

# Sticking our Heads in the Sewers, Not in the Sand

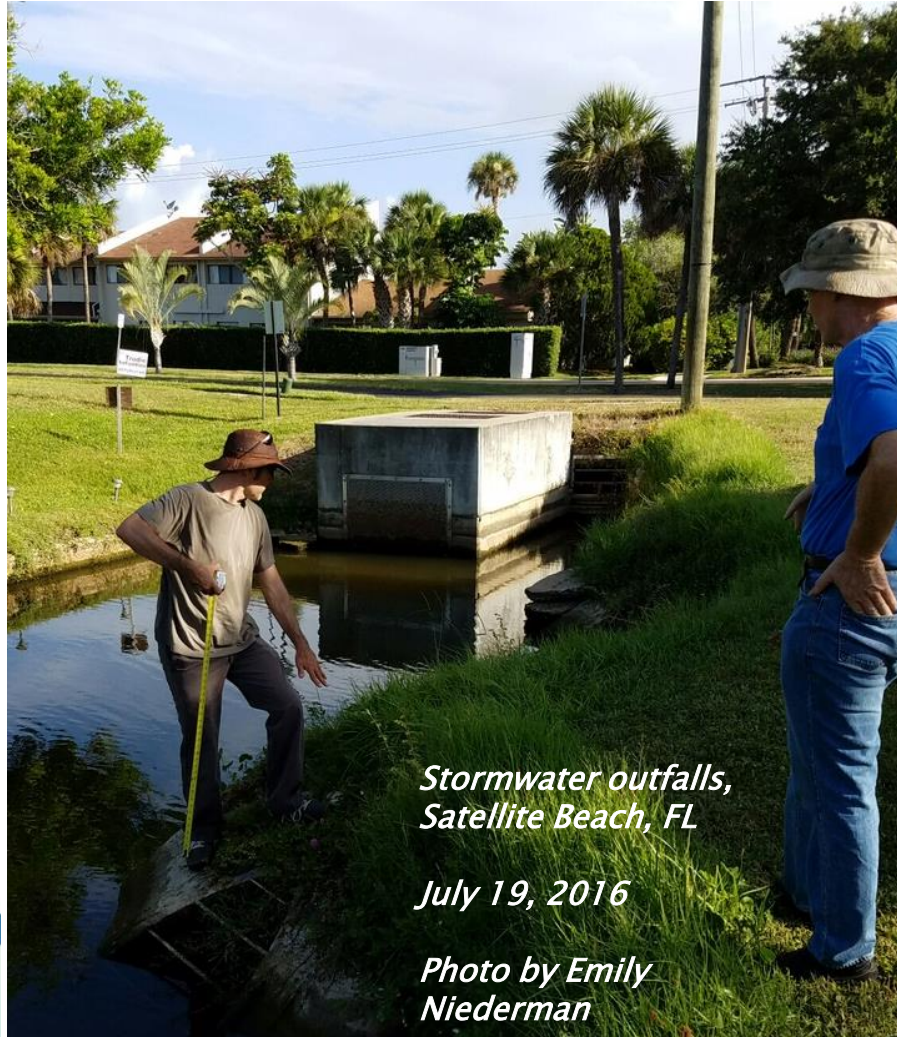
## *Sea Level Rise and Stormwater*

Jason M. Evans, Ph.D.

Assistant Professor of Environmental Science  
Stetson University

November 17, 2016

Sea-level Rise and Flooding:  
Planning and Law for Local Governments  
Cocoa, FL



*Stormwater outfalls,  
Satellite Beach, FL*

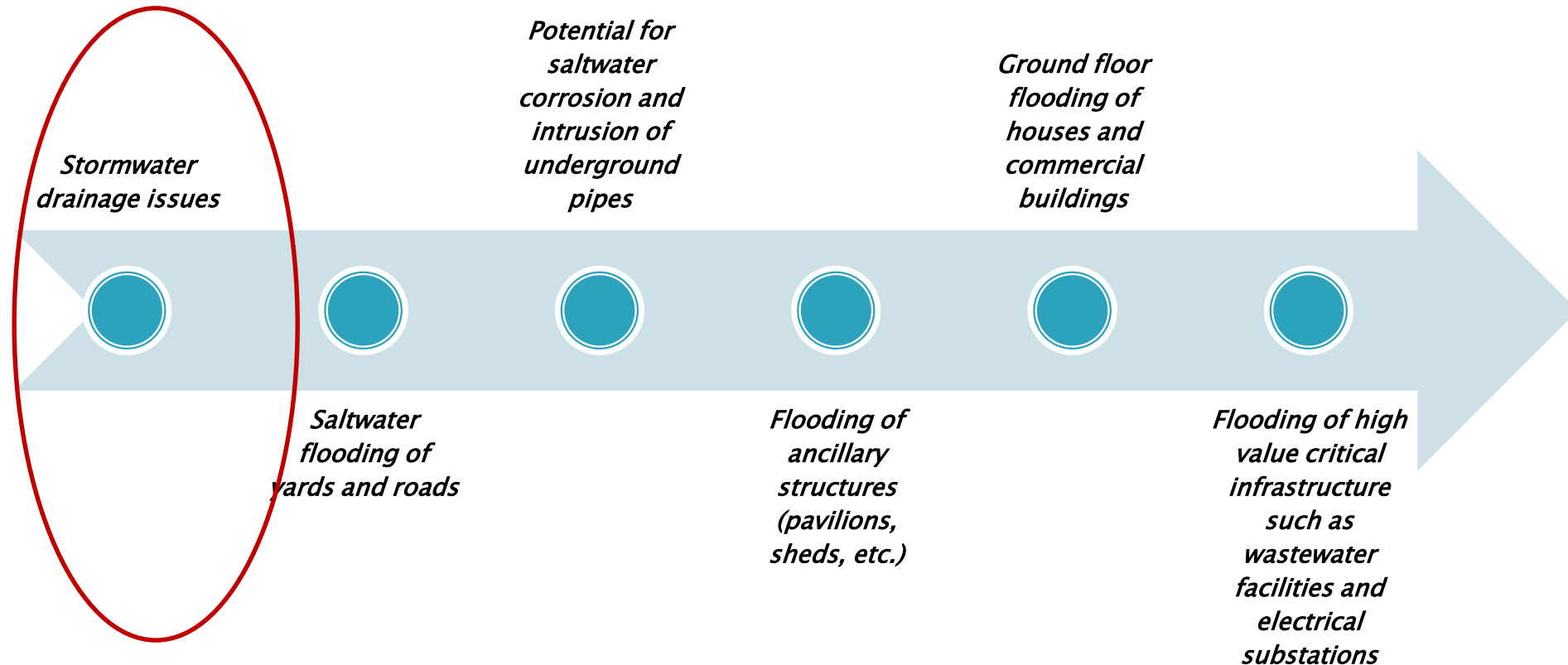
*July 19, 2016*

*Photo by Emily  
Niederman*

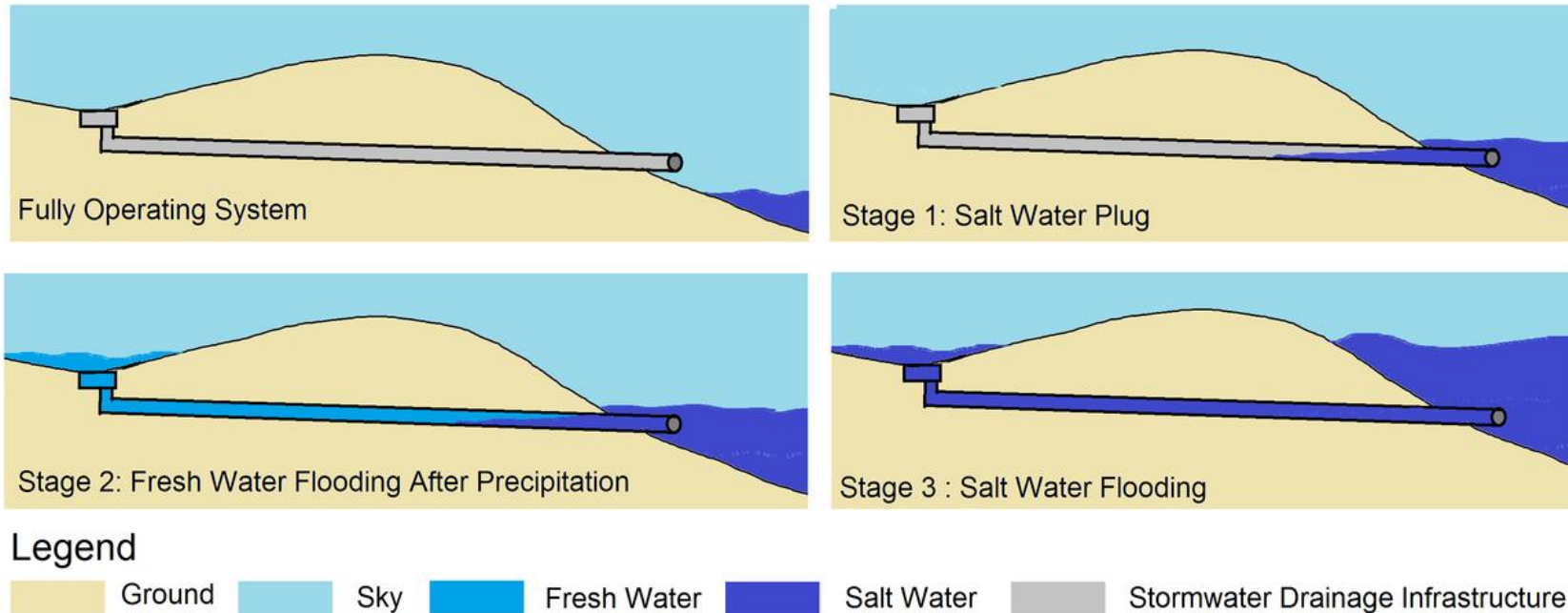
## Assertion #4

*Almost all coastal communities in the coastal southeast, even those not yet seeing dramatic direct saltwater flooding from king tides, are already being impacted by various stormwater drainage issues and failures.*

# General Timeline of Sea Level Rise Impacts on the Built Environment



# Stages of stormwater failure with sea-level rise



Graphic by Emily  
Niederman, Stetson  
University



# SW Tybee Island: November 14, 2012

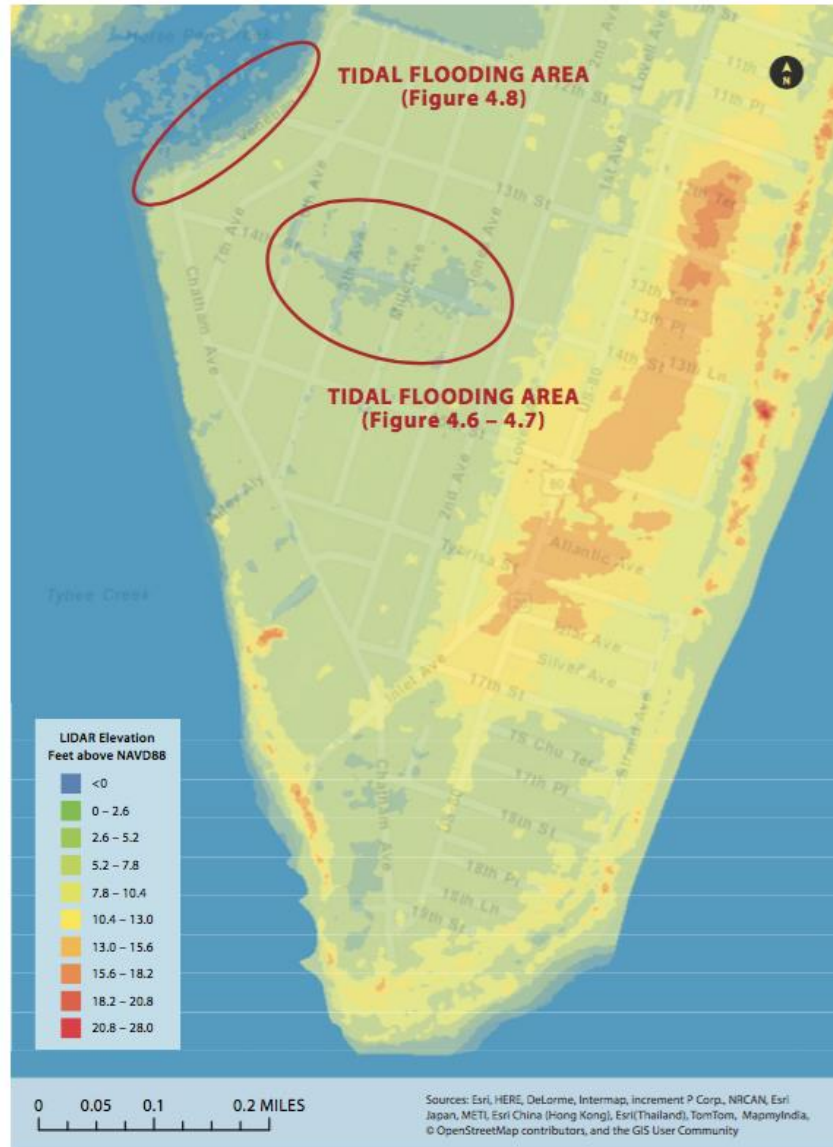
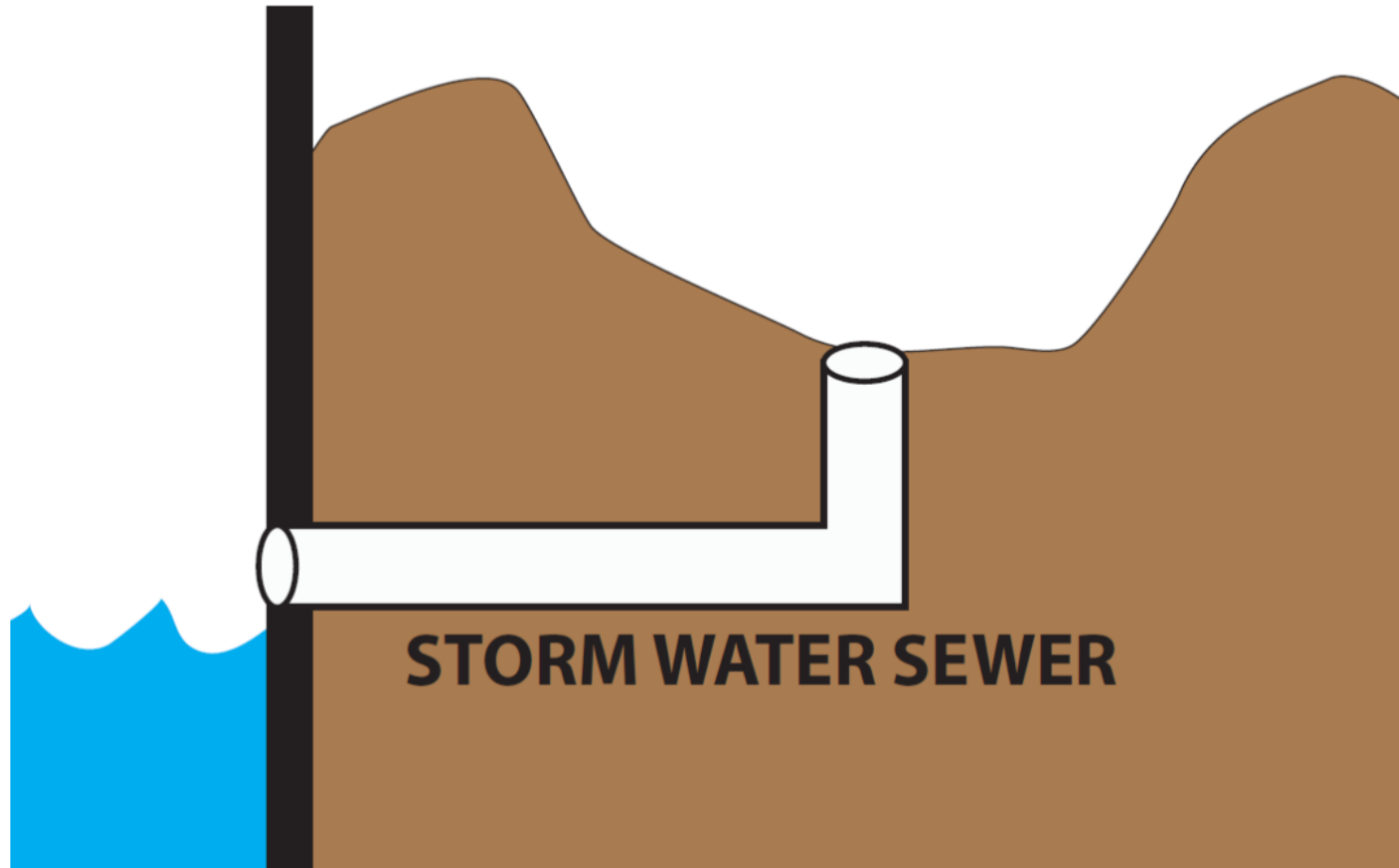


FIGURE 4.6: STORMWATER DRAIN WITH SALTWATER DISCHARGE DURING KING TIDE, NOVEMBER 14, 2012



FIGURE 4.7: SALTWATER FLOODING OF YARDS AND STREETS FROM STORMWATER DRAIN DISCHARGE DURING KING TIDE, NOVEMBER 14, 2012

**SEAWALL**

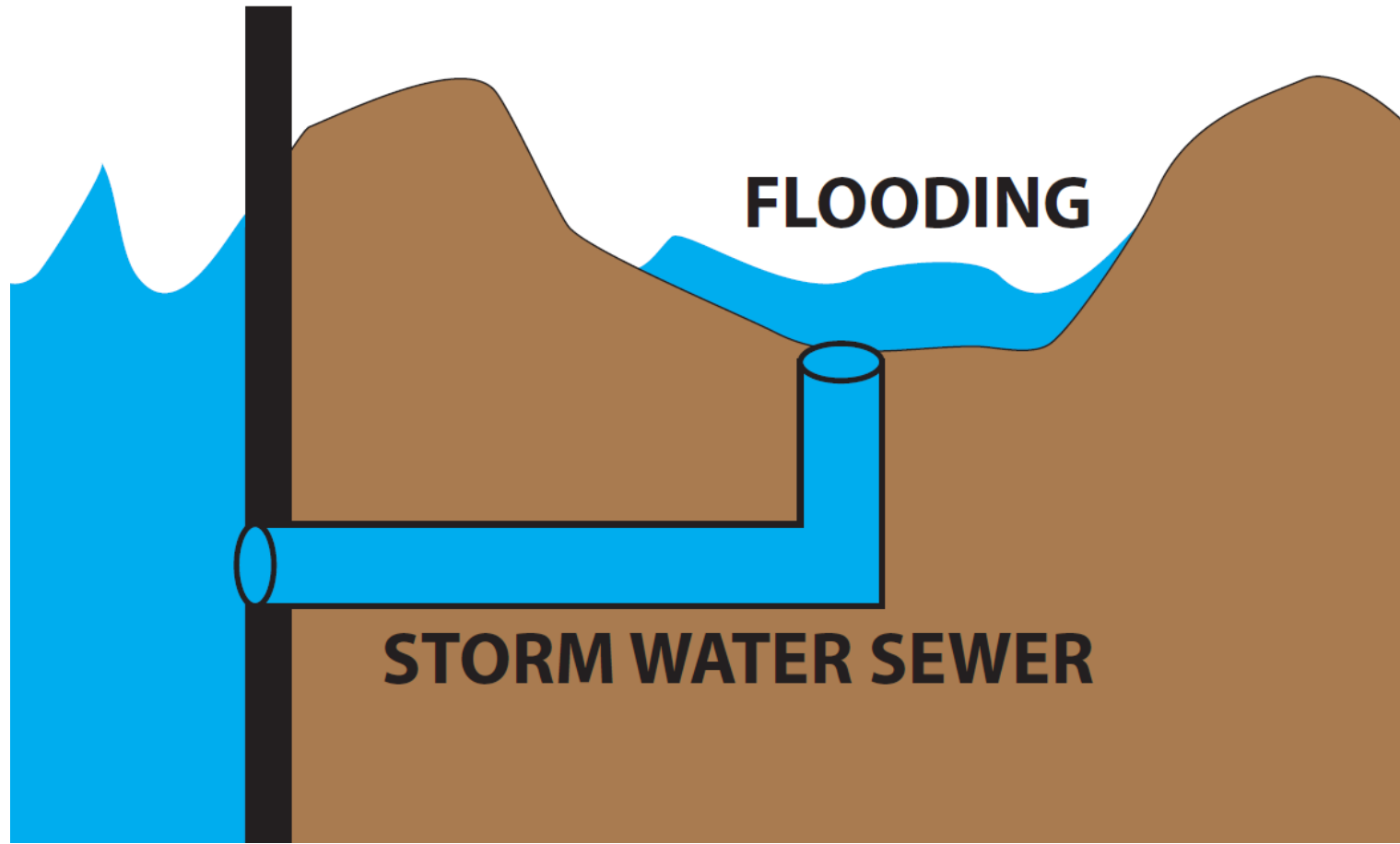


**STORM WATER SEWER**

**SEAWALL**

**FLOODING**

**STORM WATER SEWER**





# SW Tybee Island: Local Government Action

Action: Stormwater backflow preventers and pipe enlargement

~\$3 Million Investment



L BACKFLOW PREVENTERS, NEAR INTERSECTION OF 14<sup>TH</sup> ST. AND VENETIAN DR.

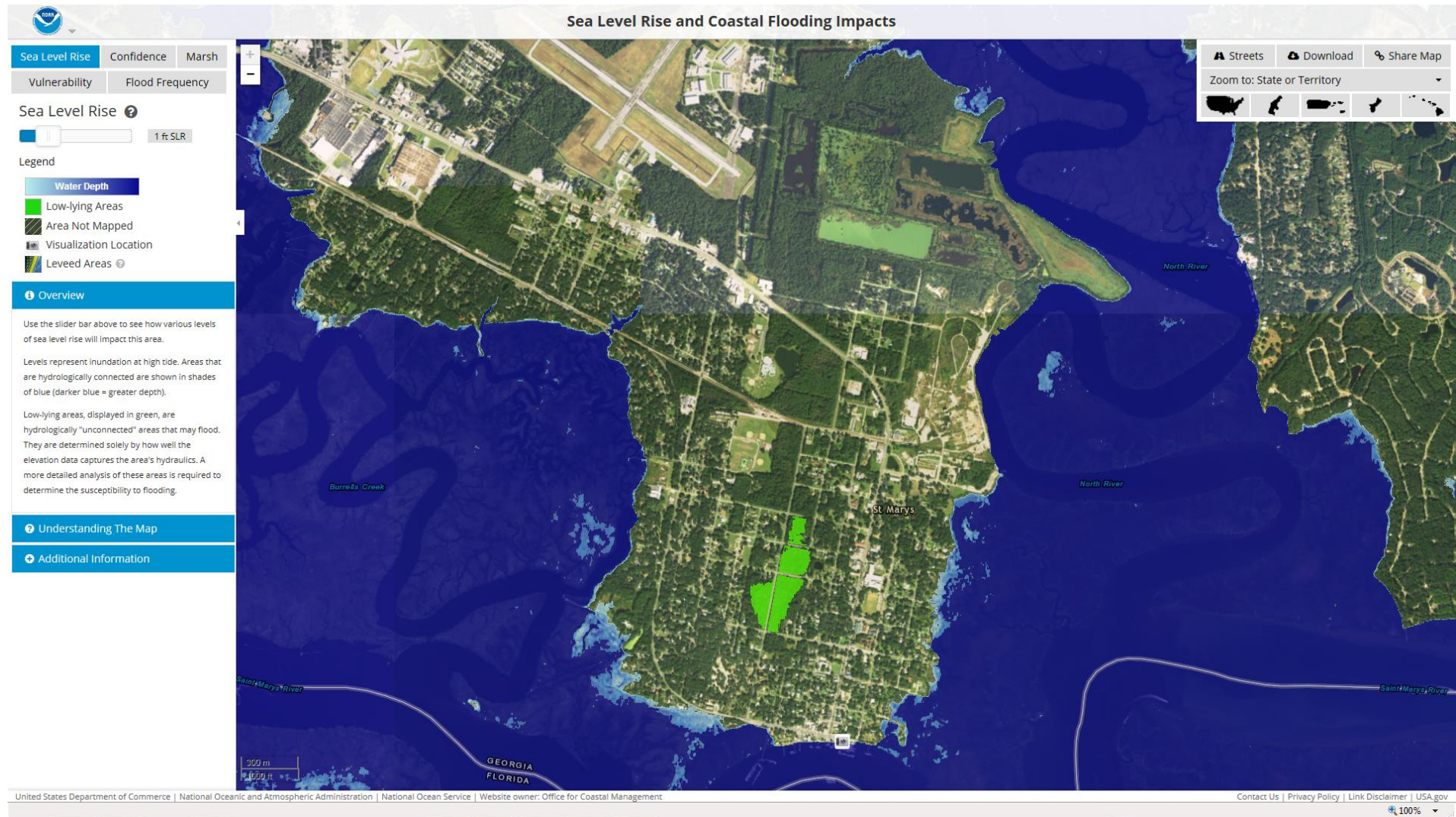


# St. Marys, GA: Mean Higher High Water, Today



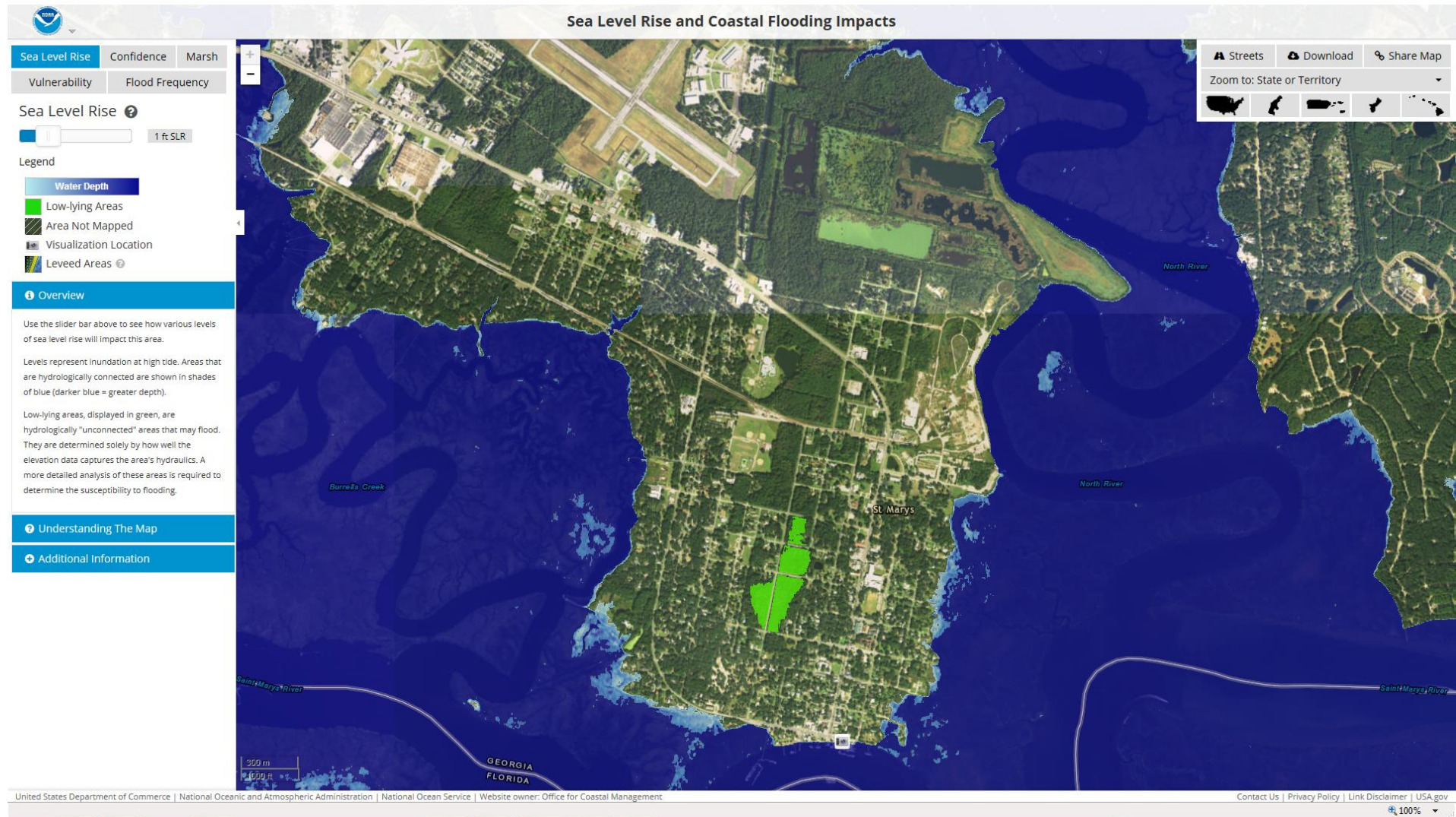


# St. Marys, GA: Mean Higher High Water, 1 Foot SLR



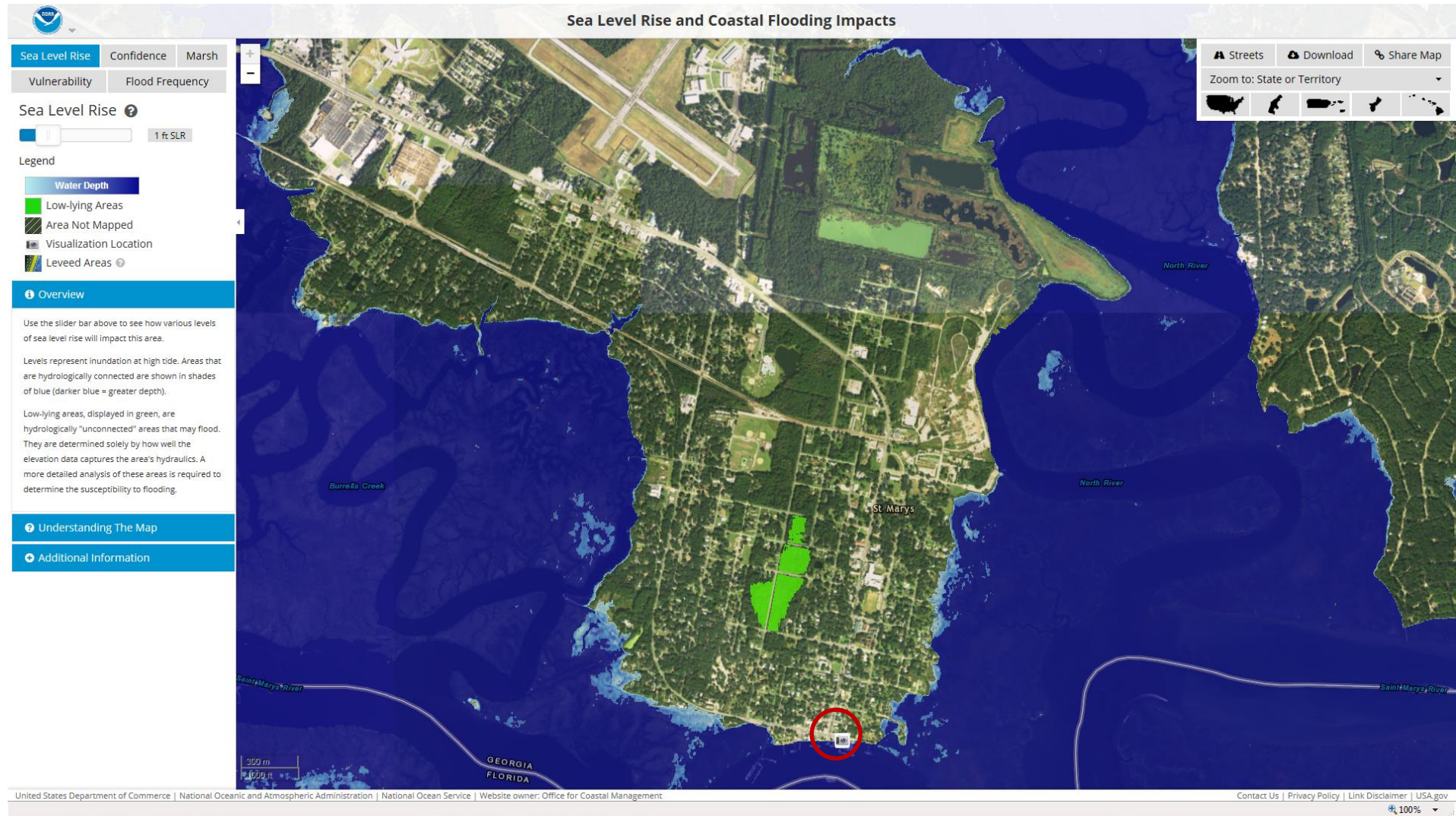


# St. Marys, GA: Mean Higher High Water, 2 Foot SLR



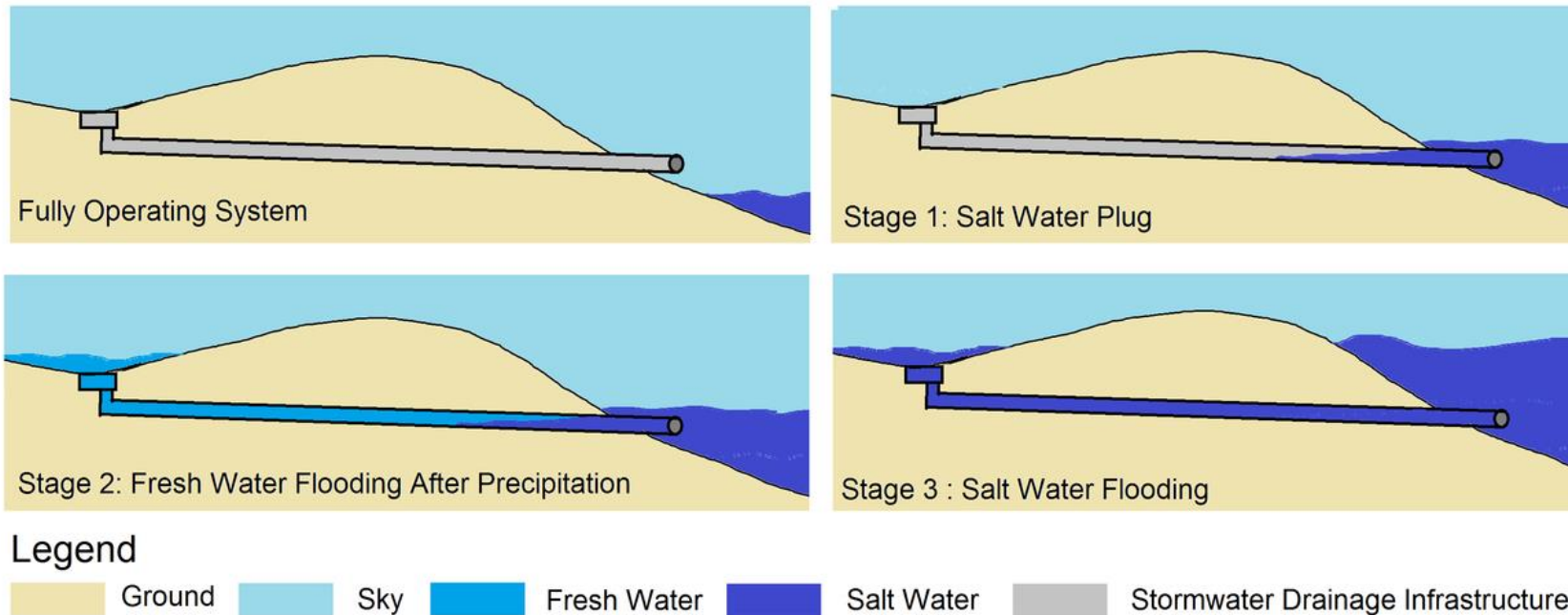


# St. Marys, GA: Mean Higher High Water, 2 Foot SLR





# Stages of stormwater failure with sea-level rise



Graphic by Emily  
Niederman, Stetson  
University



## Osborne Waterfront Stormwater Drainage

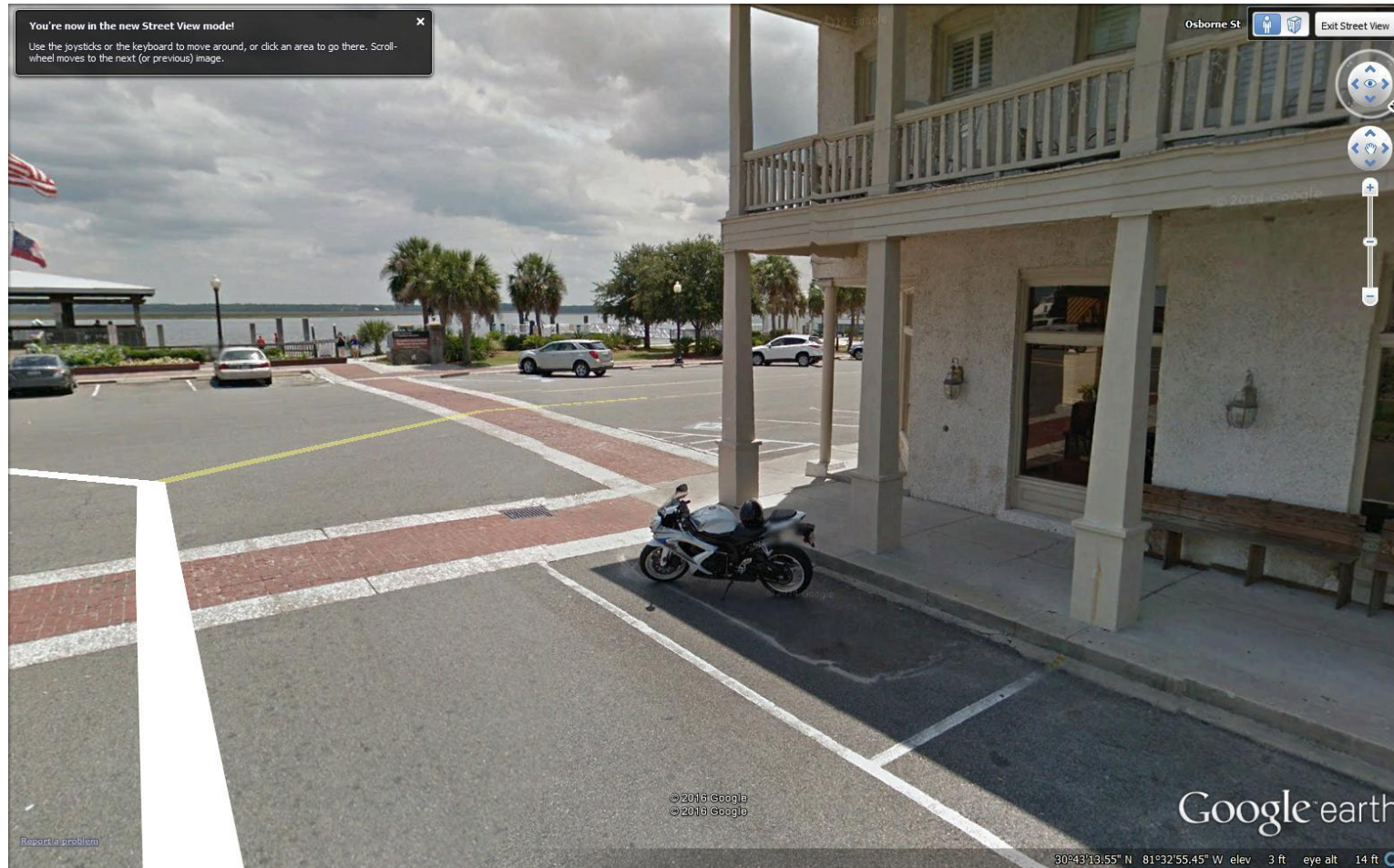
St. Marys, GA



# Osborne Ave., St. Marys, GA (Facing North)



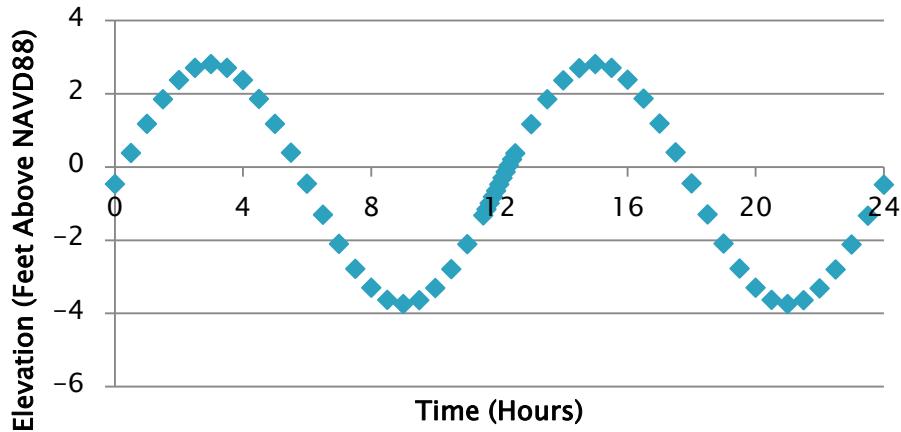
# Osborne Ave., St. Marys, GA (Facing South)



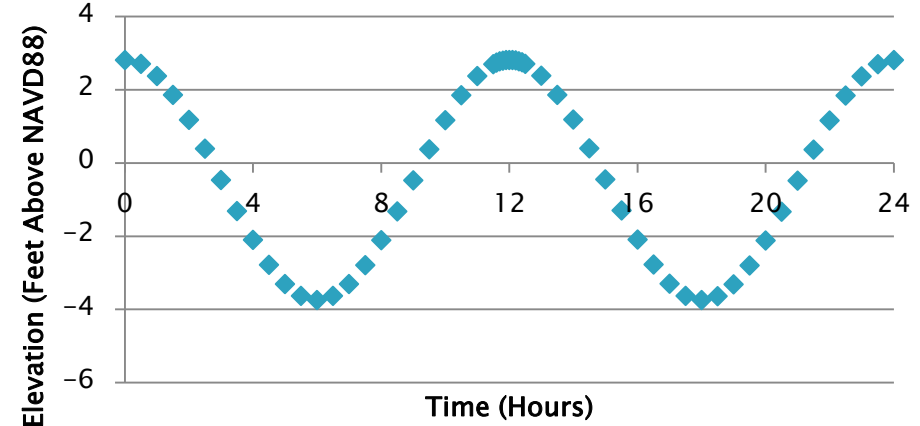


# Idealized Tidal Scenarios (24-Hour Rainfall Event)

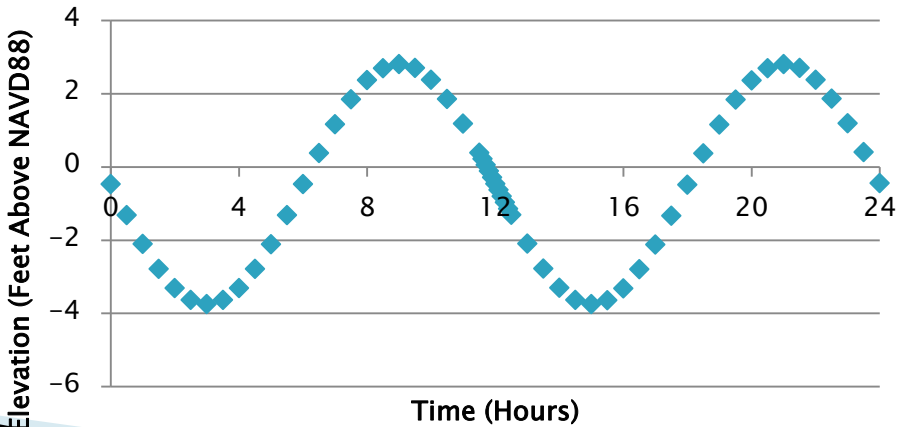
## Sine Tide



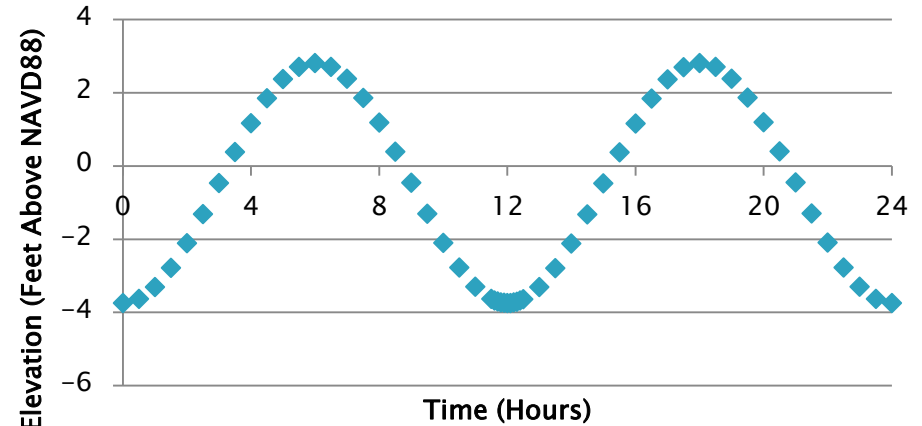
## Cosine Tide

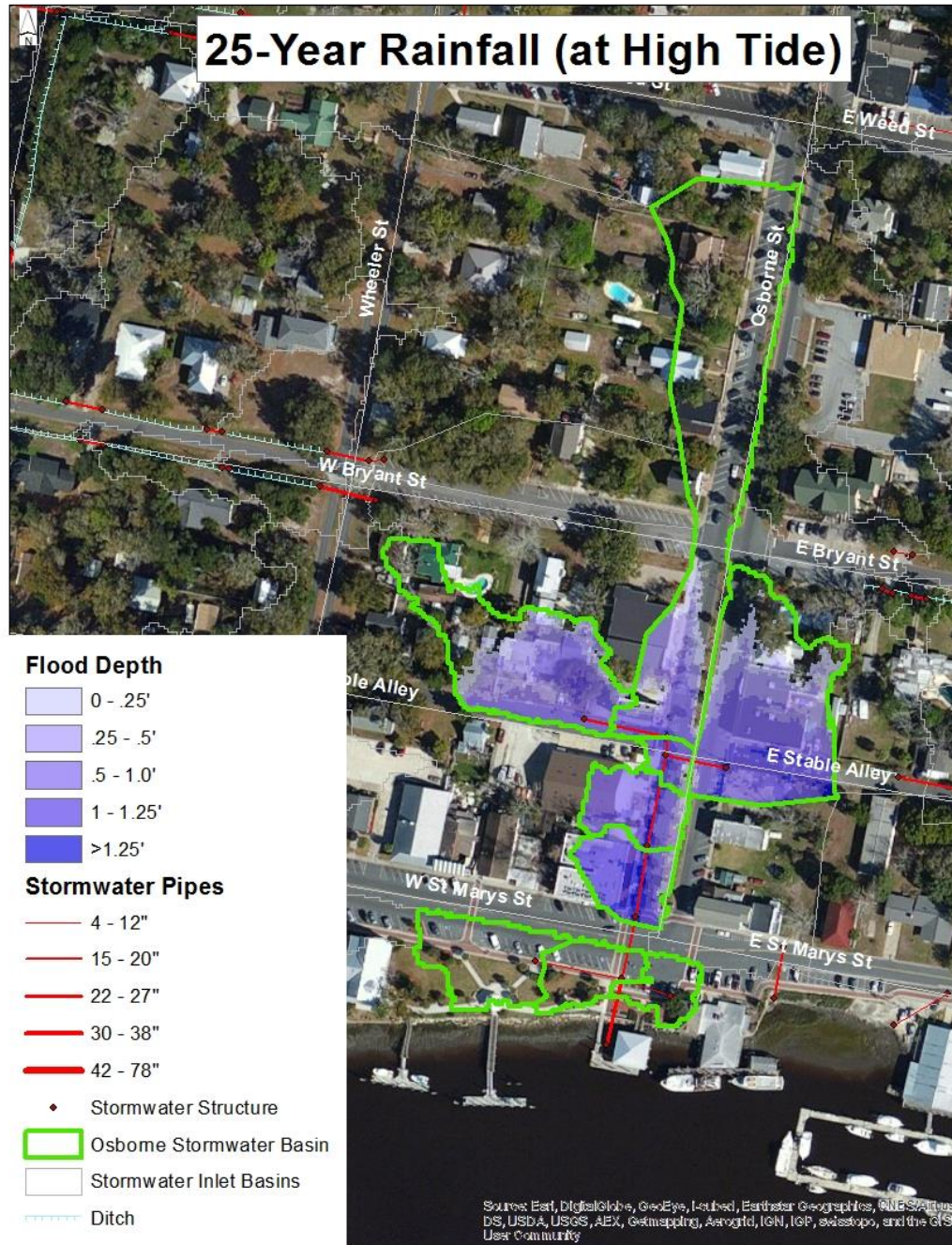


## Negative Sine Tide



## Negative Cosine Tide





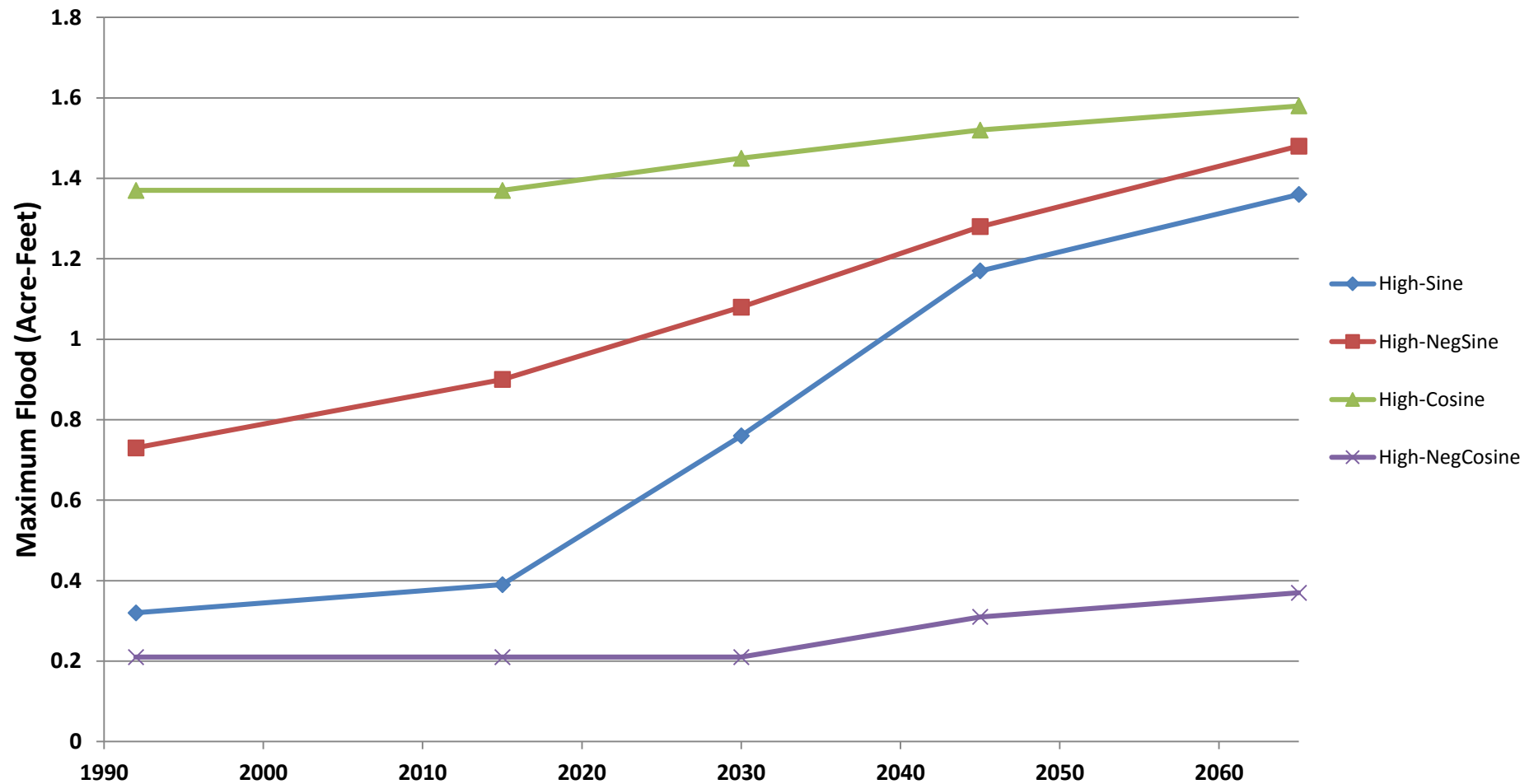
## Osborne Waterfront Stormwater Drainage

St. Marys, GA

25-Year Rainfall with  
Peak Flow at High Tide

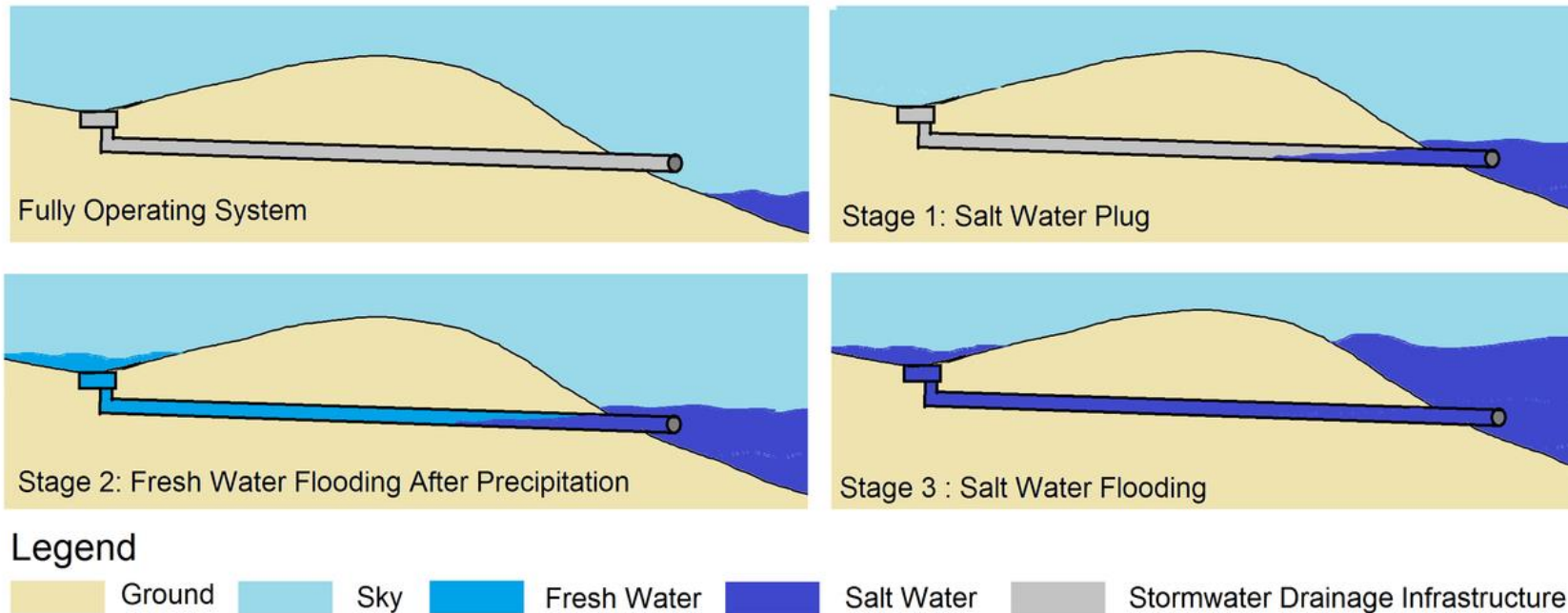
(Cosine Scenario)

## 25-Year Rainfall\* Max Drainage Volume Deficit with High Sea Level Rise (Osborne Drainage, St. Marys, GA)



\*9.05" in 24-Hours

# Stages of stormwater failure with sea-level rise



Graphic by Emily  
Niederman, Stetson  
University



# Stages of stormwater adaptation

- 1) Systematically documenting stormwater drainage failures, such as street flooding
  - 2) Digital mapping of storm  
    - a) Outfall and infall points
    - b) Pipe extents
    - c) Invert elevations
  - 3) Near-term retrofits – “di  
    - a) Backflow preventers
    - b) Decrease run-off coefficient
  - 4) Long-term retrofits  
    - a) Increase pipe sizes
    - b) Green infrastructure
    - c) Pumps
- More expensive further down the list!*
- Long-term and dedicated funding mechanisms very much implied*

# Modeling: More Accurate by the Day Policy

## Framing: Much More Difficult

What is an appropriate level of service for maintaining stormwater and roads under sea level rise?

