# NY/NJ Coastal Restudy

## Community Meeting 3 | November 10, 2020

## Essex, Hudson, Union, and Middlesex Counties

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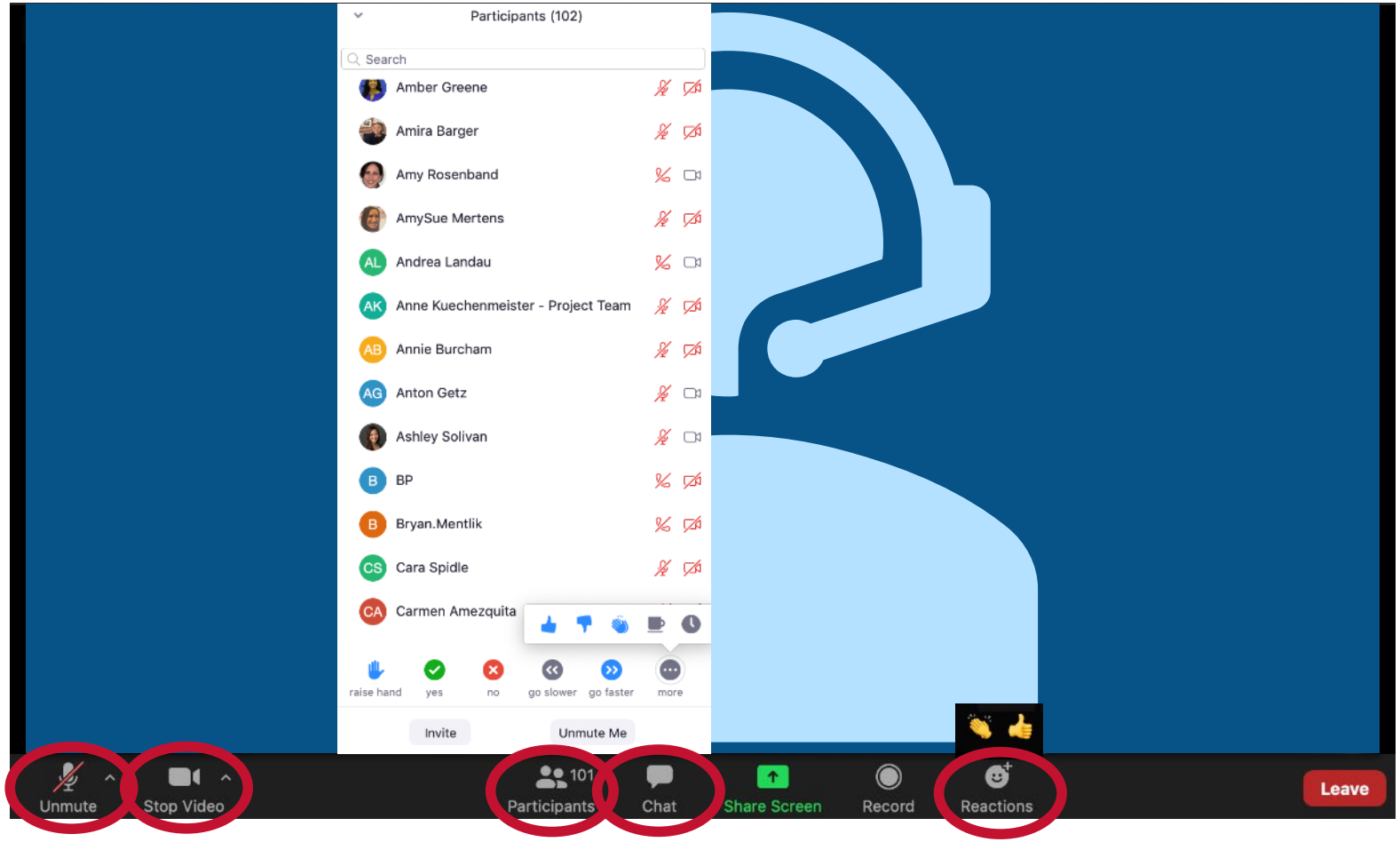
Please mute your audio and use the chat to share your name and community you're representing. We are recording today's presentation.

Photo credit NOAA/NASA

# Today's Meeting: Zoom Features

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# Use the Chat for Questions!

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# Your Presenters

**Michael P. Foley**
***Risk Analysis Branch Chief***
*FEMA Region 2*

**Chris Bender**
***Coastal Modeling Lead***
*Compass*

**Elena Drei-Horgan**
***Technical Manager***
*Compass*

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# Introductions – FEMA and State Agencies

| | Title | Staff | Phone and Email |
|---|---|---|---|
| FEMA | Region 2 Risk Analysis – Branch Chief | Michael P. Foley | (212) 680-3634<br>michael.foley3@fema.dhs.gov |
| | Region 2 Risk Analysis – Project Monitor (NJ, NYC) | Robert Schaefer, P.E. | (212) 680-8808<br>robert.schaefer@fema.dhs.gov |
| | Region 2 Risk Analysis – Project Monitor (Westchester) | Alan Springett | (212) 680-8557<br>alan.springett@fema.dhs.gov |
| | Region 2 Risk Analysis – Civil Engineer | Shudipto Rahman | (202) 702-4273<br>shudipto.rahman@fema.dhs.gov |
| | Region 2 Mitigation Division – Resiliency Specialist | Thomas Song, CFM | (917) 374-5475<br>thomas.song@fema.dhs.gov |
| | Headquarters – Coastal Engineer | Lauren Schmied, P.E. | (202) 812-6164<br>lauren.schmied@fema.dhs.gov |
| State Agencies | NYSDEC<br>NY State NFIP Coordinator's Office | Kelli Higgins-Roche, P.E. | (518) 402-8280<br>kelli.higgins-roche@dec.ny.gov |
| | NJDEP<br>NJ State NFIP Coordinator's Office | Joe Ruggeri, P.E. | (609) 292-2296<br>joseph.ruggeri@dep.nj.gov |

# Introductions – Project Support

| | Title | Staff | Phone and Email |
|---|---|---|---|
| Project Management | Floodplain Analysis and Mapping (Coastal Update, Storm Surge, and NJ and NYC Overland) – Compass | Jeff Smith, P.E. | (215) 789-2166<br>jeff.r.smith@aecom.com |
| | Floodplain Analysis and Mapping (Westchester Overland) – STARR II | Mike Salisbury, P.E. | (321) 775-6650<br>michael.salisbury@atkinsglobal.com |
| | Technical Manager – Compass | Elena Drei-Horgan, Ph.D. | (703) 682-1634<br>elena.drei-horgan@aecom.com |
| | Coastal Modeling Lead – Compass | Chris Bender, P.E. | (904) 256-1338<br>cbender@taylorengineering.com |
| Regional Support | Planner – STARR II | Rosemary Bolich, AICP | (646) 490-3848<br>rosemary.bolich@stantec.com |
| | Water Resources Engineer – STARR II | Trevor Cone, P.E. | (212) 330-6157<br>trevor.cone@stantec.com |
| Outreach | Community Engagement Lead – *Resilience Action Partners* | Melissa Herlitz, AICP | (646) 682-5558<br>melissa.herlitz@mbakerintl.com |

*We want to hear from you!*

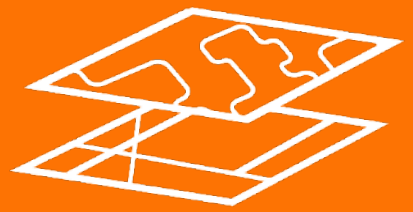
**POLL**

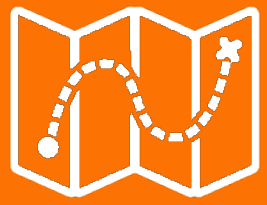
# What are you hoping to learn during today's Coastal Restudy presentation?

1) General update
2) Study details
3) Deep dive into specific topics

# Meeting Objectives

| 1 | 2 | 3 |
| --- | --- | --- |
| Review History | Provide Updates | Preview Milestones |





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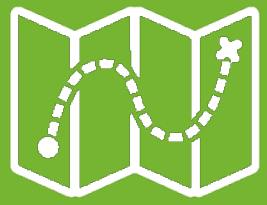
# Meeting Outcomes

| 1 | 2 | 3 |
| --- | --- | --- |
| Know the Restudy History | Be Equipped to Answer Questions | Develop Confidence in the Process |



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# Meeting Agenda

1. Coastal Restudy Overview
2. Coastal Restudy Phase 1
3. Coastal Restudy Phase 2
4. Upcoming Milestones
5. Questions and Discussion

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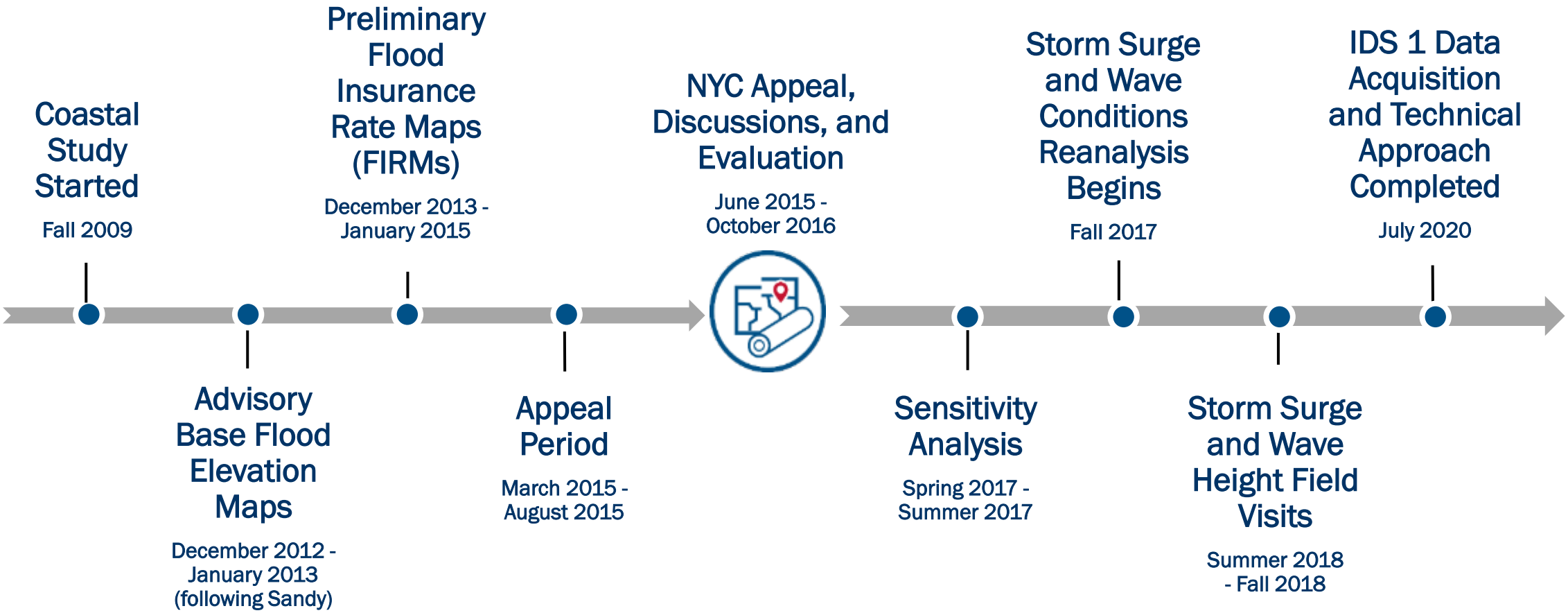
# Coastal Restudy Overview

History

Study Area

Milestones

# Coastal Restudy: A Brief History

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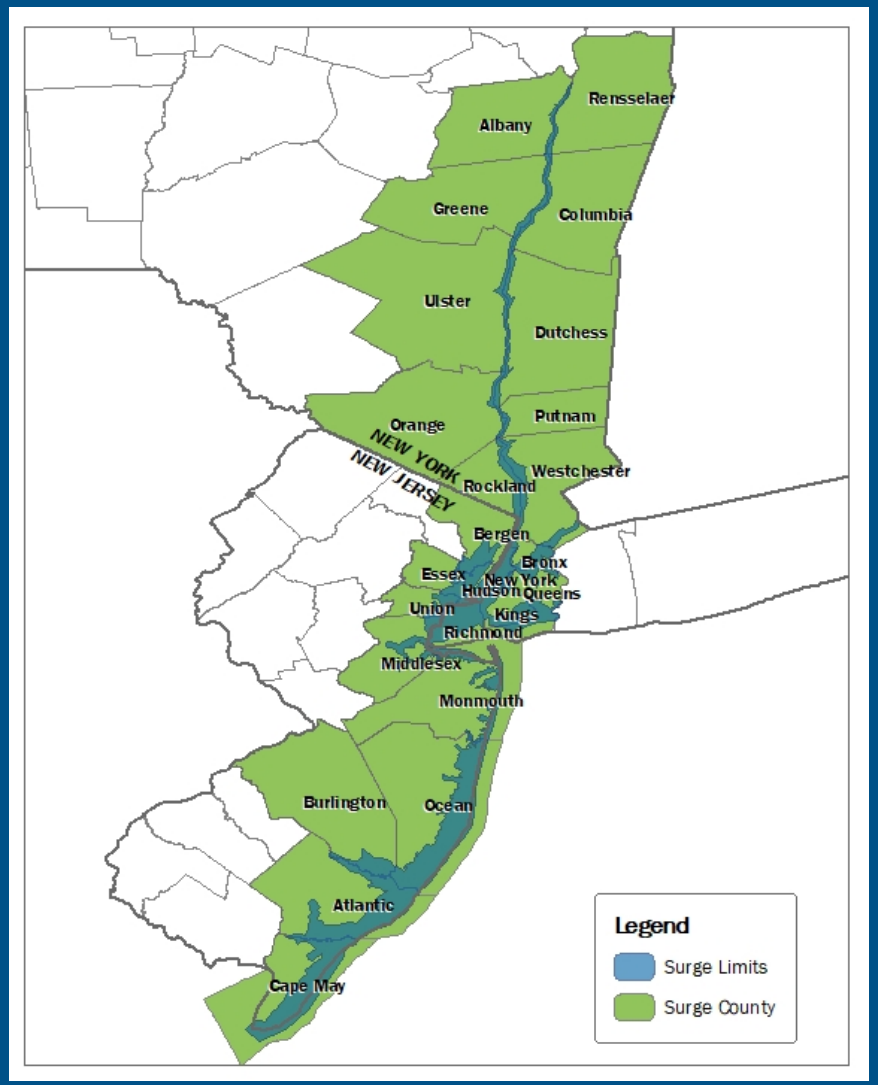
# Overview of Restudy Area – Surge Study

- Tidal Hudson River
- Western Long Island Sound
- New York and Raritan Bay
- Atlantic Ocean
- Does not include Delaware Bay

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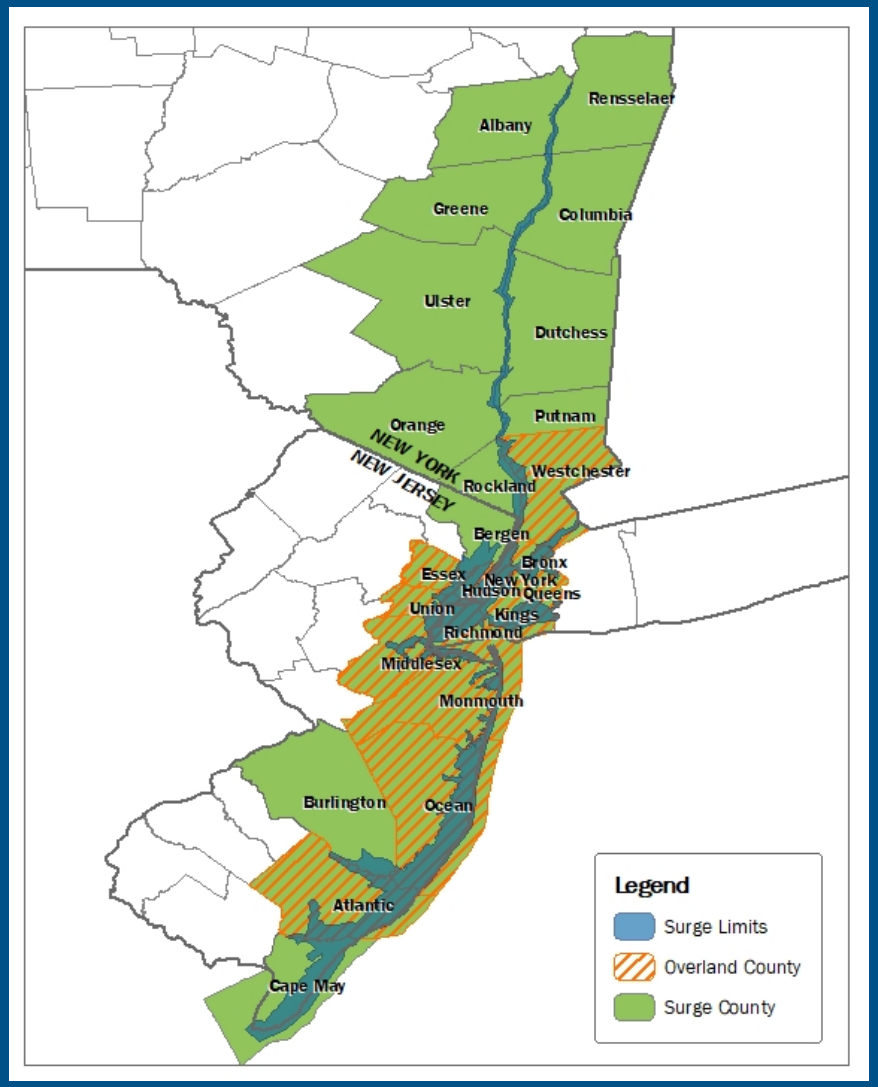
# Overview of Restudy Area – Overland Analyses and Mapping

- NY: New York City boroughs and Westchester County
- NJ: Atlantic, Essex, Hudson, Middlesex, Monmouth, Ocean, and Union counties

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# Quality Assurance

- **Coastal Advisory Panel (CAP)**
  - State of New Jersey, State of New York, Port Authority of New York and New Jersey, New York City, and FEMA
  - Internal group of experts in storm surge modeling and FEMA coastal study process
  - CAP meets bi-monthly and reviews deliverables at each project milestone


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# Key Milestones

| Summer 2017 | 2017-2021 | 2020-2023 | 2023 | 2024 | 2024-2025 |
|---|---|---|---|---|---|
| Sensitivity Analysis | Storm Surge and Wave Conditions Reanalysis | Wave Hazard Analyses and Floodplain Mapping | Work Maps - Flood Risk Review Meeting | Preliminary Maps – CCO and Open House Meetings | Appeal Period Followed by Letter of Final Determination and Effective Maps |

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# COVID-19 Impacts

- Virtual outreach
- Delayed field reconnaissance – team is taking appropriate measures into account, including local quarantine
- The overall Coastal Restudy schedule is not impacted

*Photo Credit: James Gathany*

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# Questions?

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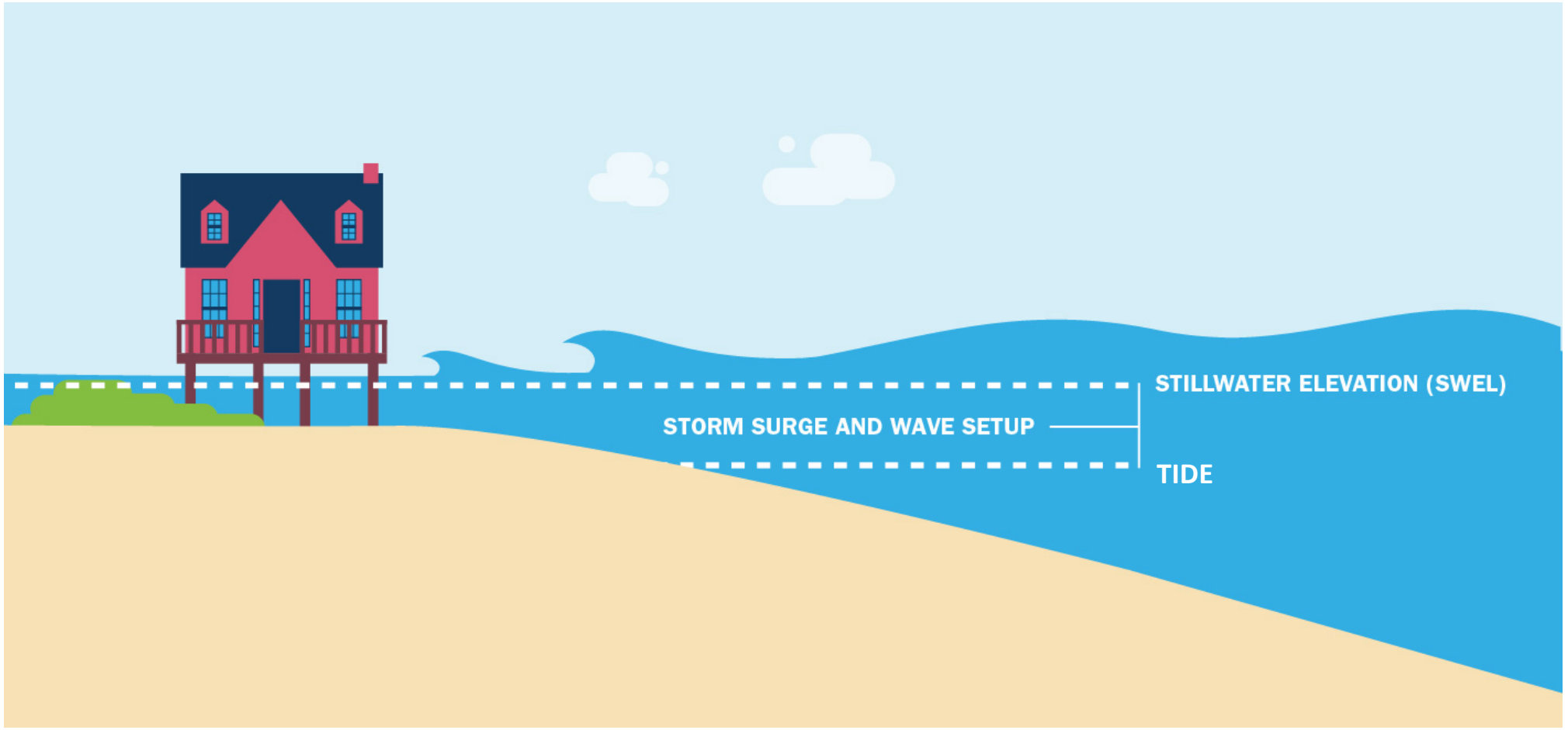
# Coastal Restudy Phase 1

- Intermediate Data Submittals
- Tidal Validation
- Tropical Cyclone Storm Validation
- Extratropical Cyclone Storm Validation
- Tropical Cyclone Production Runs

# Coastal Restudy Phase 1: Storm Surge Study

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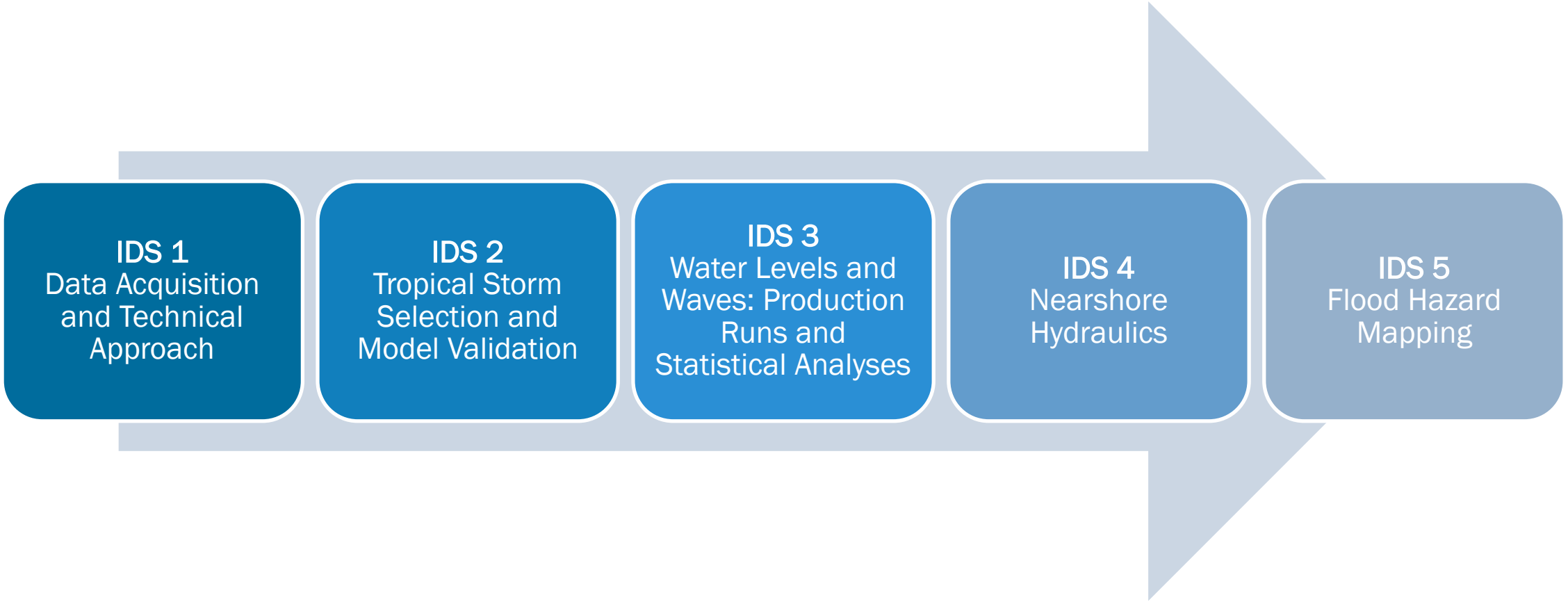
# Intermediate Data Submittals (IDS)

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# Storm Surge Study: IDS 1

| IDS 1: Understanding the Data and Technical Approach for the Storm Surge Study – Approved July 2020 | |
|---|---|
| 1 | Technical Approach |
| 2 | GIS Analysis of Coastal Features, Study Area Characteristics, and Site Reconnaissance |
| 3 | Review of STARR II Coastal Sensitivity Analysis Recommendations and Path Forward |
| 4 | Tropical Storm Validation Storm Selection |
| 5 | Extratropical Storm Validation Storm Selection |
| 6 | Topo-Bathy-Digital Elevation Model (DEM) Development |
| 7 | Storm Climatology and Initial Probabilistic Model Development |
| 8 | Storm Wind Field Methodology |
| 9 | Hydrodynamic and Wave Model Development |

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# Coastal Restudy Enhancements

Extensive model validation for all extratropical cyclones

Improved representation of tidal effects

Inclusion of additional and recent storm events

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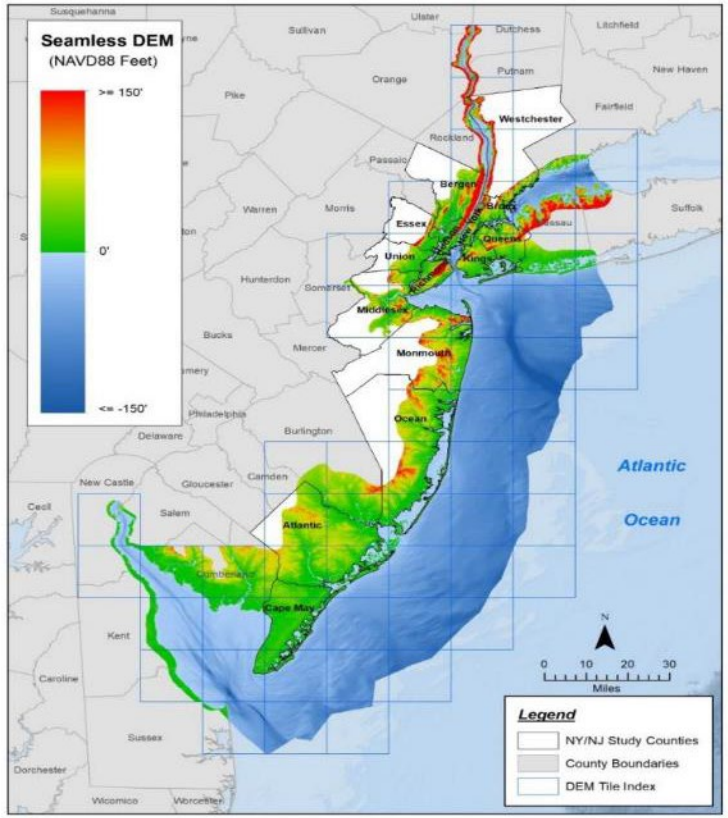
# Topographic Datasets Captured in the ADCIRC + SWAN Model Mesh




| Year | Description | Data Type | Source/ Owner |
|---|---|---|---|
| 2017 | New York City (NYC) LiDAR | LiDAR-based DEM | NYC |
| 2017 | 2017 National Coastal Mapping Program LiDAR - *Incorporated in model mesh to capture dune crest elevation* | LiDAR-based DEM | USACE |
| 2014 | 2014 Post-Hurricane Sandy New Jersey LiDAR Mapping for Shoreline Mapping | LiDAR-based DEM | NOAA |
| 2014 | Coastal and Marine Mapping Program New York Sandy LiDAR | LiDAR-based DEM | USGS |
| 2013–2015 | National Elevation Dataset DEM | LiDAR-based DEM | USGS |
| Varies | Con Edison | LiDAR-based DEM | USGS |
| Varies | FEMA Region 2 DEMs | LiDAR-based DEM | FEMA |

*DEM = Digital Elevation Model*
*LiDAR = Light Detection and Ranging, remote sensing*
*NOAA = National Oceanic and Atmospheric Administration*
*USACE = U.S. Army Corps of Engineers*
*USGS = U.S. Geological Survey*

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# Questions?

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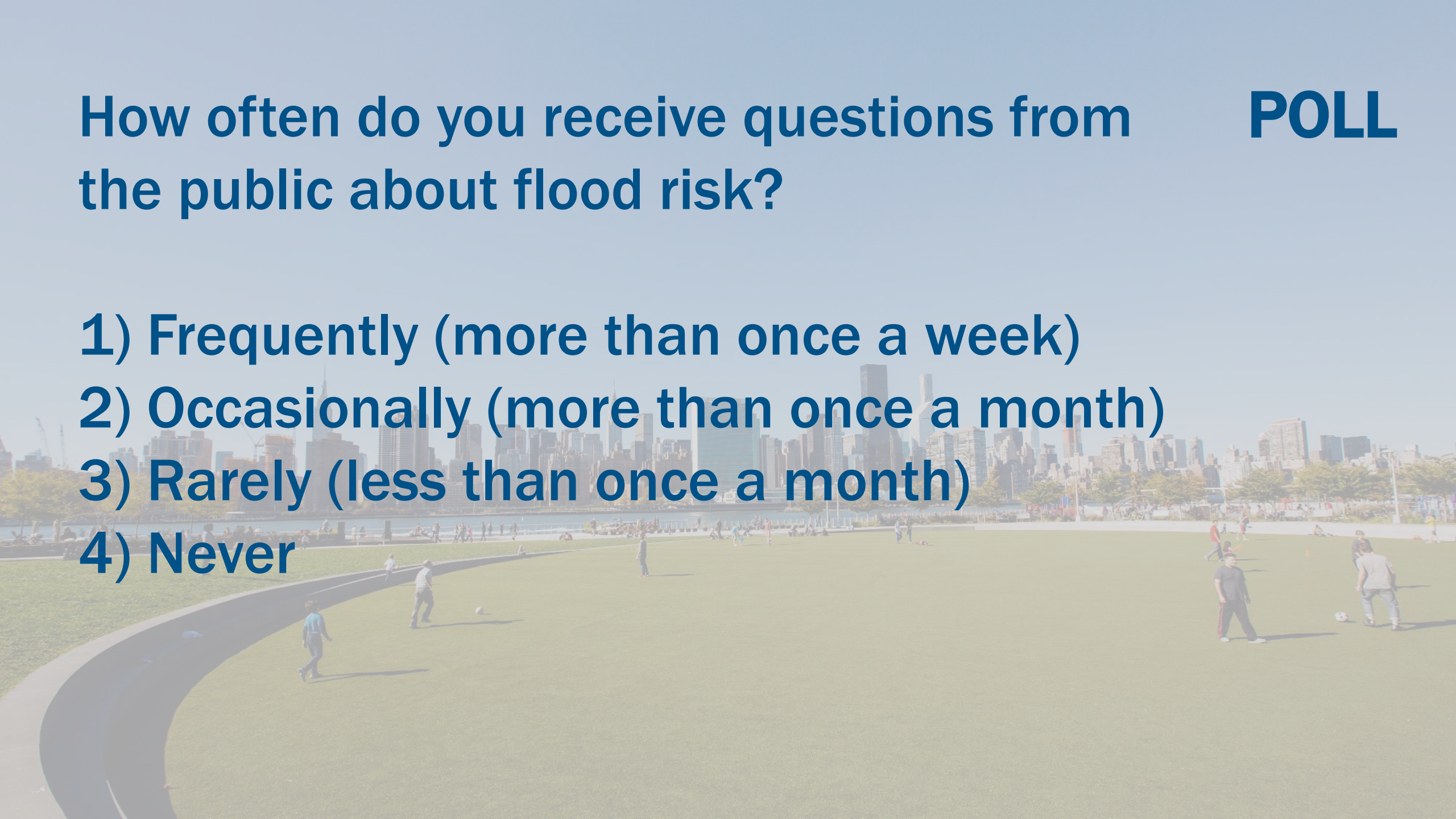
# How often do you receive questions from the public about flood risk?

**POLL**

1) Frequently (more than once a week)
2) Occasionally (more than once a month)
3) Rarely (less than once a month)
4) Never



# Storm Surge Study: IDS 2

| IDS 2: Tropical Storm Selection and Model Validation | |
|---|---|
| 1 | ADCIRC + SWAN Model Validation – Reviewed and Approved |
| 2 | JPM-OS Tropical Storm Selection – In Development |

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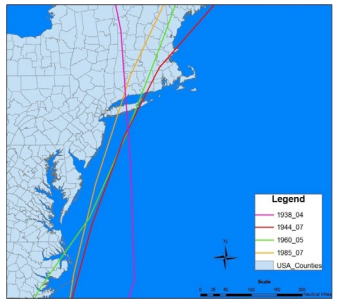
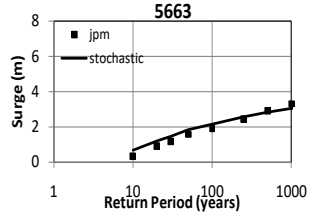
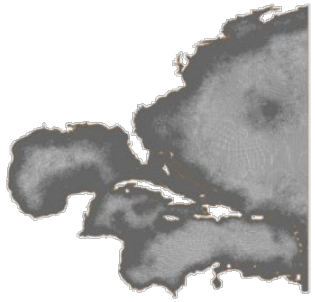
# Storm Surge Study: Stillwater Elevation (SWEL)



**Storm Forcing**
Tropical and Extratropical Tracks

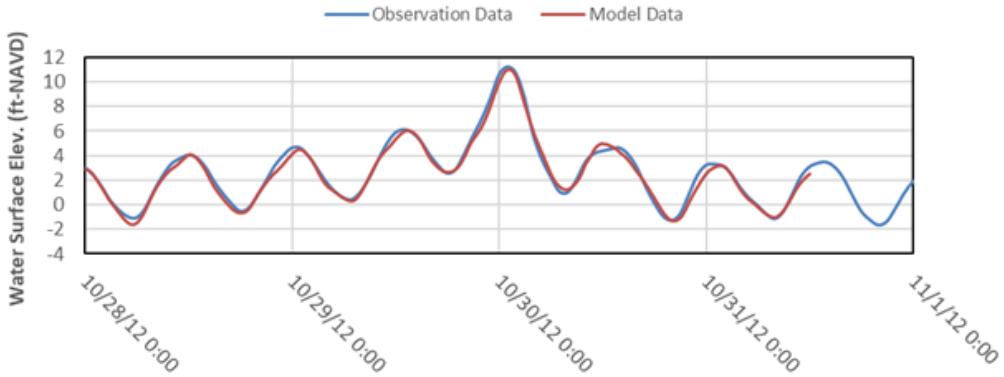
**Storm Surge Modeling**
Wind, Waves, Water Levels

**Validation**
Historical Storms and Tides

**Return Period Analysis**
Statistical Analysis for Tropical Storms (low freq.)
Statistical Analysis for Extratropical Storms (high freq.)
Analysis to Develop Combined Probability

**Stillwater Elevation**

The Battery, Hurricane Sandy




*Model validation results showing how modeled data aligns well with water levels observed during Hurricane Sandy.*

# Storm Surge Study: Storm Climatology

- Reviewed historical storms
- Selected five tropical cyclones and 50 extratropical cyclones to validate the surge model
- Analyzed important tropical cyclone parameters
  - **Central pressure**
  - **Radius to maximum winds**
  - **Forward speed**
  - **Storm heading**
  - **Holland B (shape parameter)**
- Will generate hundreds of hypothetical tropical cyclones

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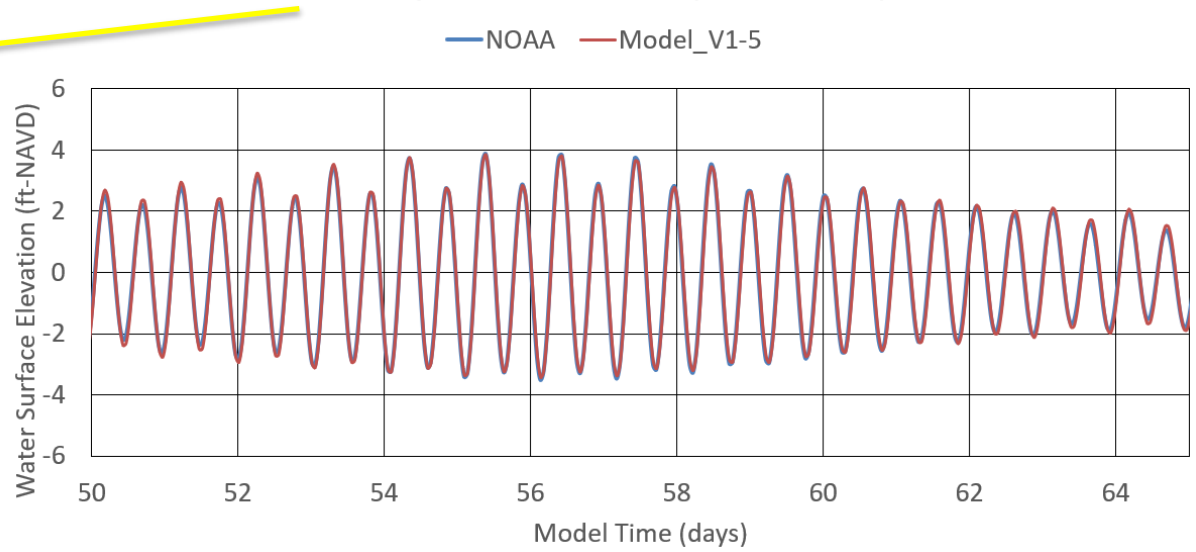
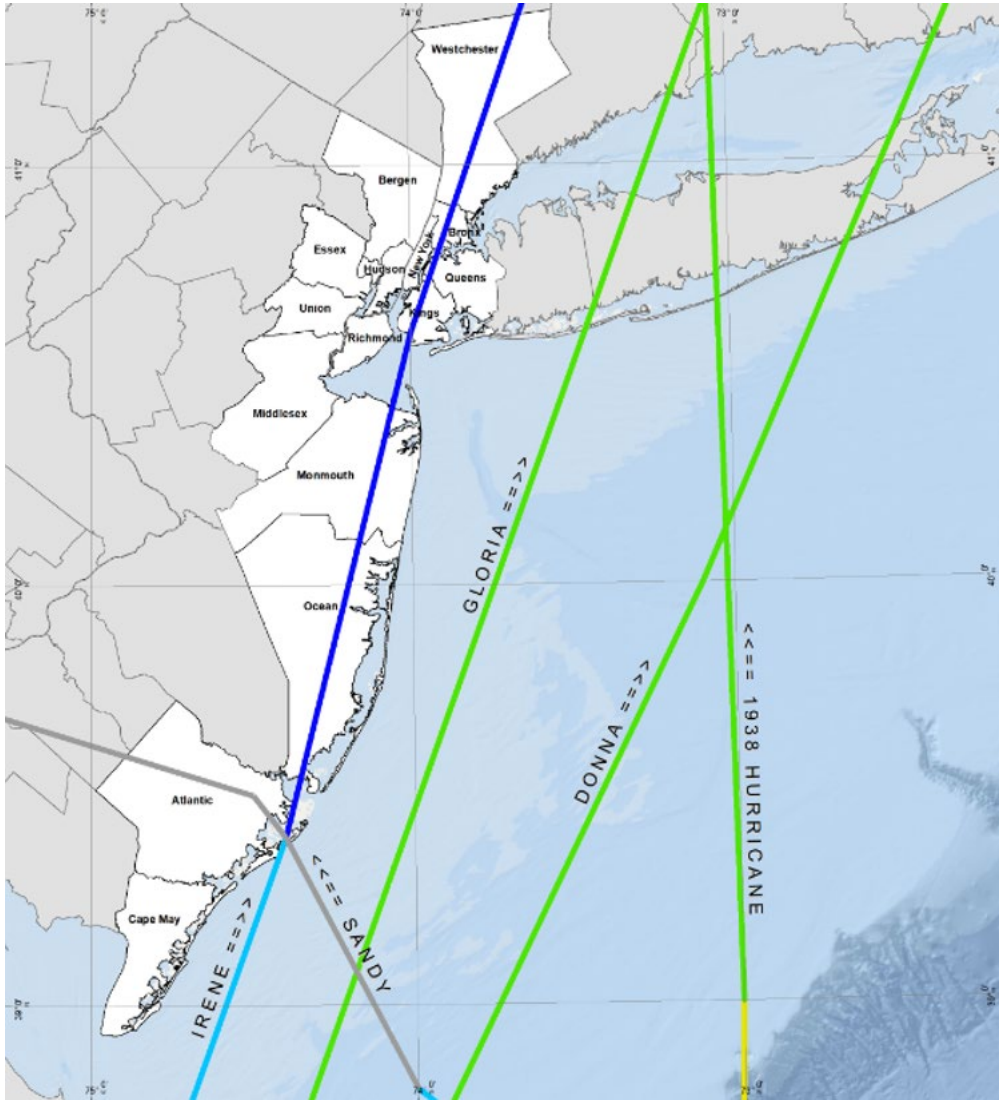
# Storm Surge Study: Tidal Validation - Essex, Hudson, Union, Middlesex Counties


- Tidal validation applied the eight most important tidal components
- Across the entire study area, examined tide amplitude and phase at 74 stations
- Example station at Keasbey:



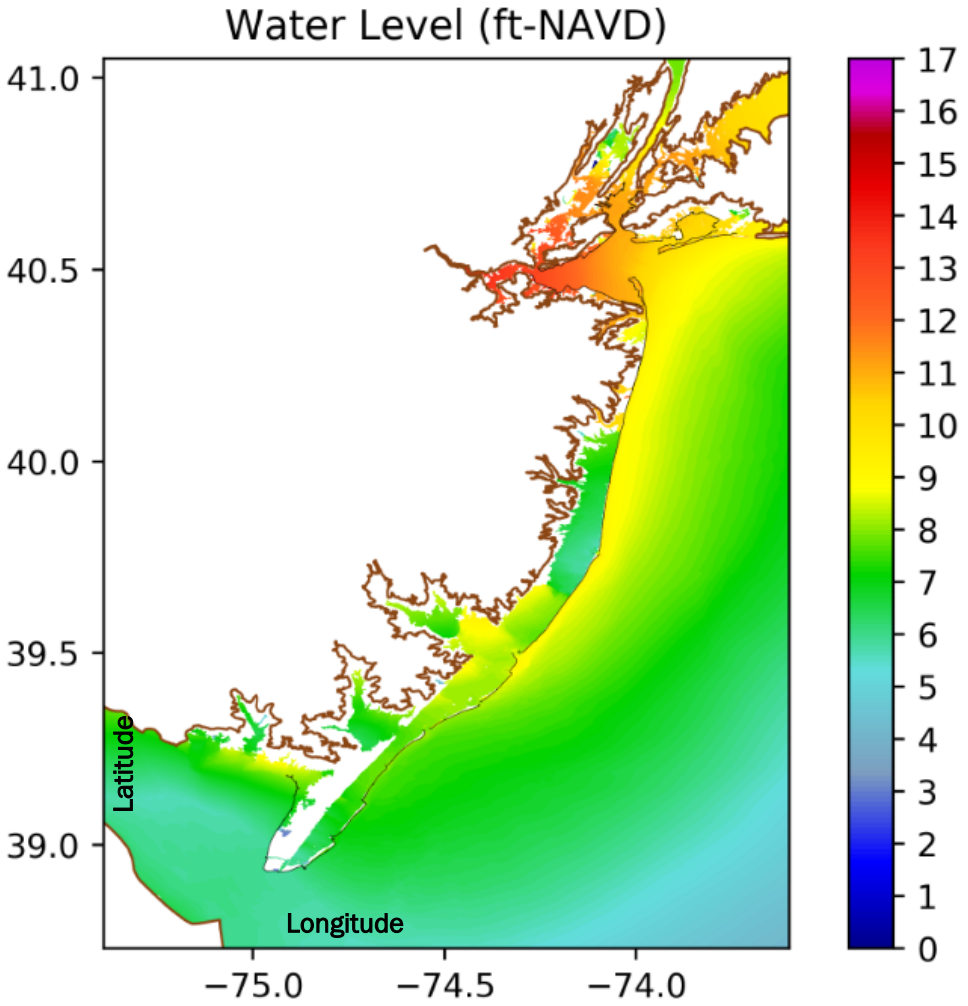
# Storm Surge Study: Tropical Cyclone Storm Validation



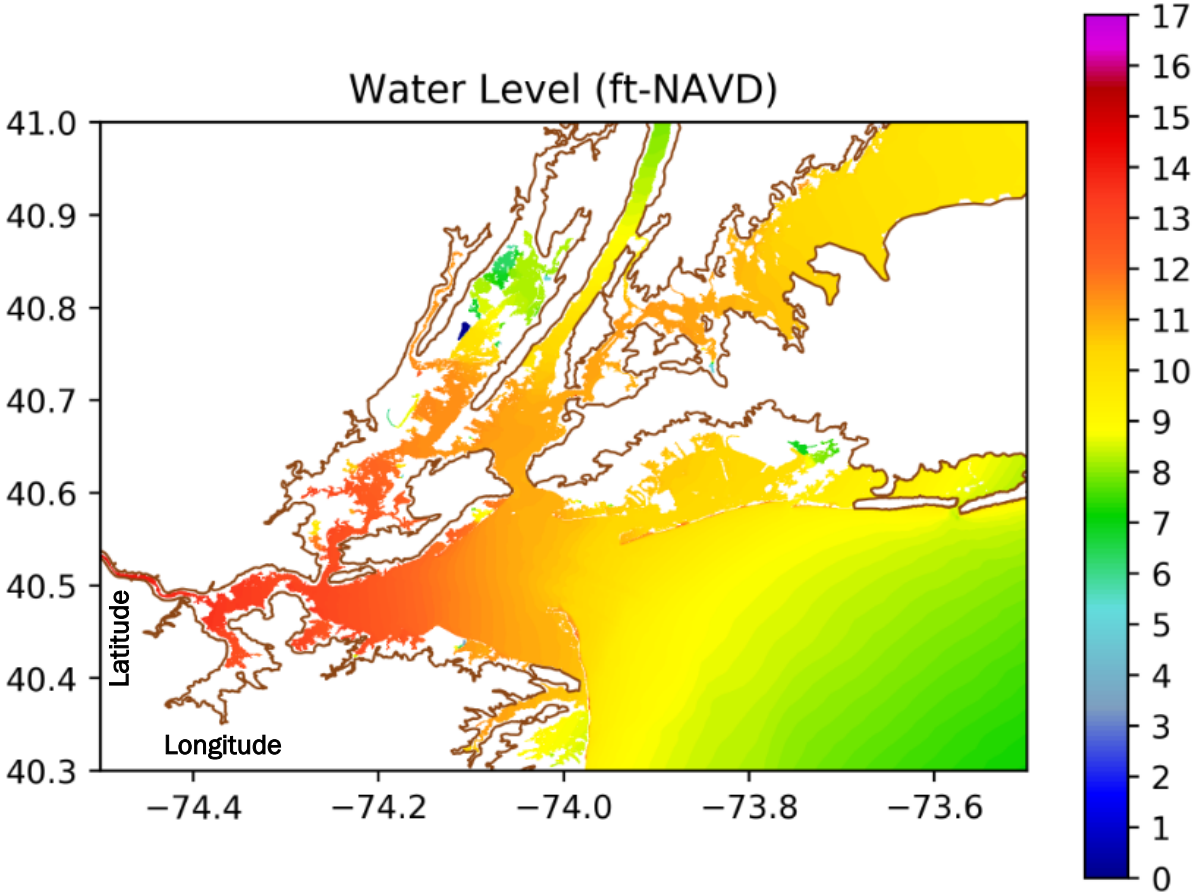

- Hurricane of 1938 (Long Island Express)
- Hurricane Donna (1960)
- Hurricane Gloria (1985)
- Hurricane Irene (2011)
- Hurricane Sandy (2012)

# Storm Surge Study: Tropical Cyclone Storm Validation, Water Levels

- Hurricane Sandy, Maximum Water Level - Essex, Hudson, Union, Middlesex Counties



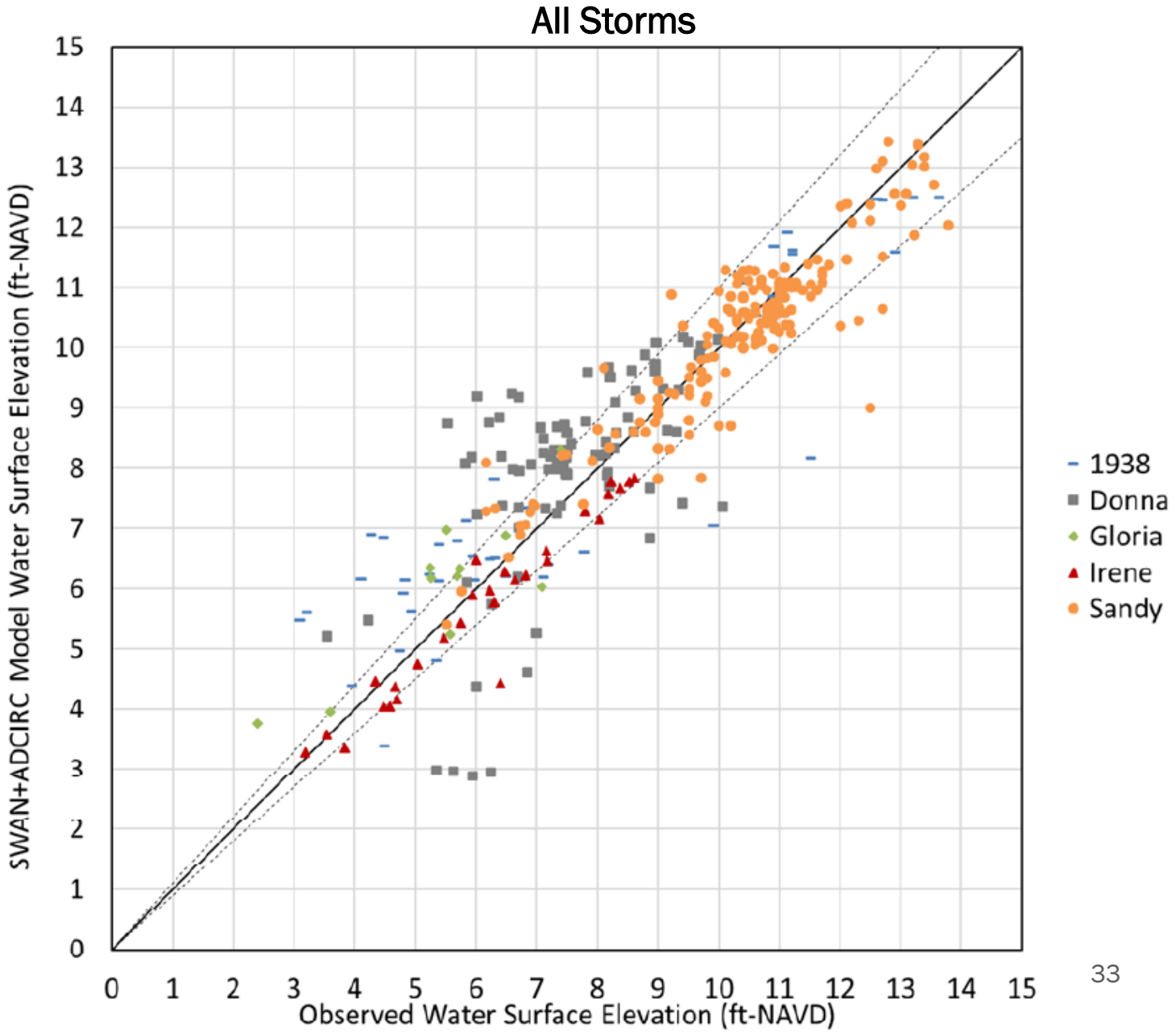

Coastal Restudy Project Area




Essex, Hudson, Union, Middlesex

# Storm Surge Study: Tropical Cyclone Storm Validation, Water Levels

- Compare measured and modeled maximum water levels
- 459 measurement points across all five tropical cyclones

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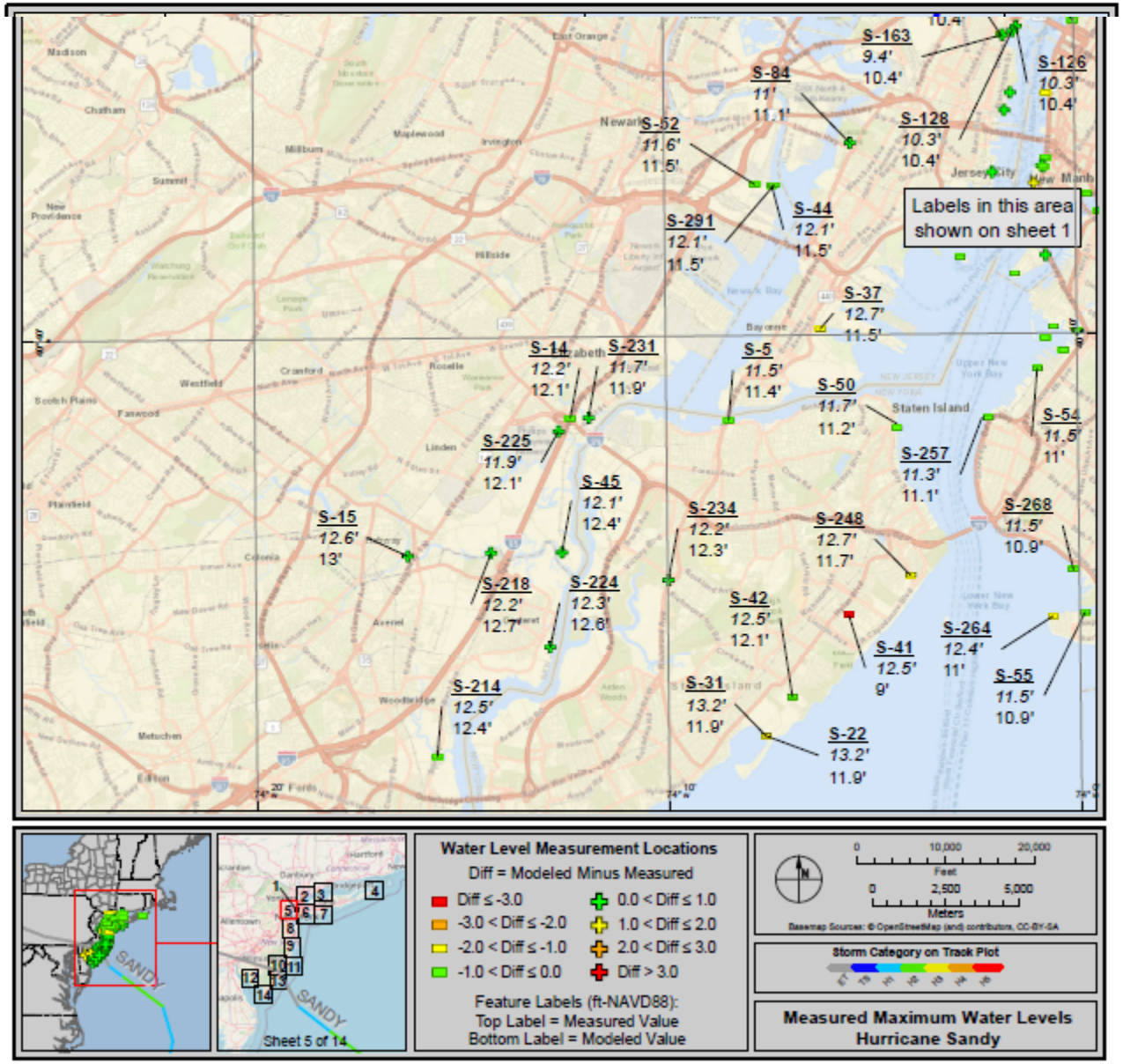
# Storm Surge Study: Tropical Cyclone Storm Validation, Water Levels - Essex, Hudson, Union, Middlesex Counties

- Hurricane Sandy – compared measured and modeled data
- GIS plots of each measured water level
  - Location
  - Measured/modeled water level
  - Color-coded difference value
- Complete analysis for each of the validation cyclones

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# Storm Surge Study: Tropical Cyclone Storm Validation, Water Levels - Essex, Hudson, Union, Middlesex Counties

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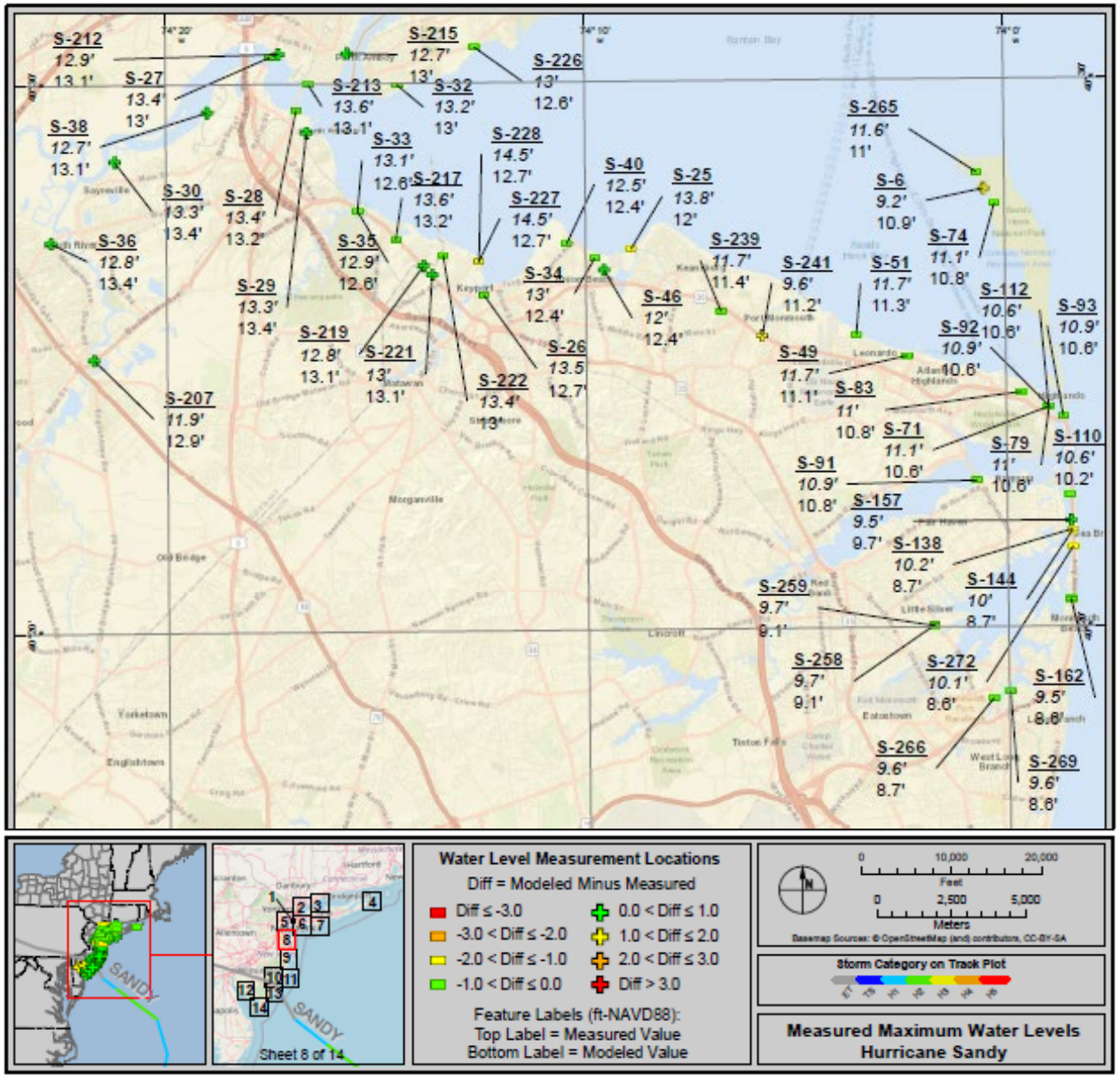


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# Storm Surge Study: Tropical Cyclone Storm Validation, Water Levels

- Summary Review
  - All five cyclones
  - Holistic view across all cyclones and study area with multiple error metrics developed for each storm and for the entire five-storm validation suite
  - Comparisons made to adjacent FEMA Coastal Storm Surge Studies to demonstrate the Coastal Restudy validation metrics are appropriate
- Error metrics for all 459 measurement stations across the five-storm validation suite
  - Mean Error = 0.05 feet
  - Mean Absolute Error = 0.68 feet

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# Questions?

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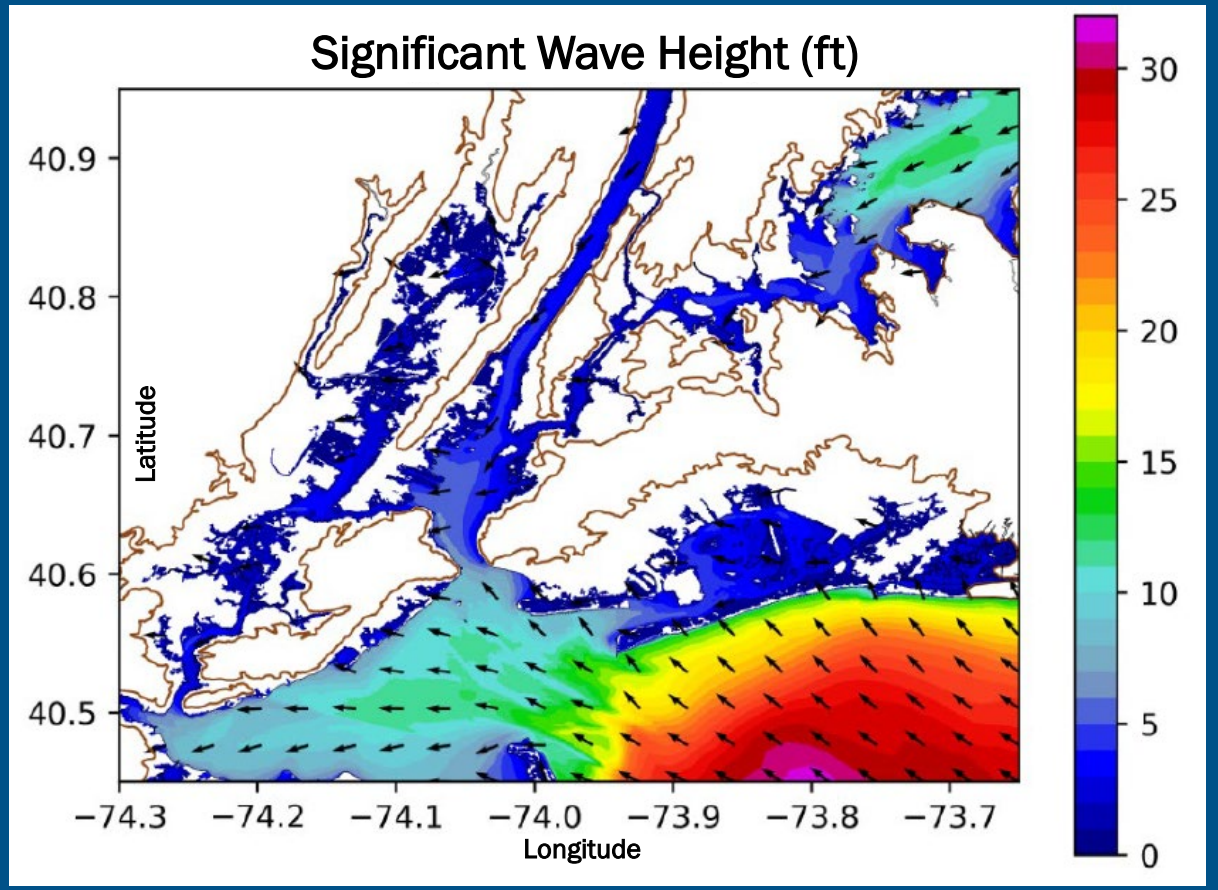
# Storm Surge Study: Tropical Cyclone Storm Validation, Waves - Essex, Hudson, and Union Counties

- Contour plots of maximum wave parameters (wave height and wave period)

- Hurricane Sandy - maximum significant wave height at time of maximum water level

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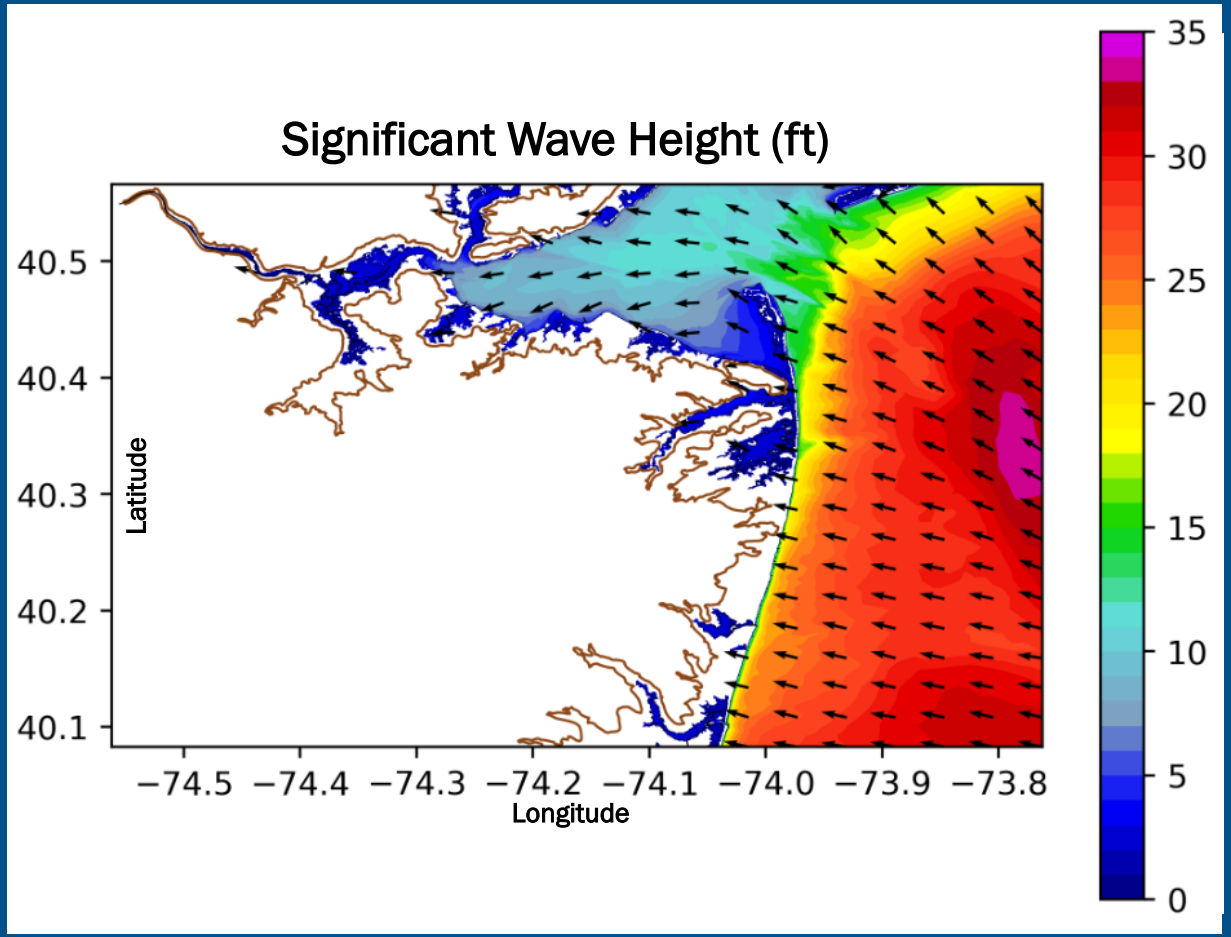
# Storm Surge Study: Tropical Cyclone Storm Validation, Waves - Middlesex County

- Contour plots of maximum wave parameters (wave height and wave period)

- Hurricane Sandy - maximum significant wave height at time of maximum water level

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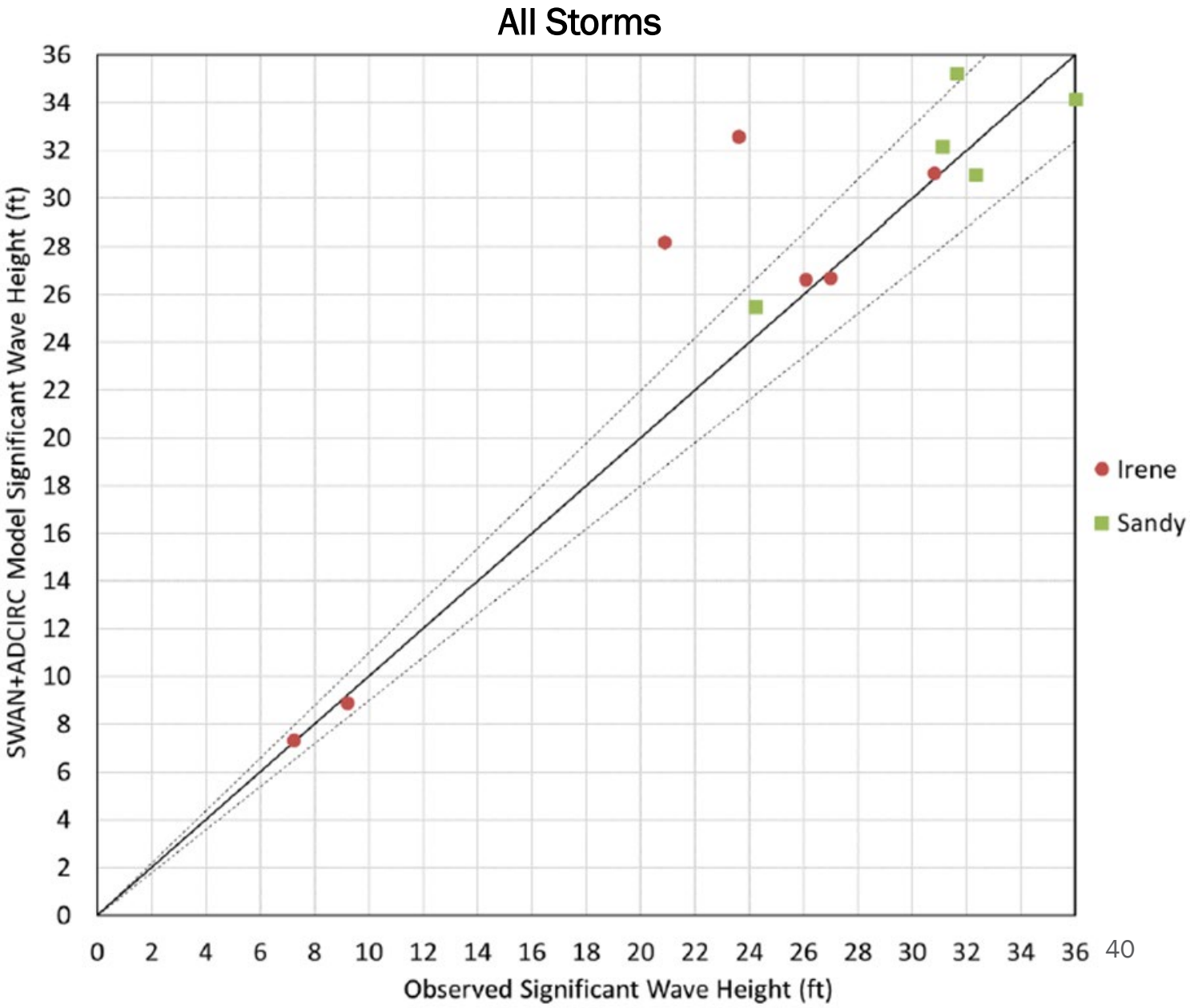
# Storm Surge Study: Tropical Cyclone Storm Validation, Waves

- Compare measured and modeled maximum significant wave heights
- Twelve stations for two most recent tropical cyclones
  - No buoys with data near project area for older storms
- Also develop for Peak Wave Period

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# Questions?

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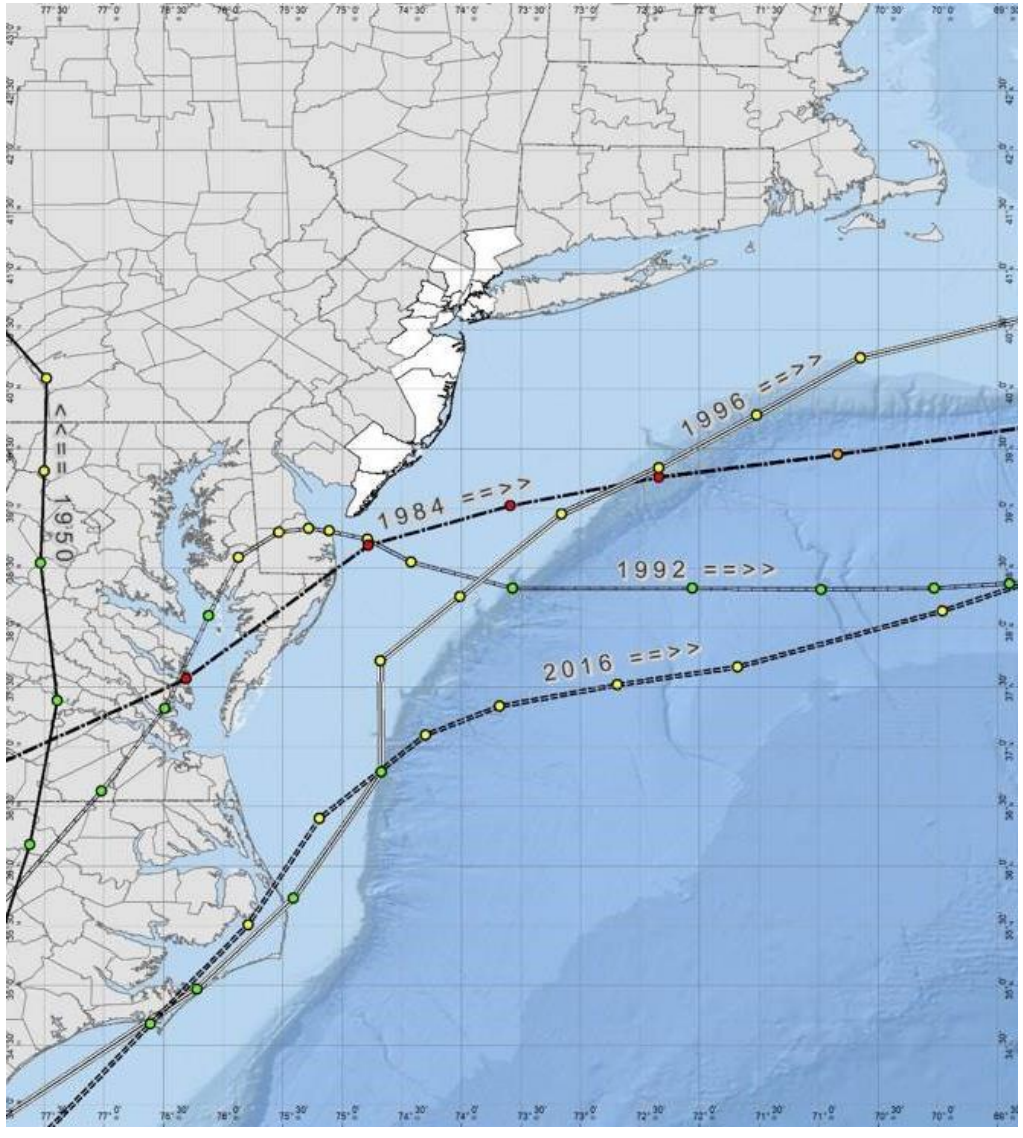
# 3-Minute Break

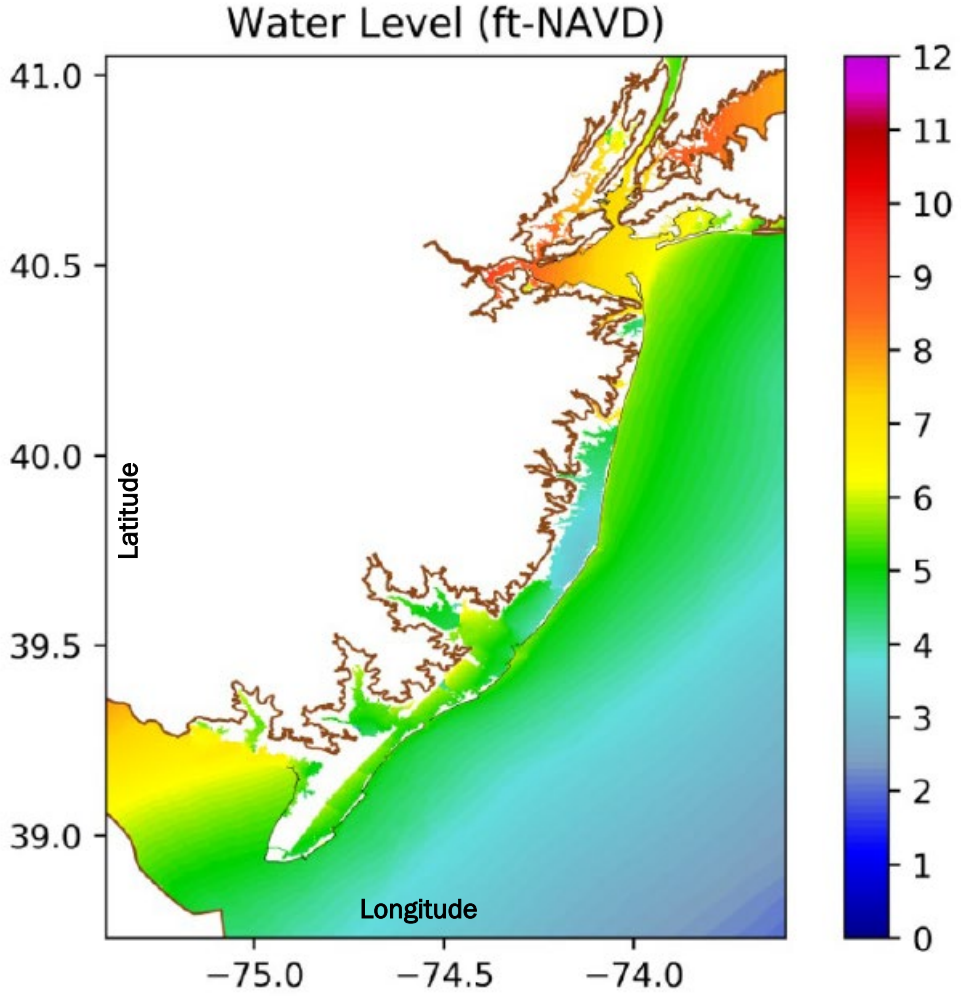
# Storm Surge Study: Extratropical Cyclone Storm Validation



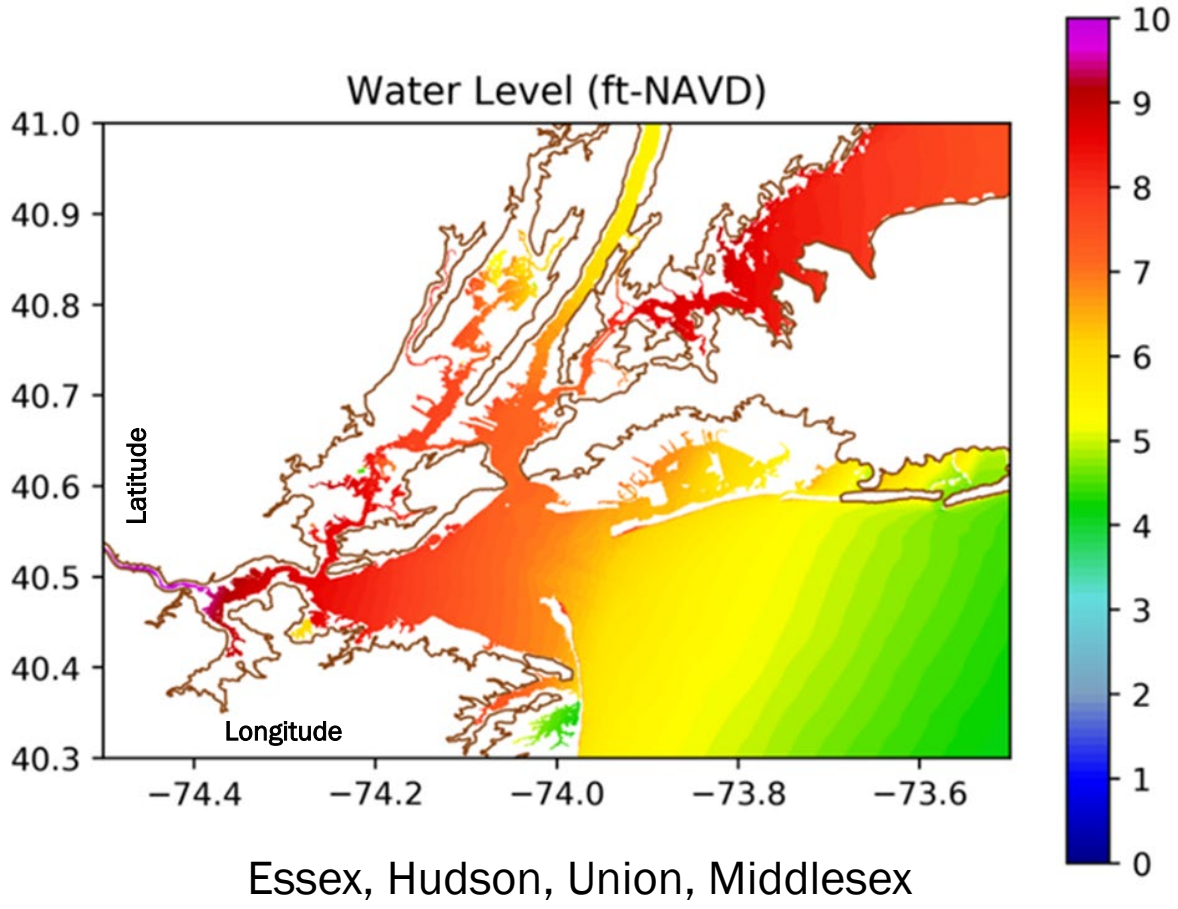

- 50 historical extratropical cyclones identified in IDS 1 as important for the project area
- Select five extratropical cyclones from the suite of 50 cyclones for the initial model validation
- During production runs, validate the model results for the other 45 extratropical cyclones and develop the uncertainty term applied in the statistical processing

# Storm Surge Study: Extratropical Cyclone Storm Validation, Water Levels

- 1950 Extratropical Cyclone, Maximum Water Level - Essex, Hudson, Union, Middlesex Counties



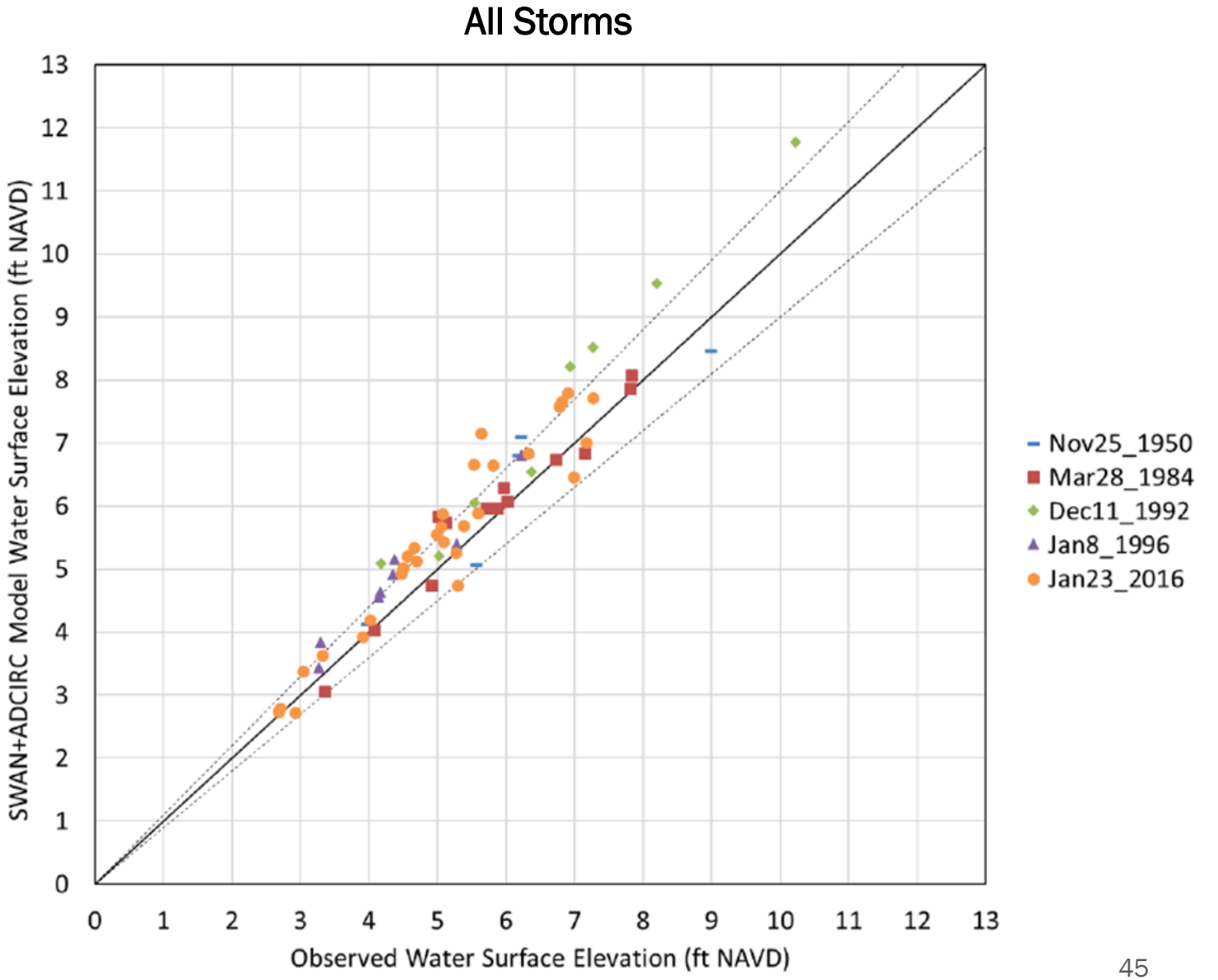

Coastal Restudy Project Area




Essex, Hudson, Union, Middlesex

# Storm Surge Study: Extratropical Cyclone Storm Validation, Water Levels

- Compare measured and simulated maximum water levels
- 64 measurement stations across all five extratropical cyclones

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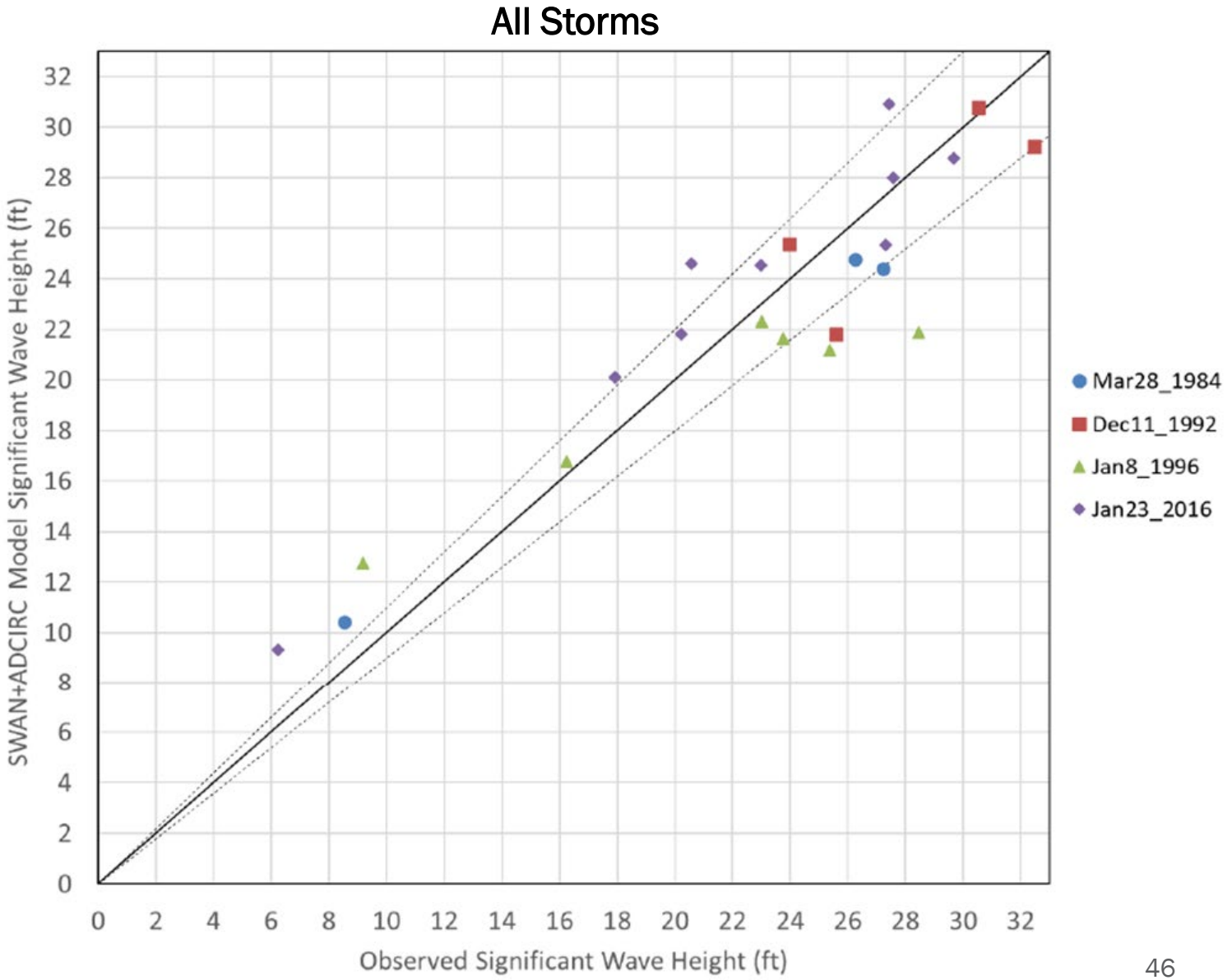
# Storm Surge Study: Extratropical Cyclone Storm Validation, Waves

- Compare measured and simulated maximum significant wave heights
- 22 measurement stations for four extratropical cyclones
  - No buoys with data near project area for November 1950 storm
- Also develop for Peak Wave Period

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# Storm Surge Study: Extratropical Cyclone Storm Validation

- Summary Review
  - Five extratropical cyclones as part of initial validation set
  - Holistic view of extratropical cyclones and study area with multiple error metrics developed for each storm and for entire five-storm suite
  - Comparisons made to adjacent FEMA Coastal Storm Surge Studies to demonstrate the Coastal Restudy validation metrics show proper model validation
- Error metrics for all 64 measurement stations across the five-storm suite
  - Mean Error = 0.40 feet
  - Mean Absolute Error = 0.50 feet

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# Tropical Cyclone Production Runs
# Joint Probability Method – Optimum Sampling (JPM-OS)

- Once the ADCIRC + SWAN model is validated, move into production runs for extratropical and tropical cyclones
- Tropical cyclone analysis will feature synthetic tropical cyclones based on parameters recorded in historical record of tropical cyclones for project area
- Study will apply a JPM approach to handle this
- Initial JPM-OS storm suite will contain approximately 150 to 180 tropical cyclones
  - Based on IDS 1 Section 7 Tropical Cyclone parameter distributions
  - IDS 2 Section 2 will document JPM development
- Execute initial JPM storm suite, examine results, and develop next iteration of storms (~100 storms)

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# Preview of Intermediate Data Submittal (IDS) 3 and 4

## IDS 3

- Summarizes storm surge runs and frequency analysis
- Expected release in winter 2021/2022

## IDS 4

- Summarizes nearshore hydraulics
- Expected release in 2022

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# Update on Production Runs

**Tropical Cyclone Production Runs**

Not started

+

**Extratropical Cyclone Production Runs**

Plots in review

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# Questions?

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# Coastal Restudy Phase 2

**Data Collection**

**Field Reconnaissance**

**Transect Layout**

# Coastal Restudy Phase 2: Wave Hazard Analysis

Define cross-shore transects

Evaluate storm-induced erosion and shore protection structures

Wave hazard modeling: overland wave propagation and wave run-up/ overtopping

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# Ongoing Data Tracking

- Monitor new release of topographic datasets:
  - Available: 2020 USACE NAN Topobathy LiDAR DEM NJ/NY, 2020 Compass Fugro LiDAR for NJ shoreline sections
  - Not Available Yet: 2020 NFWF Coastal Wetland NJ Topobathy LiDAR, 2018 South New Jersey 3DEP QL2 LiDAR, 2018 Westchester 3DEP QL2 LiDAR
- Monitor new release of aerial imagery
- Leverage appeal information
- Catalogue effective and in-process LOMRs
- Track evolution of beach nourishment projects in coordination with NJDEP/USACE Philadelphia/USACE New York

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# Field Reconnaissance Preparation – Essex, Hudson, Union, and Middlesex Counties

- Field visits occurred:
  - Essex County: October 14, 2020
  - Hudson County: week of October 19, 2020
  - Union County: October 8, 2020
  - Middlesex County: week of October 19, 2020
- Reconnaissance sites prioritized based on a tiered approach (high, medium, low)
- Local officials contacted ahead of the field work to ensure awareness of the crews in the field
- Web-based portal used for instant upload and real-time data review
- Crew members enforced COVID-19 health prevention measures

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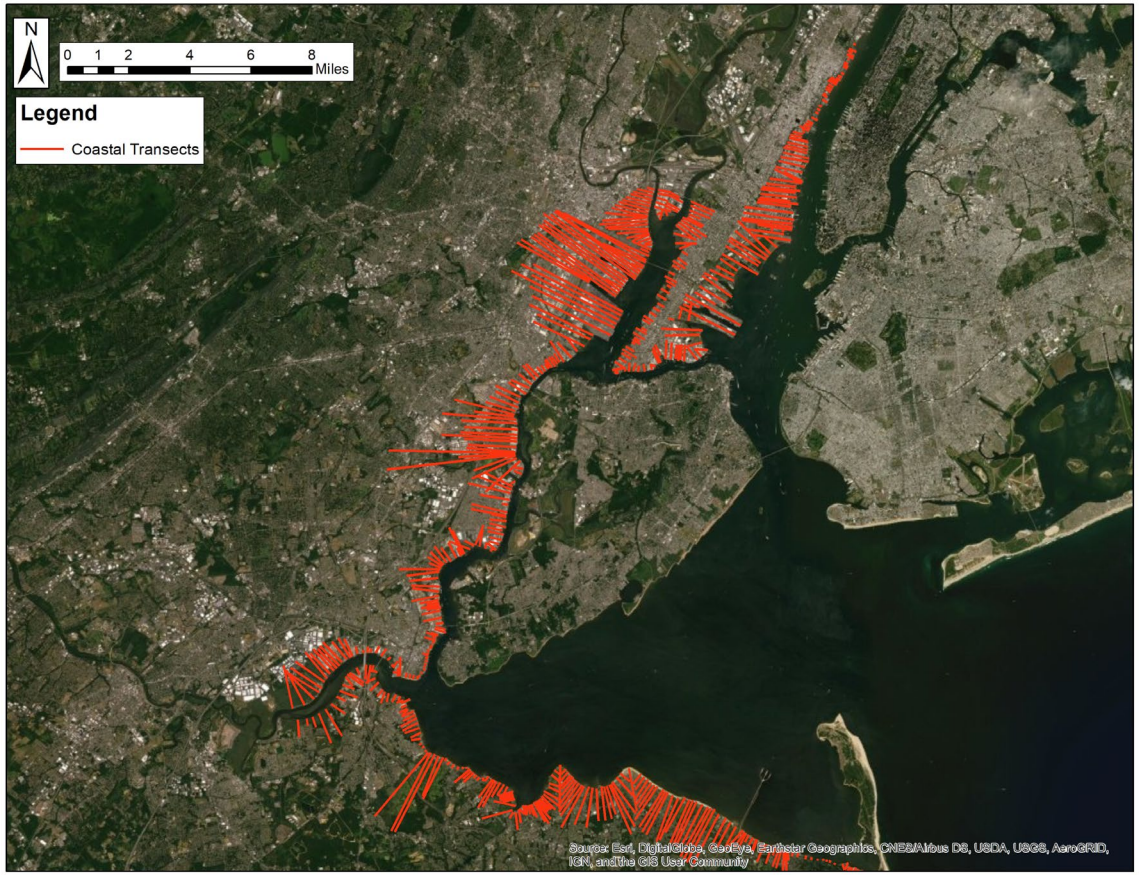
# Preliminary Transect Layout – Essex, Hudson, Union, and Middlesex Counties

- Preliminary transect layouts have been developed to account for:
  - Topographic changes
  - Land use changes (buildings, vegetation, etc.)
  - New coastal structures/waterfront development
  - Better representation of waves in sheltered areas
  - Areas of prior appeals
- Increased transect density of 11% in Essex County, 19% in Hudson County, 18% in Union County, and 13% in Middlesex County
- CAP provided review and concurrence

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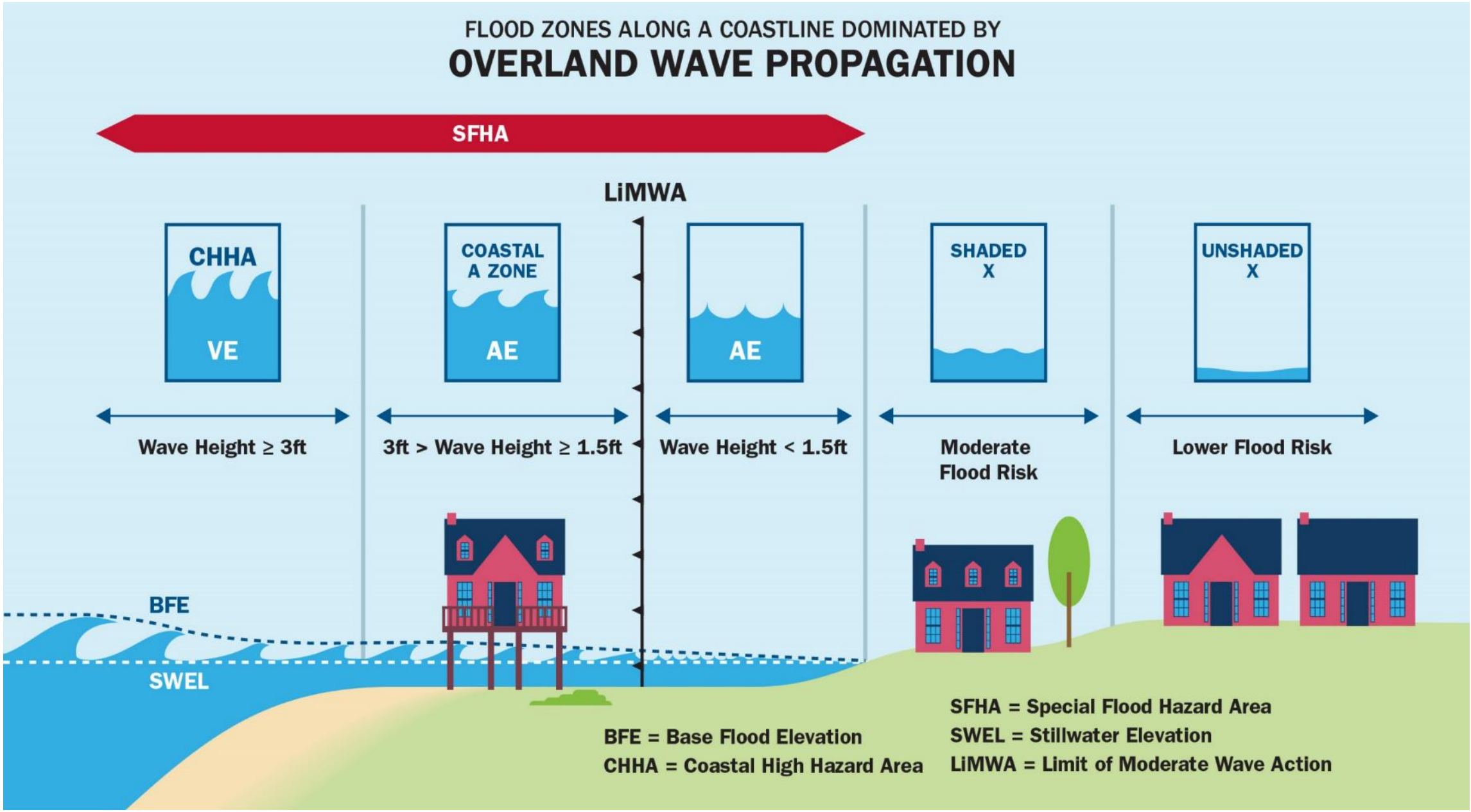
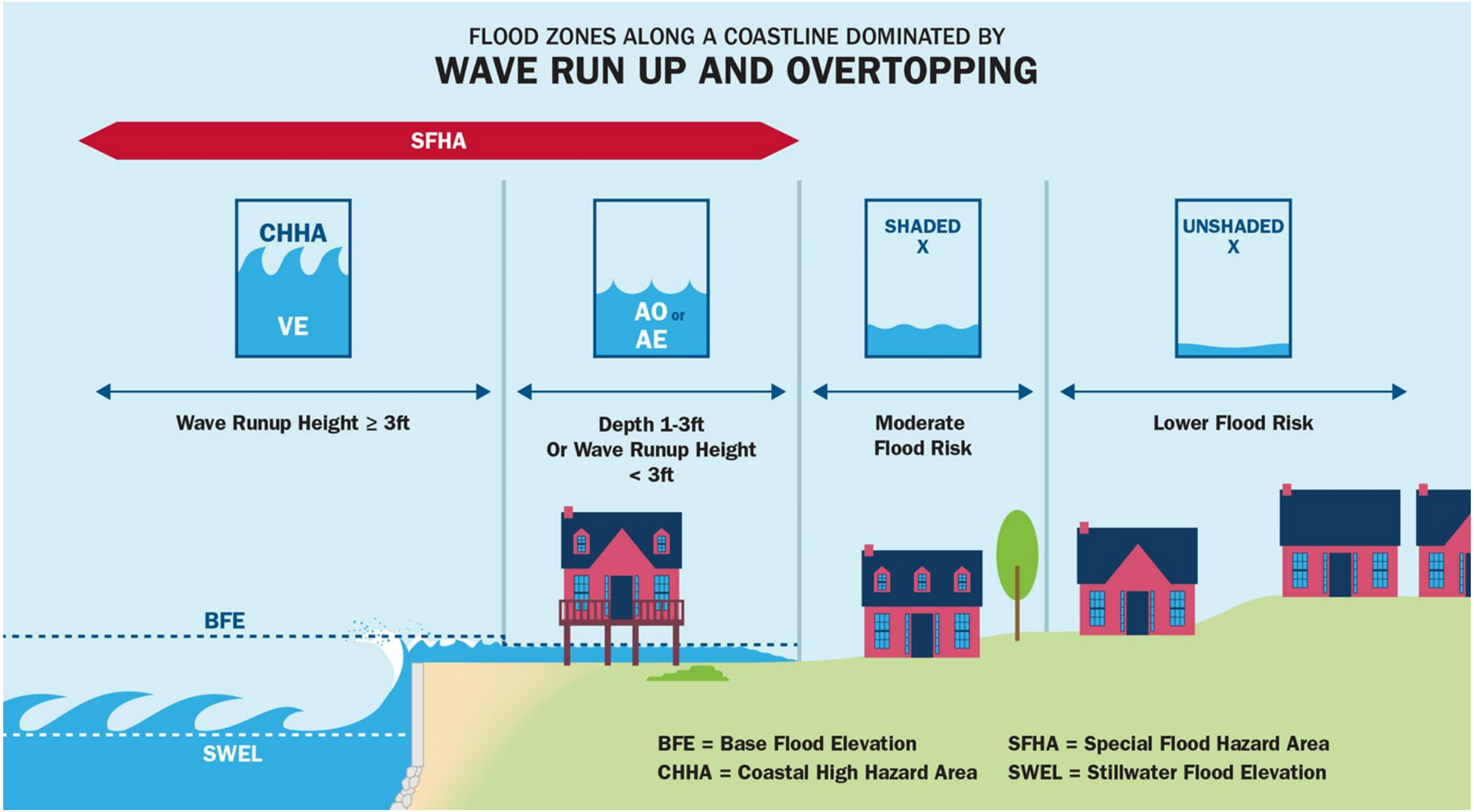
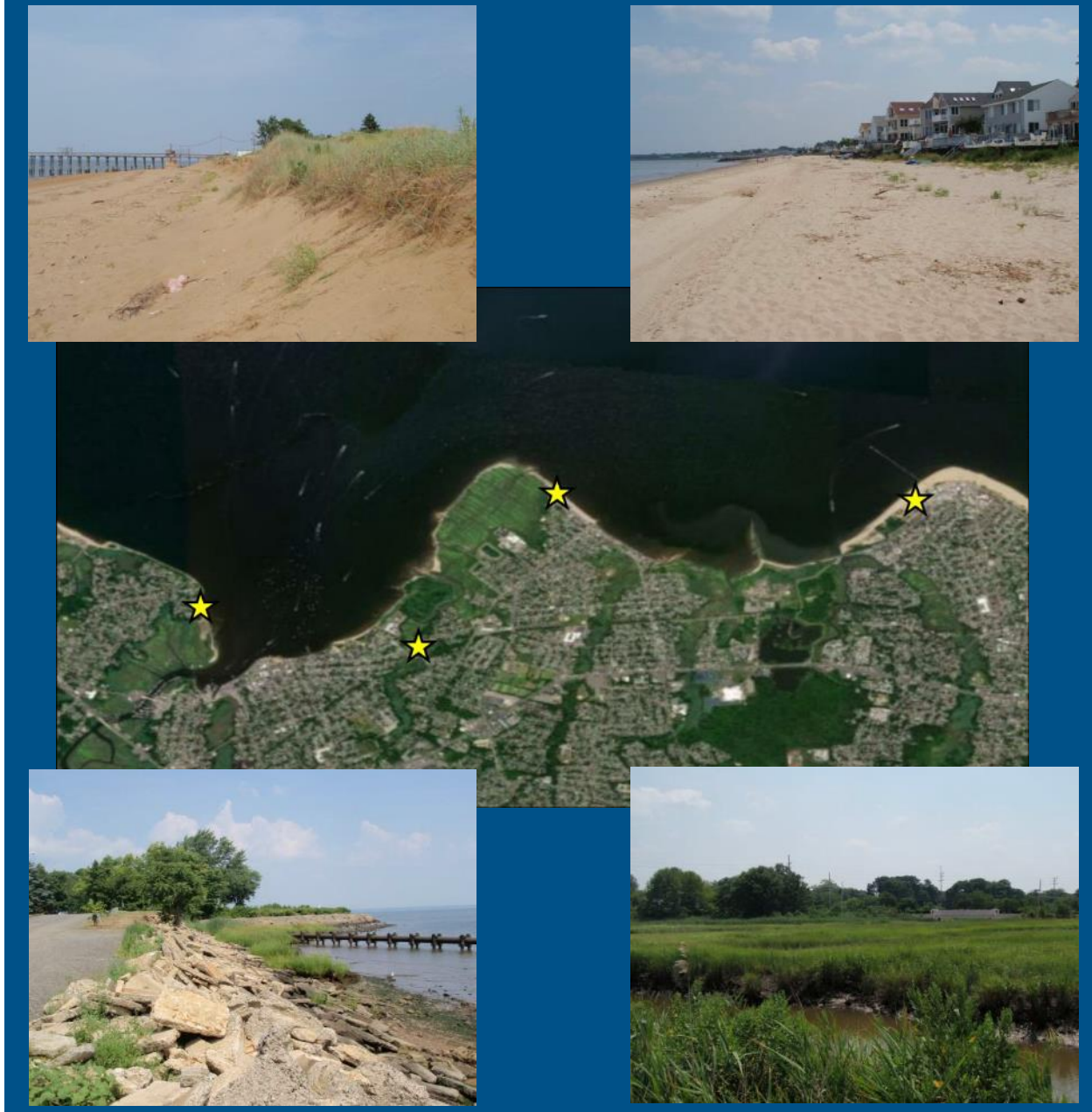

FLOOD ZONES ALONG A COASTLINE DOMINATED BY
OVERLAND WAVE PROPAGATION
SFHA
LiMWA
CHHA
VE
COASTAL A ZONE
AE
AE
SHADED X
UNSHADED X
Wave Height ≥ 3ft
3ft > Wave Height ≥ 1.5ft
Wave Height < 1.5ft
Moderate Flood Risk
Lower Flood Risk
BFE
SWEL
BFE = Base Flood Elevation
CHHA = Coastal High Hazard Area
SFHA = Special Flood Hazard Area
SWEL = Stillwater Elevation
LiMWA = Limit of Moderate Wave Action


FLOOD ZONES ALONG A COASTLINE DOMINATED BY
WAVE RUN UP AND OVERTOPPING
SFHA
CHHA
VE
AO or
AE
SHADED
X
UNSHADED
X
Wave Runup Height ≥ 3ft
Depth 1-3ft
Or Wave Runup Height
< 3ft
Moderate
Flood Risk
Lower Flood Risk
BFE
SWEL
BFE = Base Flood Elevation
CHHA = Coastal High Hazard Area
SFHA = Special Flood Hazard Area
SWEL = Stillwater Flood Elevation

# Upcoming Milestones

# Coastal Restudy: Upcoming Milestones

- **Fall 2020-Spring 2021** – Ongoing Field Reconnaissance
- **Winter 2020-2021** – Finalization of IDS 2
- **Winter 2021-2022** – IDS 3 Water Levels and Waves
- **2021-2023** – IDS 4 Nearshore Hydraulics and IDS 5 Flood Hazard Mapping
- **Fall 2021** – Next Outreach Meetings
- **Ongoing** – Bi-annual Newsletters



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# Questions and Discussion

*We want to hear from you!*

**POLL**

## Did today's presentation share the right level of detail on the Coastal Restudy?

1) Yes
2) No, I wanted more detail
3) No, I prefer a general update

*Let's stay connected!*

**POLL**

Have you received our bi-annual newsletters?

1) Yes
2) I don't know - I will share my email in the chat!
3) No - I will share my email in the chat!

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# Thank You!

*Challenges, Innovation, The Way Forward*