

# BOROUGH OF STONE HARBOR

## FLOOD MITIGATION AND STORM SEWER MASTER PLAN

April 2022



Presented By:



# Introduction

The Borough of Stone Harbor is located on the Atlantic Ocean and back bay intercoastal waterway in Cape May County, New Jersey. The Borough is comprised of approximately 2.19 square miles of barrier beach island and is geographically surrounded by the bay and Atlantic Ocean. Each year the Borough is presented with a constant threat to this community from sea level rise, coastal flooding, Nor'easters and tropical-borne storm activity, creating severe wave and flood impacts.

The Borough of Stone Harbor has been historically subject to flooding, beach erosion and many other associated problems that require an aggressive approach to successfully manage infrastructure maintenance and flood damage mitigation. The Borough has developed a varied approach to protect and maintain its infrastructure, natural areas, public safety, welfare, and property of its residents, and continues to improve annually with the implementation of improvements, new technologies and with assistance from outside public and private agencies. The Borough will continue to pursue and improve upon methods to educate its residents, protect its coastline, manage its infrastructure and natural areas, and mitigate the efforts from flood damage and natural disasters. This Flood Mitigation and Storm Sewer Master Plan (FMSSMP) demonstrates the Borough's continued commitment to these goals.

The implementation of the FMSSMP has been an ongoing activity and components of the plan include storm sewer infrastructure improvements, participation in the Community Rating System (CRS), Repetitive Loss Reduction Plan, Beach Maintenance Plan and other specific Borough projects. This plan intends to cover the next 25 years as the Borough continues to prevent and mitigate flooding in the community and is recommended to be revised every 3 years. By looking at the future of the Borough it is important to recognize the increasing impact of sea level rise along the coast of New Jersey. All recommendations are based on sea level rise projections prepared by the New Jersey Climate Adaption Alliance and all design in the future should take into account these predictions.



## ➤ This FMSSMP was developed for the purpose of:

- ➔ • Educating the Borough, public and private property owners of the existing flooding challenges facing the Borough.
- ➔ • Establishing recommendations to mitigate the adverse impact of flooding and other coastal hazards that affect the Borough.
- ➔ • Providing flood mitigation infrastructure options to guide the Borough when considering and prioritizing capital improvements.
- ➔ • Prioritizing flood mitigation capital improvement projects based upon certainty of success, cost restrictions, and need for further analysis.
- ➔ • Complying with the Federal Emergency Management Agency (FEMA) Community Rating System (CRS) Program with the potential of enhancing that status.
- ➔ • Participating and coordinating flood mitigation efforts with Federal, State, County and local entities.



# Executive Summary

This report consolidates various ongoing programs in the Borough to provide one centralized plan. The plan will continue to improve and refine as new information becomes available; therefore, we recommend revisiting this plan every three years. Specific action should be recommended after each plan revision. It is important to note that the first Borough Storm Sewer Pump Station is under final design and it serves as a testament to the Borough's commitment to protect the island.

The recommended improvements are projected over a 25 year period and divided into three priorities. Priority I projects are defined as projects that need to move forward and have a high certainty of success based on current studies. Priority II projects are those which are cost restrictive and/or further analysis is needed. Through continued studies and alternative funding routes they can be moved to Priority I projects. The projects included in these two categories are included in this report with further detail. Priority III projects require funding for additional research.

## Priority I Improvements (Year 0-10):

- Replacement of Borough Owned Bulkheads
- Beach Outfall Elimination
- 93rd Street Storm Sewer Pump Station
- 80th Street Bay Marina Improvements
- Investment into Permeable Pavement
- Replacement of Privately Owned Bulkheads
- Elevate Private Property and Roadways
- Advance Flood Warning Signs and Siren Upgrades
- Bayside Tide Control (96<sup>th</sup> Street North)
- 83rd Street Storm Sewer Pump Station
- Yearly Storm Sewer Improvements

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Total: \$42,500,000 (\$11,850,000 Private)

## Priority II Improvements (Year 10-20):

- Replacement of Privately Owned Bulkheads
- Bayside Tide Control (96<sup>th</sup> Street South)
- Additional Pump Station (location to be determined)
- Yearly Storm Sewer Improvements
- Elevate Private Property and Roadways

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Estimated Total: \$15,000,000

## Priority III Improvements (Year 20-25):

- Replacement of Privately Owned Bulkheads
- Yearly Storm Sewer Improvements
- Elevate Private Property and Roadways

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Estimate Total: \$15,000,000



# Flood Hazard Assessment

The natural hazards impacting the flooding in the Borough of Stone Harbor are well-known and have been documented. When the Borough is evaluated and during the design phase of capital improvements, the following hazards must be discussed. The most current data available will provide the designer knowledge about the requirements for the project. **The following hazards have been identified in the State of New Jersey 2019 Hazard Mitigation Plan:**

1. Coastal Erosion and Sea Level Rise
2. Coastal Flooding
3. Flash Flooding
4. Stormwater Flooding
5. Hurricanes and Tropical Storms
6. Nor'easters
7. Severe Weather
8. Severe Winter Weather
9. Wildfire

Flooding resulting from nor'easters, hurricanes, and tropical storms presents the single most significant threat to the life, safety, health, and property in the Borough. Coastal flooding can occur when the land along the coast and bay are submerged due to above normal tide action. Stormwater flooding is another type of flooding that can occur and is caused by local drainage issues. These heavy precipitation events produce flooding in areas with little or poor drainage infrastructure. The precipitation in Cape May County is likely to increase by around 32% from 1999 to 2100. Nor'easters, hurricanes, and tropical storms have also become more frequent and intense. The Borough needs to continue to prepare for these hazards.



## ➤ Existing Conditions

1. Topography
2. Storm Sewer Infrastructure
3. Drainage Areas
4. Coastal Tidal Data and Sea Level Rise
5. Bulkhead Elevations
6. FEMA Community Rating System (CRS)



# 1. Topography

Existing topographical maps have been developed to analyze the water flow paths throughout the Borough of Stone Harbor. A topographic map is characterized by a detailed representation of the elevations of an area. A topographic map is created using contour lines that connect places of equal elevation. The closer together the contour lines, the steeper the terrain.

Maps for the Borough of Stone Harbor were developed through multiple sources. A main source for the topographic maps comes from the South New Jersey County Light Detection and Ranging (LiDAR) project. The project was created to provide LiDAR and elevation data for USGS and the New Jersey Department of Environmental Protection (NJDEP). LiDAR is used to create surface models and is a surveying method that can measure the distance to the surface by emitting a pulsed laser light and measuring the reflected pulses with a sensor. High accuracy data has been produced in ArcGrid format to cover approximately 874 square miles of South New Jersey. Also, topographic information was derived from the various capital projects completed throughout the Borough, such as annual roadway improvements that provide detailed topographic information. The topographic information was obtained using Real Time Kinematics (RTK) through a GPS unit, providing the most accurate data to the Borough.

As seen on the Existing Contour Map, areas along the bayfront are lower than the properties along the ocean front. The stormwater generally travels from the oceanfront towards the bayfront until it reaches a natural or manmade barrier. Along the bay side, elevations generally range from four (4) to seven (7) feet and along the ocean side elevations generally range from ten (10) to fourteen (14) feet in the NAVD 1988 datum. The highest area of the Borough is located along the ocean side, and the lowest areas of the Borough include the bay side between 80th Street and 111th Street. This topography is naturally occurring and a result of how barrier islands form. Oceanfront higher dunes yield gradually to bayside tidal marshes.

Once these maps were developed, it created a way to determine stormwater flow patterns along the surface of the Borough. Low areas can be clearly seen and prioritized in storm water management programs. Higher areas can be targeted for suitable areas for groundwater recharge.

The flow path of stormwater becomes important when developing drainage areas and stormwater management infrastructure. The topographical maps clearly show the boundaries of the existing drainage areas and can be used to track where the water flows. After the drainage areas are developed it aids designers in stormwater management infrastructure. The size of drainage areas will determine the size and location of the infrastructure.



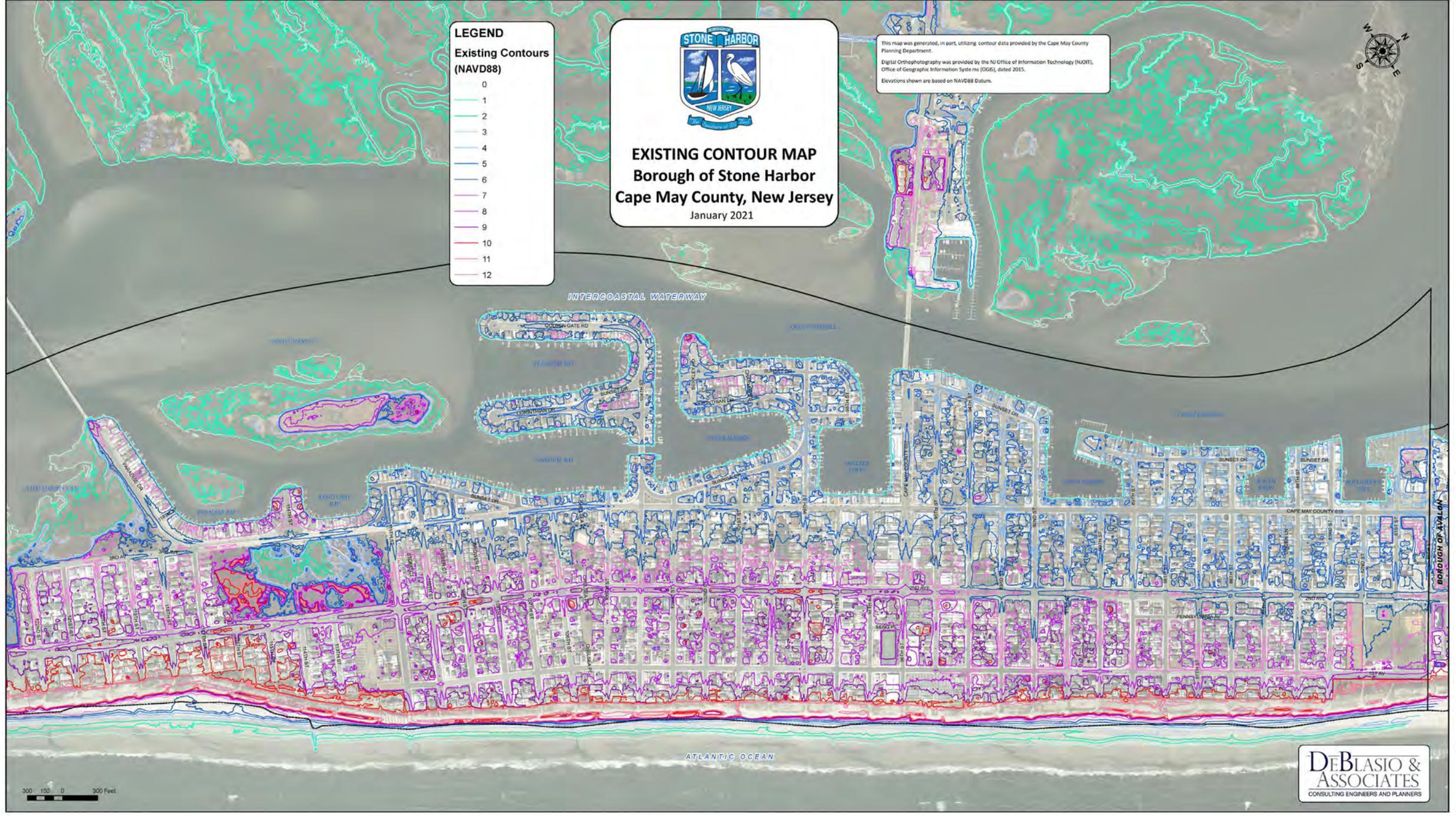


**EXISTING CONTOUR MAP**  
**Borough of Stone Harbor**  
**Cape May County, New Jersey**  
 January 2021

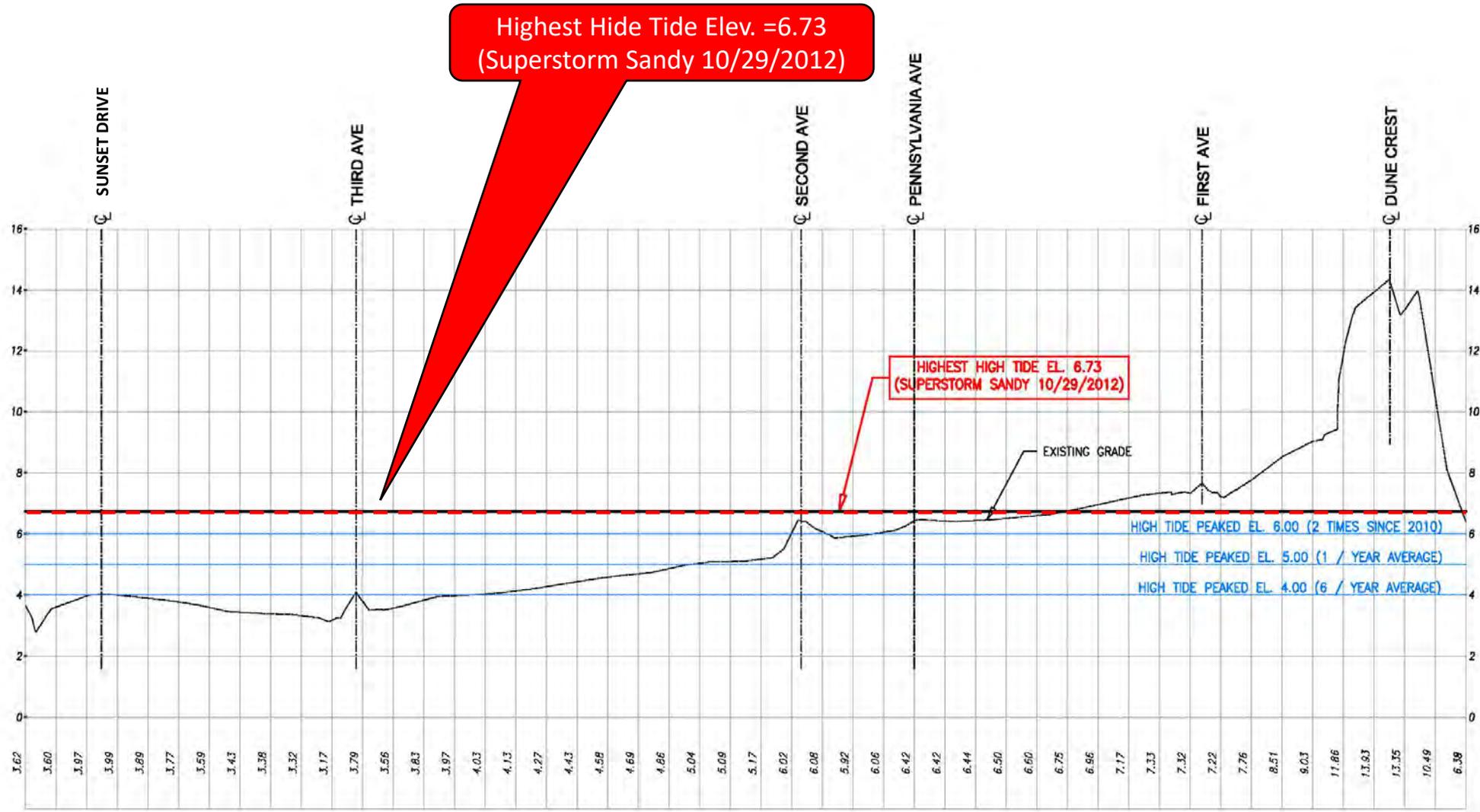
**LEGEND**  
**Existing Contours (NAVD88)**

0
1
2
3
4
5
6
7
8
9
10
11
12

This map was generated, in part, utilizing contour data provided by the Cape May County Planning Department.  
 Digital Orthophotography was provided by the NJ Office of Information Technology (NJGIT), Office of Geographic Information Systems (OGIS), dated 2015.  
 Elevations shown are based on NAVD88 Datum.



300 150 0 300 Feet



**PROFILE - 86TH STREET**

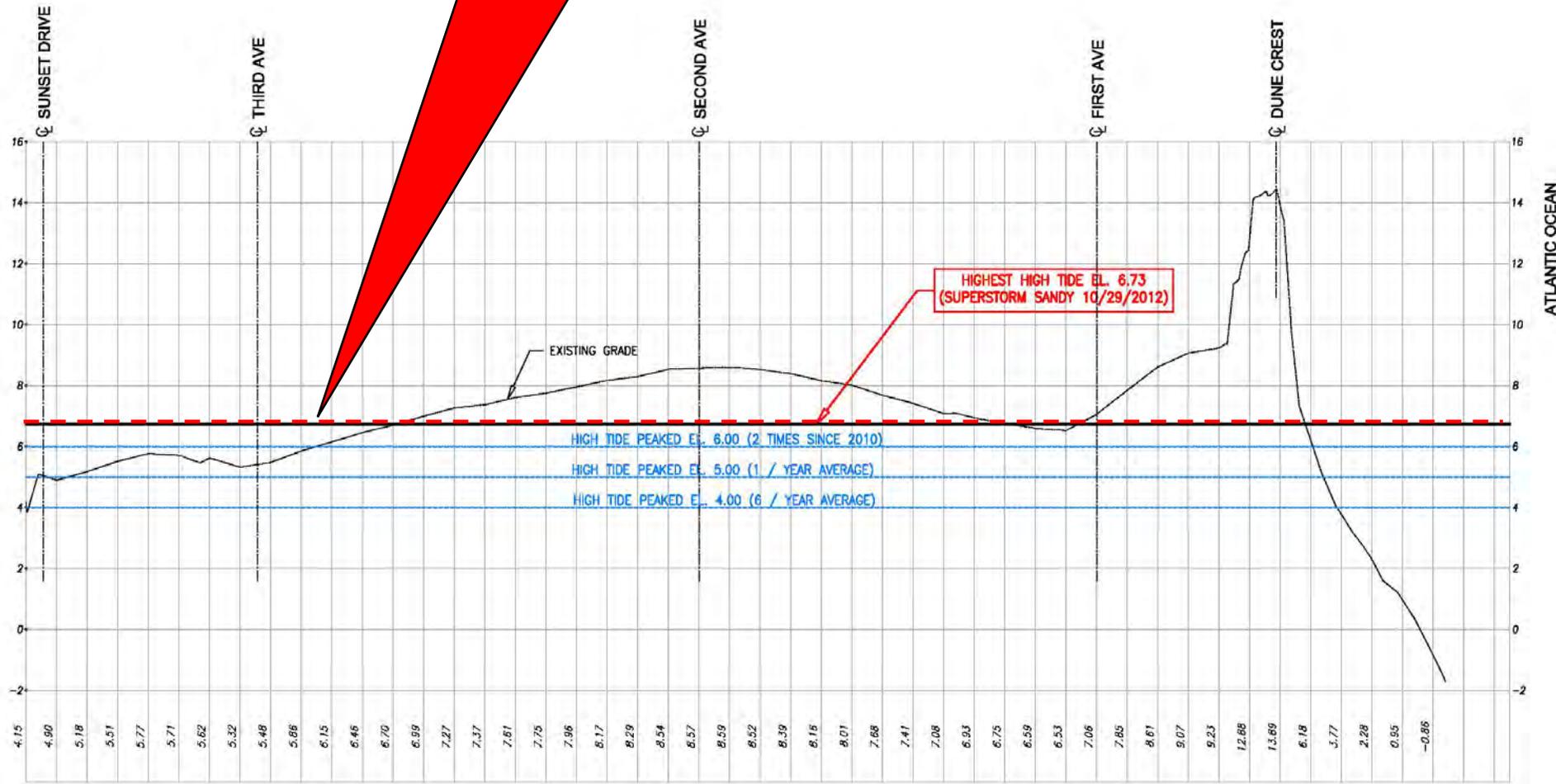
NOT TO SCALE



Flood Mitigation and Storm Sewer Master Plan



Highest Hide Tide Elev. =6.73  
(Superstorm Sandy 10/29/2012)



**PROFILE - 111TH STREET**

NOT TO SCALE



Flood Mitigation and Storm  
Sewer Master Plan



## 2. Storm Sewer Infrastructure

- The Borough of Stone Harbor storm sewer infrastructure is designed to remove excess rain water from impervious surfaces such as paved streets, parking lots, sidewalks and roofs. The subcomponents of the system vary in size and complexity and solely are gravity sewer systems that carry excess untreated water to surrounding bodies of water.
- Through GPS locators, extensive field work, and cooperation from the Borough of Stone Harbor Department of Public Works, an existing storm sewer infrastructure map was generated and includes all storm sewer inlets, manholes, and outfalls.
- The Borough's storm sewer infrastructure is comprised of a gravity system and includes the following components:
  - Existing roadway gutters to transport water above ground from one intersection to another, until an inlet is reached, and then transported to an outfall.
  - "Bubbler" systems that utilize inlets to temporarily hold storm water until the water "bubbles up" from the lower inlet and is transported along the surface to the lower side of the intersection and eventually to an outfall.
  - Inlets with connecting storm sewer pipes that hold and transport water to existing outfalls.
  - A gravity driven system that utilizes hydraulic gradients to transport water from the surface to existing outlets.
- As tide levels increase, bay water begins to surcharge through the storm inlets and create nuisance flooding at low points. Some of the bayside outfalls lack valves or are not provided with proper valves to control tidewater. When high tide coincides with rain events, major flooding can occur.





**STORM SEWER MAP**  
**Borough of Stone Harbor**  
**Cape May County, New Jersey**  
October 2019

**Legend**

- Storm Chamber
- Storm Inlet
- Storm Manhole
- Storm Outfalls

**Storm Sewer Pipes:**

Size

- Other
- 6"
- 8"
- 10"
- 12"
- 14"
- 15"
- 16"
- 18"
- 20"
- 21"
- 24"
- 30"
- 36"
- 42"

Parcels

Municipal Boundary Line





### EXISTING DRAINAGE AREAS MAP

Borough of Stone Harbor  
Cape May County, New Jersey  
February 2021

Existing Drainage Areas

- Legend**
- Storm Chamber
  - Storm Inlet
  - Storm Manhole
  - Storm Outfalls

**Storm Sewer Pipes:**

- Size**
- Other
  - 6"
  - 8"
  - 10"
  - 12"
  - 14"
  - 15"
  - 16"
  - 18"
  - 20"
  - 21"
  - 24"
  - 30"
  - 36"
  - 42"
- Parcels
- Municipal Boundary Line



300 150 0 300 Feet

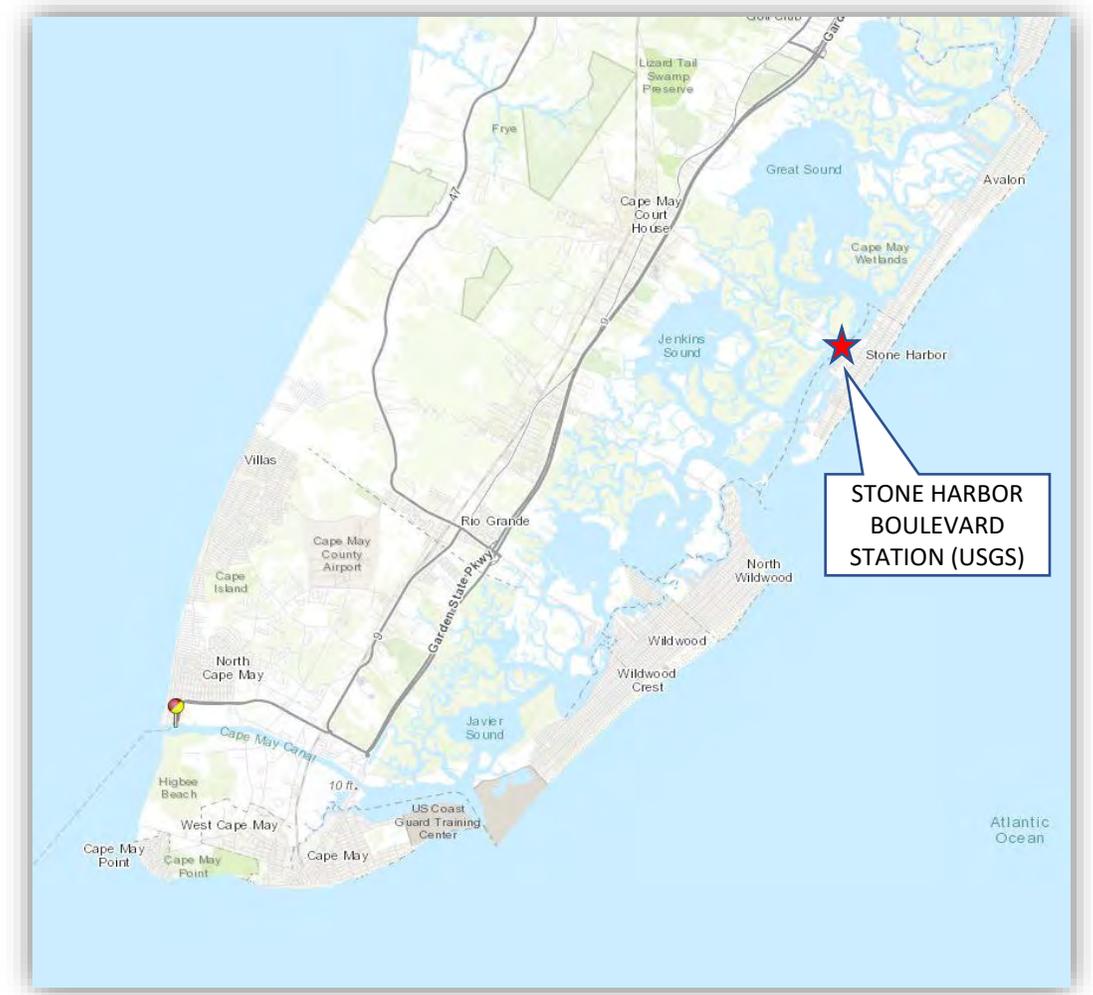
# 4. Coastal Tidal Data and Sea Level Rise

The Borough of Stone Harbor experiences semidiurnal tides, two high tides and two low tides per lunar day with one high tide typically higher than the other. The United State Geological Survey (USGS) is responsible for tidal data collection in the back bays of New Jersey. After looking at the Tide Gauge Station locations, the closest back bay station to the Borough of Stone Harbor can be found on the east abutment of the bridge on Stone Harbor Boulevard. **The datum for the gages is at 0.00 feet based on North American Vertical Datum of 1988 and the data was collected and reviewed from early 2010 to 2020 for a total of 3,781 observations.** Here is a table of the number of days with tides above elevations:

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total #	Average #
<b>Total Observations</b>	363	363	365	295	361	343	342	333	344	357	310	3781	344
<b>Above 2 feet</b>	300	289	291	223	279	245	255	260	268	299	260	2969	270
<b>Above 3 feet</b>	93	78	72	52	69	51	60	57	71	101	71	775	70
<b>Above 4 feet</b>	6	5	7	6	5	6	8	4	12	8	4	71	6
<b>Above 5 feet</b>	0	1	2	0	0	0	1	0	2	0	0	6	1
<b>Above 6 feet</b>	0	0	1	0	0	0	1	0	0	0	0	2	0
<b>Above 7 feet</b>	0	0	0	0	0	0	0	0	0	0	0	0	0

The maximum tide during this time period for the gage on Stone Harbor Boulevard was 6.73 feet on October 29, 2012 during Hurricane Sandy. Below is a table of the top six tide elevations for the station:

Date	Storm Name	Stone Harbor Station
10/27/2018	Nor'easter	5.27
1/23/2016	Winter Storm Jonas	6.22
10/29/2012	Superstorm Sandy	6.73
8/27/2011	Hurricane Irene	5.30
11/13/2009	Hurricane Ida	5.44
2/17/2003	Presidents' Day Storm II	5.37

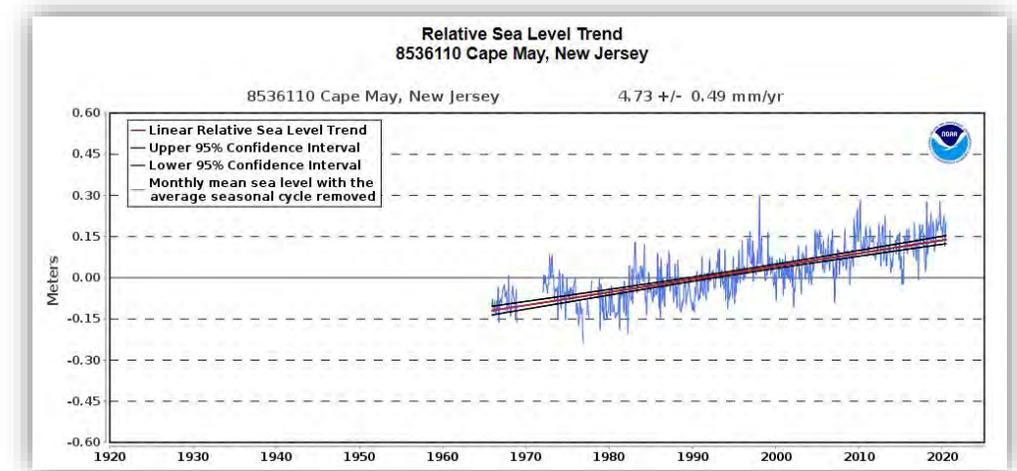


# 4. Coastal Tidal Data and Sea Level Rise

The Borough of Stone Harbor experiences the impact of sea level rise. The New Jersey Climate Adaptation Alliance is a network of organizations that works together in preparing New Jersey for climate change. Rutgers University, the facilitator of this program, indicates that sea levels along the New Jersey coast are rising faster than the global average. They completed a report in November 2019 that evaluates the rising sea levels and changing coastal storms in New Jersey.

The report identified and evaluated the most current science on sea level rise to project the impact by using the year 2000 as a baseline. The results are summarized into low end to high end sea level rise chance of occurrence. Different future emission scenarios impact the projections of sea level rise. According to the Sea-Level Rise Guidance for New Jersey report published by the NJDEP in June 2021, the sea level rise scenarios should be assessed based on the risk tolerance of an activity. Activities in the State with the low risk tolerance should plan for the upper end of the likely range and reflects a 17% chance of being met or exceeded. See below table for a summary of the projections:

		2030	2050	2070			2100			2150			
		Emissions											
Chance SLR Exceeds		Low	Mod.	High	Low	Mod.	High	Low	Mod.	High	Low	Mod.	High
Low End	> 95% chance	0.3	0.7	0.9	1	1.1	1.0	1.3	1.5	1.3	2.1	2.9	
Likely Range	> 83% chance	0.5	0.9	1.3	1.4	1.5	1.7	2.0	2.3	2.4	3.1	3.8	
	~50 % chance	0.8	1.4	1.9	2.2	2.4	2.8	3.3	3.9	4.2	5.2	6.2	
High End	<17% chance	1.1	2.1	2.7	3.1	3.5	3.9	5.1	6.3	6.3	8.3	10.3	
	< 5% chance	1.3	2.6	3.2	3.8	4.4	5.0	6.9	8.8	8.0	13.8	19.0	



The National Oceanic and Atmospheric Administration (NOAA) is a governmental agency that observes a network of more than 200 permanent water level stations. NOAA was able to look at tidal trends beginning in 1900 and predict tidal levels to 2020. NOAA completed a tide flooding study and report in February 2018 that evaluates the impact of sea level rise.

According to this trend, between 1965 and 2019 at the station Cape May the sea level trend is 4.73 +/- 0.49 mm/yr (0.19 in/yr) which is equivalent to a change of 1.55 feet in 100 years.





**LEGEND**

- Municipal Boundary
- Elevations:**  
NAVD88 Datum
- < 0'
- 0' - 4.0'
- > 4.0'



**MAP OF AREAS BELOW ELEV. 4.0 FT**  
**Borough of Stone Harbor**  
**Cape May County, New Jersey**  
January 2021



300 150 0 300 Feet



**LEGEND**

- Municipal Boundary
- Elevations:**  
NAVD88 Datum
  - < 0'
  - 0' - 5.0'
  - > 5.0'



**MAP OF AREAS BELOW ELEV. 5.0 FT**  
**Borough of Stone Harbor**  
**Cape May County, New Jersey**  
September 2019



300 150 0 300 Feet



**LEGEND**

- Municipal Boundary
- Elevations:**  
NAVD88 Datum
  - < 0'
  - 0' - 6.0'
  - > 6.0'



**MAP OF AREAS BELOW ELEV. 6.0 FT**  
**Borough of Stone Harbor**  
**Cape May County, New Jersey**  
January 2021



300 150 0 300 Feet

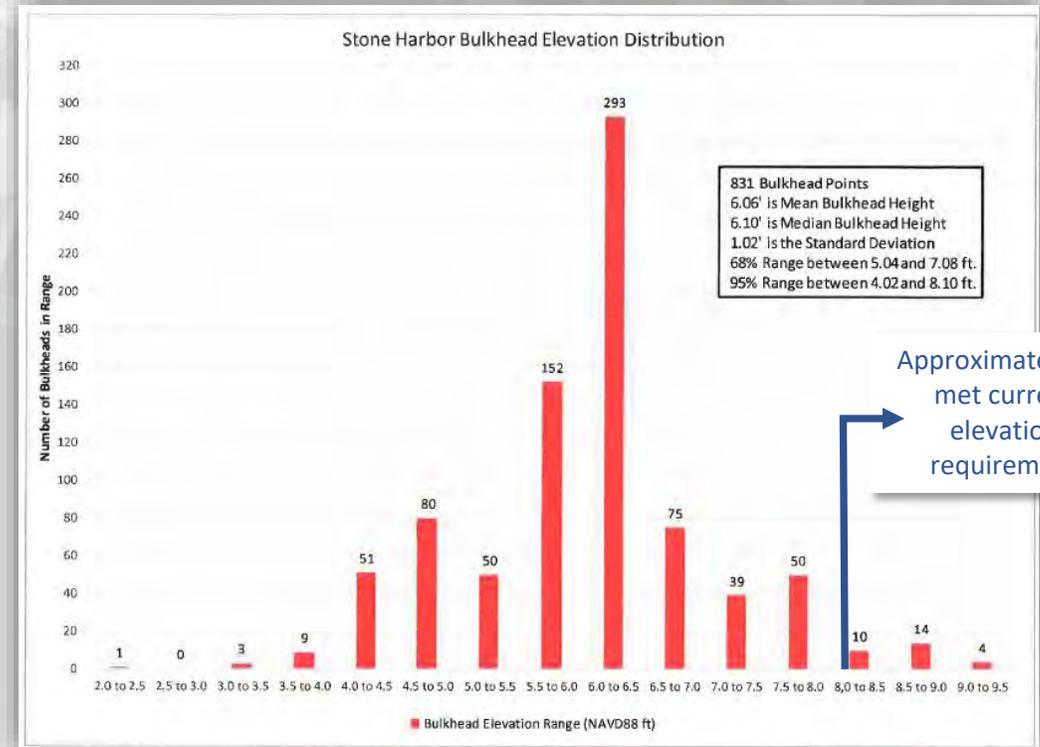
# 5. Bulkhead Elevations

A bulkhead system is the main barrier between the mainland and the bay. In order to determine the height along the barrier, the Stockton University Coastal Research Center performed a survey of bayfront properties on October 3 and completed October 6, 2017. The GPS receiver was placed on each property's barrier top surface and that elevation was recorded in the North American Vertical Datum of 1988.

The current bulkhead ordinance for the Borough of Stone Harbor Chapter 200: Bulkheads, Construction and Repair, requires the top elevation of constructed bulkheads to be set to a minimum elevation of 8.0 NAVD88.

**LOWEST ELEVATION 2.326 FT.**  
**HIGHEST ELEVATION 9.425 FT.**  
**MEAN ELEVATION 6.055 FT.**  
**MEDIAN ELEVATION 6.097 FT.**

Since this data was obtained in October 2017, over 60 residents have replaced or raised their bulkheads up to the required elevation of 8.0 NAVD88. As bulkhead elevations continue to be replaced and create a continuous protective border, the flood resiliency of the Borough increases.



# 6. FEMA Community Rating System

The National Flood Insurance Program (NFIP) offers flood insurance to all properties in communities that comply with minimum standards for floodplain management. The NFIP created a system to credit communities that go beyond the minimum standard. This program is known as the Community Rating System (CRS) and communities can strive to create a high standard for floodplain management. As communities meet certain criteria, they are awarded points. These points are used to rank communities and provide discounts on flood insurance premiums.

Communities can gain credits by following the CRS Coordinator's Manual and verifying their efforts. Based on the amount of credit points the community earns, the CRS assigns a rate class. The rate class is used to determine the discount on insurance premiums. The graph below displays the points and how they relate to the corresponding discount.

NFIP Discount Classes

Class	Credit Points	Floodplain Discount	Non-Floodplain Discount
1	4,500	45%	10%
2	4,000	40%	10%
3	3,500	35%	10%
4	3,000	30%	10%
5	2,500	25%	10%
6	2,000	20%	10%
7	1,500	15%	5%
8	1,000	10%	5%
9	500	5%	5%
10	< 500	0	0

Communities throughout Cape May County participate in the CRS and vary in current class. The table below displays Cape May County communities and current class:

Community Number	Community Name	Date Classified	Current Class
345279	Borough of Avalon	05/1/2020	3
345288	City of Cape May	10/1/2020	5
345289	Borough of Cape May Point	10/1/2013	6
340153	Township of Lower	10/1/2018	7
345308	City of North Wildwood	10/1/2017	6
345310	City of Ocean City	05/1/2020	4
345318	City of Sea Isle	05/1/2018	3
345323	Borough of Stone Harbor	05/1/2014	5
340159	Township of Upper	05/1/2017	5
345329	City of Wildwood	05/15/2017	5
345330	Borough of Wildwood Crest	05/1/2014	6



# Proposed FMSSMP Improvement Recommendations

1. Preventative
2. Capital Infrastructure Improvements
3. Preservation of Natural Resources and Cooperation with Regulatory Agencies



# Proposed FMSSMP Improvement Recommendations

## 1. Preventative

- ➔ • Continue to monitor the bulkhead ordinance that requires new bulkheads to be constructed to elevation 8.0 (NAVD 1988), including the timeline requirement to retrofit existing bulkheads to elevation 8.0 (NAVD 1988).
- ➔ • Continue to adhere to and refine the lot grading and drainage ordinance that requires private property owners to incorporate ground water recharge & elevate their properties to reduce flooding with particular emphasis on tidal nuisance flood events.
- ➔ • Continue to participate in FEMA Community Rating System (CRS)
- ➔ • Inform and improve communication to property owners of flooding events through advance warning systems, forecasting and emergency planning. Coordinate with the Borough's Office of Emergency Management to install advanced flood warning devices.



# Proposed FMSSMP Improvement Recommendations

## 2. Capital Infrastructure Improvements

- ➔ • Elevate Borough Bulkheads – Elevation 8.0 NAVD88
- ➔ • Continue Beach and Dune Maintenance including the Elimination of Beach Outfall Pipes on 114<sup>th</sup> and 111<sup>th</sup> Street
- ➔ • Elevate Roadways
- ➔ • Bayside Tide Control
  - a. Passive Control Valves
  - b. Manually Operated Control Valves
  - c. SCADA Operated Control Valves
  - d. Storm Sewer Pump Stations
- ➔ • Increase Storm Sewer System Hydraulic Capacity & Ground Water Recharge
- ➔ • Green Infrastructure Improvements



## ➤ Elevate Borough Bulkheads – Elevation 8.00 NAVD88

As sea levels continue to rise, the elevation of the Borough of Stone Harbor will need to increase. Bulkheads provide protection to bayside properties by blocking out tidal water. The Borough has adopted a new bulkhead ordinance requiring the finished height of newly constructed bulkheads to be 8.00 NAVD 88 and most Borough owned bulkheads are below this height. Borough owned bulkheads range in height from 3.15 to 9.44 feet (lowest elevations are located at the 81st Street boat ramp). As residents begin to raise the height of their newly constructed bulkheads, the Borough owned bulkheads will need to be elevated as well.

Currently, the majority of Borough owned bulkheads below the required 8.00 NAVD88 are located in the Bay Marina Park area at the west end of 81st Street. An application to the Cape May County Open Space Program has already been submitted for improvements to Bay Marina Park, which include raising of Borough Bulkheads to the required 8.00 NAVD88 elevation.



# ➤ Beach and Dune Management

## Management

The beach and dune system is an important asset to the Borough of Stone Harbor. This system creates the boundary between the Atlantic Ocean and the built environment. Although it is a naturally occurring boundary, it requires management to retain its integrity as a residency tool and provide environmental and economic benefits. As a result, the Borough has developed a management plan for the dune system and cooperated with State and Federal Agencies to manage the beach. The beach and dune system provide the following benefits to the residents of Stone Harbor:

1. Provides a protective buffer from the Atlantic Ocean by dissipating coastal storm energy
2. Supports a diverse habit for coastal plants and wildlife
3. Creates coastal aesthetics and recreation for residents and visitors

## Outfall Elimination

The Borough is seeking authorization for the elimination of the existing beach outfalls located at 111th and 114th Street to be replaced with groundwater recharge facilities and reroute stormwater towards the bay. The entire stormwater discharge system is proposed to reroute the water to a bay discharge. The system will include underground recharge facilities located at the beach blocks with overflows that will be treated and piped to the bay. The system will be connected to an existing storm system that was installed in 2014 for future connection. The proposed system will discharge into the bay at the end of Sunset Drive.



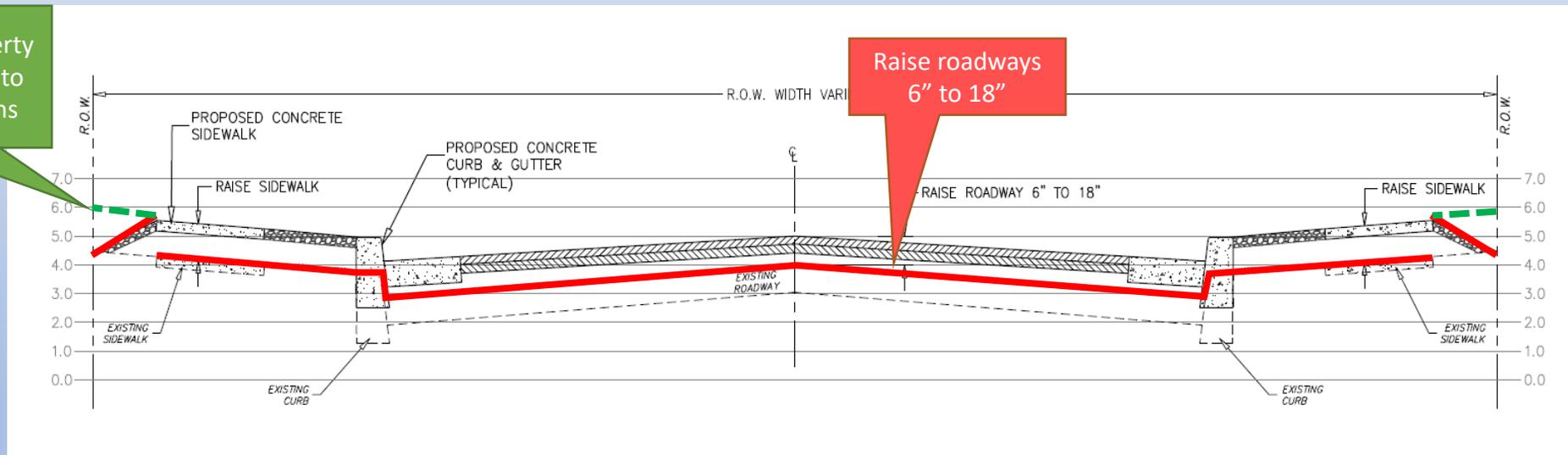
## ➤ Elevate Roadways

As flooded roads become more problematic for coastal communities, raising the street elevation is a possible solution. The Borough of Stone Harbor contains roadways with elevations as low as three feet. When the tide rises above this point, the roadway will flood and make it difficult for residents to travel through. According to the USGS tidal gauge located on Stone Harbor Boulevard, the high tide is above three feet in elevation 70 times a year.

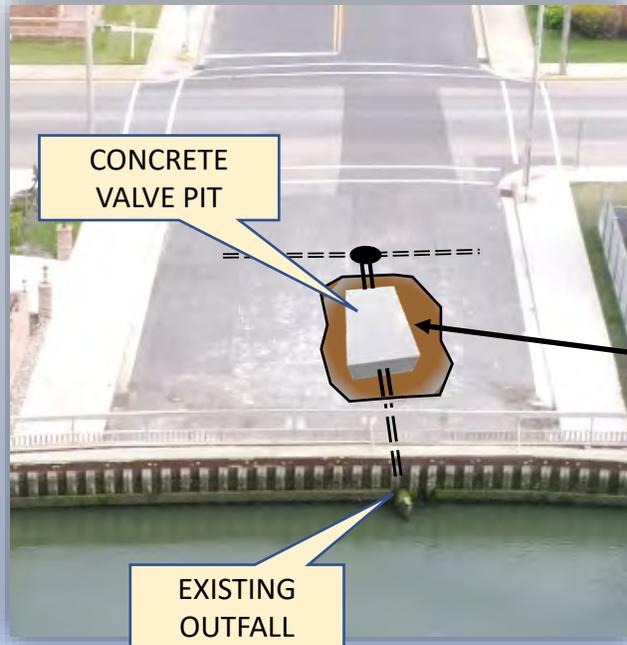
The roadways along the bay are lowest in elevation. The lowest area is located between Third Avenue and the bay from 80<sup>th</sup> Street to 93<sup>rd</sup> Street. The roadways in this area range from three feet to four feet. As discussed before, the roadways at elevation three will flood 70 days of the year. If the roadways are raised to four feet in elevation, the flooding decreases to 6 times a year. If the roadways are raised to five feet in elevation, the flooding decreases to 1 day a year on average. The benefit from elevating roadways becomes clear.

Although the benefit of elevating roadways is clear, there are high costs and difficulties associated with it. The challenges associated with this improvement include coordination with the Borough of Avalon and County of Cape May, connecting the roadway to adjacent properties and widening the travel way.

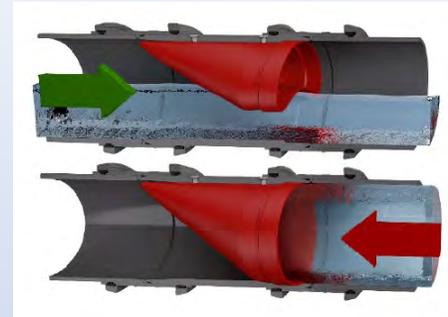
Requires Private Property Owner's cooperation to meet raised elevations



# ➤ Bayside Tide Control



TYPICAL BAYSIDE STREET END



OPTION "A" (IN-LINE CHECK VALVE)



OPTION "B" (MANUALLY OPERATED TIDE CONTROL VALVE)



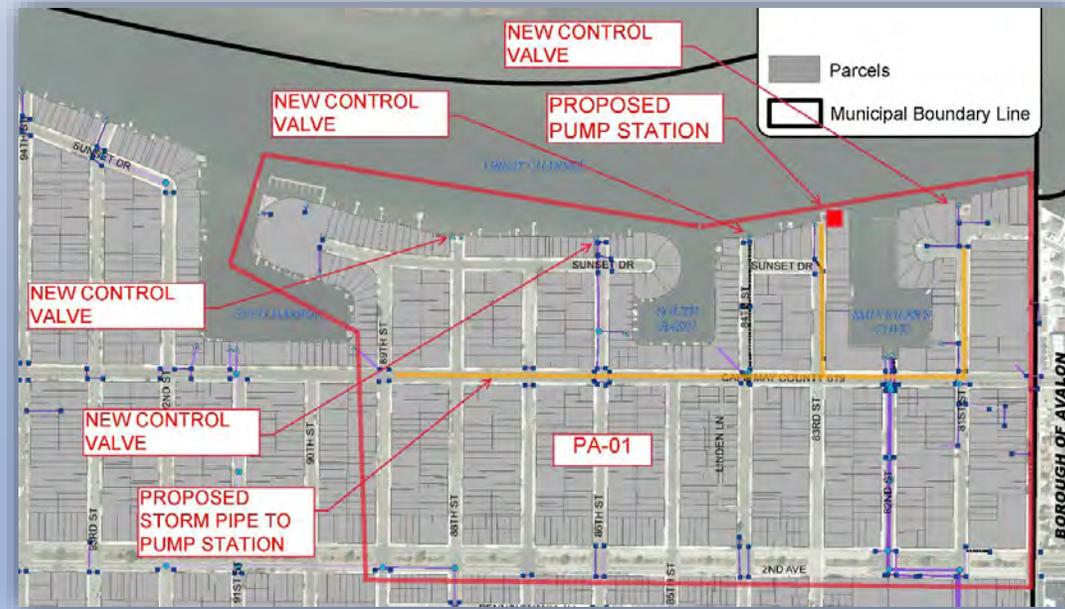
OPTION "C" (SCADA OPERATED TIDE CONTROL VALVE)

# ➤ Bayside Tide Control

## ▪ Storm Sewer Pump Stations

Bayside tidal control is an essential aspect of flood mitigation in the Borough of Stone Harbor. Techniques described that utilize passive, manual, or SCADA controlled valves will mitigate tidal flooding from increasing tidal elevation, but it will not be able to control stormwater flooding. When the tidal elevation is above the bay discharge outfalls, stormwater will not drain from the island. During a severe rain event with high tidal elevation, flooding will have damaging effects.

Currently all stormwater management in the Borough utilizes gravity. When the tidal elevations are high, these systems do not work. Pump stations are required to mitigate tidal and stormwater flooding. Pump stations would be designed to evacuate stormwater runoff from rain events. It is recommended that the Borough install a bayside pump station along the bayfront on 83rd Street. The area improved would be from 80<sup>th</sup> Street to 89<sup>th</sup> Street.



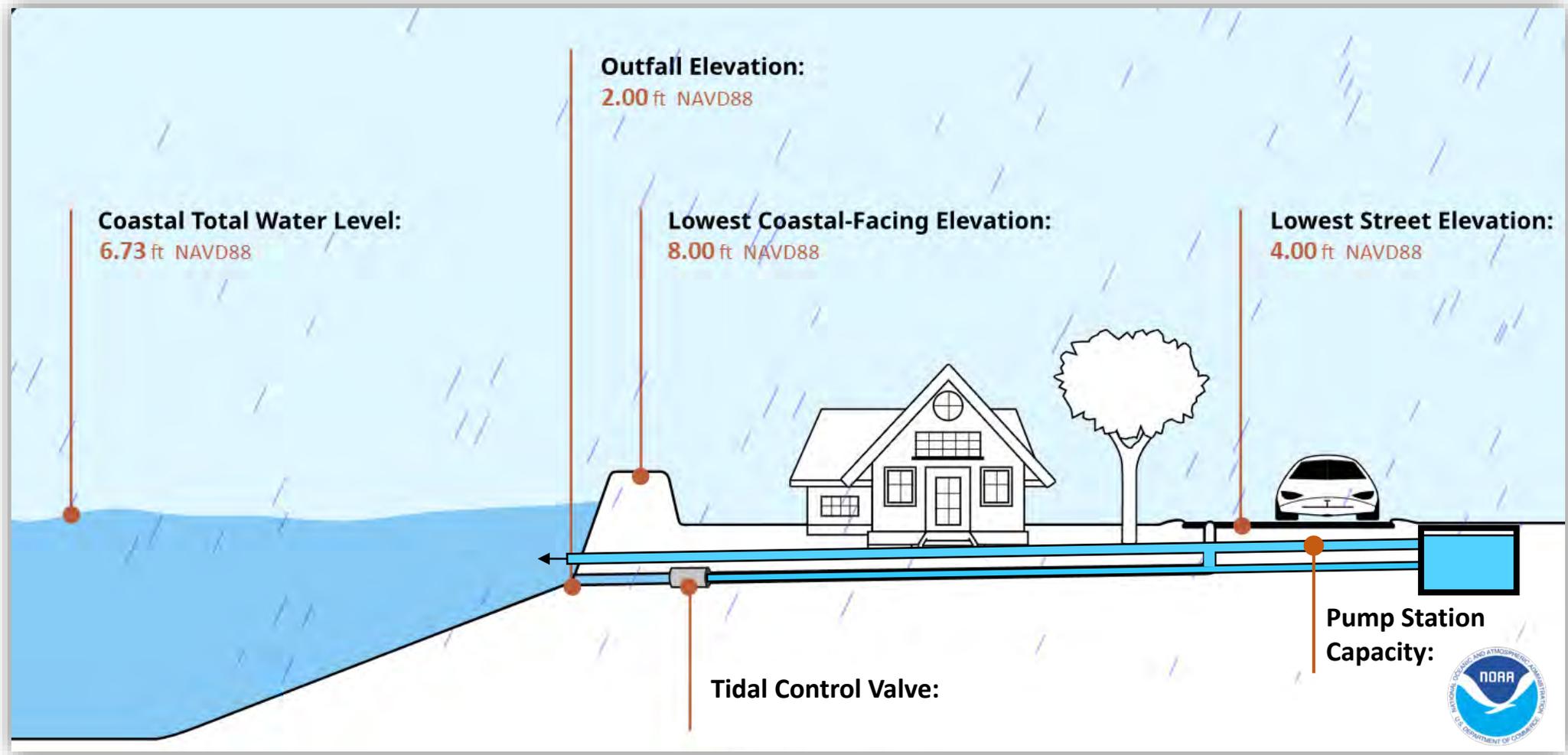
# Bayside Protection



Flood Mitigation and Storm  
Sewer Master Plan



# Bayside Protection



Flood Mitigation and Storm  
Sewer Master Plan



**CAPITAL INFRASTRUCTURE IMPROVEMENTS  
BAYSIDE TIDE CONTROL**

OPTION	ADVANTAGES	DISAVANTAGES	REGULATORY PERMITS REQUIRED	COST
Bayside Tide Control				
<b>a). Passive Control Valve</b>	<ul style="list-style-type: none"> <li>▪ No power required</li> <li>▪ Installed landward of bulkhead</li> <li>▪ Can be maintained on land</li> <li>▪ No real estate/property issues</li> <li>▪ Not visible – installed underground</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reliability on a firm closure/seal</li> <li>▪ Maintenance</li> <li>▪ Inability to evacuate surface rain water during high tide</li> </ul>	Yes	\$
<b>b). Manually Operated Control Valves</b>	<ul style="list-style-type: none"> <li>▪ No power required</li> <li>▪ Installed landward of bulkhead</li> <li>▪ Can be maintained on land</li> <li>▪ No real estate/property issues</li> <li>▪ Not visible – installed underground</li> </ul>	<ul style="list-style-type: none"> <li>▪ Requires manual labor to close valve</li> <li>▪ High labor intensive</li> <li>▪ Maintenance</li> <li>▪ Inability to evacuate surface rain water during high tide</li> </ul>	Yes	\$\$
<b>c). SCADA Operated Control Valves</b>	<ul style="list-style-type: none"> <li>▪ Controlled remotely</li> <li>▪ Reliability</li> <li>▪ Low labor intensive</li> <li>▪ No real estate/property issues</li> <li>▪ Installed landward of bulkhead</li> </ul>	<ul style="list-style-type: none"> <li>▪ Requires Power</li> <li>▪ Requires backup generator</li> <li>▪ Cost</li> <li>▪ Visible above ground controls</li> <li>▪ Inability to evacuate surface rain water during high tide</li> </ul>	Yes	\$\$\$
<b>d). Storm Sewer Pump Stations</b>	<ul style="list-style-type: none"> <li>▪ Ability to pump surface rain water during high tide</li> <li>▪ Reliability</li> <li>▪ Low labor intensive</li> <li>▪ Installed landward of bulkhead</li> </ul>	<ul style="list-style-type: none"> <li>▪ Requires Power</li> <li>▪ Requires backup generator</li> <li>▪ Real estate issues</li> <li>▪ Cost to operate</li> <li>▪ Visible above ground structures</li> </ul>	Yes	\$\$\$\$



## ➤ Green Infrastructure Improvements

As part of managing stormwater runoff in the Borough, the Borough should investigate and implement techniques and infrastructure requirements for public and private development that reduce stormwater runoff volume and increase stormwater runoff quality. Green Infrastructure (GI) is a broad term that describes efforts to capture, treat, and infiltrate stormwater runoff in urban areas. Stormwater practices include green roofs, permeable pavers, rainwater harvesting, rain gardens and planter boxes, bioswales, an urban tree canopy and constructed wetlands.

The New Jersey Department of Environmental Protection describes Green Infrastructure as follows: Green Infrastructure refers to methods of stormwater management that reduce wet weather/stormwater volume, flow, or changes the characteristics of the flow into combined or separate sanitary or storm sewers, or surface waters, by allowing the stormwater to infiltrate, to be treated by vegetation or by soils; or to be stored for reuse. Green Infrastructure (GI) methods are management practices that address stormwater runoff through soils, or reuse. GI practices include, but are not limited to:

- **Pervious Paving**
- **Bioretention Basins**
- **Vegetated Swales**
- **Cisterns**

The use of green infrastructure encourages the idea that stormwater is a resource that can be reused, instead of being treated as a nuisance that needs to be removed as quickly as possible.

A well-developed Green Infrastructure Plan would help the Borough to address water quality concerns and reduce stormwater runoff volumes. Green Infrastructure can have a significant impact on the volume and rate of stormwater runoff in the types of normal, frequent rainfall events that occur in the Borough regularly. When considering the future condition of the Borough, where nearly all stormwater will need to be pumped off the island, a reduction in runoff rates and volumes from frequent small storm events would also equate to a savings in pumpage related costs.



# Proposed FMSSMP Improvement Recommendations

## 3. Preservation of Natural Resources and Cooperation with Regulatory Agencies

- ➔ Evaluate and enact local zoning ordinances (overlay zones), policies and design requirements that are consistent with New Jersey Department of Environmental Protection and U.S. Army Corps of Engineers' regulations.
- ➔ Participate in Federal and State beach nourishment and dune building programs.
- ➔ Continue to monitor and survey the beaches, back bays and dunes.
- ➔ In conjunction with Federal and State agencies, participate in opportunities to restore degraded tidal marsh areas in back bay areas utilizing dredge materials.
- ➔ Consider land acquisition, purchasing repetitive loss properties and open space preservation in flood prone areas.
- ➔ Continue to participate in the New Jersey Coastal Coalition.





**OVERALL PROPOSED STORM DRAINAGE IMPROVEMENTS MAP**  
 Borough of Stone Harbor  
 Cape May County, New Jersey  
 December 2020

- Proposed Storm Sewer Pipe
- Outfall Elimination
- Recharge Chamber
- Elevate Roadway Areas

**Legend**

- Storm Chamber
- Storm Inlet
- Storm Manhole
- Storm Outfalls

**Storm Sewer Pipes:**

- Size
- Other
  - 6"
  - 8"
  - 10"
  - 12"
  - 14"
  - 15"
  - 16"
  - 18"
  - 20"
  - 21"
  - 24"
  - 30"
  - 36"
  - 42"
- Parcels
- Municipal Boundary Line



300 150 0 300 Feet

# Critical Paths & Priority Objectives

## A. Preventative

1. Continue to enforce and monitor the bulkhead ordinance.
2. Continue to enforce and monitor the lot grading and drainage ordinance.
3. Initiate discussions with the Borough of Avalon and County of Cape May regarding regional flood mitigation improvements and implementation.

## B. Capital Infrastructure Improvements

1. Elevate borough bulkheads.
2. Select bayside tide control method.
3. Initiate and conduct public outreach relating to raising roadways.
4. Implement recommendations contained in the FMSSMP current capital improvement projects. Properly plan future projects in concert with the FMSSMP.
5. Beach outfall elimination.

## C. Preservation of Natural Resources and Cooperation with Regulatory Agencies

1. Continue to monitor and survey the beaches, back bays and dunes.
2. Continue to participate in the New Jersey Coastal Coalition.



# References

- New Jersey Back Bays Coastal Storm Risk Management Study, Summary of Public Outreach, U.S. Army Corps of Engineer, December 2016.
- Federal Emergency Management Agency. (2017) Flood Insurance Study, Cape May County, New Jersey (All Jurisdictions), October 5, 2017.
- Federal Emergency Management Agency. (2017) Flood Rate Insurance Map, October 5, 2017.
- Federal Emergency Management Agency. (2018) NFIP/CRS New Jersey ratings, October 1, 2018.
- National Oceanic and Atmospheric Administration, Sea Level Rise and Nuisance Flood Frequency Changes around the United States, June 2014.
- New Jersey Department of Environmental Protection. (2019) Green Infrastructure in New Jersey ([www.nj.gov/dep/gil](http://www.nj.gov/dep/gil)).
- New Jersey Department of Environmental Protection. (March 2020) New Jersey Stormwater Best Management Practices Manual.
- Projected Range of Sea Level Rise, Source: Rutgers University Press Graphic.
- Tetra Tech, Inc. (2014). New Jersey State Hazard Mitigation Plan 2014.
- Tetra Tech, Inc. (2020). DMA 2000 Hazard Mitigation Plan – Cape May County, New Jersey, May 2016.
- Wikipedia (2020), “Stone Harbor, New Jersey.”
- Understanding Stormwater Inundation, National Oceanic and Atmospheric Administration, February 15, 2022



# Comments & Questions

- Presentation will be posted on Borough Website:
  - <https://stoneharbornj.org/>
- Detailed comments & questions can be submitted via email to:
  - [marc@deblasioassoc.com](mailto:marc@deblasioassoc.com)

