

# Coastal Baseline for Climate Change and Sea Level Rise Planning

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FSA Summer Conference  
Pre-Conference Workshop on Resiliency Planning

June 19, 2019

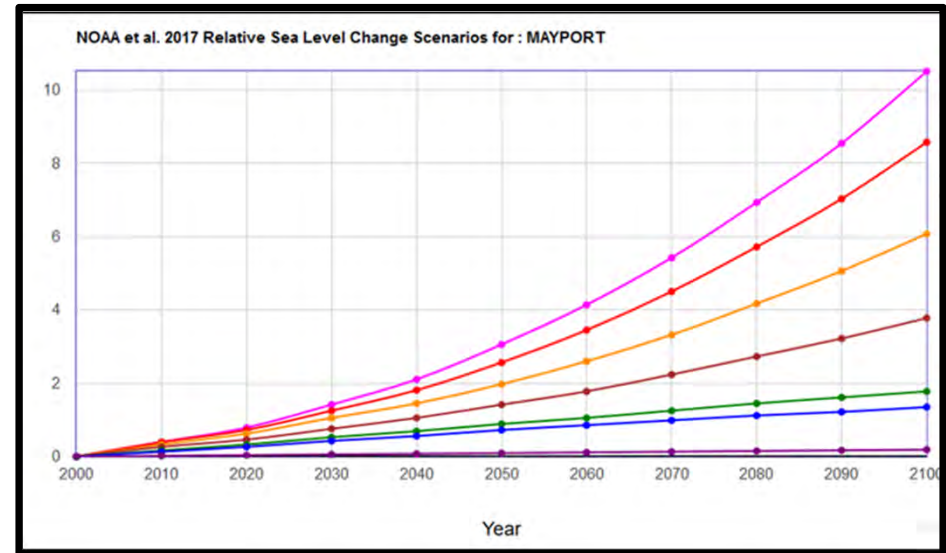
**Steve Peene, PhD**  
**Water Resources Principal**



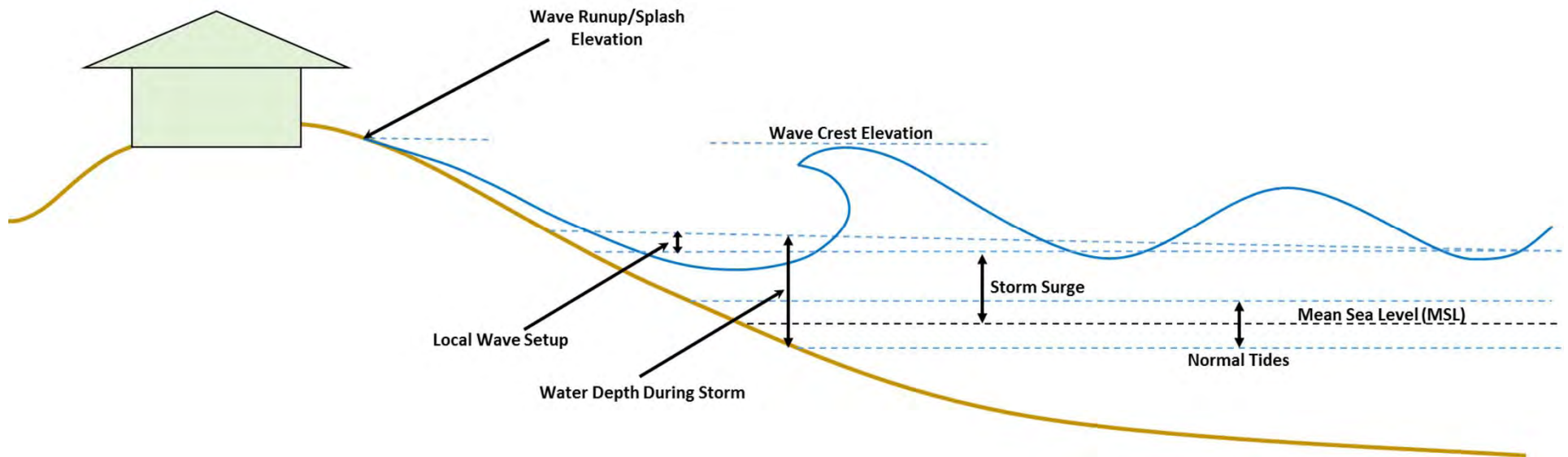
**Letting Science Tell the Story: Practical and Powerful Resiliency Planning**

# Presentation Outline

- Components of Coastal Risk (FEMA coastal terminology)
- Past Practices
- Best Practice Approaches
- Integrating Coastal Risk with Hydrologic Risk



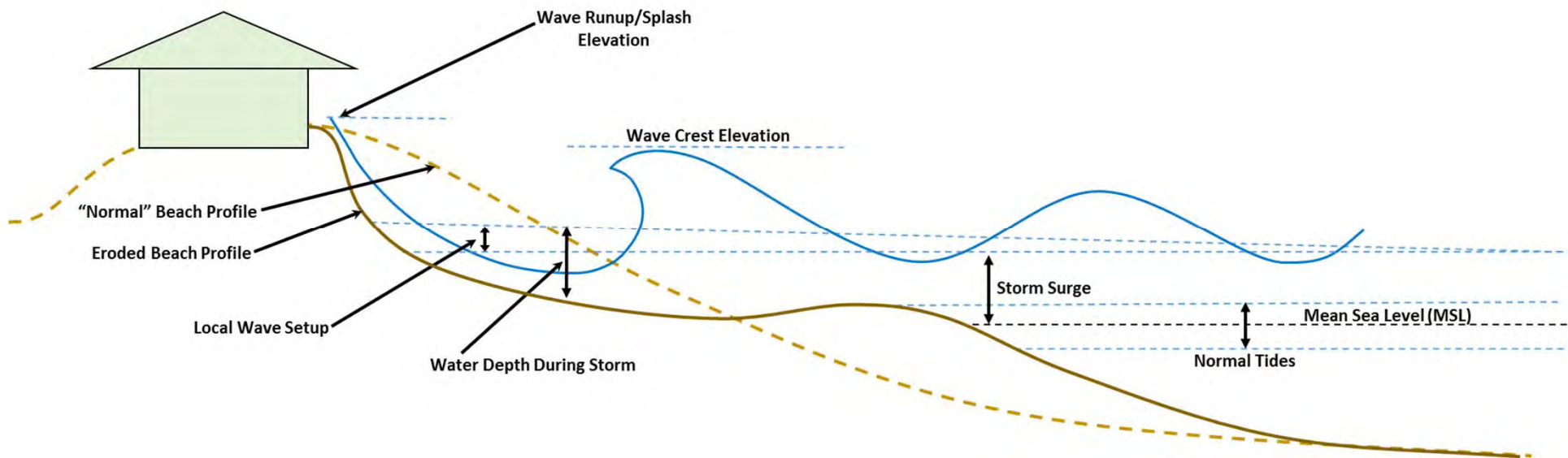
# Components of Coastal Risk Assessment



## EFFECTS FROM:

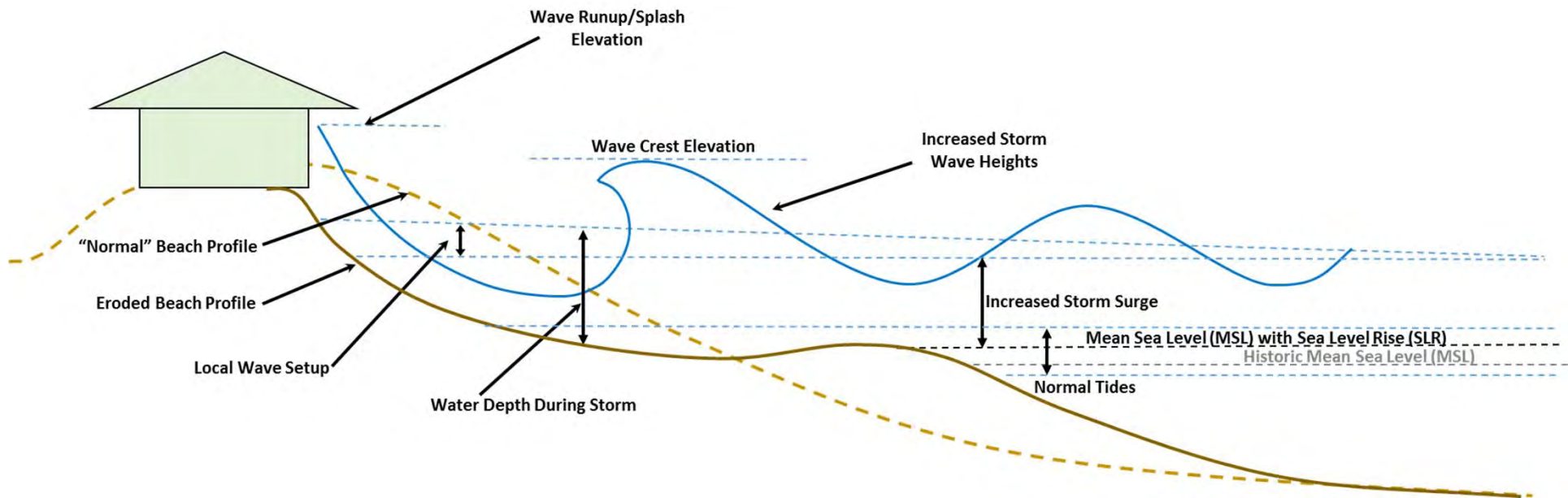
Storm Surge  
Wave Setup  
Wave Runup/Splash

# Components of Coastal Risk Assessment



**EFFECTS FROM:**  
**Storm Beach Erosion**  
Storm Surge  
Wave Setup  
Wave Runup/Splash

# Components of Coastal Risk Assessment



## EFFECTS FROM:

### Sea Level Rise

Storm Beach Erosion

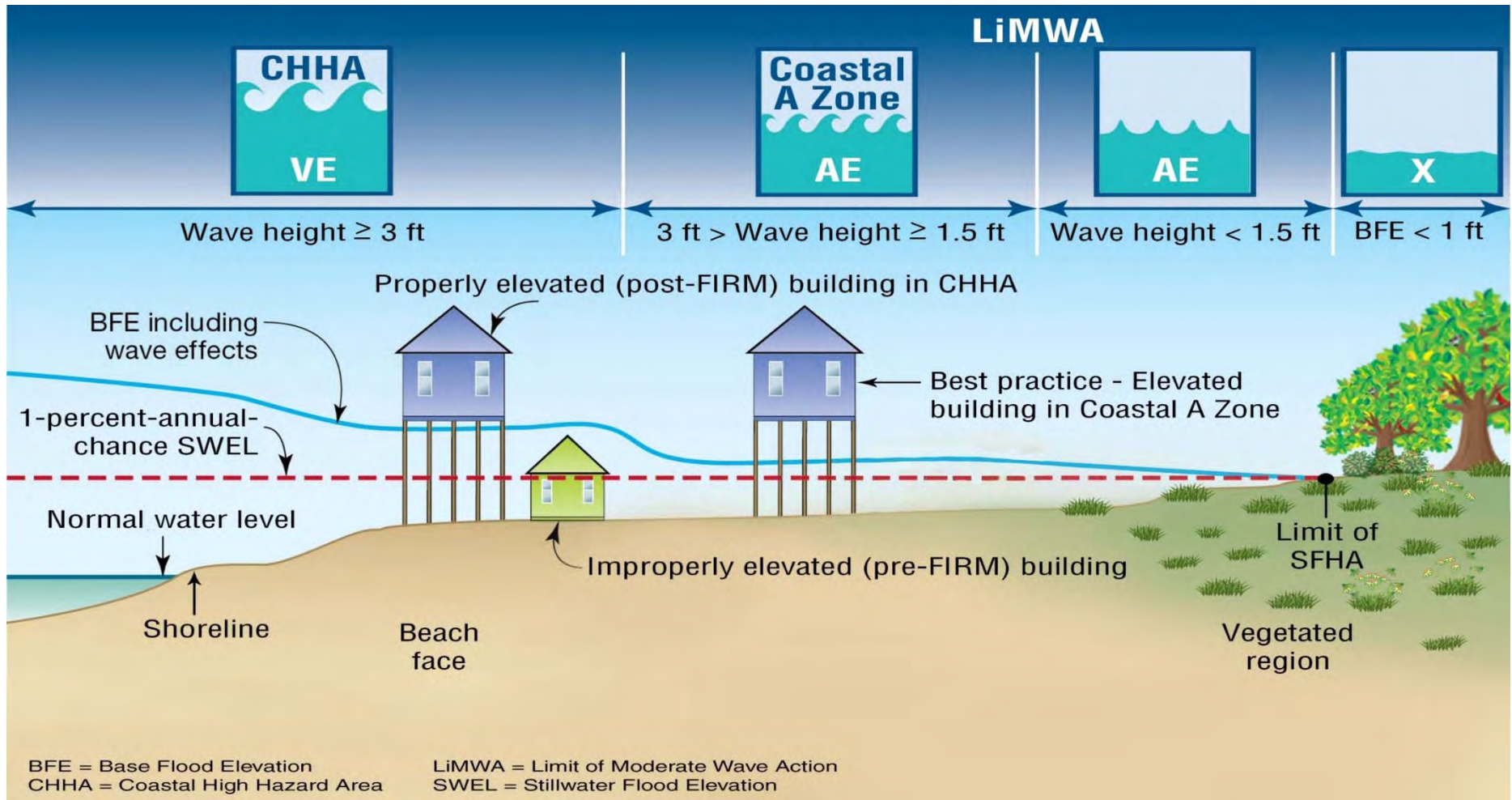
Storm Surge

Wave Setup

Wave Runup/Splash

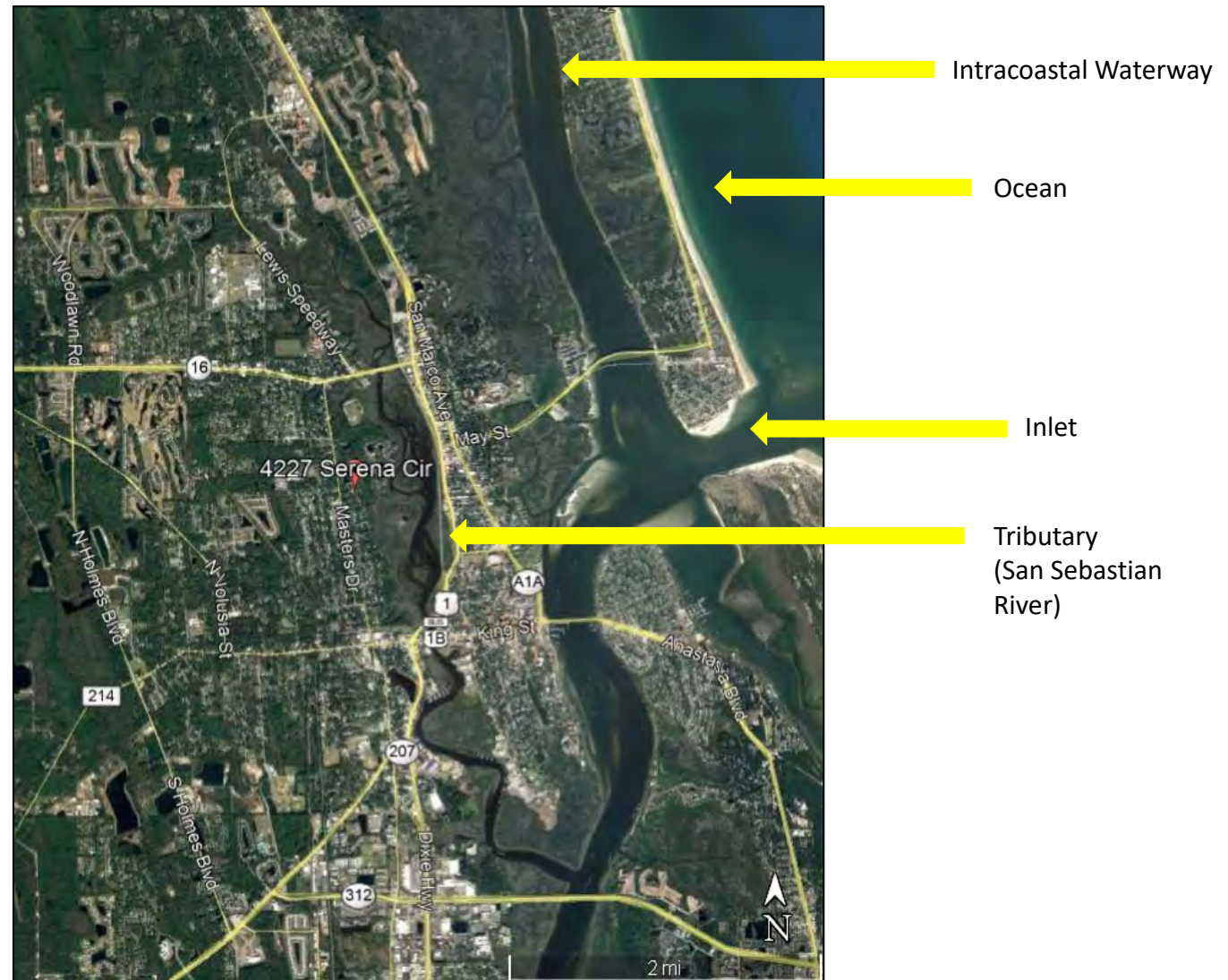


# FEMA Coastal Terminology



# Why is this Relevant to Stormwater Professionals?

North St.  
Augustine/  
St. Johns  
County





# Tools

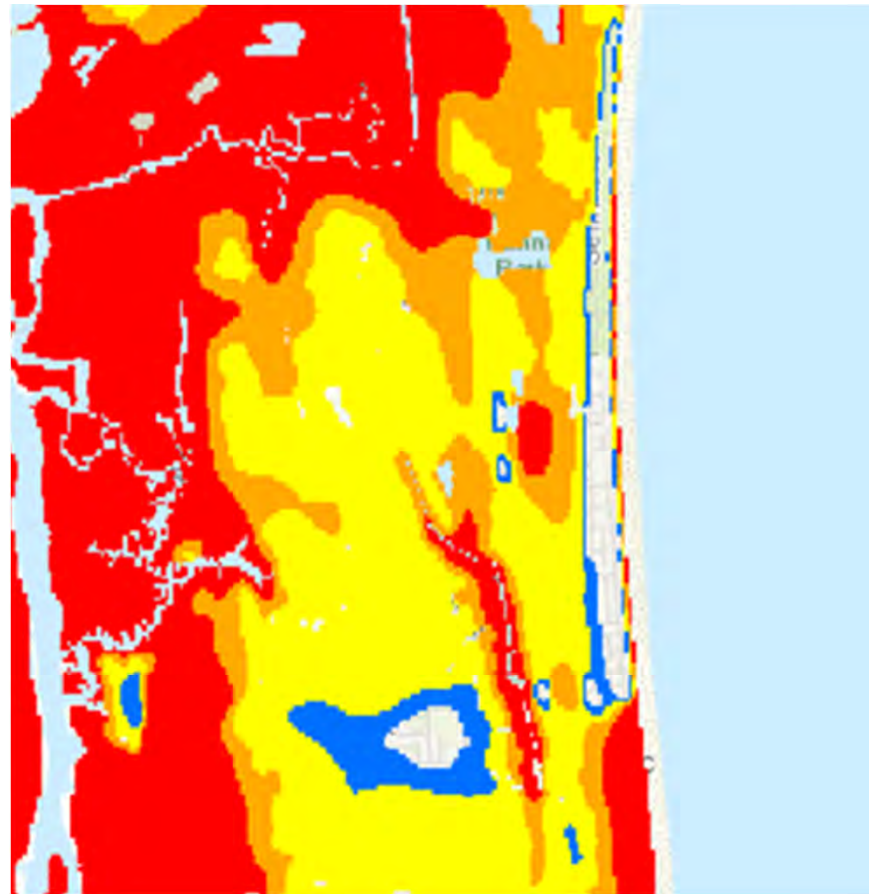
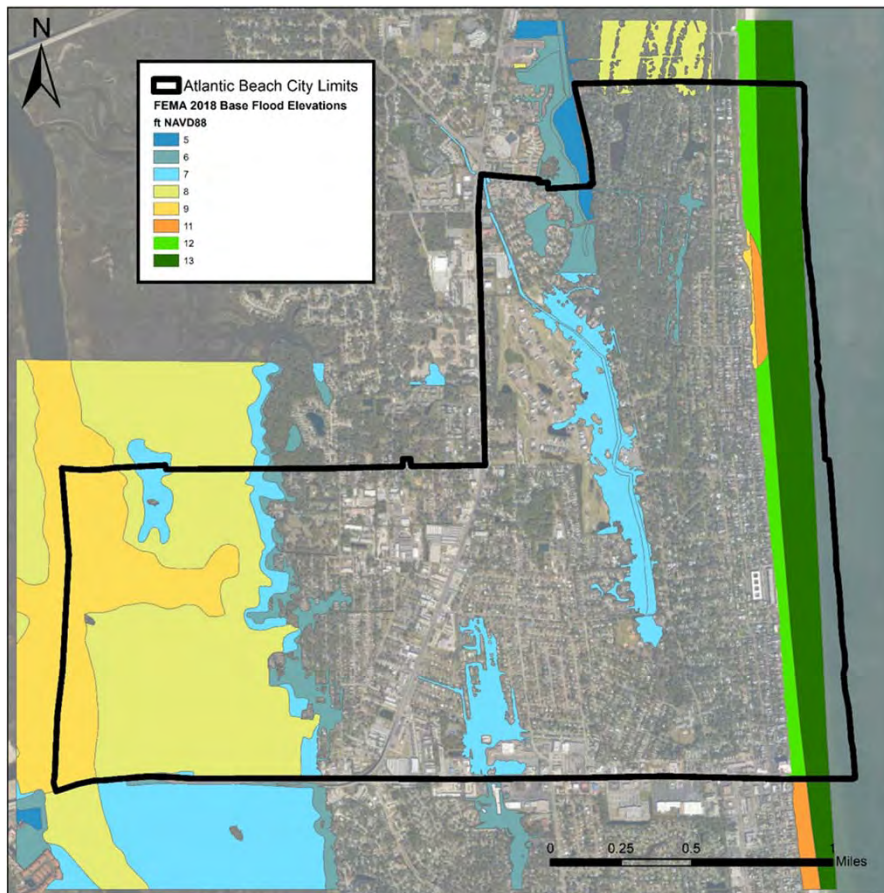
- Visualization
- **Models**
- Decision Support

ADvanced CIRCulation Model (ADCIRC) (University of North Carolina at Chapel Hill, University of Notre Dame, University of Texas at Austin)	This tool can be used to analyze the effects of sea level rise on storm surge. Future scenarios can consider a given rate of sea level rise and determine how much additional inundation is predicted during a storm event compared to that under initial conditions.
Hazus-MH (FEMA)	This tool is a risk assessment methodology for analyzing potential losses. Although it is not specifically designed for sea level rise planning applications, many communities have used it to assess potential losses due to sea level rise.
Integrated Valuation of Environmental Services and Tradeoffs (InVEST) (Nature Capital Project)	This tool is a suite of software models that is used to map and model ecosystem services and their variation under different management and climate scenarios. The Coastal Vulnerability Model can be used to calculate a vulnerability index for the impacts of erosion and inundation on coastal communities that accounts for projected change in sea level rise.
NatureServe Climate Change Vulnerability Index (CCVI)	This is an Excel-based tool that identifies plant and animal species that are particularly vulnerable to the effects of climate change and can help assess the relative vulnerability of species of interest occurring on the coast that may be impacted by sea level rise.
NOAA Wave Exposure Model (WEMo)	This is a free tool that estimates wave energy and its effects on ecosystem functions as well as on developed coastal and inland-water areas.
Sea Levels Affecting Marshes Model (SLAMM) (Warren Pinnacle Consulting, Inc.)	This tool simulates wetland conversion and shoreline modification resulting from long-term sea level rise. As such, the tool can be used for projecting the effects of sea level rise on the distribution of coastal wetlands and the geomorphic configuration of coastal areas.
Simulator of Climate Change Risks and Adaptation Initiatives (SimCLIM) (CLIMsystems Ltd.)	This tool can be used to model site-specific sea level rise. The tool can create scenarios and project impacts of sea level rise.
USACE Sea Level Change Curve Calculator	This tool can be used to calculate the amount of predicted sea level change for any location along the U.S. coast from 1992 forward. Results are shown as a graph.



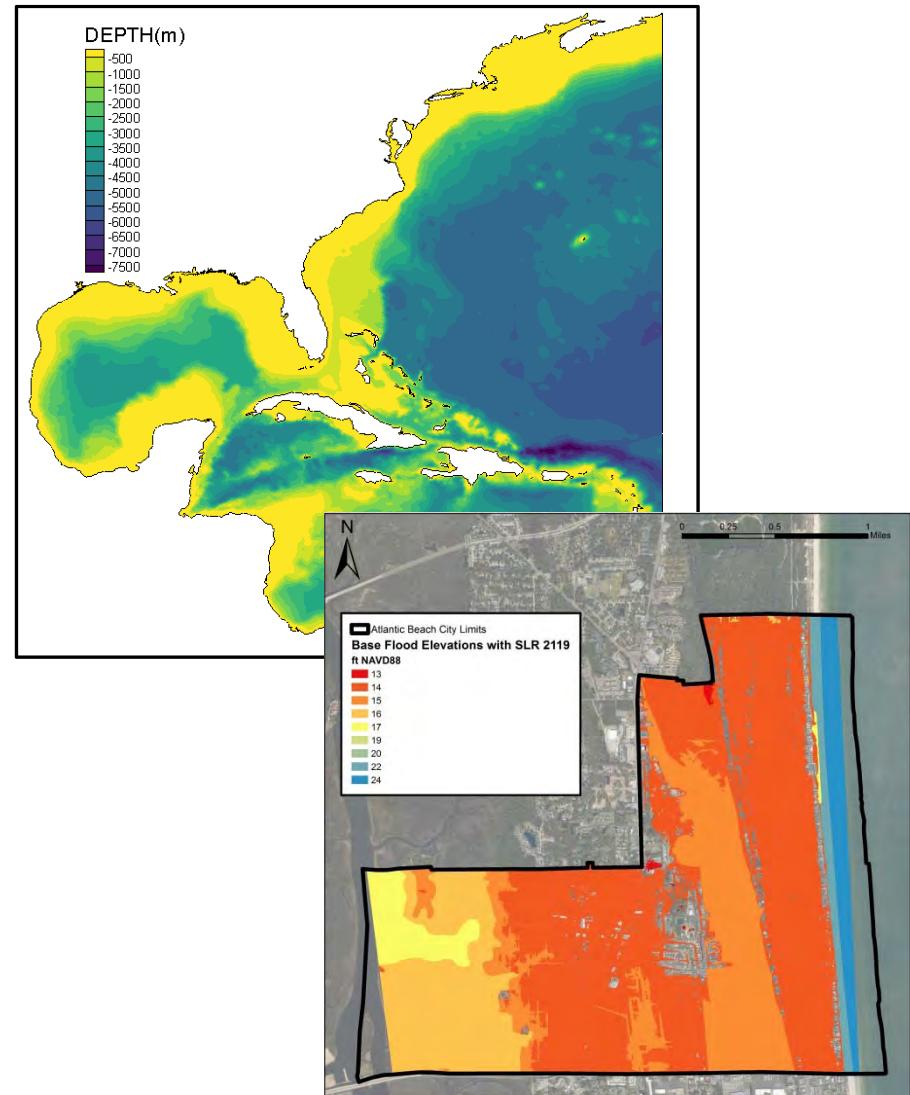
# Past Practices

Comparison of a 1:100 year present FEMA projection  
SWEL (ADCIRC/SWANN) versus SLOSH model



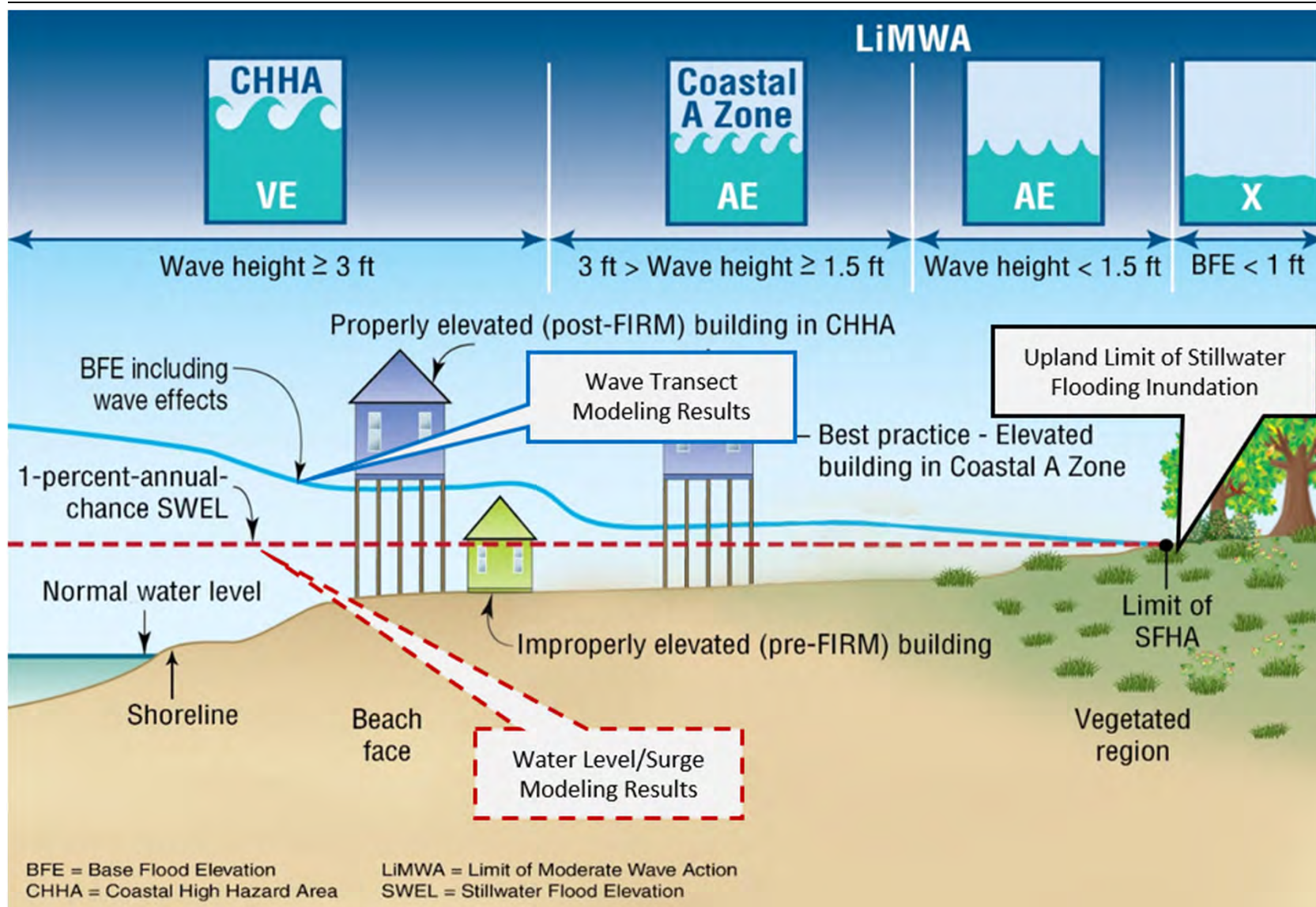
# Best Practice Approaches

- Need for a range of best practice approaches to meet community needs
- Build off FEMA accepted methods
- Account for coastal components relevant to area to be evaluated

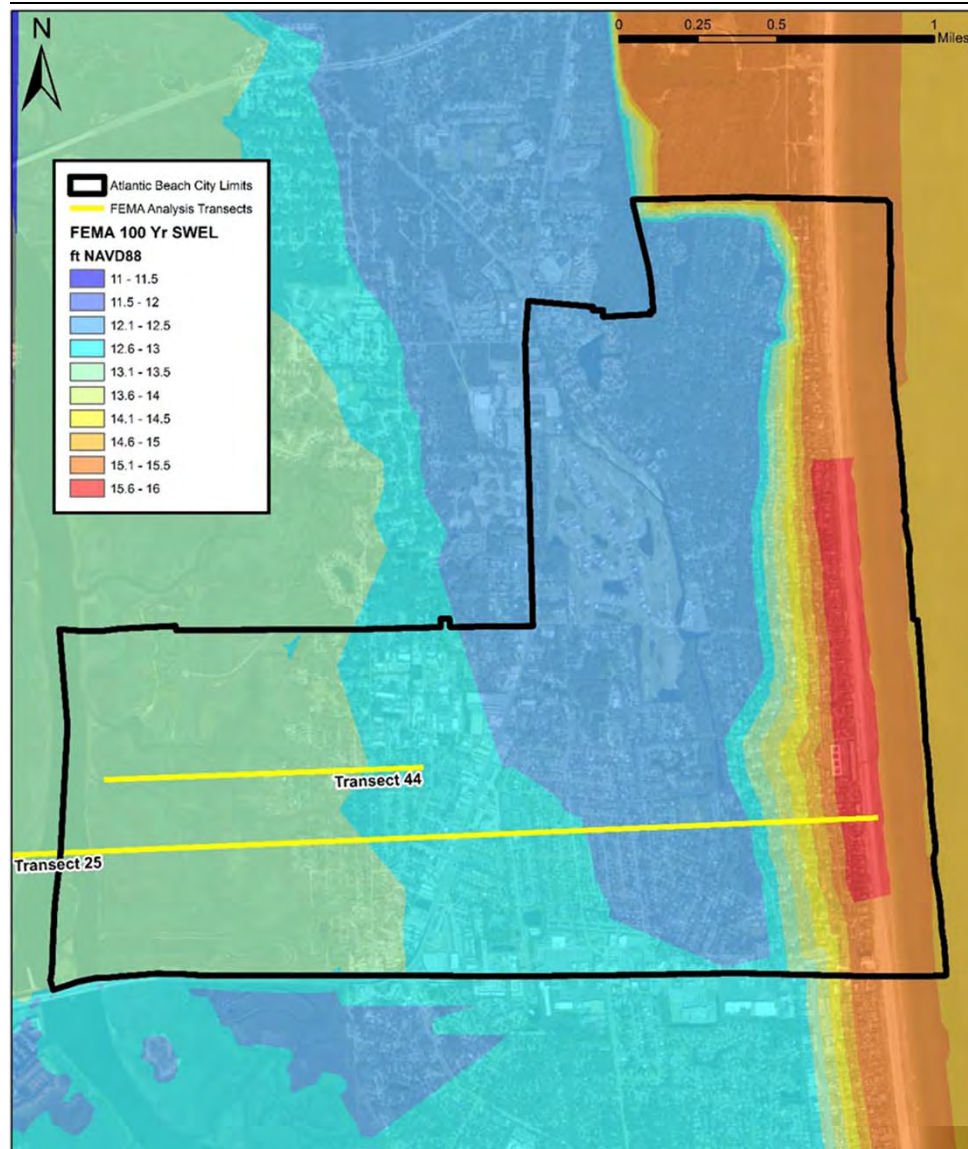




# Coastal Risk Assessment – FEMA/WHAFIS



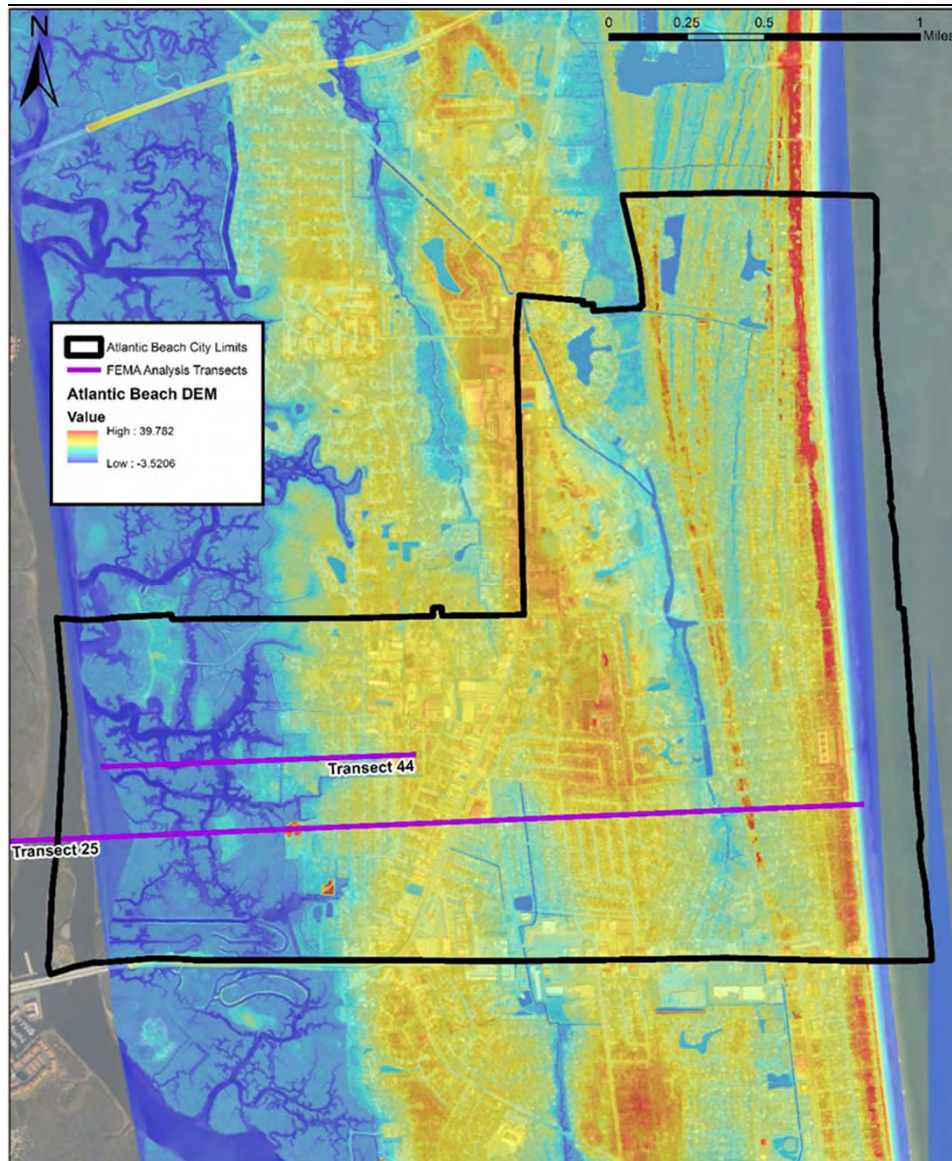
# Coastal Risk Assessment – FEMA/WHAFIS



FEMA 100-Year SWEL and  
FIS analysis transects  
Atlantic Beach, FL

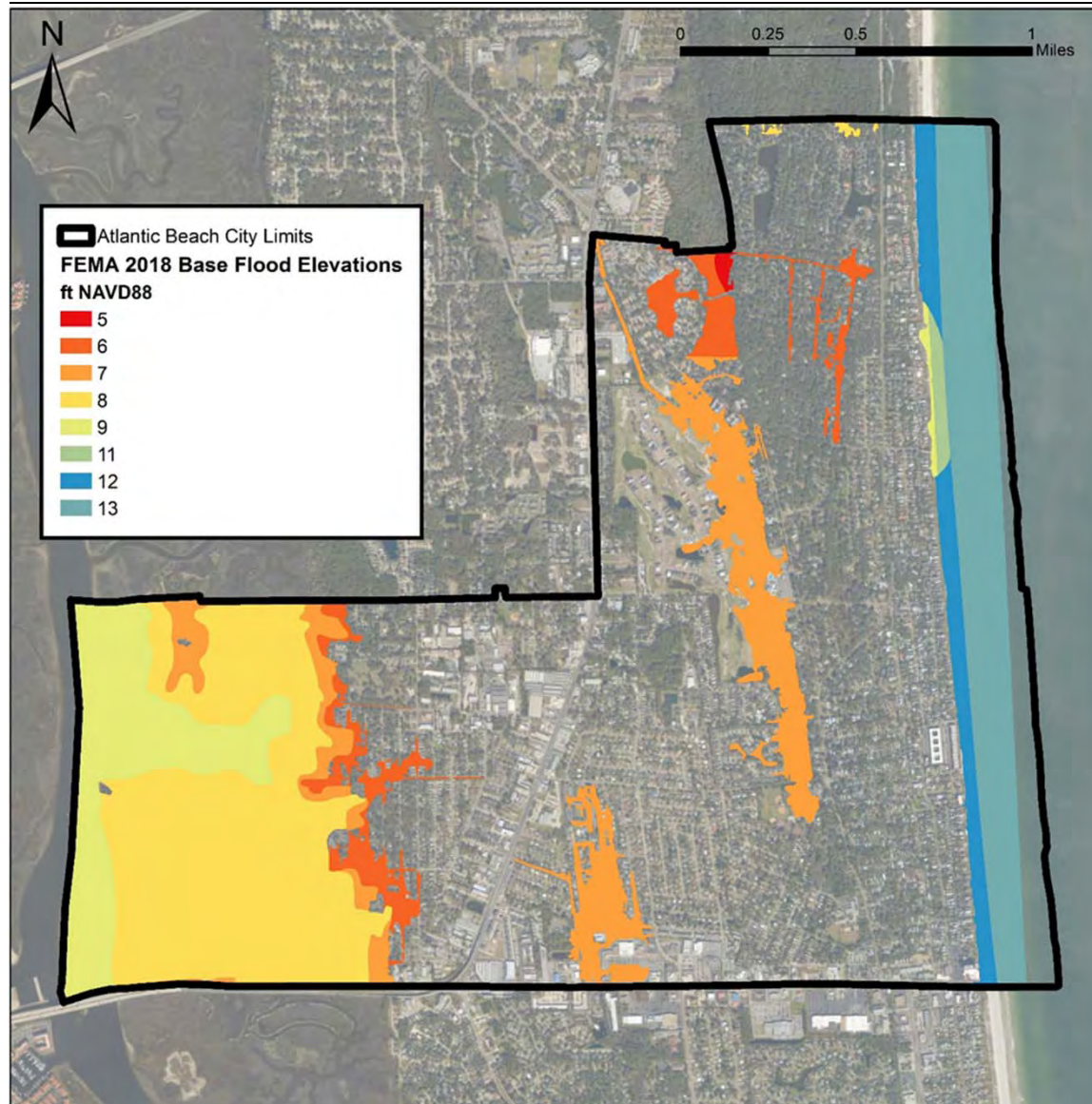


# Coastal Risk Assessment – FEMA/WHAFIS



Topography and Transects  
Atlantic Beach, FL

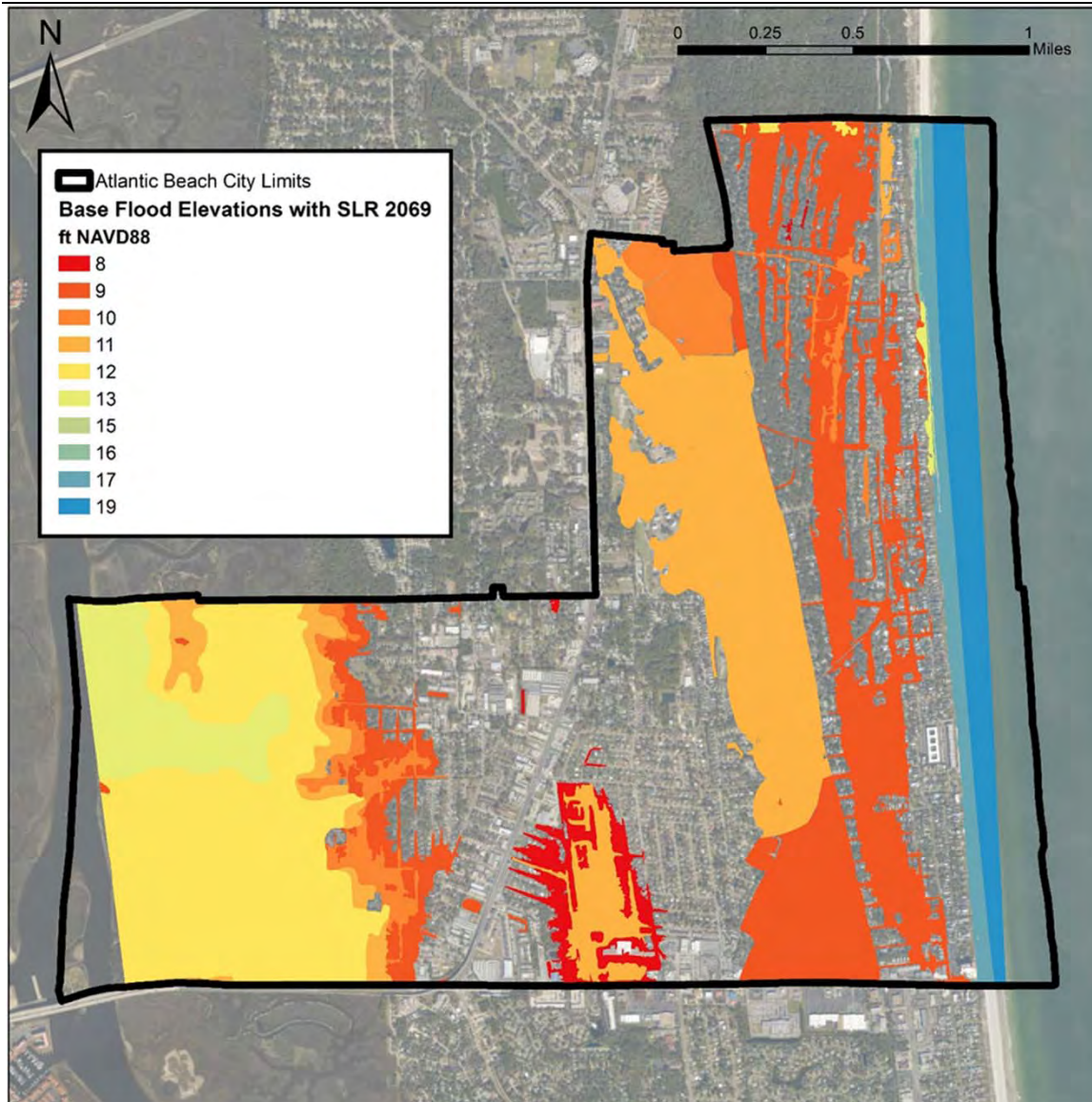
# Coastal Risk Assessment – FEMA/WHAFIS



Base flood  
elevation (BFE)  
inundation based  
on  
effective FEMA  
FIRM  
Atlantic Beach, FL



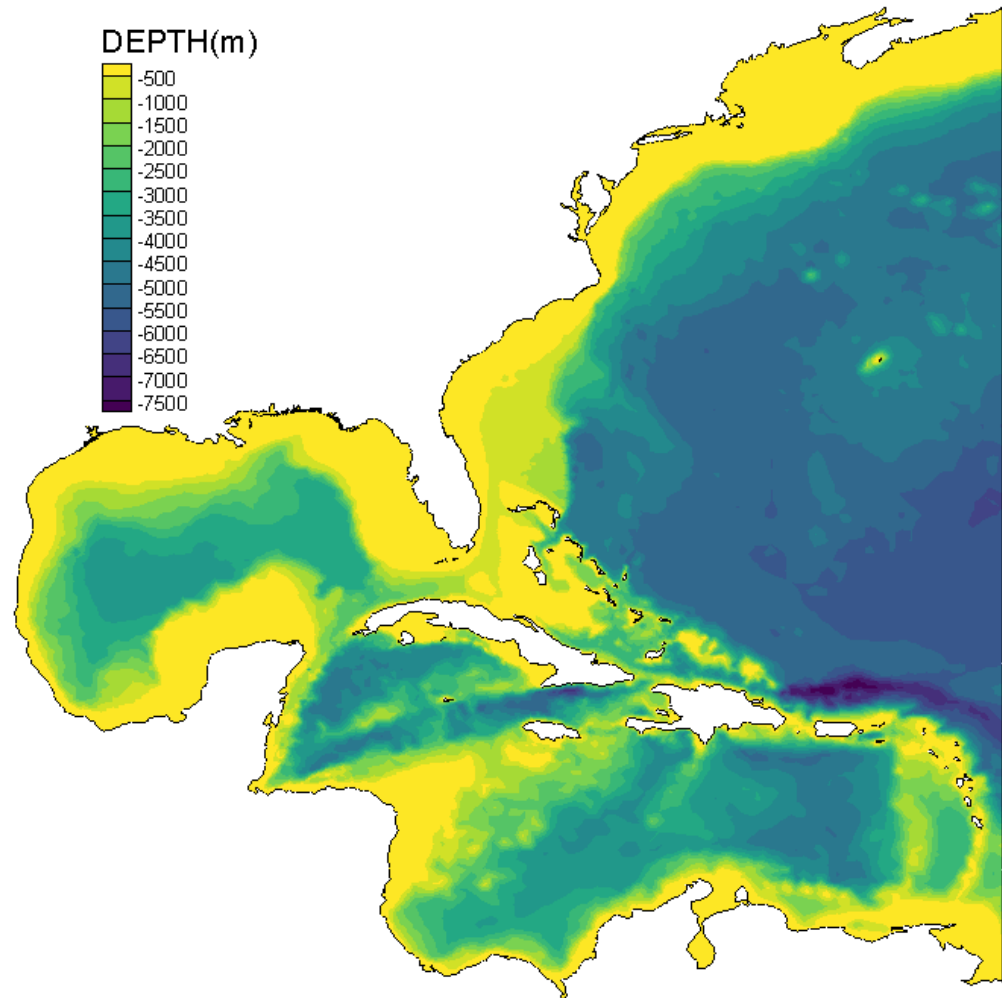
# Coastal Risk Assessment – FEMA/WHAFIS



BFE inundation  
with SLR  
Year 2069  
Atlantic Beach, FL

# Coastal Risk Assessment – ADCIRC/SWANN

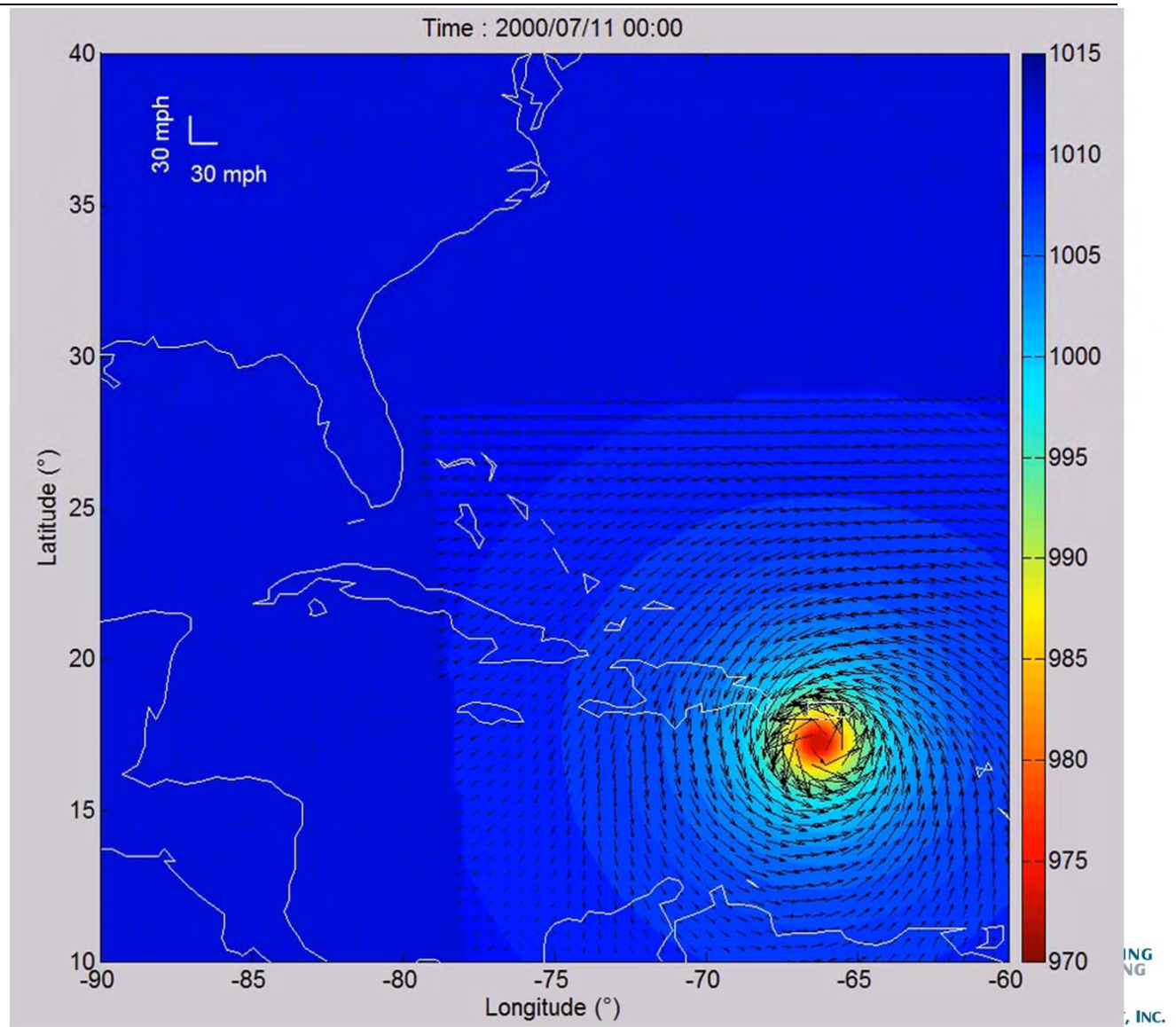
- Utilize the FEMA baseline ADCIRC/SWANN models
- Regional models focused on specific areas
- Apply sea level rise
- Allow surge waves to propagate under higher water levels





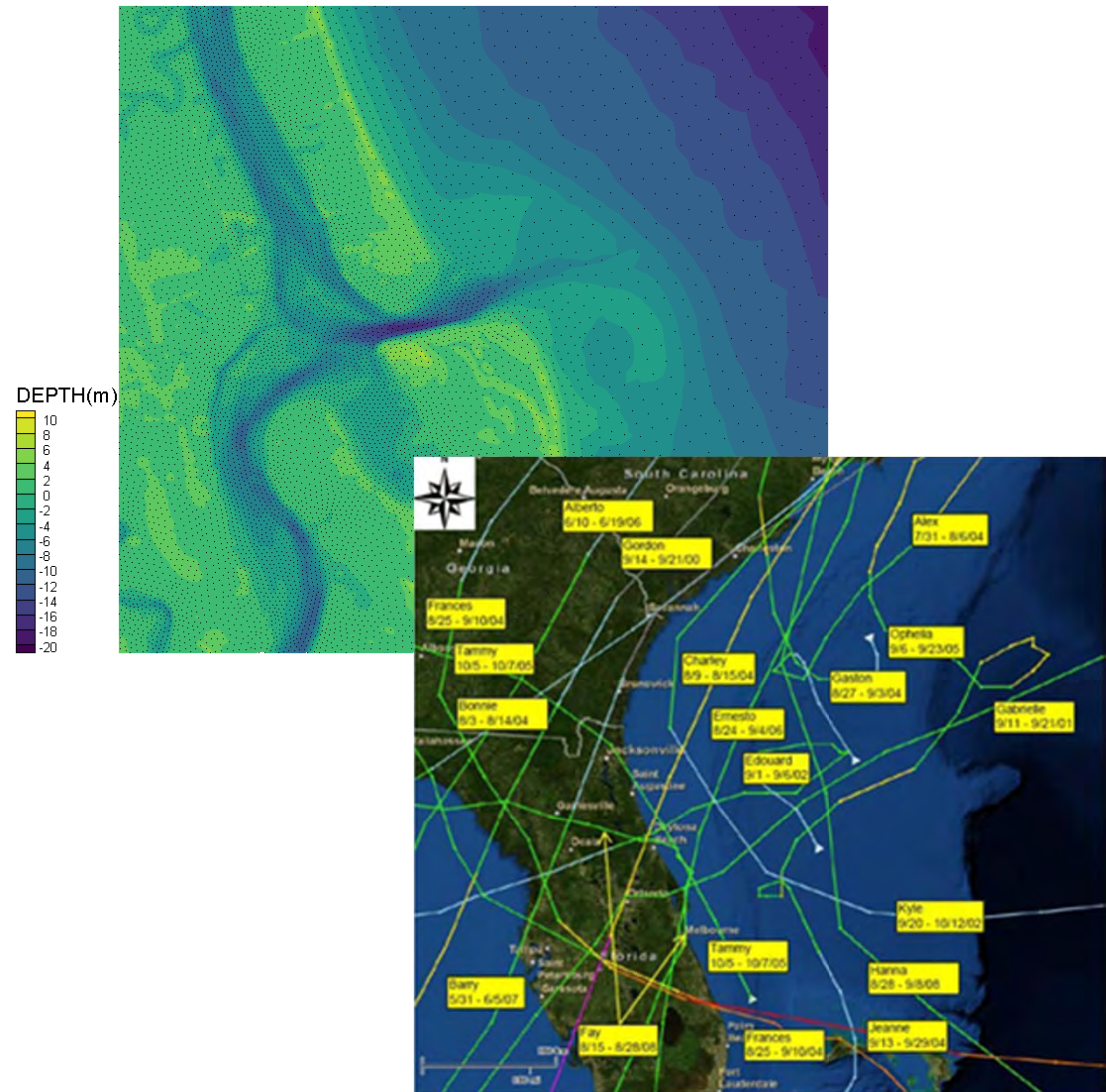
# Coastal Risk Assessment – ADCIRC/SWANN

- Uses time varying wind and pressure fields
- Models are run with multiple storms - synthetic and real
- Verified against real storm data
- Results of multiple storms post-processed



# Coastal Risk Assessment - ADCIRC

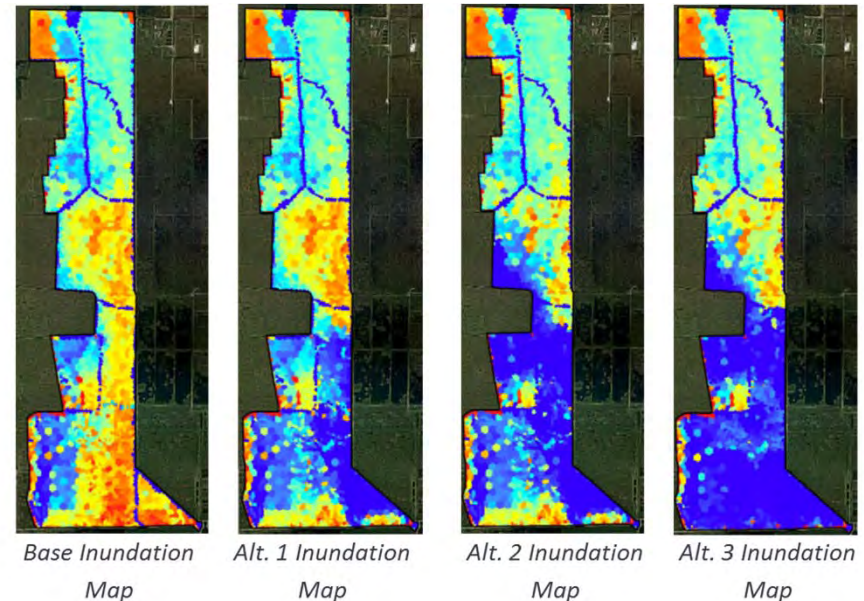
- Conduct baseline evaluation of the model results against data to improve model
- Improve localized resolution as needed to reflect the area of interest
- Adjust storm conditions as needed to reflect future changes



# Integrating Coastal Risk with Hydrologic Risk

- Coastal conditions serve as tailwater conditions for hydrologic modeling
- Real time modeling of sea level rise scenarios allows for dynamic tailwater
- Real time versus synthetic

St. Johns  
Marsh  
Conservation  
Project





# Thank you!

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