Marblehead

Municipal Vulnerability Preparedness Public Listening Session

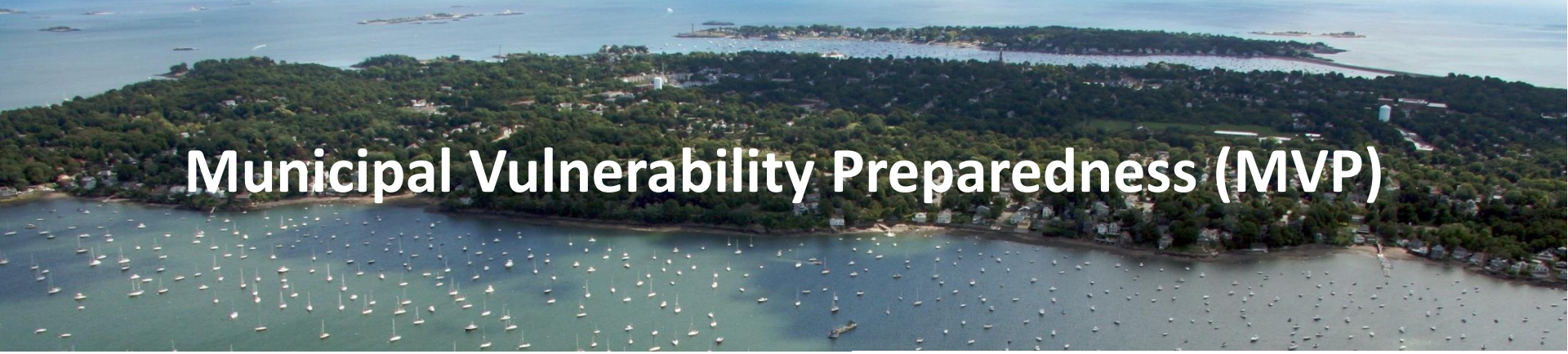
June 14, 7:00 pm. Abbot Hall

Becky Curran – Marblehead Planner

Barbara Warren - Salem Sound Coastwatch

Core Team: John McGinn, Becky Curran, Chuck Cerrutti, Charlie Quigley, Bob Picariello, Jason Gilliland, Rich Balacci, Amy McHugh, Mark Sousa, Andrew Petty, Peter James

Thank Marblehead Community Access and Media for covering this public listening session.



Municipal Vulnerability Preparedness (MVP)

MVP

– **Community-led process**

that employs local knowledge

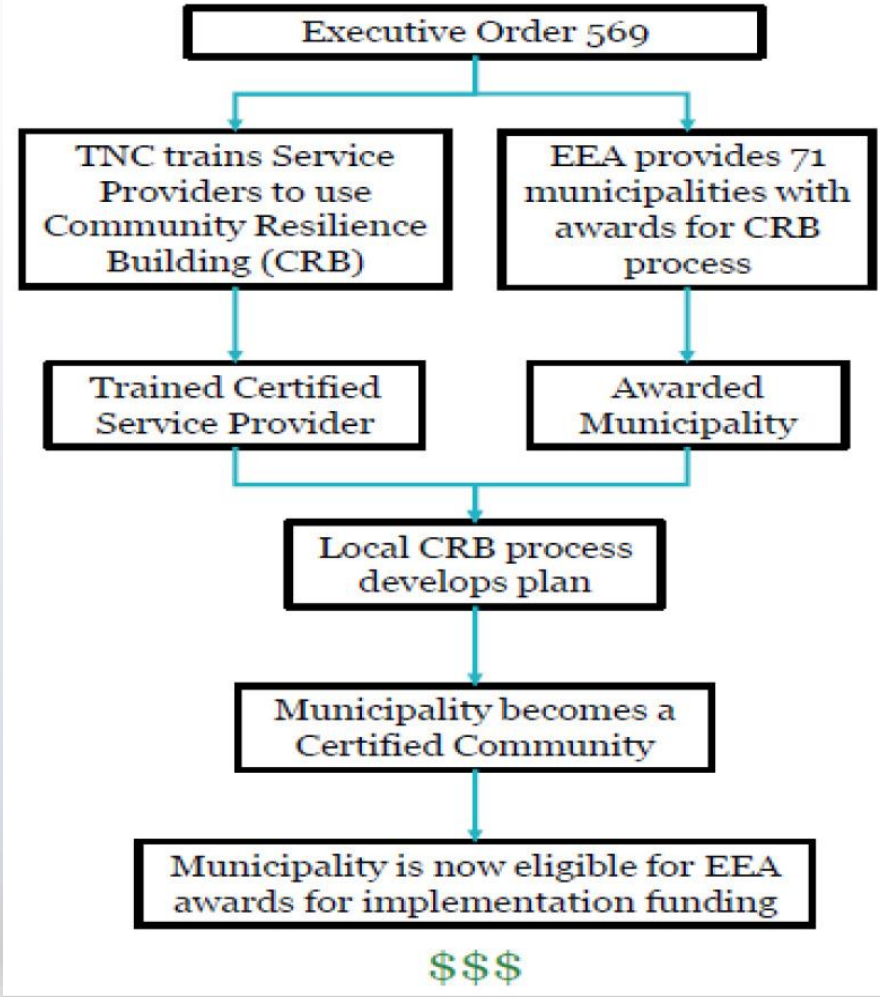
– **Partnerships** and leveraging

of existing efforts

– **Mainstream** climate change

– **Communities** as local innovators

– **Frame** coordinated statewide efforts.



MASSACHUSETTS CLIMATE CHANGE PROJECTIONS

Rising temperatures, changing precipitation, and extreme weather will continue to affect the people and resources of the Commonwealth throughout the 21st century.

Northeast Climate Science Center at the University of Massachusetts Amherst developed scaled projections for changes in temperature, precipitation, and sea level rise for counties in Massachusetts.

The **Executive Office of Energy and Environmental Affairs** provided support for these projections to enable municipalities, industry, organizations, state government and others to ***utilize a standard, peer-reviewed set of climate change projections*** that show how the climate is likely to change in Massachusetts through the end of this century.

resilientma.org

Community Resilience Building Process (TNC)

With Climate Change as the DRIVER

State and local partnership to build resiliency to climate change

1. Engage Community
2. Identify CC impacts and hazards
3. Complete assessment of vulnerabilities & strengths
4. Develop and prioritize actions
5. Take Action

Marblehead Stakeholders

Municipal Vulnerability Preparedness

Community Resilience Building Workshop

at the Boston Yacht Club
on May 16, 2018 - 36 participants

Residents, Town Staff, Town Committee Members, League of Women Voters, Marblehead Conservancy, Boston Yacht Club, Marblehead Chamber of Commerce, and Sustainable Marblehead.

Community Resilience Building Workshop

State and local partnership to build resiliency to climate change

1. Engage Community
2. Identify CC impacts and hazards
3. Complete assessment of vulnerabilities & strengths
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4 HAZARDS

ASSETS

Vulnerability and Strength

ACTIONS

Priority and Timeframe

Review and add any community assets that are critical. What is risk from changing climate?

Town of Marblehead, MA

0 750 1,500 3,000
Feet

N

Legend

- 100 — Critical Facilities
- PS — Pump Stations
- Structures
- Area of 100-year flood, shallow flooding
- Area of 100-year flood (usually sheet flow on sloping terrain)
- Area of 100-year coastal flood with velocity
- 500-year floodand 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
- Area of stormwater related flooding (identified by Community Team)

Figure A-2
Flood Hazard Areas Map

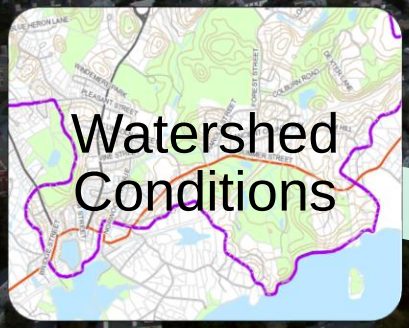
April 10, 2013
Source: MassGIS, Marblehead municipal database

Horsley Witten Group
Sustainable Environmental Solutions
370 Ives Street • Providence, RI • 02906
Phone - 401-272-1717 • Fax - 401-437-8368 • www.horsleywitten.com

Flooding History and Future Impacts

How will climate change alter future storms?

Salem Sound COASTWATCH



Future Conditions

2025 2050 2100

MARBLEHEAD's Top MVP 4 Climate Change Hazards

MASSACHUSETTS CLIMATE CHANGE PROJECTIONS

Coastal Flooding from Storm Surge and Sea Level Rise

Interior Flooding from Intense Precipitation

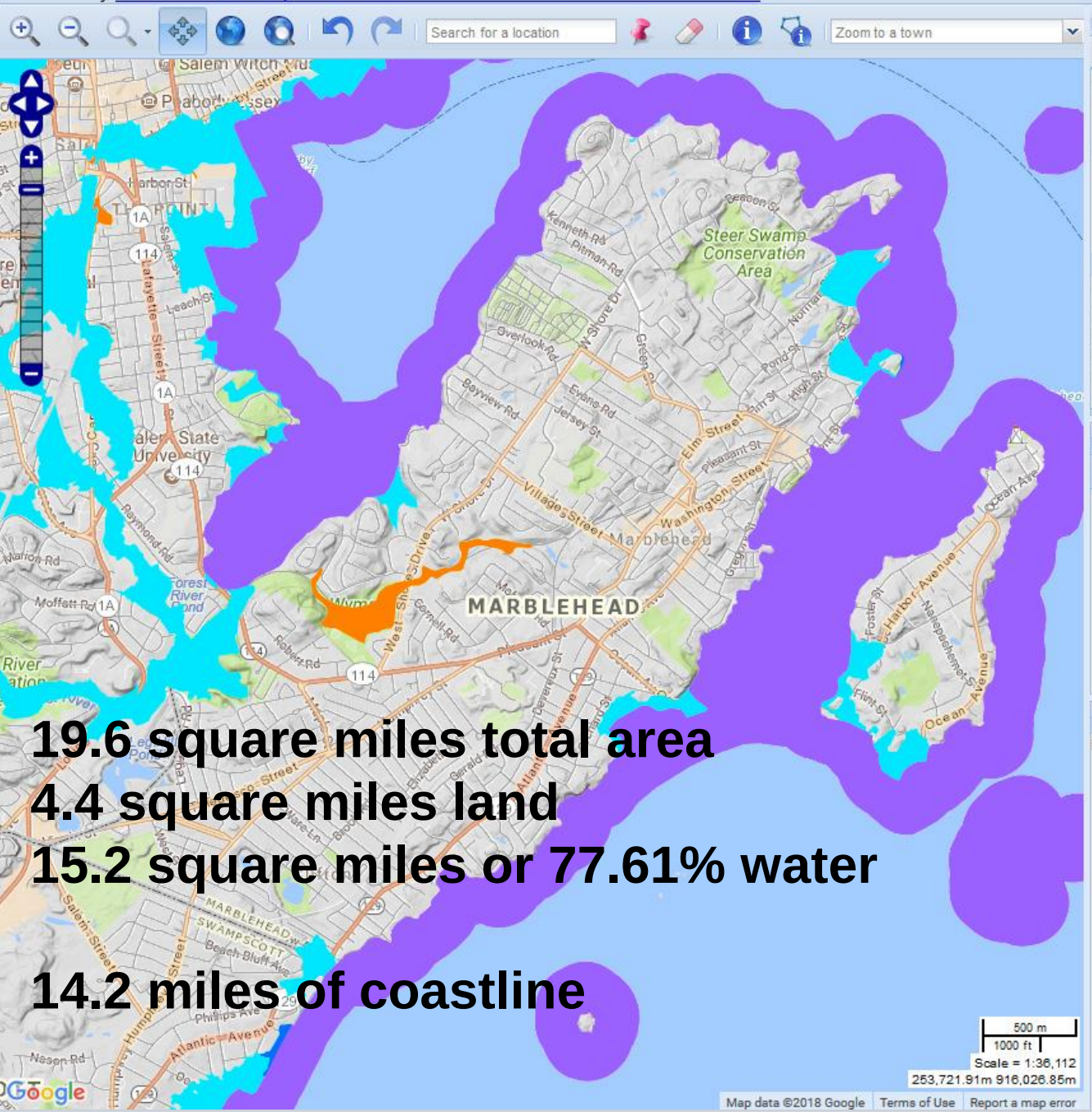
High Winds

Coastal Erosion

All storm related: Hurricanes, Nor'easters, Blizzards

Climate Change Vulnerability Map

Provided by Massachusetts Dept. of Public Health - Bureau of Environmental Health



19.6 square miles total area

4.4 square miles land

15.2 square miles or 77.61% water

14.2 miles of coastline

Available Data Layers

Search data layers

- Climate Vulnerability
  - Community Level Indicators
  - Census Tract Level Indicators
- Flood Zones
  - Hurricanes
    - Worst-case Hurricane Surge Inundation Zones
      - Hurricane Surge Inundation Zones
  - FEMA
    - FEMA National Flood Hazard Layer
- Infrastructure
- Transportation
- Political / Administrative Boundaries
- Utilities
- Tiled Layers
- Census 2010

Active Data Layers

Check all | Uncheck all

- [x] FEMA National Flood Hazard Layer
- [ ] Hurricane Surge Inundation Zones
- [ ] Percent of Residential Land in 500-Year Flood Zone
- [ ] Estimated Population in 100-Year Flood Zone
- [ ] Percent of Residential Land in 100-Year Flood Zone
- [ ] Percent of Public Open Space
- [ ] Communities Percent of 65 And Above Population Living Alone
- [ ] Communities Percent of Population Living Alone

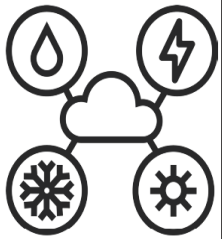
Legend

FEMA National Flood Hazard Layer

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- AH: 1% Annual Chance of 1-3ft Ponding, with BFE
- AO: 1% Annual Chance of 1-3ft Sheet Flow Flooding, with Depth
- VE: High Risk Coastal Area
- D: Possible But Undetermined Hazard
- X: 0.2% Annual Chance of Flooding
- X: 1% Drainage Area < 1 Sq. Mi.
- X: Reduced Flood Risk due to Levee
- Area Not Included
- Area with no DFIRM - Paper FIRMs in Effect

COASTAL FLOODING

Potential Effects of Climate Change



SEA LEVEL RISE

Predictions for Sea Level Rise by **mid-century range** from

1.1 feet to 2.7 feet.

Worse case for 2100 is a 9.7 feet of SLR.

MORE SEVERE STORMS

Climate change is likely to **Increase frequency of severe storms,** including hurricanes and nor'easters. **More damaging Storm Surge to be expected.**

A 2- foot sea level rise would more than triple the frequency of coastal flooding across the Northeast, without any change in storms.

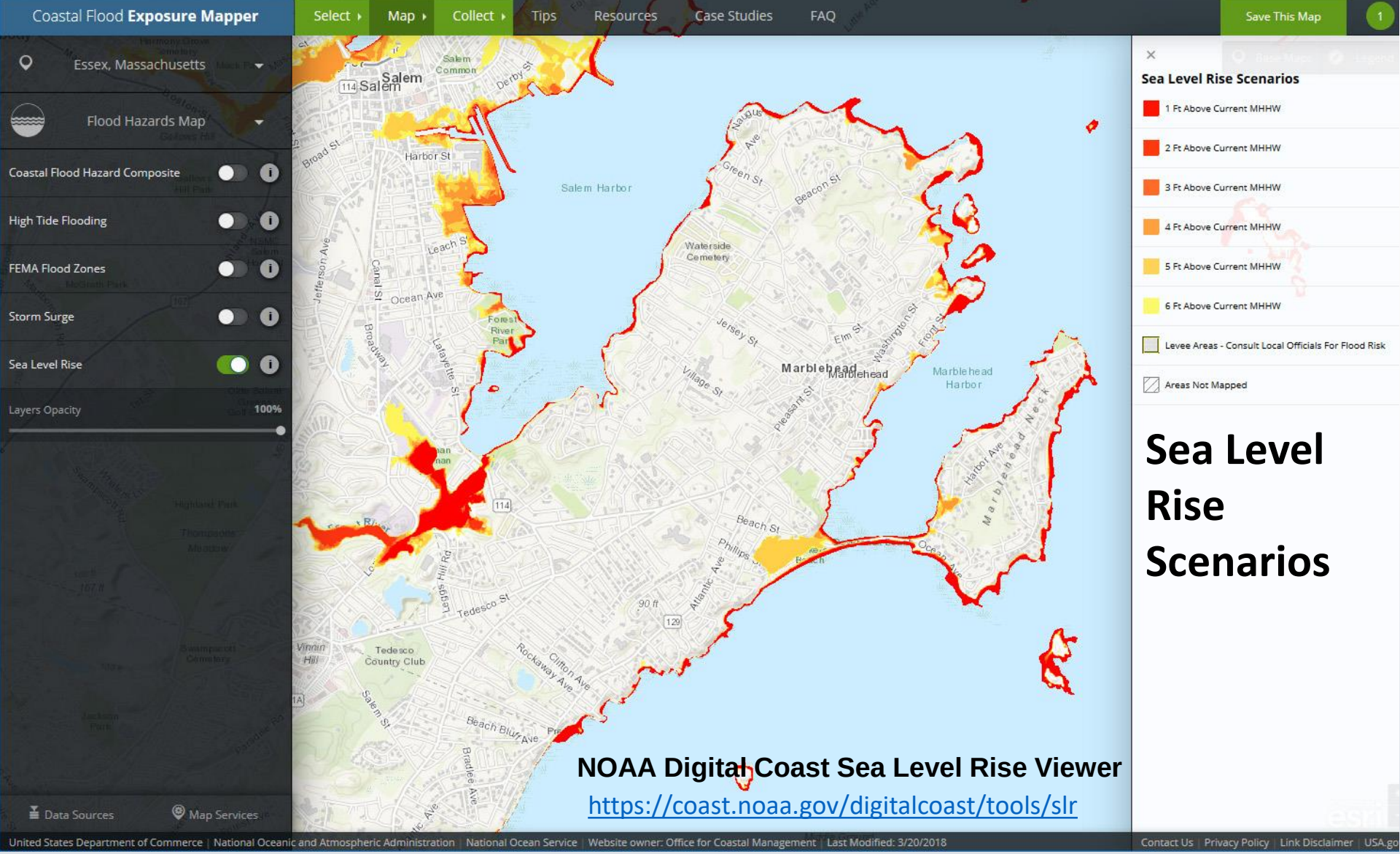
Regardless of whether these storms are getting stronger,
they are occurring over an ocean that is fuller than it used to be.
This all makes it easier for storms to push enough water onshore to cause flooding.

Climate.gov: Nor'easters pummel the U.S. Northeast in late winter 2018 Author: Tom Di Liberto March 14, 2018

https://www.climate.gov/news-features/event-tracker/nor%E2%80%99easters-pummel-us-northeast-late-winter-2018

Marblehead Geology – an Asset

A Complex of Ancient Igneous Rock with high elevations

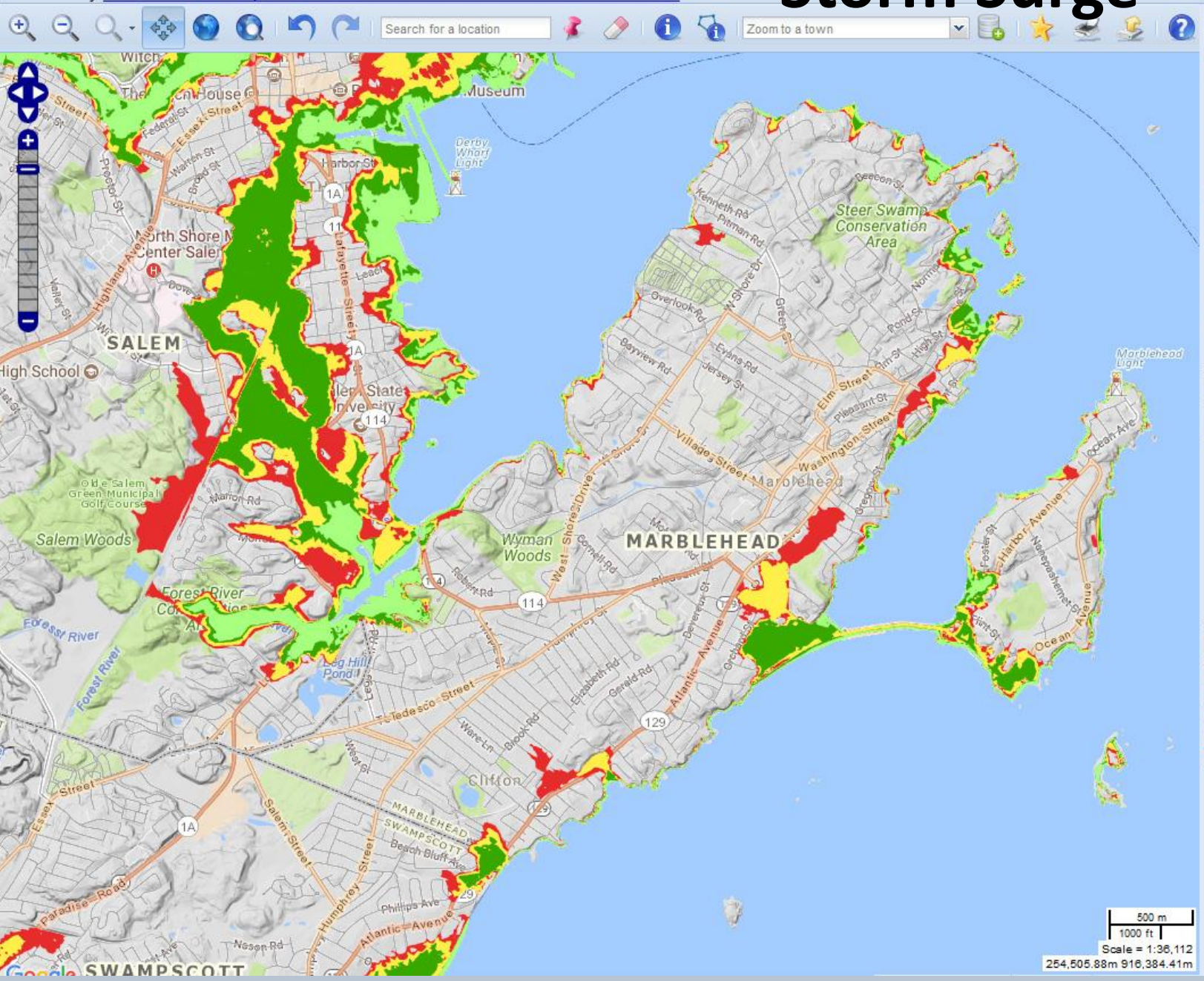


This map shows the National Oceanic and Atmospheric Administration (NOAA) modeling of coastal flooding above Mean Higher High Water (MHHW, the average height of daily highest tide) with six increasing levels of sea level rise (1-foot increments up to six feet).
This map does not account for storm surge, waves, erosion, and other dynamic factors.

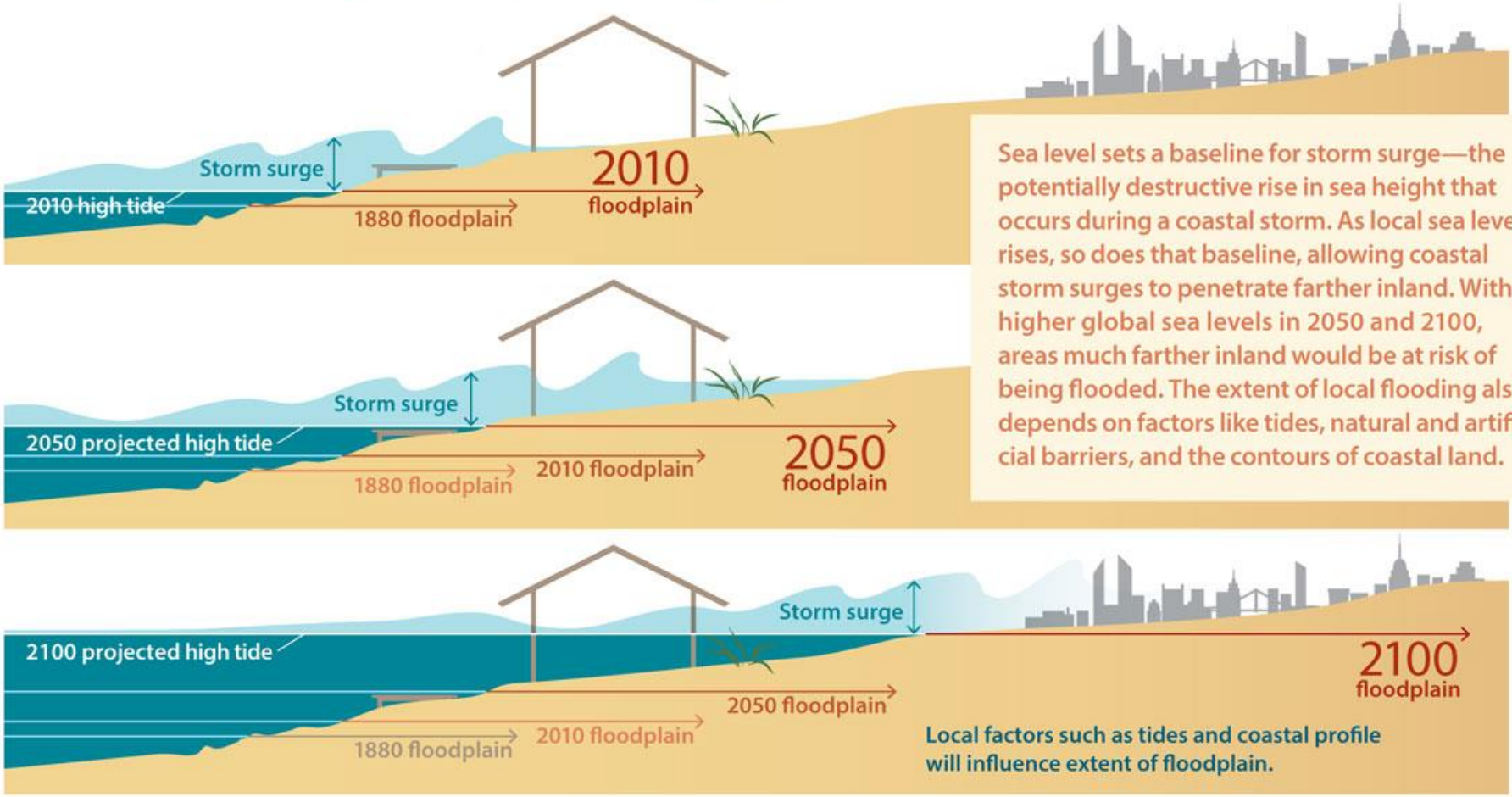
Climate Change Vulnerability Map

Provided by Massachusetts Dept. of Public Health - Bureau of Environmental Health

Storm Surge



Storm Surge and High Tides Magnify the Risks of Local Sea Level Rise



Sea level sets a baseline for storm surge—the potentially destructive rise in sea height that occurs during a coastal storm. As local sea level rises, so does that baseline, allowing coastal storm surges to penetrate farther inland. With higher global sea levels in 2050 and 2100, areas much farther inland would be at risk of being flooded. The extent of local flooding also depends on factors like tides, natural and artificial barriers, and the contours of coastal land.

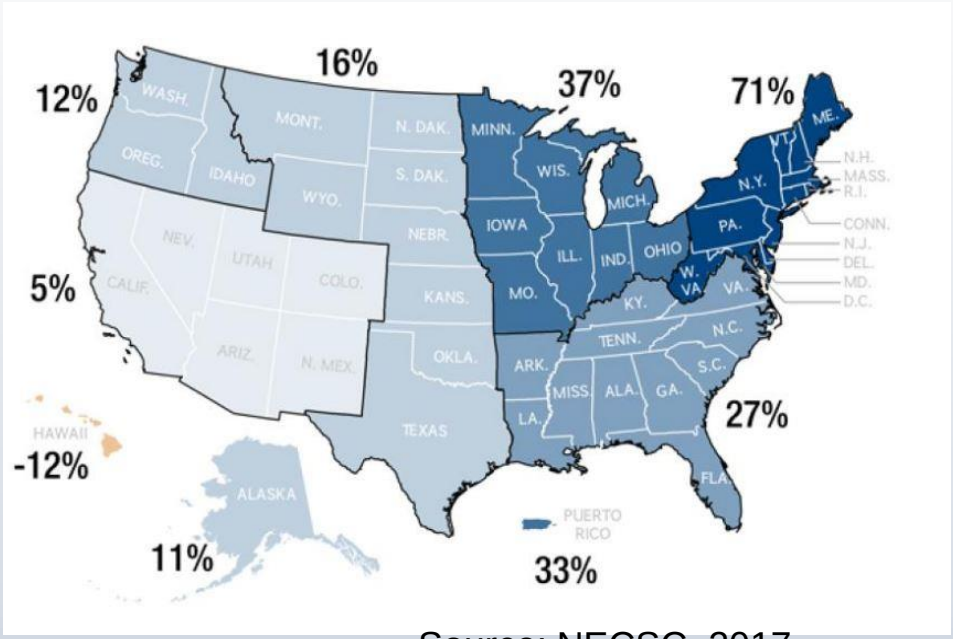
Changes in Heavy Precipitation

With every 1º C degree of warming, the air can hold 7% more moisture.

Peter Stott, U.K. Met Office's Hadley Center for Climate Change

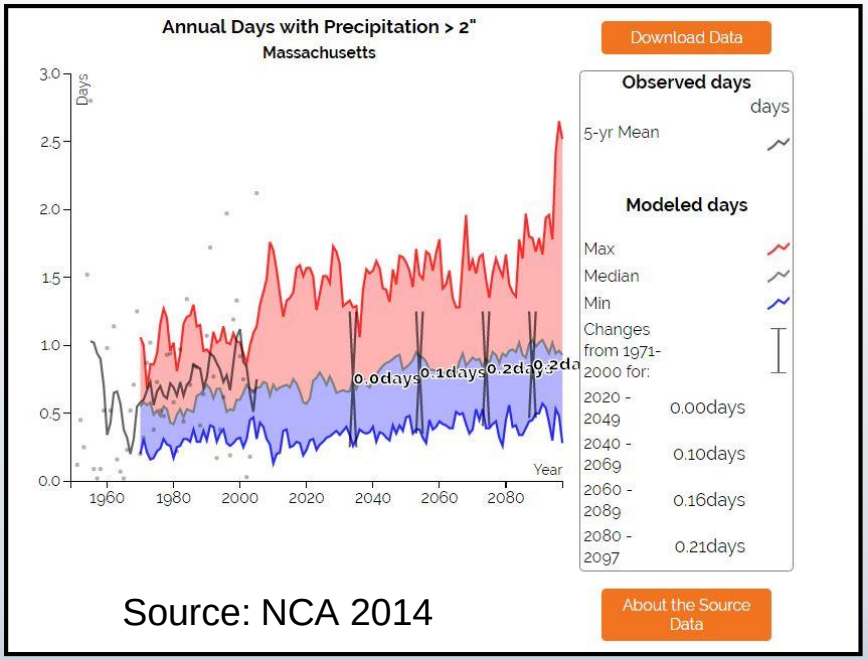
1º C = 1.8º F

Projected Frequency of Future Extreme Precipitation Events in Massachusetts



Source: NECSC, 2017

Annual Days with Precipitation >2”



Source: NCA 2014

Increase in Severe Storms bringing greater frequency of flood events with climate change.

Critical ASSETS - ACTIONS
Community Resilience Building Workshop

Critical ASSETS - their strengths and vulnerabilities

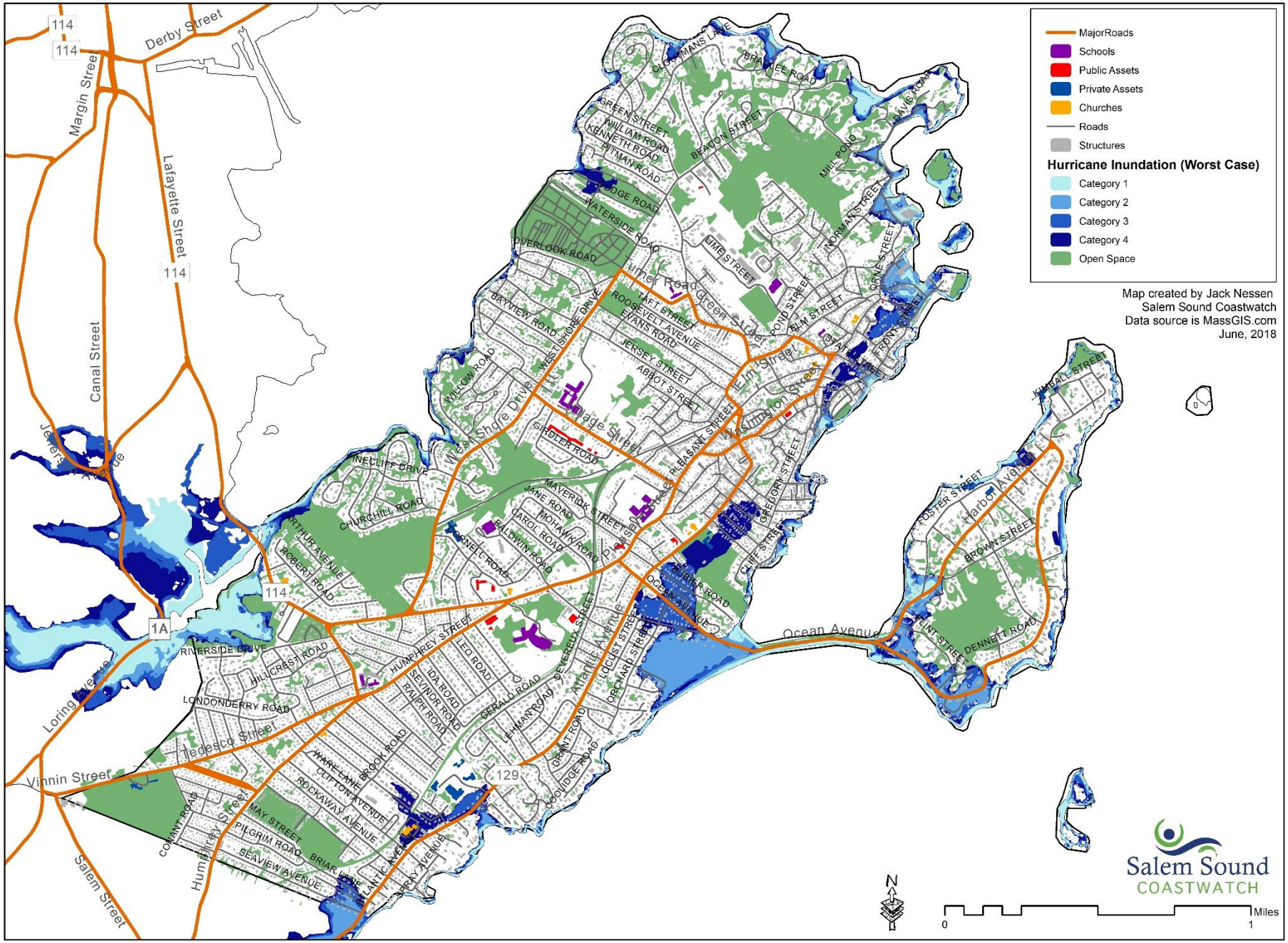
Infrastructural: buildings, roads, utilities, housing, schools

Societal: people – and services at risk

Environmental: natural resources important to community that are at risk of being lost

ACTIONS

Priority and Timeframe



Town of Marblehead, MA - Massachusetts Vulnerability Preparedness

Highest Priority - Marblehead Municipal Light

- Address **immediate need to protect the two 23-kilowat feeder lines** underground in the Lead Mills Rail Trail.

- Develop a detailed plan for **power distribution under emergency** conditions
- Evaluate **power substations near the water**
- Design deployment of town **renewable energy** sources
- Conduct town-wide **utility pole assessment** and replace as needed
- Investigate **risk of flooding** from harbor pipes to MMLD office building

Causeway closed 7 times this past year.
What does the future hold?

Highest Priority - The Causeway

Copyright Rick Cuzner

- **Assess reasons for the Causeway closures** in order to reevaluate solutions, particularly where it currently breaches
- **Install warning lights and gates**
- **Educate** coastal residents and others **about emergencies and risks**
- Make sure there are **shelters on both sides of the Neck**

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- Monitor condition and maintain **barrier beaches** – Devereux, Riverhead, Preston
- **Determine if something can be done with the water that overtops a barrier beach**
- Develop a **post storm operations and management plan**

Goldthwait Reservation
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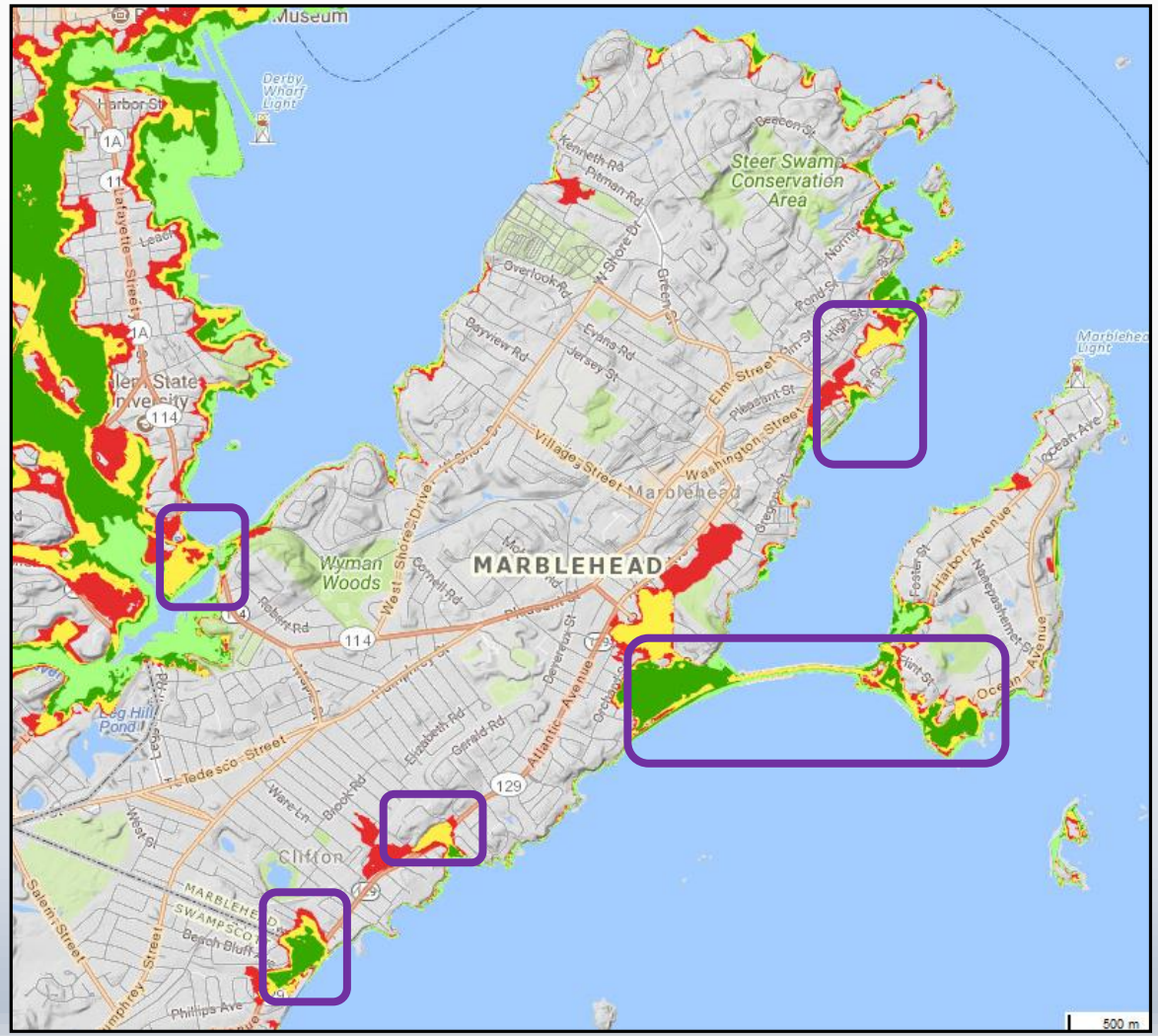
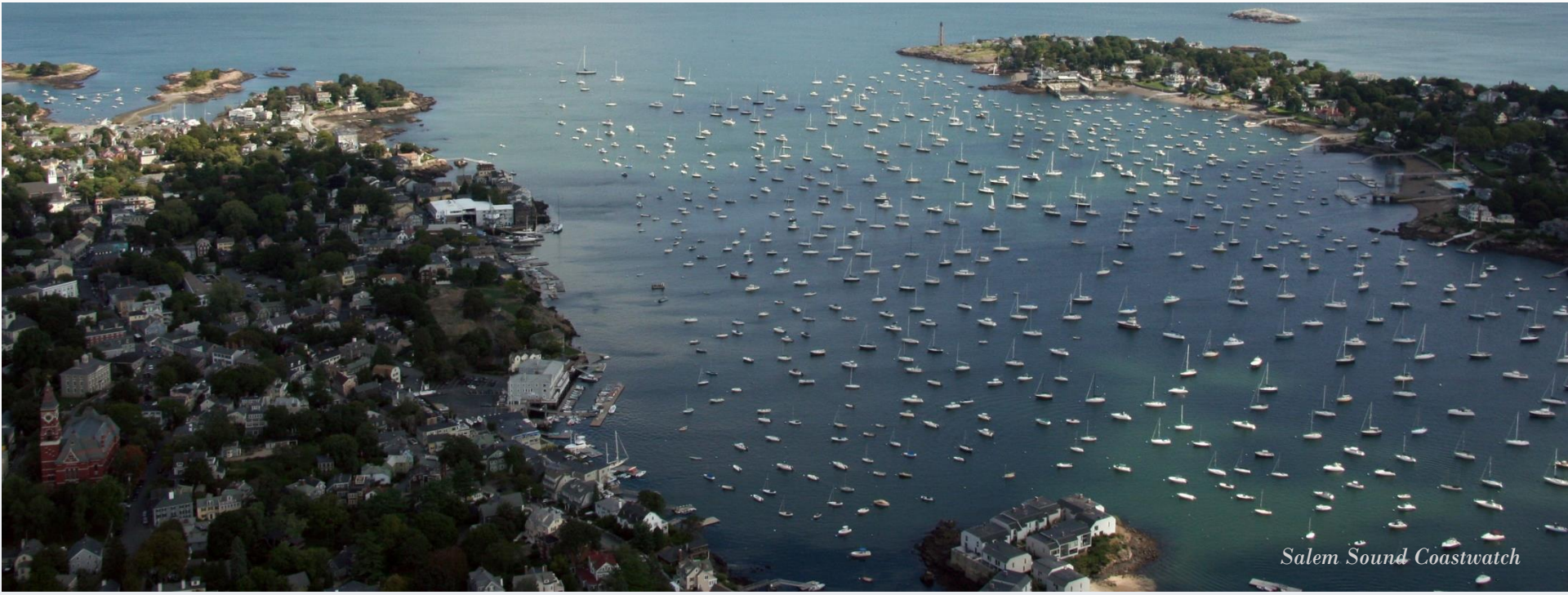
Highest Priority – Vulnerable Roads

- **Conduct flooded road analysis to determine short and long-term solutions.**
- Work with **neighboring towns to find solutions to flooding** and resiliency.



Highest Priority – The Harbor



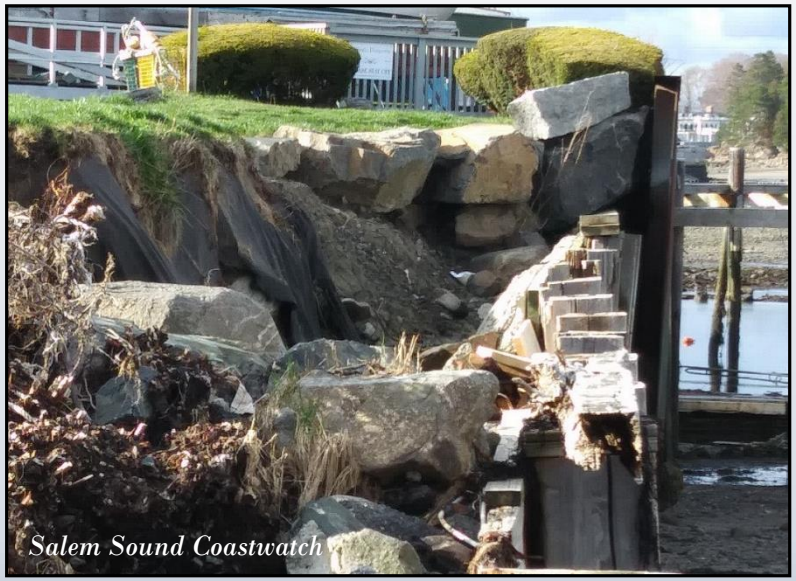
- Develop a **resilient, cohesive response to protect assets in Marblehead Harbor** that addresses the mix of private and town properties, state and federal regulations

- **Restart conversation about constructing a breakwater** to protect the harbor assets, which will require a cost/benefit analysis

Highest Priority – Seawalls

- **Permit and reconstruct or repair public seawalls** that are in immediate need from the winter 2018 storms

- **Update** the CZM **private/public seawall inventory** that includes climate change risk projections.



Highest Priority – Sewer Infrastructure

- Evaluate current flooding and future risks at **13 sewer pump stations** and then protect from flooding
- Upgrade **alarms** to SCADA; Educate public on alarm and sump pumps
- **Replace sewer lines** that are **at risk of seawater flooding** as indicated from current investigation

Highest Priority – Stormwater Infrastructure

- **Inventory stormwater infrastructure** and ocean backflow
- **Begin resiliency improvements** at flood priority areas
- **Conduct a study of imperviousness**, evaluating options to reduce hardening, increase flood storage and/or incorporate green infrastructure
- Continue public **education**
- Assess feasibility of using **Reynolds Park** for temporary underground **stormwater storage**
- Continue to **protect the environmental quality of the harbors** through sewer and stormwater improvements, boat pump outs, and residential and boater awareness.

HIGH WIND HAZARD

From 2004 to 2013 *(Source: Marblehead FEMA Hazard Mitigation Plan 2015)*

32 high wind related events –

Winds/Thunderstorms $25,000 - $1.1 million

Lightning – $45,000

• Conduct appropriate **tree maintenance** near assets to **protect power distribution** and **prevent road closures**

• Conduct **tree inventory/survey** to evaluate needs with goal of maintaining a healthy tree canopy, while **removing threats to utilities and roadways during high wind / storm events / coastal erosion**

Moderate Priority

- Improve **communications redundancy** for emergency services
- Complete **Emergency Preparedness Plan** Update
- Conduct **public education in advance of a disaster**: how to prepare, shut down power, evacuate
- Educate and encourage **retrofitting that include flood-wise** actions (e.g. blow out panels, raising utilities)
- Implement flood proofing and flood storage that would prevent the **Abbot Library** from future flooding

- **Evaluate adequacy of existing resources for boat removal during emergencies and determine possible new access points**.

Moderate Priority

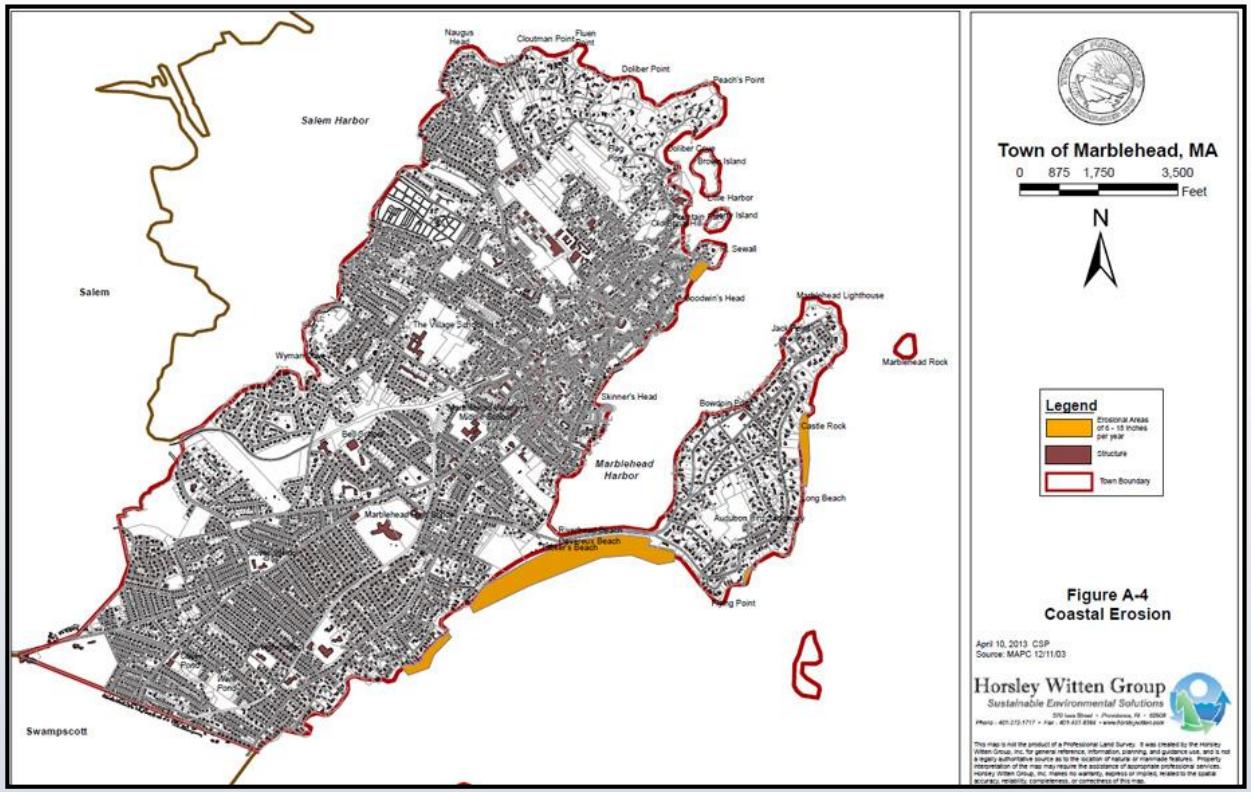
- **Evaluate and repair visible seawall erosion** at rear of MMLD building site adjacent to Hammond Park
- Maintain **parks and conservation areas**; if resiliency actions are needed to protect infrastructural assets, conduct in the most practically sound environmental manner
- Maintain access on the **Rail Trail** for non-vehicular transportation; Improve drainage, elevate areas that flood or construct alternative passage
- Maintain and repair **Fort Sewall** earthen fort using resilient solutions

Coastal Erosion Hazard

Fort Sewall 6 – 17 inches of erosion/year

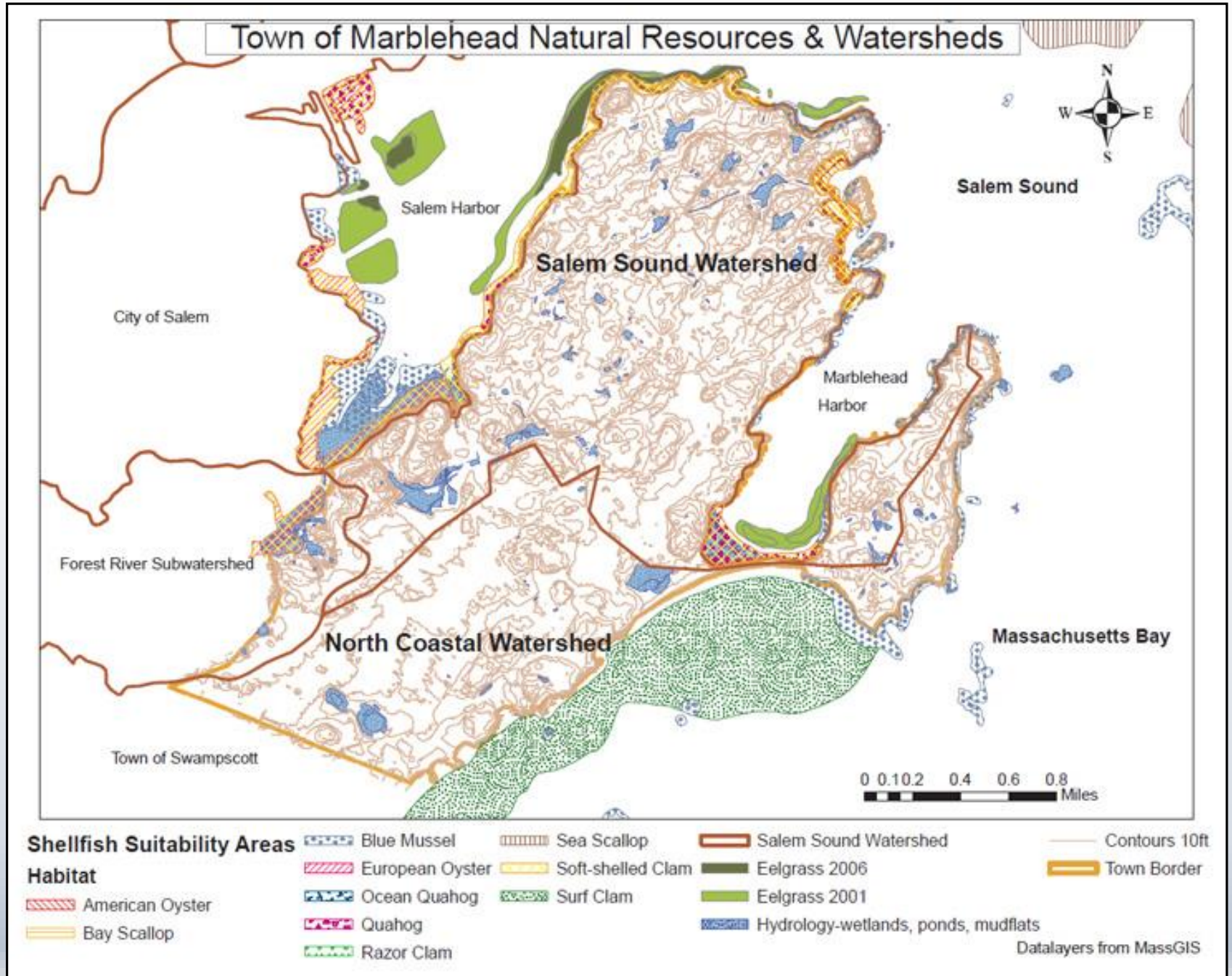
Low Priority – Coastal Erosion Hazard

- Monitor **erosion** at **Chandler Hovey Park**; Assure functionality of Marblehead Light.
- Monitor **shoreline for erosion** at the Waterside Cemetery.



The Causeway 9 – 10 inches of erosion / year
Devereux Beach 6 – 10 inches of erosion / year

Environmental: natural resources at risk of being lost from climate changes



Low Priority

- Evaluate **beach and salt marsh systems vulnerability** to inform long-term policy, which includes understanding beach erosion and habitat retreat.
- **Protect and maintain Brown and Gerry Islands**, while understanding the natural changes that will occur due to sea level rise.
- Stay informed of the **climate change research on eelgrass and shellfish**, and implement if possible.

MVP - Planning & Taking Action

Information on the effects of climate change
is sufficient to start planning now,
but flexibility and openness
to new information are essential.

No Action – Accommodate – Protect – Retreat
Prepare for Recovery – Public Safety

This will require a mix of actions taken over space and time by public and private organizations.

Salem Sound COASTWATCH

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- Email: rebeccac@marblehead.org