



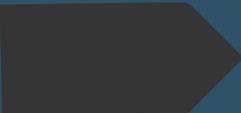
SEABROOK ISLAND  
*Property Owners Association*

# High Tides, Storm Surge, and Rain; A Discussion about Flooding

Community Presentation

February 17, 2020

Steve Hirsch – SIPOA Director of Engineering



# Goals for Today



Understand Why / How Flooding Occurs



Explore Available Resources



Explain What is Being Done



Answer Questions



## 3 Ways for Flooding to Occur



TIDAL FLOODING



STORM SURGE



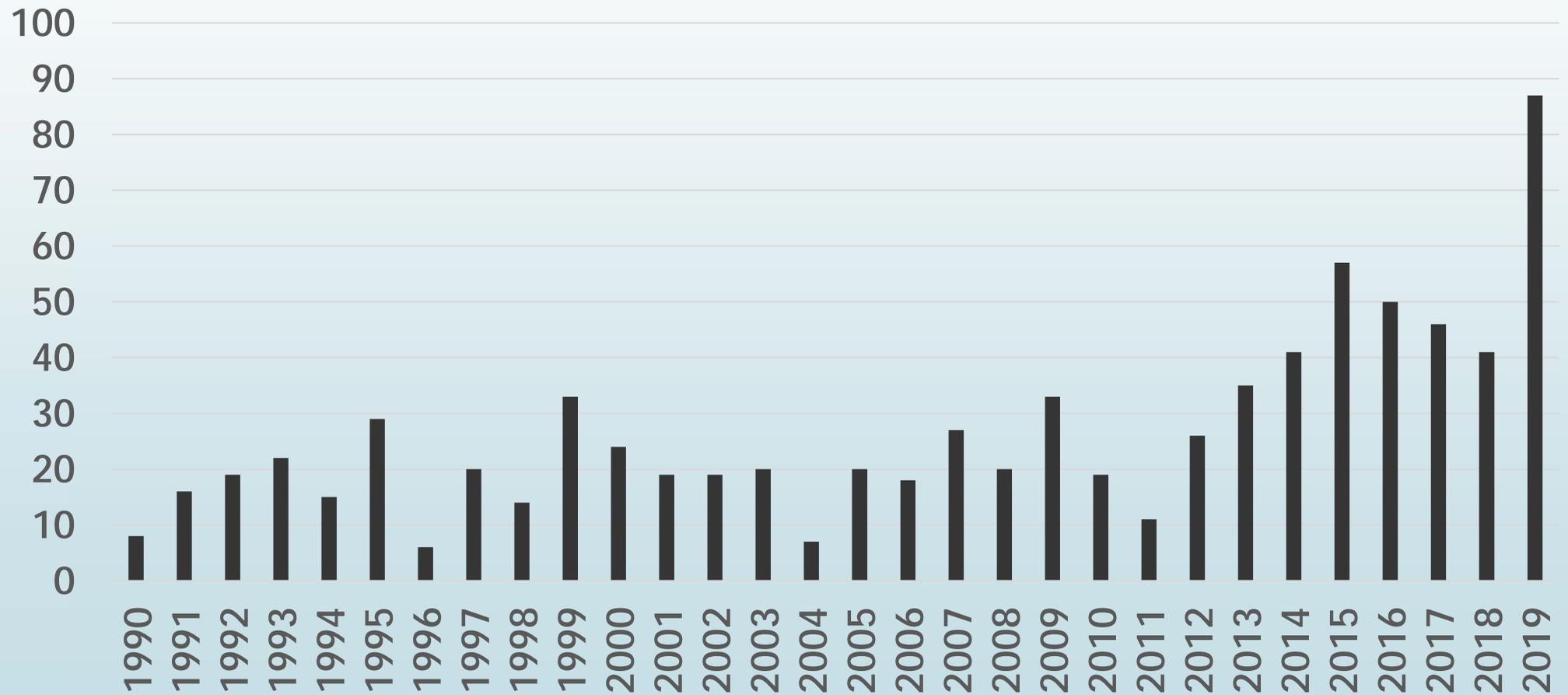
RAIN EVENT

# What is Tidal Flooding?

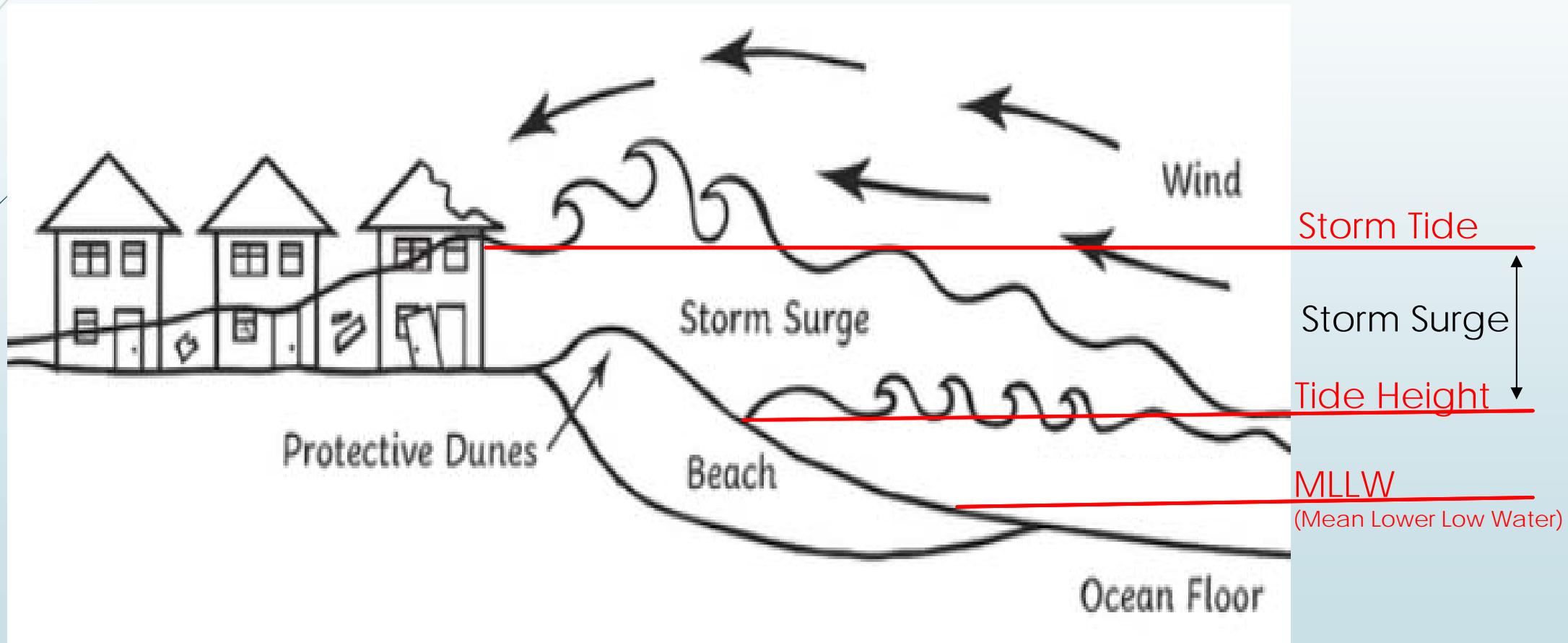
- The average high tide in Charleston Harbor is 5.76' MLLW
- Charleston County issues a Coastal Flood Advisory for any tide over 7.0'
- In 2019 there were
  - 87 days where the tide exceeded 7.0' (minor flooding)
  - 25 days where the tide exceeded 7.5' (moderate flooding)
  - 4 days where the tide exceeded 8.0' (major flooding)
- Highest recently recorded tide was 8.76' on November 24, 2018

# What is Tidal Flooding?

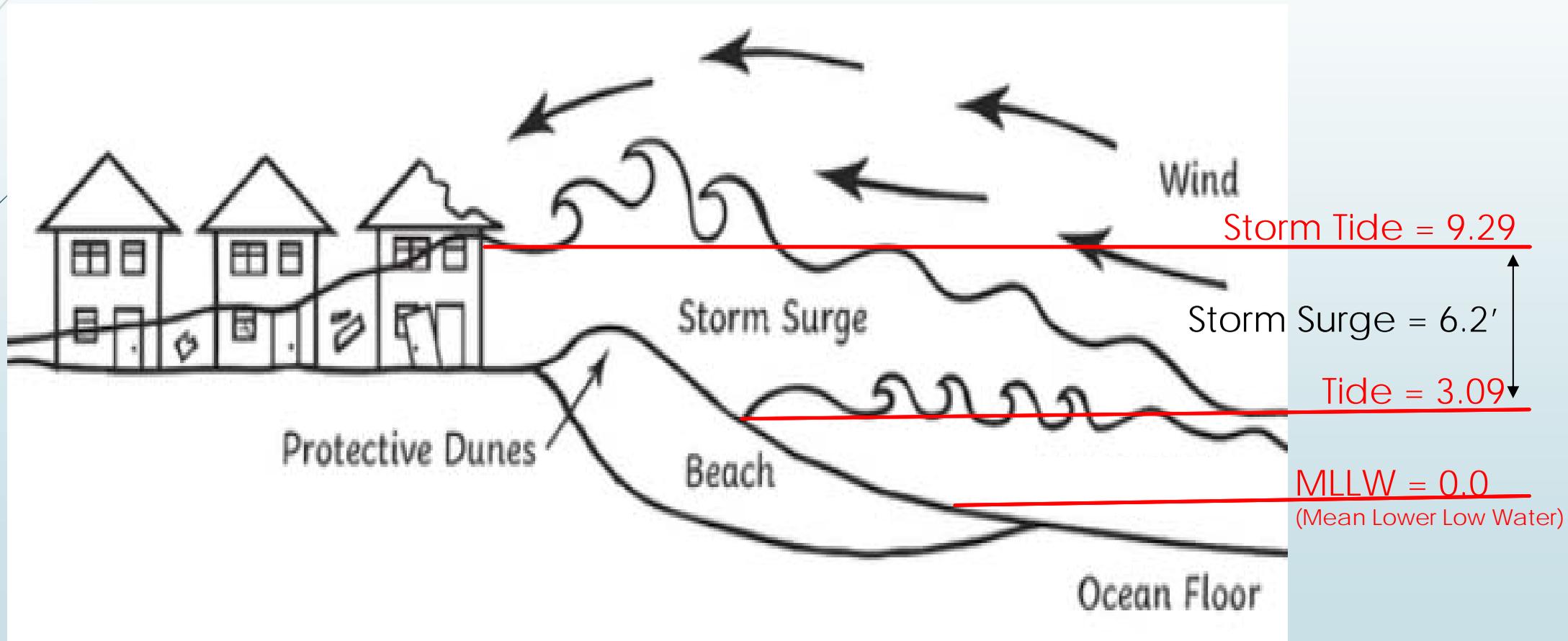
Charleston County Annual Tidal Flooding Days



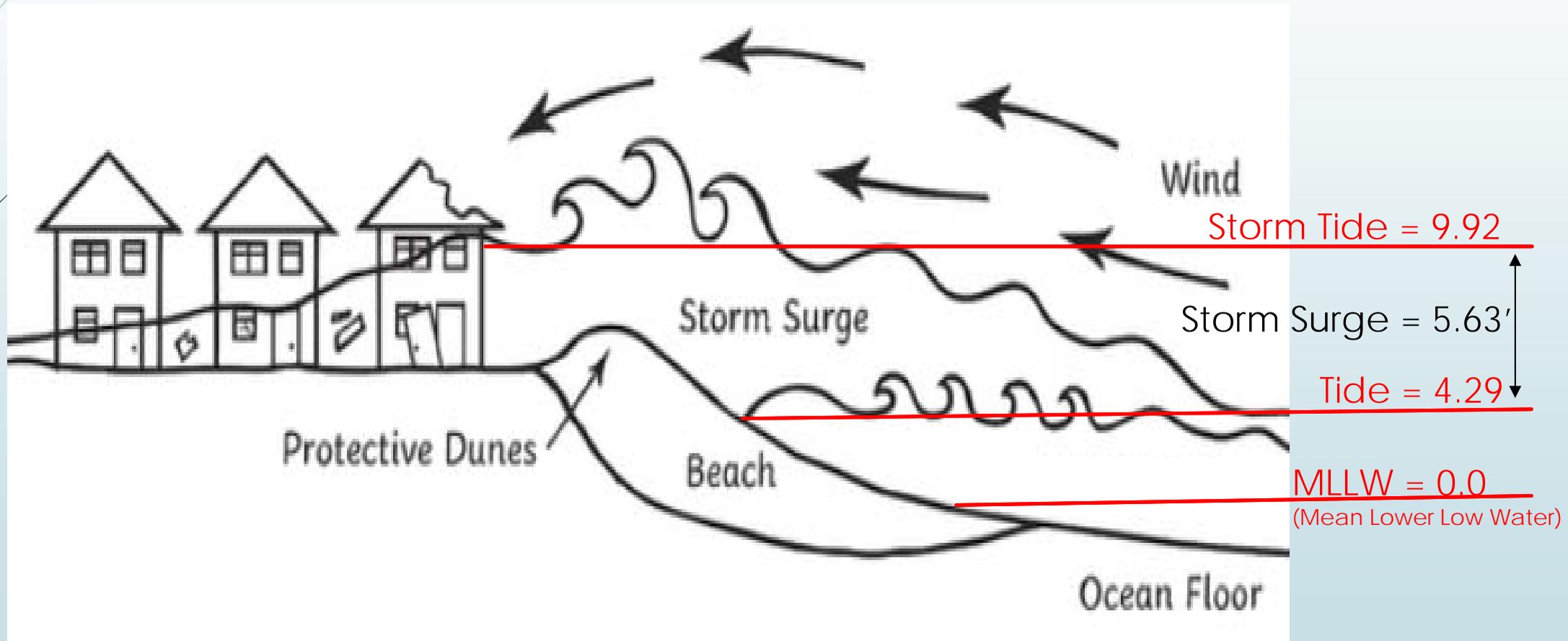
# What is Storm Surge?



# Hurricane Matthew

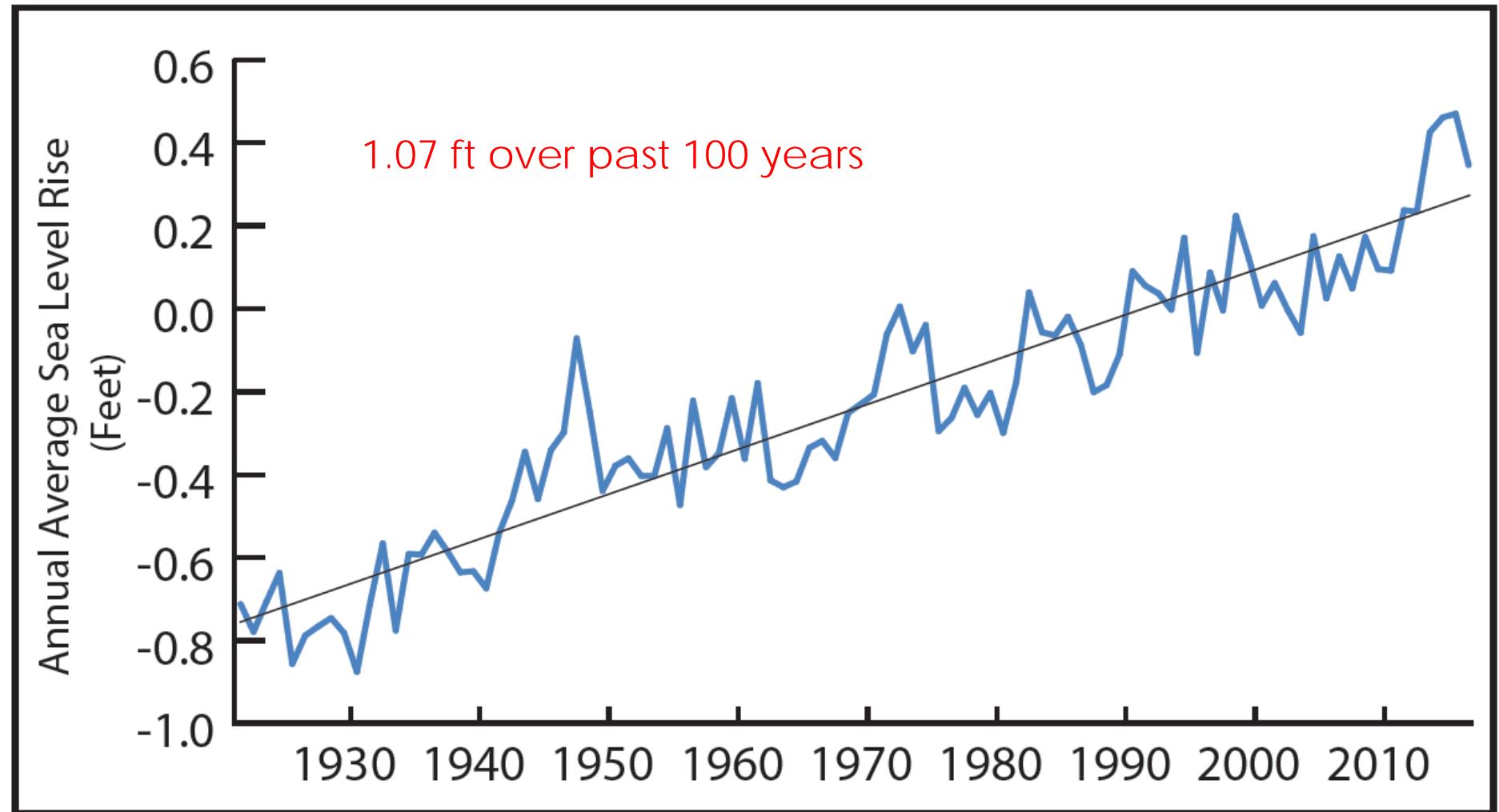


# Hurricane Irma



# What is Sea Level Rise?

**FIGURE 1: OBSERVED SEA LEVEL RISE IN CHARLESTON HARBOR<sup>(1)</sup>**



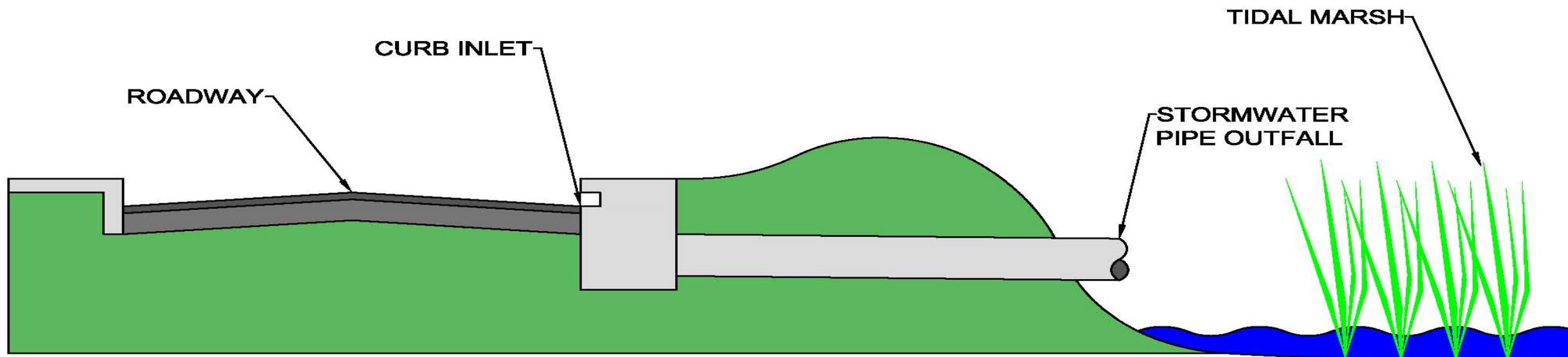
Source: City of Charleston 2019 Flooding and Sea Level Rise Strategy

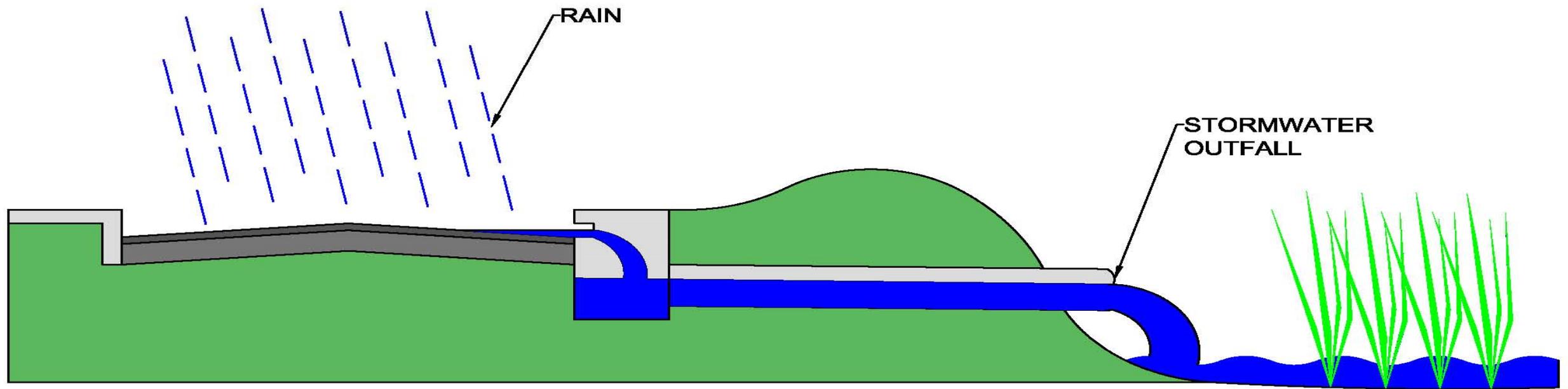
# Flooding from Rain

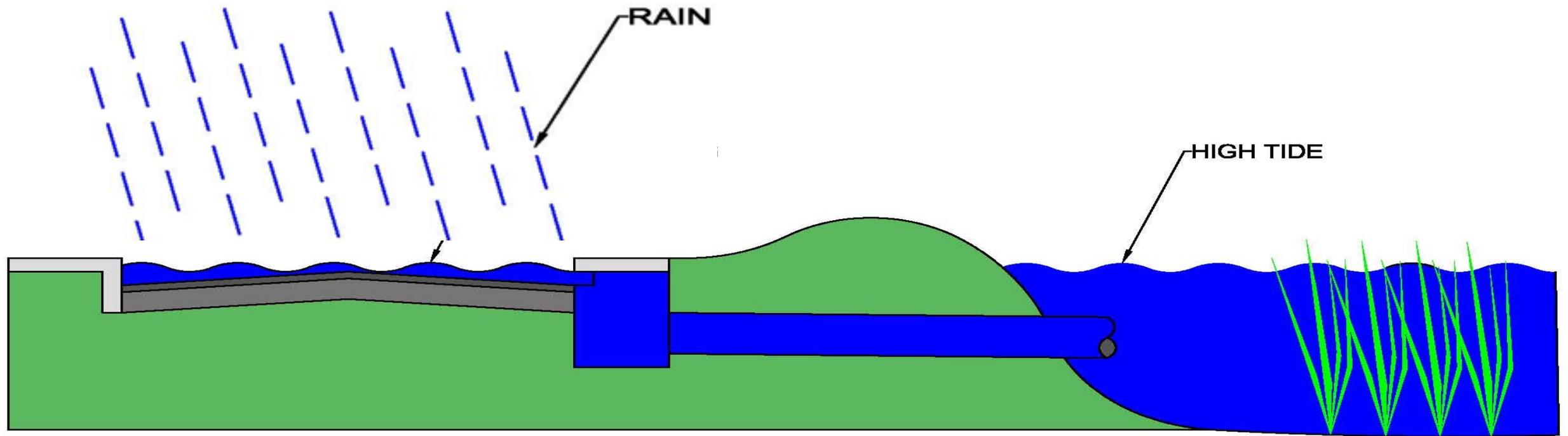
- In general, Seabrook Island is designed to accommodate a 10-yr rain event
- Charleston Stormwater Design Standards for 24-hour rain event

1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
3.5"	4.2"	5.5"	6.5"	7.9"	9.0"	10.3"

- Tropical Storm Joaquin (rainfall data from Charleston airport)
  - 5.1" on 10-3-15 (max tide height 8.14')
  - 9.1" on 10-4-15 (max tide height 8.16')
- **RAIN FLOODING CAN BE IMPACTED BY TIDE HEIGHT!**

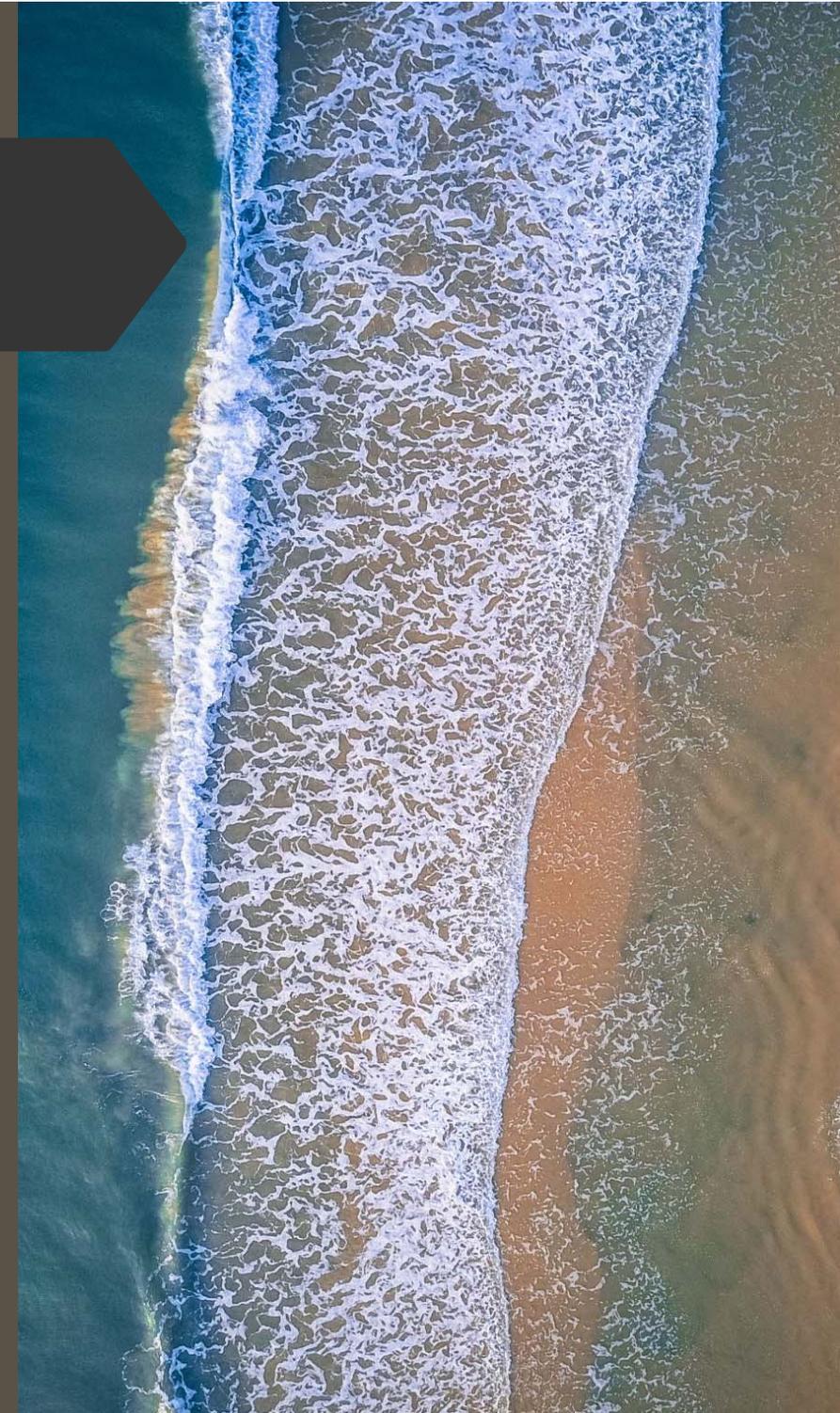




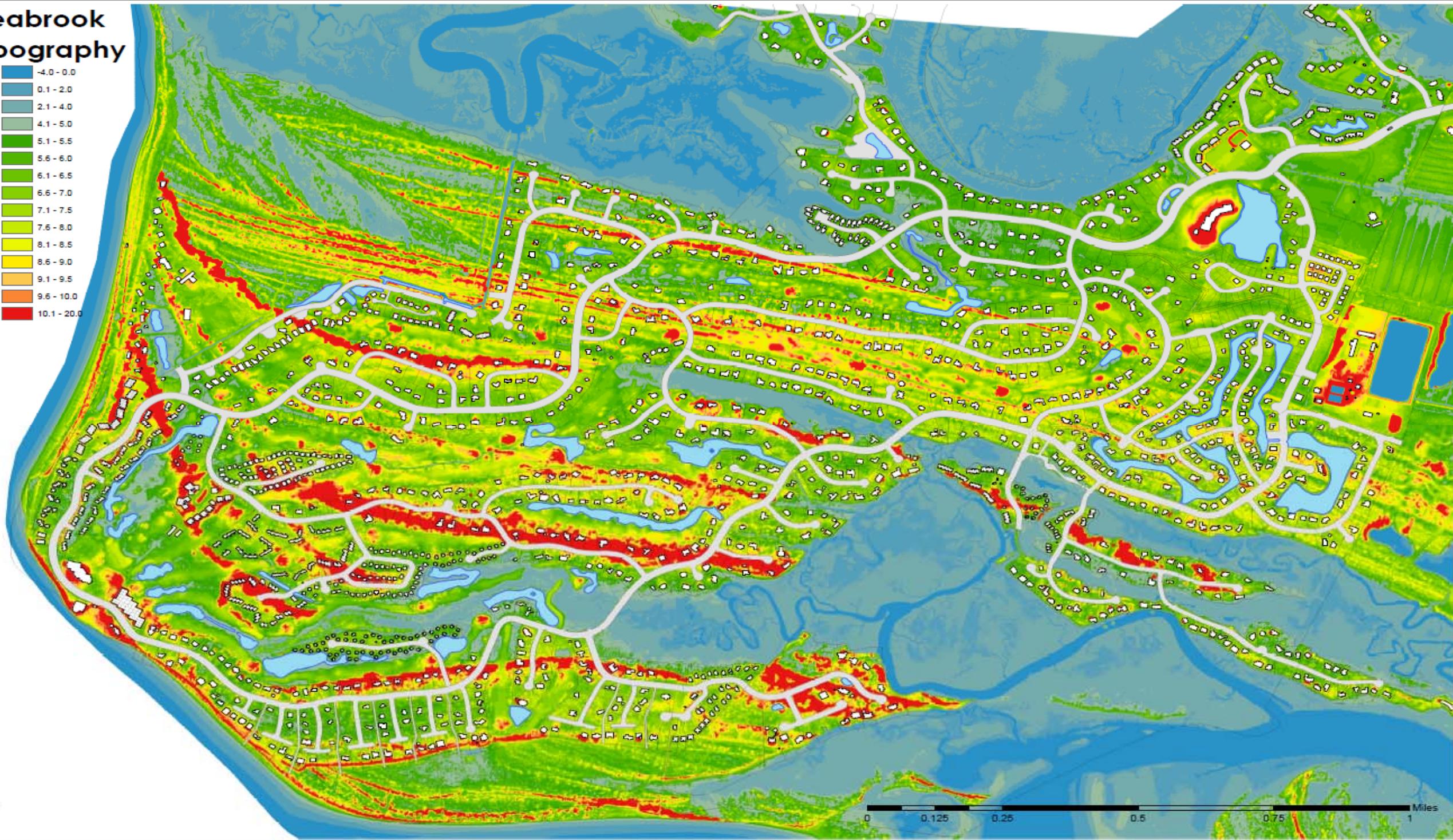
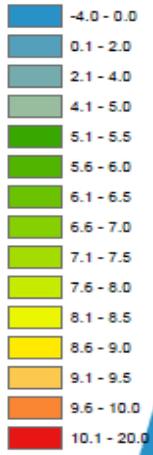


# Available Resources

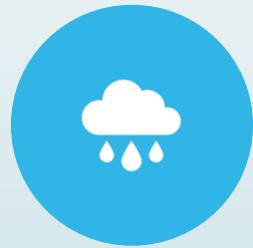
- ▶ National
  - ▶ [NOAA Sea Level Rise Viewer](#)
  - ▶ [FEMA Flood Risk Maps](#)
- ▶ State and Local
  - ▶ [SCDHEC King Tides Initiative](#)
  - ▶ [Charleston Harbor Tide Gauge Station](#)
  - ▶ [City of Charleston Flooding and Sea Level Rise Strategy](#)
  - ▶ [Kiawah Flood Mitigation and Sea Level Rise Adaptation](#)
  - ▶ [Folly Beach Sea Level Rise Adaptation](#)
  - ▶ [Charleston Resiliency Network Toolkit](#)
  - ▶ [Charleston County Hurricane Preparedness Guidelines](#)
- ▶ Specific to Seabrook
  - ▶ Seabrook Island Topography
  - ▶ [Seabrook Island Tidal Flood and Storm Surge Viewer](#)
    - ▶ <https://arcg.is/1mLz01>



# Seabrook Topography



# What is being done?



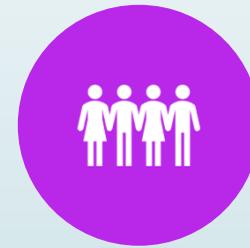
MAINTAIN  
STORMWATER  
SYSTEM



CONDUCT ISLAND  
WIDE DRAINAGE  
STUDY



INSTALL  
STORMWATER  
CHECK VALVES



FEMA COMMUNITY  
RATING SYSTEM



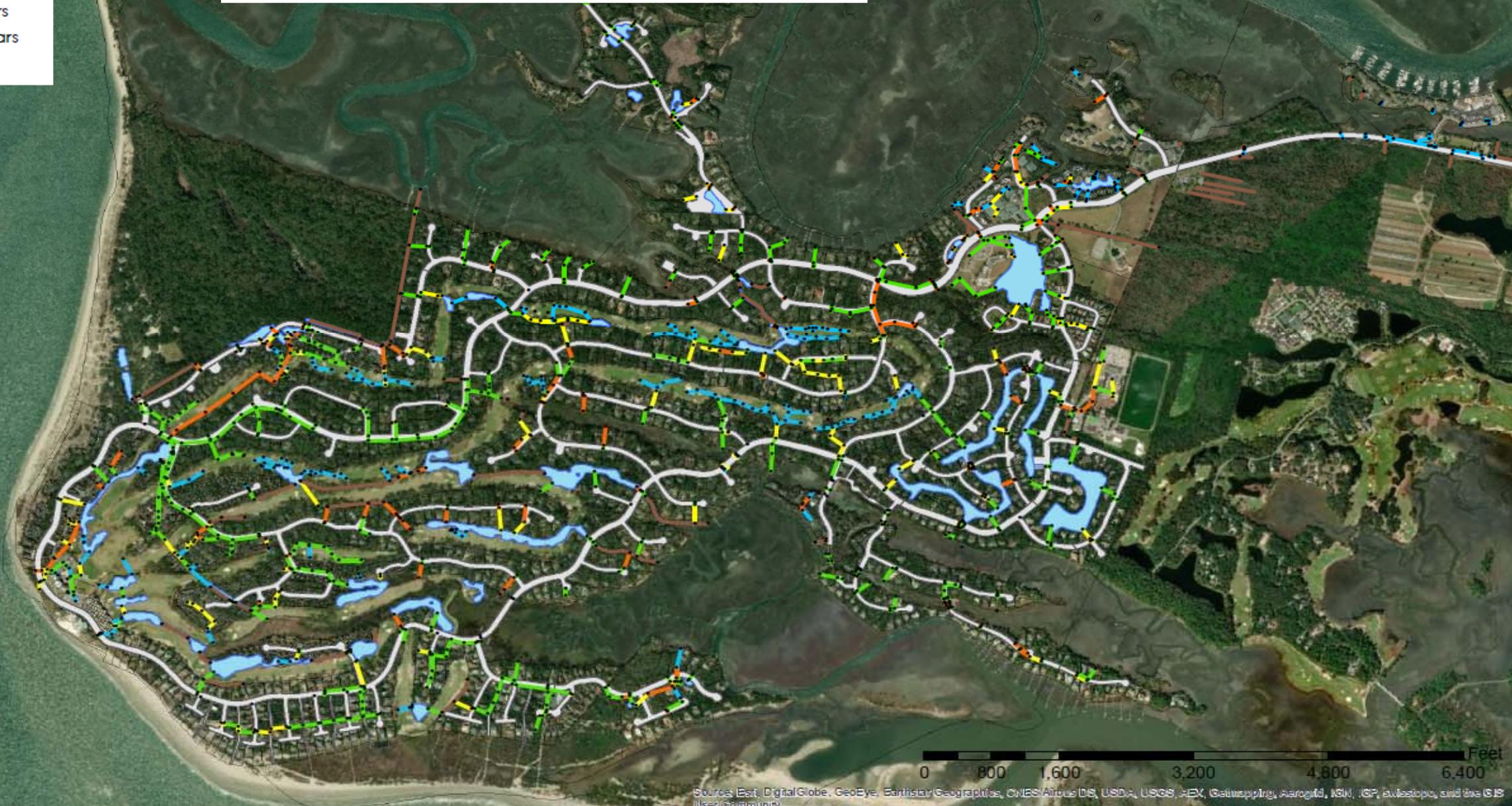
INSTALL LOCAL TIDE  
GAUGE STATION

# Pipe Rehabilitation

## Legend

- Ditch
- Unassessed
- Recommendations**
- Immediate
- 2-4 years
- 5-10 years
- Monitor

Recommendation	Pipe Length (ft)	Projected Low Cost	Projected Cost	Projected High Cost
Immediate Repair	0			
Repair in 2-4 years	11,761	\$1,646,540	\$1,881,760	\$2,116,980
Repair in 5-10 years	13,499	\$1,889,860	\$2,159,840	\$2,429,820
Monitor	55,531	NA	NA	NA
<b>TOTAL =</b>	<b>80,791</b>	<b>3,536,400</b>	<b>4,041,600</b>	<b>4,546,800</b>



Sources: Esri, DigitalGlobe, GeoEye, Earthstar/Geographics, CNES/Airbus DS, USDA, USGS, HEX, GeoIntelligence, AeroGRID, IGN, IGP, Swisstopo, and the GIS User Community

## Outfall Channel Condition

• Outfalls

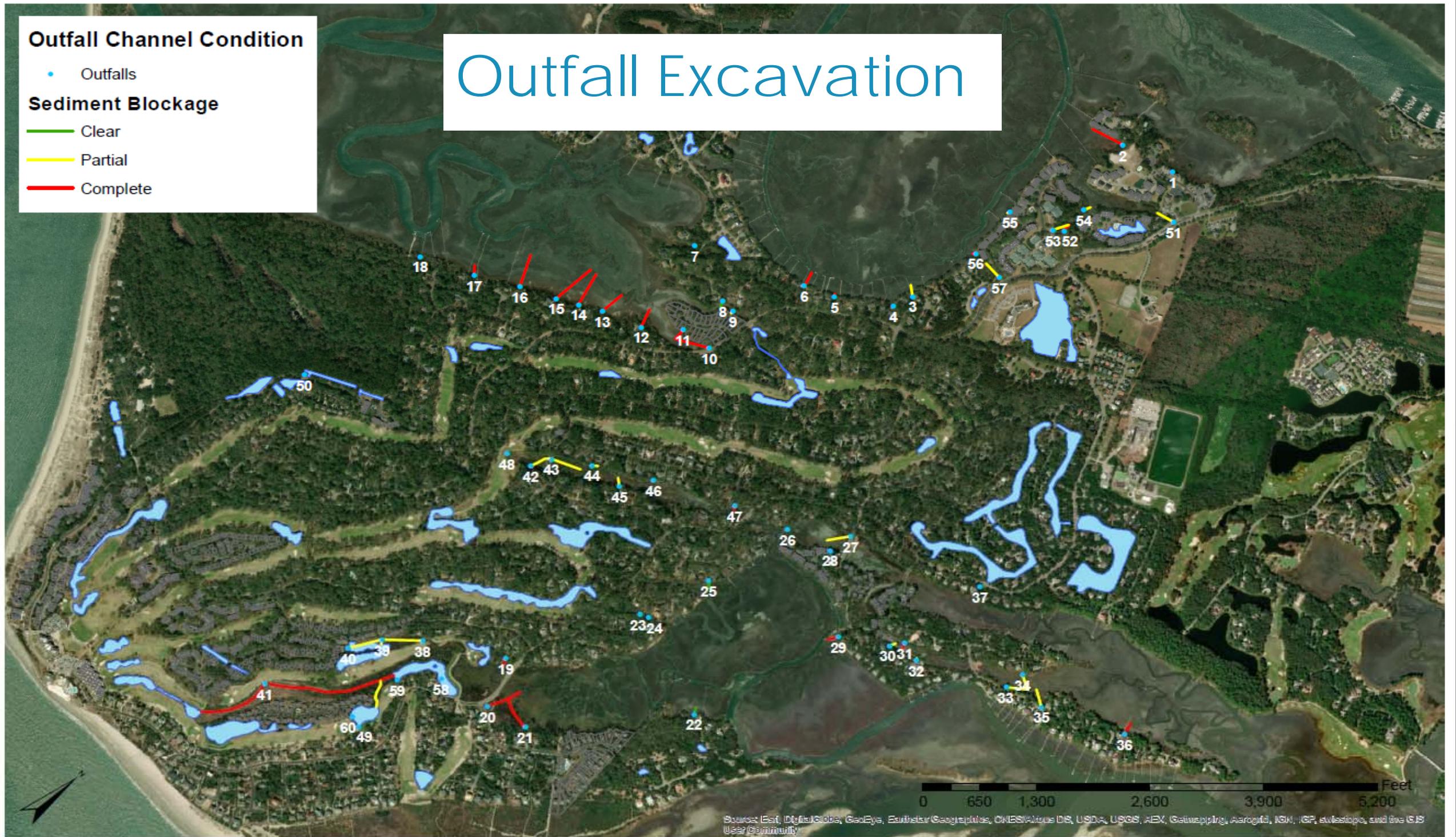
### Sediment Blockage

— Clear

— Partial

— Complete

# Outfall Excavation





# Island Wide Drainage Study



STORMWATER  
CAPACITY  
ANALYSIS



TIDAL FLOOD  
MITIGATION



CRITICAL  
INFRASTRUCTURE  
CONDITION  
ASSESSMENT



CAPITAL PROJECT  
RECOMMENDATIONS



CAPITAL PROJECT  
COST ESTIMATES AND  
PRIORITIZATION

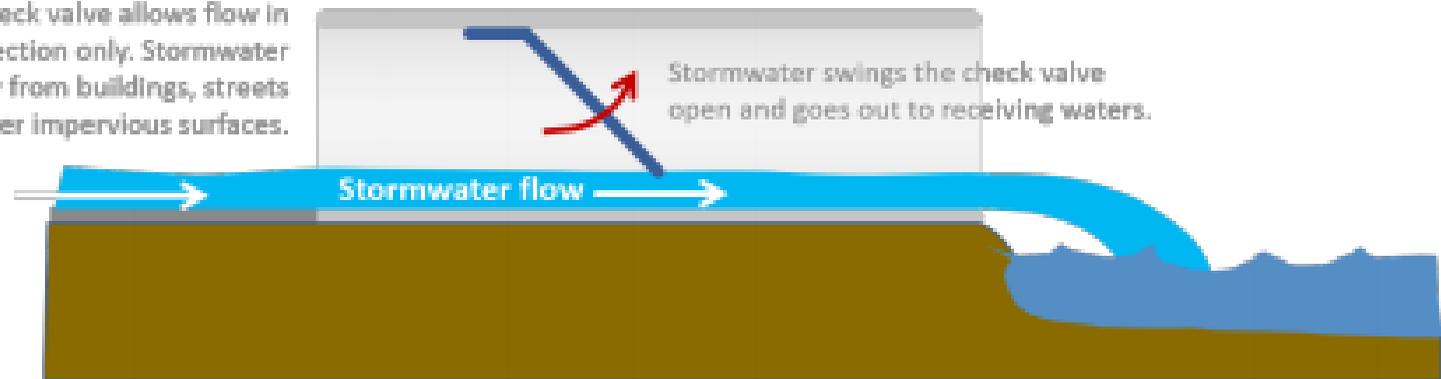
# Stormwater Check Valves

► Prevent tidal flooding of roadways

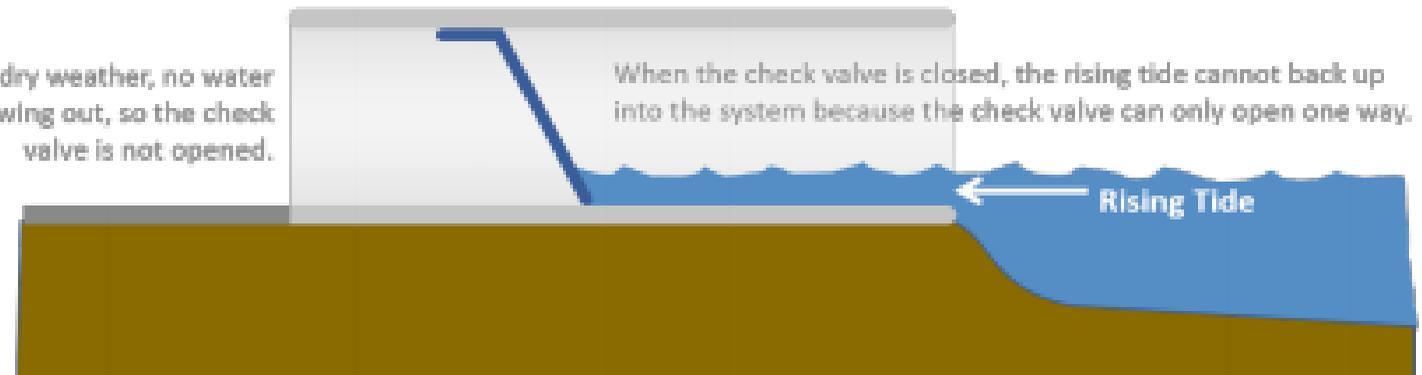
► Currently have 22 installed

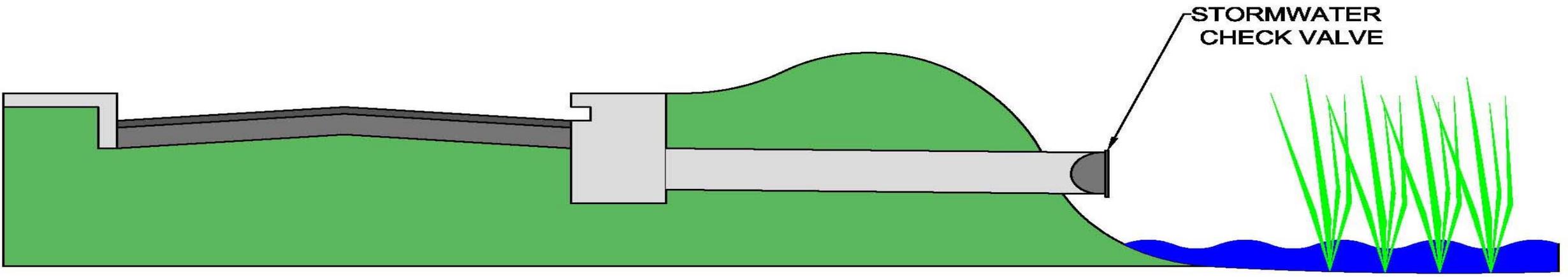
## HOW DOES AN IN-LINE CHECK VALVE WORK?

An in-line check valve allows flow in one direction only. Stormwater flows away from buildings, streets and other impervious surfaces.

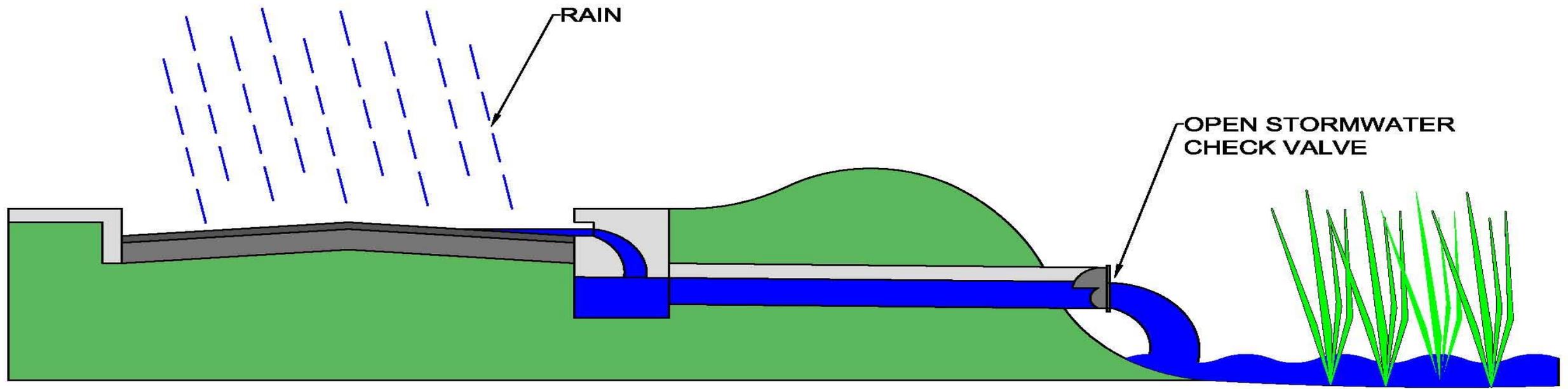


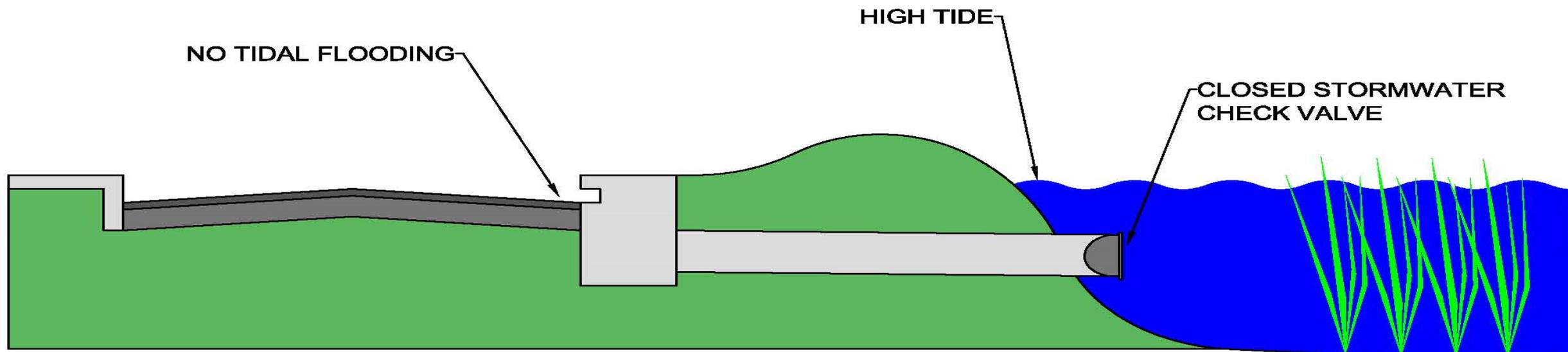
During dry weather, no water is flowing out, so the check valve is not opened.





STORMWATER  
CHECK VALVE





# FEMA Community Rating System (CRS)

- Coordinated through the Town of Seabrook Island
- On May 1, 2016, Seabrook Island improved their rating under the CRS program from a class 6 to a class 5.
- Under the 5 rating, Seabrook Island receives a 25% flood insurance premium reduction, which is an average of \$188 per policy.



**Table 110-1. CRS classes, credit points, and premium discounts.**

CRS Class	Credit Points (cT)	Premium Reduction	
		In SFHA	Outside SFHA
1	4,500+	45%	10%
2	4,000–4,499	40%	10%
3	3,500–3,999	35%	10%
4	3,000–3,499	30%	10%
5	2,500–2,999	25%	10%
6	2,000–2,499	20%	10%
7	1,500–1,999	15%	5%
8	1,000–1,499	10%	5%
9	500–999	5%	5%
10	0–499	0	0

*SFHA: Zones A, AE, A1–A30, V, V1–V30, AO, and AH*

*Outside the SFHA: Zones X, B, C, A99, AR, and D*

*Preferred Risk Policies are not eligible for CRS premium discounts because they already have premiums lower than other policies. Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage.*

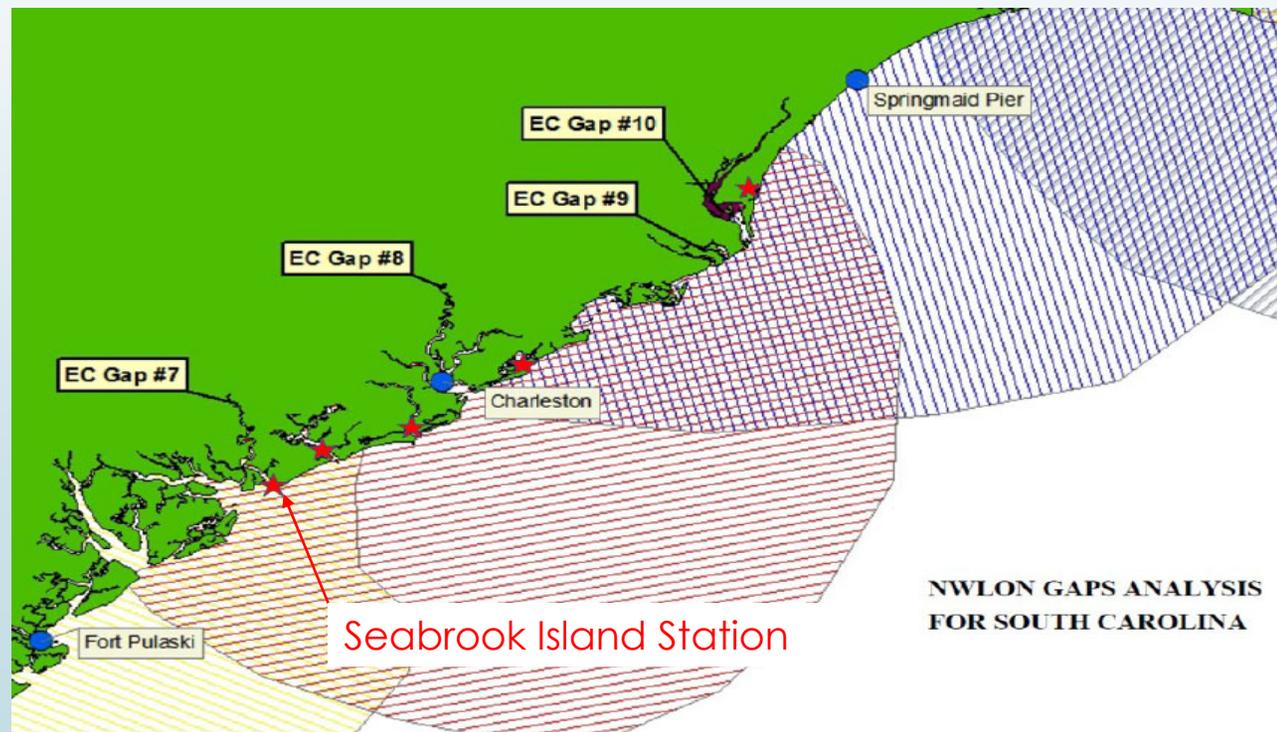
*Some minus-rated policies may not be eligible for CRS premium discounts.*

*Premium discounts are subject to change.*

Source: City of Charleston 2019 Flooding and Sea Level Rise Strategy

# Tide Gauge Station

- Installed in 2020 at the kayak launch dock
- Provides local tide data for Seabrook Island
- <https://dashboard.hohonu.io/stations/node-173>



# FAQ's

Question: Will the marsh outfall excavation project(s) help mitigate tidal flooding?

Answer: No. The marsh outfall excavation project(s) will help with stormwater drainage from rain events and will minimize the time there is standing water after a rain event. Tidal flooding will still occur on properties that are lower than the high tide elevation.

Question: When will the island wide drainage study be completed?

Answer: The drainage study was completed in the summer of 2020. 5 of the recommended projects have been implemented and 4 more are in design and permitting.

Question: When will the new FEMA floodmaps be adopted for Charleston County?

Answer: The new Charleston County flood maps were adopted in 2020.

**NOTES TO USERS**

This map is for use in determining the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map preparer should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **Flowways** have been determined, users are encouraged to consult the Flood Profile and Floodway Data and/or Summary of Floodway Elevations and Flow Capacities for the Flood Insurance Study (FIS) report that accompanies this map. Users should be aware that the 100-year BFEs shown on the FIS represent the highest water elevation. These BFEs are intended for flood insurance rating purposes and should be used as the basis for flood insurance rating information. Accordingly, flood elevation data presented in the FIS report should be obtained in conjunction with the FIS for purposes of construction and foundation management.

The AE Zone category has been divided by a **Limit of Moderate Wave Action**. The LOMWA represents the approximate landward limit of a 3-foot breaking wave. The effects of wave forces between the VE Zone and the LOMWA for houses, low structures, and the LOMWA for mobile homes are not considered and will be similar to, but less severe than those in the VE Zone.

**Coastal Base Flood Elevations** shown on this map apply only to landward of 0.7 North American Vertical Datum of 1988 (NAVD 88). Users of this FIS should be aware that coastal flood elevations are also provided in the Summary of Floodway Elevations tables in the Flood Insurance Study report for the jurisdiction. Elevations shown on the Summary of Floodway Elevations table should be used for construction and foundation management purposes when they are higher than the elevations shown on this FIS.

Boundaries of the Floodways were computed at cross sections and interpolated between cross sections. The Floodways were used for hydraulic computations with regard to sea-level rise of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Points shown on a Floodway Flood Hazard Area may be measured by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was State Plane South Carolina FIPS 3200. The horizontal datum was NAD 83. Coordinate system differences in datum, spheroid, projection or State Plane zones used in the production of FISs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIS.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. Where 1988 elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding differences between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/CGVD/> or contact the National Geodetic Survey at the following address:

NOAA Information Service  
 NOAA, NHDSE  
 National Center for  
 Surveying and Mapping  
 1215 East-West Highway  
 Silver Spring, Maryland 20910-3282  
 (301) 713-3242

To obtain names, elevation, description, and/or location information for bench marks shown on this map, please contact the nearest State Office, Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

**Base map information** shown on this FIS was provided in digital format by Charleston County, South Carolina.

This map may contain material or up-to-date stream channel configurations that those shown on the original FIS. The topographic and hydrographic data that were used to produce this FIS have been updated to conform to these new stream channel configurations and stream hydrographic data. The profile lines depicted on this map represent the hydrographic boundaries that mark the flood profile and Floodway Data Tables if applicable. In the FIS report, an "R" next to the profile boundaries may, depending on the map, mean base map channel representation and may appear outside of the floodway.

Corrections made shown on this map were made to the flood data available at the time of publication. Because changes due to renovations or de-annexations may have occurred after the map was published, users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map sheets. Community map preparer addresses and a series of Commission labels containing National Flood Insurance Program data for each community are included as a listing of the needs in which each community is located.

Contact the FEMA Map Information eXchange (MIX) at 1-877-336-3367 for information on available products associated with this FIS. Available products may include the previously issued letters of Map Change or Flood Insurance Study report and/or digital versions of this map. The MIX may also be reached by Fax at 1-800-368-9800 and by e-mail at [ifm@www.fema.gov](mailto:ifm@www.fema.gov).

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA-Map (1-877-336-3367) or visit the FEMA website at <http://www.fema.gov/nfp> or flood service program.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) LEGEND**

10-91-1983 CBRS Area  
 FLOOD INSURANCE NOT AVAILABLE FOR STRUCTURES NOWY RUILT OR SUBSTANTIALLY IMPROVED OR REPAIRED AFTER OCTOBER 1, 1983, IN DESIGNATED CBRS AREAS.

11-16-1983 CBRS Area  
 FLOOD INSURANCE NOT AVAILABLE FOR STRUCTURES NOWY RUILT OR SUBSTANTIALLY IMPROVED OR REPAIRED AFTER OCTOBER 1, 1983, IN DESIGNATED CBRS AREAS.

Boundaries of the John H. Chafee Coastal Barrier Resources System (CBRS) shown on this FIS were transferred from the official CBRS source maps for this area and are depicted as the CBRS for informational purposes only. The official CBRS maps are owned by Congress and the Coastal Barrier Resources Act, as amended, and managed by the U.S. Fish and Wildlife Service (FWS). The official CBRS maps used to determine whether or not an area is located within the CBRS are available for download at <http://www.fws.gov>. For an official determination of whether or not an area is located within the CBRS, or for any questions regarding the CBRS, please contact the FWS field office for this area at (843) 727-4701.

This FIS was prepared through a Memorandum of Understanding between the State of South Carolina and the Federal Emergency Management Agency (FEMA). The State of South Carolina has implemented a long-term approach of flood management to decrease the costs associated with flooding. This is accomplished by the State's continued investment in flood control. This is supported by the State's continued investment in flood control. This is supported by the State's continued investment in flood control. This is supported by the State's continued investment in flood control.

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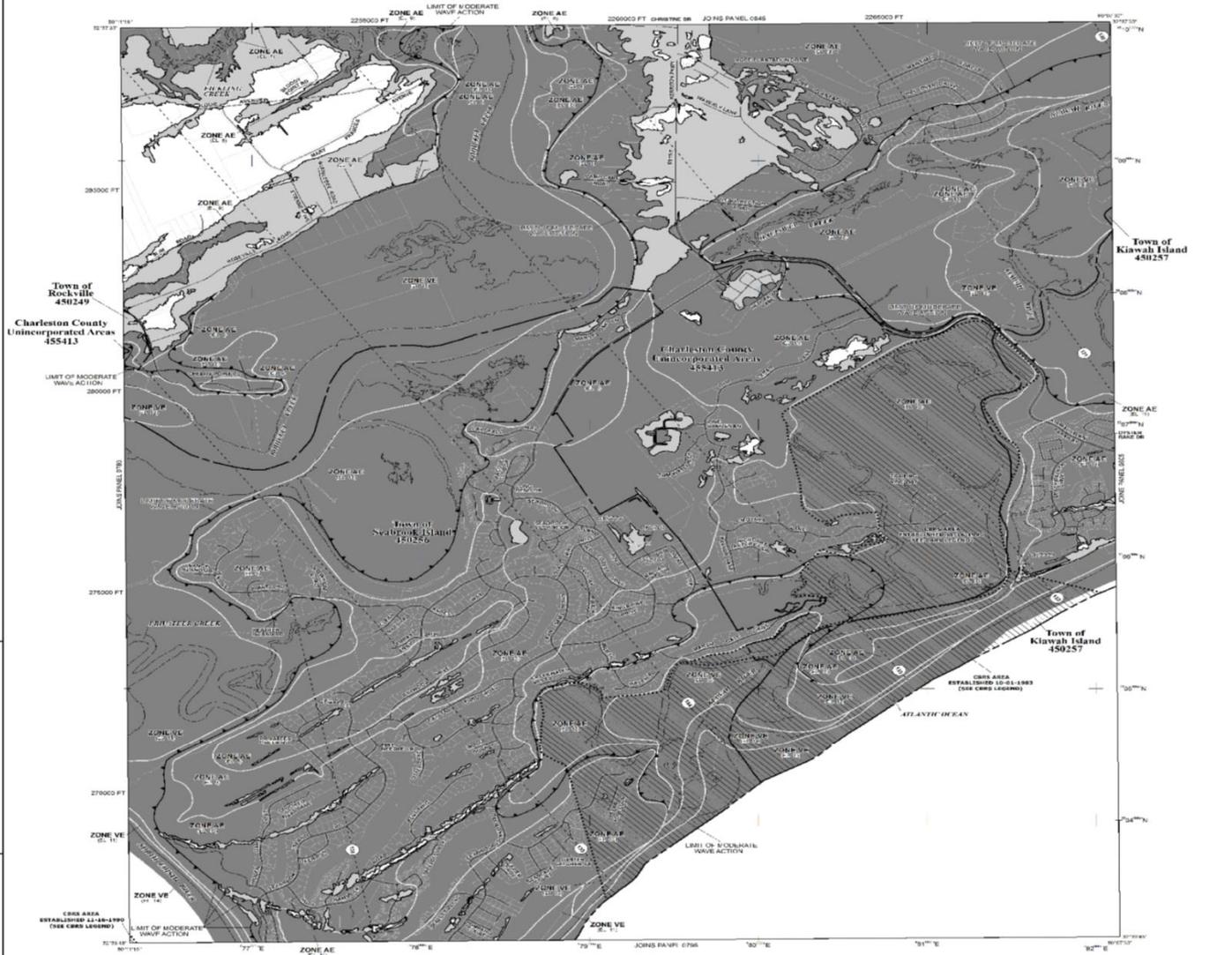
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**LEGEND**

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INSURATION BY THE NATIONAL FLOOD INSURANCE PROGRAM**
- ZONE AE** Special Flood Hazard Area (SFHA) subject to insurance by the National Flood Insurance Program. Flood depths are shown on the map.
- ZONE VE** Special Flood Hazard Area (SFHA) subject to insurance by the National Flood Insurance Program. Flood depths are shown on the map.
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- ZONE VE-100** Special Flood Hazard Area (SFHA) subject to insurance by the National Flood Insurance Program. Flood depths are shown on the map.

**OTHER FLOOD AREAS**

- ZONE X** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE Y** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE Z** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AA** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AB** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AC** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AD** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AE** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AF** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AG** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AH** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AI** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AJ** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AK** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AL** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AM** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
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- ZONE AP** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AQ** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AR** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AS** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AT** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AU** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AV** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AW** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AX** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AY** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.
- ZONE AZ** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) LEGEND**

- CBRS AREA ESTABLISHED 10-01-1983 (SEE CBRS LEGEND)**
- CBRS AREA ESTABLISHED 11-16-1983 (SEE CBRS LEGEND)**

**OTHER PROTECTED AREAS (OPAs)**

- OPAs** Areas of 1% annual chance flood, areas of 1% annual chance flood with cumulative risk of 1% or more, or areas of 1% annual chance flood with cumulative risk of 1% or more.

**MAP SCALE 1" = 1000'**

0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

**MAP NUMBER 4501C0785K**

**MAP REVISED**

**FIRM FLOOD INSURANCE RATE MAP**

**CHARLESTON COUNTY, SOUTH CAROLINA AND INCORPORATED AREAS**

**PANEL 785 OF 855**

**(SEE MAP INDEX FOR FIRM PANEL LAYOUT)**

**PRELIMINARY**

**SEPTEMBER 9, 2016**

**NATIONAL FLOOD INSURANCE PROGRAM**

**Federal Emergency Management Agency**