2017 COMPREHENSIVE FLOODPLAIN MANAGEMENT PLAN

Adopted by City Council Resolution no. _

Including
THE REPETITIVE LOSS PLAN

CITY OF SANIBEL LEE COUNTY, FLORIDA

The 2016 Comprehensive Floodplain Management Plan replaces The 2005 Floodplain Management Plan of the National Flood Insurance Program Community Rating System updates the Plan adopted by City Council (Resolution no. 95-89) on April 18, 1995. This updated Plan reflects changed conditions; the progress made in implementing the Plan, and provides direction for future actions.

National Flood Insurance Program
Community Rating System
Activities 510 & 520
SANIBEL COMPREHENSIVE
FLOODPLAIN MANAGEMENT PLAN

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

When the Federal Emergency Management Agency (FEMA) established the Community Rating System (CRS) in 1990, the City of Sanibel was one of the first to apply. Due to its historic proactive floodplain management efforts, the City is currently recognized as a Class 5 community by the CRS.

Through the CRS program, the City has made a commitment to further improve and enhance its proactive floodplain management efforts through the evaluation and updating of its comprehensive Floodplain Management Plan (FMP). The purpose of the Sanibel FMP is to reduce or eliminate risk to people and property from flood hazard and has been developed to meet CRS criteria for such planning documents, and incorporates the primary goals of the CRS to reduce flood losses, facilitate accurate insurance ratings, and promote the awareness of flood insurance. The plan includes existing and new mitigation activities, to prioritize mitigation activities and on-going activities to meet the City's floodplain management goals.

The City of Sanibel has implemented its Comprehensive Floodplain Management Plan since the initial adoption of that plan in 1995. This 2005 Floodplain Management Plan assesses updates and clarifies that plan and provides direction for future actions. On May 3rd, 2016, the Sanibel City Council established a City of Sanibel Floodplain Management Planning and Mitigation Advisory Committee to the City of Sanibel to organize and prepare the Floodplain Management Plan.

Under the Community Rating System (CRS), there is an incentive for communities to do more than regulate new construction. The CRS provides a reduction in flood insurance premiums to reflect activities that reduce flood damage to existing buildings, protect new buildings beyond the minimum NFIP protection level, and help residence obtain flood insurance. The objective of the CRS is to reward communities that are doing more than meeting the minimum NFIP requirements to help their citizens prevent or reduce flood losses, and provide an incentive for communities to initiate new flood protection activities.

The Committee identified flood hazards that pose a risk to the City, assessed the City's vulnerability to these hazards, and examined potential projects to mitigate them. The flood hazards identified in this plan include:

1. Special Flood Hazard Area – Flood from 100 year flood
2. Interior flooding caused by rain events
3. Repetitive Loss Properties
4. Beach Erosion
5. Damage to Causeway
6. Climate Change and Sea Level Rise

Based on risk for each of the flood hazards identified above, the Committee agreed the 6 goals identified in the 2005 Plan are still valid and added a 7th goal.

1. Continue to use the effective damage reduction and mitigation activities that minimize the flood threat through appropriate and proactive floodplain management regulations.
   - Retain the density established by the *Sanibel Plan*
   - Maintain limitations on improvements to buildings that do not conform to current flood regulations
   - Continue to enforce the Florida Building Code, including flood regulations in the State's Coastal Construction Control Program.
   - Continue implementation of stormwater management regulations
   - Continue to preserve the lands owned and managed for conservation purposes
2. Identify measures that can be used to protect buildings that are not complaint with current flood regulations

3. Preserve and protect as much of the Island's floodplains as possible in their natural state for the beneficial floodplain functions they provide.
4. Continue to implement the Sanibel Emergency Management Plan to provide warnings of imminent flood dangers
5. Maintain the structural components of the Surface Water Management System and provide a remote monitoring component to improve its efficiency in threat warning and flood control.
6. Continue to provide information to the community regarding the Island's flood threat, assistance in minimizing that threat, and flood insurance.
7. Allow for pre and post disaster redevelopment and mitigation policies and procedures designed to reduce or avert Sanibel's future disaster potential.

Other updates to the Plan included involvement from the public by way of questionnaire and meeting notices, and attendees of the meetings from other agencies and partners.

The largest potential impact in hazard assessment of the 100-year storm is Base Flood Elevation (BFE) requirements from the FEMA maps. In November 2014, FEMA notified the City of Sanibel that it is analyzing coastal wave action in the Gulf of Mexico as part of its Risk Mapping, Assessment & Planning (Risk MAP) program. This analysis will be used to create new elevation data for Flood Insurance Rate Maps (FIRMs). Preliminary maps are anticipated to be distributed in 2018. Previous maps included Zone VE, where the flood elevations includes wave heights equal or greater than 3 feet; and Zone AE, where the flood elevation includes wave heights less than 3 feet. The Risk Map product will include a line showing the Limit of Moderate Wave Action or LiMWA, which is the limit of the area expected to receive 1.5-foot or greater during the storm event.

Other changes were made to include updated storms, new protection projects, and new outreach projects included in the Multi-jurisdictional Program for Public Information.

II. INTRODUCTION

The City of Sanibel is a barrier island, located on southern Florida's Gulf coast. In 1974, the City was in a grassroots effort to gain local control over land development so that the fragile and unique environment of the Island could be preserved and enhanced. The City strives to be a leader in the area of land use planning and growth management. Development within the City is regulated to coexist with nature.

One of the City's initial tasks following incorporation was the adoption of the *Sanibel Plan* (a comprehensive land use plan), which uses the 'carrying capacity' concept of land use management to determine the development intensity permitted on the island: the more sensitive the land is to human activity, the less development is permitted. In the City's very fragile and vulnerable Gulf Beach, Bay Beach and Mangrove Forest Zones, little or no development is allowed. On the higher and less environmentally sensitive ridge areas of the Island, more intense development is permitted.

Prior to incorporation, Sanibel Island was zoned for the development of over 30,000 dwelling units. After the City was established and the initial *Sanibel Plan* was adopted in 1976, the projected number of dwelling units to be permitted on the Island dropped to approximately 7,800. After subsequent lawsuits and Plan amendments, the current projected number of dwelling units to be permitted on the Island has been adjusted to approximately 9,000.

Not only did the City significantly decrease the amount of development permitted on the Island, but the City's new zoning regulations severely restrained and, in some cases, prohibited development in the Island's most environmentally sensitive and flood prone areas such as the Bay and Gulf Beach Zones, the Mangrove Forest Zones and the Interior Wetlands Conservation District. By restricting or limiting development in these sensitive and vulnerable areas, the City took a giant step to protect the public health, safety and welfare from flood damage. As previously mentioned, by joining the NFIP in 1979 and requiring new construction to be built above the Program's base flood elevation, development that has occurred on Sanibel since that time is relatively safe from flood damage in all but the very worst case storm events.

A primary hazard associated with Sanibel's development is evacuation of the island prior to storm landfall. Sanibel is connected to the mainland by a two lane causeway, making advance warning time critical to the safety of the island's population.

A major part of the City's efforts to regulate development to coexist with nature includes coping with nature's harsher side as well. The City's vulnerability to erosion, hurricanes and flooding is a very real threat that must be understood, planned for and managed to minimize the potential impact on the health, safety and welfare of the community. The 1995 and 2005 Sanibel Floodplain Management Plan was developed with this objective as its basis, in an effort to continue and enhance "the orderly future development of an island community known far and wide for its unique atmosphere and unusual natural environment." This 2016 Plan updates the 2005 update of the Floodplain Management Plan, assesses the City's success in achieving the Action Plan, reflects current conditions and refocuses the Plan's objectives and activities.

III. THE PLAN

STEP 1. ORGANIZE TO PREPARE THE PLAN

On May 3, 2016, the Sanibel City Council adopted Resolution No. 16-032, attached as Appendix A, establishing a City of Sanibel Floodplain Management Planning and Mitigation Advisory Committee to the Sanibel City Council.

The Committee is composed of six (6) members, each of whom shall have expertise in one or more of the following categories and a member of the general public:

- Preventive measures (e.g., codes)
- Property protection (e.g., elevation)
- Natural resource protection
- Emergency services
- Structural flood control projects
- Public Information

The purpose and function of the City of Sanibel Floodplain Management Planning and Mitigation Advisory Committee shall be to study, plan for and advise the Sanibel City Council on ways in which the community of the City of Sanibel and the Sanibel City Council can organize and prepare its Floodplain Management Plan. The Sanibel Planning Department shall be available to the City Council and, upon direction by the City Council or City Manager, available to assist in advising on ways to incorporate the Floodplain Management or Mitigation Plan into the City of Sanibel's planning activities and/or planning regulations.

The City of Sanibel Floodplain Management Planning and Mitigation Advisory Committee shall meet a sufficient number of times to fulfil its function and purpose but, at a minimum, shall meet to accomplish the following key steps in the planning process, with at least one meeting on each of the following:

- Assess the floodplain and related hazards
- Assess the challenges and problems faced by the City of Sanibel with respect to flooding and floodplain management;
- To set goals to address floodplain management and mitigation strategies;
- Review potential activities, strategies, projects and planning to address appropriate floodplain management for the City of Sanibel; and
- Draft an action plan to address floodplain management planning, flood hazard mitigation and related activities.

The following persons are hereby appointed as the initial members of the Floodplain Management Planning and Mitigation Advisory Committee:

- Major William Dalton, Sanibel Police Department (with expertise in emergency services and public information)
- Harold Law, Sanibel Building Director (with expertise in preventative measures, e.g. Codes)
- James Jordan, Sanibel Planning Director, (with expertise in planning, zoning and incorporating recommendations into the City's planning and ordinance process)
- Sandy Larsen, Sanibel Assistant City Engineer (with expertise in structural flood control projects and property protection, e.g. elevation)
- Chris Heidrick, Sanibel full-time resident and business owner (with expertise in flood insurance and flood mitigation regulations)
- Eric Pfeifer, a City of Sanibel full-time resident and member of the general public

On December 6, 2016, City Council approved Resolution 16-089 replacing Lieutenant William Dalton with Lance Henninger, of the Sanibel Police Department attached as Appendix B.

Benefits of good floodplain management include increased public safety, reduction of damage to property and public infrastructure, avoidance of economic disruption and losses, reduction of human suffering, environmental protection, preservation of floodplains in their natural state, and reduction of flood insurance rates. The City of Sanibel has incorporated many principles and practices of good floodplain management into its land development regulations.

After incorporation and adoption of the *Sanibel Plan* in 1976, one of the next steps the City took to facilitate good floodplain management was to join the National Flood Insurance Program (NFIP) on April 16, 1979. The NFIP identified the entire Island as a Special Flood Hazard Area and from that point on, all structures on Sanibel were required to be built above or flood-proofed to the base flood elevation. This requirement significantly reduced the City's susceptibility to the damaging impacts of floods.

When the Federal Emergency Management Agency (FEMA) established the Community Rating System (CRS) in 1990, the City of Sanibel was one of the first to apply. Due to its historic proactive floodplain management efforts, the City is currently recognized as a Class 5 community by the CRS. As a part of the CRS program, the City developed a Repetitive Loss Plan. The Update of the Repetitive Loss Plan can be found in Section IV of this Plan.

Through the CRS program, the City has made a commitment to further improve and enhance its proactive floodplain management efforts through the evaluation and updating of its comprehensive Floodplain Management Plan (FMP). The Sanibel FMP has been developed to meet CRS criteria for such planning documents, and incorporates the primary goals of the CRS to reduce flood losses, facilitate accurate insurance ratings, and promote the awareness of flood insurance. The plan includes short range, long range and on-going activities to meet the City's floodplain management goals.

The process used to develop and update the Floodplain Management Plan is as follows:

1. Update the Inventory of the Flood Hazard Area, including building data, development trends, development constraints, critical facilities, and natural areas identification
2. Hazard Assessment and Problem Identification
3. Review of Current and Alternative Activities for Floodplain Management and Hazard Mitigation
4. Coordination with City Departments Responsible For Implementation of the Plan
5. Coordination with Other Local, Regional, State and Federal Agencies
6. Public Input
7. Update the Comprehensive Floodplain Management Action Plan
8. Adoption of the 2016 Comprehensive Floodplain Management Plan by Sanibel City Council
9. Strategy for Implementation, Evaluation and Future Revisions to the 2016 Comprehensive Floodplain Management Plan

On December 1, 2015, the City Council adopted by Resolution 15-096, the Multijurisdictional Program for Public Information (MJPPI). The MJPPI was developed by members of the Lee County Community Rating System Users Group to enhance their communication outreach and meet quarterly. The Committee focused on methods and messages reaching the maximum number of target audiences' including residents and businesses while considering the financial impact to the communities. At least two (2) members of the City's Advisory Committee attended the MJPPI meetings held. A copy of the MJPPI is attached as Appendix C.

Through this update process, the City attempts to identify additional programs, policies and activities that will best manage the Island's flood problems and protect the health, safety and welfare of the community.

STEP 2. PUBLIC INVOLVEMENT

A key to the implementation of the Sanibel Comprehensive Floodplain Management Plan is public involvement. The City's on-going information and assistance program and community outreach program dispenses floodplain management information throughout the community via the website and various public locations and provides a means for the public to suggest improvements to the plan.

In addition to the regular Floodplain Management Plan Advisory Committee public meetings, the March 22, 2017 public meeting approved the 2016 Floodplain Management Plan Draft to welcome public information in advance of submittal to the City Council for approval.

Public comment is invited at all Sanibel Planning Commission and City Council meetings regarding any topic. Separate from the Floodplain Management Plan Advisory Committee meetings, to obtain public input, the Sanibel City Council conducted a public hearing on April 4, 2017 regarding the 2016 Floodplain Management Plan. Therefore, public input on current activities and alternative considerations for floodplain management is on-going. The Committee will continue to meet annually, at minimum, to update the City's Action Plan. The agendas of the meetings are attached as Appendix D, and Minutes are attached as Appendix E. Electronic copies of Agendas, Minutes, and the Audio is available live or can be heard at a later date via the City's website. A screenshot of the website's Comprehensive Floodplain Management Committee Meetings is attached as Appendix F.

All meetings are open to the public. Public Notices were distributed to members of the public via e-mail through the City's system that have signed up for notices and/or posted on the City's website at http://www.mysanibel.com and select *NEWS YOU CAN USE* under QUICK LINKS.

The Committee considered at its July 13, 2016 meeting, an electronic questionnaire to go out to the citizens to encourage more input from the public.

On September 14, 2016 and October 7, 2016, the City Manager's office sent out a News Release via City's website and email system seeking Citizen Input on Flood Insurance Questionnaire. Notices for the questionnaire are attached as Appendix G. The copy of the questionnaire long with written responses to questions Q.7 and Q.10 are included as Appendix H. The results indicate that 67% of respondents obtain their public information through direct emails. Overall there appears to be a need for more information on insurance options.

Questionnaire Responses

Q.1. Do you live on Sanibel full time?

Answer Choices	Responses	
Yes	**41.48%**	343
No	**58.52%**	484
Total		827

Q.2. If not full time, what months of year they reside on Sanibel?

Answer Choices	Responses	
January	82.35%	392
February	81.72%	389
March	81.51%	388
April	73.11%	348
May	42.44%	202
June	13.87%	66
July	10.08%	48
August	9.66%	46
September	12.18%	58
October	47.06%	224
November	65.97%	314
December	60.71%	289
Total Respondents: 476		

Q.3. How long have you lived on Sanibel?

Answer Choices	Responses	
Less than 1 year	5.00%	41
1-5 years	32.07%	263
6-10 tears	16.34%	134
11+ years	46.59%	382
Total		820

Q.4. Is your home on Sanibel?

Answer Choices	Responses	
Single Family	80.22%	661
Multi-Family	19.78%	163
Total		824

Q.5. Is the structure you live in on Sanibel?

Answer Choices	Responses	
Ground Level	28.55%	235
Elevated	71.45%	588
Total		823

Q.6. Do you recall receiving information in the past on the topic of how to protect your family and home from flooding?

Answer Choices		Responses	
Yes		15.35%	126
No		48.60%	399
If yes, from whom?	Responses	36.05%	296
Total			821

Q.7. What government agency or office would you contact regarding the risks associated with flooding for your Sanibel home?

Summarized write in responses: Note that some gave multiple agencies.

FEMA	281
CITY	209
DON'T KNOW	101
INSURANCE AGENT	75
NFIP	19
LEE CO., FL, OTHER	15
NONE	13

Q.8. What is the most effective way to receive information about safeguarding your family and home from flooding?

Answer Choices	Responses	
Electronic media	54.39%	440
City website	39.31%	318
City email	67.49%	546
Direct mail	32.39%	262
An insert into your utility bill	0.00%	0
Home Owner's Association ("HOA") newsletters	20.40%	165
Public workshops/meetings	15.45%	125
An insert into your utility bill	20.89%	169
Other	0.12%	1
Total Respondents: 809		

Comments (25)

Q.9. Are you aware you can sign up for "CodeRed" at MySanibel.com and receive emergency alerts and notifications from the City to your home phone, cell phone or email?

Answer Choices	Responses	
Yes	65.21%	538
No	34.79%	287
Total		825

Q.10. Do you have any suggestions how the City of Sanibel could better engage and educate our citizens and property owners regarding flood risks and insurance options?

STEP 3. COORDINATE

A. REVIEW OF EXISTING PLANS

The Committee reviewed the 2005 Comprehensive Floodplain Management Plan and found much of the Plan is still effective and needed to be updated.

B. COORDINATE WITH COMMUNITIES AND OTHER AGENCIES

Invitations to attend the Committee meetings were sent to the City's Emergency Contact and Community Partner Lists as well. The list and emailed invitations is attached as Appendix I.

The September 21st, 2016 committee meeting was attended by other agencies/communities to discuss flood protection activities.

In attendance was Chief Jim Bjostad, Lee County Department of Public Safety who introduced Senior Planning Officer Celeste Fournier. Ms. Fournier spoke about the Lee County Comprehensive Emergency plan and Mr Bjostad addressed getting information regarding the Sanibel Causeway evacuation and erosion.

Erick Lindblad Executive Director of Sanibel Captiva Conservation Foundation spoke about SCCF land acquisitions program that has acquired 1200 acres and has provided pre-storm and post storm staging areas.

The October 19th, 2016 meeting was attended by Margaret Mohundro, Executive Director of the Sanibel Library and Chief Matt Scott of the Sanibel Fire and Rescue.

The November 16th, 2016 meeting was attended by Linda Estep, Executive Director of CROW and Caitie Eck, Preparedness Planner of the Florida Department of Health in Lee County.

The December 14th, 2016 meeting was attended by Kelly Collini, Executive Director of Community Housing and Resources Inc. that spoke on their plan with emphasis on evacuation and assistance to their tenants.

Lt. Jeff Corkhill of Lee County Sheriff's Department spoke FEMA's Emergency Management Institute and the National Incident Management System (NIMS) training program.

The City's CRS Consultant, Tetra Tech, was asked to review the draft document after the November 16th, 2016 meeting. Their comments were approved at the December 14th, 2016 meeting.

STEP 4. ASSESS THE HAZARD

The City of Sanibel is a barrier island, located three miles off the southwest coast of Florida in Lee County. A location map is provided in the appendix of this Plan. The Island is approximately 11 miles long by 2 miles wide, and covers 11,600 acres. City limits extend 1/2 mile offshore.

The topography of Sanibel is very flat, with elevations ranging from sea level to 10 feet above, averaging about 4 feet above sea level. The soil is predominately sand and shell.

Over 5,000 acres of land on Sanibel are the J.N. "Ding" Darling National Wildlife Refuge. Another 2,000 acres are owned by the State, City, or Sanibel-Captiva Conservation Foundation and are preserved as natural open space. About 2/3rds of the land area of the City of Sanibel is preserved conservation lands. The locations of these open spaces in the floodplain are show on the map provided in the appendix of this Plan.

Development on Sanibel is generally concentrated along two high ridges of land: the Gulf Beach Ridge runs along the Island's Gulf Coast and the Mid-Island Ridge bisects the length of the Island. Land use is predominately multi-family resorts and condominiums along the Gulf Beach Ridge. Commercial uses, non-residential uses and medium and low density residential uses are along the Mid-Island Ridge and single family residential uses are in the interior portions of the Island. Approximately 90% of the developable land on the Island has been developed. A Land Use Map of the City of Sanibel is included as Appendix J of this Plan.

Storm water drainage on the island occurs by two means. Areas located seaward of the Gulf Beach and Mid-Island Ridges primarily drain directly into the Gulf of Mexico or Pine Island Sound, or into saltwater canals that lead to the Gulf and Sound. Areas in the Freshwater Management Area drain through a series of swales, catch basins and drainage structures that are maintained by the City, to the Sanibel River in the center of the island. The river is controlled in two locations by weirs, where the water is released into Pine Island Sound. Being an isolated barrier island, Sanibel is not impacted by flooding influences or problems of other watersheds.

The primary threats of flood damage on Sanibel are associated with tidal surges and rainfall of tropical storms and hurricanes. Due to its flat topography and susceptibility to flooding from tropical storms, **the entire Island Is considered a Special Flood Hazard Area by the Federal Emergency Management Agency on Its Flood Insurance Rate Maps.**

Surface water drainage on the area of the Island outside of the National Wildlife Refuge generally flows toward the center of the Island, where it is eventually enters the Sanibel River. The river outfalls into Pine Island Sound through two water control structures. These two water control structures were replaced and significantly enlarged to provide better flood control capabilities on the Island.

A major restoration effort restored the historical course of the Sanibel River through conservation lands and enhanced its water storage capacity in 1997. Current surveys are being undertaken to determine if restoration maintenance will be required again.

Due to the Island's low topography and Florida Gulf Coast location, Sanibel is extremely vulnerable to flooding, particularly in association with coastal and tropical storms and hurricanes. FEMA has recognized this threat, and has identified the entire Island as a Special Flood Hazard Area (SFHA) on the City's Flood Insurance Rate Maps (FIRM). Hurricane computer modeling indicates that, in a worst case scenario, over 17 feet of water could be pushed over the entire Island during a major storm. This is obviously a very serious threat to life and property on Sanibel.

Sanibel relies heavily on its beach and dune systems to protect development on the Island from coastal

flooding. The Island's beaches have, in recent years, been generally stable or accreting. However, a few areas of erosion "hot spots" occur. The predominate area of erosion on Sanibel, which has a very long history of instability and drastic· change is at Blind Pass, which separates Sanibel Island from Captiva Island to the north. The Blind Pass area was the location of a number of coastal floods that resulted in property damage and flood insurance claims. Three structures in this area that were repeatedly damaged by storms were purchased by the City and were eventually demolished and removed. Other hot spots include Gulf Pines and Lighthouse area.

A. ASSESSMENT OF THE FLOOD HAZARD

Flood hazard data was obtained from the Lee County Local Mitigation Strategy, Federal Emergency Management Agency, Florida Division of Emergency Management, Risk Map, National Oceanic and Atmospheric Administration and other sources to assess hazards.

The Committee agreed upon a list of natural flood hazards that could affect Sanibel as summarized in the following Table 1.

SIGNIFICANCE	HAZARD	POSSIBLE MAGNITUDE	FREQUENCY
HIGH	1. Special Flood Hazard Area - Flood from 100 year flood	Catastrophic	Likely
HIGH	2. Interior flooding caused by rain events.	Moderate	Likely
HIGH	3. Repetitive Loss Properties	Limited	Occasional
MEDIUM	4. Beach Erosion	Limited	Likely
MEDIUM	5. Damage to Causeway	Moderate	Likely
LOW	6. Climate Change and Sea Level Rise	Limited	Likely

1. Known Flood Hazards

The map shown in Figure 1 illustrates the area with known flood hazards based on flooding from a 100 year storm.

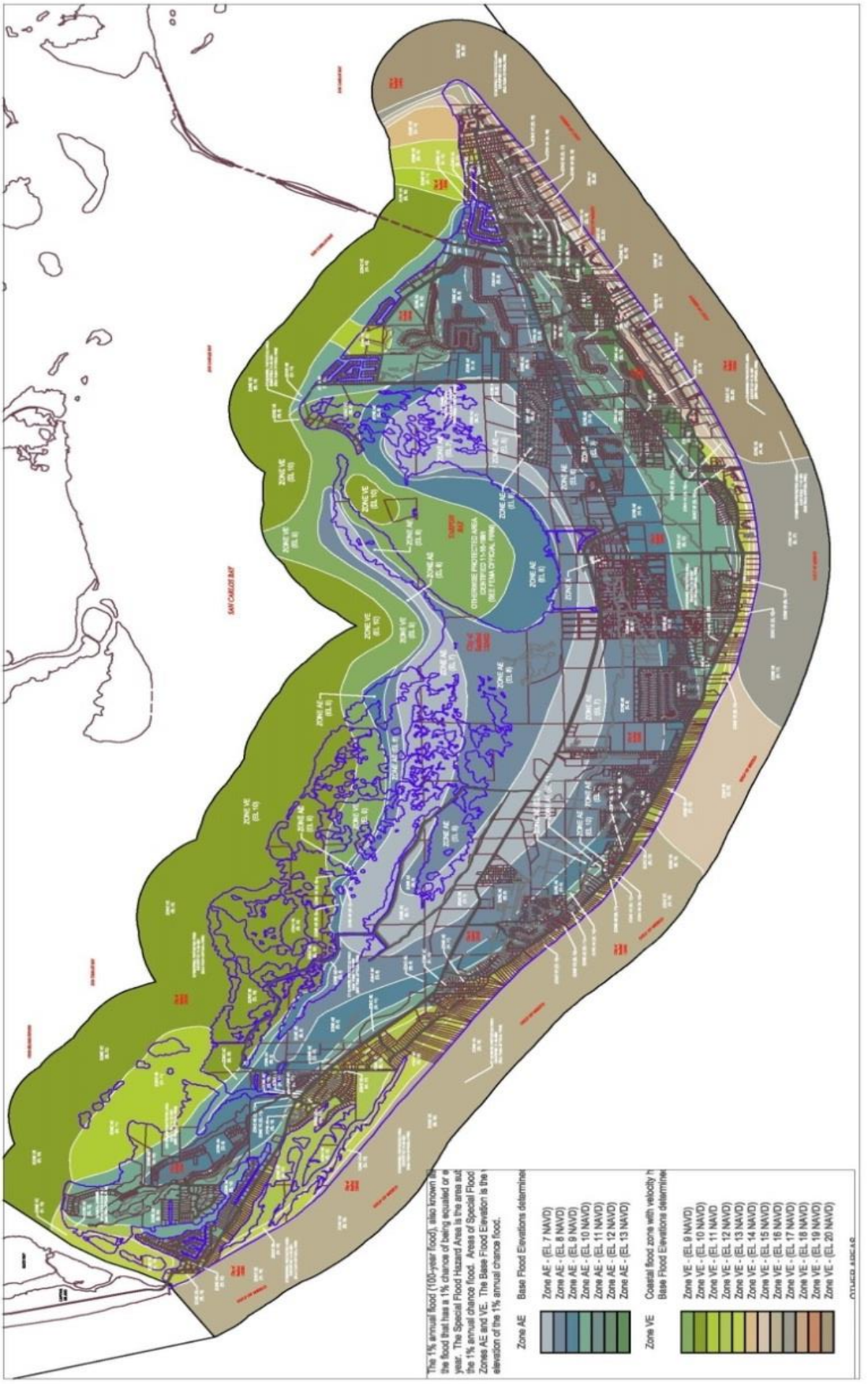


Figure 1 – Flood Hazard Areas

As per FEMA FIRM, VE-Zone is also known as the coastal high hazard areas. These are areas subject to high velocity water including waves. They are defined by the 1% chance (base) flood limits also known as the 100-year flood) and wave effects 3 feet or higher.

AE-Zone is also within the 100-year flood limits. They 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.

2. Description of Known Flood Hazards

The Committee identified interior flooding caused by rain events as the the most significant hazard with the potential to cause significant human and/or monetary losses. Figure 2 depicts the amount of precipitation causing hazardous flooding. From the figure, Sanibel receives approximately 50-inches on average annually.

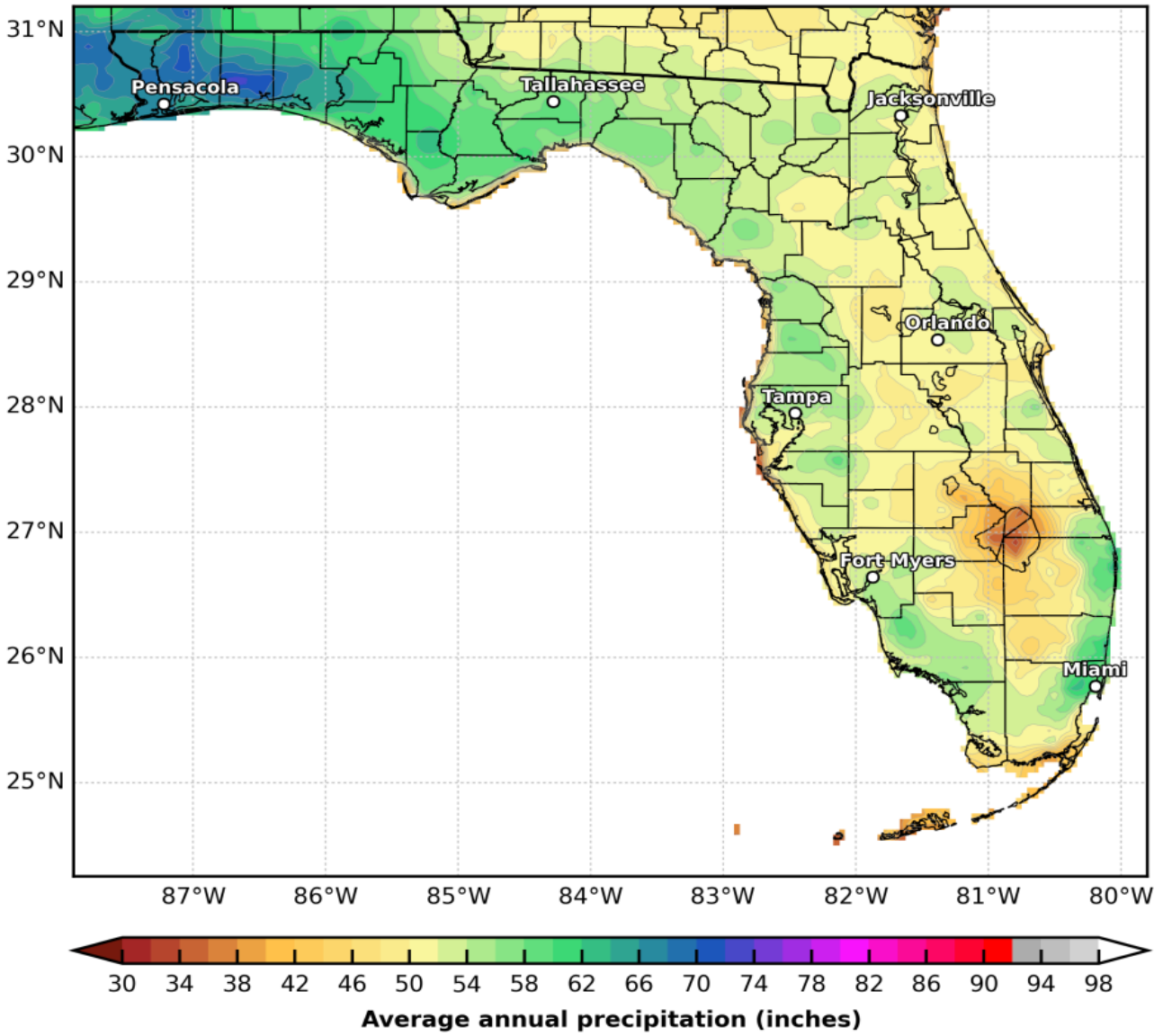


Figure 2 – Average Annual Precipitation:

3. Past Floods - History of Tropical Storms and Hurricanes

Based on previous flooding, storms and hurricanes create the highest risk of flooding.

Flooding in the coastal regions of the study area is primarily caused by hurricanes and tropical storms and poses the highest risk. Not all storms which pass close to the study areas produce extremely high storm surges. Similarly, storms which produce extreme conditions in one area may not necessarily produce critical conditions in other parts of the study area. However, with the condition of high winds directed onshore, the storms surges produced can inundate the coastal islands and flood the coastal areas behind them for some distance inland. Wave action which accompanies wind-generated storms can cause flooding, erosion, and structural damage, particularly on the offshore islands.

The Table 2 below lists the federally declared disasters in Lee County as summarized in the FEMA Disaster Declarations Summary (FEMA, 2013e).

Disaster Declarations in Lee County

COUNTY	DATE	TYPE	TITLE
Lee	September 1965	Hurricane	Hurricane Betsy
Lee	November 1968	Hurricane	Hurricane Gladys
Lee	June 1972	Coastal Storm	Tropical Storm Agnes
Lee	October 1995	Hurricane	Hurricane Opal
Lee	September 1998	Hurricane	Hurricane Georges
Lee	October 1999	Hurricane	Tropical Storm Irene
Lee	September 2001	Coastal Storm	Severe Storms, Tornadoes and Flooding associated with Tropical Storm Gabrielle
Lee	August 2004	Hurricane	Tropical Storm Bonnie and Hurricane Charley
Lee	September 2004	Hurricane	Hurricane Frances
Lee	September 2004	Hurricane	Hurricane Ivan
Lee	September 2004	Hurricane	Hurricane Jeanne
Lee	October 2005	Hurricane	Hurricane Wilma
Lee	August 2008	Severe Storm	Tropical Storm Fay
Lee	July 2012	Severe Storm	Tropical Storm Debby

Source: Data based on FEMA Declared Disasters dated October 2013 (FEMA, 2013e)

Major storm occurrences from 1950 to the 2013 and their respective damage can be found in the Storm Events Database, which is maintained by NOAA's National Climatic Data Center (NOAA, 2013a). Table 3 below summarizes the damage associated with events that occurred in Lee County. However, the Storm Events Database associates damage by zones that include multiple counties, so the amounts are not necessarily solely for Lee County. In the Storms Events Database, Lee County is included in the West-Central Florida area. The West-Central Florida area includes Charlotte, Citrus, Desoto, Hardee, Hernando, Highlands, Hillsborough, Lee, Levy, Manatee, Pasco, Pinellas, Polk, Sarasota, and Sumter Counties.

Historical Storm Events in West-Central Florida

DATE	TYPE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
WEST-CENTRAL FLORIDA					
10/07/1996	Tropical Storm Josephine	0	1	$44,600,000	0
09/25/1998	Hurricane Georges	0	0	$250,000	0
09/02/1998	Hurricane Earl	0	2	$1,130,000	0
11/04/1998	Tropical Storm Mitch	0	0	$78,000,000	0
09/14/1999	Hurricane Floyd	0	0	$20,000	0
09/20/1999	Tropical Storm Harvey	0	0	$100,000	0
10/15/1999	Hurricane Irene	0	0	0	0
09/17/2000	Hurricane Gordon	0	0	$5,050,000	0
09/14/2001	Tropical Storm Gabrielle	0	6	$16,900,000	0
08/13/2004	Hurricane Charley	7	780	$5.42 billion	$285,000,000
09/05/2004	Hurricane Frances	1	0	$179,400,000	0
09/25/2004	Hurricane Jeanne	0	0	$134,800,000	0
07/09/2005	Hurricane Dennis	0	0	$32,000	0
10/24/2005	Hurricane Wilma	0	0	$1,100,000	0
08/19/2008	Tropical Storm Fay	0	0	$250,000	0

Source: NOAA National Climatic Data Center (NOAA, 2013a)

The following descriptions from the Lee County Flood Insurance Study (FIS) (FEMA, 2008) and Lee County Local Mitigation Strategy (LMS) document several significant tropical storms and hurricanes throughout history:

- The hurricane of September 11-22, 1926, was one of the most destructive events of the century in Florida. Damage for this storm was estimated at $100 million statewide. High tides up to 12 feet above normal were reported at Fort Myers and Punta Rassa. The offshore islands of Sanibel and Captiva were inundated, with many homes being swept off their foundations. Flooding damage in the Fort Myers, Sarasota, and Bradenton areas were estimated at $3 million.

- The hurricane of September 4-21, 1947, entered the Florida coastline at Fort Lauderdale on September 17th. As it moved across the peninsula, it maintained its full intensity and caused extensive flooding. Winds of 90 knots were recorded at Fort Myers, where storm damage totaled nearly $1 million.

- In September 1960, the southern portion of Lee County was particularly affected by Hurricane Donna. High-water marks of 10 to 11 feet NGVD of 1929 were recorded on Eastern Island. The effects of the hurricane were augmented by antecedent rains which, in the previous three weeks, totaled almost 10 inches over the affected areas. This resulted in higher-than-normal water tables.

The following is a description of selected tropical storms and hurricanes that have affected Lee County since 1984.

- July 21-25, 1985 Hurricane Bob: Hurricane Bob, relatively short-lived, struck the southwest

Florida coast near Fort Myers on July 21-25, 1985, as a tropical storm. Winds reached 50-70 miles per hour (mph). Bob crossed Lake Okeechobee and went out to sea near Vero Beach on the 23rd of July. The hurricane then turned to the north, skirting Daytona on the 24th.

- October 9-13, 1987 Hurricane Floyd: Even though Hurricane Floyd did not make landfall on the gulf coast of Florida, it poured large amounts of rain as it traveled from the western tip of Cuba through the Florida Keys. One of the meteorological stations in Lee County recorded almost seven inches of rain.

- November 17-26, 1988 Hurricane Keith: Hurricane Keith, a tropical storm during November 17-24, 1988 moved into Florida's west coast between Ft. Myers and Tampa as a tropical storm with 65 mph winds. The storm crossed the state intact and entered the Atlantic Ocean. Heavy rains were recorded and tornadoes were sighted throughout the state.

- August 16-28, 1992 Hurricane Andrew: Hurricane Andrew developed into a Category 4 hurricane on August 23rd while en route to the southern tip of Florida. When it made landfall just south of Miami on the 24th, it had sustained winds of 145 mph and gusts up to 175 mph. The entire southern portion of the Florida Peninsula, from Vero Beach south through the Keys and up the west coast to Fort Myers, fell under a Hurricane Warning. Even though Hurricane Andrew became one of the most powerful hurricanes to hit Florida, the reported highest rainfall in Lee County totaled less than one inch on the 24th.

- November 8-21, 1994 Hurricane Gordon: This hurricane formed on November 8th, just off the coast of Nicaragua. It traveled erratically toward Florida, moved through Jamaica, crossed eastern Cuba and the Florida Keys, and finally made landfall very close to Fort Myers on the 16th. The tropical system crossed Florida with sustained winds of 45 mph and heavy rains. Rainfall amounts up to 2.5 inches were recorded in Lee County. This tropical storm became a hurricane only after it crossed the peninsula and reached the Atlantic Ocean.

- August 22-28, 1995 Tropical Storm Jerry: Even though this storm never became a hurricane, it dropped large amounts of rain throughout Florida. On August 24, 1995, a meteorological station in Lee County recorded 5.1 inches of rain. The system made landfall near Palm Beach, traveled across Florida into the Gulf of Mexico around Cedar Key, and dissipated close to the Florida-Georgia border.

- October 22-November 5, 1998 Hurricane Mitch: Probably the strongest hurricane to strike Central America in modern times, Hurricane Mitch became a Category 5 hurricane while in the Caribbean. After it made landfall in Honduras, it quickly reduced power and dropped huge amounts of rain in the region. Then it traveled through Guatemala, Mexico, crossed the Gulf of Mexico, and made landfall close to Fort Myers in Lee County. The storm did not have much wind organization, but it still carried large amounts of rainfall, as registered on November 5, 1998. That day, a Lee County rain station measured 6.3 inches of rain.

- September 19-22, 1999 Tropical Storm Harvey: Tropical Storm Harvey, a short-lived tropical system, crossed Florida from the Gulf of Mexico just south of Lee County and entered the Atlantic Ocean in about 72 hours. The amount of rain recorded for the county reached 5.1 inches.

- August 2, 2001 Tropical Storm Barry: Barry formed in the Gulf of Mexico, adjacent to the Lee County shoreline on August 2, 2001. The storm brought heavy rains to much of Florida, as it moved into the Florida panhandle on August 6, 2001. The storm may have reached Category 1 hurricane status while over the Gulf of Mexico, but was a tropical storm as it struck the Pensacola area. After the 6th, the storm was downgraded to a tropical depression. By the evening of August 8, 2001, the storm had dissipated.

- September 14, 2001 Tropical Storm Gabrielle: Tropical Storm Gabrielle began to affect the Southwest Florida coast during the pre-dawn hours of September 14th with sustained winds of 40 to 50 mph along the coasts of Lee and other counties. Total damage across the 15 county-area of Southwest and West Central Florida from Gabrielle was estimated to be nearly 17 million dollars. In Lee County, tropical storm wind gusts of 45 to 55 mph and flooding caused up to 5.7 million dollars in damage. Most of the wind damage was caused to roof shingles, carports, and lanais, mainly in the Cape Coral area. Flooding caused major damage to nearly 100 homes and another 500 incurred minor flood damage, mainly due to storm tides of three to four feet along coastal areas from Ft. Myers Beach to Sanibel, Captiva, and Pine Islands from sunrise through 1 p.m. At least four, separate and distinct, narrow sporadic tornadoes occurred with the outer spiral bands on the east side of Gabrielle. All tornadoes observed produced minor damage, were determined to be EF0 category, and occurred over rural portions of Lee, Charlotte, DeSoto, and Manatee Counties between 3:00 and 6:00 a.m.

- August 9-14, 2004 Hurricane Charley: Hurricane Charley strengthened rapidly just before striking the southwestern coast of Florida as a Category 4 hurricane. Charley was the strongest hurricane to hit the United States since Andrew in 1992 and, although small in size, it caused catastrophic wind damage in Charlotte County, Florida. Serious damage occurred well inland over the Florida peninsula. A storm surge of 4.2 feet was measured by a tide gauge in Estero Bay, near Horseshoe Key. This is near Fort Myers Beach. Storm surges of 3.4 and 3.6 feet were measured on tide gauges on the Caloosahatchee River, near Fort Myers. There were also visual estimates of storm surges of 6 to 7 feet on Sanibel and Estero Islands. Maximum rainfall totals from gauges in Florida ranged up to a little over 5 inches, but radar-estimated storm precipitation over central Florida were as high as 6 to 8 inches. Homeowner insurance claims totaled 77,582 with $911,784.880 being paid out. To date, 2,274 flood claims have been paid totaling $44,432,069. Seven deaths were attributed to this storm in Lee County. Approximately 2,000,000 cubic yards of debris was collected by Lee County Solid Waste, Crowder-Gulf, and the cities.

- September 5, 2004 Hurricane Frances: Hurricane Frances made landfall just after midnight on September 5th near Vero Beach as a Category 2 storm. In Lee County the observation at Big Carlos Pass recorded a gust to 51 knots (59 mph) from the west at 12:18 a.m. Eastern Standard Time (EST) on September 5, 2004. One direct death was reported when an elderly man was blown over by a wind gust while walking his dog 10 feet outside of his home. Fourteen homes were destroyed by the wind.

- September 26, 2004 Hurricane Jeanne: Hurricane Jeanne followed the nearly the same path across Florida as Hurricane Frances three weeks earlier. In Lee County the Big Carlos Pass observation recorded a gust to 49 knots (56 mph) from the west southwest at 7:42 a.m. EST on September 26, 2004.

- July 19, 2005 Hurricane Dennis: A bubble of storm surge from Hurricane Dennis moved north along the west Florida Gulf Coast during the day. The surge peaked at Fort Myers around 3:30 a.m. EDT. Lee County: Fort Myers - Storm Surge 3.08 feet at 3:36 a.m. EDT, Storm Tide 3.20 feet at Four to six inches of rain fell near Punta Gorda and Fort Myers. In Lee County, maximum winds were estimated at 40 mph with gusts to 50 mph along Sanibel Island. No significant damage was reported.

- October 24, 2005 Hurricane Wilma: Hurricane Wilma made landfall near Cape Romano in Collier County around daybreak on October 24th as a Category 3 hurricane with a 60 mile wide eye wall. The storm produced widespread heavy rains of 4 to 8 inches across the area but unseasonably dry conditions prior to Wilma limited flooding. Storm surge was not a problem in the Fort Myers area as winds were offshore. The north part of Hurricane Wilma's eye wall passed along the Lee/Collier county border. Southern Lee County received widespread minor to

isolated moderate damage. A peak wind gust of 87 mph was reported at the C-MAN station at Big Carlos Pass at 6:54 a.m. EDT. The Regional Southwest airport recorded a peak wind from the north of 79 mph at 8:28 a.m. EDT and Page Field recorded a peak wind of 76 mph at 8:12 a.m. EDT. Damages to private property were initially estimated at $108.4 million in structure damage. Of this, $69.7 million was attributed to flooding. Final total structures affected to date are 959. Homeowner insurance claims totaled 23,639 with $182,709,253 being paid out. To date, 47 flood claims have been paid totaling $945,168. The debris totaled about 200,000 cubic yards, or about 1/10 of the debris left by Hurricane Charley in 2004. Power was out to about 208,000 customers at the peak of the storm.

- August 19, 2008 Tropical Storm Fay: Tropical Storm Fay made landfall in Collier County and initially caused little damage to Lee County. During Tropical Storm Fay's course, it again went over water and came back into Florida on a Westward track. The ensuing rain bands from Tropical Storm Fay caused the evacuation of Saldivar Migrant Camp and Manna Christian Mobile Home Park in the Bonita Springs area. The Bayshore and Alva areas also experienced some flooding issues, including private roads.

B. ASSESSMENT OF LESS FREQUENT FLOODS

The City identified several areas prone to flooding after prolonged rain events not associated with storm events. These are depicted in Figure 3. These are generally interior low lying areas that have limited outfall. Also included are older and private subdivisions where the drainage systems haven't been well maintained or lack active subdivision associations.

C. ASSESSMENT OF AREAS LIKELY TO FLOOD

Based on areas of repetitive loss, the areas likely to flood are the Coastal Areas associated with storm surge. These include Velocity (V)-Zones and A-Zone areas adjacent to V-Zones. The next version of FEMA map products are intended to better identify the risks in these areas.

D. OTHER NATURAL HAZARDS

Other natural hazards were considered but their occurrence would be considered unlikely or less than 1% probability of occurrence within the next year. These other hazards include:

- Uncertain flow paths: Since there are no riverine systems on Sanibel, this is considered unlikely.
- Ice jams: Due to our tropical location, this hazard is considered unlikely.
- Mudflow hazards: With a basically flat topography on Sanibel, this is considered unlikely.
- Dams: The National Inventory of Dams (NID), a congressionally authorized database maintained by United States Army Corps of Engineers (USACE), houses information about dams in the United States (USACE, 2013a). The only dam listed in the NID in Lee County is the W.P. Franklin Lock and Dam, which is located on the Caloosahatchee River and is owned by USACE. The NID lists several dams in Hendry County, but they are all outside the expected storm surge inundation area.
- Earthquakes
- Wildfires
- Tornadoes
- Tsunamis

STEP 5. ASSESS THE PROBLEM

A. HAZARD SUMMARY AND COMMUNITY IMPACT

The City of Sanibel is located in the subtropical climactic zone along the southwest Florida Gulf Coast. This region has historically been vulnerable to hurricane and tropical storm activity. The year in this region is divided into wet and dry seasons, with the wet season running from June through September. The wet season coincides with hurricane season, which runs from June through November. During the four month wet season, the Island receives nearly two-thirds of its annual precipitation.

With its low topography and barrier island location, the City of Sanibel is extremely vulnerable to flooding, particularly in terms of the tidal surges associated with coastal and tropical storms and hurricanes. The gently sloping bottom of the Gulf of Mexico off of Sanibel's coast allows for potentially devastating tidal surges accompanying tropical storms.

Using computer modeling available to predict the threat of tidal surge flooding during tropical storms, the City has a good idea of what to expect under various storm scenarios. In the *"Southwest Florida Regional Hurricane Evacuation Study 2001",* produced by the South Florida Regional Planning Council, hurricane storm surge inundation was mapped for the entire County for a variety of storm events.

In this study, paralleling storm and exiting storm surges from hurricanes were used to predict the various levels of tidal flooding on the Island. In the *2001 Hurricane Evacuation Study,* the majority of Sanibel Island is forecasted to be impacted by floodwaters up to 2.4 feet deep during even a minor tropical storm. The entire Island can expect to experience flooding up to 3.6 feet deep in a Category One hurricane. If a major hurricane (Category 4 or 5) were to hit Sanibel, the Island could be inundated with anywhere from 11 feet to 17 feet of floodwater. Areas along the exposed coast will likely experience the greatest additional flooding associated with storm waves. It is obvious that these levels of flooding on Sanibel pose a significant threat to life and property.

Since incorporation, careful evaluation of flood hazards attributed to the City's physical characteristics, development history and location in a region vulnerable to tropical storms and hurricanes, is foremost in the City's planning efforts to minimize the threat to life, property and the economy of this fragile barrier island. Aside from the immediate life threatening and destructive forces experienced by the City of Sanibel following Hurricane Charley in August, 2004, the storm's devastation to the local economy is ongoing. Sanibel's tourism based economy has suffered because many of the accommodations damaged by the hurricane are still undergoing repairs. Without the economic support of tourists, many small businesses, which comprise most of Sanibel's economic base, are suffering. Property values, however, have remained constant, despite Hurricane Charley's devastating effect on the island's landscape.

Based upon the aforementioned flood hazards identified in Step 3, the City's primary risks are as follows:

1. **Properties in Special Flood Hazard Areas and Velocity Zones. This would include coastal flooding with tidal and storm surge associated with storm events.**

Due to Sanibel's vulnerability to flooding, FEMA has identified the entire Island as Special Flood Hazard Area (SFHA) on the City's Flood Insurance Rate Maps (FIRM). Base Flood Elevations required on the City's FIRM's range from 8 to 20 feet above sea level. The City's FIRM's identify a Velocity Zone (V-Zone) along the City's entire Gulf Coast As an additional local requirement to minimize flood hazards in all coastal areas, the City's flood regulations apply velocity zone elevations and construction standards to lands within 500 feet of San Carlos Bay, Pine Island Sound and Blind Pass.

The Flood Depth Map at 100-year event shown in Figure 4 takes the 2008 Flood Insurance Rate Maps and takes into consideration the topography of the island. If the 100-year event occurred, the modelling predicts flooding on the island between 2'-20'.

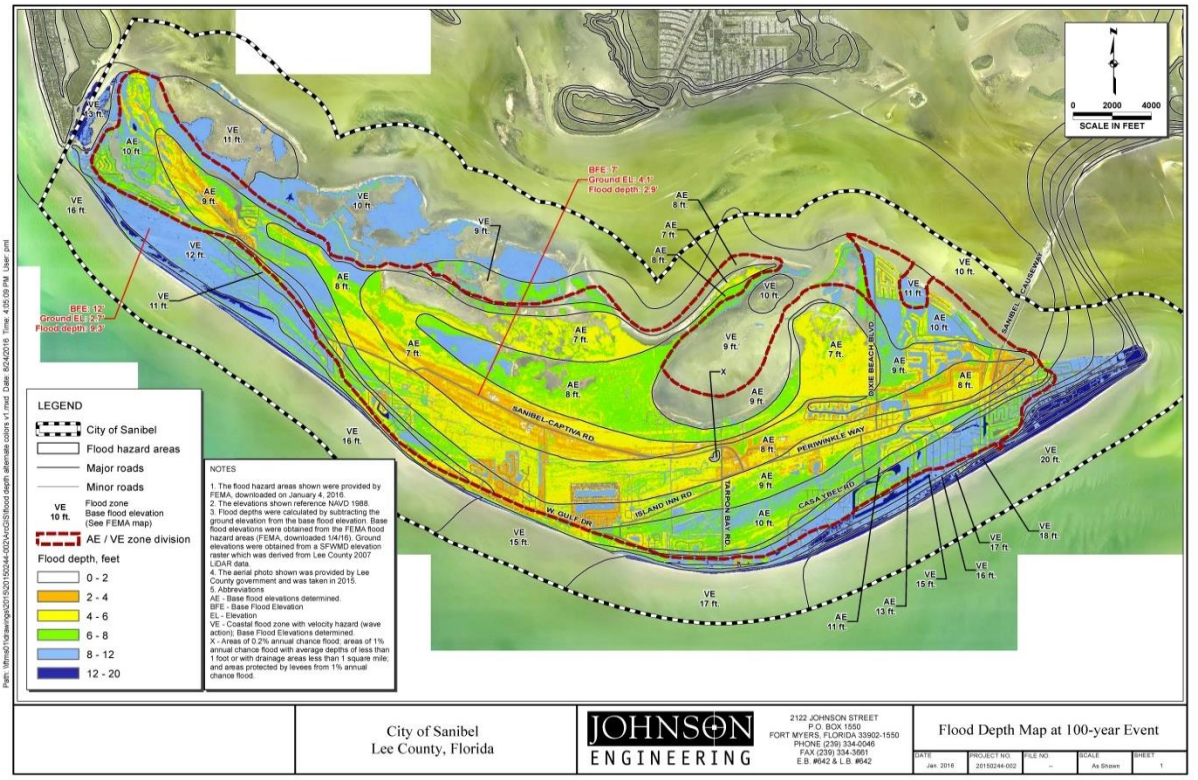


Figure 3 - Flood Depth Map of 100-year Event

Due to FEMA-based flood regulations, almost all buildings constructed after the City joined the regular program of the NFIP in 1979 are built to or above the Base Flood Elevation or, in a few situations, flood-proofed to above the Base Flood Elevation. These flood-compliant buildings should be safe from flood damage in all but the worst hurricanes that could hit Sanibel. Structures built prior to 1979, however, represent a flood threat problem, even during minor storm events.

2. Interior flooding caused by rain events. This would include closed basins including lakes and isolated wetlands.

During the month of January 2016, 16.31 inches of rain was recorded at Public Works. This rainfall caused increased flooding in areas previously identified and as flood prone and in one area not previously identified. Although there was flooding in these areas in the roads, yards, garages and possibly lower level enclosures (permitted for storage), there was Staff documentation of flooding in the main levels of the homes or businesses.

Below is a map Figure 5 which identifies Flood Prone Areas due to rain events

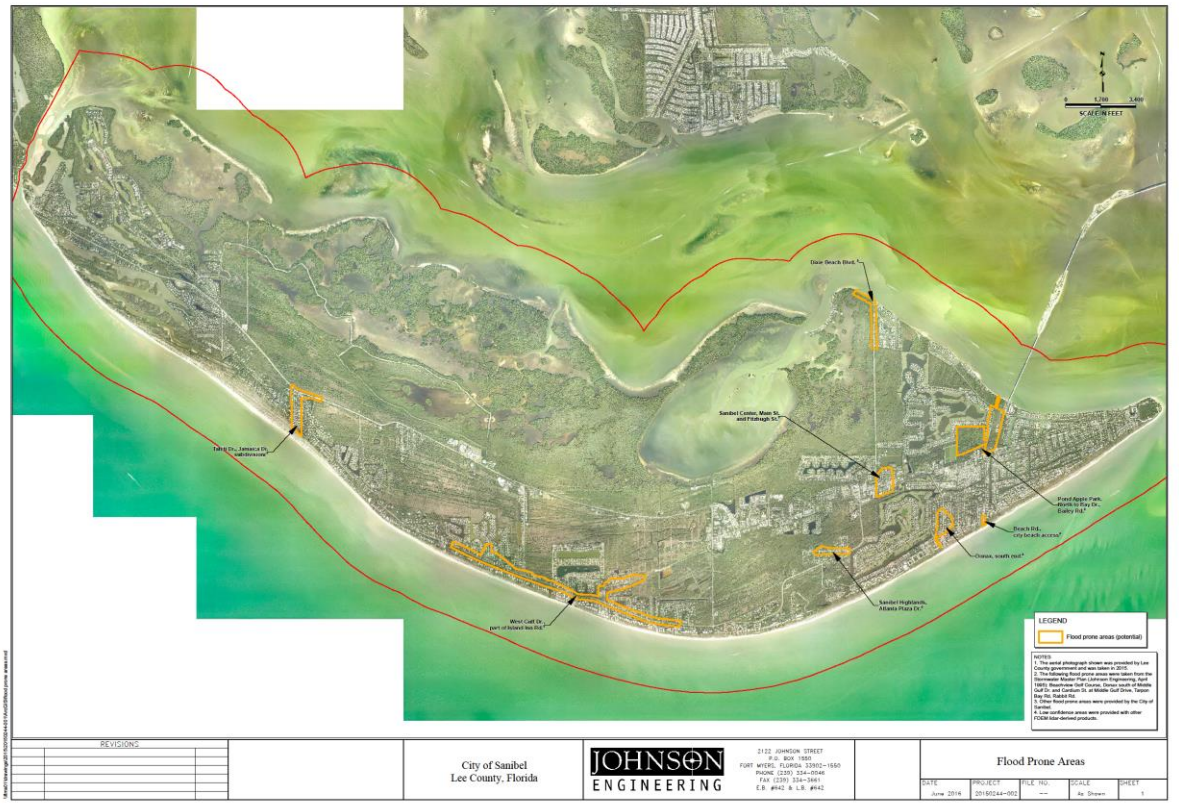


Figure 4 – Flood Prone Areas

The overall topography of the island is generally higher along Periwinkle and Sanibel-Captiva Road and gradually lowers toward the Gulf of Mexico (south) and San Carlos Bay (north).

a. Description of Flood Prone Areas

1. **Tradewinds Subdivision (Tahiti and Jamaica Drive.)**
   Tradewinds Subdivision was first platted in 1958 prior to current stormwater regulations. At that time, the water was stored in drainage areas and discharged into the Gulf of Mexico. Current regulations required discharge to the Gulf of Mexico to be removed. Subsequent City projects attempted to direct overflow to a swale on Sanibel Captiva Road eastward to a canal that connects to the Sanibel River system. During the January rains, a significant amount of water built up in the southernmost (Gulf) portion of the subdivision.

2. **West Gulf Drive - Island Inn Area**
   There are several dynamics going on in this area. Some of the smaller private subdivisions and areas along West Gulf Drive have roadside swales on on-site drainage but there is no outfall in much of this area, but rather the water only dissipates from evaporation or percolation.

3. **Sanibel Highlands**
   This area was platted in 1926. Many of the homes were built at-grade in lower elevations. The City acquired property and constructed drainage areas in the subdivision before additional homes could be built. There is still isolated flooding during heavy rains in this area.

4. **Donax south end**
   This area is part of Sanibel Shores Subdivision which was platted in 1925. Localized private drainage areas over the years have been compromised by redevelopment causing local flooding toward the south.

5. **Pond Apple Park, north to Bay Drive including Bailey Road.**
   This area prior to 2016 was not identified as a flood prone area. Water built up in the Pond Apple Park area until it breached Bailey Road near Periwinkle and locked in the area in front of the Dunes until it eventually breached at the north end into the Bay.

6. **Dixie Beach Boulevard north**
   This area experiences salt water from San Carlos Bay that breaches the road at Woodring and Dixie Beach Boulevard. The water becomes trapped to the south. Although there is minimal flooded yard problems, the salt water damages the grass yards and low lying areas hold water for long periods of time. This area appears to be a combination of coastal flooding and flooding from rain events.

7. **Sanibel Center – Main Street – Fitzhugh**
   Platted in 1926, this area has historically had isolated flooding. Low lying homes and minimal drainage.

b. Watershed Management Plan

1. History of Storm Water Plans

- 1987 Surface Water Management Plan creates the Freshwater Management Area. The Plan proposed improvements to the Tarpon Bay and Beach Road weirs and alterations to the system of existing culverts, drainage channels and swales to basically reduce flooding in developed areas.

- 1989 Conceptual Plan Pump Controlled Surface Water Management System, considered gravity system, Full Pump Controlled System and Gravity/Pump system

- 1992 Update Report Surface Water Management. Recommends phased approach, lowering weir elevations to 2.7' Beach Rd. and 3.2' for Tarpon Bay weir and eliminating pump and berm system and establishing a weir policy. Adopt Phasing Plan for Weirs and box culverts. These projects were constructed through approx. 1998 including the maintenance dredging of the Sanibel River.

- 1994 – Adoption of the City of Sanibel Weir Control Policy.

- 1995 Stormwater Master Plan – Specific Plan for area bounded by Gulf of Mexico, Fulgur, Sanibel River and Beach Road.

- The 1995 plan was designed to protect the island from undesirable flooding from a 25-year storm event. Increase capacity of the structures will also provide quicker flood relief for the many small intense summer storms common in this area. Even more important, protection is greatly improved from rainfall flooding of evacuation routes prior to a hurricane tidal surge.

2. Watershed Master Plan

During the 2013 Cycle Visit for the Community Rating System, it was determined that due to the age of the existing Stormwater Management Plan, the City could no longer use these documents for credit under Stormwater Management. The current manual credits communities if it implements stormwater management regulations through an adopted watershed master plan.

Credit is also provided for Watershed Master Plans that

- Evaluate future conditions and long-duration storms,
- Identify wetlands and natural areas,

- Address the protection of natural channels, and
- Provide a dedicated funding source for implementing the plan.

The City has contracted with Johnson Engineering, Inc., to create a Watershed Master Plan. The plan will determine capacity, in the River System, evaluate conditions up to and including the 100-year storm event, consider flood prone areas, and consider water quality and updates to the City's Stormwater Regulations.

3. Repetitive Loss Properties

There are 64 Repetitive Loss Properties within Sanibel and approximately 140 properties similarly situated in the Repetitive Loss Area.

All of the City's repetitive loss properties to date can attribute their losses to a combination of unusually high tides, coastal storms, and/or tropical storms or hurricanes. A storm that occurred on March 13, 1993, "The Storm of the Century", caused additional coastal flooding and flood losses on Sanibel. On August 13, 2004, when the eye wall of Category 4 Hurricane Charley skirted Sanibel's shoreline, the projected 14 to 18 foot storm surge did not occur. Since Hurricane Charley produced only a four-foot tidal surge, Sanibel sustained only minimal flooding. After the storms of 2004 and 2005, the City's Repetitive Loss Properties increased from 4 (four) to 64 (sixty-four).

The City's most serious flood threat is tidal surges associated with tropical storms and hurricanes. The City is also susceptible, however, to minor flooding due to the heavy rainfall that is often associated with typical summer thunderstorms. As described in Sanibel's "Physical Characteristics", the majority of the Island's storm water is drained toward the Sanibel River, and ultimately released into Pine Island Sound through two water control structures (weirs).

To resolve minor flooding problems, the City adopted the Sanibel Surface Water Management Plan (SWMP) in 1989. The implementation of the SWMP replaced the two weirs and all of the road box culverts along the Sanibel River. These drainage structures are significantly larger than the old ones. The City had the ability to release floodwaters approximately 10 times faster than before.

Implementation of the Surface Water Management Plan addressed the flooding problem on Sanibel associated with all but the most severe summer thunderstorms.

A major restoration effort in 1997 restored the historical course of the Sanibel River through conservation lands and enhanced its water storage capacity. It has been 20 years since the restoration of the Sanibel River. The City is currently conduction surveys as part of the new Watershed Management Plan along the Sanibel River to determine the water storage capacity. If the storage capacity does not meet the required 25 year storm event, it is anticipated that a restoration project will be required.

The City's Public Works Department has an annual inspection and maintenance program for all of the City's storm water drainage facilities to ensure this system remains functional and reliable. Figure 5 shows the current map of the Repetitive Loss Areas and Localized Drainage Areas.

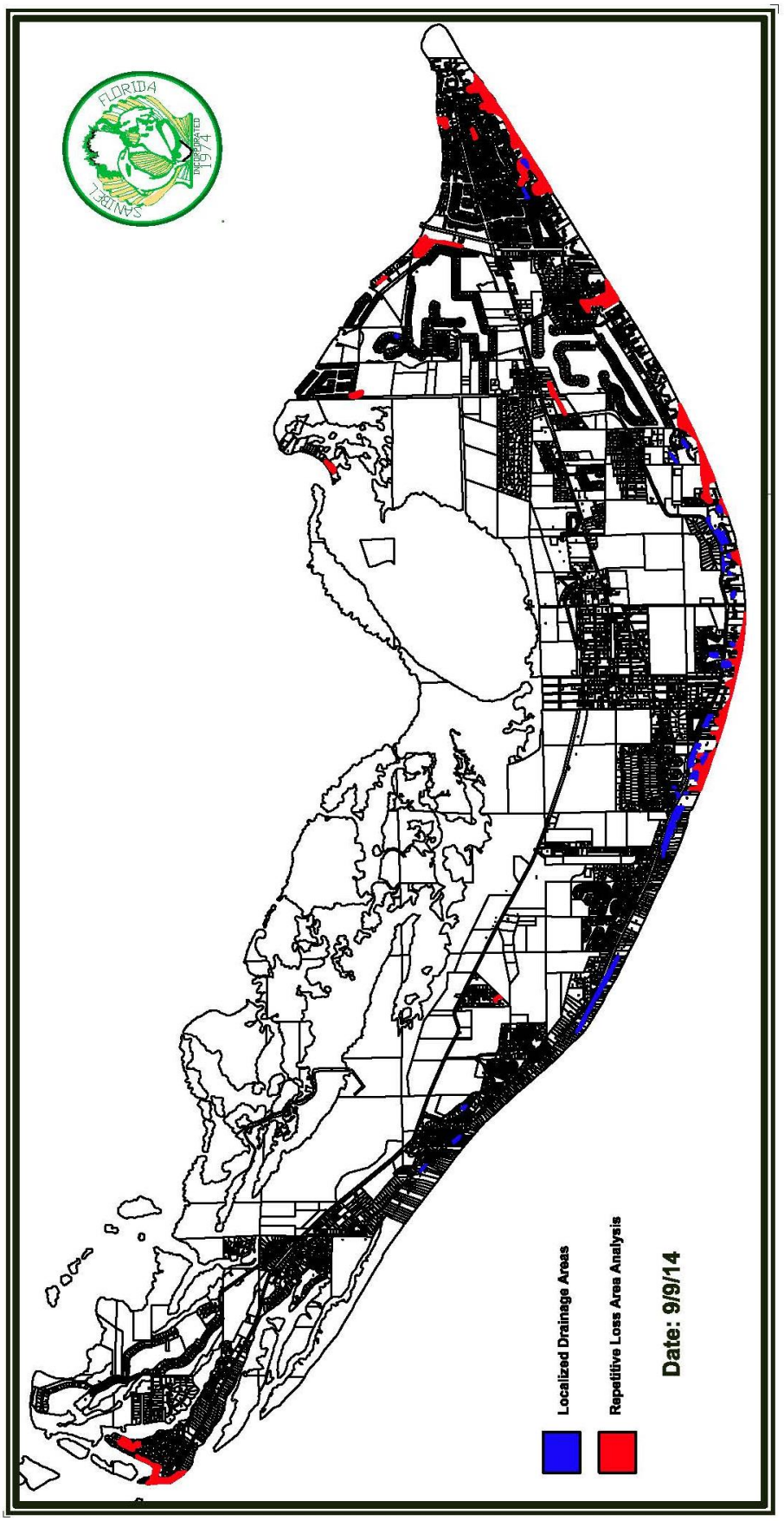


Figure 5 – Repetitive Loss Areas

4. Coastal Flood Threats from Beach Erosion including threats to roads and private property

A critical erosion area is a segment of the shoreline where natural processes or human activity have caused or contributed to erosion and recession of the beach or dune system to such a degree that upland development, recreational interests, wildlife habitat, or important cultural resources are threatened or lost. Critically eroded areas may also include peripheral segments or gaps between identified critically eroded areas which, although they may be stable or only slightly eroded now, must be included for continuity of management of the coastal system or for the design integrity of adjacent beach management projects (Florida Department of Environmental Protection (FDEP), 2012).

Beach erosion also contributes to the flood threat on Sanibel. The City adopted an Island-wide Beach Management Plan in 1995 (City Council Resolution No. 95-111), which addresses many of the City's beach related policies and programs, including erosion and the Island's coastal flood threat.

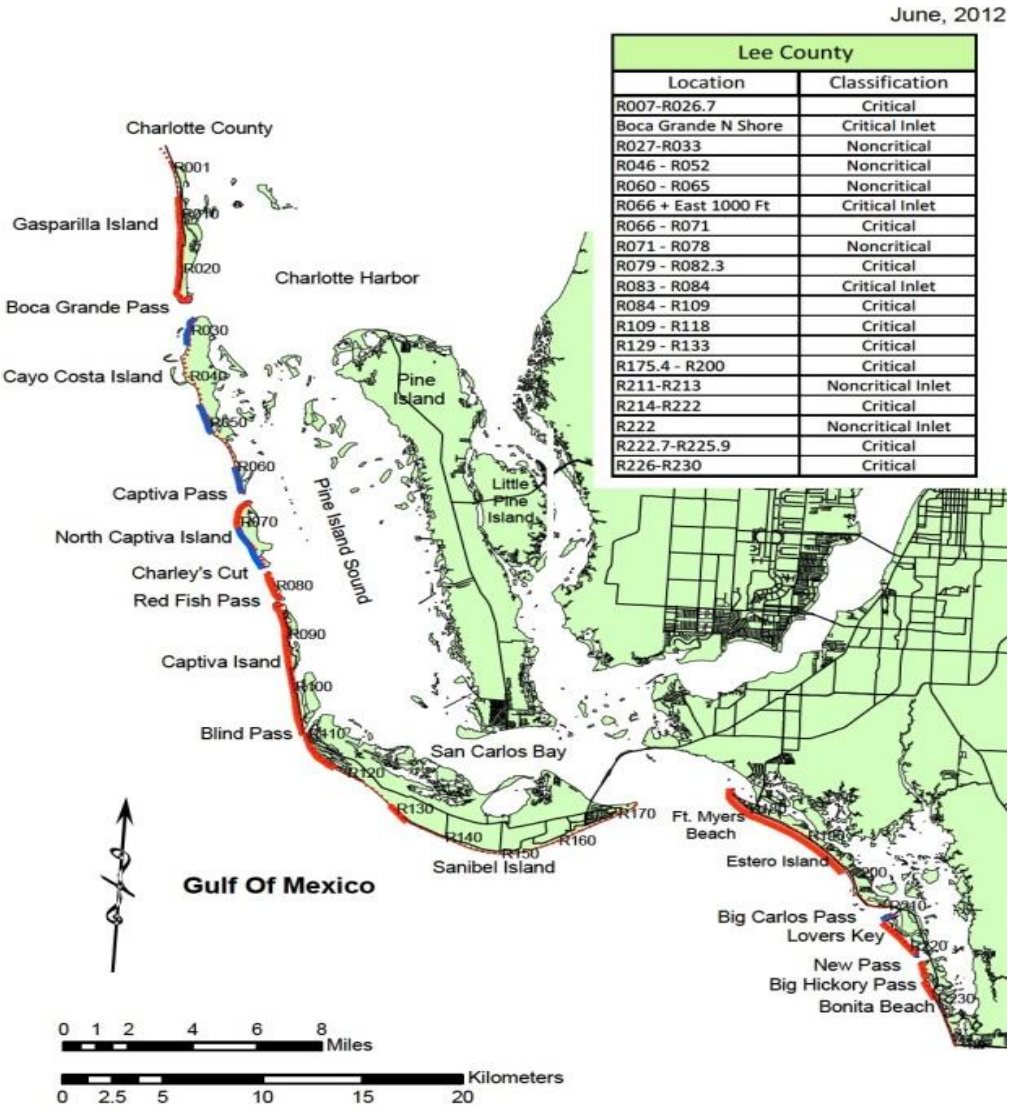


Figure 6 – Critically and Non-Critically Eroded Beaches
Eroded beaches and inlets in Lee County
Critically (red lines) and non-critically (blue lines)
(Source: (FDEP)

One finding of the background study of Sanibel's Beach Management Plan is that, with the exception of three erosion "hot spots", Sanibel's beaches in recent years have been stable or accreting. In the erosion hot spots, however, flooding and property damage has occurred.

Sanibel's Beach Management Plan includes the following strategies that address erosion and the associated coastal flood threat:

- Natural Resources management strategies for island-wide dune protection and restoration, encompassing both public and private property, include dune planting, dune walkover construction, and limited access and use in the Island's beach dune system. A healthy dune system will help protect the upland developed areas of the Island from erosion and tidal flooding.

- A beach erosion monitoring program has been established with funding from the Lee County Tourist Development Council (TDC). The City currently has a contract with Sea Diversified to survey the Island's entire beach system at least once a year. Several problematic areas with historical erosion issues are surveyed in more detail and with more frequency if needed. The City Engineer is in charge of this program and maintains records of the survey data. The monitoring program enables the City to identify erosion problems as early as possible, and plan for action to protect the public health, safety and welfare accordingly.

- In addition to City and State regulatory measures that restrict development in vulnerable areas near the coast, the Beach Management Plan includes alternative erosion protection and mitigation strategies. Building relocation, land acquisition, beach nourishment and limited structural alternatives are among the solutions to the Island's erosion problems.

Other Beach Management Plan policies ensure the Island's beaches are protected in as natural a state as possible. The beneficial functions of a healthy dune system will help to limit future erosion and coastal flooding problems on Sanibel.

The City, with Lee County and the Captiva Erosion Prevention District, constructed a box culvert linking Clam Bayou and Dinkins Bayou. This project will provide relief from the impoundment of excess fresh water in Clam Bayou when Clam Bayou's connection to the Gulf of Mexico is closed.

a. Update to the Island Wide Beach Management Plan

The City requested and was awarded funds through the TDC in 2016 to update the Island Wide Beach Management Plan. The estimated cost to update the plan is $125,000.

The original Plan includes six sections that cover Coastal Processes, Natural Resources, Coastal Activities and Impacts, Beach Access and Public Lands, Beach Management Goals and Objectives, and Management Strategies. Overall, the Beach Management Plan has served the community well. However, the Plan was intended to be a living document and has not been updated in more than 20 years. The purpose of this project will be to revise and update the Plan with current information based on the best available science and engineering data in order to protect Sanibel's beaches for the next 20 years.

The City is seeking to complete a comprehensive review and update of the Island Wide Beach Management Plan. The City's Natural Resources Department will be responsible for updating several sections of the Plan including Natural Resources, Coastal Activities and Impacts, Beach and Public Lands, and Beach Management Goals and Objectives. However, additional expertise is needed to update the highly technical sections of the Plan, including Coastal Processes and Beach Management Strategies. This project will contract the services of a coastal engineering firm to update the relevant Plan sections, ensuring that the coastal engineering data and natural resource-related information is current and based on the best available science and engineering. Tasks will include updating the

existing shoreline survey with new available data, performing hydrodynamic and sediment transport modeling to evaluate coastal processes, holding public workshops, and others.

The purpose of the Plan is to ensure the protection, conservation, and natural function of Sanibel's beaches. Since the Plan's adoption, work has been performed to restore the dune system and has allowed the tidal zone to remain as a natural system. In turn, the naturally functioning beaches of Sanibel have aided in protecting properties from storm related impacts such as wind damage and storm surge (e.g. Hurricane Charley and Tropical Storm Debbie), improved wildlife habitat for a number of protected species (e.g. sea turtles, snowy plovers, least terns and gopher tortoises), improved beach aesthetics, and protected water quality experience.

Plan Components and Timeline

1. Coastal Engineer Consultants Competitive Negotiation Act (CCNA) Bid (4-months)
2. Update shoreline survey (3-months)
3. Perform hydrodynamic and sediment transport modeling (3-months)
4. Update chapters of the Island Wide Beach Management Plan with current data (3-months)
5. Update beach management plan management recommendations (2-months)
6. City Council to adopt updated Island Wide Beach Management Plan (2-months)

b. Blind Pass Inlet Management Study

- In April of 2016, Lee County announced a Stakeholder's Meeting for the Introduction of the Blind Pass Inlet Management Study.

An inlet management study

- Evaluate changes and trends in the inlet, shoals and adjacent beaches
- Establish maintenance options
- Establish monitoring plan

Study Objectives

- Update 1995 Inlet Management Study
- Maintain Blind Pass in an open condition
- More effective dredging/nourishment
- Extend the life of related beach projects
- Protect the existing infrastructure
- Maintain existing level of recreation access and use
- Define potential impacts to navigation

Study Scope

- Inlet history
- Sediment budget
- Develop and test management strategies
- Management recommendations
- Study Report
- Stakeholder Input
- Technical Advisory Committee
- FDEP adoption of plan

On April 21, 2016, a Stakeholders Meeting was held at the Sanctuary on Sanibel. Representatives from Lee County, Sanibel, Captiva Erosion Prevention District, Florida Department of Environmental Protection, CB&I (Consultant) and the Public were invited.

On August 29, 2016, a Webinar was hosted by CB&I to the Technical Advisory Committee. Some alternatives were chosen for preliminary analysis. Some of the alternatives were eliminated based on modeling. Additional alternatives will be analyzed with morphology.

Presently, this Study is ongoing.

c. Coastal Erosion of Roads

Shorelines are often stabilized with hardened structures, like bulkheads, revetments, and seawalls. Ironically, these structures often increase the rate of coastal erosion, remove the ability of the shoreline to carry out natural processes, and provide little habitat for estuarine species. As a result, the Sanibel Plan and the Island Wide Beach Management Plan recommend against this type of coastal armoring. This project will implement a more natural bank stabilization technique called "living shorelines." This approach will use both structural and organic materials, such as native plants, submerged aquatic vegetation, oyster reefs, and rip- rap to provide shoreline protection and create/maintain valuable habitat. Living shorelines also offer potential water quality benefits via filtration of upland runoff. This project will provide a basis for the use of living shorelines as a management tool and as a beneficial and practical alternative to traditional shoreline hardening methods.

Two areas where coastal erosions of roads exist are the shell road leading to Lighthouse Beach Park and Woodring Road adjacent to Bock Public Beach Park. The Lighthouse Beach Park design was funded in 2016 from TDC. The City is looking for grants to construct these projects.

This pilot project will construct two living shorelines adjacent to erosion prone areas on Sanibel's bayside. One living shoreline will be constructed at Lighthouse Beach Park, where high tides and storm conditions often result in closure of the access to one of Sanibel's most popular attractions, the historic Sanibel Lighthouse. The second will be constructed alongshore and in nearshore waters adjacent to Woodring Point, where high wave energy routinely erodes the shoreline adjacent to Bock Public Beach Park, destroying mangrove habitat important for local fisheries. Construction of living shorelines will reduce these hydrodynamic impacts while promoting the expansion of mangroves and other native habitats. This effort will serve as a pilot project for possible application in other areas along the Sanibel shoreline to address potential future impacts of sea level rise.

The living shoreline will consist primarily of rip-rap planted with red mangroves and other suitable native vegetation placed adjacent to the existing access. The second living shoreline will be constructed adjacent to Woodring Point, where high wave energy routinely erodes the bayside shoreline adjacent to Bock Public Beach Park. This shoreline will consist of rip-rap to stabilize the existing shoreline as well as oyster shell placed in the intertidal, nearshore waters to function as both a breakwater and living oyster reef. This project will provide a basis for the use of living shorelines as a management tool for improving habitat and adapting to sea level rise.

B. IMPACT OF HAZARDS ON LIFE, SAFETY, HEALTH, AND PROCEDURES FOR WARNING AND EVACUATION.

One critical issue regarding public health, safety and welfare during a flood event on Sanibel is evacuation. With the Sanibel Causeway connecting Sanibel and Captiva Islands to the mainland, it is estimated that a safe evacuation prior to an impending storm could take as long as 18 to 24 hours. The Causeway itself is a series of bridges and small, human made islands that are extremely vulnerable to flooding. The Causeway has a history of being inundated early during a storm event, cutting off Island residents' and visitors' lifeline to safety to the mainland.

An another equally important safety concern on Sanibel is that of uninformed or unprepared Island

residents and visitors To safely evacuate Sanibel and Captiva Islands prior to a potential life-threatening storms, residents and visitors must secure their property and leave the Island more than 24 hours in advance of the storm's landfall. In most cases, the weather is still warm and sunny at this time, and people may be reluctant to heed evacuation notices. Further exacerbating this problem is the fact that much of the Island's summer population are tourists and visitors, who have yet to experience the destructive power of a hurricane, and may not have plans or know exactly what to do when such a threat occurs.

A special needs shelter has been designated at the Ray V. Potter Elementary School located at 4600 Challenger Drive, Fort Myers, Florida 33912. A “pet friendly” shelter has been designated at the South Fort Myers High School, 14020 Plantation Road, Fort Myers, Florida 33912.

Careful hurricane and evacuation planning is extremely important to ensure the safety of Sanibel residents and visitors, and their property, during a storm. The City participates in the Lee County Emergency Management Planning process, which is one of the most proactive storm warning and recovery efforts in the State of Florida. The City has its own emergency management plan designed to satisfy the specific needs of Island residents and visitors. All of these emergency management efforts concentrate on: careful storm monitoring; early and frequent public notices and evacuation orders if necessary; public information programs regarding public safety; property protection and mitigation efforts; communicating the area's flood threat to residents and visitors; communicating the area's flood warning system and the benefits of evacuation planning to residents and visitors and storm recovery.

CODE RED is an emergency notification service that allows emergency officials to notify residents and businesses by telephone, cell phone, text message, email and social media regarding time-sensitive general and emergency notifications.

Residents and visitors can register to receive emergency notifications on the City’s website by clicking on the “CodeRed” link. CodeRed is a software based notification system that can also target specific geographical areas for notice as well. The city will post evacuation notices on it’s website, Facebook and Twitter pages and send them to its email database. Additionally, the city will utilize police and fire personnel to go door to door or use a public address system for the purposes of notifying elderly or shut in type individuals unaware of the evacuation order. The City also retains the services of a professional weather consultant to be available to the City on an as-needed basis.

Assisted by early departures during the voluntary evacuation for Hurricane Charley, August 13, 2004, and the restriction on entry the day of evacuation, the City of Sanibel and Captiva Island successfully completed evacuation the day before the storm's arrival on the following afternoon.

Lee County's limited mandatory evacuation for Hurricane Charley allowed evacuees from Sanibel and Captiva to find adequate shelters. However, in the preparation for Hurricanes Frances and Ivan, and when a mandatory evacuation of a larger area was considered, the availability of adequate shelters was a major concern. Availability of adequate shelters, including shelters for those with special needs and for pet owners, is a challenge for the entire region and the State of Florida. These shelters need to be provided outside the evacuation zone. The City has no on-Island shelters. As a barrier island, it is not safe to remain in the City of Sanibel when a mandatory evacuation order is issued.

The City will be working as quickly as possible after the storm to ensure a speedy and safe return to the Island. Often more people are injured after a storm due to unsafe buildings, downed power lines, contaminated water, and other unsafe conditions than are injured in the storm itself. Do not walk through flowing water. Drowning is the number one cause of flood related deaths. Do not attempt to drive through a flooded road. The depth of water is not always obvious. Carefully check for structural damage prior to entering a building. Use caution when reentering the structure. Turn on electricity one breaker at a time and watch for smoke or sparks.

Additional information on the City's storm threat and evacuation issues can be found in the Safety Element of the *Sanibel Plan.* The Sanibel Plan can be found at the website www.municode.com

1. Protection of Critical Facilities

Critical facilities such as police and fire stations and utility buildings require special attention in floodplain management planning, as they play an important role before, during and after a flood emergency. It is important that critical facilities have carefully prepared emergency response plans, and where possible are constructed to standards above and beyond those typically required so that they can perform their required protection and response duties as efficiently and effectively as possible.

The inventory of the City's critical facilities is summarized as follows:

- **Sanibel Police Department and Emergency Operations Center**, 800 Dunlop Road, is built to withstand 155 mph winds and is elevated to 15 feet NGVD (6 feet above the base flood elevation). Contact Chief Dalton 473-3111

- **Sanibel Fire and Rescue**, 2351 Palm Ridge Road Station 1, has been redeveloped to meet or exceed flood and wind requirements. (This facility also houses County Emergency Medical Personnel and equipment) Contact Chief Scott 472-5525

- **Sanibel Fire and Rescue,** 5171 Sanibel-Captiva Road Station 2, has constructed a garage addition with flood resistant material and will be evacuated if flood warning is issued. (This facility also houses County Emergency Medical Personnel and equipment). Contact Chief Scott 472-5524.

- **Island Water Association**, 3651 Sanibel-Captiva Road, except for pre-NFIP components, the water treatment plant and administrative offices are built to withstand 130 mph winds and elevated to the base flood elevation. A garage and equipment storage building is elevated to the base flood elevation. Contact Don DuBrasky

- **Sanibel Department of Public Works** 750 Dunlop Road, houses the City's emergency recovery equipment and is built-to-withstand 130 mph winds and both buildings and vehicle garage and storage areas are elevated to the base flood elevation (9 feet NGVD). Contact Keith Williams 472-6397.

- **Sanibel Sewer System Donax** Wastewater Reclamation Facility, 930 Donax has all critical components elevated to the base flood elevation. Contact Joe Gudinas 472-3179.

- **Sanibel Sewer System Wulfert** Advanced Wastewater Reclamation Facility, 2222 Wulfert Rd. has all critical components elevated to the base flood elevation. (This facility is currently not active). Contact Keith Williams 472-6397.

Location of these facilities is indicated in Figure 7.

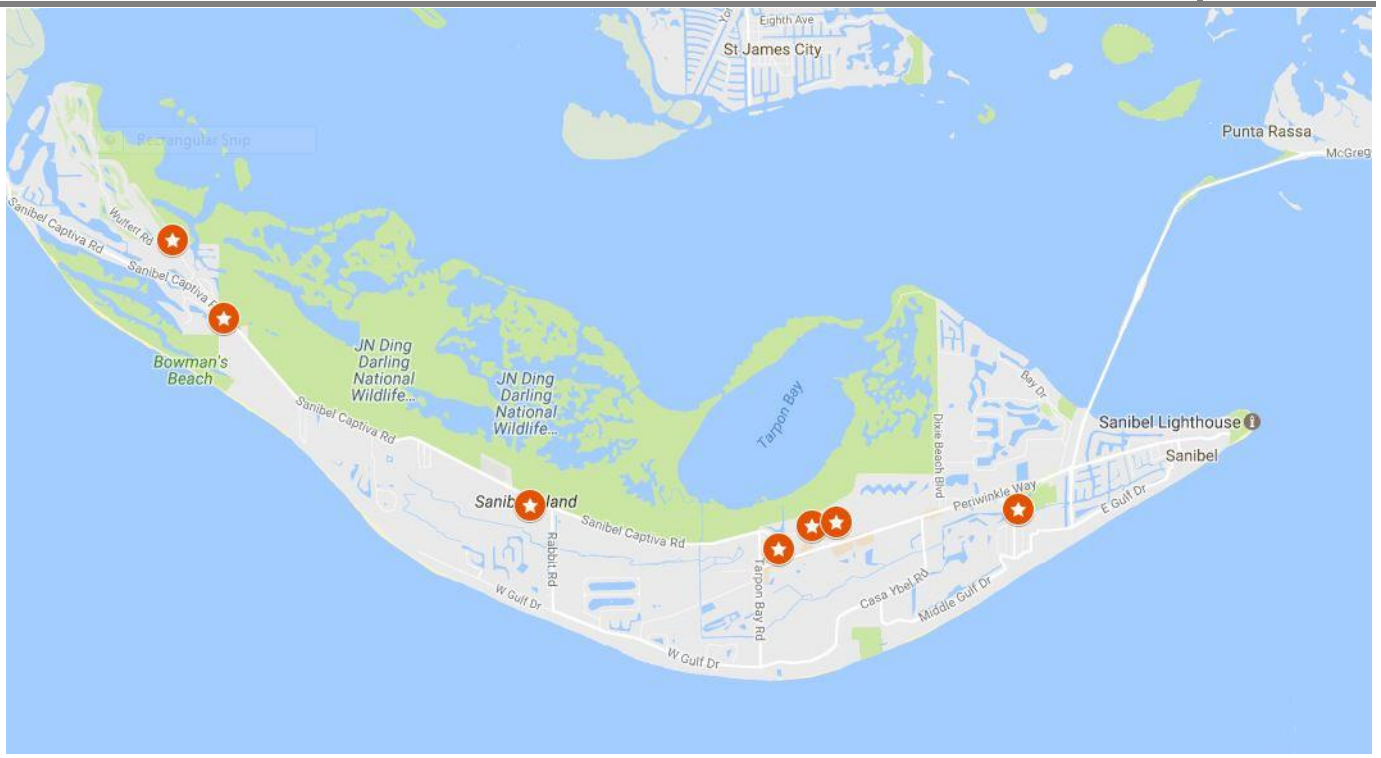


Figure 7 – Critical Facilities Map

All of these critical facilities currently have their own emergency management plans in place. These plans are closely coordinated with the overall City of Sanibel Emergency Management Plan. These critical facilities remained intact during the destructive forces of Hurricane Charley.

A threat to the City's critical facilities likely exists with vehicles and equipment at the Sanibel Police and Fire Departments, due to the low elevation of the vehicle and equipment garage and storage areas at these locations. These Departments have made arrangements to either move their critical equipment to the City Department of Public Works property, which has the highest garage storage area elevation of the City's critical facilities, at above 9 feet above sea level. The Island Water Association has a large garaged area elevated to the base flood elevation. The Sanibel-Captiva Conservation Foundation has created a large area elevated above the base flood elevation. These areas are available for storage of vehicles during flood events. Off-island locations are also available for protection of vehicles.

Since the City's incorporation, none of the above mentioned critical facilities have experienced flood damage.

2. Risk of Damage to Causeway

The City's only road onto the island is by the Causeway which is owned and operated by Lee County. An important concern to both evacuation and re-entry is the risk of damage to the Causeway during a storm event.

Prior to 2009, the City's Marine Patrol trailered their boat to the City's boat ramp for launching. This procedure was inefficient and increases critical response time. Several sites for a marine patrol dock were explored over the years, with the site immediately east of the City's boat ramp at Causeway Boulevard being selected for the facility. In 2009, the City constructed the dock, which is also being utilized by the Sanibel Fire District. It also serves as a barge landing facility in an emergency.

At the September 21, 2016 meeting, Lee County addressed concerns regarding challenges to erosion on the Causeway in respect to Lee County Department of Transportation and Lee County Parks and

Recreation.

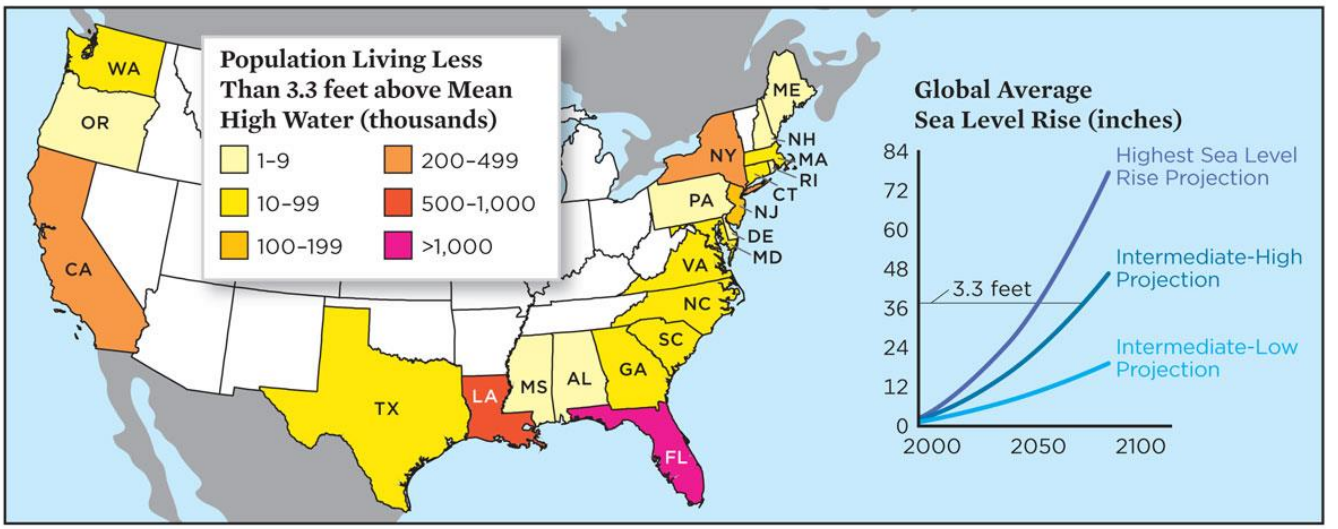
3. Climate Change and Sea Level Rise

Climate change is a alteration in the statistical distribution of weather patterns when that alteration lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events). Climate change may be due to natural internal processes or external forces. Climate change is a natural occurrence in which the earth has warmed and cooled periodically over geologic time. This warming is occurring almost everywhere in the world which suggests a global cause rather than changes in localized weather patterns.

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). Southwest 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. Seawalls cannot block seawater from infiltrating the porous limestone underground, and saltwater has already contaminated freshwater aquifers

Climate change has the potential to alter the nature and frequency of flood hazards such as hurricane storm surge, coastal erosion, and stormwater drainage. Sea level rise may also place additional stress on gravity flow stormwater and septic systems due to saltwater corrosion and rising groundwater conditions. 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.

FIGURE 2. Coastal States at Risk from Global Sea Level Rise



People in states with low-lying coastlines have been subject to severe flooding and damage from coastal storms in recent years. Although all coastal states are vulnerable, Florida, Louisiana, New York, and California have the most residents living on land less than 3.3 feet above high tide. Depending on our future emissions—and the resulting ocean warming and land ice loss—global average sea level could rise to the 3.3-foot mark within this century.

SOURCES: NOAA 2012A; STRAUSS ET AL. 2012.

C. FLOOD HAZARD AREA INVENTORY

As discussed in the previous section, the City of Sanibel's most significant flood threat lies in the tidal surges associated with coastal or tropical storms and hurricanes. With this threat, the entire Island is identified as a Special Flood Hazard Area by FEMA and as a Coastal High Hazard Area by the State of Florida.

1. Current

The properties that are most vulnerable to flooding on Sanibel are characterized by one or more of the following::

a. Structures built prior to the City's joining the regular phase of the NFIP in April 1979, which were constructed below the Base Flood Elevation (BFE) (Pre-FIRM buildings).

b. Structures located in areas of coastal erosion.

c. Structures located seaward of the City's Coastal Construction Setback Line (CCCL) (1974 State CCCL).

d. Structures located along Sanibel's Gulf or Bay shores, especially those located in the Island's FIRM Velocity Zone.

e. Structures located seaward of the State of Florida's 1991 Coastal Construction Control Line.

f. Elevated structures which meet the Base Flood Elevation but which have appurtenances (i.e., elevator shafts, entryways, etc.), which are below the Base Flood Elevation.

g. Any building on Sanibel during a catastrophic hurricane.

An estimate of the pre-FIRM (structures built prior to April, 1979) and post-FIRM structures on Sanibel, taken from City files is as follows:

Number of Structures			
Building	Pre-FIRM	Post-FIRM	**Total**
Type	(Prior to 4/16/1979)	(After 4/16/1979)	
Single Family	1,257 (31%)	2,853 (69%)	**4110 (100%)**
Multi-Family	549 (69%)	246 (31%)	**795 (100%)**
Non-Residential	125 (61%)	80 (39%)	**205 (100%)**
Total	**1,931 (38%)**	**3,179 (62%)**	**5,110 (100%)**

Source Planning and Building Departments – September, 2016

Since the City initiated participation on the National Flood Insurance Program (NFIP), the majority of existing structures are compliant with flood regulations. However, about 38% of existing structures were built prior to the City's implementation of the NFIP. These noncompliant buildings represent the City's most vulnerable flood prone properties, particularly those located within 500 feet of San Carlos Bay, Pine Island Sound, Blind Pass or the Gulf of Mexico.

Coastal pre-FIRM structures have proven to be the City’s greatest flood damage concern. Between

1979 and 2016, the City had 64 repetitive loss properties. The majority of the reported losses to these properties were associated with tropical storms or hurricanes.

The following table indicates the most recent data on residential development, by type, on Sanibel, taken from a report compiled by the Sanibel Planning Department in January 2016 titled *"The Housing Stock in the City of Sanibel".*

Housing Type	2016		Buildout	
	Units	%	Units	%
Single Family (includes 112duplexes)	4,179	49%	4700	**52%**
Multi-family	3,113	37%	3136	**35%**
Motel	703	8%	700	**8%**
Time Share	384	5%	384	**4%**
Mobile Homes	80	1%	80	**1%**
TOTAL	**8,459**	100%	**9000**	**100**
Source: Source: Sanibel Planning and Building Departments – December, 2016				

A similar study compiled by the Planning Department regarding non-residential land use on Sanibel estimates that existing commercial development represents over 90%of the commercial floor area projected at buildout.

2. Projected

With Sanibel approaching buildout, very little vacant property remains to be developed. As this time nears, more and more construction on the Island will be targeted at redevelopment of older buildings. The effective implementation of City's land development regulations, the State's Coastal Construction Control Line program and FEMA's flood regulations make it unlikely that new development will add to the City's current flood problems. In most cases, redevelopment that replaces nonconforming older buildings will help eliminate existing non-conforming flood prone property on Sanibel.

Even though the majority of the City's repetitive loss properties front on the Gulf of Mexico, if the City were hit by a major hurricane (Category 4 or 5) with a severe storm surge, the entire Island would be impacted. This is why it is important to maintain and enforce all of the current local, state, and federal regulations that address storm and flood proofing as Sanibel further develops and redevelops.

The following Table summarizes the population and housing trends per the *Sanibel Plan:*

Sanibel Plan Year	2007	2007	2013	2013
Projection Year	2004/05/06	2025/26	2011	**2022**
Functional Seasonal Population	18,040	19,800	18,200	**18,920**
Projected Dwelling Units	**8,200**	**9,000**	**8,272**	**8,600**

As evident, based upon the estimates and projections from the 2013 Evaluation and Appraisal Report of the *Sanibel Plan,* the City expects "buildout of the Island to occur within the next 10 to 20 years. New development on the Island has slowed considerably, and most building consists of in-fill development and redeveloping or replacing older existing structures.

STEP 6. SET GOALS

The 2016 Sanibel Floodplain Management Plan (FMP) updates and revises the goals of the Plan to guide the assessment and selection of alternative FMP policies and procedures:

The primary issues and problems regarding floodplain management on Sanibel have been analyzed in previous sections of this plan. The following are the goals established to address these issues and problems.

A. Continue to use the effective damage reduction and mitigation activities that minimize the flood threat through appropriate and proactive floodplain management regulations.

- Retain the density established by the *Sanibel Plan*
- Maintain limitations on improvements to buildings that do not conform to current flood regulations
- Continue to enforce the Florida Building Code, including flood regulations in the State's Coastal Construction Control Program.
- Continue implementation of stormwater management regulations
- Continue to preserve the lands owned and managed for conservation purposes

B. Identify measures that can be used to protect buildings that are not complaint with current flood regulations

C. Preserve and protect as much of the Island's floodplains as possible in their natural state for the beneficial floodplain functions they provide.

D. Continue to implement the Sanibel Emergency Management Plan to provide warnings of imminent flood dangers

E. Maintain the structural components of the Surface Water Management System and provide a remote monitoring component to improve its efficiency in threat warning and flood control.

F. Continue to provide information to the community regarding the Island's flood threat, assistance in minimizing that threat, and flood insurance.

G. Allow for pre and post disaster redevelopment and mitigation policies and procedures designed to reduce or avert Sanibel’s future disaster potential.

The City continues to consider all viable alternative ways to accomplish its FMP goals. Through the floodplain management planning process, the City identifies numerous policies, programs and regulations that are being and can be implemented to improve floodplain management.

STEP 7. REVIEW POSSIBLE ACTIVITIES

The floodplain management activities and alternative considerations summarized below were included for consideration in the FMP public review and adoption process.

A. PREVENTIVE ACTIVITIES

The City of Sanibel has, over the years, adopted a number of regulations and policies designed to protect the public health, safety and welfare and minimize potential property damage from flooding. These City regulations are in addition to Federal and State regulations governing special flood hazard areas. The City enforces all of these regulations and looks for areas to strengthen them wherever possible. A brief summary of the current City, State and Federal development regulations and policies relating to the City's flood hazard is as follows

Preventative activities, as listed, keep flood problems from getting worse. The use and development of flood-prone areas is limited through planning, land acquisition, or regulation. They are administered by building, zoning, planning, and/or code enforcement offices.

1. Floodplain mapping and data
2. Coastal Mapping, Assessment and Planning (RISK MAP)
3. NFIP Construction Standards
4. Drainage system maintenance
5. State Regulations
6. City Regulations

This section provides further description of the preventive activities applicable to the City in detail including pros and cons.

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1. Floodplain Mapping and data (FEMA)

National Flood Insurance Program (NFIP) Base Flood Elevation (BFE) requirements. The City joined the regular program of the NFIP in April 1979, and since that time all structures have been built to meet base flood elevation standards. In October 1985, and again in 1996 and 2008, FEMA significantly revised the City's Flood Insurance Rate Maps and the required BFE's. In inland zones, most BFE's remained the same or decreased in required elevation by 1 to 3 feet. The area of the City's velocity zone increased in size in the 2008 revision; while, the required elevations either remained the same or increased by 1 to 8 feet. The 2008 changes to the velocity zone requirements had a meaningful impact on Sanibel. The majority of the east end of the island, much of the western portion of the island between Sanibel Captiva Dr. and the Gulf of Mexico and significant portions along Middle Gulf Drive were added into the velocity zone. The City of Sanibel meets or exceeds FEMA building requirements within the Special Flood Hazard Area. The City imposes FEMA's velocity zone standards on any new development within 500 feet of the island's coast, even if the parcel is not in a velocity zone. The City has not granted variances for development in these areas. In 2008, as part of a nationwide map modernization, the City of Sanibel adopted the current maps. These maps generally raised elevations and based the new maps on the more accurate North American Vertical Datum of 1988 (NAVD 88).

2. Coastal Mapping, Assessment & Planning (RISK MAP)

In November 2014, FEMA notified the City of Sanibel that it is analyzing coastal wave action in the Gulf of Mexico as part of its Risk Mapping, Assessment & Planning (Risk MAP) program. This analysis will be used to create new elevation data for Flood Insurance Rate Maps (FIRMs). Preliminary maps will be distributed in 2018. These maps will be subject to local appeal.

Timeline for IDS (Intermediate Data Submittal) and other reports: There will be a 30 day response period for each IDS. There will be no more outreach meetings until the Work Maps are released which will be in the around the release of IDS #3 (Q3 2016).

- *IDS #1 Released in June 2014*. Includes Digital Elevation Model (DEM), ADC/IRC mesh, historical validation storm
- *IDS #2 6-8 months.* Tide Storm Surge, Joint Probability Methodology Setup.
- *IDS #3 Q3 2016.* Production Runs, Return Period Analysis. Release of Work Maps
- Q4 2017 Flood Risk Review Meeting
- Q4 2018 Community Coordination and Outreach meeting to reveal preliminary maps

Low-lying coastal areas are especially vulnerable to damage from erosion, waves and storm surge. The NFIP depicts two coastal flood zones on its Flood Insurance Rate Maps.

- Zone VE, where the flood elevation includes wave heights equal or greater than 3 feet; and
- Zone AE, where the flood elevation includes wave heights less than 3 feet.

Post-storm field visits and laboratory tests throughout coastal flood hazard areas have consistently confirmed that wave heights as low as 1.5 feet can cause significant damage to structures that are constructed without considering coastal hazards. The new Risk MAP will include a line showing the Limit of Moderate Wave Action or LiMWA, which is the inland limit of the area expected to receive 1.5-foot or great breaking waves

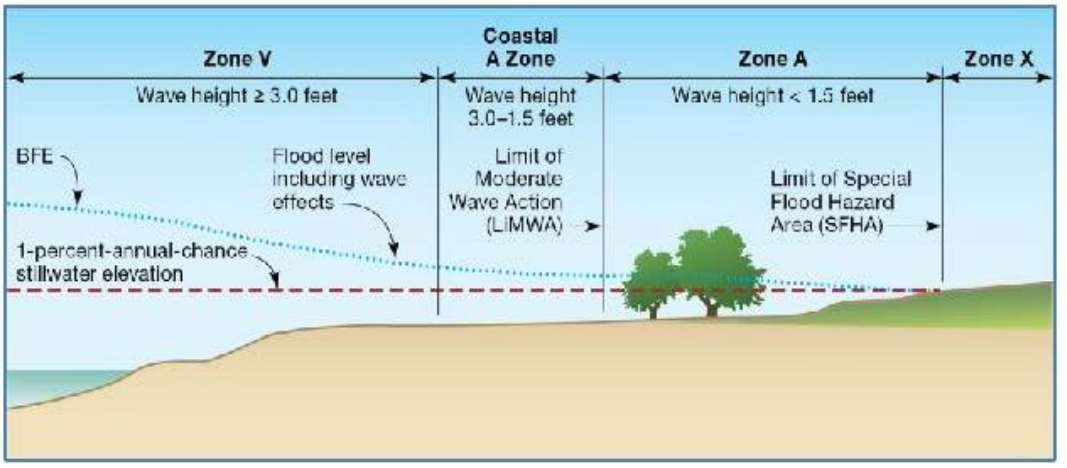

Figure 8 – Zone V – Coastal A Zone (LiMWA) and Zone A

The addition of the LiMWA area to FIRMs allows communities and individuals to better understand the flood risks to their property. The LiMWA area alerts property owners on the seaward side of the line that although their property is in Zone AE, their property may be affected by 1.5-foot or higher breaking waves and may therefore be at significant risk during a 1-percent-annual-chance flood event. While not formally defined in the NFIP regulations or mapped as a flood zone, the area between Zone VE and the LiMWA is called the Coastal A Zone. This area is subject to flood hazards associated with floating debris and high-velocity flow associated with waves and debris that can erode and scour building foundations, and in extreme cases, cause foundation failure.

Pro: Communities that adopt Zone VE standards in the Coastal A Zone and reference the LiMWA area receive Community Rating System credits.
Con: Restrictions and elevation requirements increase construction cost.

~~2.~~ NFIP Construction Standards

NFIP Construction standards regulate breakaway walls; foundation protection; flood proofing requirements; flood resistant construction materials.

4. Drainage System Maintenance

The City inspects and maintains the Island's drainage system on a regular basis, and enforces the City's stream dumping ordinance (Section 30-39 of the Code of Ordinance) to ensure the functioning, integrity and reliability of the islands drainage system.

5. State Regulations

Coastal Construction Control Line (CCCL) Regulations. The State of Florida has established, through detailed analysis, a CCCL in most coastal areas in Florida. The *Sanibel Plan* prohibits development seaward of the 1974 CCCL. Development that occurs seaward of the 1991 CCCL is required to obtain a permit from the Florida Department of Environmental Protection. This permit process involves erosion studies and other construction related reviews targeted to ensure the safety of the development, its occupants, and adjoining properties.

The State Building Code regulates building elevation seaward to the 1991 state Coastal Construction Control Line, building strength, foundation protection and erosion protection.

6. City Regulations

- **Zoning Regulations.** The City does not allow development to occur in the Gulf Beach Zone. This zone comprises a significant percentage of FEMA's velocity zones, which are the City's most vulnerable flood prone areas. The City appropriately limits development in the Bay Beach, Lowland Wetlands and Mangrove Forest Zoning Districts, which are all low lying and flood prone areas on the Island. Additional development regulations apply in the Interior Wetlands Conservation (Overlay) Zoning District, which further protects developments from flooding and preserves the beneficial floodplain functions of the Island's interior wetlands in their natural state.

- **Environmentally Sensitive Lands Conservation District (ESLCD) Regulations.** The City has established an additional Overlay Zoning District, the ESLCD, which further protects public and conservation lands by prohibiting residential development and is limited to minor buildings in the district. This added protection of public and conservation lands also helps preserve the beneficial floodplain functions of the Island's environmentally sensitive lands in their natural state and virtually eliminates potential flood damage on well over half the land area in the City.

- **Land Acquisition Efforts**. Since the mid-1980's, the City has been actively acquiring undeveloped lands in environmentally sensitive areas of the Island, predominately in the Island's Interior Wetlands District. Lands that are acquired by the City using environmentally sensitive lands acquisition funds are automatically included in the City's ESLCD, thereby restricting development in those areas. The City has completed acquisition of essentially all privately owned (non-conservation) lands in the Sanibel Gardens and Tarpon Bay subdivisions. The acquisition and restoration of this Preserve (Sanibel Gardens) removed potential development and associated flood risk in a low- lying area naturally prone to flooding.

- **City Development Regulations**. City development regulations in all City zoning districts protect property from flood damage through on-site storm water retention requirements and FEMA-based storm and floodproofing requirements. Consideration of additional or alternative regulations regarding development standards to minimize flood hazards is an ongoing process in the City's proactive approach to floodplain management.

- **City Building Code Regulations**. The City has strict building code regulations established by the State of Florida, designed to augment and support FEMA regulations that protect development on the Island from flood damage. These regulations include, but are not limited to the areas of foundation protection, flood proofing, flood resistant materials and break-away construction.

- **Miscellaneous.** The City has adopted a policy for the operation of its water management system designed to reduce and prevent flood damage on the Island. The policy is also designed to restore and preserve the beneficial floodplain functions of the Island's Interior Wetlands District in its natural state. Both the Florida Department of Environmental Protection and the South Florida Water Management District approved this policy.

Pros: City codes in place discourage armoring of the shoreline and to encourage more natural erosion abatement techniques, such as vegetation and "living shoreline"-type projects within the bay beach zone (armoring of any type prohibited along gulf-beach).

City codes in place protect mangroves on Sanibel; the City has been delegated the authority by the FDEP to regulate mangroves on Sanibel in accordance with the 1996 Mangrove Trimming and Preservation Act.

B. PROPERTY PROTECTION

Property protection activities listed are usually undertaken by property owners on a building-by-building or parcel basis.

1. Relocation
2. Acquisition
3. Building elevation
4. Retrofitting
5. Sewer backup protection
6. Insurance

Pros: Due to high property values on Sanibel, direct flood damage reduction alternatives, such as acquisition or relocation of vulnerable properties are economically infeasible for the City to pursue, to a great degree. A few alternative activities, however, would create a positive impact on the Island's flood threat and floodplain management objectives. Flood damage reduction alternatives include:

1. Acquisition

One important activity that the City has undertaken is the identification of the City's most flood vulnerable properties, those that could become future repetitive loss properties. No properties are currently identified for potential acquisition. The City has acquired lands in the 265-acre Sanibel Gardens Preserve that removes private development potential from these low lying flood prone areas and restores the natural flood storage function of the Sanibel River. Opportunities for relocation, retrofitting or mitigation improvements continue to be pursued.

2. Repetitive Loss

The City pursues acquisition, relocations, and retrofitting of any existing or potential repetitive loss properties. Wherever economically feasible, the City is willing to relocate or retrofit flood prone property. City staff should remain familiar with Federal financial programs for acquisition and relocation, and post-disaster relief programs for financial assistance.

C. NATURAL RESOURCE PROTECTION

Natural resource protection activities listed preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are implemented by a variety of agencies, primarily parks, recreation, or conservation agencies or organizations.

1. Wetlands protection
2. Erosion and sediment control
3. Natural area preservation

4. Natural area restoration
5. Water quality improvement
6. Coastal barrier protection
7. Environmental corridors
8. Natural functions protection
9. Native vegetation protection on public and private lands
10. Mangrove protection through the State's 1996 Mangrove Trimming and Preservation Act and City delegation from the State to enforce through City codes
11. Use of "living shorelines" along our bay beaches to enhance protection of the shoreline through the use of vegetation, oyster reefs and other natural habitats in lieu of traditional armoring of the shoreline.

1. Island Wide Beach Management Plan

The City implements the Island-wide Beach Management Plan, which contains a number of policies and programs targeted to protect, preserve and enhance the Island's beach dune system for the beneficial floodplain functions it provides.

2. Natural Area Preservation

Over 5,000 acres of land on Sanibel are within the J. N. "Ding" Darling National Wildlife Refuge. Another-2000 acres are owned by the State, City, or Sanibel-Captiva Conservation Foundation and are preserved as natural open space. About 2/3rds of the land area of the City of Sanibel is preserved conservation lands. The locations of these open spaces in the floodplain are show on the map provided in Appendix K of this Plan.

3. Protection of Dunes

Sanibel relies heavily on its beach and dune systems to protect development on the Island from coastal flooding. Fortunately, the Island's beaches have, in recent years, been generally stable or accreting. However, there are a few areas where erosion "hot spots" occur. The predominate area of erosion on Sanibel, which has a very long history of instability and drastic change is at Blind Pass, which separates Sanibel Island from Captiva Island to the north. The Blind Pass area was the location of a number of coastal floods that resulted in property damage and flood insurance claims. Three structures in this area, which were repeatedly damaged by storms, were purchased by the City and were eventually demolished and removed.

Pros: Beach renourishment is used to mitigate erosional impacts along the northern end of Sanibel Island as part of Lee County's Blind Pass inlet management dredging project.

The City budgets funds for annual native beach dune plantings at all of the City's beach parks. This enhances dune habitat protection and wildlife habitat, resulting in a more resilient dune system.

D. EMERGENCY SERVICES

Emergency services measures are taken during an emergency to minimize its impact. These measures are usually the responsibility of Emergency Management staff and the owners or operators of major or critical facilities. These services include:

1. Hazard threat recognition
2. Hazard warning
3. Hazard response operations
4. Critical facilities protection
5. Health and safety maintenance
6. Post-disaster mitigation actions

1. Flood Warning

The City of Sanibel and Lee County already have in place one of the premier flood forecasting, warning and emergency programs in the State. The City cooperates with the County in its emergency planning efforts and reviews and improves the City's Emergency Management Plan. Residents and visitors can register to receive emergency notifications on the City's website by clicking on the "CodeRed" link. CodeRed is a software based notification system that can also target specific geographical areas for notice as well. The city will post evacuation notices on it's website, Facebook and Twitter pages and send them to its email database. Additionally, the city will utilize police and fire personnel to go door to door or use a public address system for the purposes of notifying elderly or shut in type individuals unaware of the evacuation order. The City also retains the services of a professional weather consultant to be available to the City on an as-needed basis. Sandbags and sand are made available prior to a storm by the Sanibel Fire Department.

Based upon the analysis of hazard and risk assessment, current goals, current flood hazard mitigation activities and alternative considerations, input from outside agencies, the public, and the Sanibel City Council, the Action Plan is provided to meet the goals of the 2016 Floodplain Management Plan.

The Action Plan specifies the responsible departments for each activity, timeframe for implementation, and budget for the activity, if appropriate. Many activities are on-going and have no deadline. Many activities are undertaken in-house by City staff and resources and have no itemized budget.

Following each activity description is a note regarding if and how the activity is credited by the Community Rating System (CRS).

2. Emergency Management Plan

The Olson Group, LTD has been hired by the City to assist with a complete update to the Emergency Operations Plan. This plan is controlled by the City's Division of Emergency Management which is part of the Police Department. Representatives from all of the City's Departments have been involved in a workgroup to review and provide input towards the updated document. The Plan is anticipated to be completed by the spring of 2017 and will be presented to City Council for Adoption.

E. STRUCTURAL PROJECTS

Structural projects samples listed below keep flood waters away from an area with a levee, reservoir, or other flood control measure. They are usually designed by engineers and managed or maintained by public works staff.

1. Reservoirs
2. Levees/floodwalls
3. Diversions
4. Channel modifications
5. Storm drain improvements

In addition to listed structural projects, the City's system includes weir controls and box culverts.

Weir Control

The City has completed implementation of the Sanibel Surface Water Management Plan.

The system includes two weirs, one at the east end of the island adjacent to Beach Road and one

near the middle of the island at Tarpon Bay. These weirs control water levels within entire system. In the 1990s, they were rebuilt and all of the culverts that discharge to the Sanibel River were also improved to enhance performance of the water management system.

The City operates the system in accordance with the adopted weir control policy, which helps alleviate flooding on the Island, but also helps restore and preserve the natural and beneficial floodplain functions of these lands.

In October 2016, a one-way tidal flow gate was installed on the Dunes Community weir to prevent saltwater intrusion and increase stormwater capacity within the lakes.

F. PUBLIC INFORMATION activities advise property owns, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of local floodplains.

1. Map information
2. Outreach projects
3. Real estate disclosure
4. Library
5. Technical assistance
6. Environmental education

One of the best ways to reduce the threat of flooding from tidal surges associated with coastal and tropical storms and hurricanes, is to have residents and property owners who are informed and educated to deal with the potential for flooding on the Island. Public communication and assistance alternatives include:

1. Flood Facts Brochure

The City provides a significant amount of information to Island residents and businesses regarding Sanibel's flood threat. The City published a brochure entitled "Sanibel Flood Facts", which was mailed to all island residents and property owners. A copy is attached as Appendix L. This brochure includes:

- a description of the local flood hazard and a map of the Island to illustrate that the entire City is in a Special Flood Hazard Area (SFHA) and is vulnerable to flooding; a description of the City's flood warning systems;
- a description of the City's development permit requirements, substantial improvement regulations and drainage system maintenance program and stream dumping restrictions;
- measures that property owners can take to protect their lives and property before, during and after a flood;
- the natural functions of the Island's floodplains and the benefits of protecting them and;
- flood insurance information.

2. Multi-Jurisdictional Program for Public Information (MJPPI)

The City participates in the Lee County MJPPI annually in April to update the projects including updates on multijurisdictional projects. Outreach projects are identified in the MJPPI attached as Appendix C. They include mailouts to residents, realtors, insurance companies and include meetings with homeowners associations and other outreach projects on Sanibel and with the County and other Municipalities.

3. Library

Another good source of information regarding the Island's flood threat and flood protection measures is the local public library. The City works in cooperation with the local library to see that information is available to the citizenry to help them identify the local flood threat and measures to protect their lives and property from that threat.

4. Real Estate Disclosure

One of the best times to notify potential property owners of the Island's flood threat is when they are ready to purchase property on Sanibel. The City works in cooperation with the Board of Realtors to see that potential purchasers are notified that the entire City is in a Special Flood Hazard Area (SFHA) and of flood insurance purchase requirements and are notified of the special hazards in erosion prone areas as applicable, and that realtors distribute other information regarding the City's flood threat. The City wants to look into similar requirements for all sellers to disclose this information.

5. Map Information

The City requires that boundary surveys and subdivision plats display the notation that the City is entirely within a Special Flood Hazard Area of the Federal Flood Insurance Program.

The City of Sanibel itself is an excellent source of information on flood related data, regulations, and mitigation and protection techniques in the community. The City makes significant efforts to provide as much information and assistance as possible to the public. Such programs and policies include:

- keeping and requiring accurate elevation certificates on all building permits issued; elevation certificates are now available online;
- assisting the public in reading and understanding the pertinent information on FIRM's;
- providing site specific flood related data to the public;
- providing professional advice on retrofitting techniques;
- assisting in identifying and selecting contractors to do retrofitting work;
- performing on-site visits to review flood related issues, development constraints and to provide advice;
- providing information on financial disaster assistance and retrofitting and relocation programs;
- maintaining the City's pertinent flood zone information on a computerized mapping system for quick and accurate public access;
- maintaining data on the City's erosion patterns; and
- maintaining the City's FIRM elevation reference marks.

6. Outreach Projects

The City disseminates flood information via various methods, media, and locations in the following ways: flood information at public meetings, direct mail outs for new residents and businesses and email blasts at the City website at www.mysanibel.com . The matrix of Outreach projects included in the MJPPI Appendix C.

STEP 8. DRAFT AN ACTION PLAN

Based upon the analysis of hazard and risk assessment, current goals, current flood hazard mitigation activities and alternative considerations, input from outside agencies, the public, and the Sanibel City Council, the Action Plan is provided to meet the goals of the 2016 Floodplain Management Plan.

The Action Plan specifies the responsible departments for each activity, timeframe for implementation, and budget for the activity, if appropriate. Many activities are on-going and have no deadline. Many activities are undertaken in-house by City staff and resources and have no itemized budget.

Action items for mitigation of other hazards will be monitored closely and appropriate actions will be made based on the hazard. Reserve money can be made available in the event of an emergency.

The following Table summarizes the Existing Actions and New Actions with corresponding goals, mitigation category, budget, responsible department, how the activity is credited by the Community Rating System (CRS) and the Priority of the Action.

A - Existing Mitigation Activities							
No	Action	Related to Goal	Mitigation Category	Budgeted	Responsible Department	CRS Credit	Priority
1	Continue requiring FIRM Base Flood Elevation and V-zone requirements in accordance with NFIP	A,G	Prevention, Property Protection, Structural Projects	Y	PLAN BLDG	430 Higher Regulatory Standards	HIGH
2	Continue to implement State Policies including Coastal Construction Program and the Florida Building Code.	A,G	Prevention, Property Protection, Structural Projects, Natural Resource Protection	Y	PLAN BLDG	500 Flood Damage Reduction Activities	HIGH
3	Continue to implement City Regulations prohibiting development in the Gulf Beach Zone and limited development in Bay Beach, Lowland Wetlands and Mangrove Forest Zone.	A	Emergency Services, Public Information and Outreach	Y	PLAN	420 Open Space Preservation	HIGH
4	Continue to implement City Regulations designed to preserve and enhance the land in all of the zones in their natural state to protect their beneficial floodplain functions.	A,B	Prevention, Natural Resource Protection	Y	PW NR	420 Open Space Preservation 450 Stormwater Management	HIGH
5	Continue to implement building and development regulations and standards including on-site stormwater retention, sediment control policies, foundation proofing and break away construction requirement.	A,G	Prevention, Property Protection, Structural Projects Natural Resource Protection	Y	PLAN BLDG PW	450 Stormwater Management 540 Drainage System Maintenance	HIGH
6	Continue to implement the Surface Water Management Plan weir control policies and stream dumping prohibitions;	A,B,E	Public Information and Outreach	Y	PW	450 Stormwater Management 540 Drainage System Maintenance	HIGH
7	Continue to enforce higher regulatory standards limiting development within 500' of the Bay Beach Zone and 200' of the Sanibel River	A	Public Information and Outreach	Y	PLAN	420 Open Space Preservation 430 Higher Regulatory Standards	HIGH
8	Consider Acquisition, Relocation and/or Retrofitting of Flood Vulnerable Property.	A,B,F,G	Prevention, Property Protection, Natural Resource Protection	Y	ADMIN PLAN NR	500 Flood Damage Reduction Activities	MED

A - Existing Mitigation Activities							
No	Action	Related to Goal	Mitigation Category	Budgeted	Responsible Department	CRS Credit	Priority
9	Continue Environmentally Sensitive Lands Acquisition, Restoration and Protection	A,C	Prevention, Property Protection, Natural Resource Protection	Y	NR	420 Open Space Preservation	HIGH
10	Continue Flood/Storm Warning Program.	D,E,F	Prevention, Property Protection, Structural Projects, Natural Resource Protection	Y	POLICE	330 Outreach Projects 600 Warning and Response	HIGH
11	Continue Drainage system Maintenance	A,B,C,E	Prevention, Property Protection, Natural Resource Protection	Y	PW	540 Drainage System Maintenance	HIGH
12	Continue Information and Assistance Provision.	B,C,F,G	Prevention, Property Protection, Structural Projects, Natural Resource Protection	Y	PLAN	330 Outreach Projects	HIGH
13	Continue Community Outreach Flood Information Programs. Consider Insurance component in the Annual Hurricane Seminar.	B,D,F	Prevention, Property Protection, Natural Resource Protection	Y	ADMIN POLICE BLDG	330 Outreach Projects 350 Flood Protection Information	HIGH
14	Continue Flood Hazard Disclosures	B,F	Prevention, Property Protection, Structural Projects Natural Resource Protection	Y	PLAN BLDG	340 Hazard Disclosure	HIGH
15	Continue Building Elevation Certificate Maintenance and continue to make Elevations Certificates available online	B	Prevention, Property Protection,	Y	BLDG	310 Elevation Certificates 350 Flood Protection Information	HIGH

B - New Mitigation Activities							
No	Action	Related to Goal	Mitigation Category	Budg eted	Responsible Department	CRS Credit	Priority
1	Annually prepare and schedule FMP Progress report by _____ of each year and recommend activity changes and priorities.	A,B	Prevention	N	ALL	510 Floodplain Management Planning	HIGH
2	Coordinate roadway stormwater Maintenance programs to address stormwater flooding problems.	A,B,E	Prevention, Property Protection, Structural Projects	Y	PW	450 Stormwater Management 540 Drainage System Maintenance	HIGH
3	Continue to implement policies requiring BMPs for erosion and sediment controls to comply with NPDES permit requirements	A,C,E	Prevention, Natural Resource Protection	Y	PW PLAN	450 Stormwater Management 540 Drainage System Maintenance	HIGH
4	Continue to annually fulfill all Training and reporting requirements to be certified as a “Storm Ready” community.	D,F	Emergency Services, Public Information and Outreach	Y	POLICE	350 Flood Protection Information	HIGH
5	Continue stormwater management and water quality programs to address BMP opportunities throughout the City	A, B, E	Prevention, Natural Resource Protection	Y	PW NR	450 Stormwater Management 540 Drainage System Maintenance	HIGH
6	Annually prepare a budget to complete the Watershed Management Plan and fully implement the Plan.	A,B,C,E,G	Prevention, Property Protection, Structural Projects Natural Resource Protection	Y	PW	450 Stormwater Management 540 Drainage System Maintenance	HIGH $200k in LMS
7	Implement all components of the MJPPI, meet annually to prioritize and update.	D, F	Public Information and Outreach	Y	BLDG	330 Outreach Projects 350 Flood Protection Information	HIGH
8	Maintain the “Repetitive Loss Map”	B, G	Public Information and Outreach	Y	PW BLDG	500 Flood Damage Reduction Activities	HIGH
9	Continue to be active in the County’s Blind Pass Inlet Management Study	B	Prevention, Property Protection, Structural Projects Natural Resource Protection	Y	NR	500 Flood Damage Reduction Activities	HIGH
10	Oyster Reef Restoration along San Carlos Bay. Breakwater Concept	B,C	Prevention, Property Protection, Structural Projects Natural Resource Protection	y	NR	500 Flood Damage Reduction Activities	MED

B - New Mitigation Activities							
No	Action	Related to Goal	Mitigation Category	Budgeted	Responsible Department	CRS Credit	Priority
11	Closely monitor Risk Map Project for Accuracy. Consider Consultant.	A, F	Prevention, Property Protection	N	AD MI	430 Higher Regulatory Standards	HIGH
12	Adopt Model Flood Ordinance including LiMWA higher standards	A, F	Prevention, Property Protection, Structural Projects	Y	PLAN	430 Higher Regulatory Standards	HIGH
13	Adopt Risk Map in accordance with Federal Guidelines	A, F	Prevention, Property Protection, Structural Projects	N	PLAN BLDG PW	430 Higher Regulatory Standards	HIGH
14	Utilize Digital Format , Website Facebook and Email whenever possible	A, B, C	Prevention, Property Protection	Y	MIS	310 Elevation Certificates 330 Outreach Projects 350 Flood Protection Information	HIGH
15	Drainage Improvement Considerations and Priorities Tahiti-Jamaica	B, D	Prevention, Property Protection, Structural Projects, Natural Resource Protection	Y	PW	450 Stormwater Management 540 Drainage System Maintenance	HIGH In LMS $60k+ $500k Est.
16	Native beach dune plantings at Beach Parks.	A, B, C	Prevention, Property Protection, Natural Resource Protection	Y	NR	500 Flood Damage Reduction Activities	MED
17	Create and adopt codes that encourage more natural erosion abatement techniques, such as vegetation and “living shoreline” type projects within the Bay	A, B, C	Prevention, Property Protection, Structural Projects Natural Resource Protection	N	NR	500 Flood Damage Reduction Activities	MED
18	Completion and Adoption of the Beach Management Plan	A, B, C	Prevention, Property Protection, Natural Resource Protection	Y	NR	500 Flood Damage Reduction Activities	HIGH
19	Living Shoreline Projects Bailey Beach Park Woodring Road Lighthouse Beach	B, C	Prevention, Property Protection, Structural Projects, Natural Resource Protection	Y	NR	500 Flood Damage Reduction Activities	HIGH In LMS $53k+22k+91k
20	Utilization of Code Red	D, E, F	Prevention, Property Protection	Y	POL ICE	600 Warning and Response	HIGH

STEP 9. ADOPT THE PLAN

The 2016 Floodplain Management Plan is to be considered for adoption by the Sanibel City Council at a public hearing on April 4, 2017.

STEP 10. IMPLEMENT, EVALUATE AND REVISE

The City has been implementing its Floodplain Management Plan since 1995. The implementation of this Plan is an important part of the City of Sanibel's continuing commitment to responsible growth management. Through the Action Plan, the City will move toward achieving the goal of reducing and eliminating flood hazards in the community.

City departments are responsible for the implementation of the Action Plan and monitor its effectiveness. Furthermore, comments and suggestions from other agencies have been considered in the updating of the 2016 Floodplain Management Plan.

The committee that prepared this update of the 2016 Floodplain Management Plan will prepare an annual evaluation of the plan and submit the report to the City Council. This report will be submitted to the Federal Emergency Management Agency. The report will also be released to the media and made available to the public.

The 2016 Floodplain Management Plan will again be updated in 2021 or before as necessary. The Committee will meet annually to discuss the status, consider knew items, funding and priority.

IV. REPETITIVE LOSS PLAN

One of the activities involved with the Annual NFIP CRS Re-Certification process is the analysis of Repetitive Loss Areas. Repetitive loss properties are those properties for which two or more claims of more than $1,000 have been paid by the NFIP within any 10-year period. The City is considered a Category C community in which 10 or more repetitive loss properties have not been mitigated. For each Re-Certification visit, the City will submit the CC-RL Repetitive Loss List Community Certification assuring repetitive loss properties have been reviewed and continue to update the list as mitigated.

In order to maintain compliance with the requirements of FEMA's NFIP Community Rating System for the next Annual Re-Certification submittal and the CRS ISO Recertification Visit, this Repetitive Loss Plan of the National Flood Insurance Program Community Rating System updates and refocuses the Plan adopted by City Council Resolution No. 05-131 on September 13, 2005. The updated Plan reflects changed conditions and the progress made in implementing the Plan. As defined by FEMA in the CRS Coordinator's Manual, the area analysis will identified repetitive loss areas, evaluated mitigation approaches, and determined the most appropriate alternatives to reduce future repetitive losses.

The following Repetitive Loss Plan Update was based on flood insurance claims data for 64 repetitive loss properties identified by FEMA as received with corresponding Activity Worksheet 501 (AW-501) from ISO for data compiled through 2013.

1. RLA DESCRIPTIONS

The City of Sanibel must manage potential flooding problems that result from two primary sources. The first are summer thunderstorms that occur during the areas "rainy season which runs in general from May until October. The second is from rains and storm surges associated with tropical storms and hurricanes.

Summer thunderstorms occur almost daily in Southwest Florida. These storms build during the late afternoon. They are usually isolated weather systems, but can be severe at times and result in significant rainfall in a short period of time. The City has identified the following eight (8) flood prone areas where repetitive loss properties exist.

- **Area 1 –** Includes properties along Pine Avenue, Mangrove Lane, Castaways Lane, Blind Pass Court, Coconut Drive and the northwest end of Sanibel Captiva Road.
- **Area 2** – South side of West Gulf Drive between Murey Boulevard and Tarpon Bay Road
- **Area 3** – South side of West Gulf Drive between east of Tarpon Bay Road along Casa Ybel Road to Birdsong Place
- **Area 4 –** Along Periwinkle Way from Casa Ybel Road to Main Street
- **Area 5 –** South side of Middle Drive and Shell Basket Lane, Fulgur Street, Pyrula Avenue, Junonia Street and Beach Road
- **Area 6 –** Bounded from 827 East Gulf Drive to Point Ybel by the Sanibel Lighthouse, to Morningside Place, to Periwinkle Way to Sabal Street, to Kinzie Island Court, Spoonbill Road, to East Gulf Drive
- **Area 7 –** Along Bailey Road from Periwinkle Way to Bay Drive, and Bayview Drive including Bird Lane and Mayer Drive.
- **Area 8 –** Includes Woodring Road to Dixie Beach Boulevard, to Royal Poinciana Drive to Venus Drive.

2. PROCEDURE

Per FEMA's CRS Coordinator's Manual, the five-step process to mitigate a property is outlined as follows:

- Step 1: Each repetitive loss property owner was advised that the analysis was being conducted through outreach notification.
- Step 2: Data was collected on each building to determine the cause(s) of the repetitive damage.
- Step 3: Alternative approaches were reviewed to determine whether any property protection measures or drainage improvements were feasible.
- Step 4: Agencies or organizations shall be contacted that may have plans that could affect the cause or impacts of the flooding.
- Step 5: The findings have been documented in this report, including a map showing all parcels in each area, recommendations, and how the recommendations will be funded as shown in Appendix P.

STEP 1: NEIGHBORHOOD NOTIFICATION

The first step in the area analysis process was to advise the residents about their status as repetitive loss property or that their property is within an area that has experienced repetitive flooding. The letter included in Appendix M is distributed annually to the addresses provided in the Repetitive Loss Areas Address List also included in Appendix N.

Site visits were conducted by Sanibel staff.

STEP 2: DATA COLLECTION

The second step in the analysis process was to collect relevant data on the problem and the properties exposed to flooding. Five sources of information were used: flood insurance data provided by FEMA, the Flood Insurance Rate Map (FIRM), the City Building Official and Engineer, the resident/property owner, and the on-site visit.

- **Flood insurance data:** The flood insurance claims records provided to the City, contain the date of flooding and contents damage amount for those floods that occurred when the property was insured. Due to restrictions per the Privacy Act of 1974 (5 U.S.C. 552a) regarding the release of certain types of data to the public, the insurance claim data provided by FEMA, for the purposes of floodplain management, mitigation or research, will not be included in this report. The individual repetitive loss properties or claims information will not be identified. The properties in Areas 1 through 8 have received flood insurance claims payments from floods related to different events listed in Table X below. In total, the homeowners for the 64 repetitive loss properties have received $4,185,804, in paid flood claims since 1979. On average, each of the RLPs has received $12,752 in flood claims. The maximum amount paid to one building is $500,000 and the minimum is $11. The table below shows the dates versus number of flood claims paid on RLPs.

TABLE X

Event Date	Event Description	Flood Claims
6/25/1992	Tropical Depression One	6
09/14/2001	Hurricane Gabrielle	56
09/04/2004	Hurricane Frances	
08/13/2004	Hurricane Charley	56

- **FIRM:** FEMA issued an updated FIRM on September 08, 2008 for the City of Sanibel as provided in Figure 1. The FIRM shows that Areas 1 through 8 lie within the 100-year floodplain mapped by FEMA and designated as an "VE Zone" and "AE Zone" with the 100-year flood elevation ranging between 8.0 and 13.0 feet above sea level as shown in the Flood Insurance Rate Map (FIRM) included in Figure 1. Per coordination with the City's various departments, review of historical events, review of existing stormwater management system, and topographic data, these areas are prone to flooding due to tidal effects, high water table and low lying elevations. Zones AE and VE are considered Special Flood Hazard Areas (SFHA) because they represent areas that will be covered by floodwater during a base flood. VE Zones, also known as Coastal High Hazard Areas, inherently have an additional hazard due to storm-induced velocity wave action. Homeowners who live in AE and VE Zones are required to purchase flood insurance through the National Flood Insurance Program. Properties located in AE flood zones are subject to inundation by 100-year flooding event, for which base flood elevations (BFEs) have been determined. In other words, areas designated as flood zone AE have a 1 percent chance of experiencing a flood each year, and a 26 percent chance of flooding at some point over the length of a 30-year mortgage.

- **City of Sanibel:** The City Engineer and Building Department shared vast personal experience and findings regarding each of the flood events.

- **Visit:** The City's Building Official visited each site after each event. The surrounding terrain was inspected to review the building's construction and mitigation measures taken. All the information collected was recorded and maintained with associated demolition permits, redevelopment permits, and acquisition documentation.

STEP 3: MITIGATION MEASURES

The third step in the area analysis procedure was to review alternative approaches to protect the properties from future flood damage. The following five (5) approaches were analyzed:

1. Elevating the building above the Base Flood Elevation (BFE)
2. Protecting by a flood control/stormwater management project
3. Partially floodproofing, but not up to the BFE
4. Replacing with a new elevated/floodproofed building.
5. Acquiring and demolishing the existing building

Each approach has its advantages and disadvantages. Even though this section discusses different mitigation options, property owners are required to comply with the City of Sanibel Code of Ordinances, *Article III Flood Hazard Reduction Standards*, Section 94-52, where "New construction or substantial improvements of any residential structure shall have the lowest floor elevated to or above the base flood elevation designated in the FIRM." In VE Zones, as specified in Section 94-53, "All new construction or substantial improvements shall be elevated on pilings and columns so that the bottom of the lowest horizontal structural member of the lowest floor is elevated to or above the base flood level, with all space below the lowest floor open so as not to impede the flow of water, except for breakaway walls, open lattice work, decorative screening or mesh screening."

Therefore, elevating a building above the BFE as a mitigation measure is required by law for those structures that were substantially damaged by flooding due to hurricanes or other events.

1. **Elevation:** Raising the structure above the flood elevation was considered the best flood protection measure compared to relocation outside of the floodplain since the entire island where the City of Sanibel resides is located within a floodplain. Even though the depth of flooding in some instances were at least one foot or greater, the benefit/cost ratio was low. In the cases where expansive masonry structures are located on a foundation slab, the cost of elevating was deemed economically unfeasible. Since a large percentage of residences within Repetitive Loss Areas 2, 3, 4 and 5 are slab on grade structures, elevating above the BFE was not pursued as a cost-effective option.

2. **Flood control project:** As mentioned in Step 5, Item 3, the City completed implementation of their Surface Stormwater Management Plan in1997 . This plan installed weirs, rerouted the Sanibel River and updated the drainage conveyance system. Currently, Johnson Engineering is contracted to update the Watershed Master Plan

3. **Partial Floodproofing:** This measure was the most common option implemented throughout the repetitive loss residents. It is intended to prevent floodwaters from entering a building. Since the structure itself is part of the barrier to the passage of floodwater, partial floodproofing is recommended mainly for building with slab foundations. Per Section 10-21, *Floodproofing* is defined as "any combination of structural and nonstructural additions, changes or adjustments (other than elevating) to Structures which reduce or eliminate Flood damage to real estate or improved real property, water supply and sanitary sewage facilities, Structures, and their contents." The repetitive loss property owners in Area 1 applied one or more of the following floodproofing methods:
   (1) Installation of watertight doors, bulkheads, shutters, removable shields, sandbags or similar methods of construction to protect against winds, wave action, or Flood waters.
   (2) Reinforcement of walls to resist water pressures.
   (3) Use of paints, membranes or mortars to reduce seepage of water through walls.
   (4) Installation of pumps to lower water levels in Structures.
   (5) Location of all electrical equipment, circuits and installed electrical appliances in a manner which will assure they are not subject to Flooding and to provide protection from inundation by the Base Flood.

4. **Replacement:** Relocation is another measure to be considered when mitigating. Because the entire island is a Special Flood Hazard Area, physical relocation in itself will only provide minimal relief from potential flood damage. Relocation must be associated with structural improvements including elevating the structure and bringing the structure up to current building standards.

5. **Acquisition and demolition:** This measure involved the purchase of one or more properties and removal of the existing structures. If FEMA funds were to be applied, the site would need to meet the following three (3) requirements:

   - The applicant for FEMA funds must demonstrate that the benefits exceed the costs, using FEMA's benefit/cost software,
   - The owner must be willing to sell, and
   - The parcel would be deeded to a public agency agreeing to maintain the property as open space.

STEP 4: COORDINATION

There are many different agencies and organizations that could participate in a flood mitigation

project for the Area 1 study area. The following were contacted by the consulting team:

- Lee County
- FEMA
- SFWMD

STEP 5: FINDINGS

The data collected from the various sources provide a picture of both the general flood problem and details on each property's exposure. The following are the main facts:

1. The major problem causing flooding and potential flood damage on Sanibel Island is associated with the rains and storm surges associated with tropical storms and hurricanes.

2. Prior to the implementation of the Surface Water Management Plan, brief and heavy summer thunderstorms would cause problems on Sanibel with roadside and yard flooding. Seldom, however, would flooding from rainfall result in property damage on the island. After implementation, these localized flooding problems have been significantly reduced. It is now highly unlikely that Sanibel would experience flood loss claims as a result of non-tropical storm rainfall. The City's continued commitment to inspecting and maintaining its storm water management system control facilities will ensure that the potential of future flood problems, damages or losses from future summer thunderstorms and related rainfall are reduced.

3. The repetitive loss areas are located along a barrier island contained within special and coastal high risk areas as indicated in the FIRM for Zones AE and VE with the base flood elevations ranging from 8 feet to 13 feet above sea level.

4. The City has been monitoring the Repetitive Loss Areas to determine if action by maintenance or drainage improvements could reduce flooding in these areas further. Although heavy rains in January of 2016 resulted in 16.31 inches of rainfall, flooded roads, yards and some lower level enclosures, there were no new repetitive additional loss properties reported.

5. 168 properties have been demolished and rebuilt above the base flood level per regulations throughout the City. The table below summarizes the number of properties within each Repetitive Loss Area, the number of repetitive loss properties mitigated within the area by rebuilding to elevations at or above BFE, and the number of repetitive loss properties within each RLA.

RL Area	# of Insurable Structures	# of RL Rebuilt
1	169	2
2	44	1
3	124	1
4	49	
5	225	
6	250	3
7	78	
8	133	1
TOTAL	1,072	8

6. There have been 64 Repetitive Loss Properties in the City of Sanibel since 1979. No additional properties are currently identified for acquisition. In addition to the rebuilt properties, there have been 10 properties that have demolished structures and remain vacant. Two (2) properties were converted to conservation areas and have no structures. Three (3) RL properties remain vacant after demolition of existing structure and are located in RL Area 1. The remaining seven (7) vacant lots were not repetitive loss properties. AW-501s are being submitted to ISO for mitigation.

7. The City has acquired two (2) of the 64 Repetitive Loss Properties identified. Further examination of Sanibel's repetitive loss properties (between 1978 and 2016) revealed some other important facts regarding these losses. Both the Santiva Cottages and the Newnan residences were older beachfront structures, located on Sanibel's west end in an area that has historically experienced severe beach erosion problems. With very little or no beach dune system to protect these structures from tidal surges, they were particularly vulnerable buildings. In addition, they were built prior to the City's incorporation so they were constructed on grade, not to the City's strict building standards, and seaward of the1974 State Coastal Construction Control Line. Both of these vulnerable properties were purchased by the City. The City demolished and removed the buildings on these properties.

   The Junonia Condominium is a different situation. This is a small Gulf beach condominium complex that was constructed in accordance with all the appropriate flood rules, regulations and standards in effect at that time. The lowest finished floors of the Junonia buildings are constructed to the elevations required by the Flood Insurance Rate Maps. The flood losses at Junonia resulted from equipment and appurtenances located in elevator shaft pits on the ground level of the complex. Under current standards, however, it is unlikely that similar flood losses would occur, as now this type of equipment is required to be elevated above flood levels. Similar situations with older developments exist in many areas on Sanibel, and are not isolated to Gulf Beach developments.

6. RECOMMENDATIONS

This plan reviewed the different nonstructural mitigation options. The advantages and disadvantages of the different mitigation approaches as summarized in the table below:

Summary of Mitigation Measures		
Measure	**Advantages**	**Disadvantages**
Elevating	More secure flood protection; effective for deep flooding; qualifies for flood insurance rate reduction	High cost; low benefit/cost ratios with minimal opportunity for FEMA funding
Flood Control	Protects yards, driveways and roadways	High cost; disruptive
Flood proofing	Low cost; effective for shallow flooding on slab foundations	Subject to seepage for long standing water; not feasible for substantially damaged homes; for commercial structures
Relocation	More secure flood protection; flood insurance rate reduction; FEMA funding availability	High cost; not effective if completely within SFHA; need non-FEMA cost share

Acquisition / Demolition	100% flood protection; FEMA funding availability	High cost; low Benefit/cost ratios with minimal opportunity for FEMA funding; requires public agency to maintain land

Based on the costs, effectiveness, advantages and disadvantages of the mitigation measures discussed in this report, the following are recommended:

1. The City of Sanibel is aware of its vulnerability to flood damage. This City shall continue to implement the shared initiatives and goals of the Federal Emergency Management Agency and its Community Rating System Program to "reduce flood losses, facilitate accurate insurance ratings, and promote the awareness of flood insurance".

2. The goal of the City of Sanibel's Repetitive Loss Plan is: To continually monitor and identify flood hazards in the City of Sanibel, and to take necessary actions to mitigate, reduce and eliminate those flood hazards in the community.

3. The City shall continue to maintain the existing stormwater conveyance system and related structures.

4. At this point in time, the City of Sanibel has not incurred additional repetitive loss structures. If more repetitive losses occur in the future, the following are some alternatives that the City can consider.

    - An obvious alternative is the outright purchase of repetitive loss properties. Property values on Sanibel, however, are extremely high, particularly for beachfront/coastal developments. These high property values exceeds the economic means of the City to acquire additional properties, and are not a feasible solution to flood management of Sanibel.

    - Another very positive alternative to reduce the potential for damage due to flooding on Sanibel is for property owners to make physical improvements to their properties to mitigate the possibility of flood damage. The City makes an effort to identify all such structures through its Floodplain Management Plan.

    - The City can assist these property owners in any fashion to acquire assistance from outside sources, if necessary, to relocate such property to safer locations and conditions.