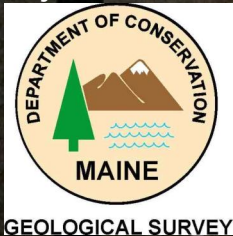




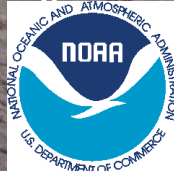
Adaptation to Sea Level Rise – A Regional Approach in Saco Bay, ME

Project Partners:

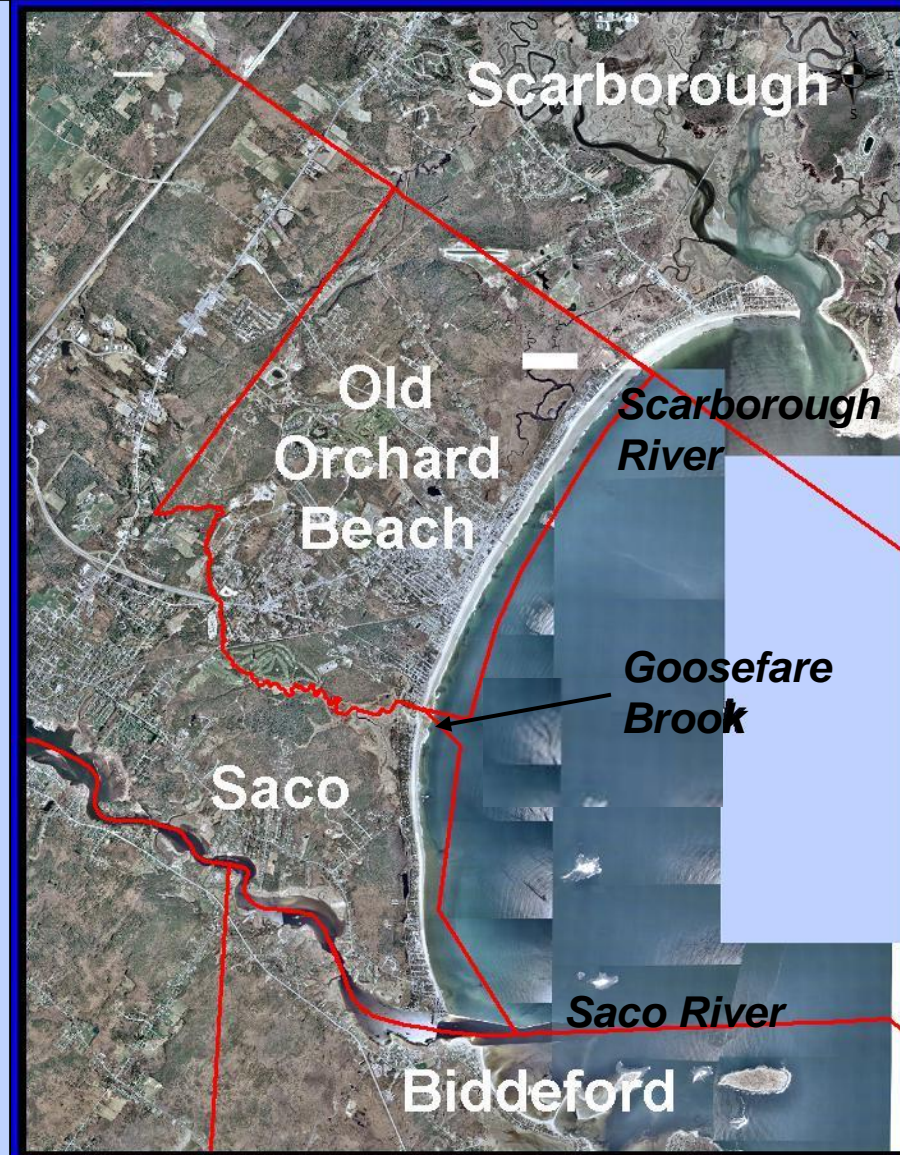
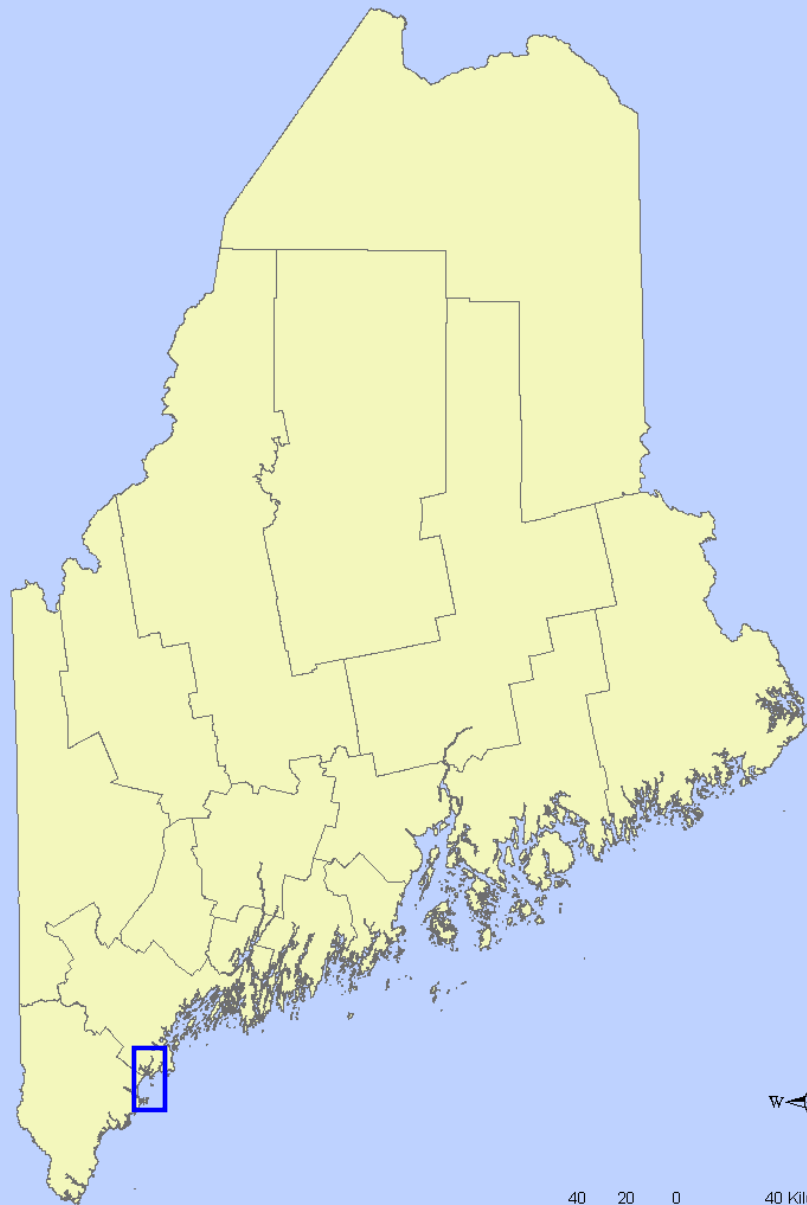


*Peter Slovinsky, Marine Geologist
Maine Geological Survey, Department of
Conservation*

Project Funding from:



Saco Bay – Hazards and Habitats



Coastal Hazard Resiliency Tools (CHRT) Project

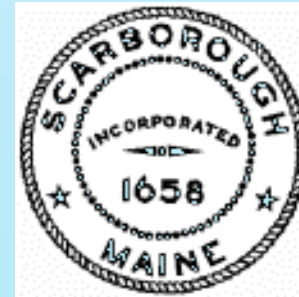
Year 3 Rounding Up!

State Agencies – Regional Planning Commission - Municipalities

Data Development, Outreach, Education, and Partnership Development



Maine Coastal Program



GEOLOGICAL SURVEY



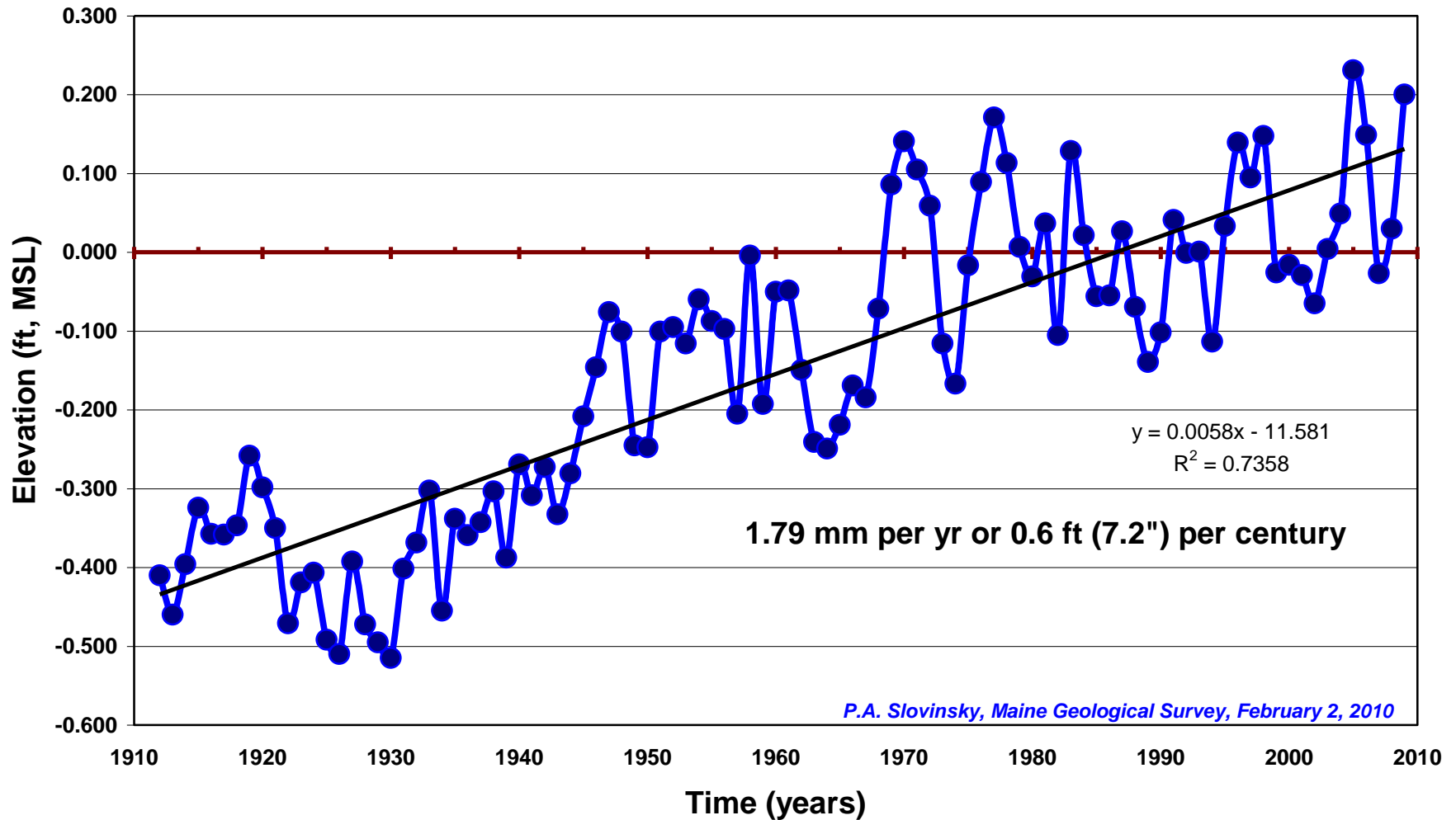
Framing the Problem



By how much? What will the potential impacts be? What can be done?

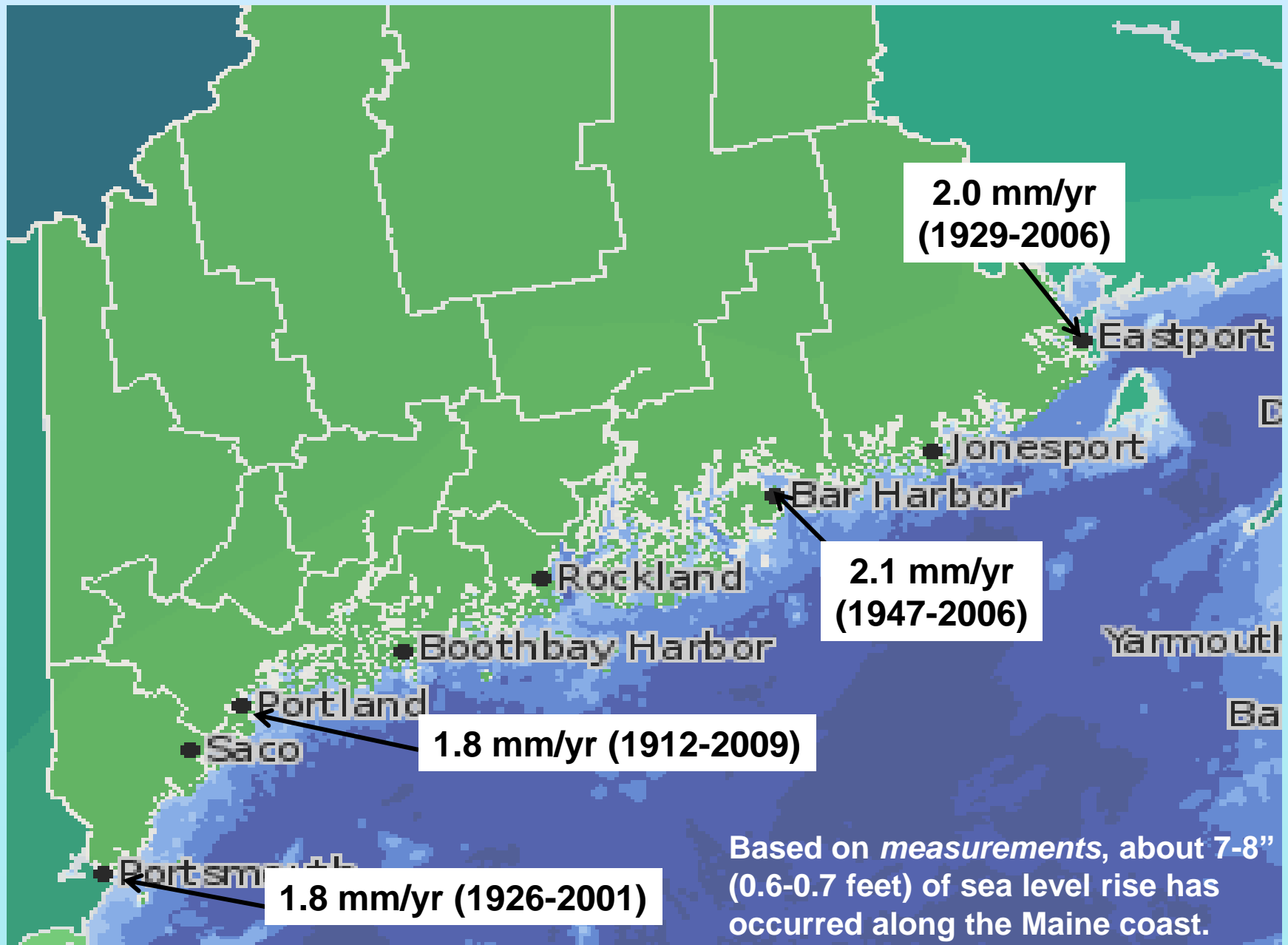
Sea Level is RISING, right?

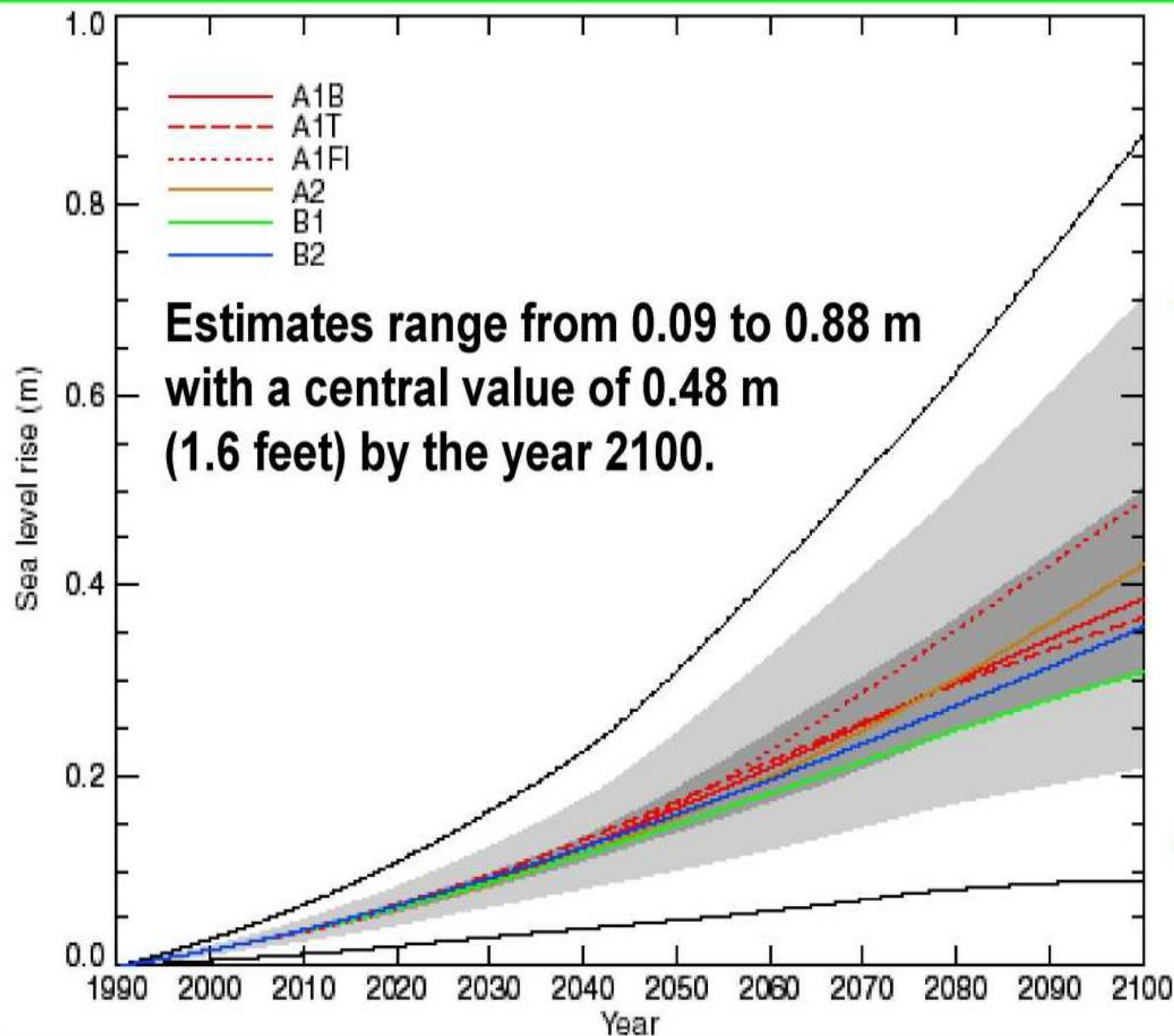
Sea Level, Portland, Maine 1912-2009



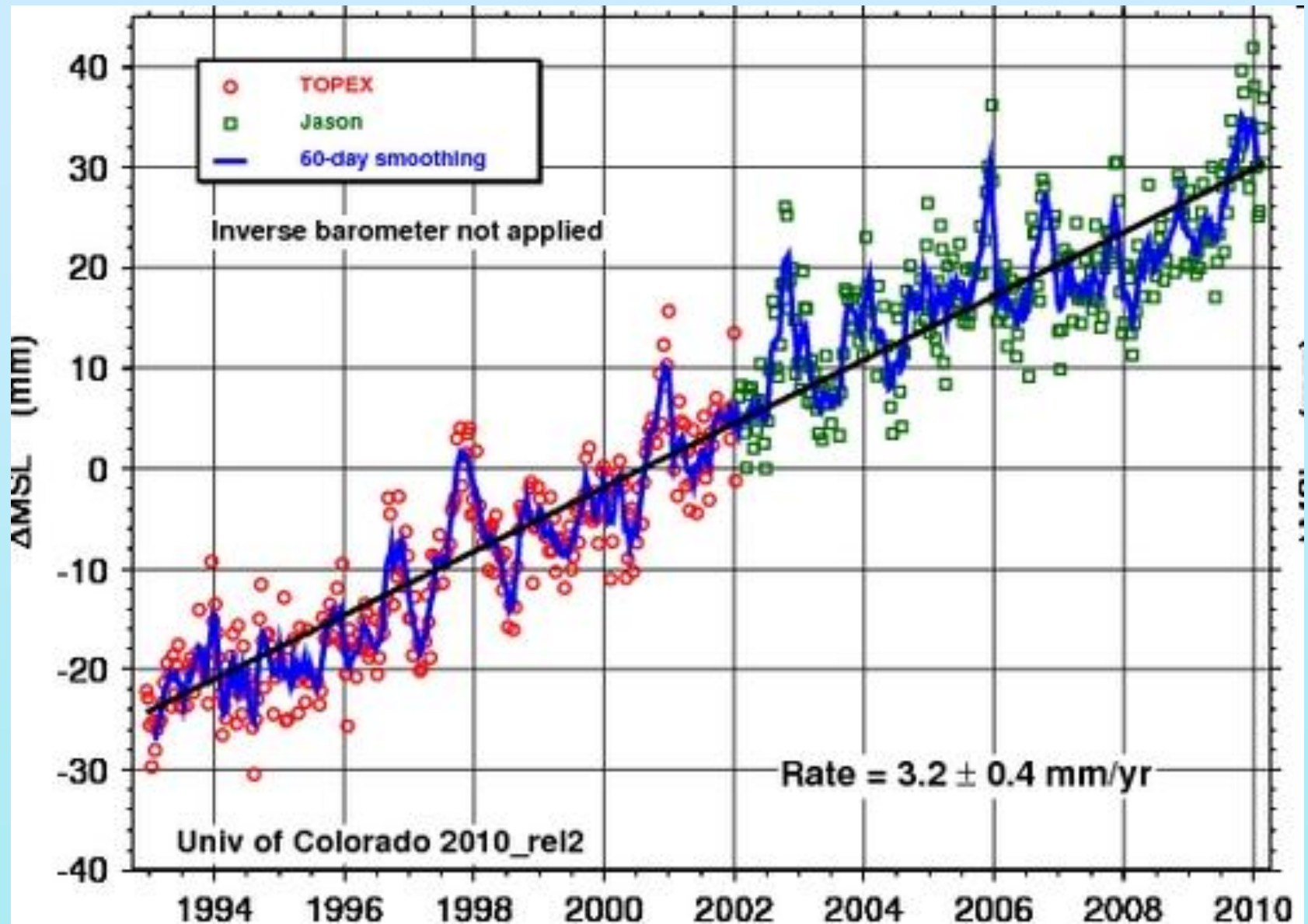
Portland Tide gauge = global ocean over last century **1.8 mm/yr** (IPCC, 2007).
In Maine, this is the fastest in past 3000 years

Documented Sea Level Rise





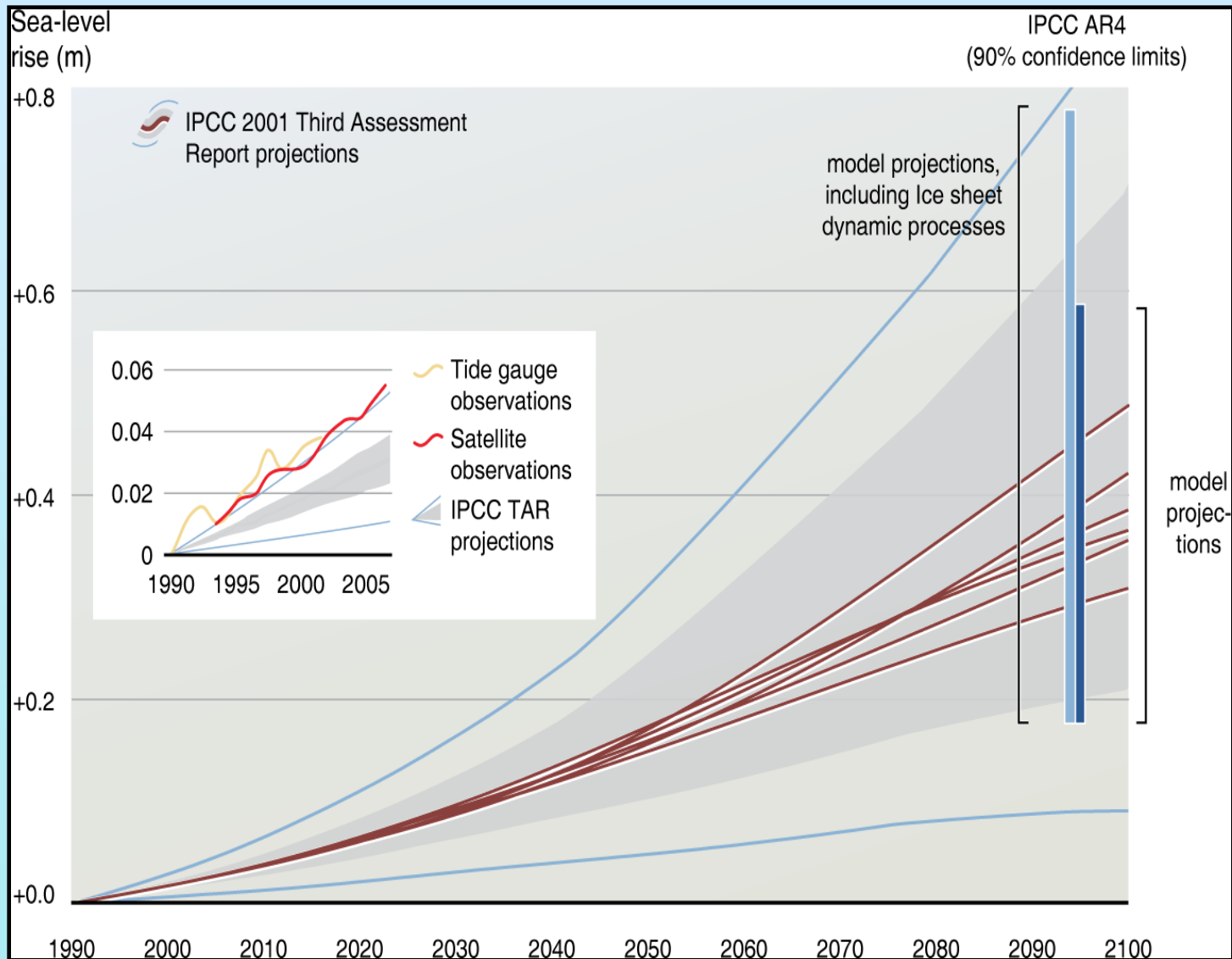
**Estimates range from 0.09 to 0.88 m
with a central value of 0.48 m
(1.6 feet) by the year 2100.**



Satellite altimetry (1992-2010) = global sea level 3.2 ± 0.4 mm/yr

Portland during same time period = 1.9 mm/yr

<http://sealevel.colorado.edu/>

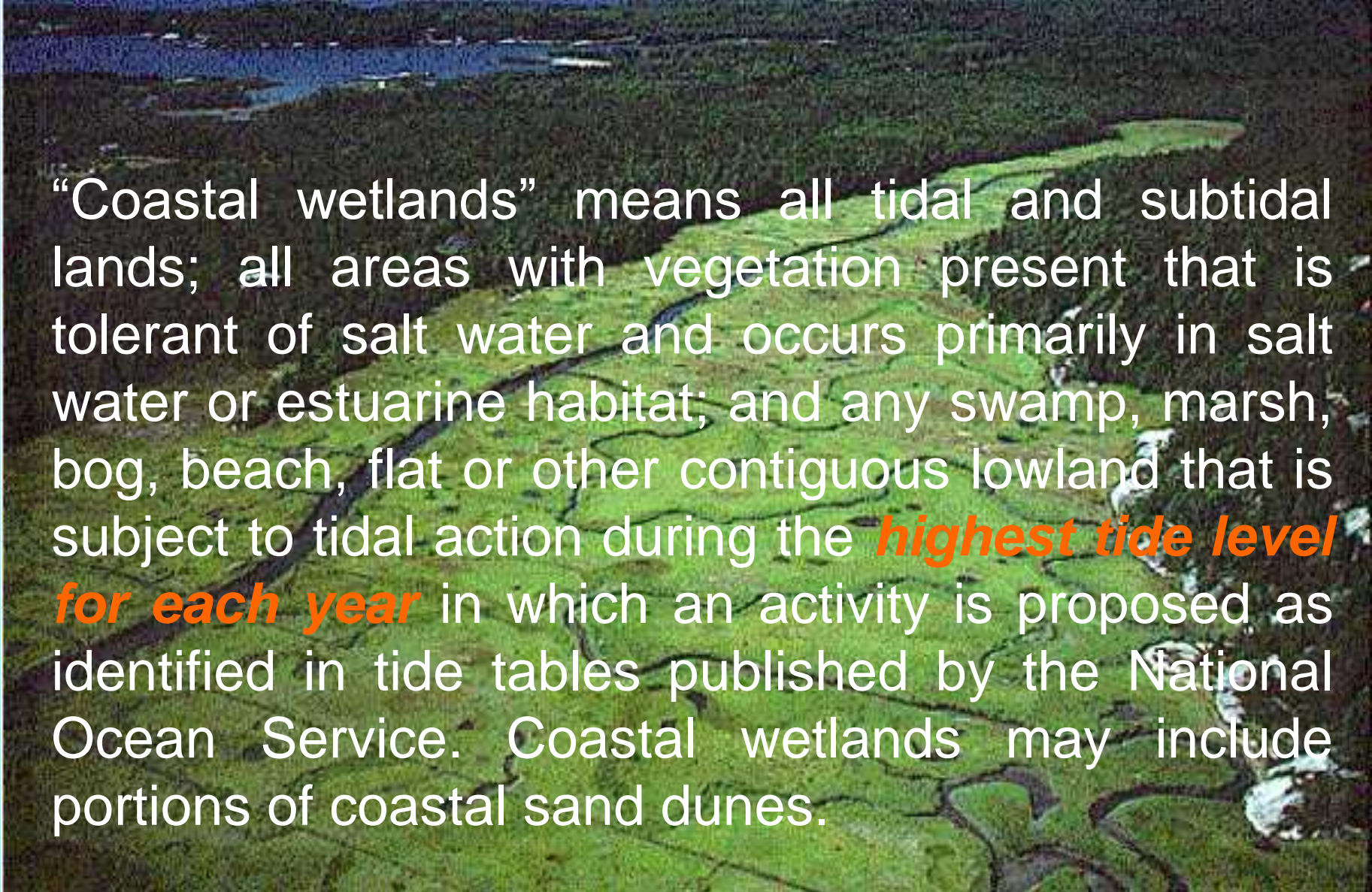


Coastal Sand Dune Rules (Chapter 355 NRPA)

In response, in the coastal sand dune system, Maine is planning for **2 feet of sea level rise over the next 100 years**, which is generally a “middle-of-the road” prediction for global sea level rise.



Coastal wetlands



“Coastal wetlands” means all tidal and subtidal lands; all areas with vegetation present that is tolerant of salt water and occurs primarily in salt water or estuarine habitat; and any swamp, marsh, bog, beach, flat or other contiguous lowland that is subject to tidal action during the **highest tide level for each year** in which an activity is proposed as identified in tide tables published by the National Ocean Service. Coastal wetlands may include portions of coastal sand dunes.

Using the Sea Level Rise Simulation Tool

Steps:

- 1) Demonstrate accuracy of **LIDAR** in representing ground conditions.
- 2) Demonstrate accuracy in simulating **existing conditions** using **tidal elevations** to define marsh habitats and inundation
- 3) Simulate **potential impacts of sea level** rise on:
 - a) Marsh Habitat
 - b) Existing Infrastructure
- 4) Identify at-risk areas
- 5) Identify adaptation strategies

Represent Marsh Boundaries Using Tidal Elevations

Assumptions:

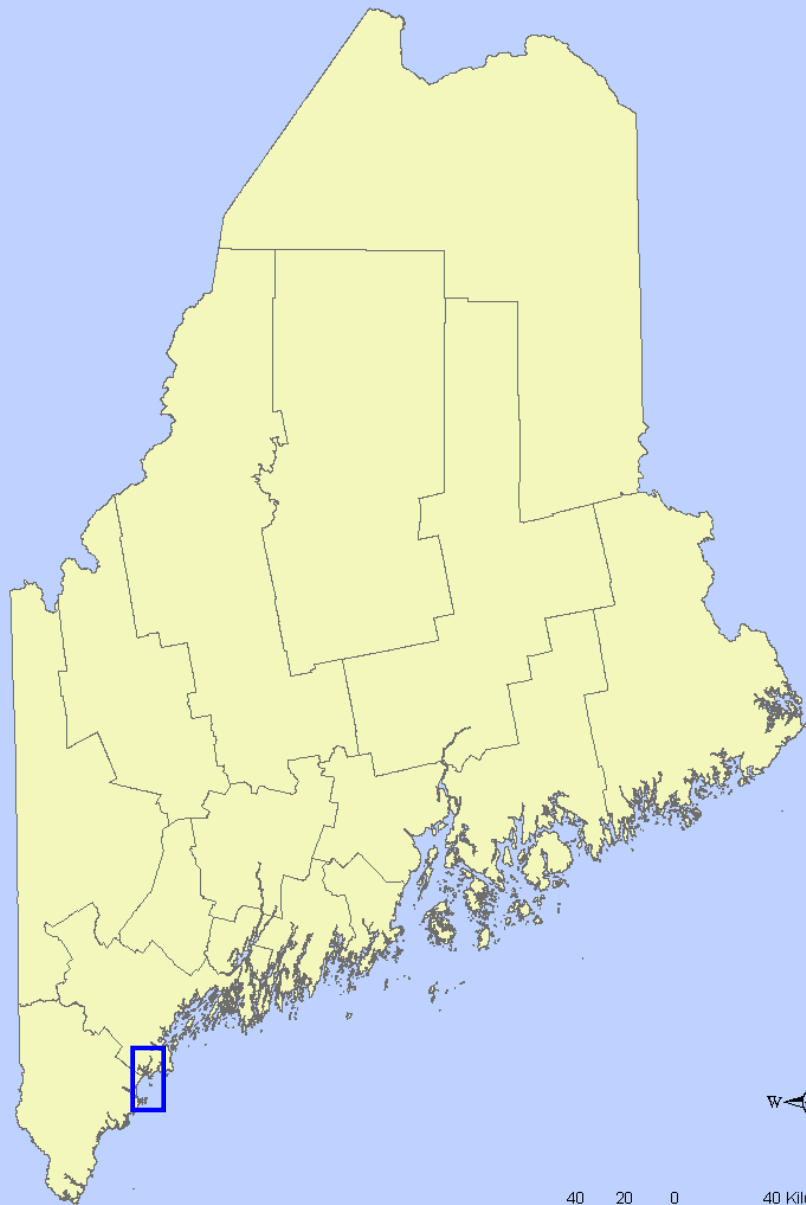
Open Water *generally exists below mean sea level.*

Low Marsh *generally exists from mean sea level to mean high water.*

High Marsh *generally exists from mean high water to highest annual tide.*

Data is limited to where we have LIDAR data coverage.

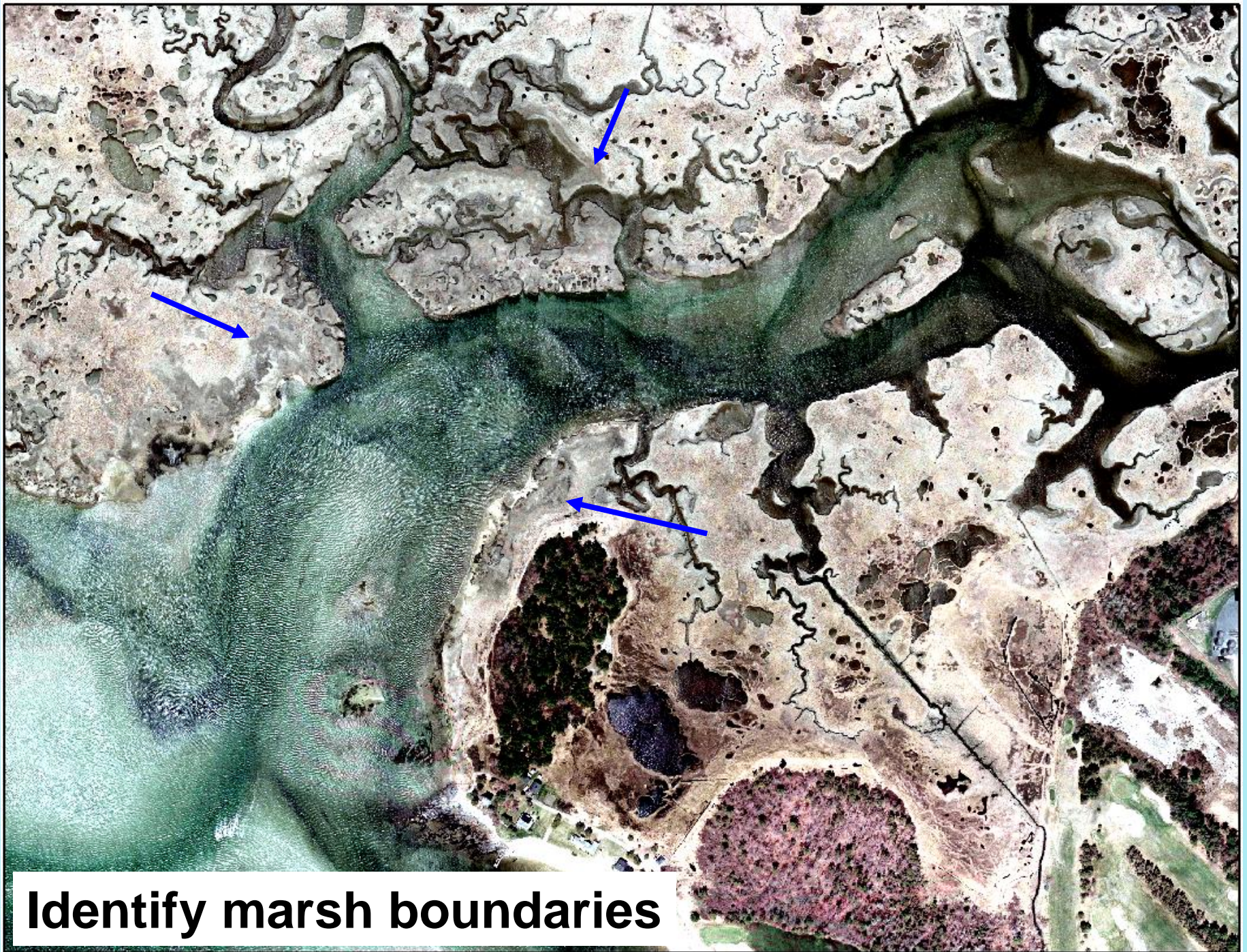
Saco Bay



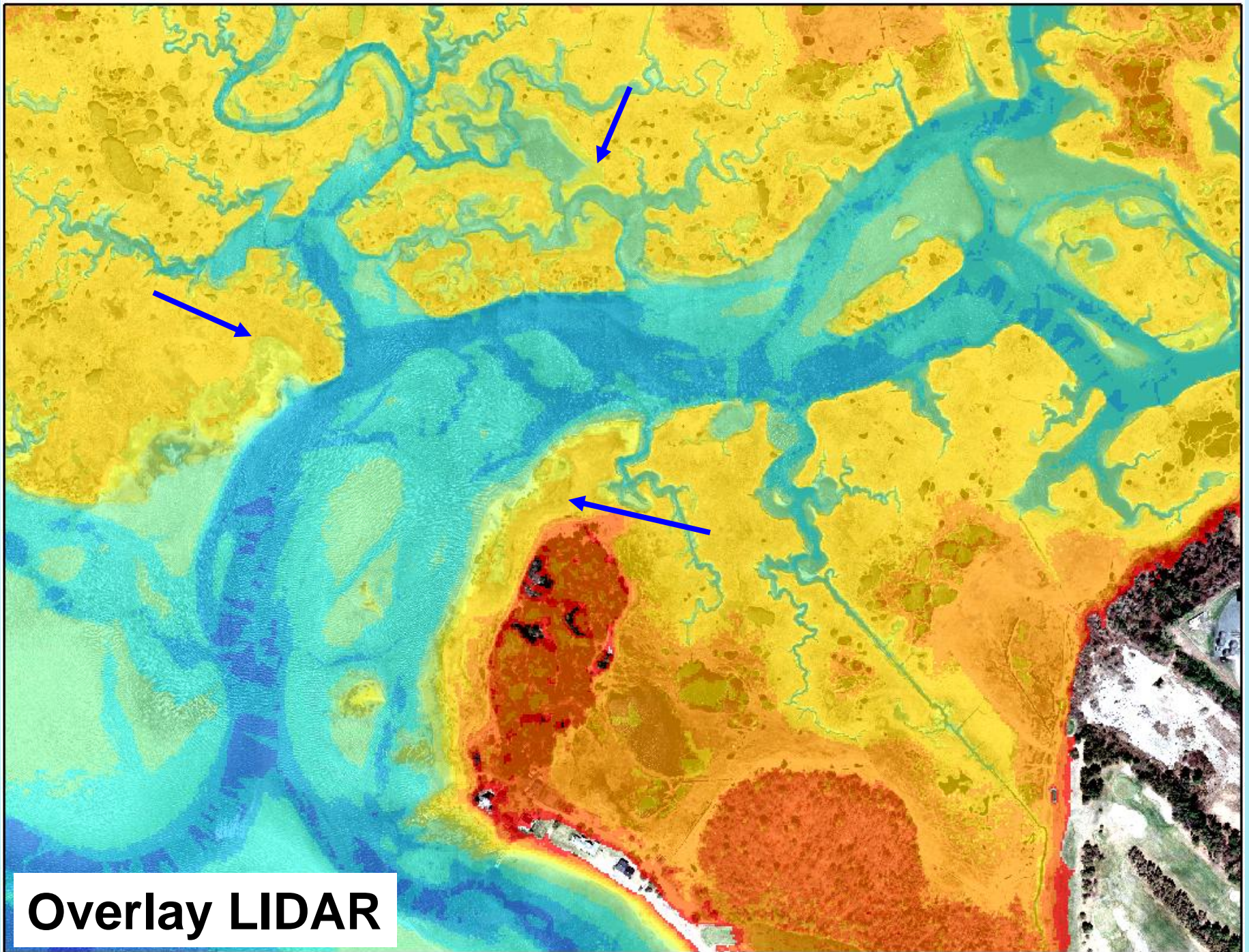
Marsh Habitats
Scarborough River, Scarborough

“Groundtruthing”





Identify marsh boundaries



Overlay LIDAR



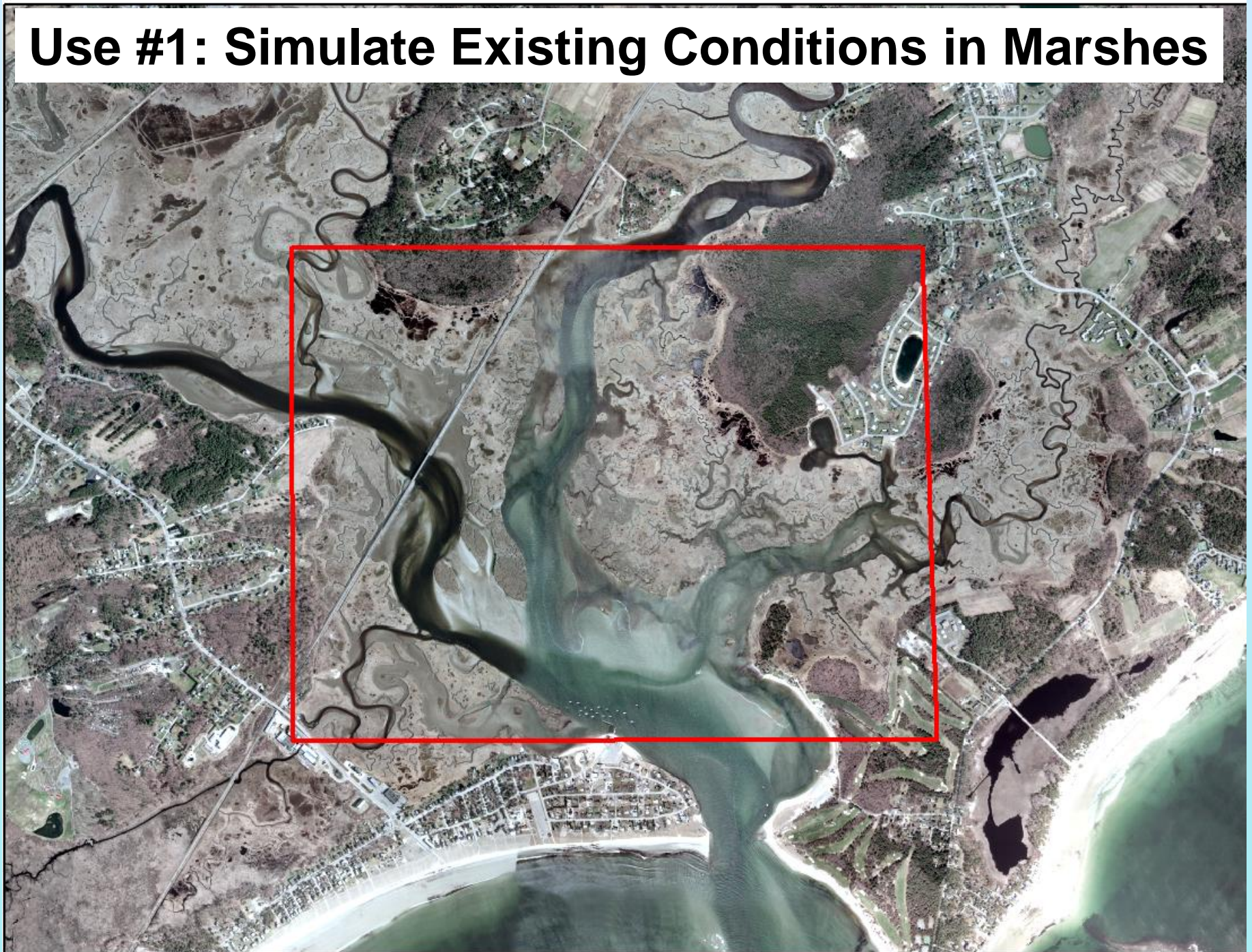
Identify using tidal elevation ranges

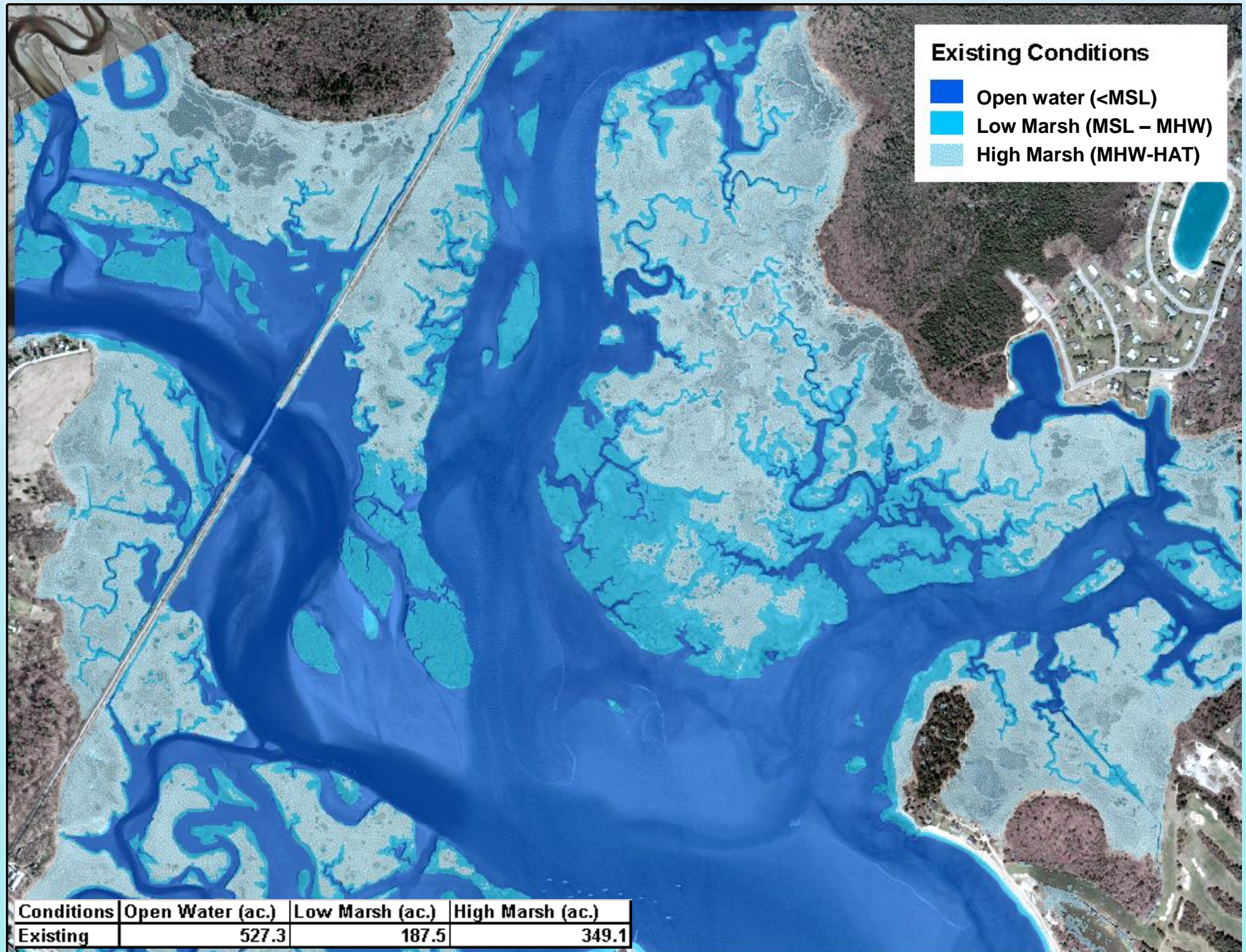
High Marsh = Above MHW and below HAT

Low Marsh = Above MSL and below MHW

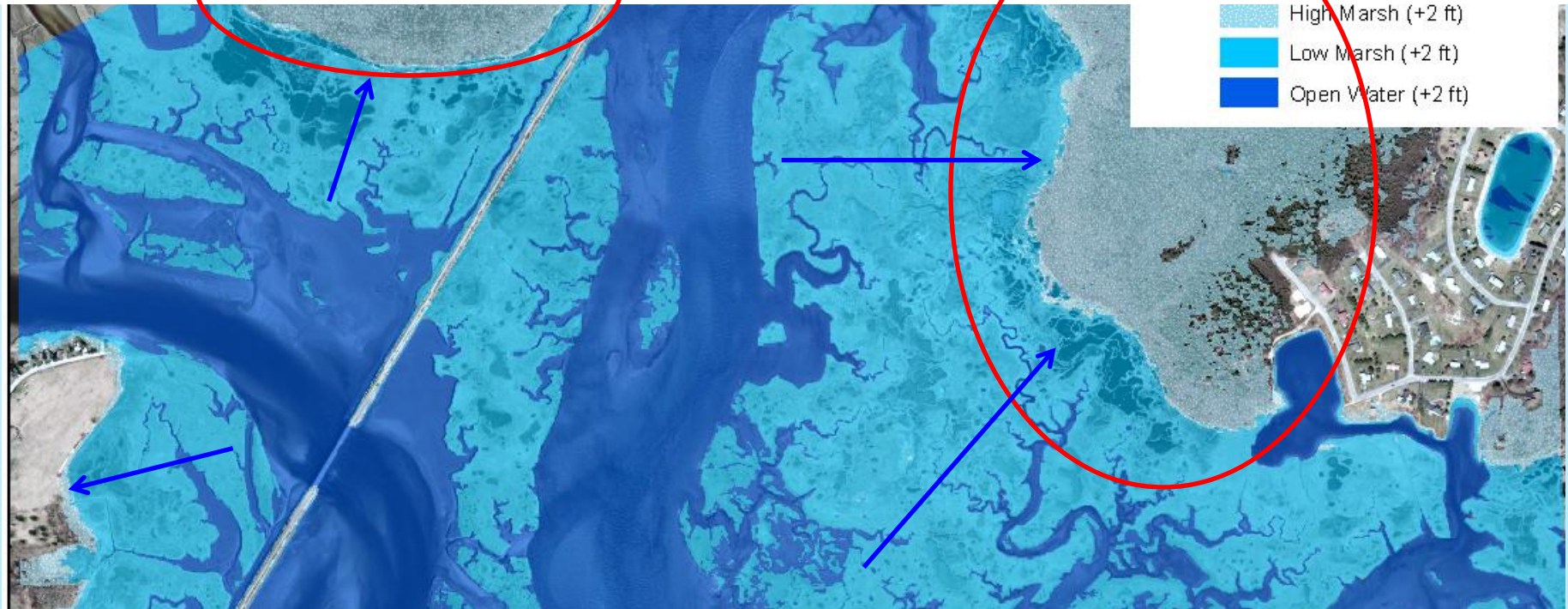
Open Water = Below MSL

Use #1: Simulate Existing Conditions in Marshes

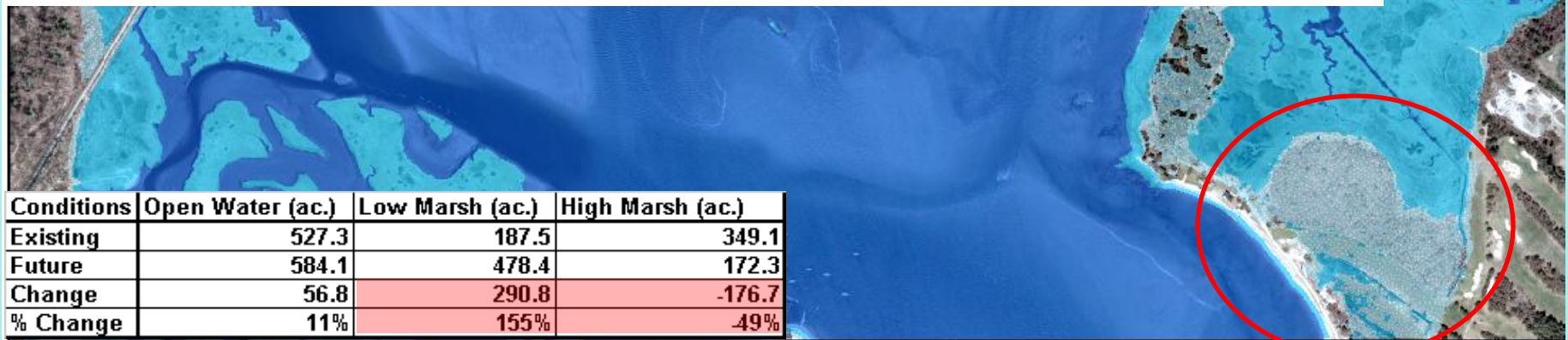




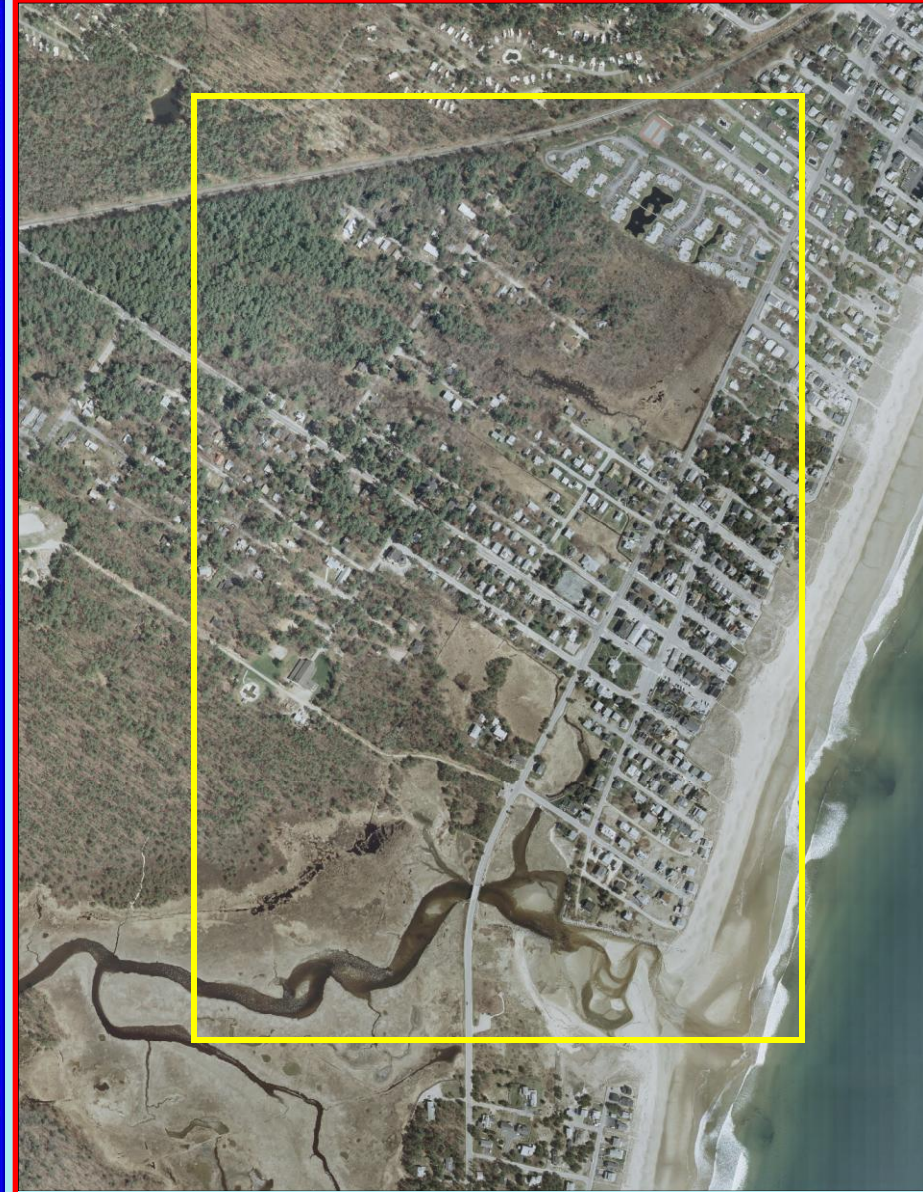
Use #2: Simulate Potential Future Marsh Conditions



Use #3: Identify low-lying uplands for marsh transgression

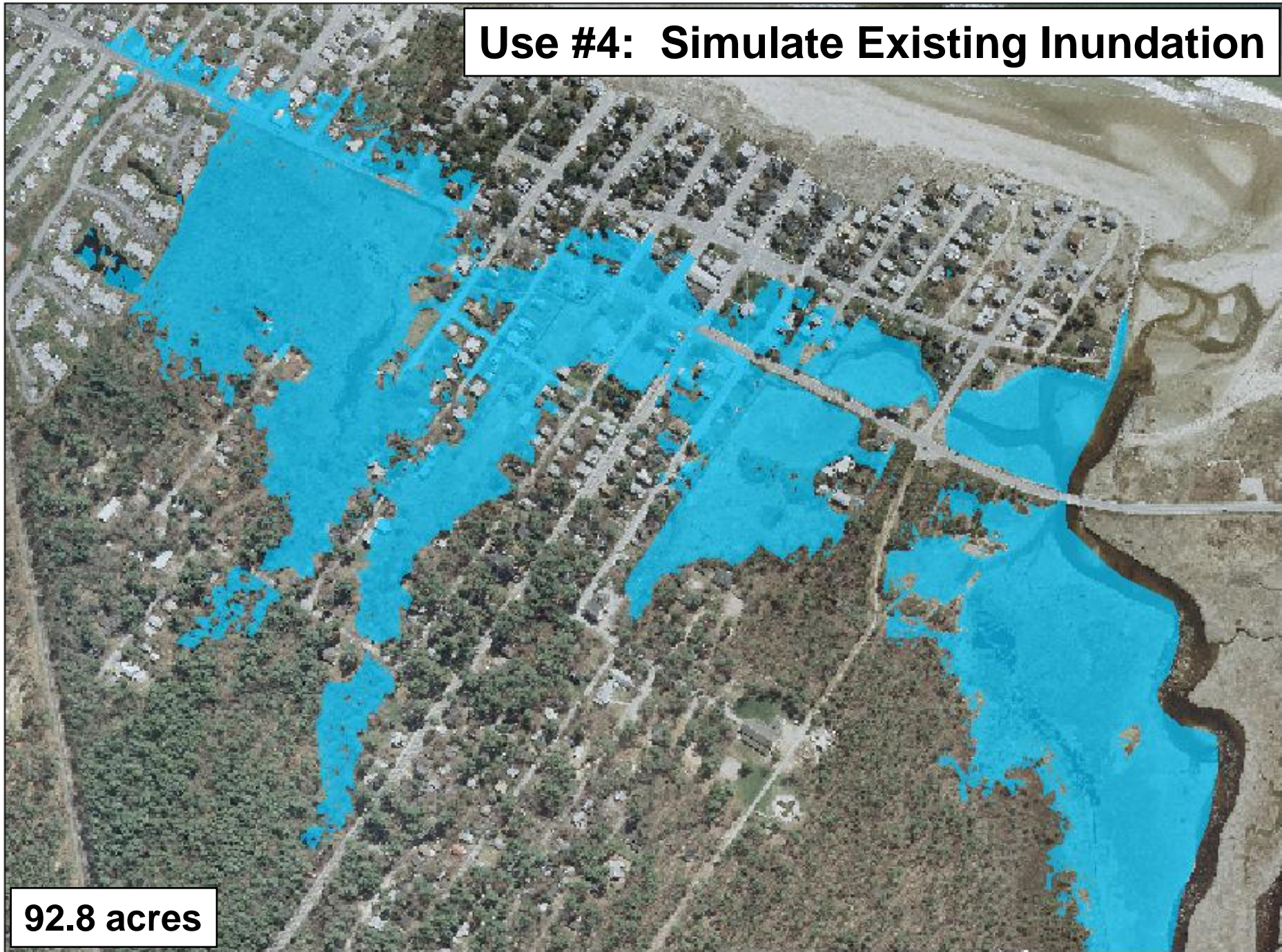


Simulation of Existing Conditions



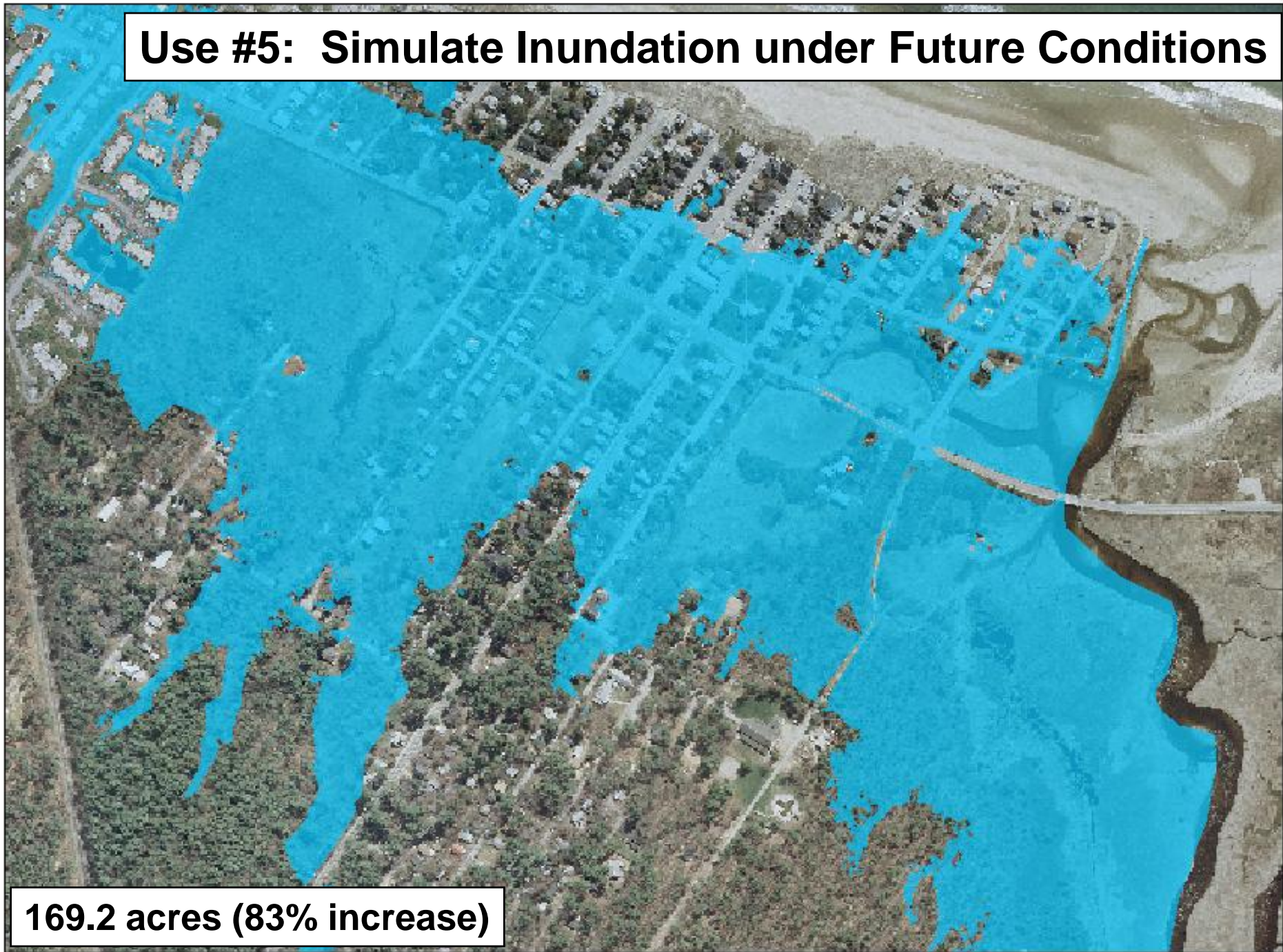
**Flooding and Inundation
Ocean Park, Old Orchard Beach**

Use #4: Simulate Existing Inundation



92.8 acres

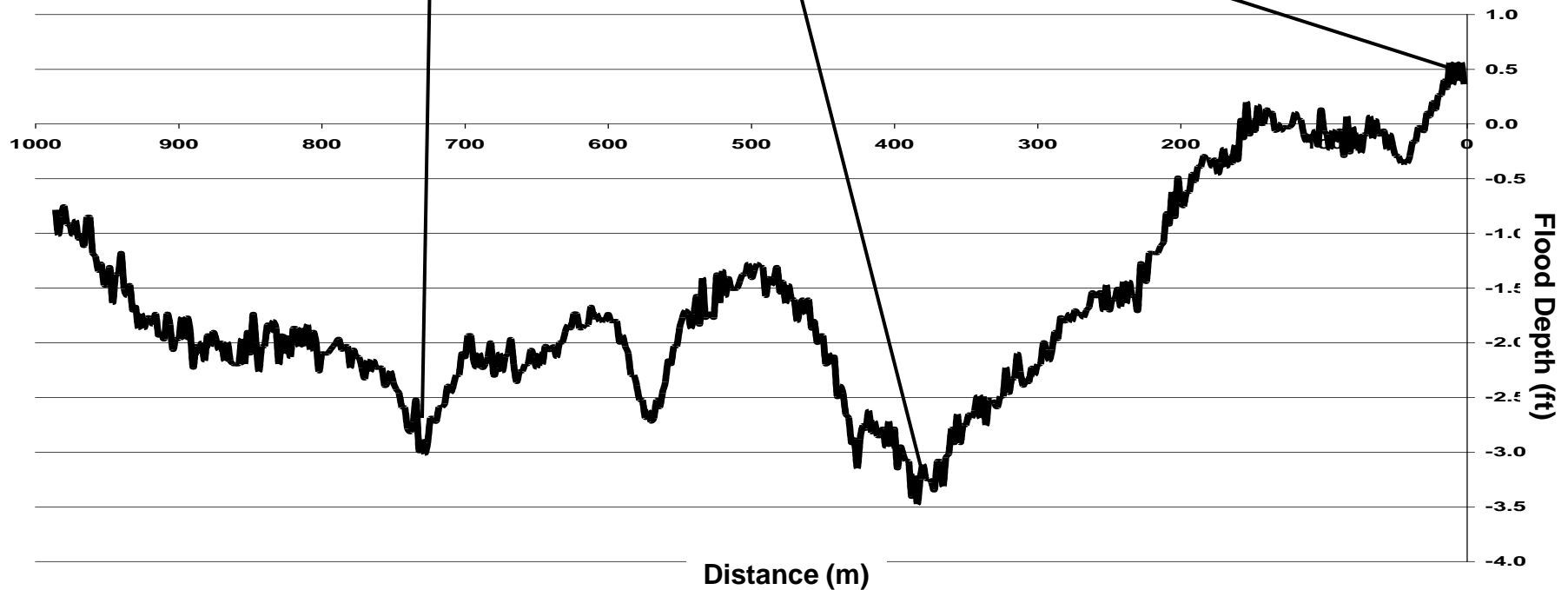
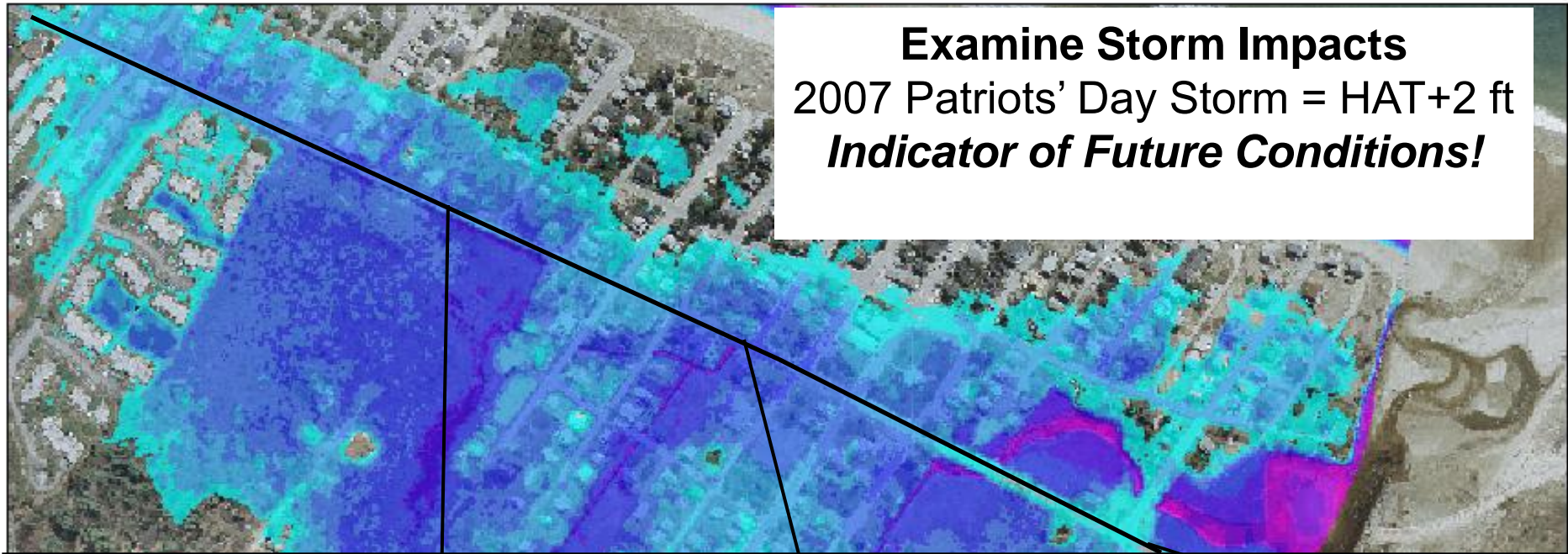
Use #5: Simulate Inundation under Future Conditions



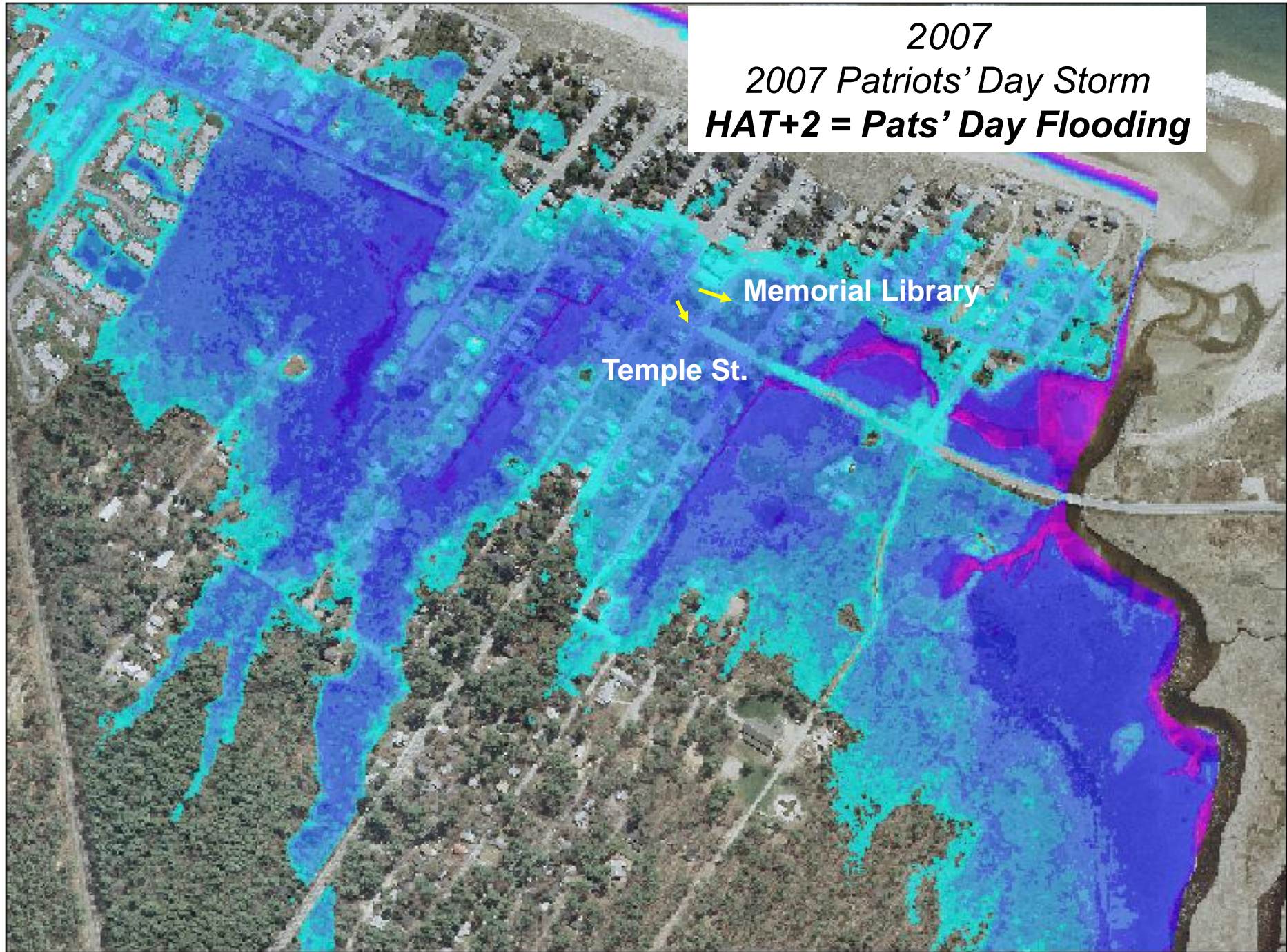
169.2 acres (83% increase)

Examine Storm Impacts

2007 Patriots' Day Storm = HAT+2 ft
Indicator of Future Conditions!



2007
2007 Patriots' Day Storm
HAT+2 = Pats' Day Flooding





**Memorial Library
2-3 feet flooding**

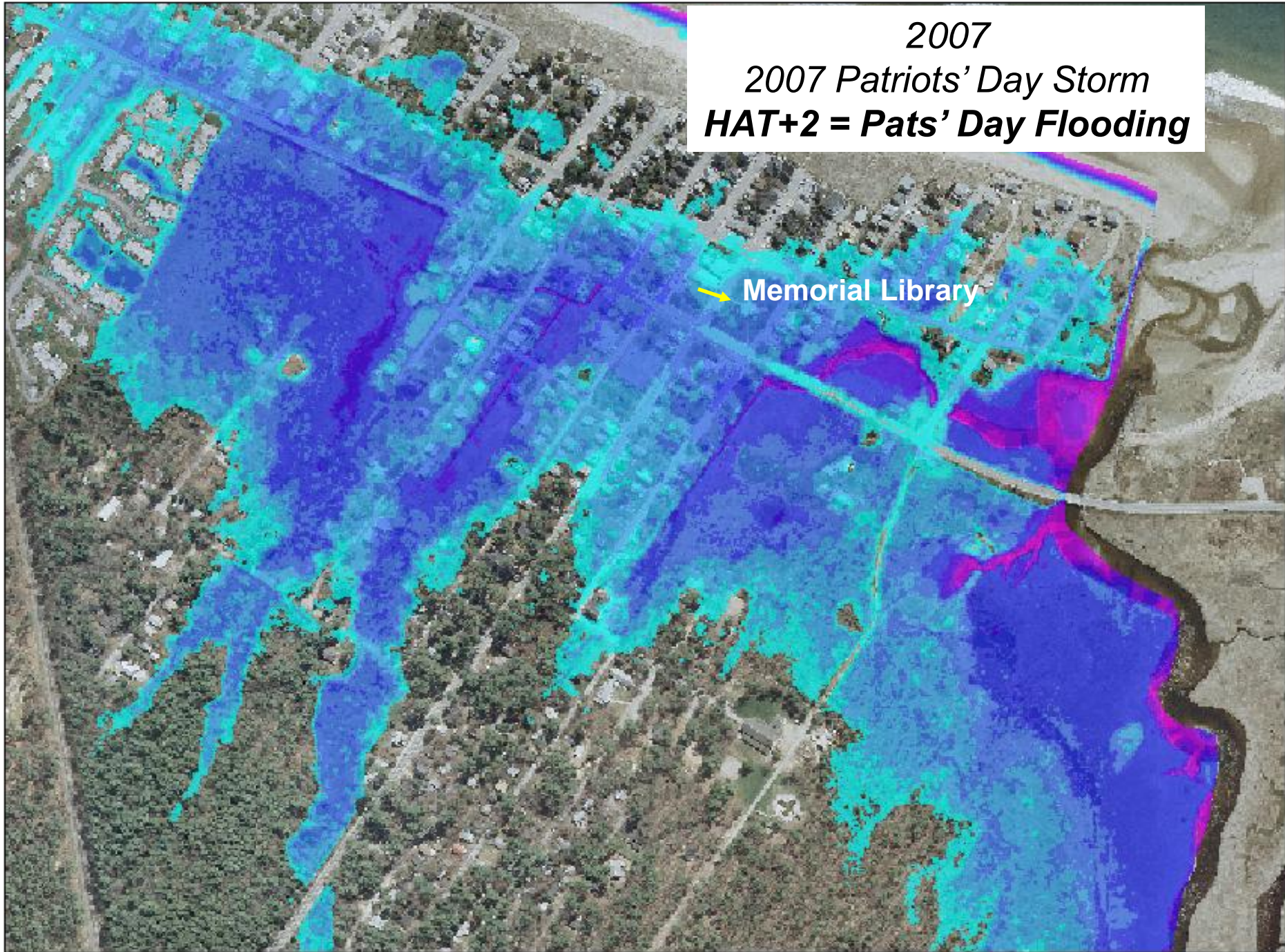
**Temple St.
2-3 feet flooding**



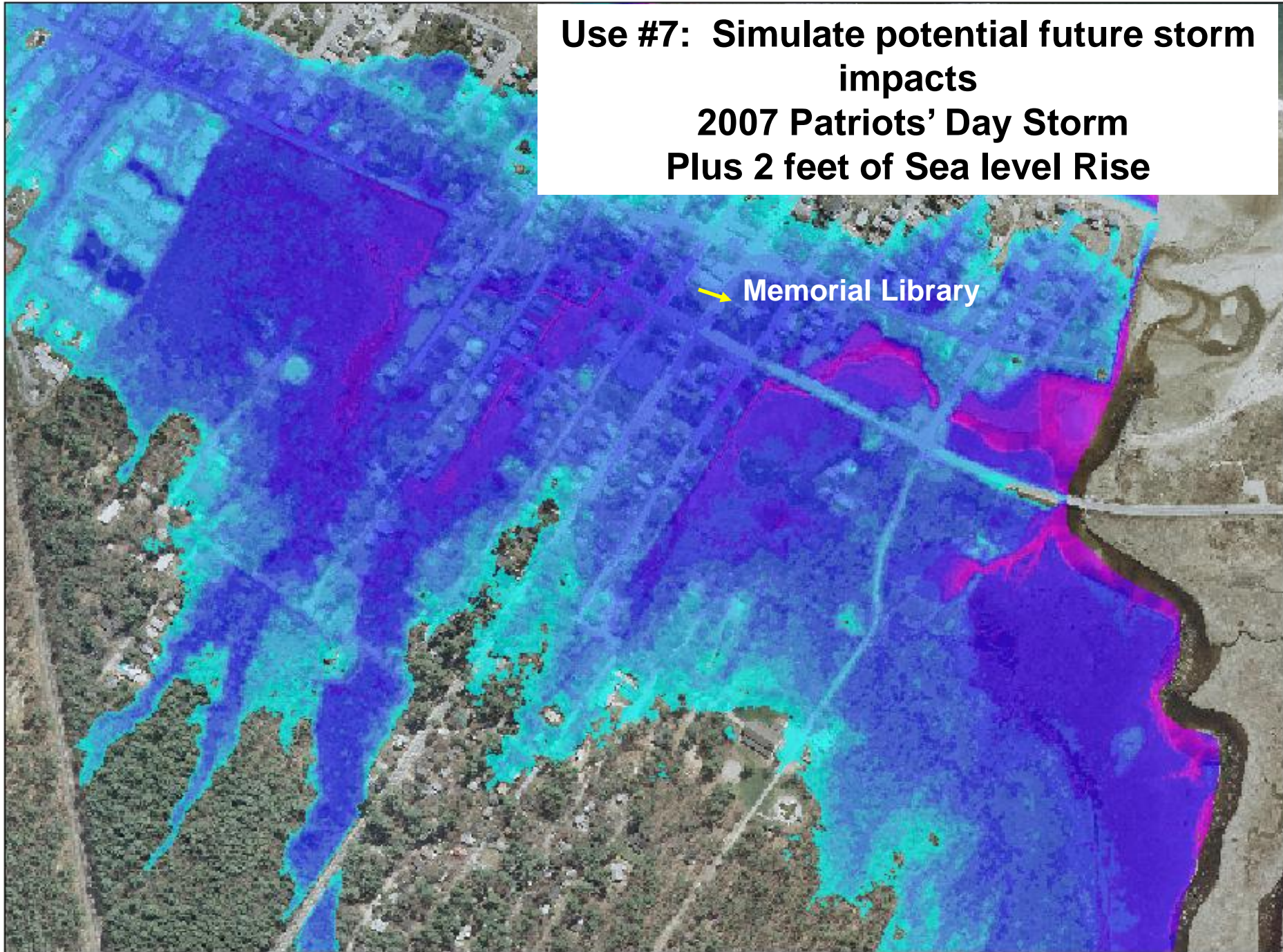
Images courtesy of Bill Edwards, www.maineoastimages.com and NOAA NWS

2007
2007 Patriots' Day Storm
HAT+2 = Pats' Day Flooding

→ Memorial Library



**Use #7: Simulate potential future storm
impacts
2007 Patriots' Day Storm
Plus 2 feet of Sea level Rise**

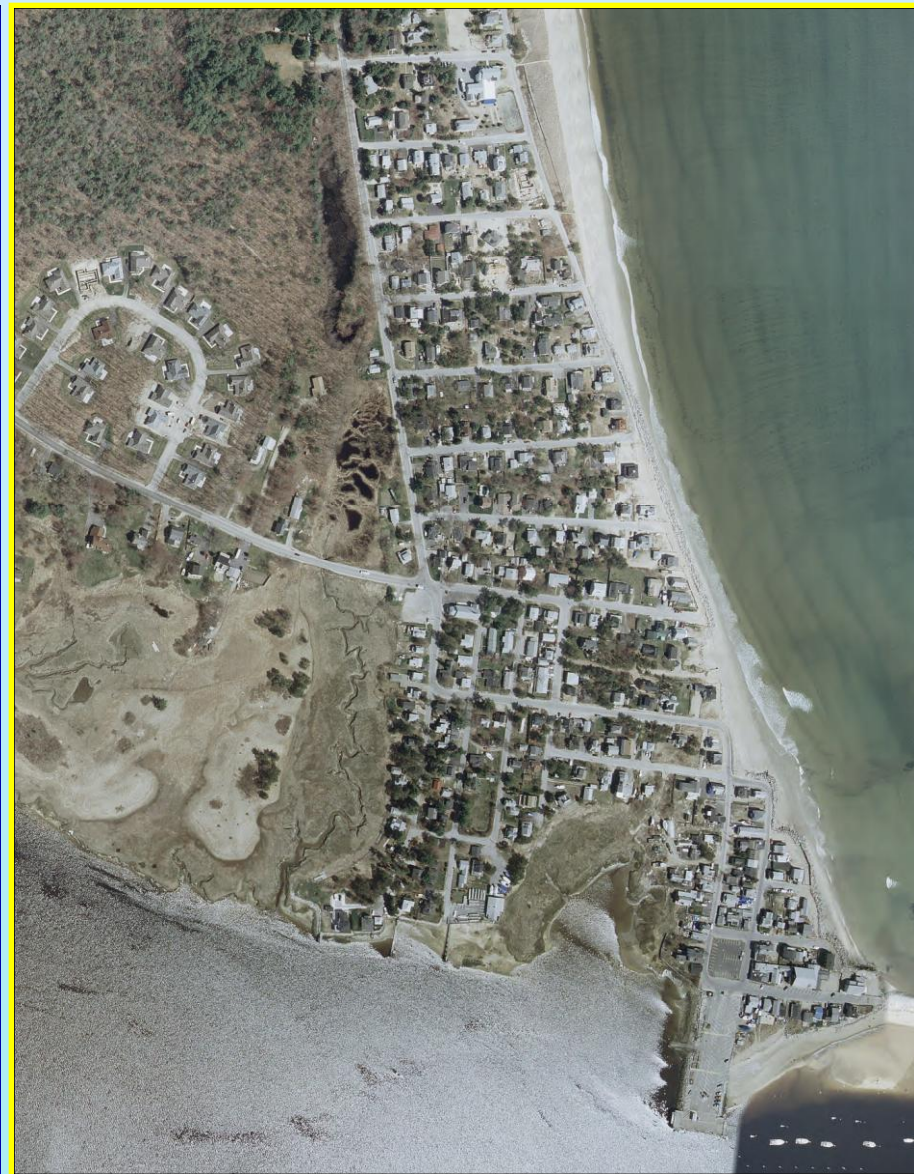


Show Visualization Techniques (CanVis2.3)



Memorial Library

Simulation of Mapped Flood Conditions



Use #8: Simulate impacts to FEMA FIRM static floodplains



Existing A-zone (9 ft)



Future A-zone (11 ft)



Route 1, Scarborough, ME

**Use #9: Simulate impacts
on volumetric increases at culverts**

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

©2010 Google

Imagery Date: May 17, 2010

43°33'31.93" N

70°22'14.35" W

elev 5 m

Eye alt 9.04 km

Flood Depth (ft)

Flood Depth, HAT

feet

0.0 - 2.0

2.0 - 4.0

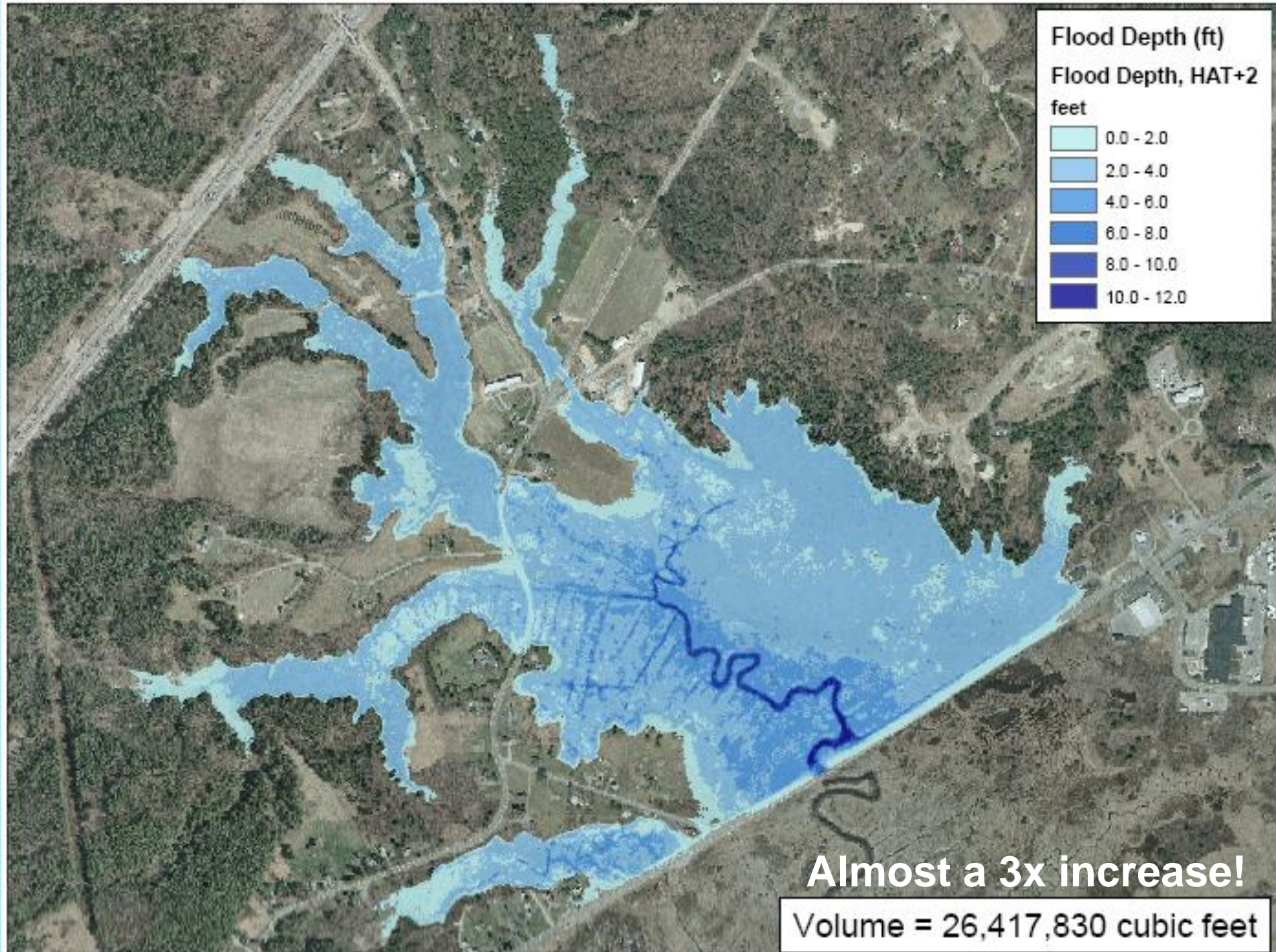
4.0 - 6.0

6.0 - 8.0

8.0 - 10.0

Culvert

Volume = 9,380,161 cubic feet



Some Potential Regional Adaptation Techniques

Open Space Designation/Acquisition “Future” Flood or Wetland Areas



Emergency Access Rerouting Stormwater Improvements



April 16, 2007, approximately 10:00 am

Images courtesy of Bill Edwards, www.maineimages.com and NOAA NWS

Tidal Flow Control...elevation, sizing New locations?





Elevation and siting

P.A. Slovinsky, MGS

Sea Level Rise as Future requirement?

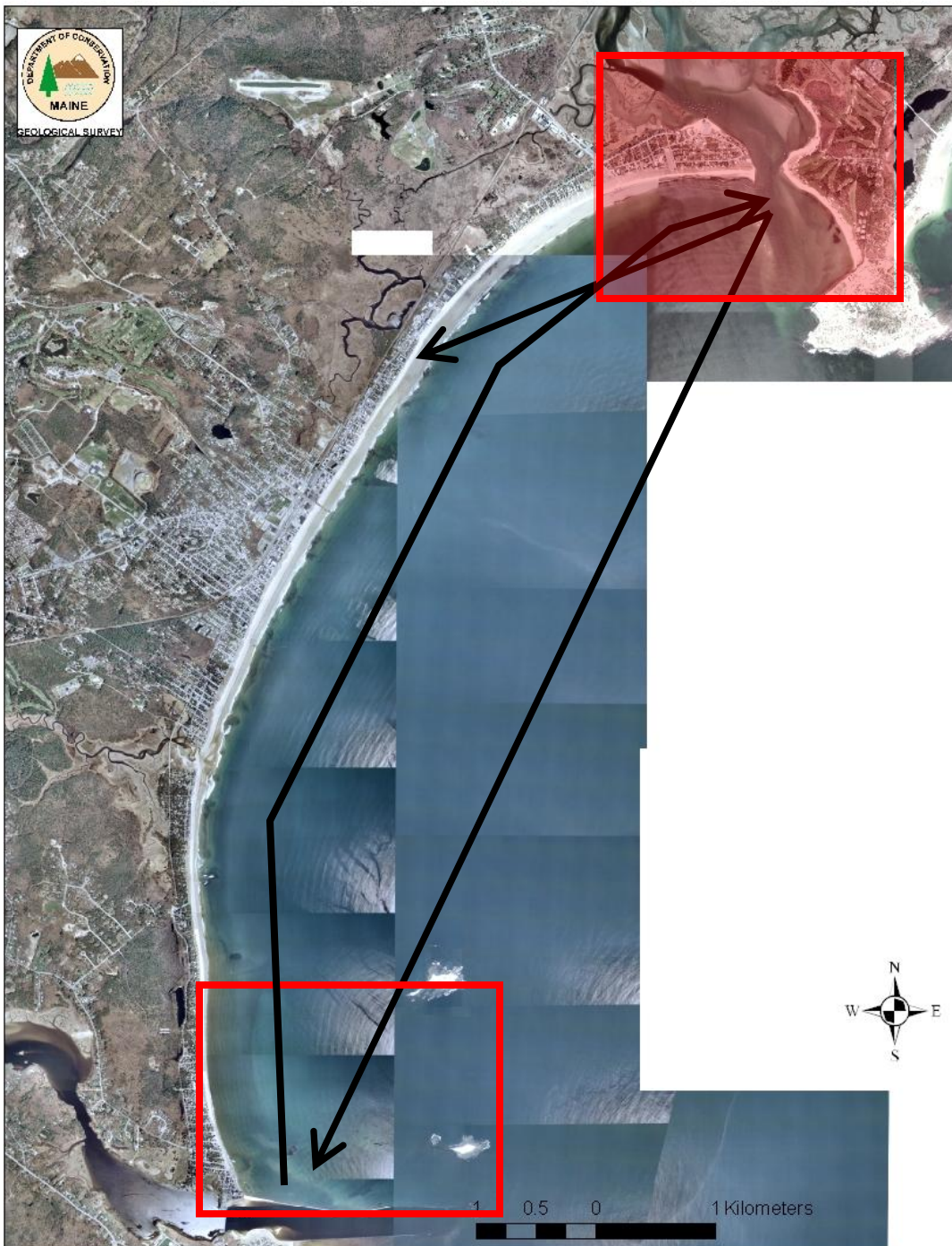
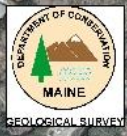


Utility Relocation



Selective Structure Improvement





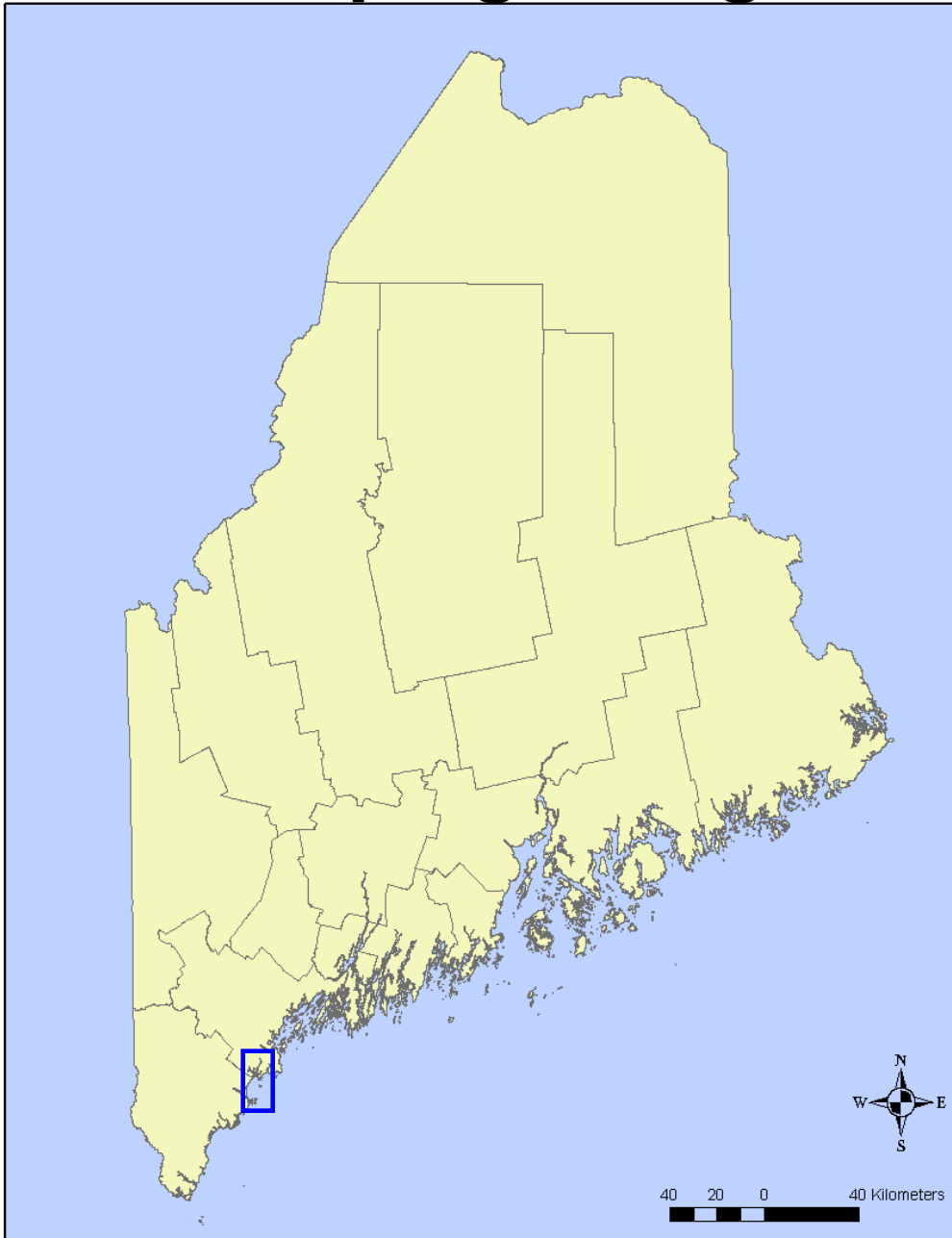
Regional Sediment Management

2 federal projects

- Northerly drift
- RSM within the community (intra)
- RSM Within the Region (inter)

Beach nourishment
Dune restoration/creation

Developing a Regional Approach...SLAWG



Hazards do not follow geopolitical boundaries!