

Modeling, Visualizing, & Communicating Nor'easter and Hurricane Threats with Sea-level Rise to Support Coastal Management within New England

Ninigret and Trustom Pond National Wildlife Refuges (NITR)

27 October 2022



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The logo for the Schoodic Institute. It features three stylized, overlapping mountain peaks in shades of green and blue. To the right of the peaks, the words "SCHOODIC INSTITUTE" are written in a bold, blue sans-serif font. Below this, the text "AT ACADIA NATIONAL PARK" is written in a smaller, blue sans-serif font.

SCHOODIC
INSTITUTE
AT ACADIA NATIONAL PARK

The logo for PennState. It features a blue shield with a white lion's head in profile. To the right of the shield, the words "PennState" are written in a bold, blue sans-serif font. Below this, the text "College of Arts and Architecture" is written in a smaller, blue sans-serif font.

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College of Arts
and Architecture

Agenda

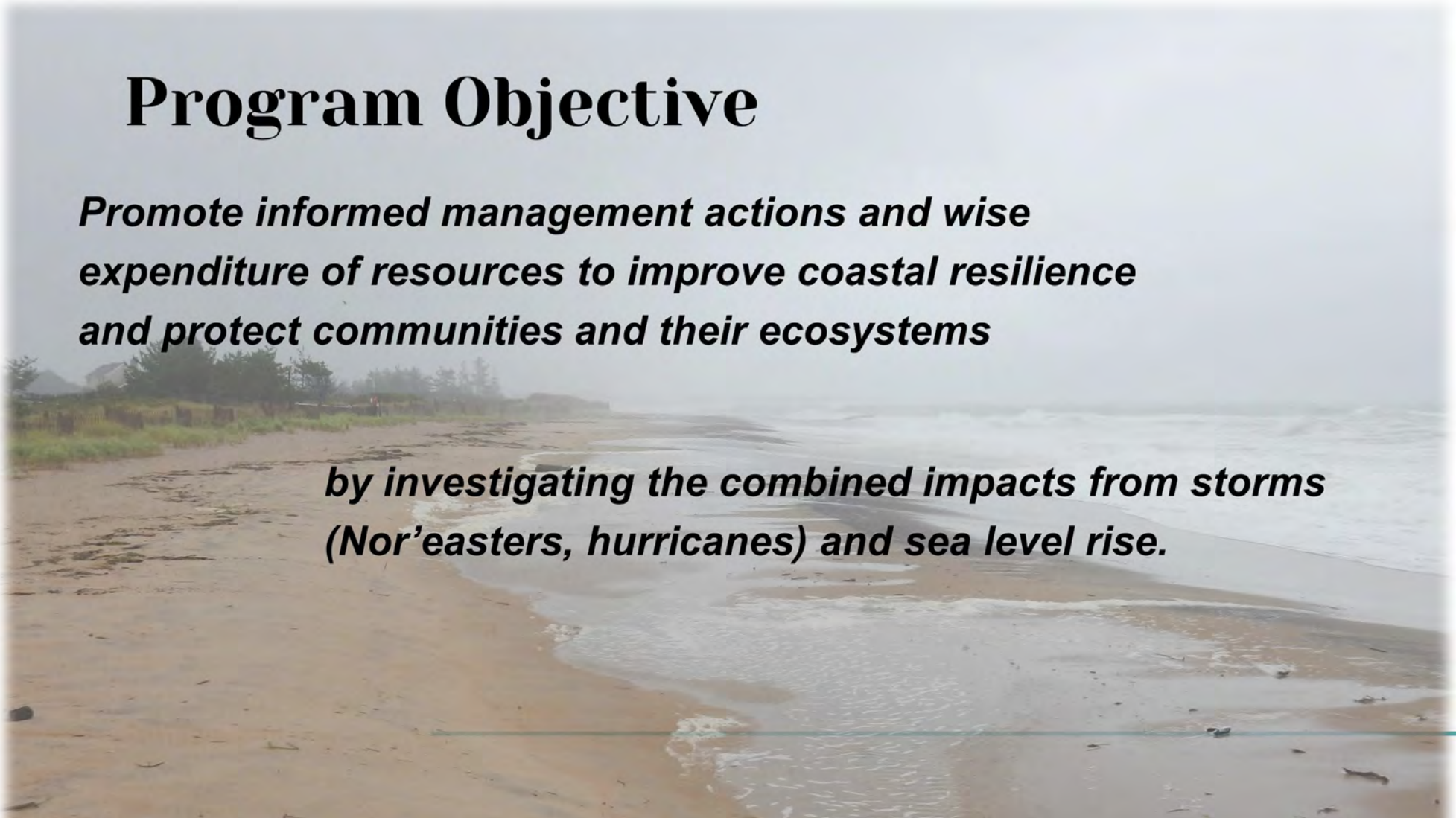
Summarizing the Concerns; Discussing Management Decisions, Capabilities, and Opportunities

10:30	Introduction and Overview
10:40	What we heard
10:50	Focusing scope of work
11:15	Group discussion
11:40	Conclusion

Program Objective

Promote informed management actions and wise expenditure of resources to improve coastal resilience and protect communities and their ecosystems

by investigating the combined impacts from storms (Nor'easters, hurricanes) and sea level rise.



NITR Timeline

Year 1



Year 2



We are here

Year 3



Year 4



- ✓ MTAG meeting (11/21)
- ✓ NITR kick off (12/21)
- ✓ Field visit (5/22)
- ✓ Issue identification
- ✓ Sandy storm modeling
- ✓ Erosion modeling
- ✓ Pilot mgmt actions
- ✓ Field research on barrier morphology

✓ *Initiate NITR & CACO sites*

- ✓ Clarify issues & management options for modeling
- ✓ Expand modeling for storms and mgmt
- ✓ Complete field research
- ✓ Begin development of decision support tools.
- ✓ MTAG meeting

✓ *Initiate all other sites*

- ✓ Refine modeling, visualizations, and support tools based on feedback from project participants.
- ✓ Build upon results and promote discussion on management implications.

- ✓ Finalize ALL site efforts and tools for use and dissemination.

What we heard – Is this a good reflection of your concerns?

Storm/SLR Scenarios

Sandy-like storm
1938

Ponds

Nutrient
Circulation
Sedimentation
Flooding in back

Barriers

Erosion
Over wash
Breaching
Trustom, W side Breachway

Barrier Habitat

Plovers
Black Pines
Vegetation options

Wetlands

Loss
Migration

Breachway

Dredge frequency
Sedimentation

Shore Development

Private Property
damage, tax base
Road
improve/maintain

Communication

Solution-based tools
Support decision makers

Public Access

Lateral access
Off Road Vehicles
Limit dune crossover

What was the South Coast like before-Hurricane Sandy?

16 ft



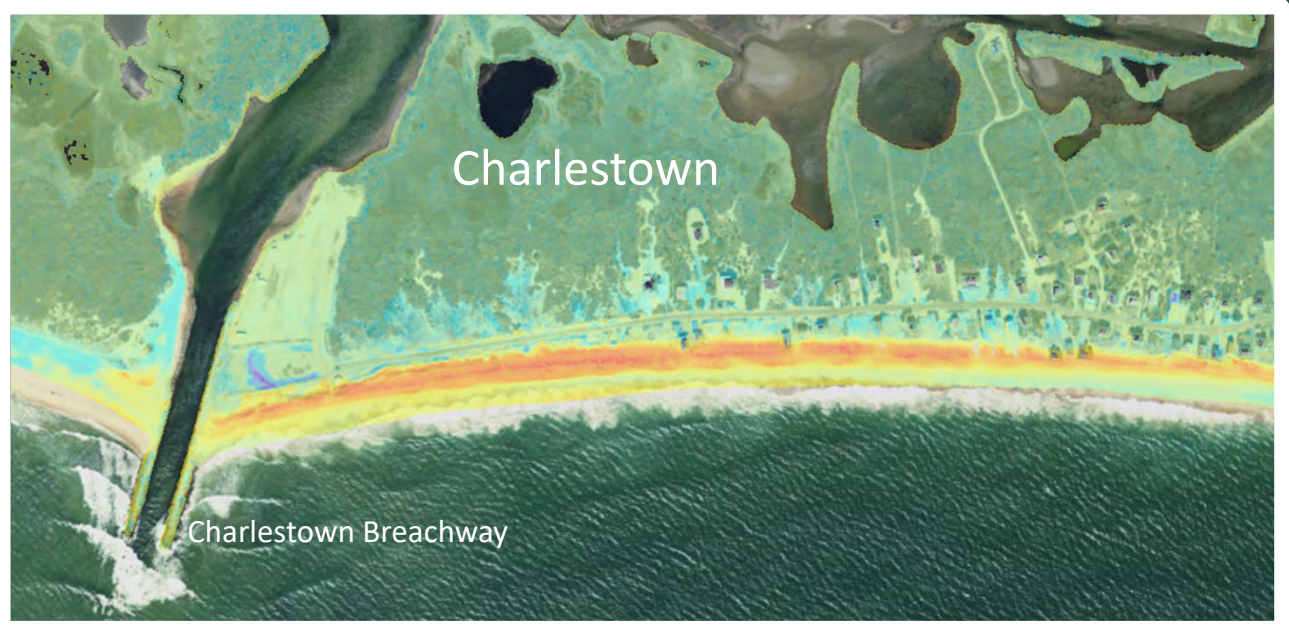
Elevation (ft)

0 ft

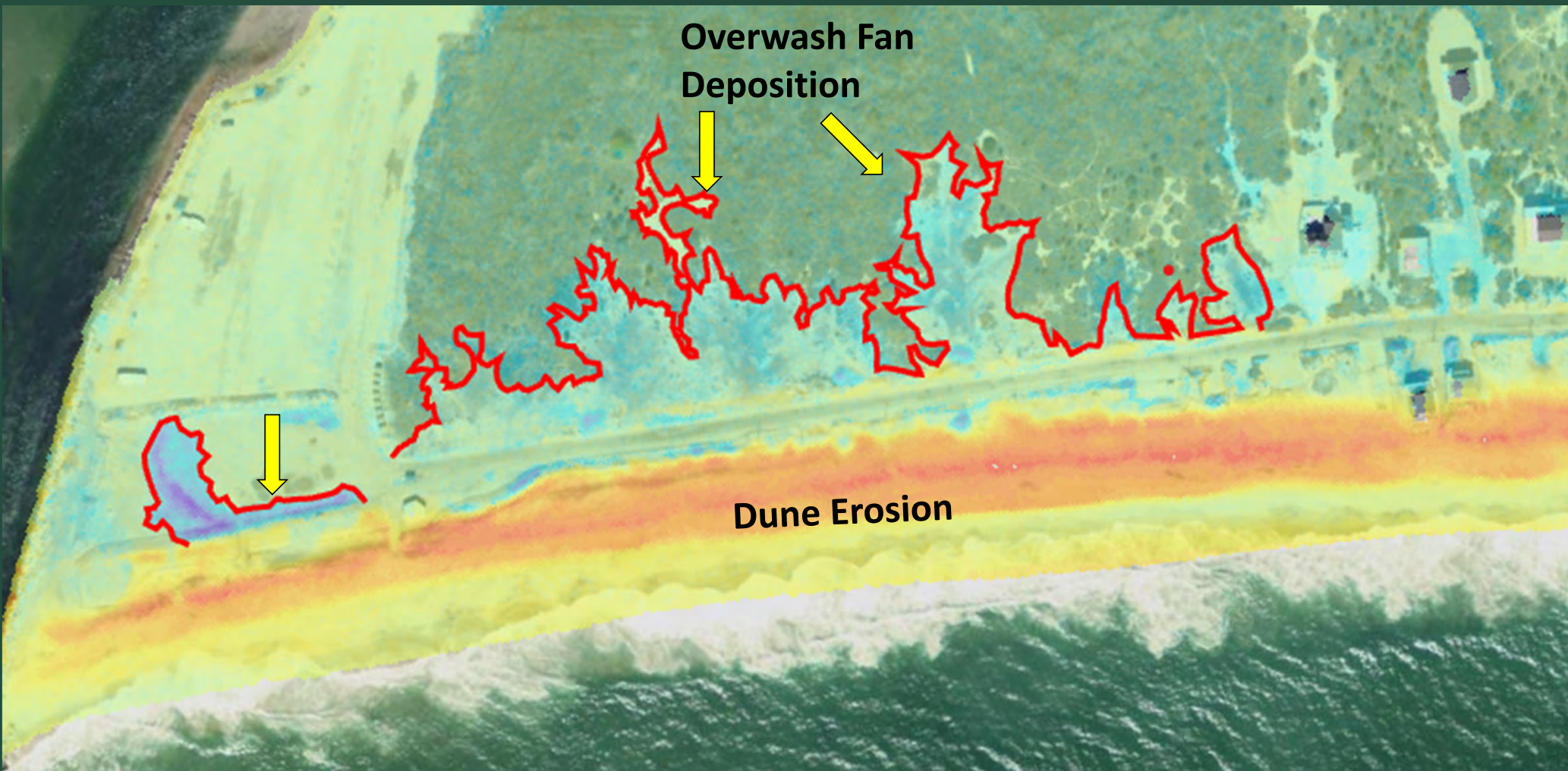
Relatively Broad Continuous Dune (preventing overwash)

2011 aerial imagery overlain with 2011 LiDAR

How has the area responded to hurricane Sandy forcing?

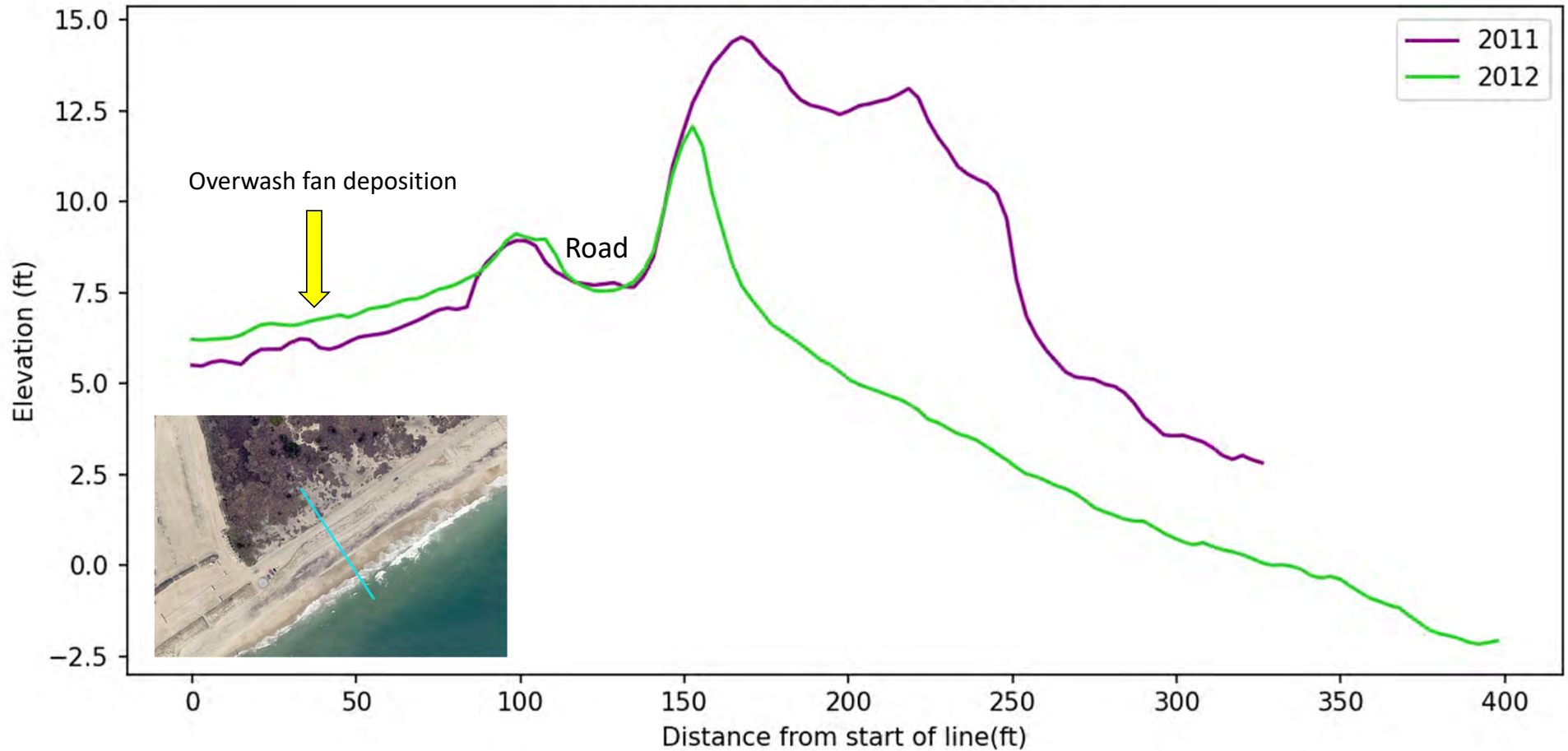


Post-Sandy aerial with LiDAR difference



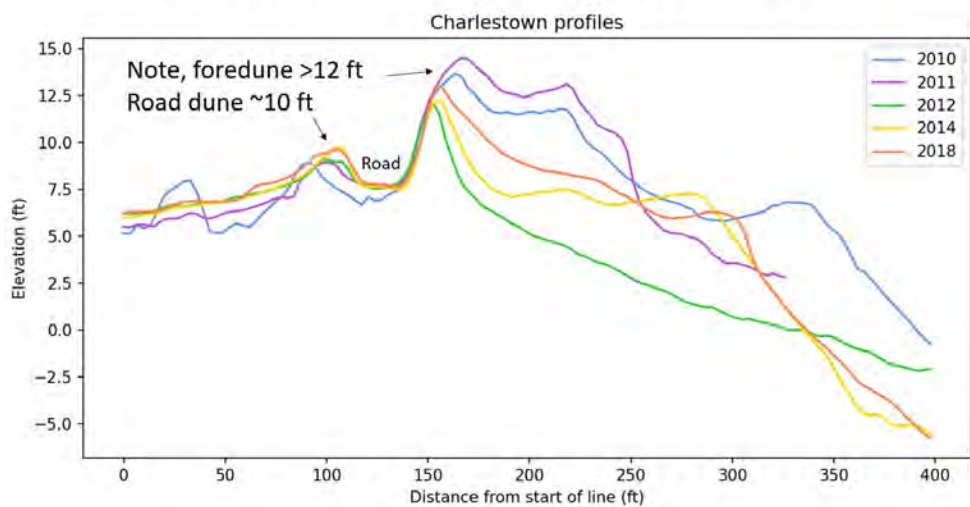
Pre & post-sandy cross sections

Charlestown 2011 and 2012 profiles

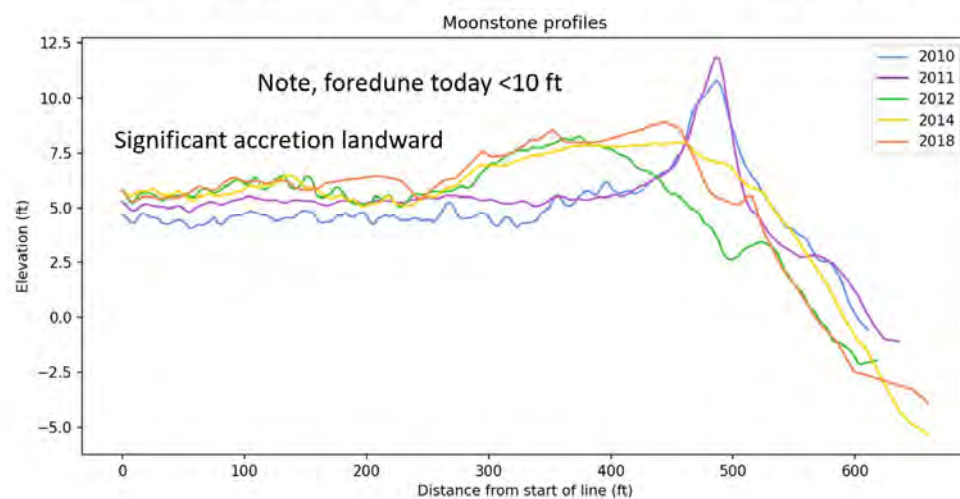


Monitoring

Cross sections 2010-2018 at Charlestown



Cross sections 2010-2018 Moonstone Beach

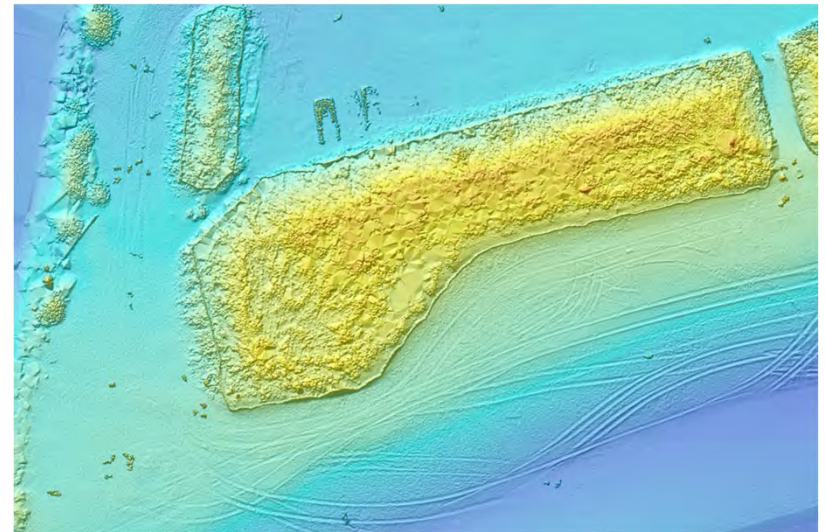


Observing real time morphological change

Terrestrial LiDAR setup



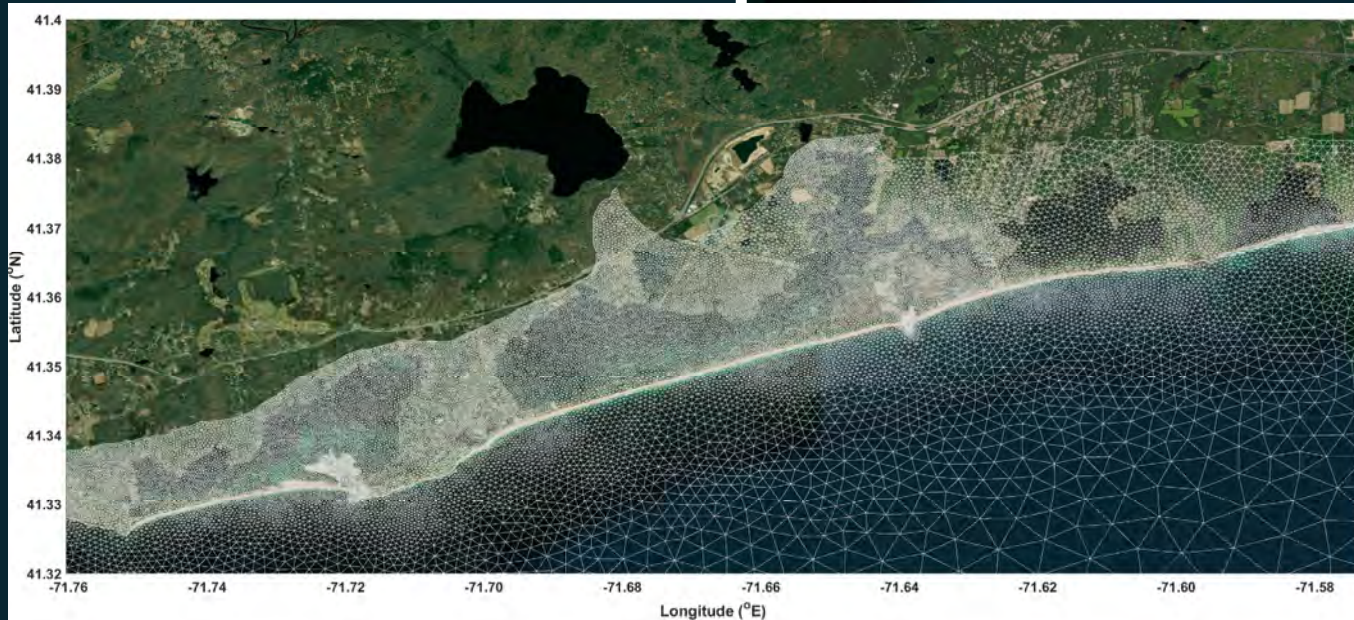
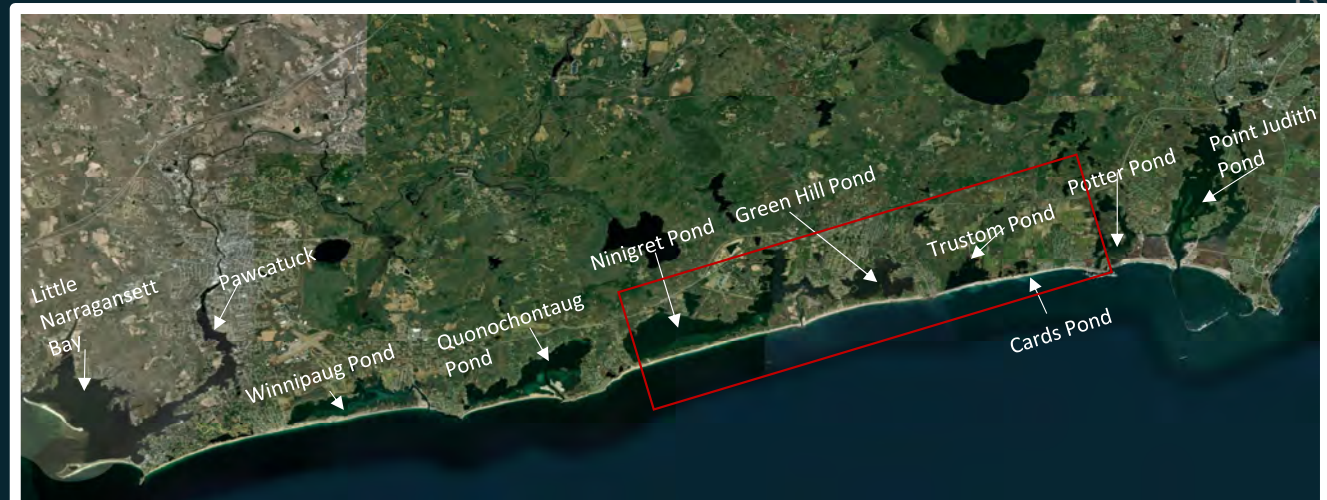
Point clouds for analysis



Bi-weekly scanning results in a library of real time, high resolution, morphological datasets to analyze how the coastal barrier system of the Ninigret Trustom area is responding to everyday wind/wave stress, along with larger storm events that may occur. Something we cannot capture with historical LiDAR alone!

ADCIRC Computational Mesh

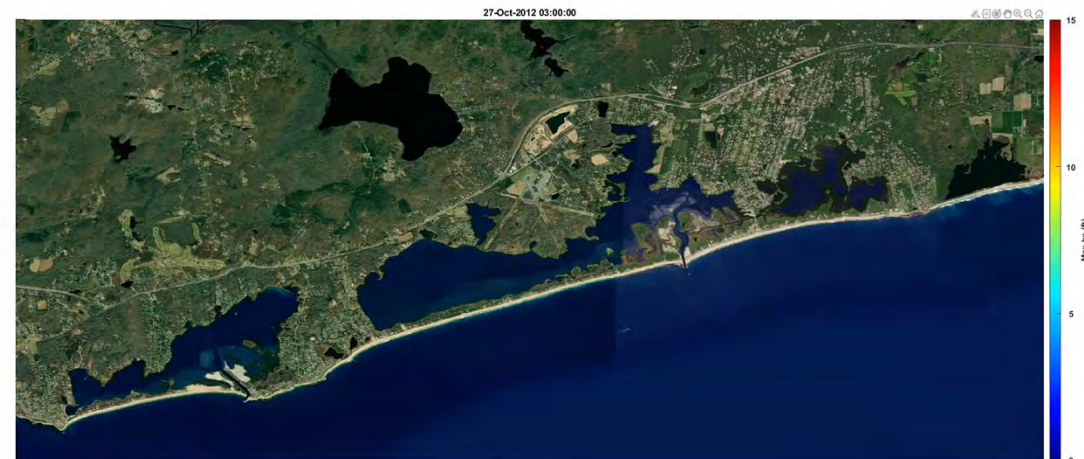
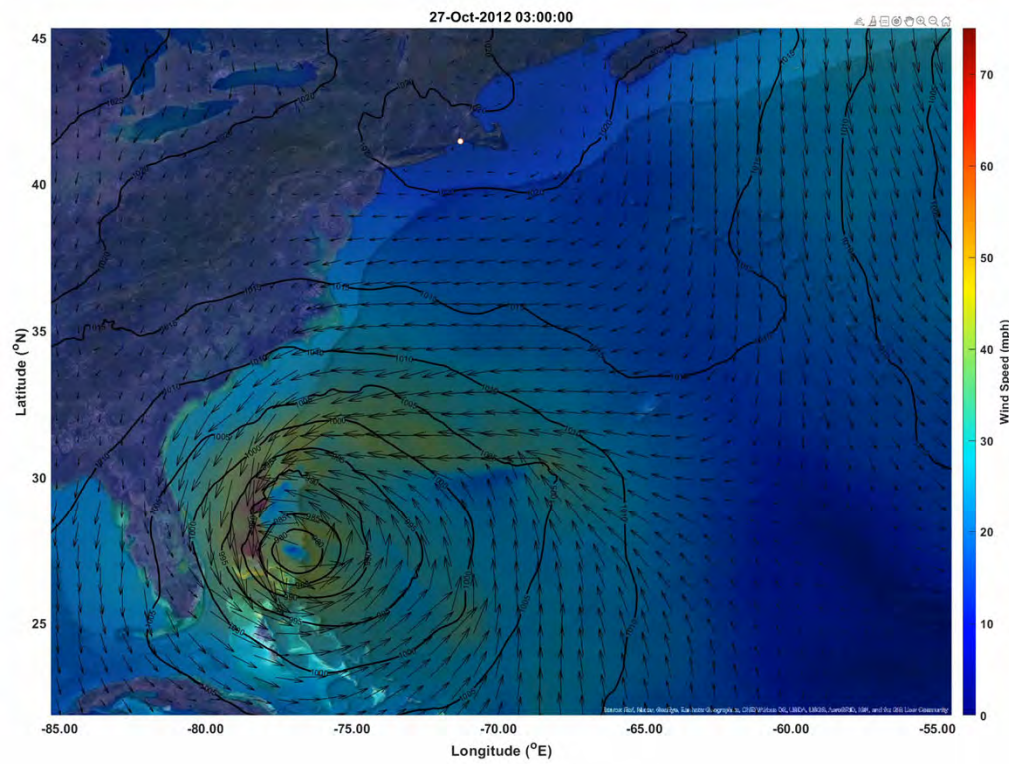
ADCIRC high-resolution
computational mesh developed
for the NITR area.



Hurricane Sandy Modeling

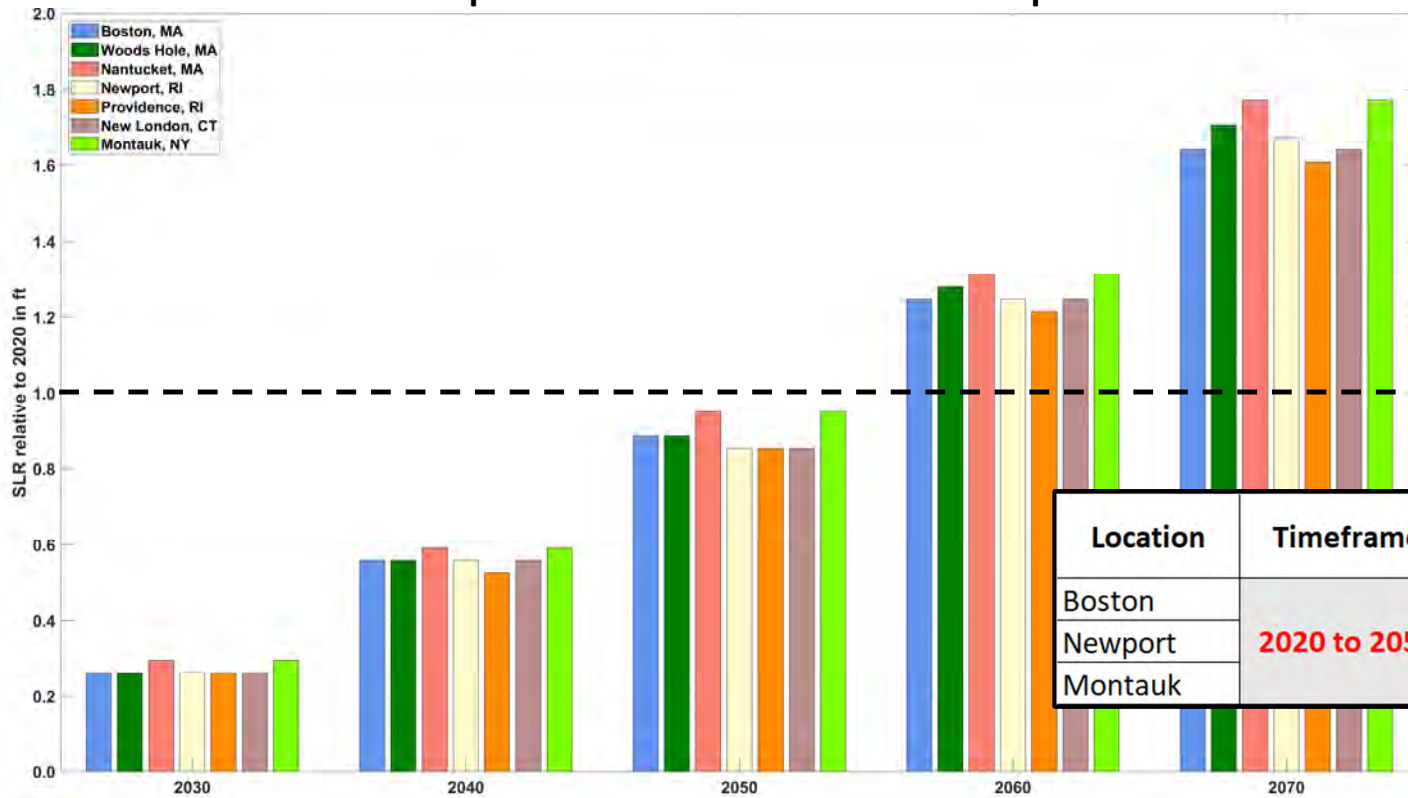
Wind speed (mph)

Significant Wave Height (ft)



SLR – 2050: 1 ft above 2020

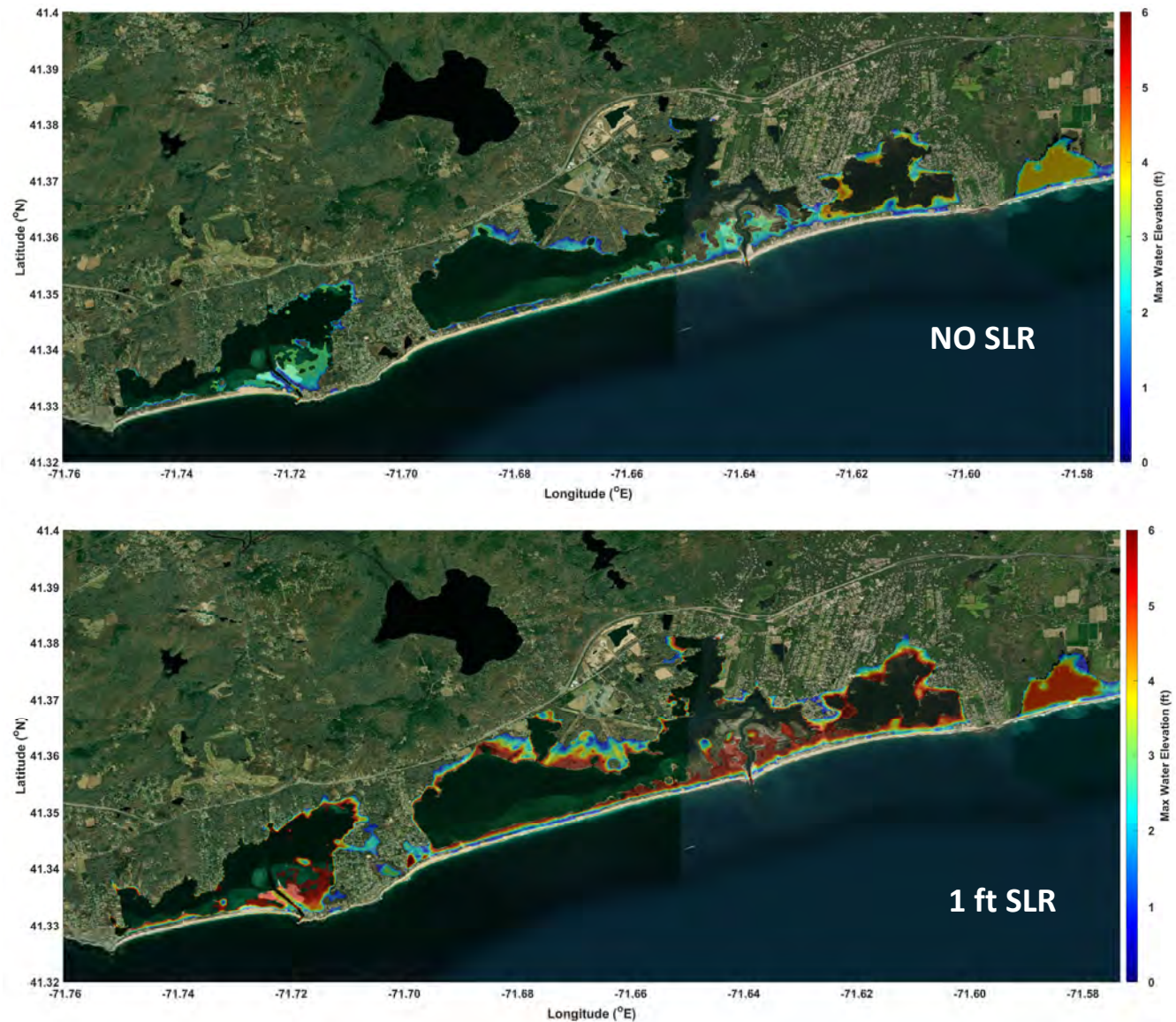
NOAA 2022 Report – Intermediates Scenario – Expected Value



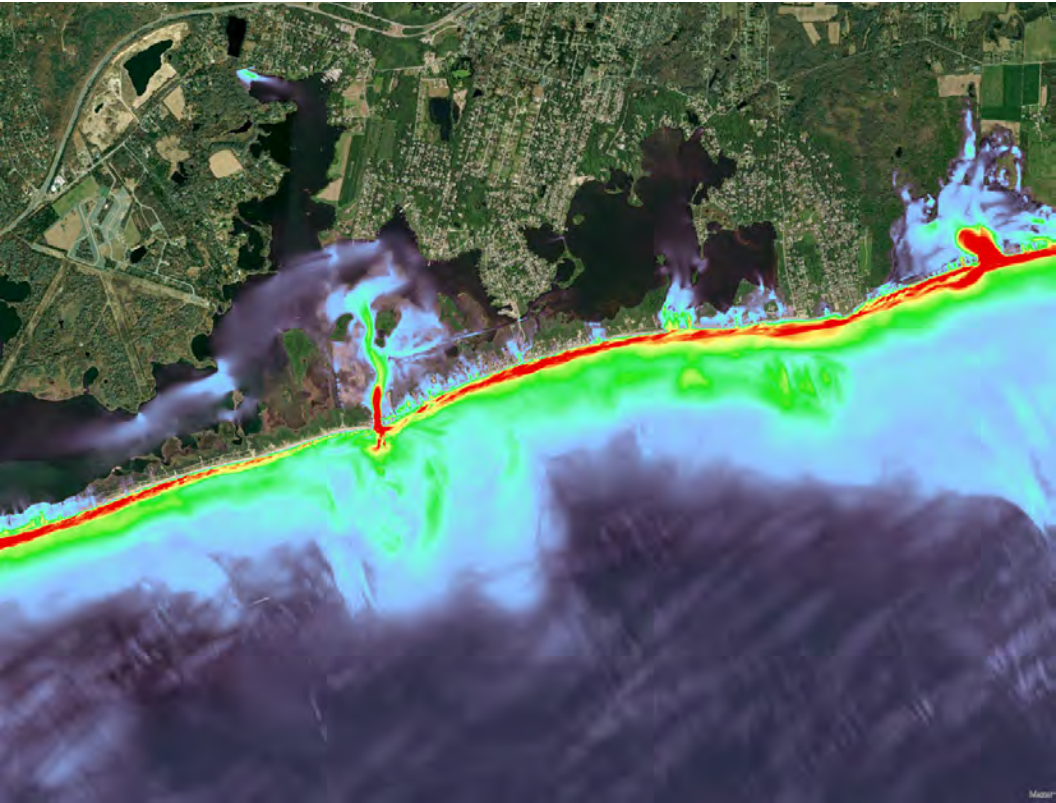
Location	Timeframe	ft		
		Low	Intermediate	High
Boston	2020 to 2050	0.66	0.89	1.15
Newport		0.62	0.85	1.18
Montauk		0.69	0.95	1.25

Sandy – Inundation

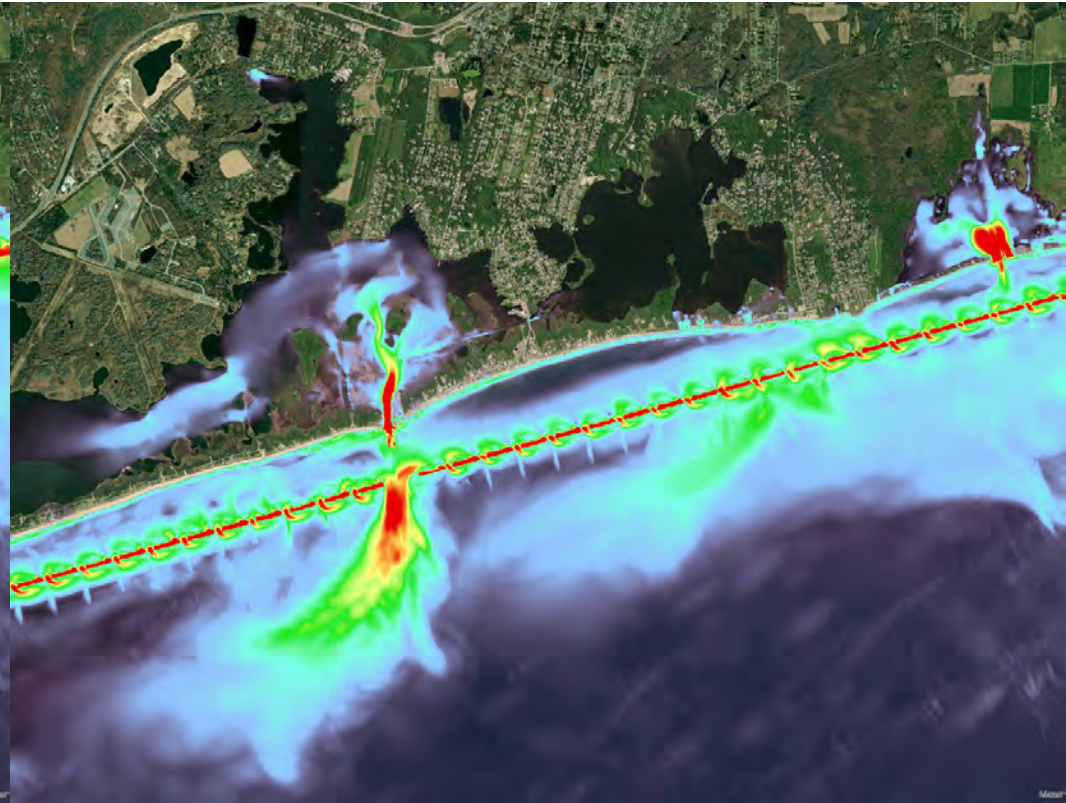
Inundation over land at
locations above MSL
for historical storm
(Top) and with 1 ft SLR
(Bottom)



Modeling changing morphology and scenarios

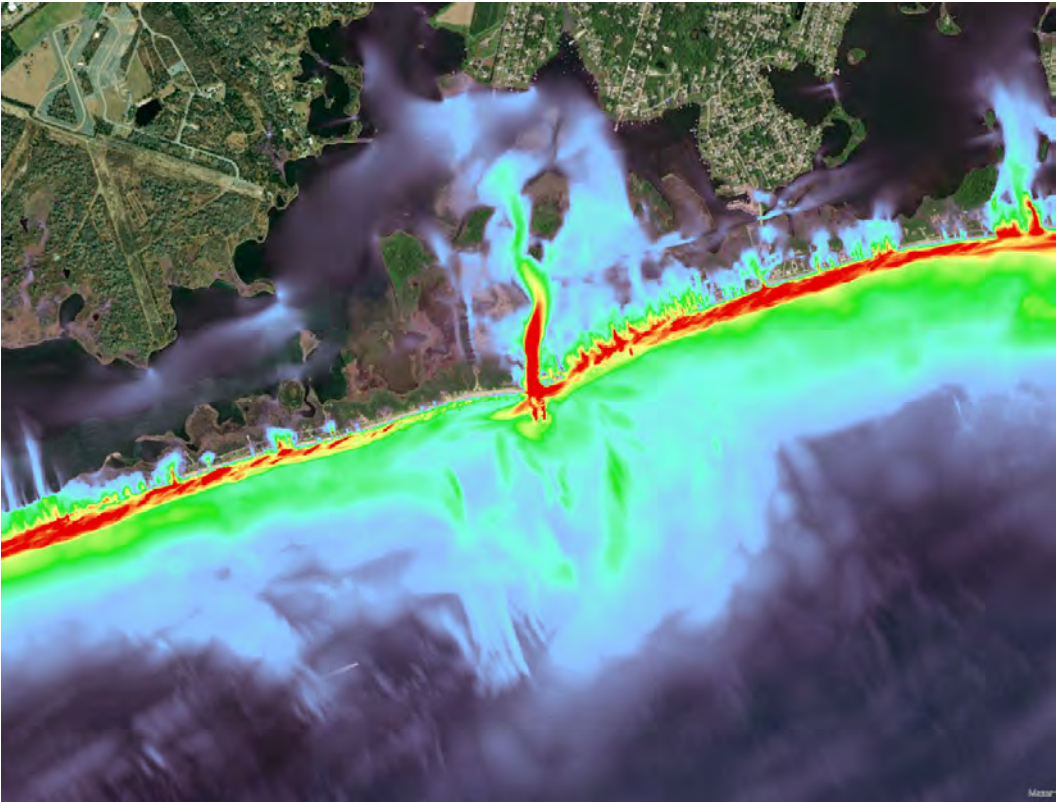


Sandy-like storm

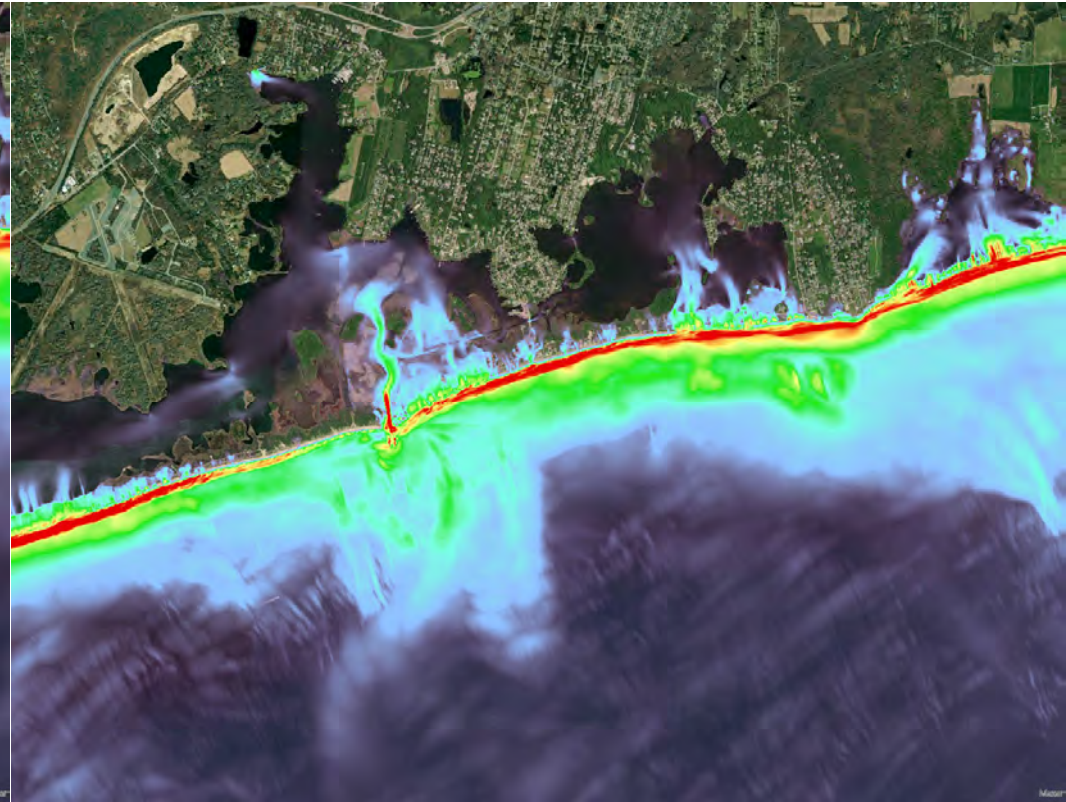


Artificial Reef (not a “real option”,
but informative).

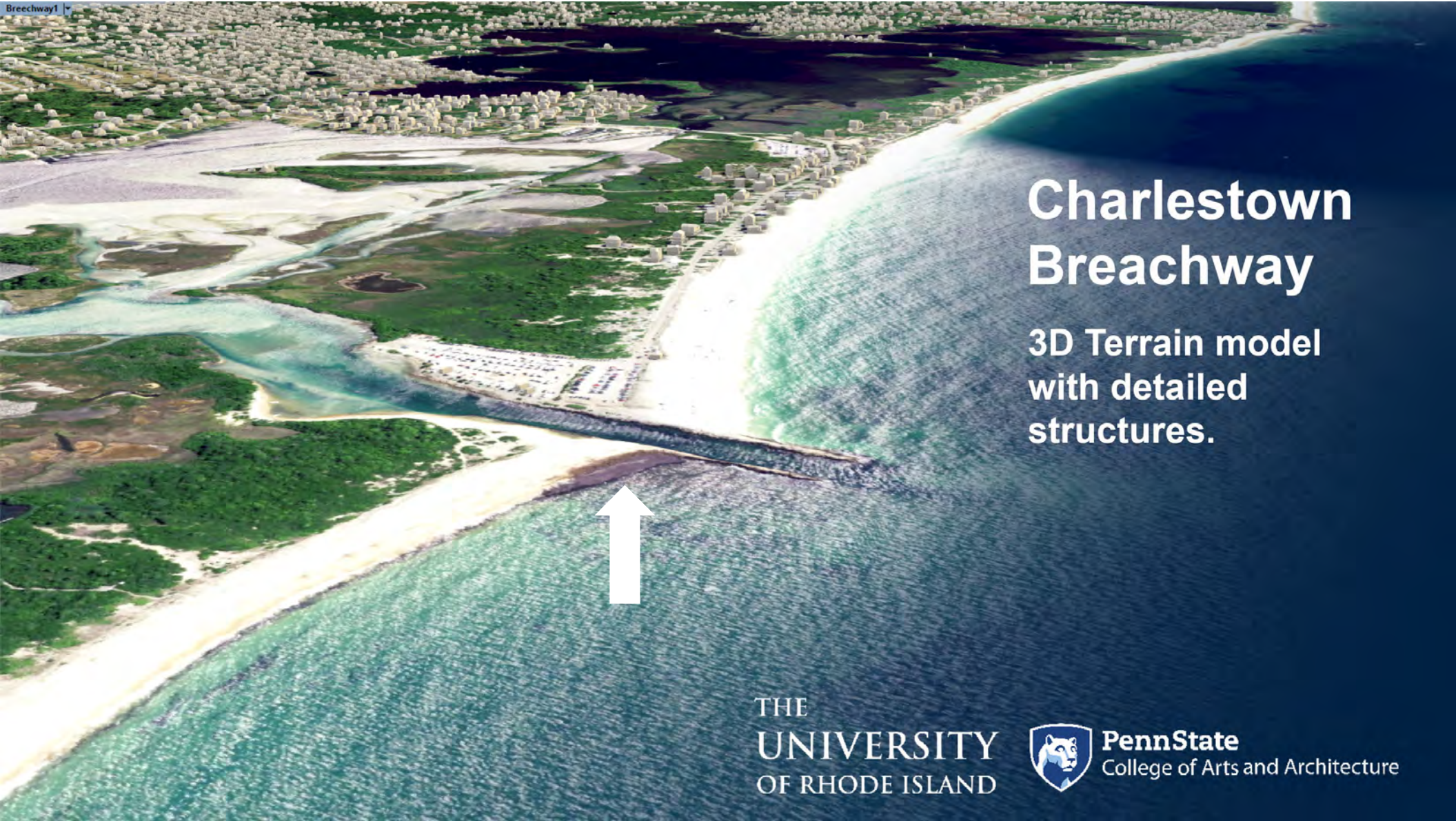
A Sandy-like storm with 1' of Sea Level Rise



Existing Vegetation



Maximum Possible
Vegetation



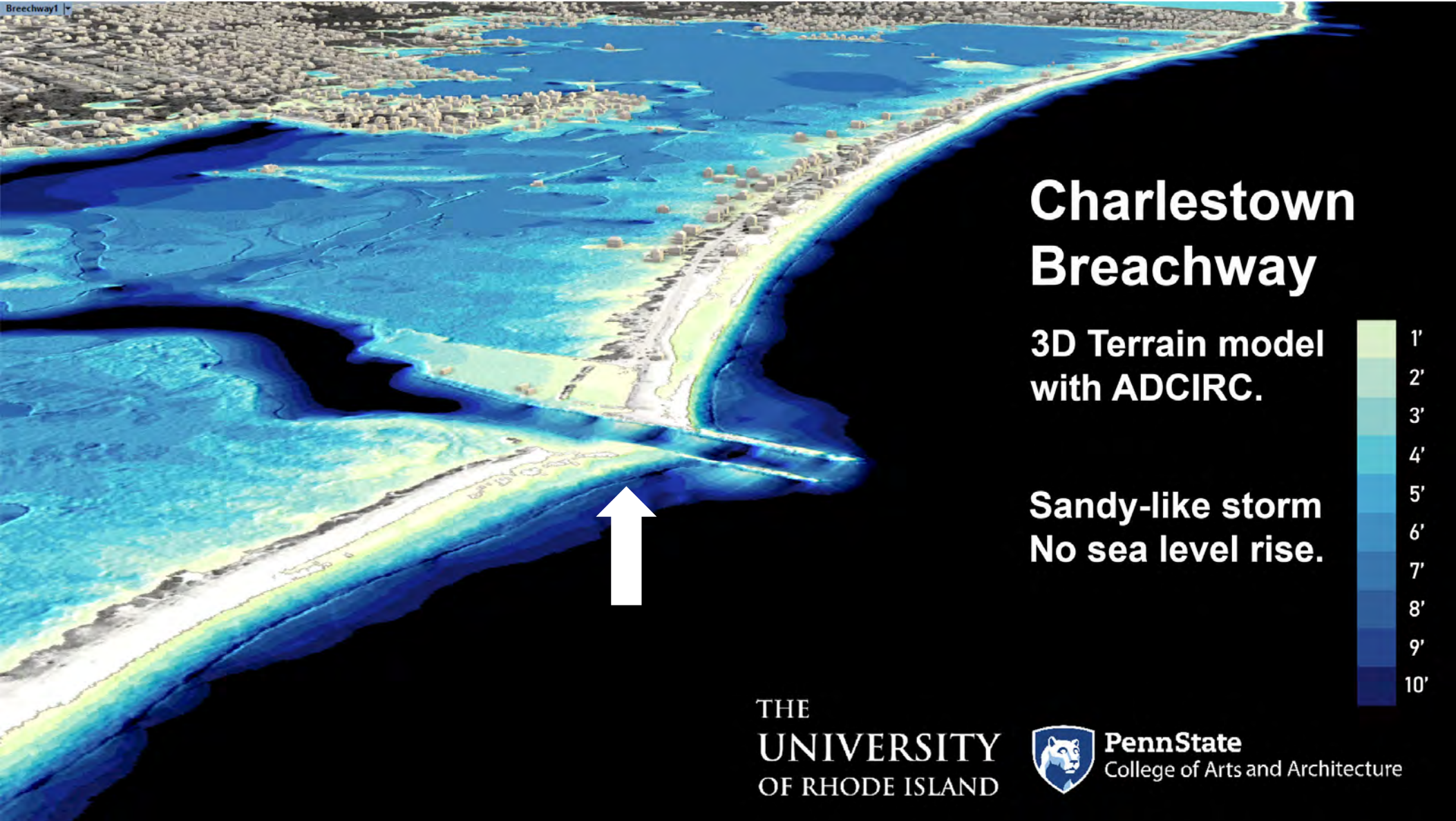
Charlestown Breachway

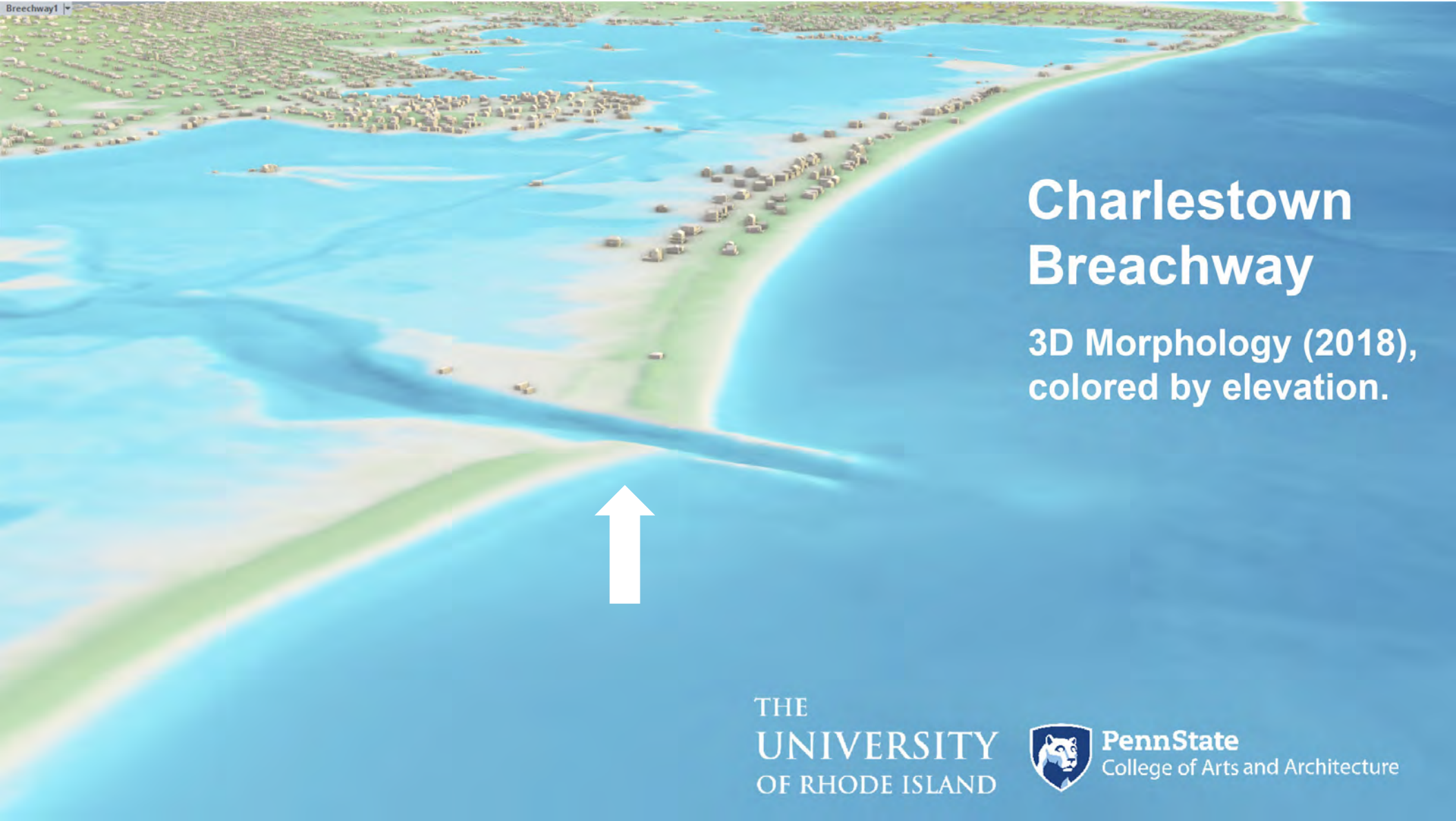
3D Terrain model with detailed structures.

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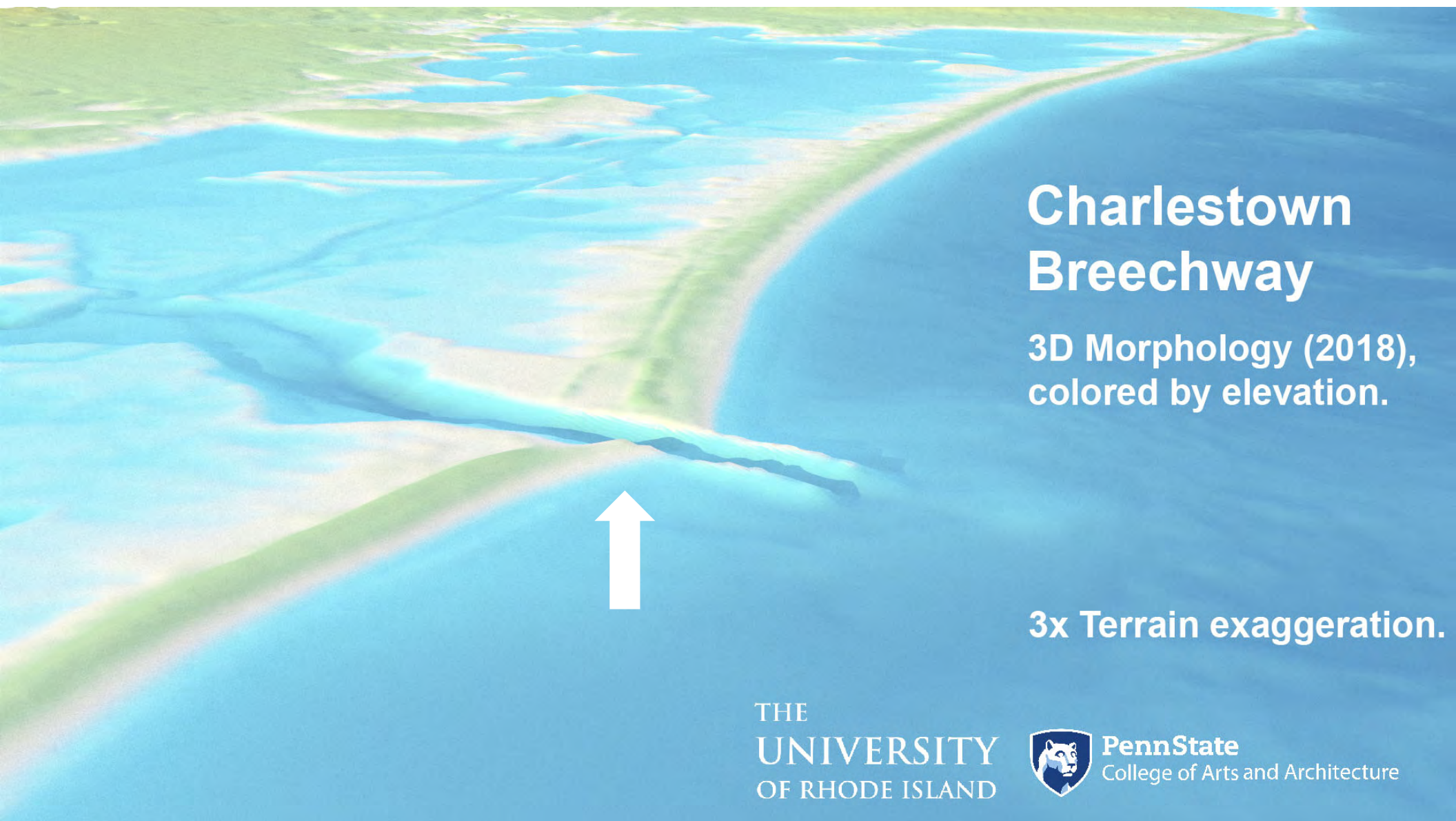
Charlestown Breachway

3D Morphology (2018),
colored by elevation.

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Charlestown Breechway

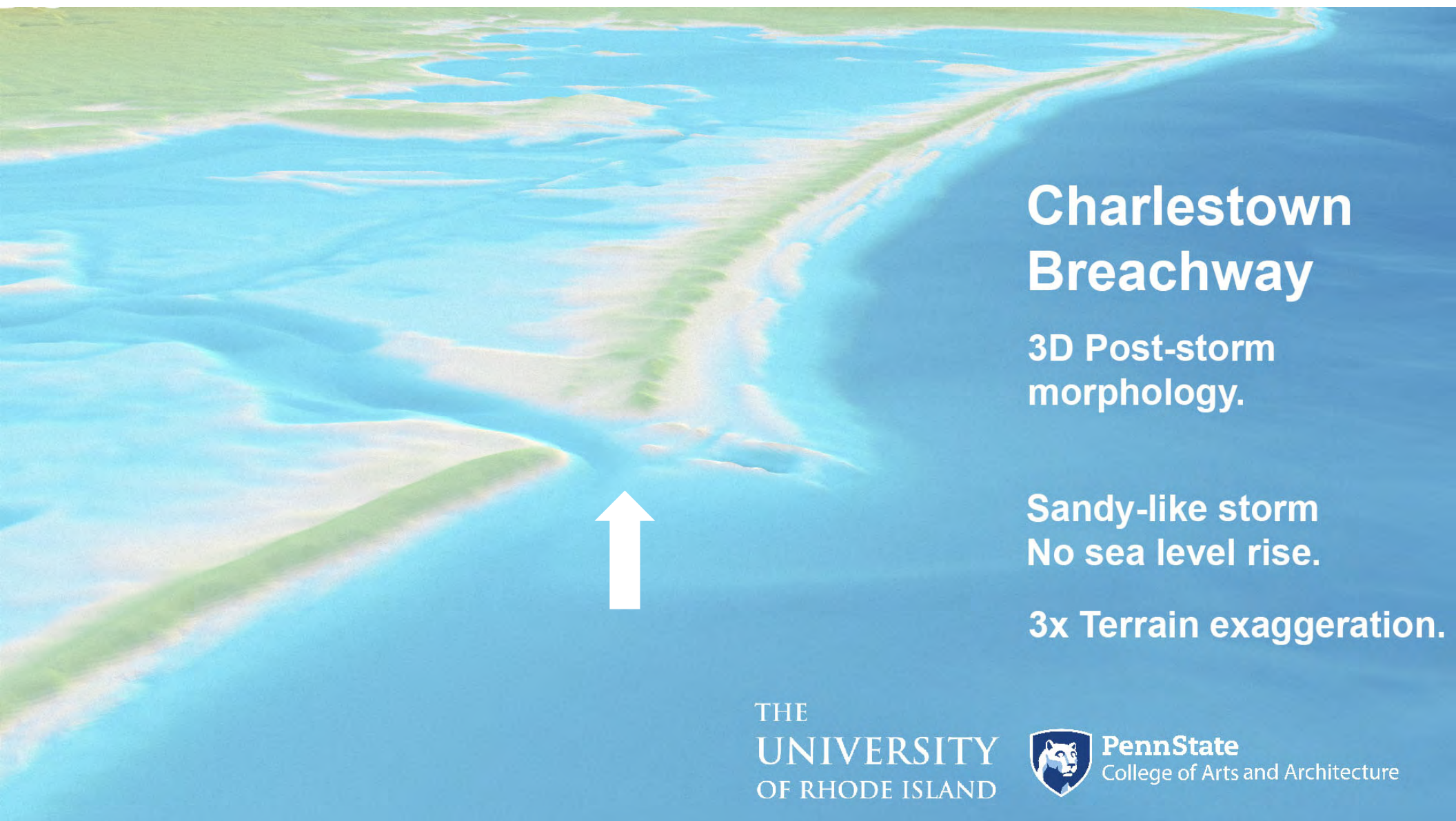
3D Morphology (2018),
colored by elevation.

3x Terrain exaggeration.

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Charlestown Breachway

3D Post-storm
morphology.

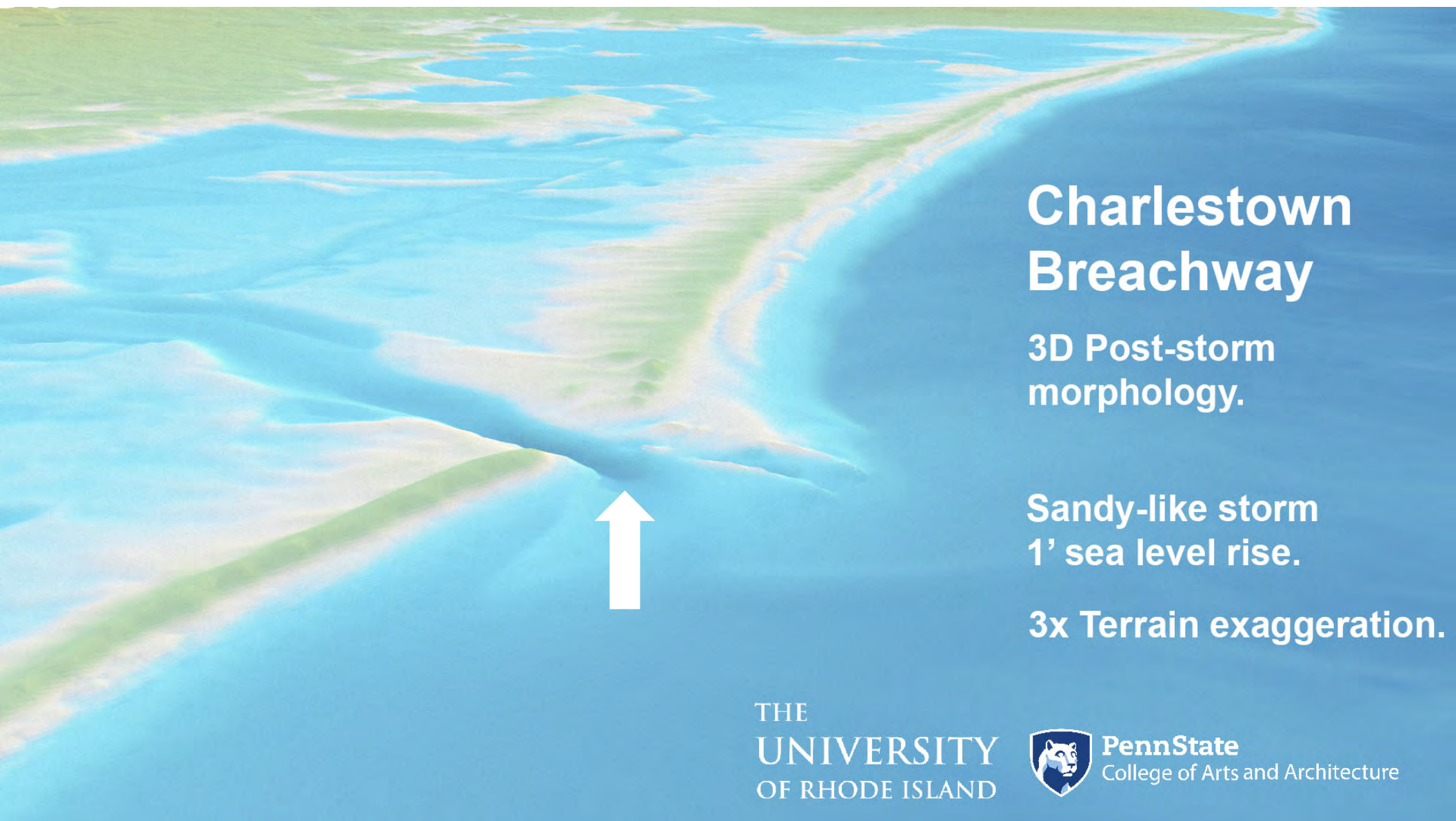
Sandy-like storm
No sea level rise.

3x Terrain exaggeration.

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Charlestown Breachway

3D Post-storm
morphology.

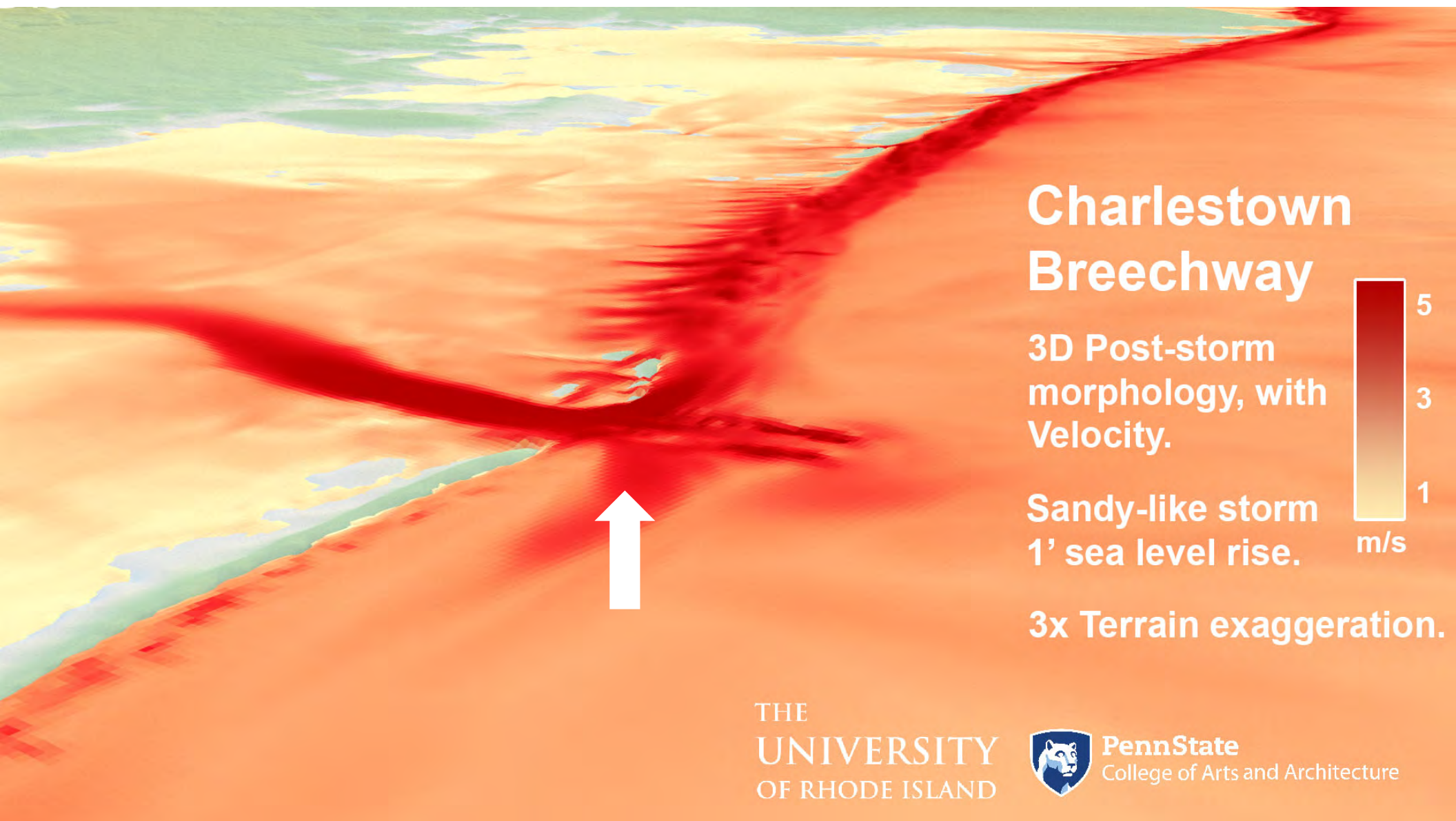
Sandy-like storm
1' sea level rise.

3x Terrain exaggeration.

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Charlestown Breechway

3D Post-storm morphology, with Velocity.

Sandy-like storm 1' sea level rise.

3x Terrain exaggeration.



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Breachway

**3D Terrain model
with detailed structures.
Reverse angle, looking from
South Kingstown to Charlestown**

Green Hill
Pond



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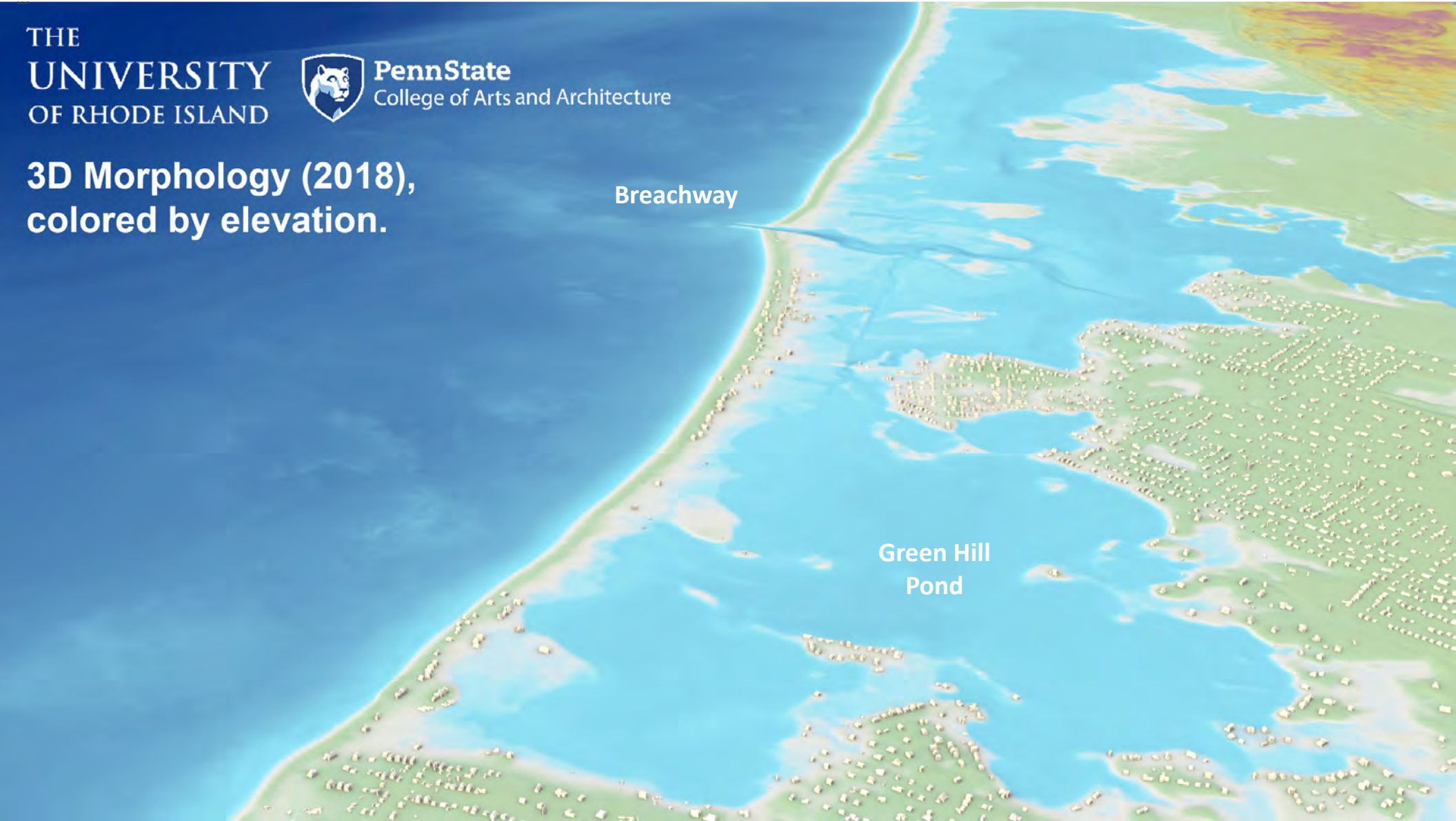


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**3D Morphology (2018),
colored by elevation.**

Breachway

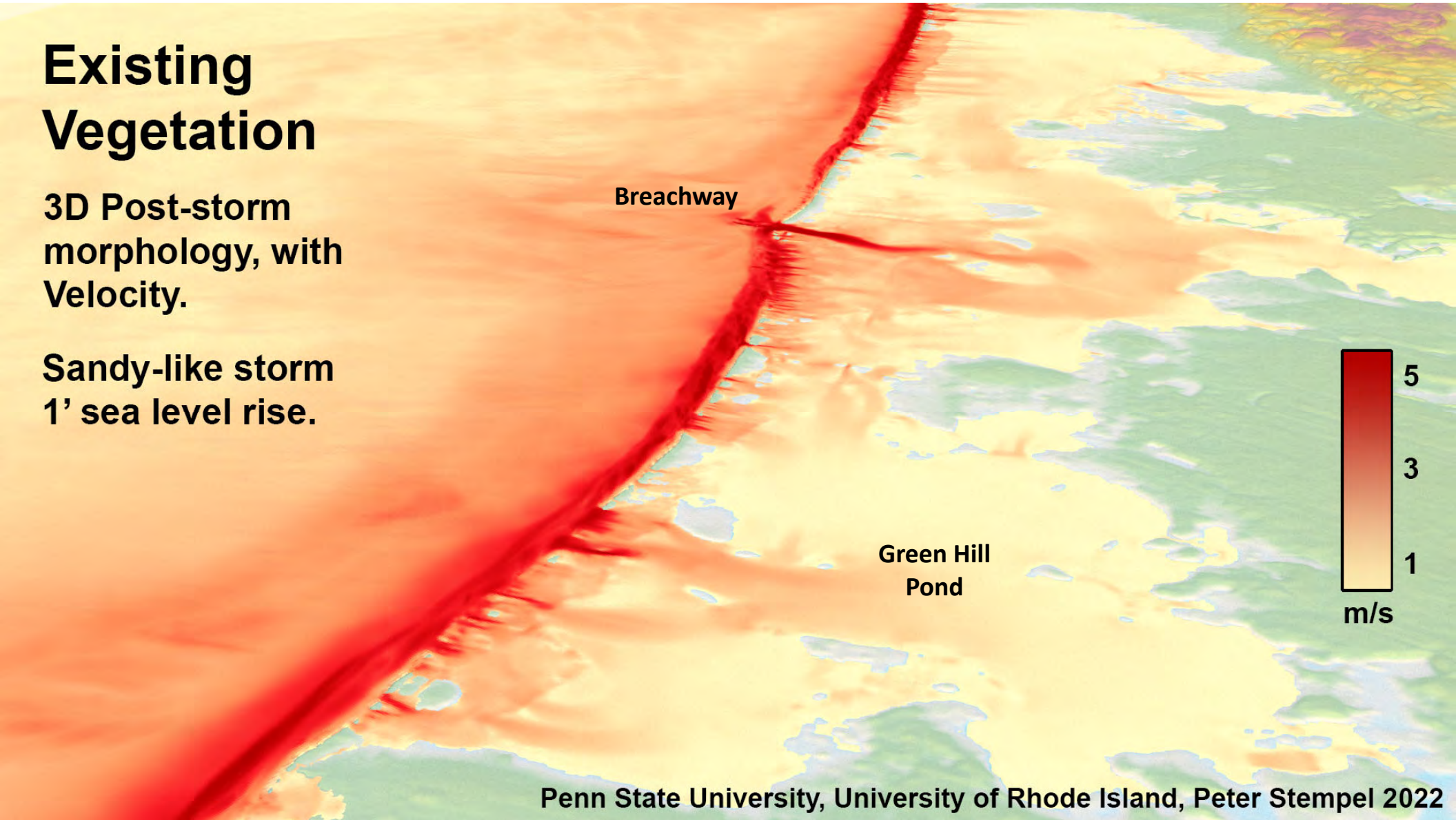
Green Hill
Pond



Existing Vegetation

3D Post-storm
morphology, with
Velocity.

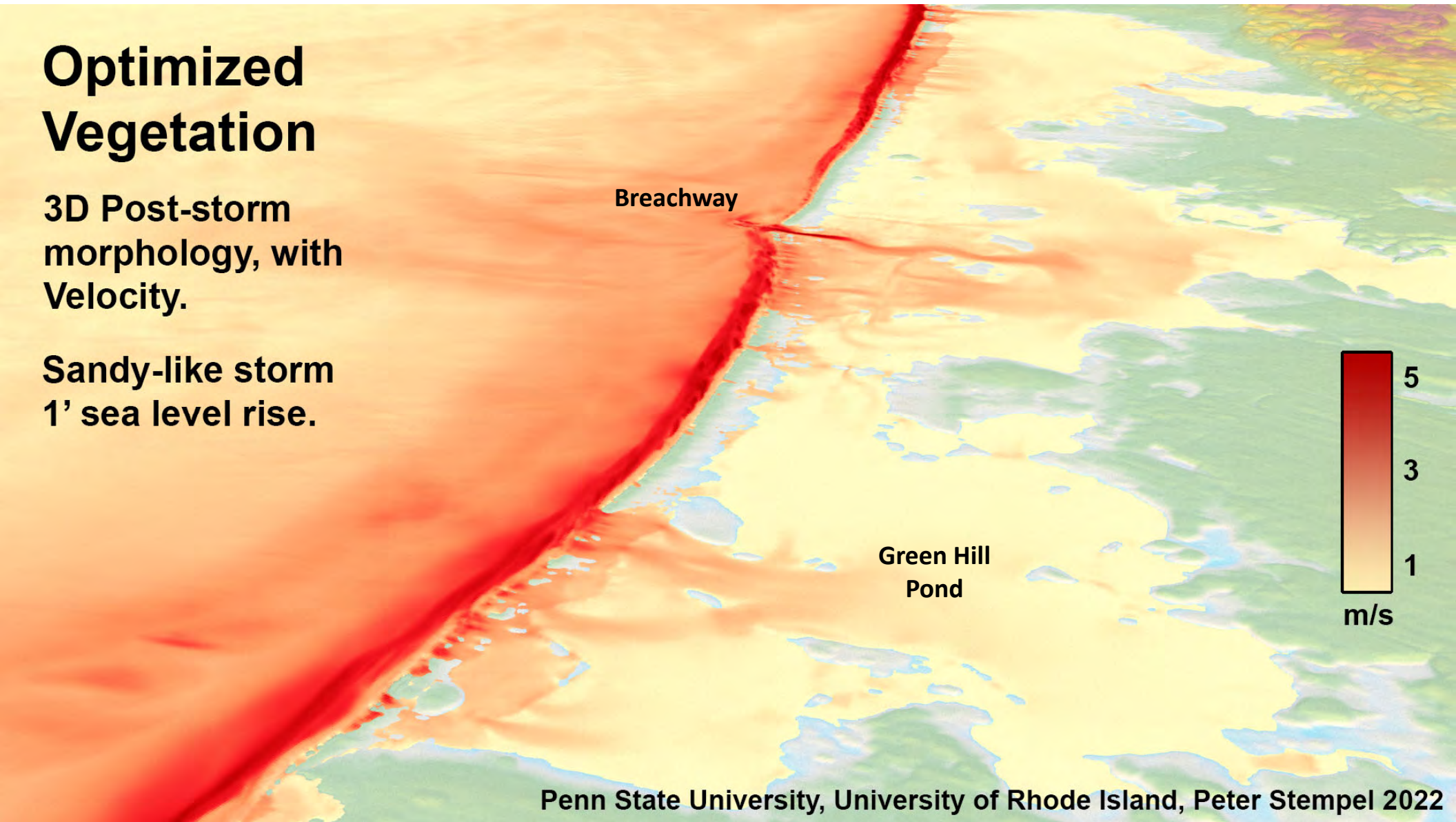
Sandy-like storm
1' sea level rise.



Optimized Vegetation

3D Post-storm morphology, with Velocity.

Sandy-like storm 1' sea level rise.



Penn State University, University of Rhode Island, Peter Stempel 2022

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**3D Terrain model
with detailed structures.
Trustom Pond**

Trustom Pond





Trustom Pond

3D Pre-storm
morphology
with reef.

1' SLR

3x Terrain
exaggeration.



Trustom Pond

3D Post-storm
morphology
with reef.

1' SLR

3x Terrain
exaggeration.

Scope: Key Opportunities/Alignment

Storm/SLR Scenarios

Sandy-like storm
1938

Ponds

Nutrient
Circulation
Sedimentation
Flooding in back

Barriers

Erosion
Overwash
Breaching
Trustom, W side Breachway

Barrier Habitat

Plovers
Black pines
Vegetation options

Communication

Solution-based tools
Support decision makers

Wetlands

Loss
Migration

Breachway

Dredge frequency
Sedimentation

Shore Development

Private property *damage,*
tax base
Barrier roads
improve/maintain

Public Access

Lateral access
Off Road Vehicles
Limit dune crossover

Discussion

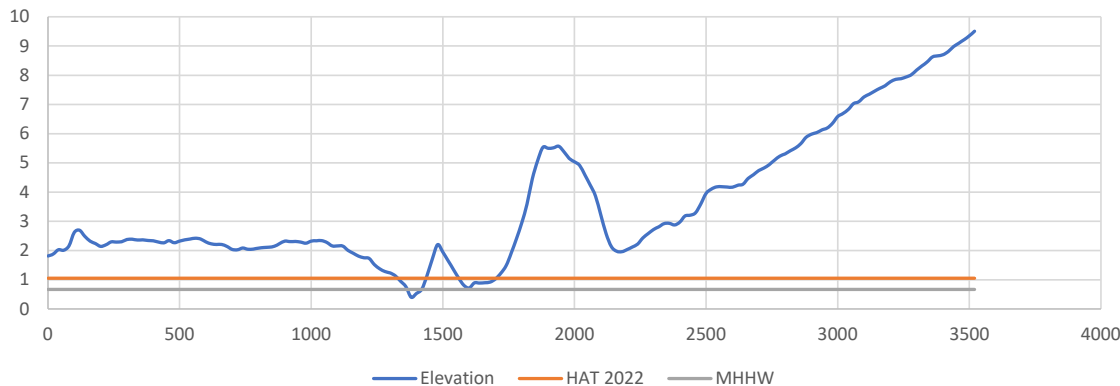
1. Are there specific management opportunities/sites that we can explore?
 2. Are there possible metrics, e.g., impacts on tax base, vol of sediment for nourishment, specific infrastructure assets affected, area of habitat.
-

Examples of metrics

- Volume of sand moved from road / nourishment
- Effect on tax base – e.g., showing the intersection of affected tax base and vegetation in quantitative terms.
- Area meeting habitat criteria.
- Effects on specific infrastructure, testing thresholds.



Road Centerline Analysis (Meters)



Discussion

1. Are there specific management opportunities/sites that we can explore?
 2. Are there possible metrics, e.g., impacts on tax base, vol of sediment for nourishment, specific infrastructure assets affected, area of habitat.
-

Next Steps

- ✓ Clarify/link issues & mgmt options for modeling
- ✓ Expand modeling for storms & mgmt
- ✓ Complete field research
- ✓ Begin development of decision support tools.
- ✓ MTAG meeting

- ✓ *Initiate all other sites*

