on past events and existing data. The frequency is determined by dividing the number of events observed by the number of years on record and multiplying by 100. This provides the percent chance of the event happening in any given year (e.g. 10 hurricanes or tropical storms over a 30-year period equates to a 33 percent chance of experiencing a hurricane or tropical storm in any given year). The likelihood of future occurrences is categorized into one of the classifications as follows:

- ***Highly Likely*** – Near 100 percent chance of occurrence within the next year
- ***Likely*** – Between 10 and 100 percent chance of occurrence within the next year (recurrence interval of 10 years or less)
- ***Occasional*** – Between 1 and 10 percent chance of occurrence within the next year (recurrence interval of 11 to 100 years)
- ***Unlikely*** – Less than 1 percent chance or occurrence within the next 100 years (recurrence interval of greater than every 100 years).

Those hazards determined to be of high or medium significance were characterized as priority hazards that required further evaluation in Section 3.3 Vulnerability Assessment. Significance was determined by frequency of the hazard and resulting damage, including deaths/injuries and property, crop and economic damage. Hazards occurring infrequently or having little to no impact on the Cutler Bay planning area were determined to be of low significance and not considered a priority hazard. These criteria allowed the FMPC to prioritize hazards of greatest significance and focus resources where they are most needed.

The National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC) has been tracking severe weather since 1950. The NCDC Storm Events Database contains an archive of destructive storm or weather data and information which includes local, intense and damaging events. This database contains 176 severe weather events that occurred in Miami-Dade County between January 1, 1950 and October 2, 2013. Table 3.4 summarizes these events.

Table 3.4 - NCDC Severe Weather Reports for Miami-Dade County and Cutler Bay, 1950-2013

Type	# of Events	Property Loss	Deaths	Injuries
Flash Flood	26	$101,968,000	0	0
Flood/Urban Flood	6	$75,000	0	0
Heavy Rain	18	$325,000	0	0
Storm Surge/Tide	4	0	0	0
Tropical Depression	1	0	0	0
Tropical Storm	9	$112,000	0	0
Waterspout	112	0	0	0
Total:	**176**	**$102,480,000**	**0**	**0**

Source: National Climatic Data Center Storm Events Database
Note: Losses reflect totals for all impacted areas within Miami-Dade County.

The FMPC supplemented NCDC data with data from SHELDUS™ (Spatial Hazard Events and Losses Database for the United States). SHELDUS™ is a county-level data set for the United States that tracks 18 types of natural hazard events along with associated property and crop losses, injuries, and fatalities for the period 1960-2013. Produced by the Hazards Research Lab at the University of South Carolina, this database combines information from several sources (including the NCDC). For events that covered multiple counties, the dollar losses, deaths, and injuries were equally divided among the affected counties (e.g., if four counties were affected, then a quarter of the dollar losses, injuries, and deaths were attributed to each county).

SHELDUS™ contains information on 82 severe weather events that occurred in Miami-Dade County between 1960 and 2013. Table 3.5 summarizes these events.

Table 3.5 - SHELDUS Severe Weather Reports for Miami-Dade County, 1960-2013

Type	# of Events	Property Loss	Crop Loss	Deaths	Injuries
Coastal	21	$1,498,053.00	$0.00	20	16
Flooding	22	$446,156,299.00	$635,454,713.00	0	0
Hurricane/Tropical Storm	28	$13,972,458,333.00	$789,380,779.00	13	21
Severe Storm/Thunder Storm	11	$575,715.00	$445,422.00	0	0
Total:	**82**	**$14,420,688,400.00**	**$1,425,280,914.00**	**33**	**37**

Source: Hazards & Vulnerability Research Institute (2013). The Spatial Hazard Events and Losses Database for the United States, Version 13.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org
Note: Losses have been adjusted for inflation to 2013 dollars.

The following sections provide profiles of the natural flood hazards that the FMPC identified in Table 3.1 Flood Hazard Summary.

3.2.1 Climate Change and Sea Level Rise

Hazard/Problem Description

Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2014). Climate change is a natural occurrence in which the earth has warmed and cooled periodically over geologic time. The recent and rapid warming of the earth over the past century has been cause for concern, as this warming is very likely due to the accumulation of human-caused greenhouse gases, such as CO_2, in the atmosphere (IPCC, 2007). This warming is occurring almost everywhere in the world which suggests a global cause rather than changes in localized weather patterns.

There are generally two separate mechanics involved in global sea level rise. The first is directly attributed to global temperature increases, which warm the oceans waters and cause them to expand. The second is attributed to the melting of ice over land which simply adds water to the oceans. Global sea level rise is likely caused by a combination of these two mechanics and can be exasperated on the local level by factors such as erosion and subsidence.

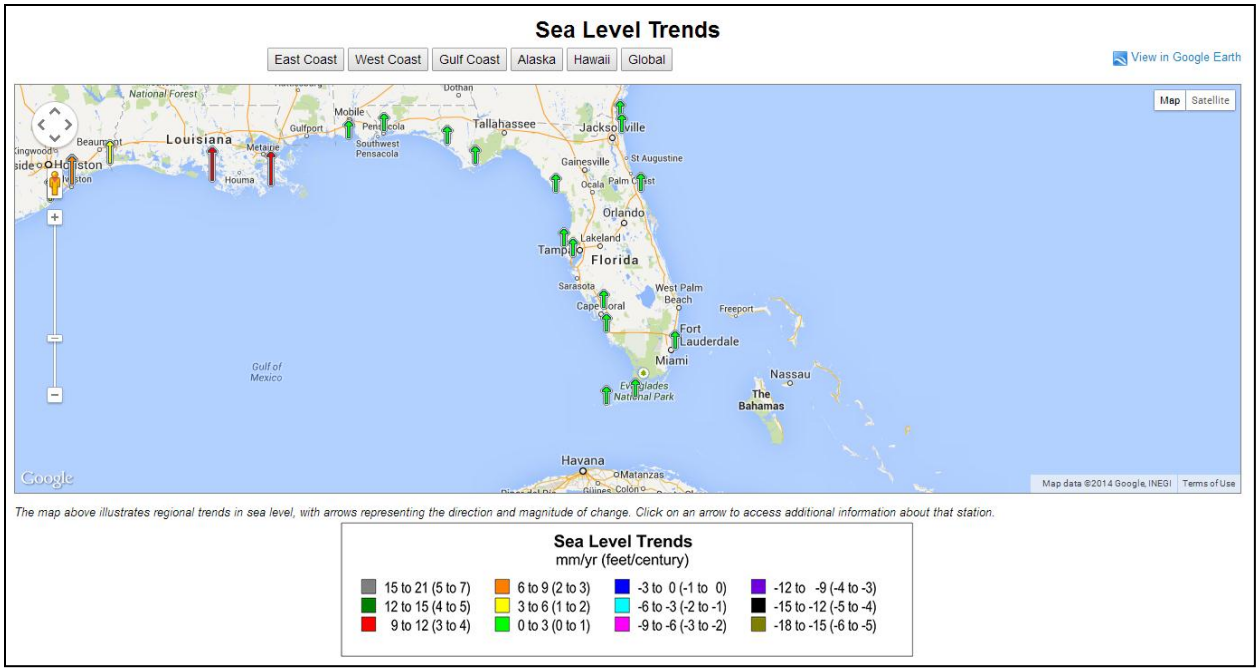
Due to sea-level rise projected throughout the 21st century and beyond, coastal systems and low-lying areas will increasingly experience adverse impacts such as submergence, coastal flooding, and coastal erosion. The population and assets projected to be exposed to coastal risks as well as human pressures on coastal ecosystems will increase significantly in the coming decades due to population growth, economic development, and urbanization (IPCC, 2014). South Florida is particularly vulnerable to the effects of climate change and sea level rise, due to its populous coastal counties, subtropical environment, porous geology and low topography. However, a 1 foot sea level rise projection on the Town of Cutler Bay is shown on figure 3.25 in Section 3.3.2.

Climate change has the potential to alter the nature and frequency of flood hazards that the Town already experiences such as hurricane storm surge, coastal erosion, and stormwater drainage. Sea level rise may also place additional stress on aquifers (saltwater intrusion) and gravity flow stormwater and septic systems to a rising groundwater table. An elevated storm surge due to sea level rise could produce a cascade of consequences affecting things such as land use, infrastructure, facilities, waterway navigation, the local economy, public health and safety, drinking water supplies, and ecosystems.

The potential for climate change influences on each flood hazard summarized in this plan is noted within each of the hazard's "Frequency/Likelihood of Future Occurrence" discussion section.

Past Occurrences

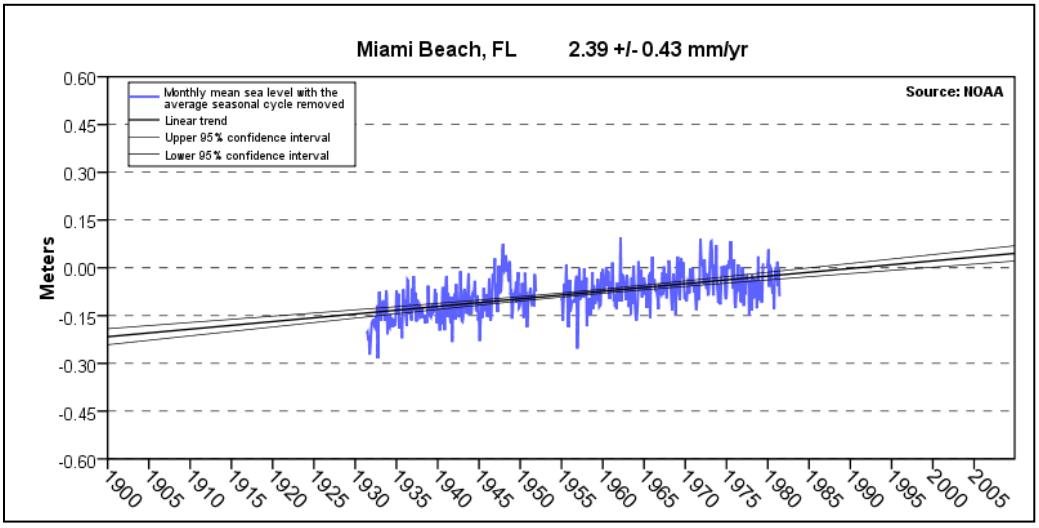
The rate of sea level rise has varied throughout geologic history, and studies have shown that global temperature and sea level are strongly correlated. The Center for Operational Oceanographic Products and Services within NOAA has been measuring sea level for over 150 years, with tide stations operating on all U.S. coasts. Changes in Mean Sea Level (MSL), either a sea level rise or sea level fall, have been computed at 128 long-term water level stations using a minimum span of 30 years of observations at each location. These measurements have been averaged by month to remove the effect of higher frequency phenomena (e.g. storm surge) in order to compute an accurate linear sea level trend. Figure 3.1 illustrates the regional trends in sea level appropriate for the Cutler Bay planning area.



Source: http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml

Figure 3.1 – Gulf/Atlantic Coast Sea Level Trends

Figure 3.2 shows the monthly mean sea level at NOAA's Miami Beach, FL station which is the station located closest to the Cutler Bay planning area. The mean sea level trend at the Miami Beach, FL station is 2.39 millimeters/year with a 95% confidence interval of +/- 0.43 mm/yr based on monthly mean sea level data from 1931 to 1981 which is equivalent to a change of 0.78 feet in 100 years.



Source: http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml

Figure 3.2 - Mean Sea Level Trend for Miami Beach, Florida

Frequency/Likelihood of Future Occurrence

Occasional **–**

Temperature Trends

As previously mentioned, studies have shown that global temperature and sea level are strongly correlated. Since 1901, the average surface temperature across the contiguous 48 states has risen at an average rate of 0.14°F per decade (1.4°F per century). Average temperatures have risen more quickly since the late 1970s (0.36 to 0.55°F per decade). Seven of the top 10 warmest years on record for the contiguous 48 states have occurred since 1998, and 2012 was the warmest year on record. Figure 3.3 below provided by the EPA shows how annual average air temperatures have changed in different parts of the United States since 1901. The rate of temperature change for southeast Florida is 3°F per century. Current science is projecting that the southeastern United States could experience a general increase in average temperatures anywhere from 4.5°F to 9°F in the coming century (Karl et al, 111).

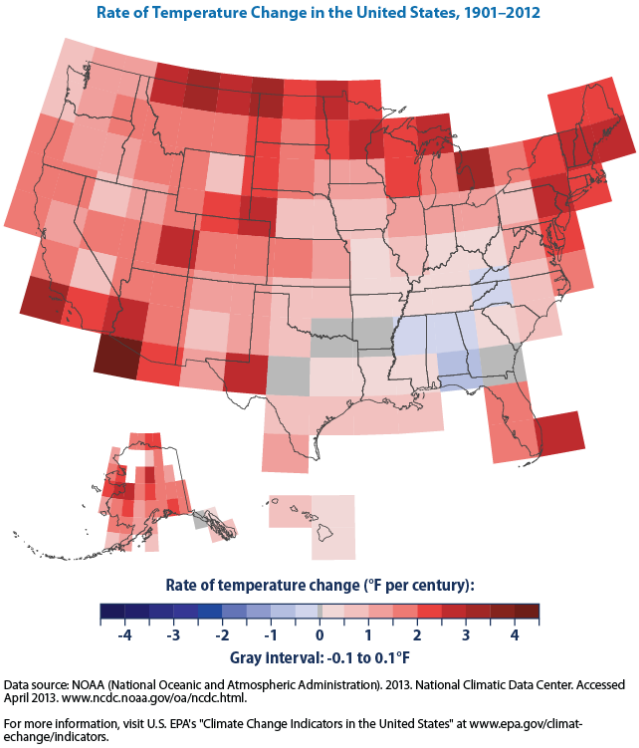


Figure 3.3- Rate of Temperature Change in the United States, 1901-2012

Sea Level Trends

Recognizing the variability in local sea level rise projections, the Southeast Florida Regional Climate Change Compact (SFRCCC) was created in order to unify the existing southeast Florida sea level rise projections and create a single projection for regional planning purposes. The SFRCCC consists of the county commissions of Monroe, Miami-Dade, Broward and Palm Beach Counties.

Key participants in developing existing sea level rise projections were invited to participate in the Regional Climate Change Compact Technical Ad hoc Work Group (Work Group). The Work Group reviewed available scientific literature to develop a unified sea level rise projection to be used as a guide for future policy decision makers. The Work Group ultimately agreed that the U.S. Army Corps of Engineers Guidance Document curves (USACE, 2009) offered a reasonable and defensive projection to be used for planning purposes in the southeast Florida region. The USACE projection uses Key West

tidal data from 1913-1999 as the foundation for the projection and references the year 2010 as the starting date as shown in Figure 3.4. Sea level rise is currently projected at 3-7 inches by 2030 and 9-24 inches by 2060.

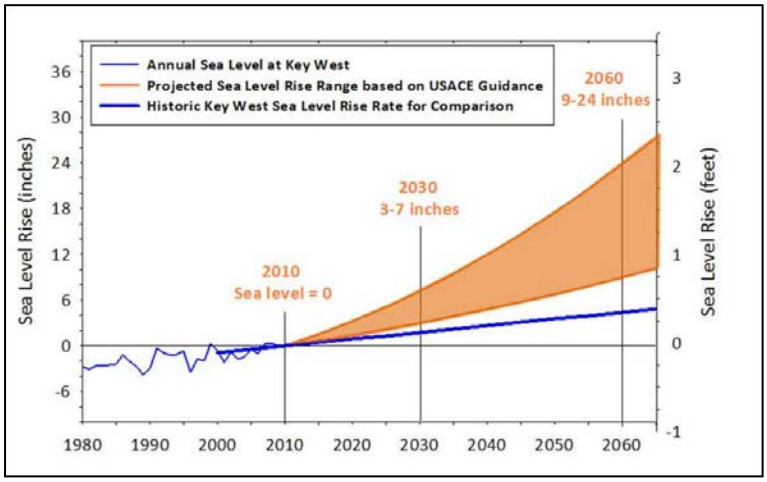


Figure 3.4 - Southeast Florida Sea Level Rise Projection

Source: Southeast Florida Regional Climate Compact, *A Unified Sea Level Rise Projection for Southeast Florida, April 2011.*

Table 3.6 shows the projected change in the rate of rise of sea level by decade, illustrating the acceleration of rate with time.

Table 3.6 - Projected Rate of Sea Level Rise by Decade

Time Range		Decadal Rate of Rise	
	Projected Rise (Inches)	Historic (Inches/Decade)	Projected Rate of Sea Level Rise (Inches/Decade)
		0.82 - 0.94	
2010-2020	1.5 - 3.0		1.4 - 3.2
2020-2030	3.0 - 7.0		1.6 - 4.0
2030-2040	5.0 - 12.0		1.8 - 4.8
2040-2050	7.0 - 17.5		2.0 – 5.6
2050-2060	9.0 - 24.0		2.2 – 6.3

Source: Southeast Florida Regional Climate Compact, *A Unified Sea Level Rise Projection for Southeast Florida, April 2011.*

According to the SFRCCC, scientific evidence strongly supports that sea level is rising and will continue to rise beyond 2060 even if mitigation efforts to reduce greenhouse gas emission are successful. Uncertainties in sea level rise projections do exist due to natural variability, limitations of existing computer models, and the inability to forecast human response in limiting greenhouse gas emissions. Therefore, projections will need to be reviewed and revised in the future as modeling capabilities improve and major findings in climate science data become available.

Ultimately, it is important to understand that sea level rise is not an endpoint but rather a continuing trend, and Cutler Bay must consider and plan for sea level rise in future policy decisions. Understanding trends in sea level, as well as the relationship between global and local sea level, provides critical information about the potential impacts of climate change and sea level rise on the Cutler Bay planning area. By examining local rates of sea level change and local projections for sea level rise at 3-7 inches by 2030 and 9-24 inches by 2060, Cutler Bay can begin to analyze and plan for the impacts of sea level rise in long-range planning.

3.2.2 Coastal/Canal Bank Erosion

Hazard/Problem Description

Coastal Erosion

Coastal erosion is a process whereby large storms, flooding, strong wave action, sea level rise, and human activities, such as inappropriate land use, alterations, and shore protection structures, wears away the beaches and bluffs along the coast. Erosion undermines and often destroys homes, businesses, and public infrastructure and can have long-term economic and social consequences. According to NOAA, coastal erosion is responsible for approximately $500 million per year in coastal property loss in the United States, including damage to structures and loss of land. To mitigate coastal erosion, the federal government spends an average of $150 million every year on beach nourishment and other shoreline erosion control measures.

Coastal erosion has both natural causes and causes related to human construction activities. Gradual coastal erosion results naturally from the very slow rise of sea-level. Severe coastal erosion can occur over a very short period of time when the state is impacted by hurricanes, tropical storms and other weather systems. In Florida, sand is moved parallel to most beaches by longshore drift and currents. Sand is continually removed by longshore currents in some areas but it is also continually replaced by sand carried in by the same type of currents. Structures such as piers or sea walls, jetties, and navigational inlets may interrupt the movement of sand, and sand can become "trapped" in one place by these types of structures. The currents will continue to flow, though depleted of sand trapped elsewhere which leads to erosion.

Erosion rates and potential impacts are highly localized. Average coastline recession rates of 25 feet per year are not uncommon on some barrier islands in the Southeast. Severe storms can remove even wider beaches, along with substantial dunes, in a single event. In undeveloped areas, these high recession rates are not likely to cause significant concern, but in some heavily populated locations, one or two feet of erosion may be considered catastrophic (NOAA, 2014).

Canal Bank Erosion

Streams/canals erode by a combination of direct stream processes, like down cutting and lateral erosion, and indirect processes, like mass-wasting accompanied by transportation. When the channel bends, water on the outside of the bend (the cut-bank) flows faster and water on the inside of the bend (the point) flows slower as shown in Figure 3.5. This distribution of velocity results in erosion occurring on the outside of the bend and deposition occurring on the inside of the bend.

Stream bank erosion is a natural process, but acceleration of this natural process leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss and other adverse effects. Stream bank erosion processes, although complex, are driven by two major components: stream bank characteristics (erodibility) and hydraulic/gravitational forces. Many land use activities can affect both of these components and lead to accelerated bank erosion. The vegetation rooting characteristics can protect banks from fluvial entrainment and collapse, and also provide internal bank strength. When riparian vegetation is changed from woody species to annual grasses and/or forbs, the internal strength is weakened, causing acceleration of mass wasting processes. When land use changes occur in a watershed, such as clearing land for agriculture or development, runoff increases. With this increase in runoff the stream channel will adjust to accommodate the additional flow, increasing streambank erosion. Stream bank aggradation or degradation is often a response to stream channel instability. Since bank erosion is often a symptom of a larger, more complex problem, the long-term solutions often involve much more than just bank stabilization. As a result canal bank erosion can occur throughout the Town of Cutler Bay as shown on Figure 3.13 (Cutler Bay Canal System) in Section 3.2.5.

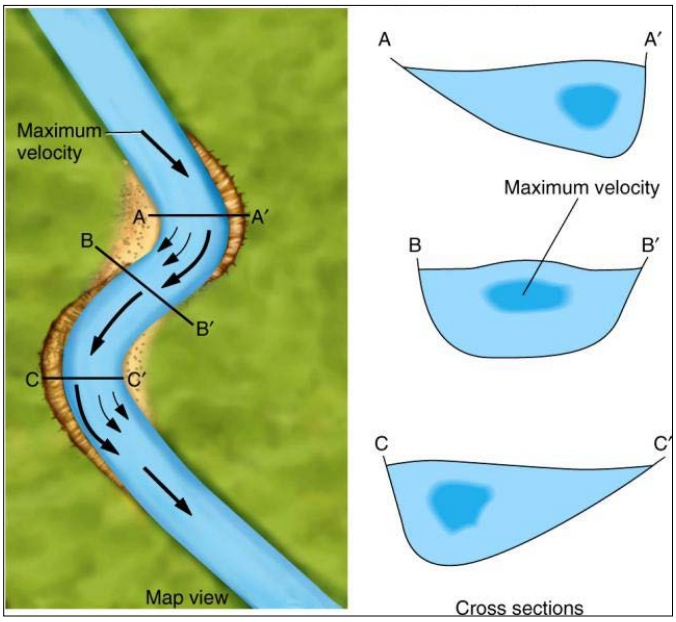


Figure 3.5- Stream Meanders

Past Occurrences

Miami-Dade County has been addressing coastal erosion since 1975 and invests approximately $6 million annually in beach restoration. However, unlike other communities within Miami-Dade County affected by coastal erosion, the shoreline of Biscayne Bay (the eastern boundary of the Cutler Bay planning area) is protected by mangroves within Biscayne National Park which assist in shoreline protection and stabilization. The tangled root systems of the mangroves trap sediments which prevents coastal erosion. Mangroves also assist in buffering the coastal zone from tropical storms and hurricanes as their branches and root systems create friction that reduces the force of winds and waves. Therefore, the mangroves play a large role in protecting Cutler Bay from coastal erosion. As a result, coastal erosion does not pose an imminent threat to insurable buildings in Cutler Bay.

Cutler Bay has reported one localized instance of limited canal erosion. A search of the NCDC database and SHELDUS database resulted in no past occurrences of coastal erosion or canal bank erosion. Furthermore, a report completed in June 2012 by the Florida Department of Environmental Protection (DEP), Division of Water Resource Management, titled "Critically Eroded Beaches in Florida" which inventoried critically eroded areas along the Atlantic and Gulf coasts did not identify any areas of erosion within the Cutler Bay planning area.

Canal Erosion on SW 194th Street

Frequency/Likelihood of Future Occurrence

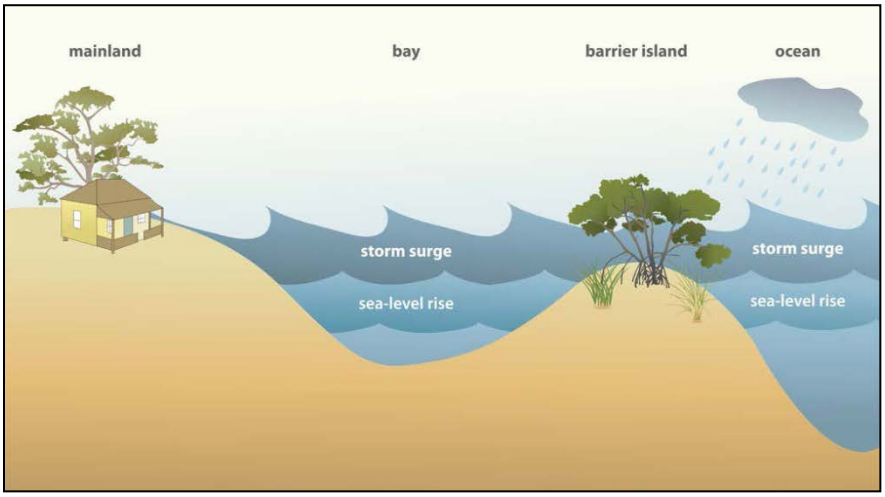
Likely – Several known localized instances of canal erosion prove that his hazard should be considered as a likely concern. However, no structural damage of insurable structures has occurred and is not likely to impact any buildings.

Coastal erosion is an unlikely concern for Cutler Bay.

However, it is paramount that Cutler Bay continues to maintain the natural flood protection benefits and floodplain functions provided by Biscayne National Park. This coastal flood zone should remain preserved and undeveloped in order to continue to protect the Cutler Bay planning area from coastal erosion. In areas along the canal system throughout the Cutler Bay Planning area, the extent of canal bank erosion is an average of 1 to 2 feet of erosion along the top and/or sides of canal banks. The maintenance of the canal system is the responsibility of Miami-Dade County and the South Florida Water Management District.

Climate Change and Coastal/Canal Bank Erosion

Sea-level rise will raise all tide levels, from low tide to storm surge. Wave action at higher tide levels may cause erosion of sandy beaches. Higher storm surges, which may be accompanied by stronger storm winds, could wash over the tops of sand dunes, flooding the burrows of dune-nesting animals. The combined effects of wind and waves could damage dunes, leaving the beachfront more vulnerable. (UF/IFAS Extension, 2013).



Credits: Jane Hawkey, IAN Image Library (ian.umces.edu/imagelibrary/)

Figure 3.6 - Seal Level Rise and Coastal Erosion of Dunes

According to the Center of Ocean Solutions, there has been a dramatic increase in coastal erosion over the last two decades and this is expected to continue as sea level rises and storm frequency and severity increase. Rather than occurring over the same time scale with sea level rise, erosion of beaches and coastal cliffs is expected to occur in large bursts during storm events as a result of increased wave height and storm intensity. Because of these large events, scientific models predict that shoreline erosion may outpace sea level rise by 50 to 200 fold. Erosion will have significant effects on coastal habitats, which can lead to social and economic impacts on coastal communities. With the reduction of coastal habitats and the ecological services they provide, coastal communities will experience more frequent and destructive flooding, compromised water supplies and smaller or fewer beaches.

3.2.3 Dam/Levee Failure

Hazard/Problem Description

Dam Failure

A dam is a barrier constructed across a watercourse that stores, controls, or diverts water. Dams are usually constructed of earth, rock, or concrete. The water impounded behind a dam is referred to as the

reservoir and is measured in acre-feet. One acre-foot is the volume of water that covers one acre of land to a depth of one foot. Dams can benefit farm land, provide recreation areas, generate electrical power, and help control erosion and flooding issues.

A dam failure is the collapse or breach of a dam that causes downstream flooding. Dam failures may be caused by natural events, human-caused events, or a combination. Due to the lack of advance warning, failures resulting from natural events, such as hurricanes, earthquakes, or landslides, may be particularly severe. Prolonged rainfall and subsequent flooding is the most common cause of dam failure.

Dam failures usually occur when the spillway capacity is inadequate and water overtops the dam or when internal erosion in dam foundation occurs (also known as piping). If internal erosion or overtopping cause a full structural breach, a high-velocity, debris-laden wall of water is released and rushes downstream, damaging or destroying anything in its path. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failures can result from any one or a combination of the following:

- Prolonged periods of rainfall and flooding;
- Inadequate spillway capacity, resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross-section of the dam and abutments, or maintain gates, valves, and other operational components;
- Improper design, including the use of improper construction materials and construction practices;
- Negligent operation, including the failure to remove or open gates or valves during high flow periods;
- Failure of upstream dams on the same waterway; and
- High winds, which can cause significant wave action and result in substantial erosion.

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major casualties and loss of life could result, as well as water quality and health issues. Potentially catastrophic effects to roads, bridges, and homes are also of major concern. Associated water quality and health concerns could also be issues. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

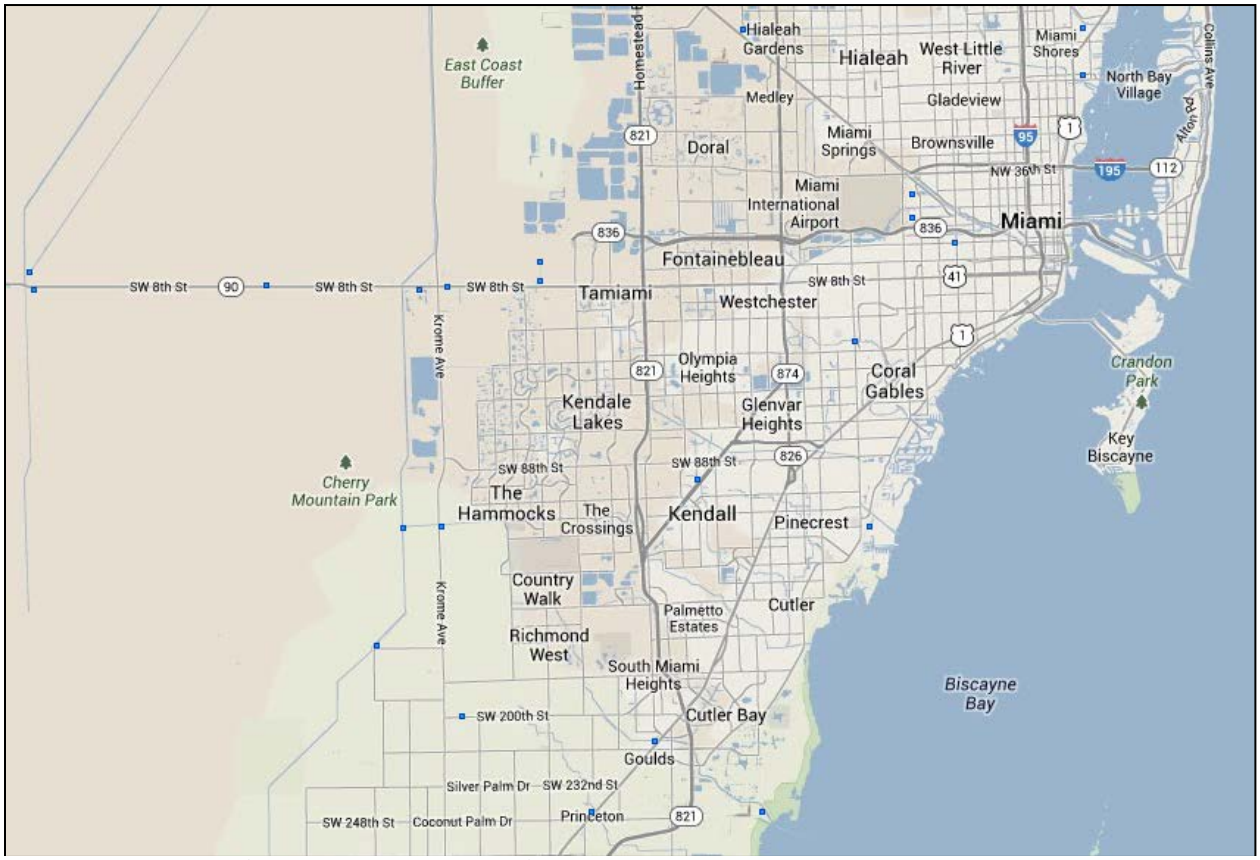
The National Inventory of Dams (NID) is a database of dams in the United States which was developed and is maintained by the USACE. Congress authorized the USACE to inventory dams as part of the 1972 National Dam Inspection Act. Several subsequent acts have authorized maintenance of the NID and provided funding. The USACE collaborates with FEMA and state regulatory offices to collect data on dams. The goal of the NID is to include all dams in the United States which meet at least one of the following criteria:

1. High hazard classification - loss of at least one human life is likely if the dam fails
2. Significant hazard classification - possible loss of human life and likely significant property or environmental destruction

3. Equal or exceed 25 feet in height and exceed 15 acre-feet in storage
4. Equal or exceed 50 acre-feet storage and exceed 6 feet in height

Low hazard dams which do not meet the criteria specified in number 3 or 4 are not included in the NID even if they are regulated according to state criteria. In some states, the number of these dams is several times the number of dams included in the NID.

Figure 3.7 reflects all dams included in the NID that are located around the Cutler Bay planning area. There are no dams located within the jurisdictional boundaries of Cutler Bay and no areas within Cutler Bay that could be affected by a dam failure. Table 3.7 details all dams located within Miami-Dade County as included in the NID.



Source: U.S. Army Corps of Engineers National Inventory of Dams

Figure 3.7- National Inventory of Dams for Cutler Bay

Table 3.7 - National Inventory of Dams, Miami-Dade County

Dam Name	NIDID	Owner	Height (Ft.)	NID Storage (acre-feet)	Primary Purpose	River
Structure 338	FL00690	SFWMD	26	242	Other	CANAL 1
Structure No. 148	FL00390	SFWMD	20	2977	Flood Control	BLACK CREEK (C-1)
Structure No. 21	FL00399	SFWMD	20	853	Flood Control	BLACK CREEK (C-1)
Structure No. 20A	FL00402	SFWMD	32	495	Flood Control	CANAL 106
Structure No. 333	FL00681	SFWMD	23	2726900	Other	LEVEE 29 BORROW CANAL

Dam Name	NIDID	Owner	Height (Ft.)	NID Storage (acre-feet)	Primary Purpose	River
Structure No. 166	FL00386	SFWMD	23	92	Flood Control	MOWRY CANAL (C-103(N))
Structure No. 22	FL00394	SFWMD	23	1270	Flood Control	SNAPPER CREEK CANAL (C-2)
Structure No. 337	FL00693	SFWMD	15	545380	Irrigation	S-31 BYPASS CANAL
Structure No. 165	FL00387	SFWMD	22	507	Flood Control	PRINCETON CANAL (C-102)
Structure No. 21A	FL00400	SFWMD	31	527	Flood Control	PRINCETON CANAL (C-102)
Structure No. 194	FL00381	SFWMD	24	1039	Flood Control	PRINCETON CANAL (C-102)
Structure No. 173	FL00376	SFWMD	20	2977	Flood Control	LEVEE 31N BORROW CANAL
Structure No. 25	FL00688	SFWMD	13	560	Other	COMFORT CANAL (C-5)
Structure No. 197	FL00389	SFWMD	14	1326	Flood Control	AEROJET CANAL (C-111)
Structure No. 20	FL00403	SFWMD	27	495	Flood Control	MODEL LAND CANAL (C-107)
Structure No. 30	FL00383	SFWMD	14	292	Flood Control	SNAKE CREEK CANAL (C-9)
Structure No. 176	FL00373	SFWMD	23	1639	Flood Control	AEROJET CANAL (C-111)
Structure No. 27	FL00405	SFWMD	20	1400	Flood Control	LITTLE RIVER CANAL (C-7)
Structure No. 32	FL00385	SFWMD	16	292	Flood Control	LEVEE 33 BORROW CANAL
Structure No. 29	FL00407	SFWMD	21	3410	Flood Control	SNAKE CREEK CANAL (C-9)
Structure No. 25B	FL00679	SFWMD	21	1500	Flood Control	TAMIAMI CANAL (C-4)
Structure No. 20F	FL00401	SFWMD	32	683	Flood Control	MOWRY CANAL (C-103)
Structure No. 31	FL00384	SFWMD	24	545380	Flood Control	MIAMI CANAL (C-6)
Structure No. 196	FL00377	SFWMD	13	1039	Flood Control	MOWRY CANAL (C-103)
Structure No. 26	FL00404	SFWMD	25	1460	Flood Control	MIAMI RIVER (NORTH FORK)
Structure No. 121	FL00392	SFWMD	13	1000	Flood Control	--
Structure No. 28	FL00406	SFWMD	21	1247	Flood Control	BISCAYNE CANAL (C-8)
Structure No. 336	FL00683	SFWMD	18	545380	Other	TAMIAMI CANAL (C-4)
Structure No. 32A	FL00691	SFWMD	17	2618	Other	LEVEE 30 BORROW CANAL
G93 Control Structure	FL76008	SFWMD	12	280	Flood Control	C-3 CANAL
Structure No. 179	FL00388	SFWMD	32	812	Flood Control	MOWRY CANAL (C-103)
G211Control	FL76001	SFWMD	22	600	Flood Control	C-1W CANAL

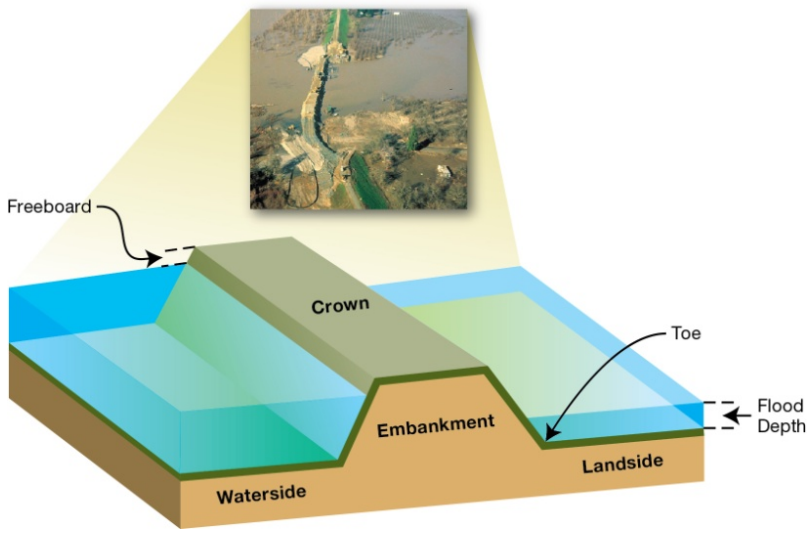
Dam Name	NIDID	Owner	Height (Ft.)	NID Storage (acre-feet)	Primary Purpose	River
Structure						
C4 EDB South Control Structure	FL76003	SFWMD	11	1872	Flood Control	TAMIAMI CANAL
C4 EDB East Control Structure	FL76002	SFWMD	11	1872	Flood Control	TAMIAMI CANAL
G119 Control Structure	FL76004	SFWMD	22	40000	Water Supply	TAMIAMI CANAL (C4)
G58 Control Structure	FL76005	SFWMD	14	200	Other	ARCH CREEK
G70 Control Structure	FL76006	SFWMD	20	42220	Fish and Wildlife Pond	L-29 CANAL
G72 Control Structure	FL76007	SFWMD	14	1250	Other	C-7 EXTENSION CANAL

Source: U.S. Army Corps of Engineers National Inventory of Dams

Levee Failure

FEMA defines a levee as "a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water in order to reduce the risk from temporary flooding." Levee systems consist of levees, floodwalls, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices. Levees often have "interior drainage" systems that work in conjunction with the levees to take water from the landward side to the water side. An interior drainage system may include culverts, canals, ditches, storm sewers, and/or pumps.

Levees and floodwalls are constructed from the earth, compacted soil or artificial materials, such as concrete or steel. To protect against erosion and scouring, earthen levees can be covered with grass and gravel or hard surfaces like stone, asphalt, or concrete. Levees and floodwalls are typically built parallel to a waterway, most often a river, in order to reduce the risk of flooding to the area behind it. Figure 3.8 below shows the components of a typical levee.

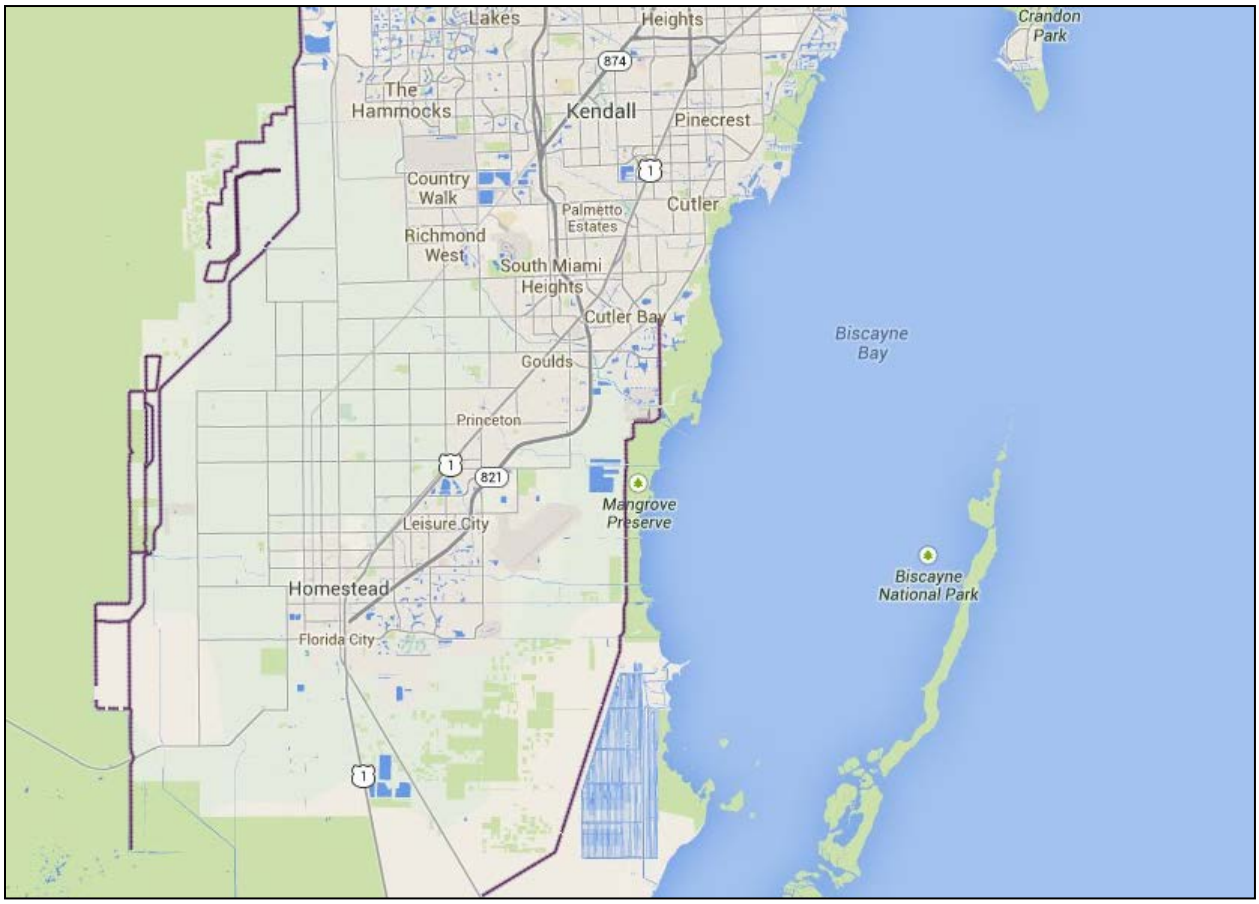


Source: FEMA, *What is a Levee Fact Sheet*, August 2011

Figure 3.8- Components of a Typical Levee

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events. Levees reduce, not eliminate, the risk to individuals and structures behind them. A levee system failure or overtopping can create severe flooding and high water velocities. It is important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Figure 3.9 below reflects all levees included in the U.S. Army Corps of Engineers National Levee Database (NLD). Levee centerlines are indicated in purple. Table 3.8 details all levees within a 25 mile radius of the Town of Cutler Bay as included in the NLD. No areas with Cutler Bay could potentially be affected by a levee failure.



Source: U.S. Army Corps of Engineers National Levee Database

Figure 3.9 - National Levee Database for Cutler Bay

Table 3.8 - National Levee Database, Cutler Bay Planning Area

County(ies)	System Name	Sponsor	Length (mi)	Inspection Rating	Leveed Area Type
Broward, Hendry, Miami-Dade, Palm Beach	L-38 Section 2	SFWMD	3.74	Minimally Acceptable	Agricultural
Miami-Dade	East Coast, L-30	SFWMD	13.88	Minimally Acceptable	Urban
Miami-Dade	L-31 East	SFWMD	18.91	Minimally Acceptable	Rural
Miami-Dade	8.5 Square Mile Area	SFWMD	13.38	Minimally	Urban

County(ies)	System Name	Sponsor	Length (mi)	Inspection Rating	Leveed Area Type
				Acceptable	
Miami-Dade	L-31W Segment 3	SFWMD	5.15	Minimally Acceptable	Agricultural
Miami-Dade	L-31 West	SFWMD	16.5	Minimally Acceptable	Urban
Miami-Dade	C-111 SD South	SFWMD	6.76	Minimally Acceptable	Agricultural
Broward, Collier, Miami-Dade, Monroe	L-29	SFWMD	45.38	Unacceptable	Agricultural
Broward, Miami-Dade	East Coast, L-33	SFWMD	8.17	Minimally Acceptable	Urban
Miami-Dade	C-111 SD North	SFWMD	5.86	Minimally Acceptable	Agricultural
Broward, Miami-Dade	WCA-3B	SFWMD	51.89	Minimally Acceptable	Agricultural
Miami-Dade	L-31 North	SFWMD	21.11	Minimally Acceptable	Urban

Source: U.S. Army Corps of Engineers National Levee Database

Past Occurrences

There are no past reported dam breaches or levee failures within Cutler Bay.

Frequency/Likelihood of Future Occurrence

Unlikely –There are no high or significant hazard dams located within Cutler Bay, and there are no documented occurrences of past levee failure. Therefore, the extent of dam and levee failure on the Cutler Bay planning area would be negligible and have no effect (0 feet) in rising flood levels.

It should be noted that there are no levees within Cutler Bay that have been certified by FEMA to protect against the 100-year flood. Therefore, Cutler Bay residents should not be lulled into a false sense of security by the surrounding levees as no level of protection is guaranteed. In fact, areas behind levees that cannot be certified are typically considered high-risk areas.

Climate Change and Dam/Levee Failure

While average annual rainfall may increase or decrease slightly as a result of climate change, the intensity of individual rainfall events is likely to increase which could overwhelm fragile flood control systems. Climate change is unlikely to change the risk of the Town to dam failure. However, future levees and sea walls may need to be built to combat the effects of sea level rise and storm surge which would affect future risk.

3.2.4 Flood: 100-/500-year

Hazard/Problem Description

Flooding is defined by the rising and overflowing of a body of water onto normally dry land. Flooding can result from an overflow of inland or tidal waters or an unusual accumulation or runoff of surface waters from any source. Flooding within Cutler Bay can be attributed to tidal flooding resulting from hurricanes and tropical storms and heavy rainfall that overburdens the drainage system within the community.

The primary source of flooding in Cutler Bay is due to stormwater runoff where catch basins and the underground drainage system are not able to handle heavy rainfall events. This type of flooding causes

intersections to become impassible and sometimes affects nearby buildings. The FMPC and Town staff identified several locations where localized stormwater flooding occurs.

During major flood events the canal system has the potential to overflow which can impact nearby properties. Because the water table is extremely high in south Florida, the potential for canal flooding is prominent during major events.

Coastal storm surge can impact properties in eastern Cutler Bay especially in the Saga Bay area. The last time properties were affected by storm surge was during Hurricane Andrew. The Cutler Wetlands which sits between Key Biscayne National Park and Saga Bay provides some protection from coastal storm surge flooding.

Sources and Types of Flooding

In Cutler Bay, all flooding can be defined as coastal, drainage or flash flooding. Most drainage related flooding results from intrusion of tide water into drainage outlets which prevents drainage features from operating as they were designed.

Coastal (Tidal) Flooding: All lands bordering the coast along Biscayne Bay are prone to tidal affects/flooding. Coastal land such as sand bars, barrier islands and deltas provide a buffer zone to help protect human life and real property relative to the sea much as flood plains provide a buffer zone along rivers and other bodies of water. Coastal floods usually occur as a result of abnormally high tides or tidal waves, storm surge and heavy rains in combination with high tides, tropical storms and hurricanes.

Drainage: Drainage flooding occurs primarily in urban or developed areas when the volume of runoff exceeds the capacity of the drainage system. Flooding of this nature can be the result of increased development, inadequate drainage structures, riverine flooding, coastal flooding or a combination of these causes.

Flash or Rapid Flooding: Flash flooding is the result of heavy, localized rainfall, possibly from slow-moving intense thunderstorms that cause small streams to overflow. In Cutler Bay, flash floods are most common when rain fall on built-up areas where impervious surfaces, gutters and storm sewers speed up the flow of run-off. These flood waters have high velocities that are capable of sweeping everything in their path.

Health Hazards Associated with Flooding

Certain health hazards are also common to flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where farm animals are kept or their wastes are stored can contribute polluted waters to the receiving streams.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as e. coli and other disease causing agents.

The second type of health problem arises after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed

mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If the county water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and personal belongings destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

Flooding and Floodplains

The area adjacent to a channel is the floodplain, as shown in Figure 3.10. A floodplain is flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current.

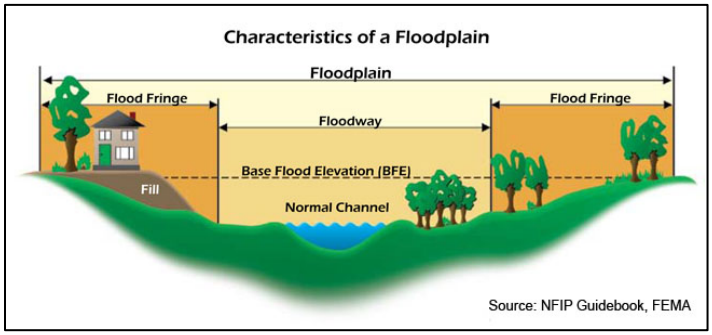


Figure 3.10 - Characteristics of a Floodplain

In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a 1% chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program (NFIP). The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

The Town of Cutler Bay has been a participant in the NFIP since August 31, 2006. Cutler Bay has achieved a Class 6 flood insurance rating through participation in the NFIP's Community Rating System which rewards all policyholders in the Town with a 20 percent reduction in their flood insurance premiums. Tables 3.9 – 3.12 reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

Table 3.9 - NFIP Policy and Claims Data by Structure Type

Structure Type	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	2,623	$1,592,000	$640,369,700	4	$127,940
2-4 Family	23	$10,150	$4,922,000	0	$0
All Other Residential	651	$111,094	$75,238,600	0	$0
Non-Residential	28	$41,538	$12,736,600	0	$0
Total	**3,325**	**$1,754,782**	**$733,266,900**	**4**	**$127,940**

Source: FEMA Community Information System, April 2014

Table 3.10 - NFIP Policy and Claims Data by Flood Zone

Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	2,482	$1,433,176	$517,974,300	1	$6,388
A Zones	0	$0	$0	0	$0
AO Zones	0	$0	$0	0	$0
AH Zones	535	$196,197	$127,246,300	1	$37,858
AR Zones	0	$0	$0	0	$0
A99 Zones	0	$0	$0	0	$0
V01-30 & VE Zones	0	$0	$0	0	$0
V Zones	0	$0	$0	0	$0
D Zones	0	$0	$0	0	$0
B, C & X Zone	0	$0	$0	0	$0
Standard	5	$5,990	$1,223,300	1	$46,367
Preferred	303	$119,419	$86,823,000	1	$37,327
Total	**3,325**	**$1,754,782**	**$733,266,900**	**4**	**$127,940**

Source: FEMA Community Information System, April 2014

Table 3.11 - NFIP Policy and Claims Data Pre-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	1,128	$565,394	$196,551,500	0	$0
A Zones	0	$0	$0	0	$0
AO Zones	0	$0	$0	0	$0
AH Zones	482	$176,615	$114,464,800	1	$37,858
AR Zones	0	$0	$0	0	$0
A99 Zones	0	$0	$0	0	$0
V01-30 & VE Zones	0	$0	$0	0	$0
V Zones	0	$0	$0	0	$0
D Zones	0	$0	$0	0	$0
B, C & X Zone	242	$99,243	$68,388,000	1	$46,367
Standard	3	$4,463	$975,000	1	$46,367

Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
Preferred	239	$94,780	$67,413,000	0	$0
Total	**1,852**	**$841,252**	**$379,404,300**	**2**	**$84,225**

Source: FEMA Community Information System, April 2014

Table 3.12 - NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	1,354	$867,782	$321,422,800	1	$6,388
A Zones	0	$0	$0	0	$0
AO Zones	0	$0	$0	0	$0
AH Zones	53	$19,582	$12,781,500	0	$0
AR Zones	0	$0	$0	0	$0
A99 Zones	0	$0	$0	0	$0
V01-30 & VE Zones	0	$0	$0	0	$0
V Zones	0	$0	$0	0	$0
D Zones	0	$0	$0	0	$0
B, C & X Zone	66	$26,166	$19,658,300	1	$37,327
Standard	2	$1,527	$248,300	0	$0
Preferred	64	$24,639	$19,410,000	1	$37,327
Total	**1,473**	**$913,530**	**$353,862,600**	**2**	**$43,715**

Source: FEMA Community Information System, April 2014

Regulated floodplains are illustrated on inundation maps called Digital Flood Insurance Rate Maps (DFIRMs). It is the official map for a community on which FEMA has delineated both the special flood hazard areas (SFHAs) and the risk premium zones applicable to the community. SFHAs represent the areas subject to inundation by the 1-percent-annual chance flood event. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk and type of flooding. Flood prone areas were identified within the Town of Cutler Bay using the most current Flood Insurance Study (FIS) and associated DFIRMs developed by FEMA and adopted by ordinance on September 11, 2009. Table 3.13 summarizes the flood insurance zones identified by the DFIRMs. Figure 3.11 reflects the mapped flood insurance zones for the Town of Cutler Bay.

Table 3.13 – Mapped Flood Insurance Zones within Cutler Bay

Zone	Description
VE	Also known as the coastal high hazard areas. They are areas subject to high velocity water including waves; they are defined by the 1% annual chance (base) flood limits (also known as the 100-year flood) and wave effects 3 feet or greater. The hazard zone is mapped with base flood elevations (BFEs) that reflect the combined influence of stillwater flood elevations, primary frontal dunes, and wave effects 3 feet or greater.
AE	AE Zones, also within the 100-year flood limits, are defined with BFEs that reflect the combined influence of stillwater flood elevations and wave effects less than 3 feet. The AE Zone generally extends from the landward VE zone limit to the limits of the 100-year flood from coastal sources, or until it reaches the confluence with riverine flood sources. The AE Zones also depict the SFHA due to riverine flood sources, but instead of being subdivided into separate zones of differing BFEs with possible wave effects added, they represent the flood profile determined by

Zone	Description
	hydrologic and hydraulic investigations and have no wave effects.
AH	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are 1–3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone.
0.2% Annual Chance (shaded Zone X)	Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X (shaded) is used on new and revised maps in place of Zone B.)
Zone X (unshaded)	Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. (Zone X (unshaded) is used on new and revised maps in place of Zone C.)

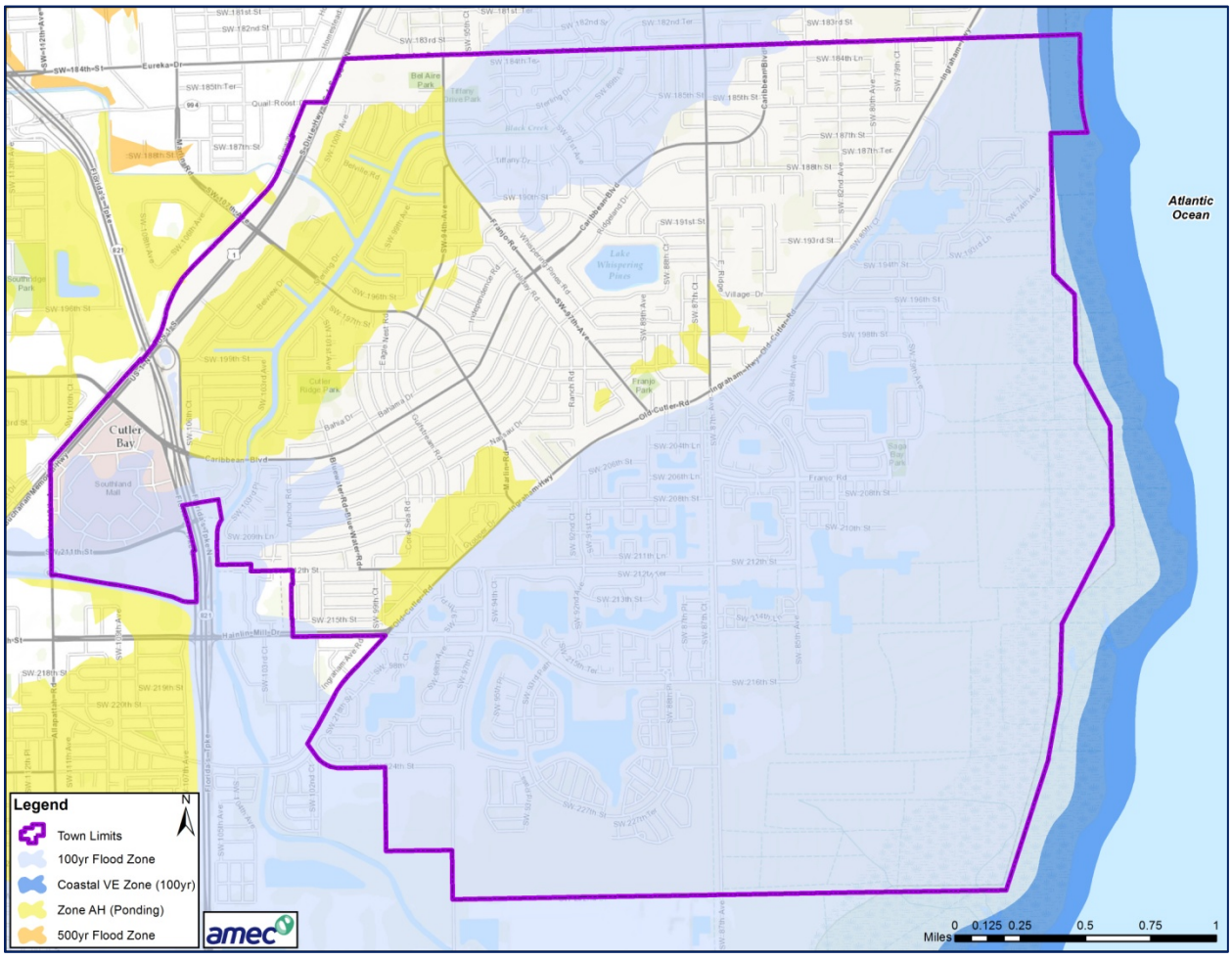


Figure 3.11- Cutler Bay DFIRM Flood Zones

The NFIP utilizes the 100-year flood as a basis for floodplain management. The FIS defines the probability of flooding as flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 100 year period (recurrence intervals). Or considered another way, properties within a 100-year flood zone have a one percent probability of being equaled or exceeded during any