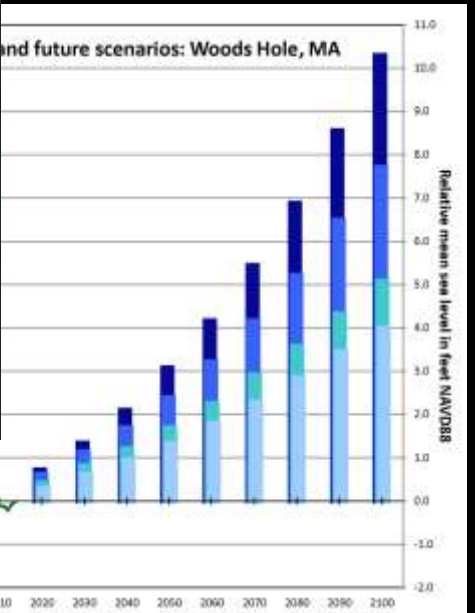
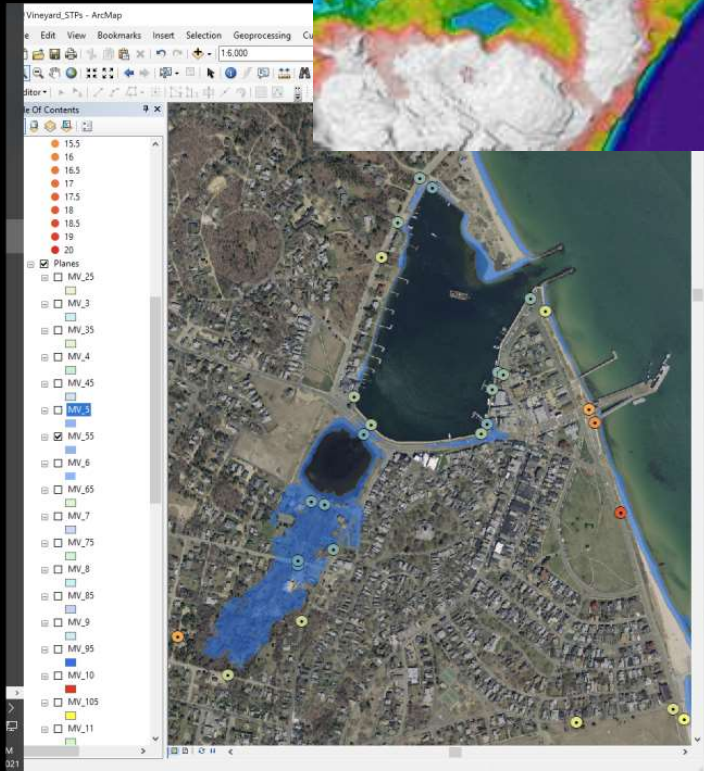
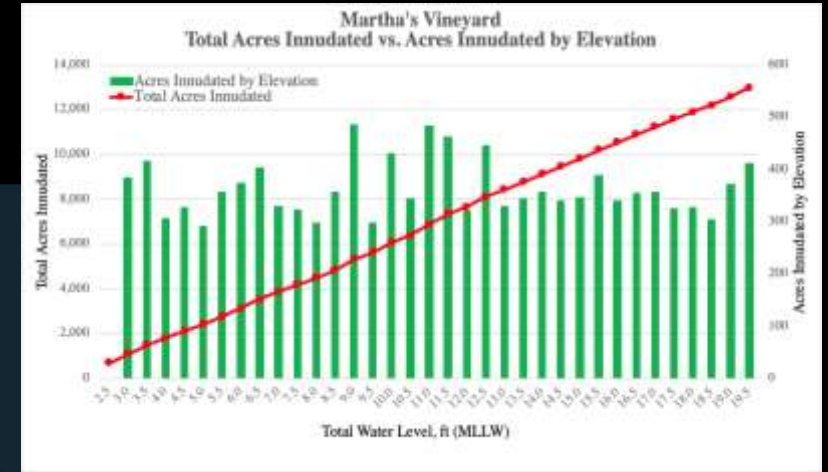
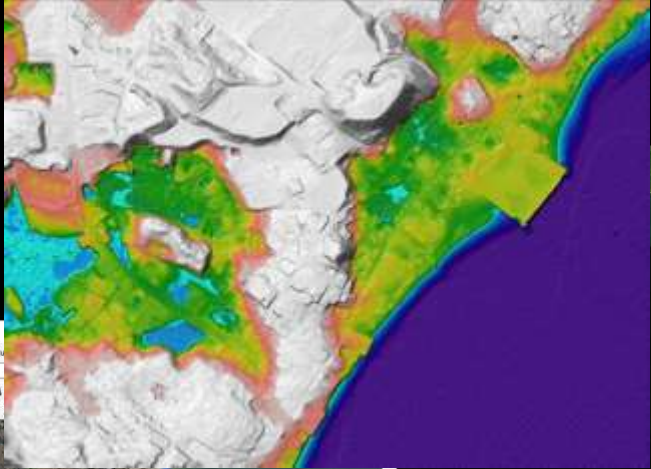


# Mapping Storm Tide Pathways on Martha's Vineyard



## Partners

# ACKNOWLEDGMENTS



Massachusetts Office of Coastal Zone Management

Steve Mckenna, Patricia Bowie



Martha's Vineyard Commission:

Adam Turner, Liz Durkee



National Weather Service:

Joseph Dellicarpini



Cape Cod Cooperative Extension:

Shannon Hulst, Greg Berman

# Talk Overview

- **The Context:**
  - Sea Level Rise and Coastal Storms
- **The Project:**
  - Mapping Storm Tide Pathways Island
  - Preliminary Loy-Lying Roads Assessment
- **The Outlook**
  - Lots to do, but we know what it is



# Northeast is likely to experience more than a century's worth of sea level rise from 2000 to 2050, report finds

By [David Abel](#) Globe Staff, Updated February 15, 2022, 9:13 p.m.

[Email](#) [Bookmark](#) [Facebook](#) [Twitter](#) [Print](#) [Comments](#) 102



A section of Long Wharf was flooded during high tide during the snowstorm in downtown Boston on Jan. 29, 2022. CRAIG F. WALKER/GLOBE STAFF



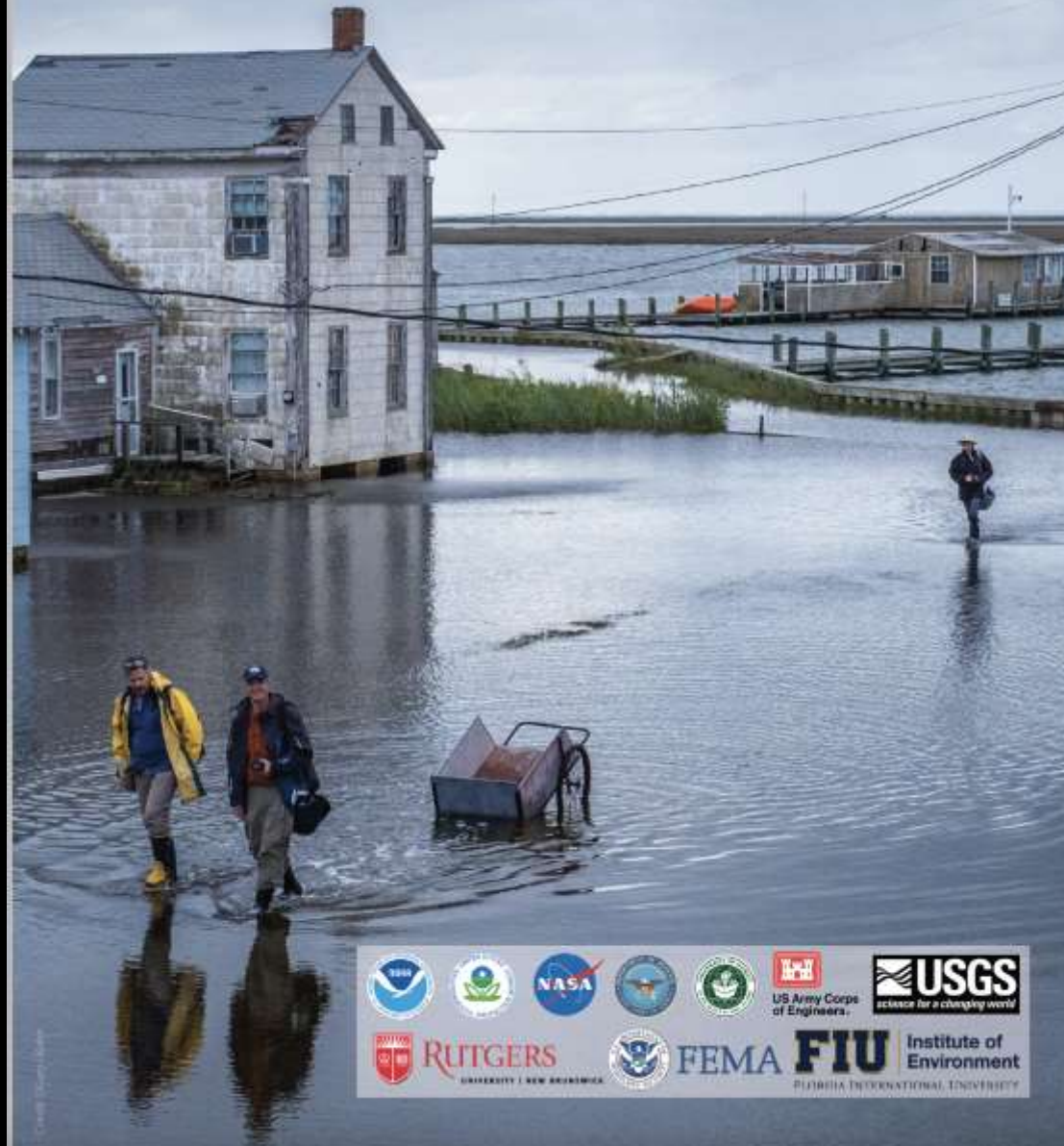
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Marine Geology

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The Coastal Processes and Ecosystems Laboratory

The University of Massachusetts, Boston  
School for the Environment



# Global and Regional Sea Level Rise Scenarios for the United States



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## Key Message #1:

*Multiple lines of evidence provide increased confidence, regardless of the emissions pathway, in a narrower range of projected global, national, and regional sea level rise at 2050 than previously reported (Sweet et al., 2017).*

- Both trajectories assessed by extrapolating rates and accelerations estimated from historical tide gauge observations, and model projections, fall within the same range in all cases, giving higher confidence in these relative sea level (RSL; land and ocean height changes) rise amounts by 2050.
- Relative sea level along the contiguous U.S. (CONUS) coastline is expected to rise on average as much over the next 30 years (0.25–0.30 m over 2020–2050) as it has over the last 100 years (1920–2020).
- Due to processes driving regional changes in sea level, there are similar regional differences in both the modeled scenarios and observation-based extrapolations, with higher RSL rise along the East (0–5 cm higher on average than CONUS) and Gulf Coasts (10–15 cm higher) as compared to the West (10–15 cm lower) and Hawaiian/Caribbean (5–10 cm lower) Coasts.
- The projections do not include natural year-to-year sea level variability that occurs along U.S. coastlines in response to climatic modes such as the El Niño–Southern Oscillation.



# Northeast is likely to experience more than a century's worth of sea level rise from 2000 to 2050, report finds

SCIENCE

**WALL STREET JOURNAL | February 15, 2022**

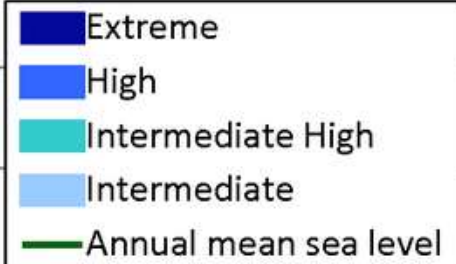
## Scientists Forecast U.S. Sea Levels Could Rise a Foot by 2050

Sea levels are forecast to rise rapidly over the next 30 years, bringing more frequent and more destructive floods

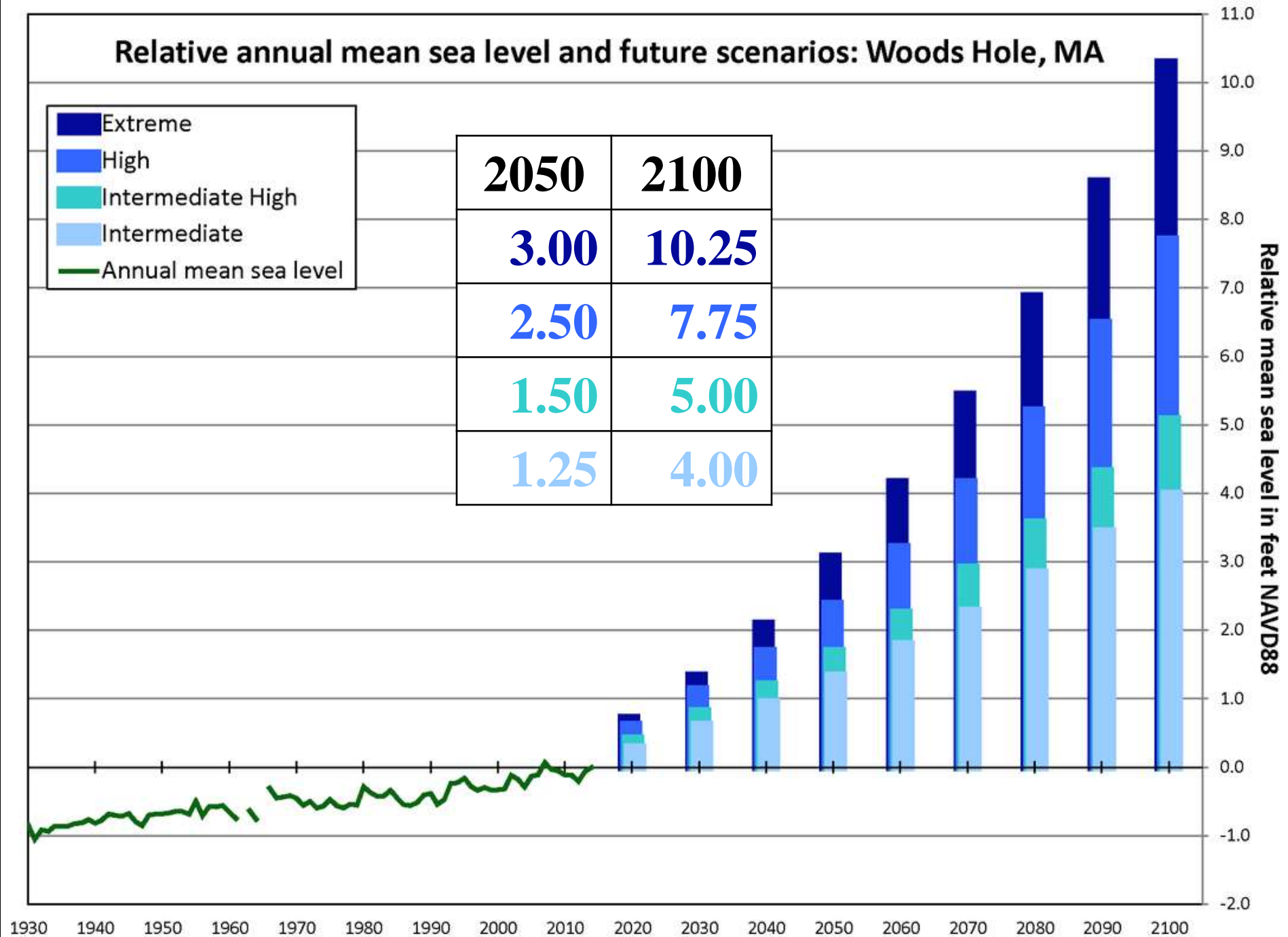
The New York Times

## *Coastal Sea Levels in U.S. to Rise a Foot by 2050, Study Confirms*

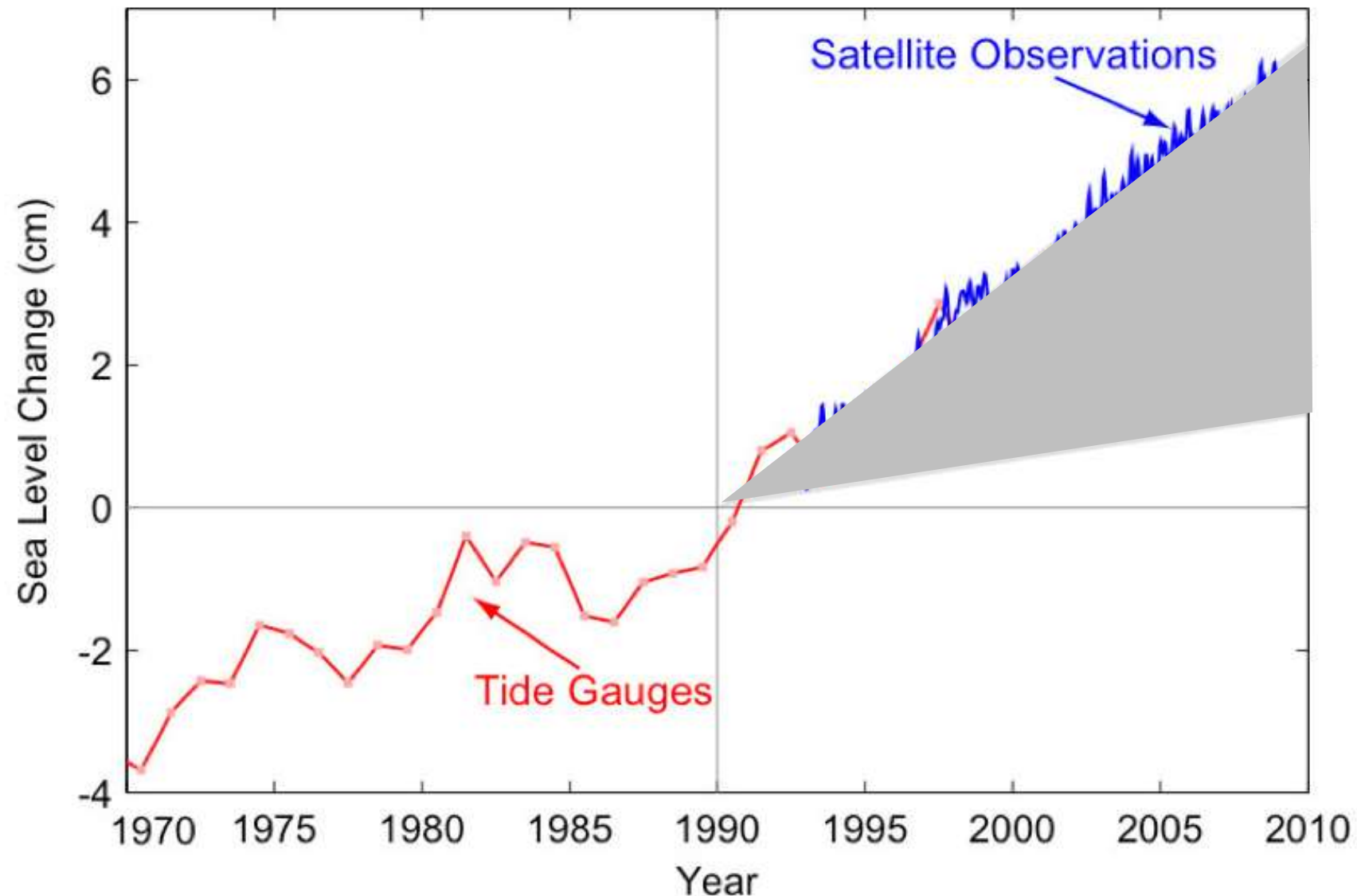
## Relative annual mean sea level and future scenarios: Woods Hole, MA



	2050	2100
Extreme	3.00	10.25
High	2.50	7.75
Intermediate High	1.50	5.00
Intermediate	1.25	4.00



‘They can’t predict the weather next week what do they know about the climate in 20 years’



## Quick Quiz

A \_\_\_\_\_ft rise in MSL would enable a 10-year storm to flood areas that today are only flooded by 100-year storms

a) 1

b) 3

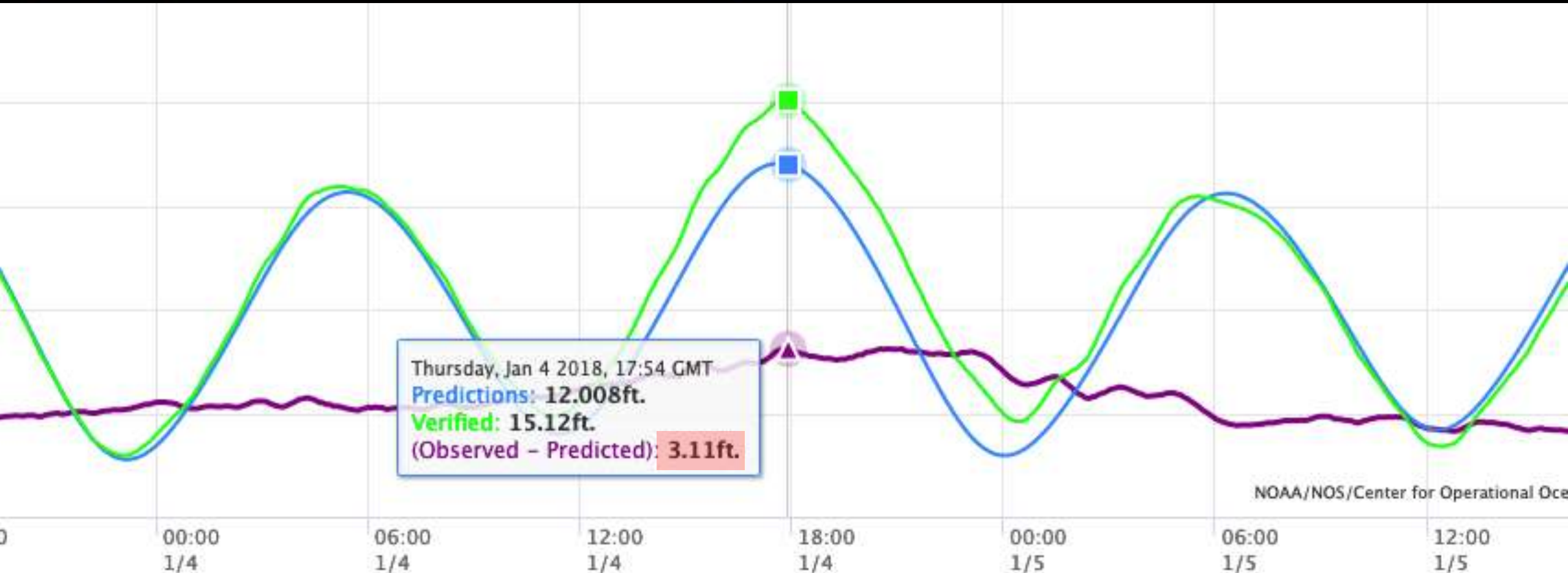
c) 5

d) 7

e) 9







— Predictions — Verified — Preliminary — (Observed - Predicted)

Show Data Listing

Show nearby stations

Products available at 8443970 Boston, MA



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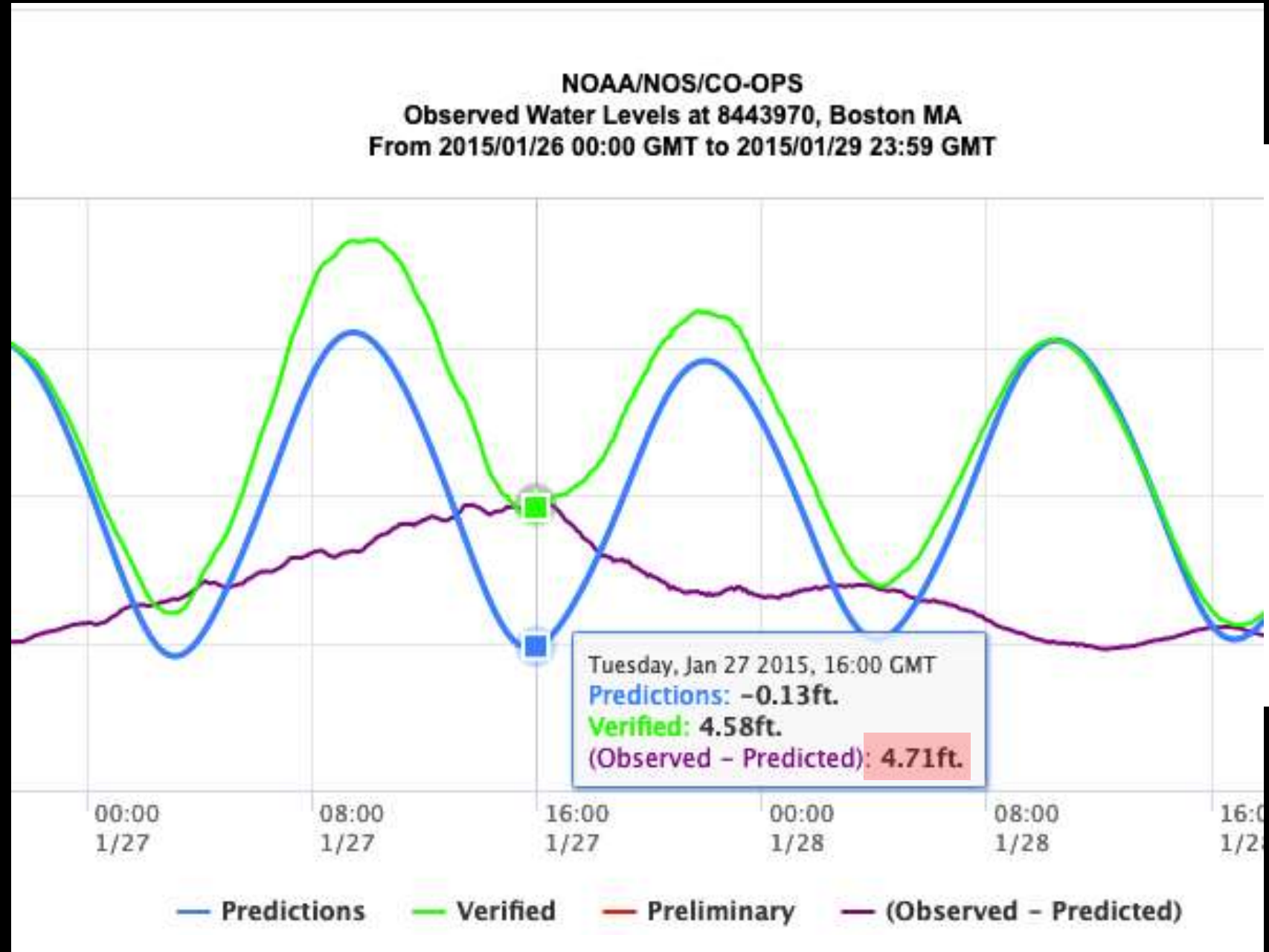


# The January 27<sup>th</sup> storm of 2015...*is not a thing*

2018 Storm of Record  
Storm Surge: 3.11 ft  
TWL 15.12 ft

2015 Storm of Record  
Storm Surge: 4.71 ft (+1.6 ft)

2015 SS + 2018 WL (16.72 ft)



**Peggotty Beach**

**Scituate**

**2/9/2016 High Tide**

# Mapping Storm Tide Pathways

## MAPPING & MODELING

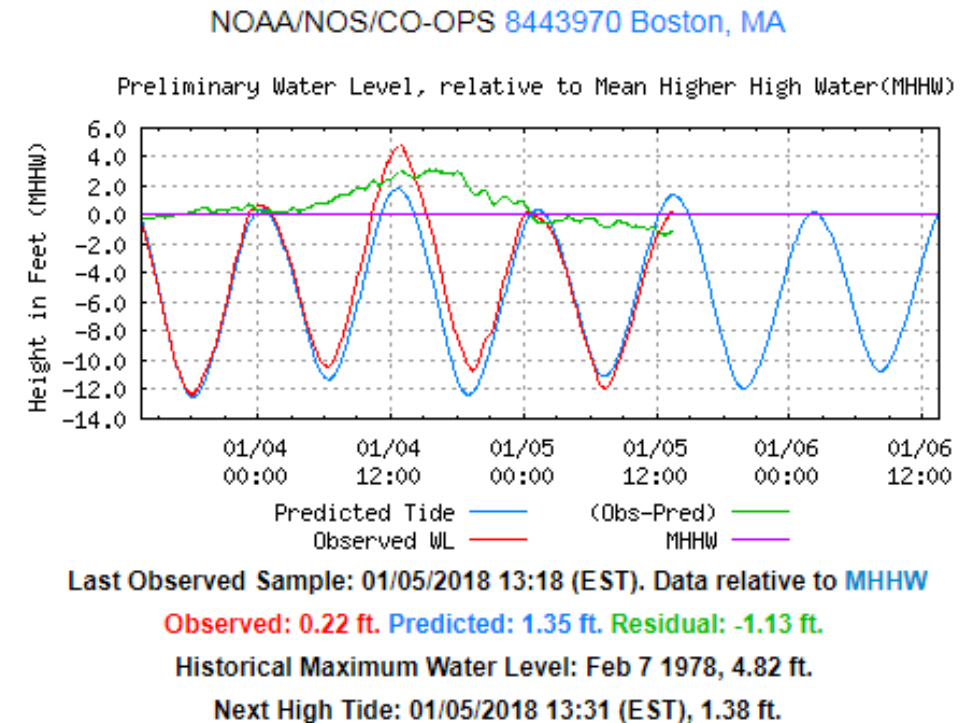


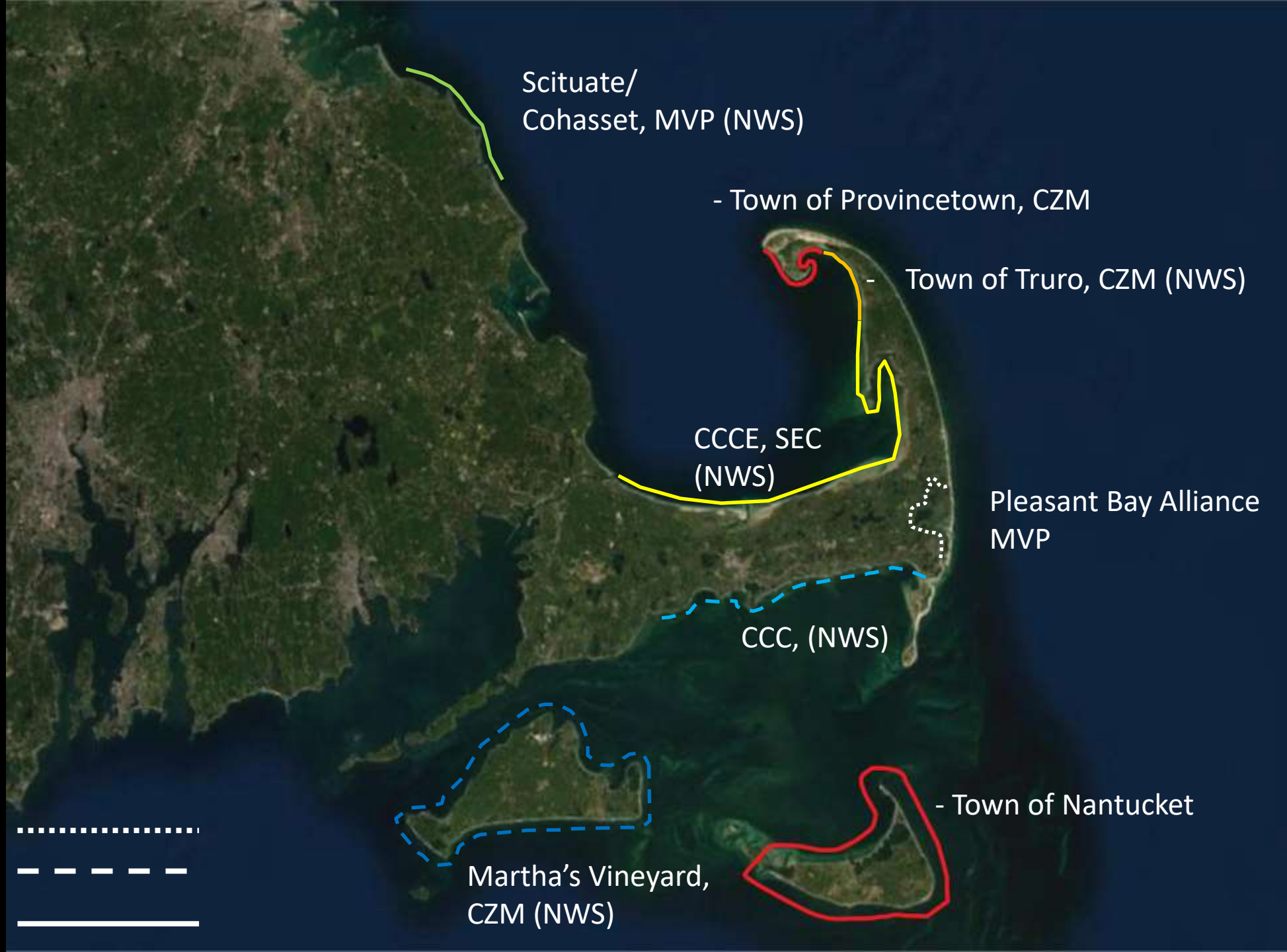
1. Useful AND usable to local, regional entities/managers
2. Address current and future concerns
3. Little, to no, computing resources
4. Increase resiliency and autonomy



# Mapping of STPs, what are they and where to begin...

- Highest HT of the year  $\rightarrow$  SoR  $\rightarrow$  +2-3 ft for SLR
- January 4<sup>th</sup> 2018





Scituate/  
Cohasset, MVP (NWS)

- Town of Provincetown, CZM

- Town of Truro, CZM (NWS)

CCCE, SEC  
(NWS)

Pleasant Bay Alliance  
MVP

CCC, (NWS)

- Town of Nantucket

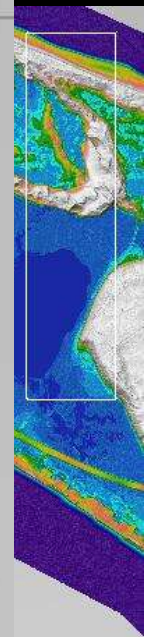
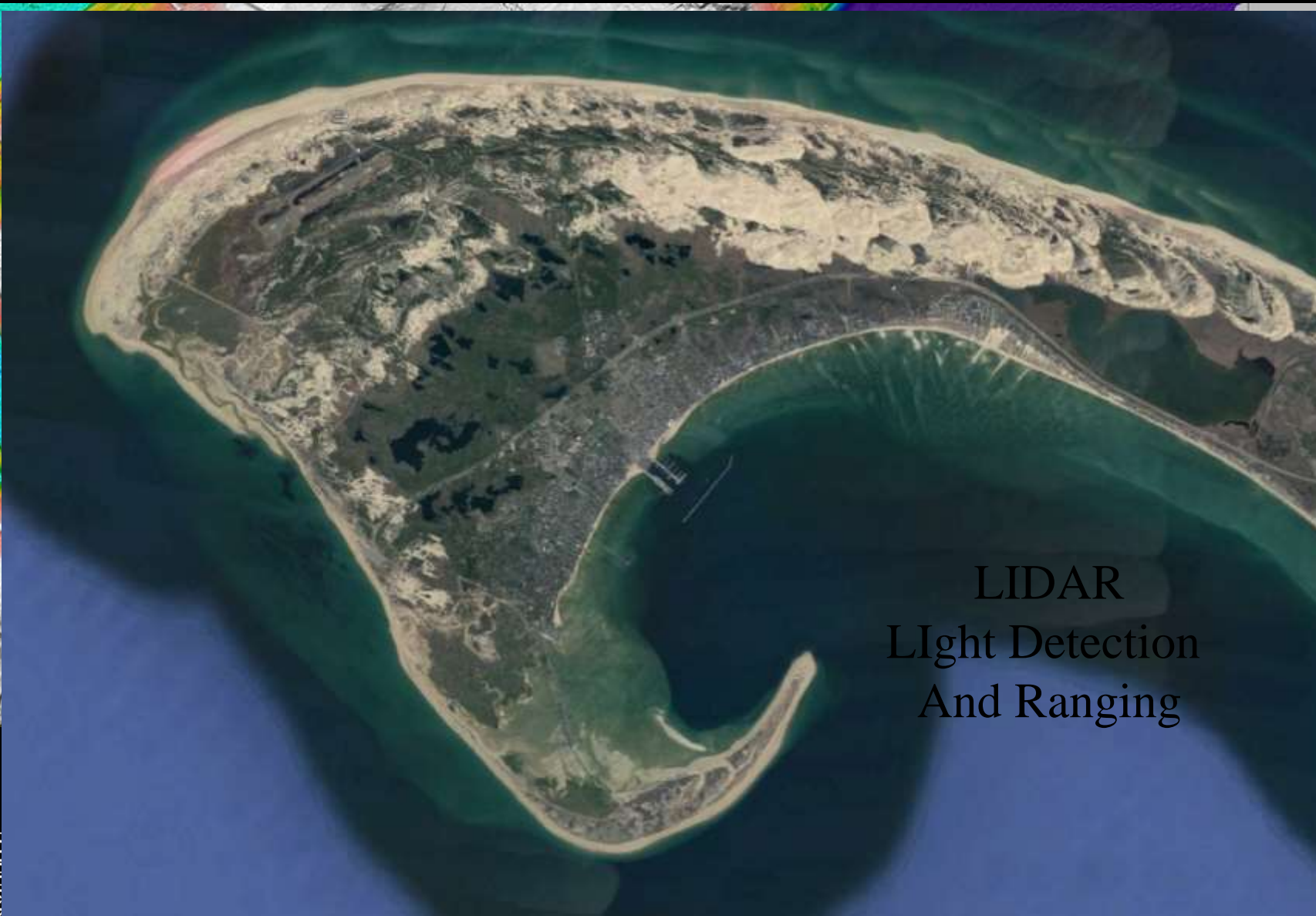
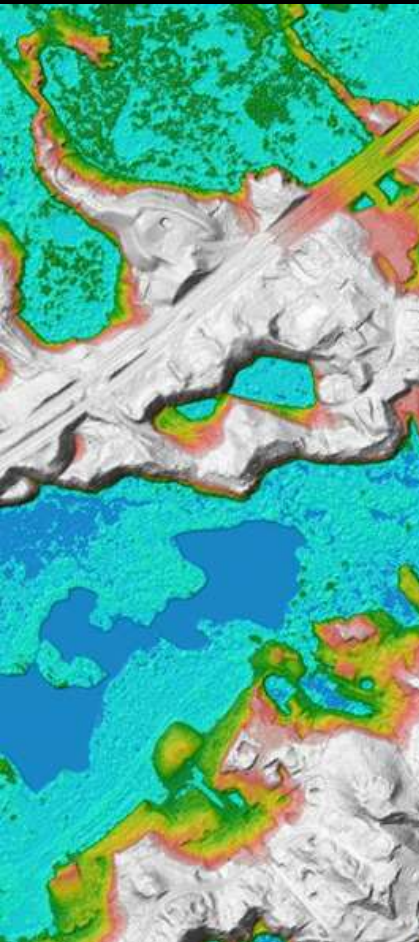
Martha's Vineyard,  
CZM (NWS)

Ongoing

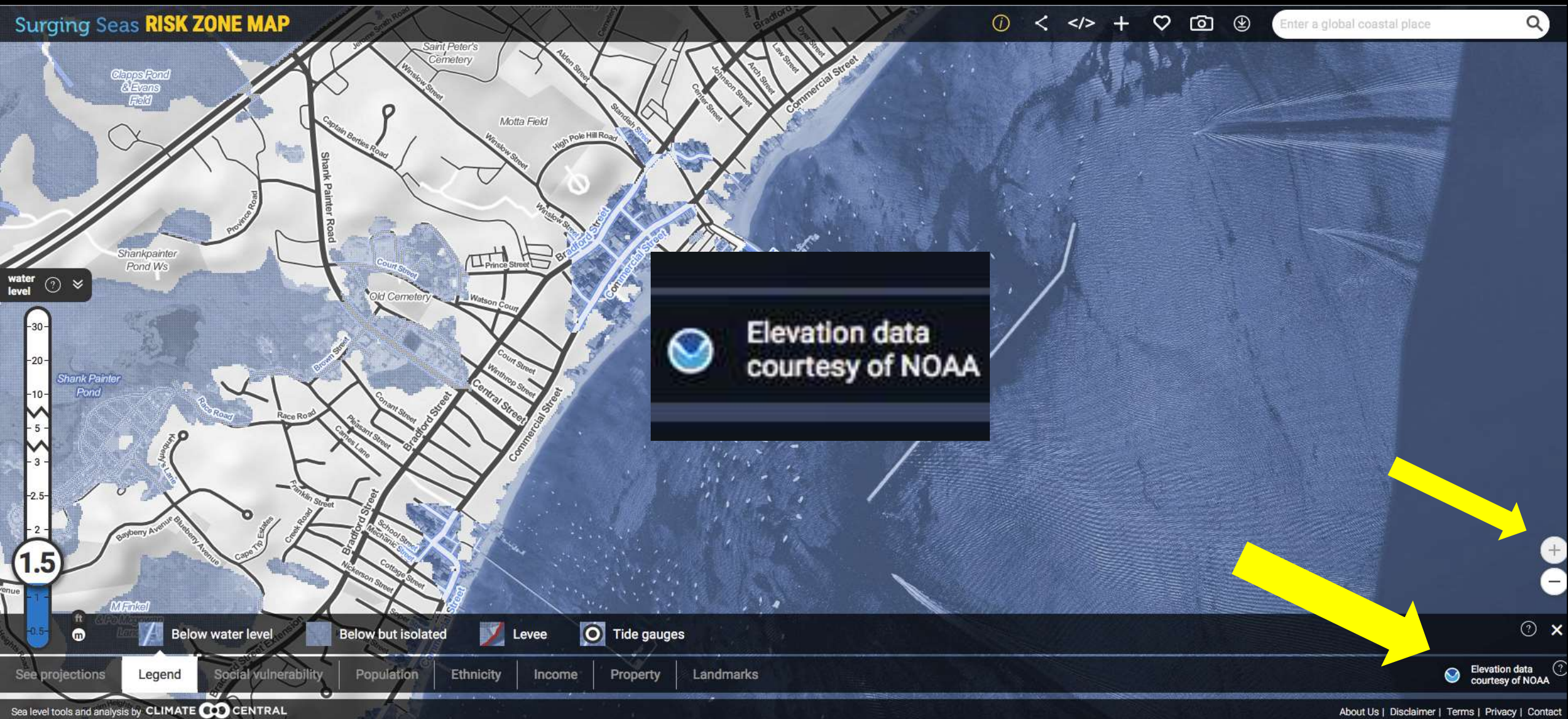
Recent

Completed

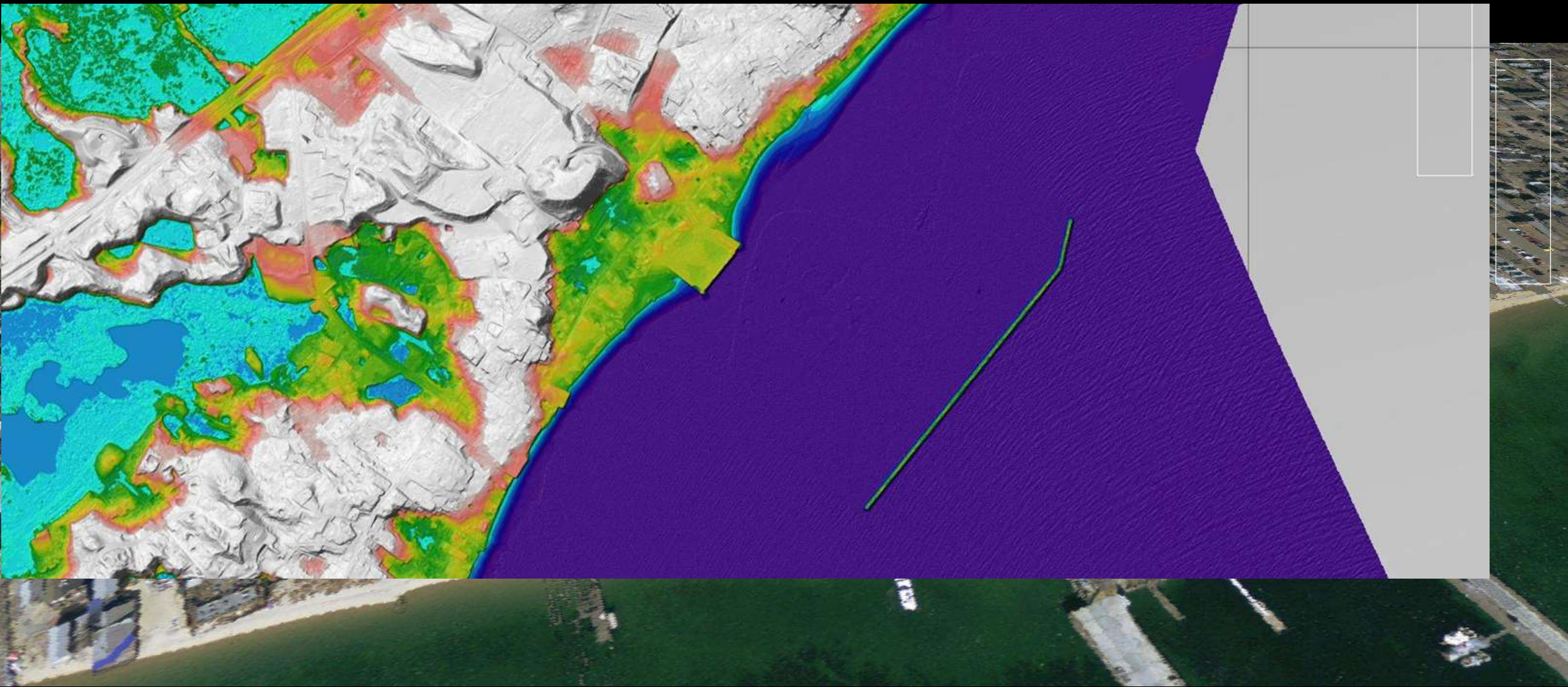
# Downtown Provincetown

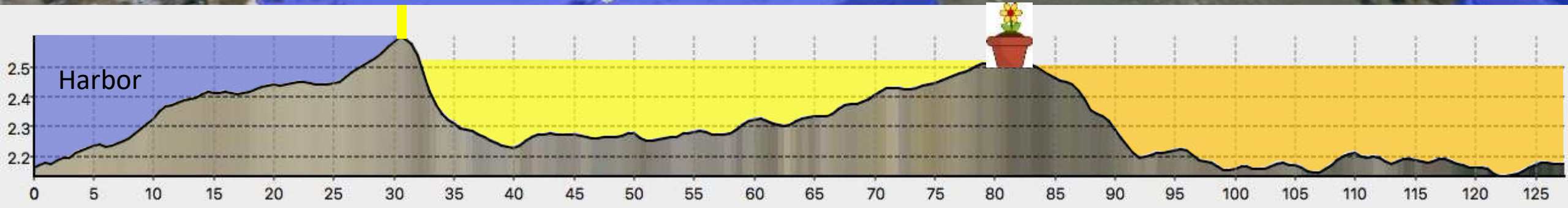


# Surging Seas (<http://sealevel.climatecentral.org/>)



# Downtown Provincetown









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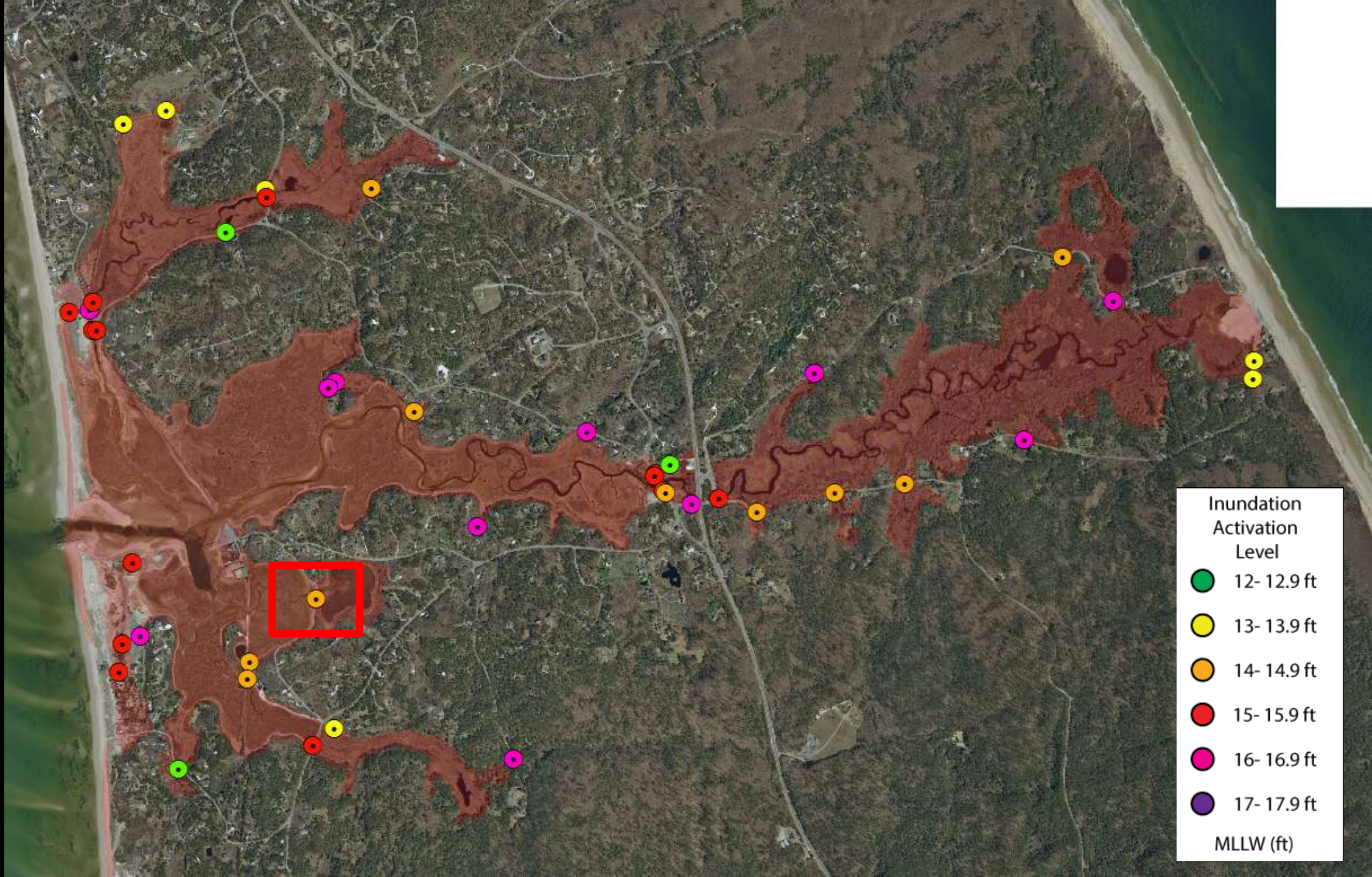
The University of Massachusetts, Boston  
School for the Environment

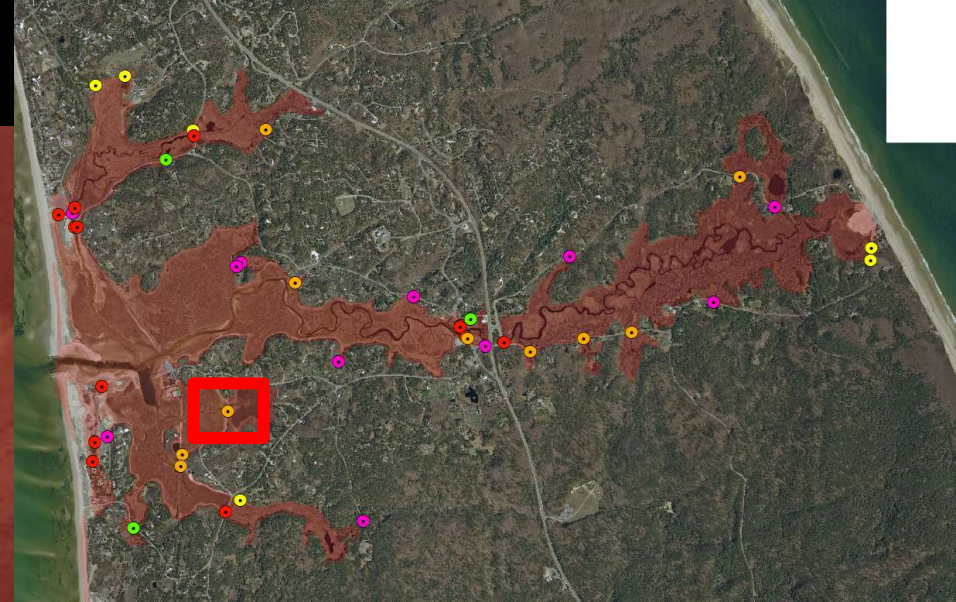




ID: 11-07  
N 70.1920 W 42.0501  
13.7ft MLLW





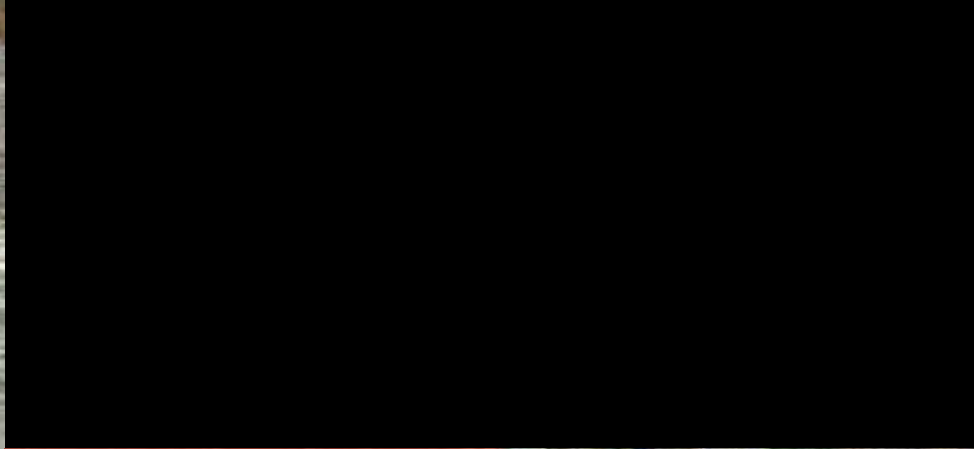


Center for Coastal Studies  
Marine Geology

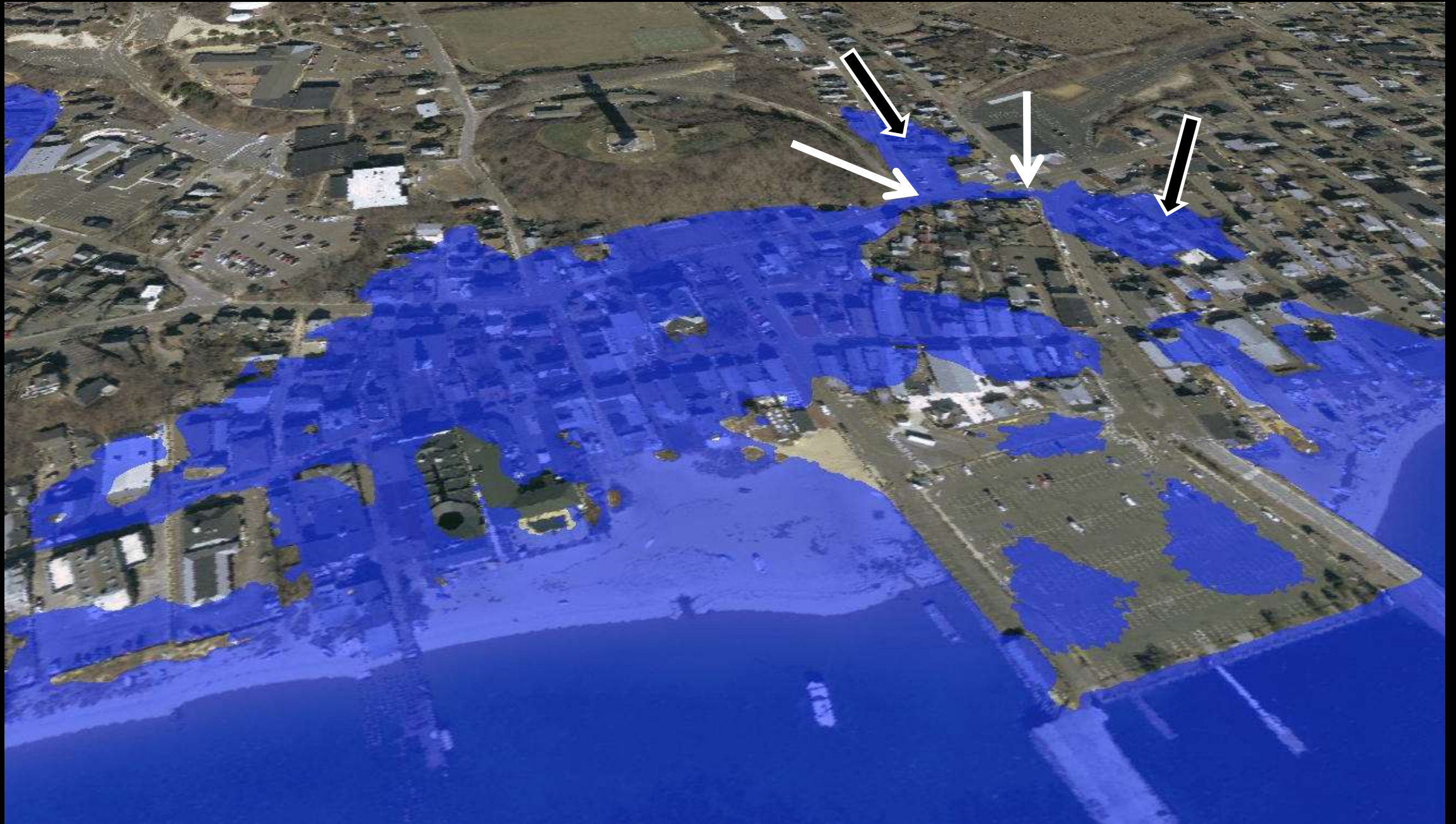
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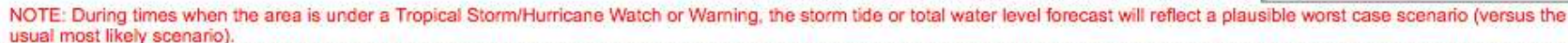


# Secondary Pathways and Sea Level Rise



[Weather.gov](#) > [Boston, MA](#) > NWS Boston - Coastal Flood Threat and Inundation Mapping

Weather Forecast Office

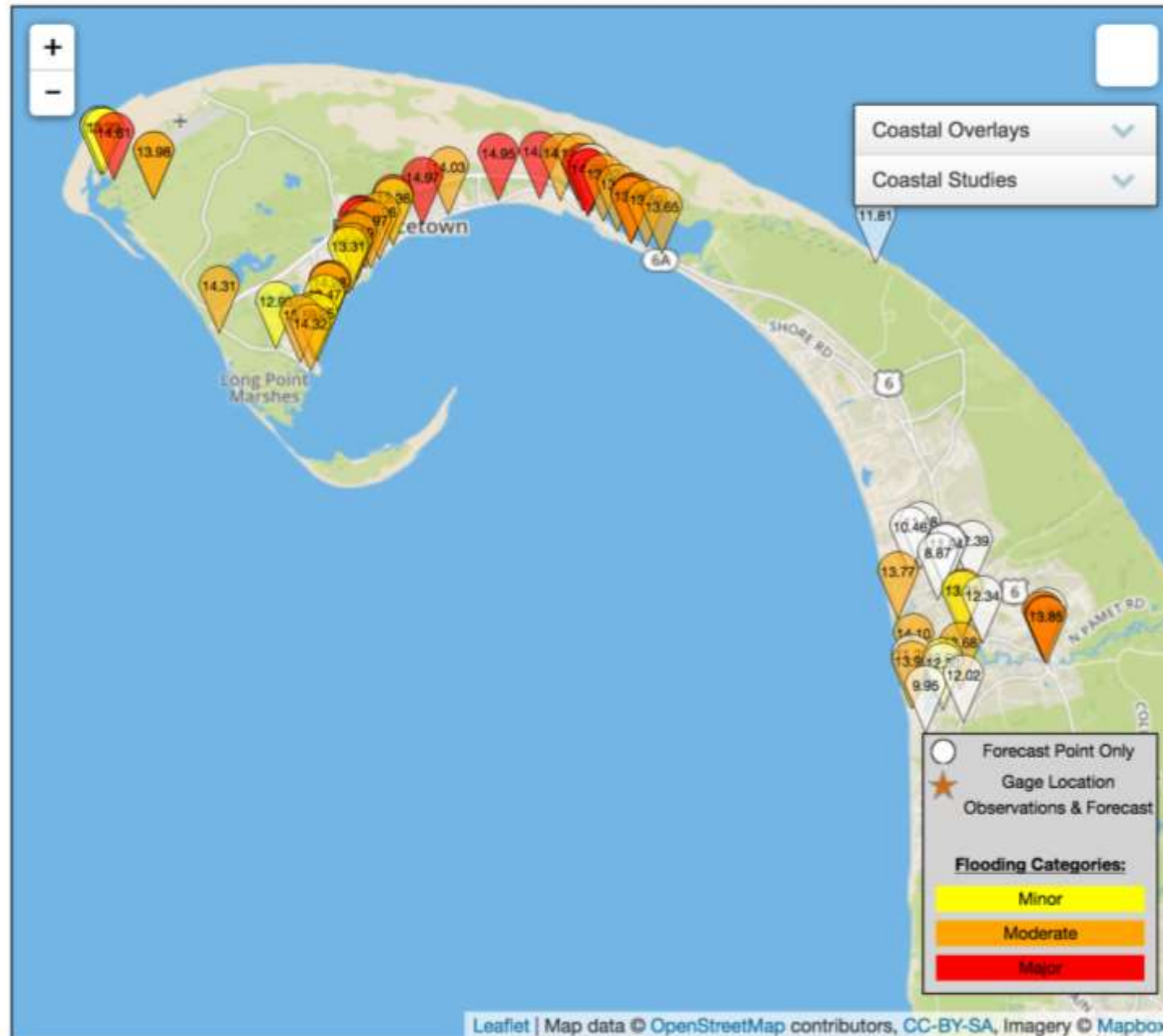


# Partnering with NWS & Development of new webpage

# NWS Boston - Coastal Flood Threat and Inundation Mapping

[Weather.gov](#) > [Boston, MA](#) > NWS Boston - Coastal Flood Threat and Inundation Mapping

Boston, MA  
Weather Forecast Office



Forecast Issued:  
NA

High Tide Cycle



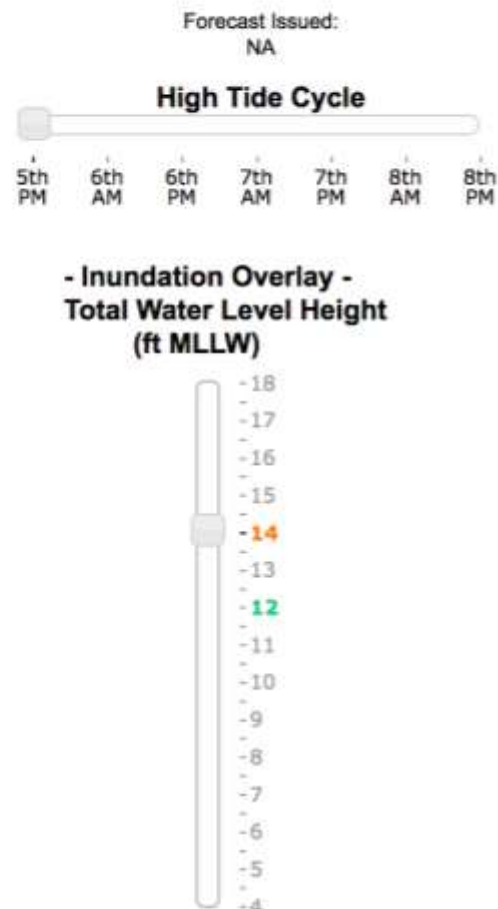
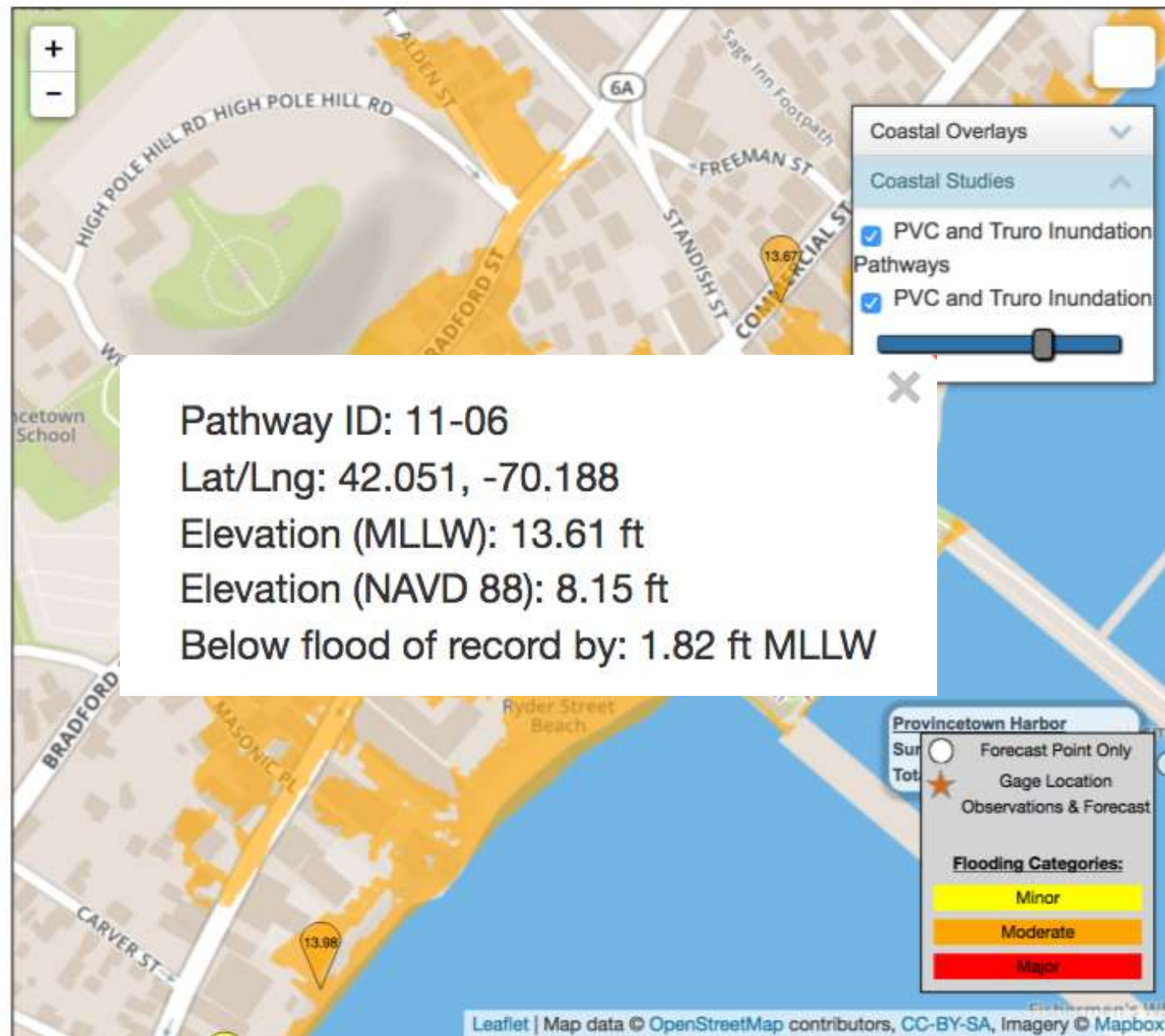
- Inundation Overlay -  
Total Water Level Height  
(ft MLLW)



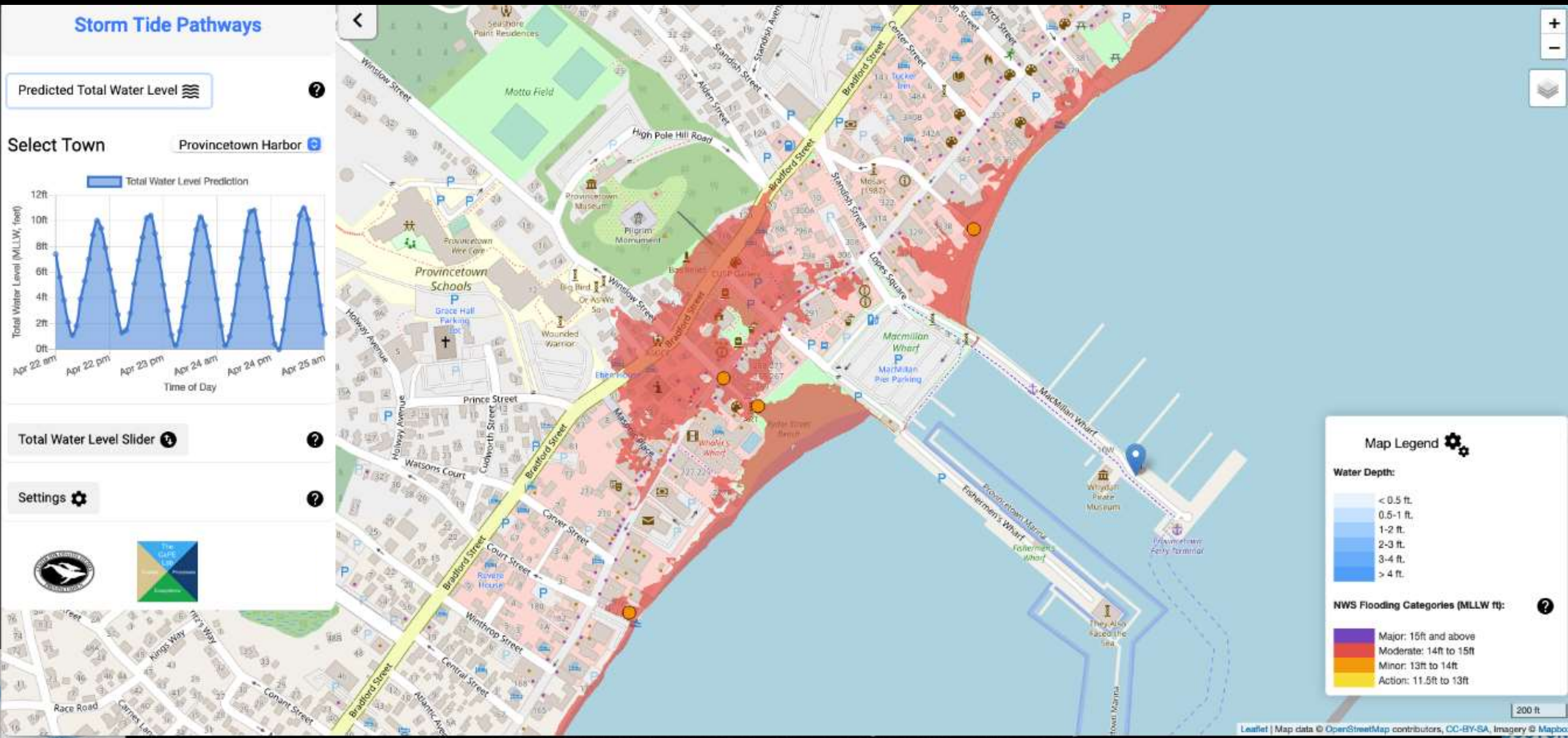
# NWS Boston - Coastal Flood Threat and Inundation Mapping

[Weather.gov](#) > [Boston, MA](#) > NWS Boston - Coastal Flood Threat and Inundation Mapping

**Boston, MA**  
Weather Forecast Office



# Stormtides.org



## Storm Tide Pathways

Predicted Total Water Level 

Total Water Level Slider 



Settings 

Partners, Sponsors & Supporters



**Total Water Level**

**13.0 MLLW**

**13.5 MLLW**

Map Legend 

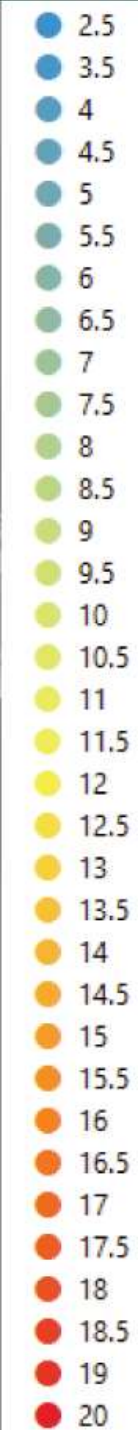


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**Total Water Level  
in Feet (MLLW)**

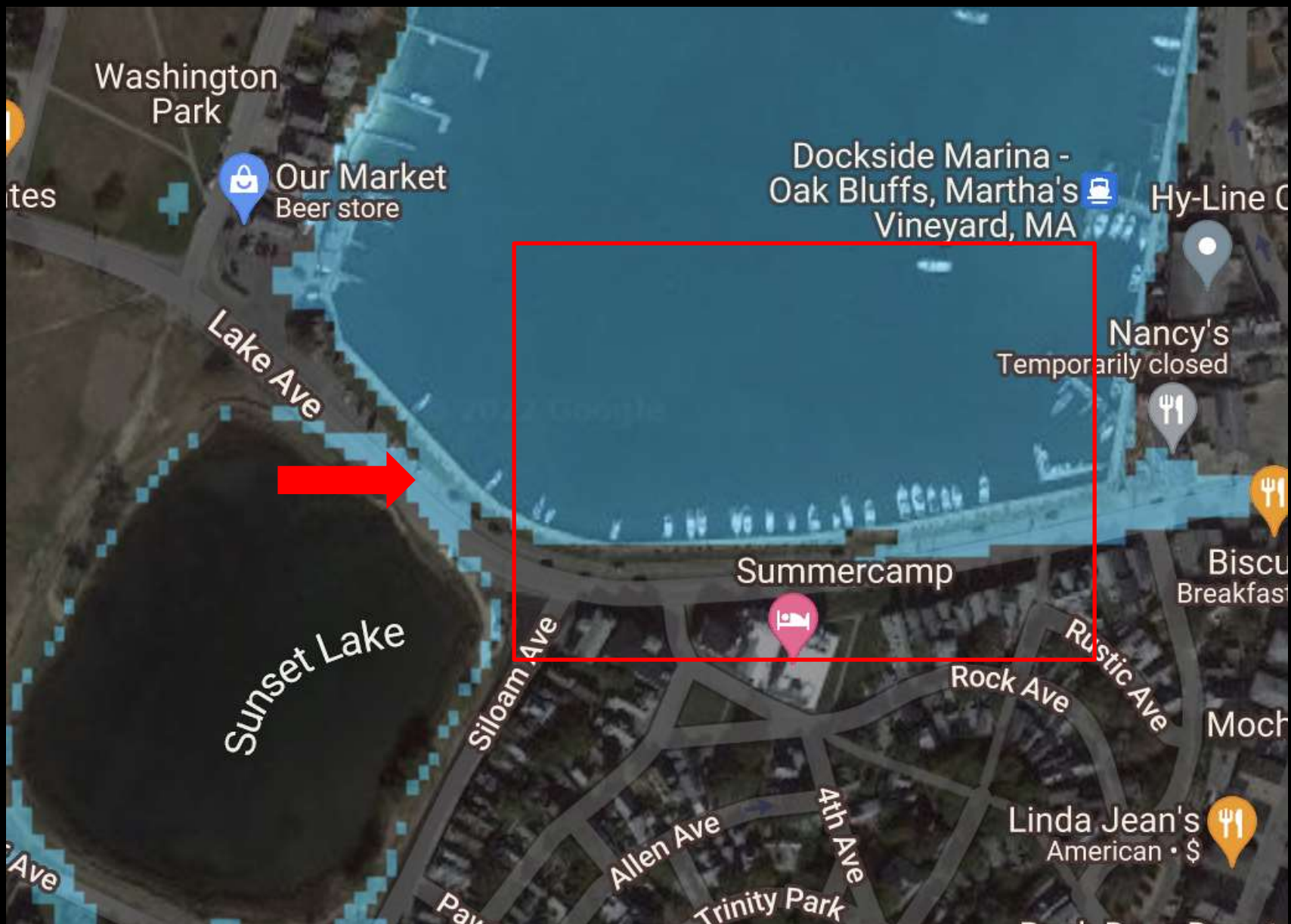


• 6 towns

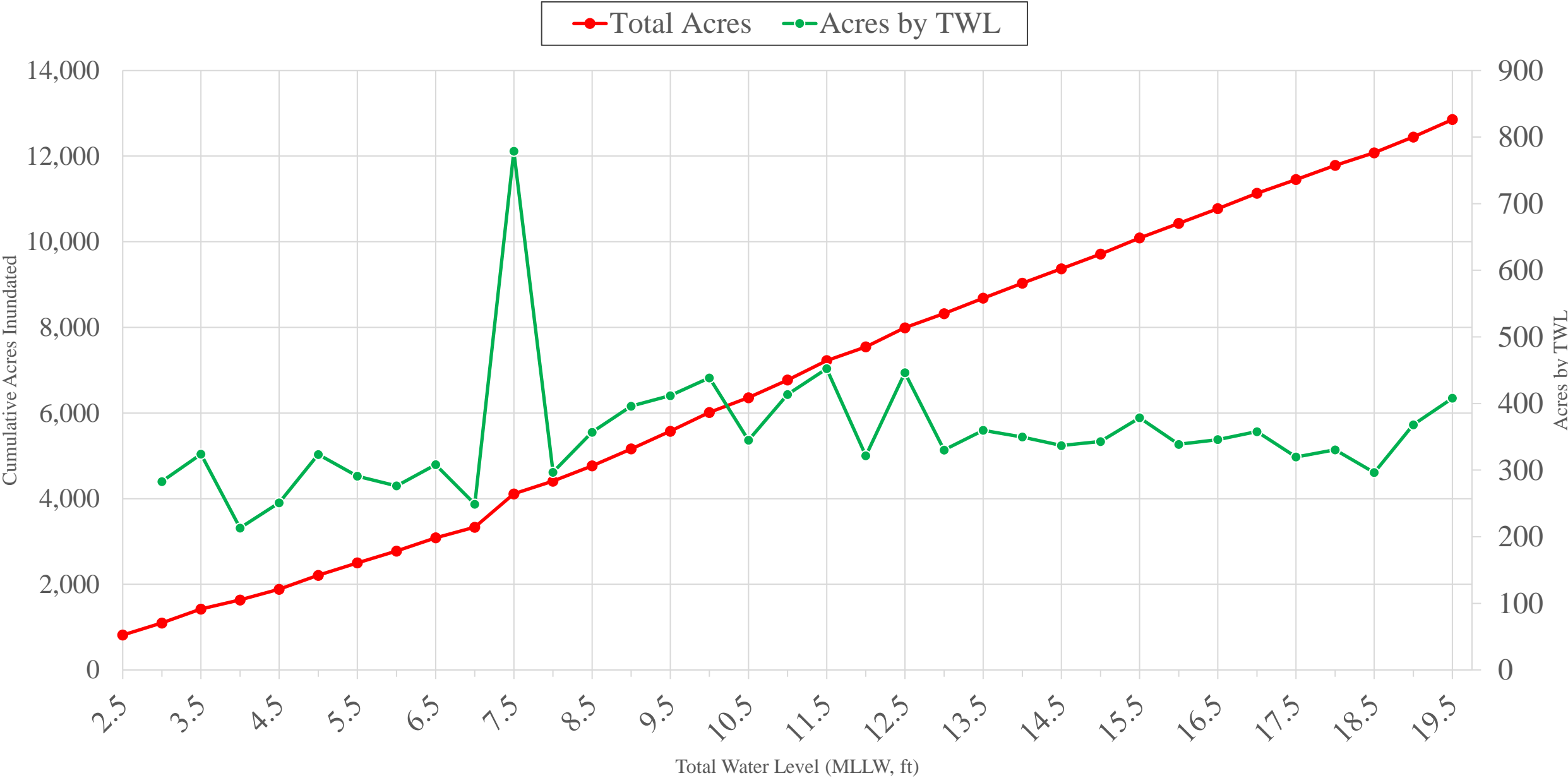
• 716 Storm Tide Pathways

**3 Miles**





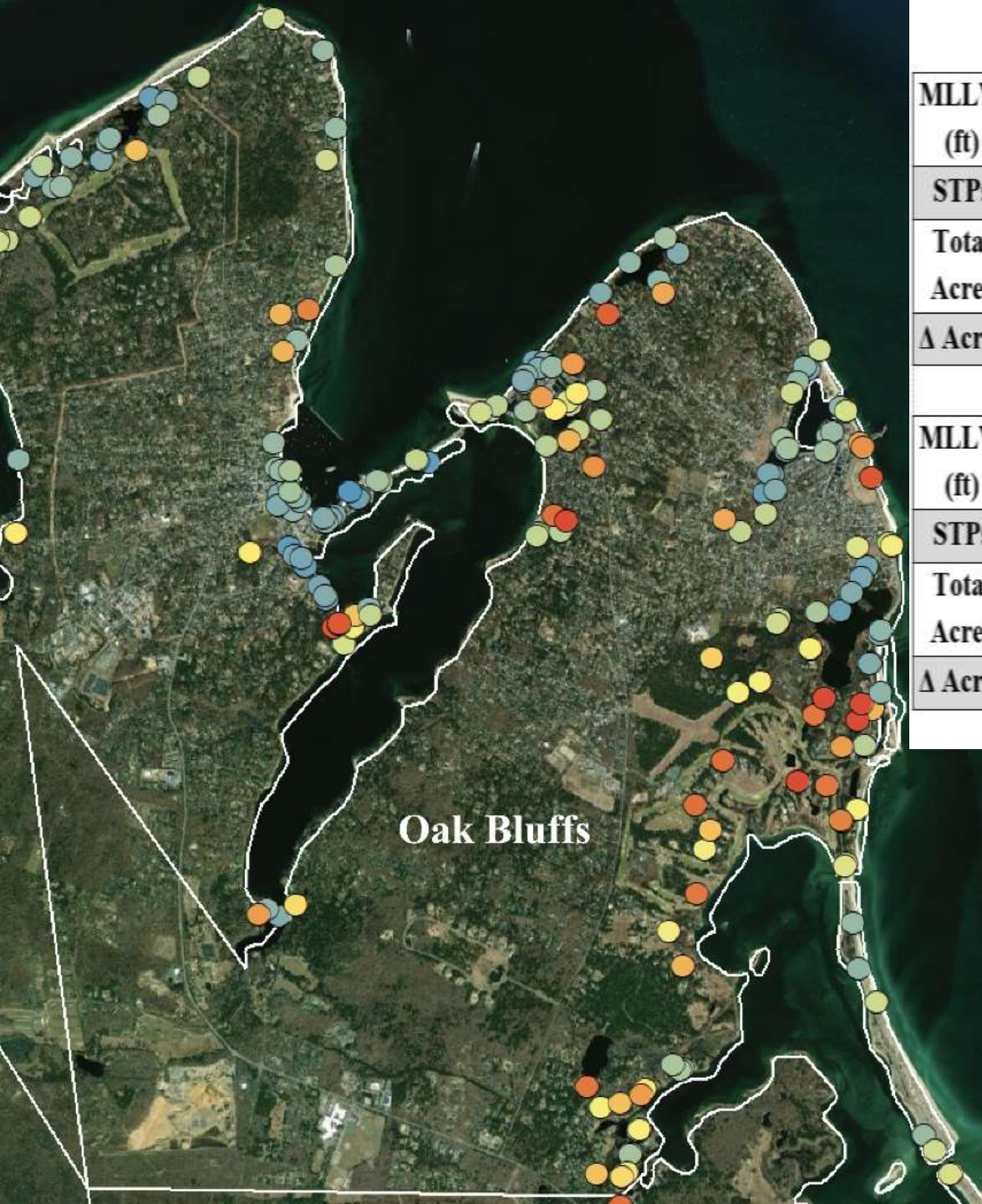
# Martha's Vineyard Municipalities



# Storm Tide Pathways by Town

Town	Total	Verified	Unverified	% Unverified
Aquinnah	33	21	10	36.4%
Chilmark	86	40	46	53.5%
Edgartown	290	136	154	53.1%
Oak Bluffs	128	90	38	29.7%
Tisbury	99	59	40	40.4%
West Tisbury	80	19	61	76.3%
<b>Totals</b>	<b>716</b>	<b>365</b>	<b>351</b>	<b>49.0%</b>





**Table 18. Oak Bluffs STPs by Elevation.**

MLLW (ft)	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
STPs	0	0	0	1	2	8	11	12	6	8	5	7	7	6	4	3	0	4
Total Acres	77	105	137	162	188	213	263	302	350	382	413	441	472	497	519	542	564	588
Δ Acres	--	27	32	25	26	25	50	39	47	33	30	28	30	26	21	24	22	24
MLLW (ft)	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	--
STPs	6	4	1	1	3	3	3	4	3	1	4	3	1	1	5	0	1	128
Total Acres	609	628	651	669	690	712	733	756	791	814	845	872	896	922	945	974	1,008	1,008
Δ Acres	21	19	23	18	21	23	21	23	35	23	31	27	24	26	23	28	34	27.4

MLLW (ft)	--
STPs	128
Total Acres	1,008
Δ Acres	27.4



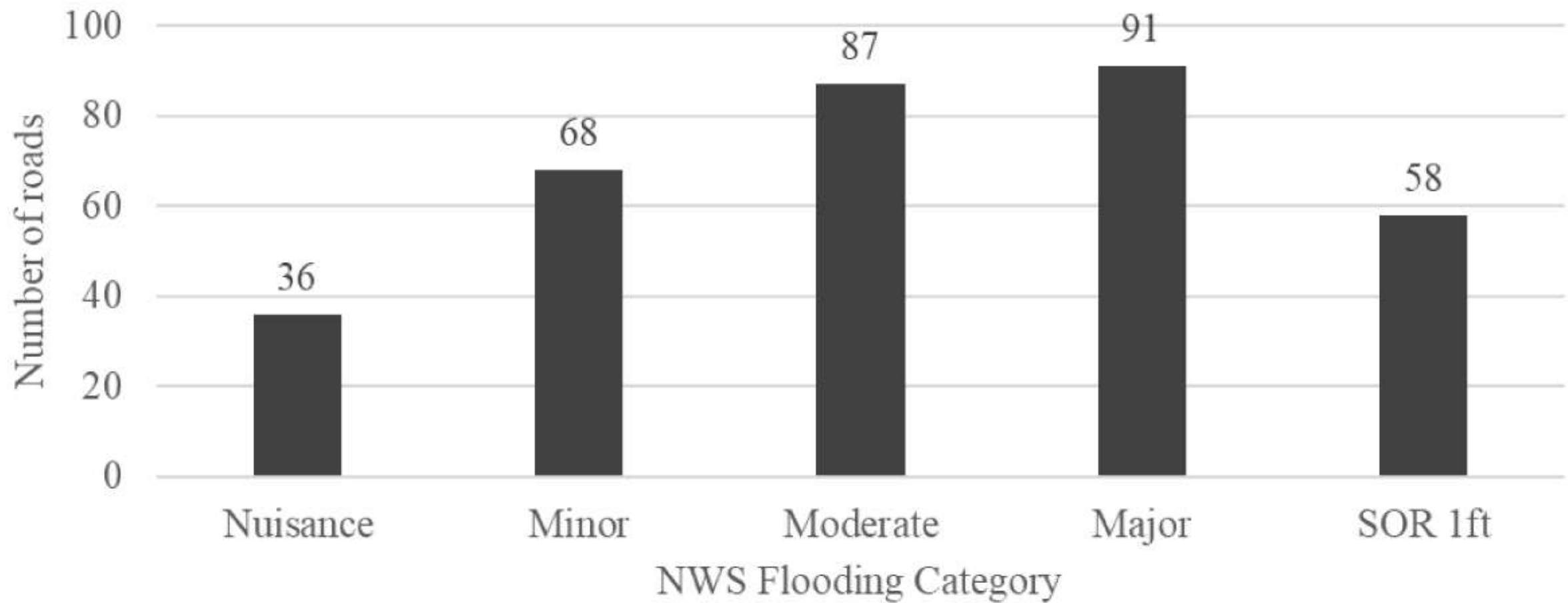
**Storm Tide Pathways  
1 foot above  
the Storm of Record**

● 11.5 Total Water Level  
● 12 in Feet (MLLW)

31 STPs at 11.5 ft MLLW  
16 STPs at 12.0 ft MLLW  
46 STPs ~ SoR +1ft

3 Miles

# Number of roads with <1 ft of standing water based on NSW Flooding Category



## 27 Critical Infrastructure Units

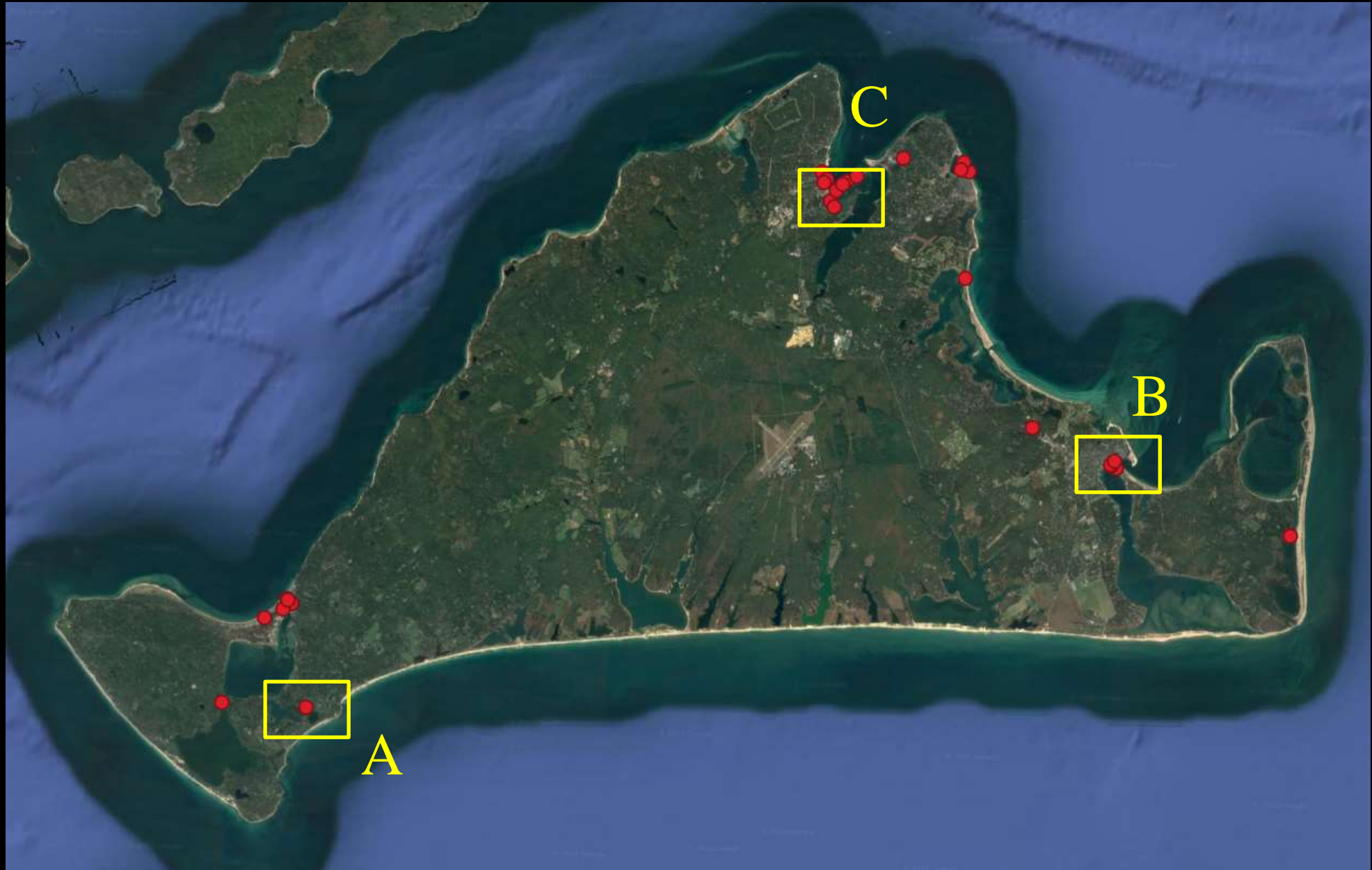


# Top Ten Critical Infrastructure Units

ID	Ranking	Critical Infrastructure	NWS Flooding Category
1	Critical	Chappy Ferry Terminal - Chappy	Nuisance
2	Critical	Chappy Ferry Terminal - Edgartown	Nuisance
3	Very Vulnerable	Packer Fuel Dock West	Nuisance
4	Very Vulnerable	Water Street	Minor
5	Very Vulnerable	Beach Rd - Tisbury	Minor
6	Vulnerable	Tisbury SSA Ferry Terminal	Moderate
7	Vulnerable	Eastville/County Rd	Moderate
8	Vulnerable	Packer Fuel Dock East	Moderate
9	Vulnerable	Beach Rd Seawall	Moderate
10	Vulnerable*	Hariph's Creek Bridge	SOR + 1ft

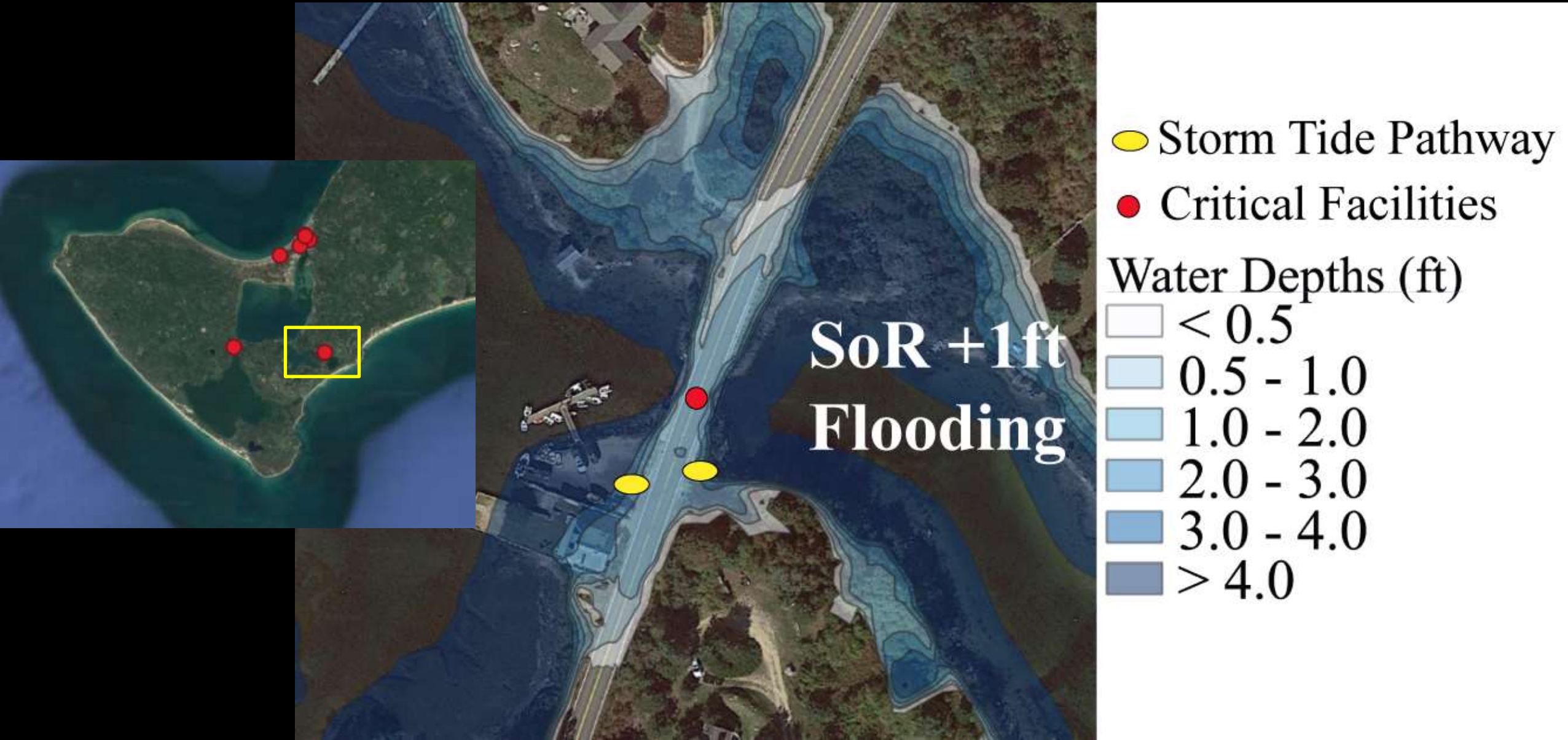


## 27 Critical Infrastructure Units

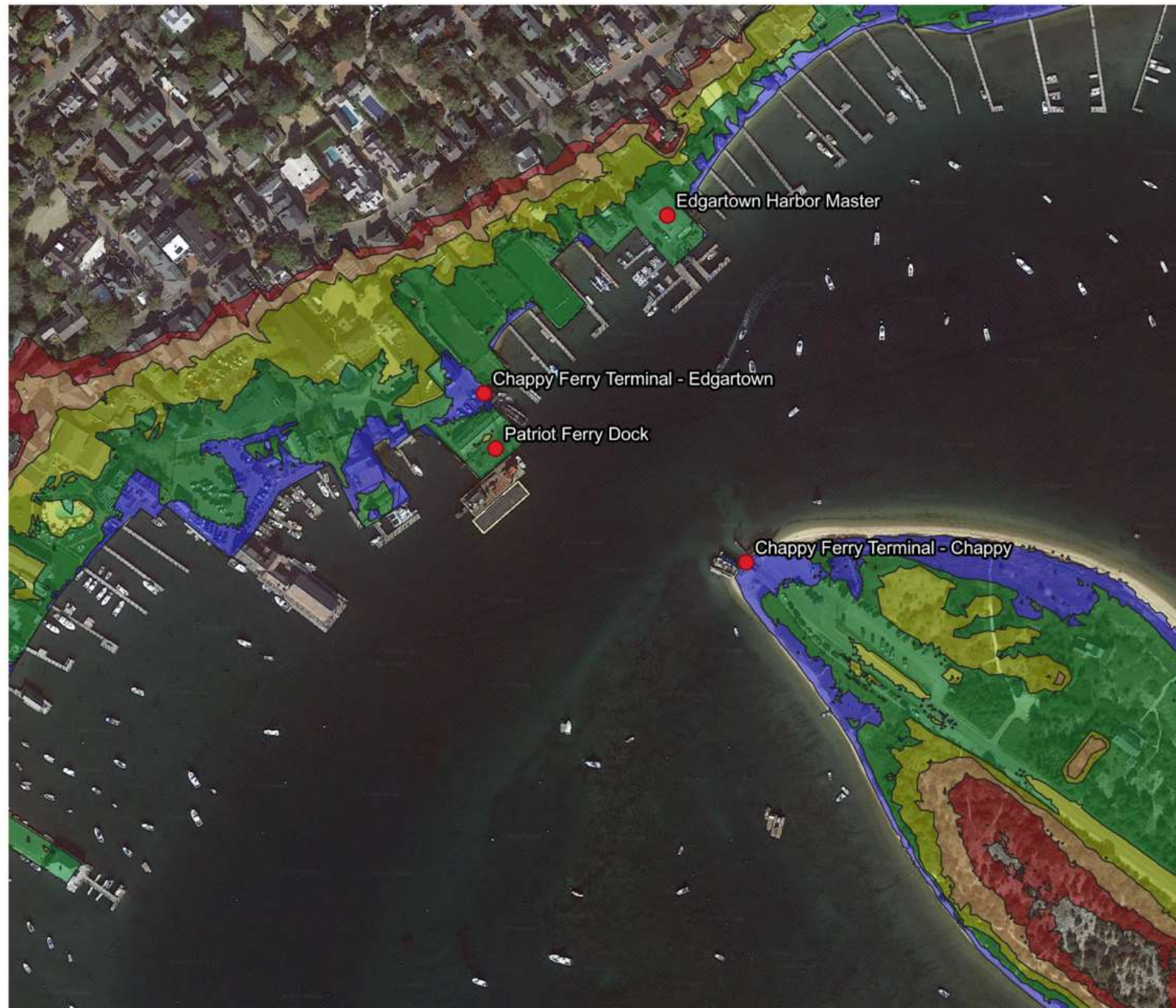


A

## Hariph's Creek Bridge



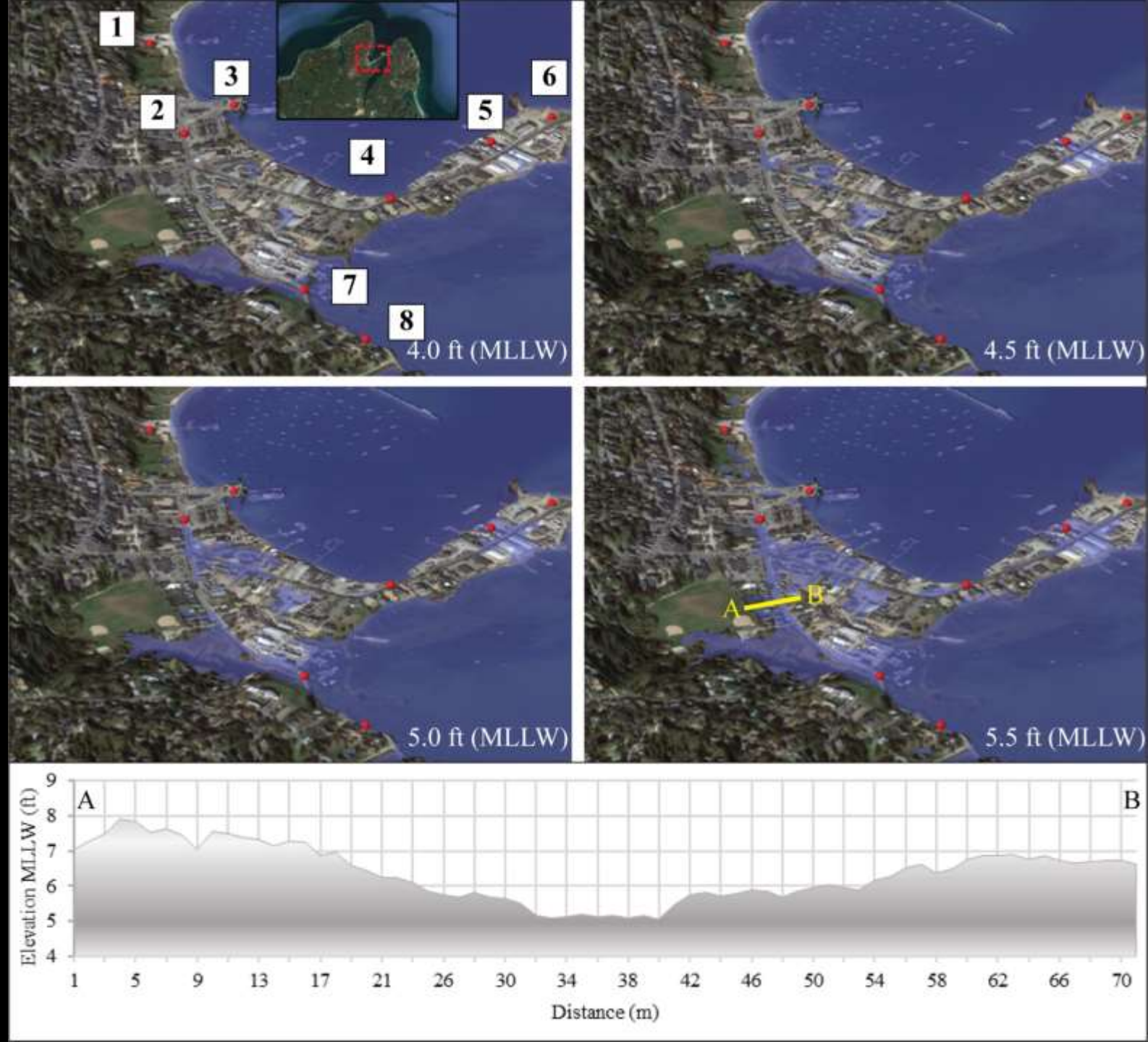
B

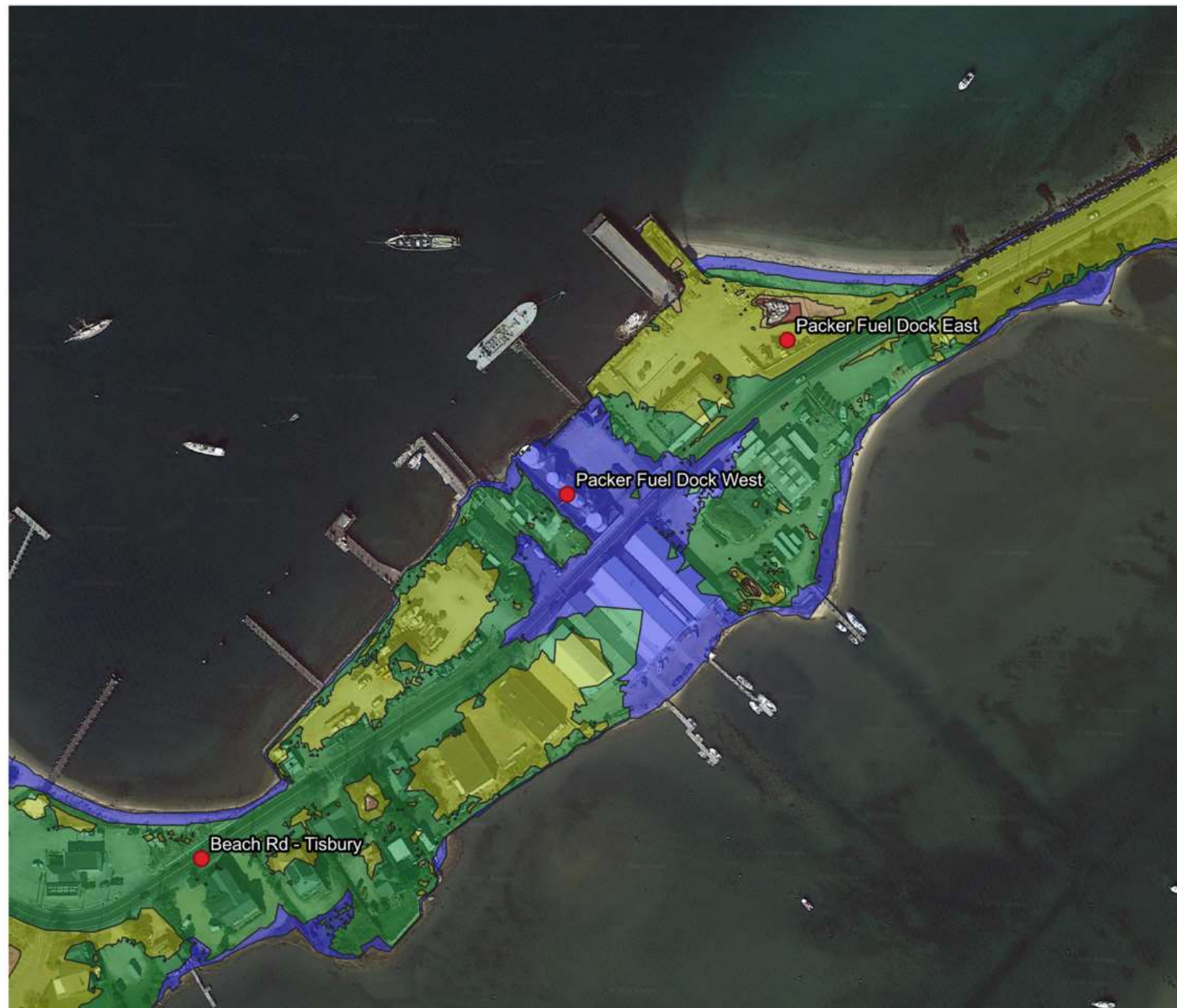


C

## 8 critical facilities from 27

1. Tisbury Harbormaster
2. Water Street
3. Tisbury SSA Ferry Terminal
4. Beach Road, Tisbury
5. Packer Fuel Dock – West
6. Packer Fuel Dock – East
7. Lagoon Pond Rd Bridge Culvert
8. Lagoon Pond Road.





- Nuisance
- Minor
- Moderate
- Major
- SOR+1ft

● Critical\_Facilities\_analysis

Depths

- < 0.5
- 0.5 - 1
- 1-2
- 2-3
- 3-4
- > 4

# Storm Surge

## Storm Tide Pathways

Predicted Total Water Level 

Select Town Edgartown

Total Water Level (MLLW, feet)

Oct 26, 2022, 12:00:00 pm  
Total Water Level Prediction: 3

Time of Day

Total Water Level Slider 

Settings 

Partners, Sponsors & Supporters Information



## Partners

# ACKNOWLEDGMENTS



Massachusetts Office of Coastal Zone Management

Steve Mckenna, Patricia Bowie



Martha's Vineyard Commission:

Adam Turner, Liz Durkee

QUESTIONS?



National Weather Service:

Joseph Dellicarpini



Cape Cod Cooperative Extension:

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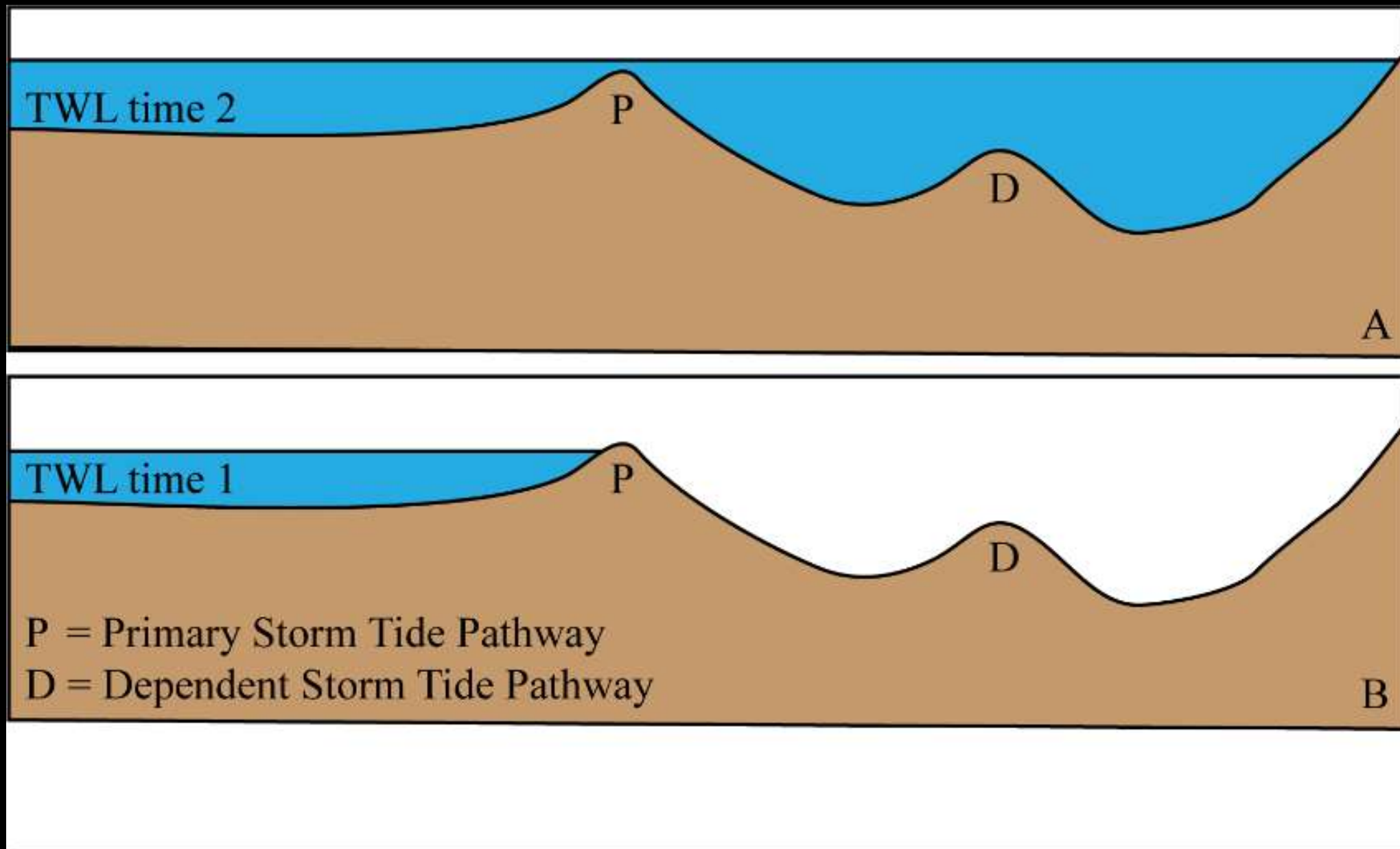


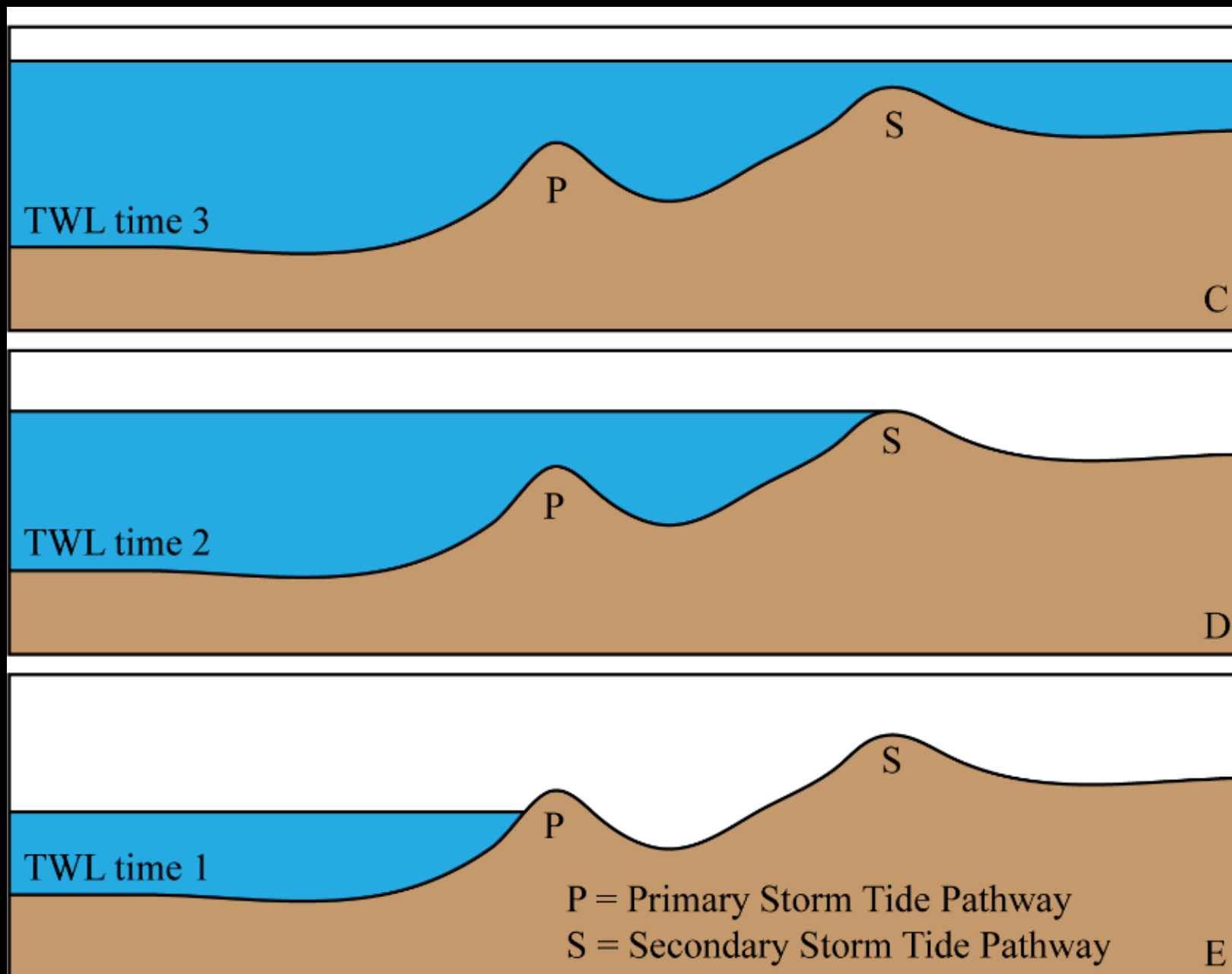
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11.5 ft (MLLW)

