



Rhode Island CRMC-Planning for Climate Change and Sea Level Rise.





- Erosion Rate Mapping For The Entire Shoreline.
- Research In The Areas Sediment Budget And Offshore Sediment Transport and Dynamics
- Ban On Shoreline Protection Structures
- Dune Protection-No Development
- Erosion Rate Setbacks--Off Features
- Encourage Use of Non Structural Shoreline Protection
- Sea Level Rise Policy (3-5 Feet) It is the lens which we look at all other policies

Coastal Hazards

- Classification Barriers 82% No Residential Or Commercial Structures
- Specific Policies That Relate To Specific Features
- Ban on Infrastructure Both Public And Private On Barrier Systems
- Enforce CRBS
- Habitat Restoration Tied To Beach Nourishment
- Beneficial Reuse Of Dredge Material
- Protect Coastal Wetland

Coastal Hazards

Additional Considerations for the Future

- Add Freeboard for Storm Surge
- Erosion Setbacks Adjusted for Sea Level Rise
- Coastal A Zone with Adjustment for Sea Level Rise for A and V zones
- TDR's redirecting Development

Coastal Hazards and Climate Change

Shoreline Change (Beach) SAMP



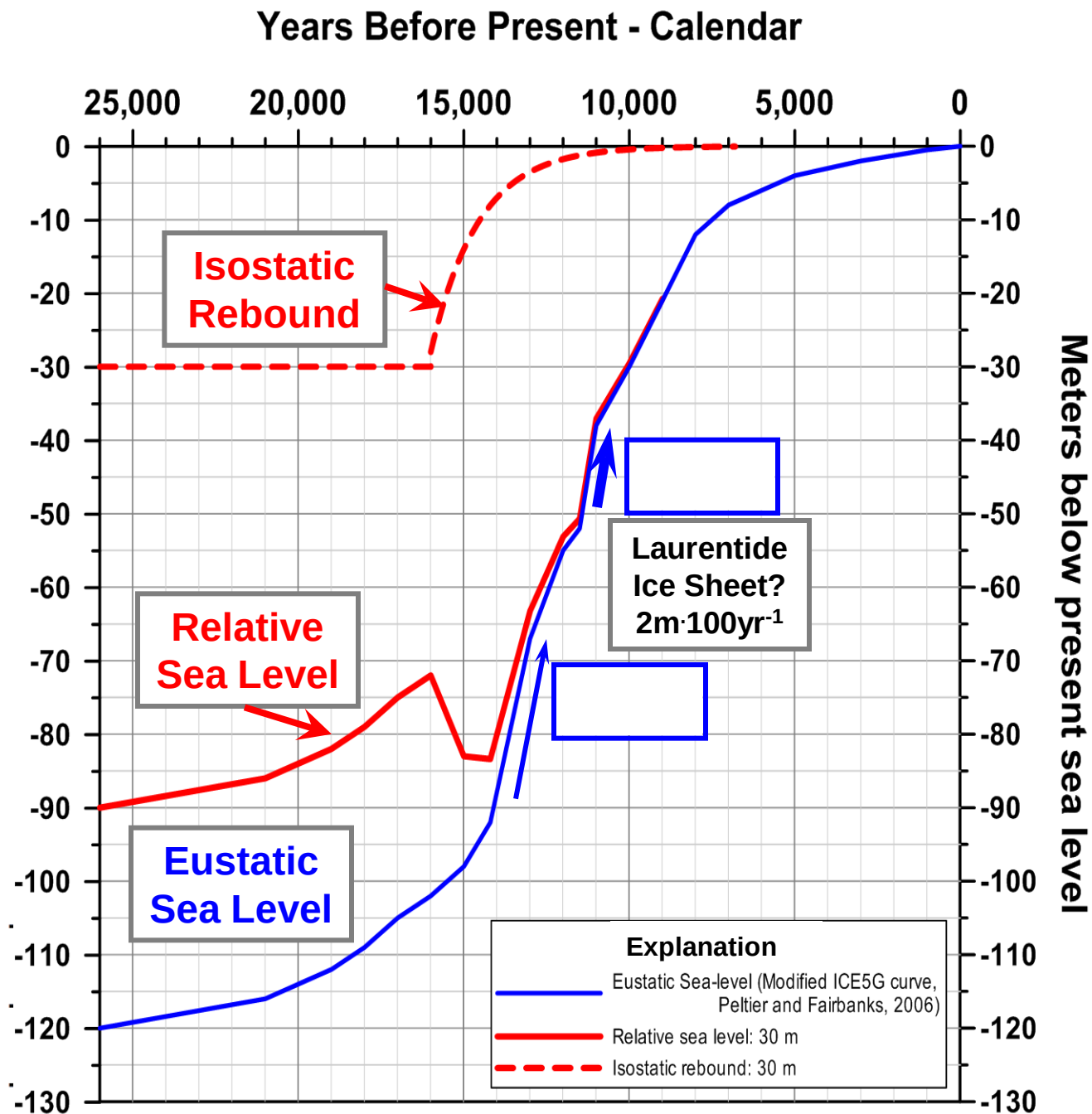
**Coastal Hazards and Climate
Change**

Summary for Rhode Island:

- **Glacial Geology, Past and Present, the Underlying Key to Understanding Processes and Products**
- **Storms the Most Important Driver in Coastal Change**
- **Sea-Level Rise a Secondary Effect**
- **Future Major Storms Combined With Sea-Level Rise a Very Large Problem**
- **Accelerated Sea-Level Rise Resulting in Inundation also a Very Large Potential Problem**
- **RICRMC Planning for a 3-5 foot Rise by 2100**

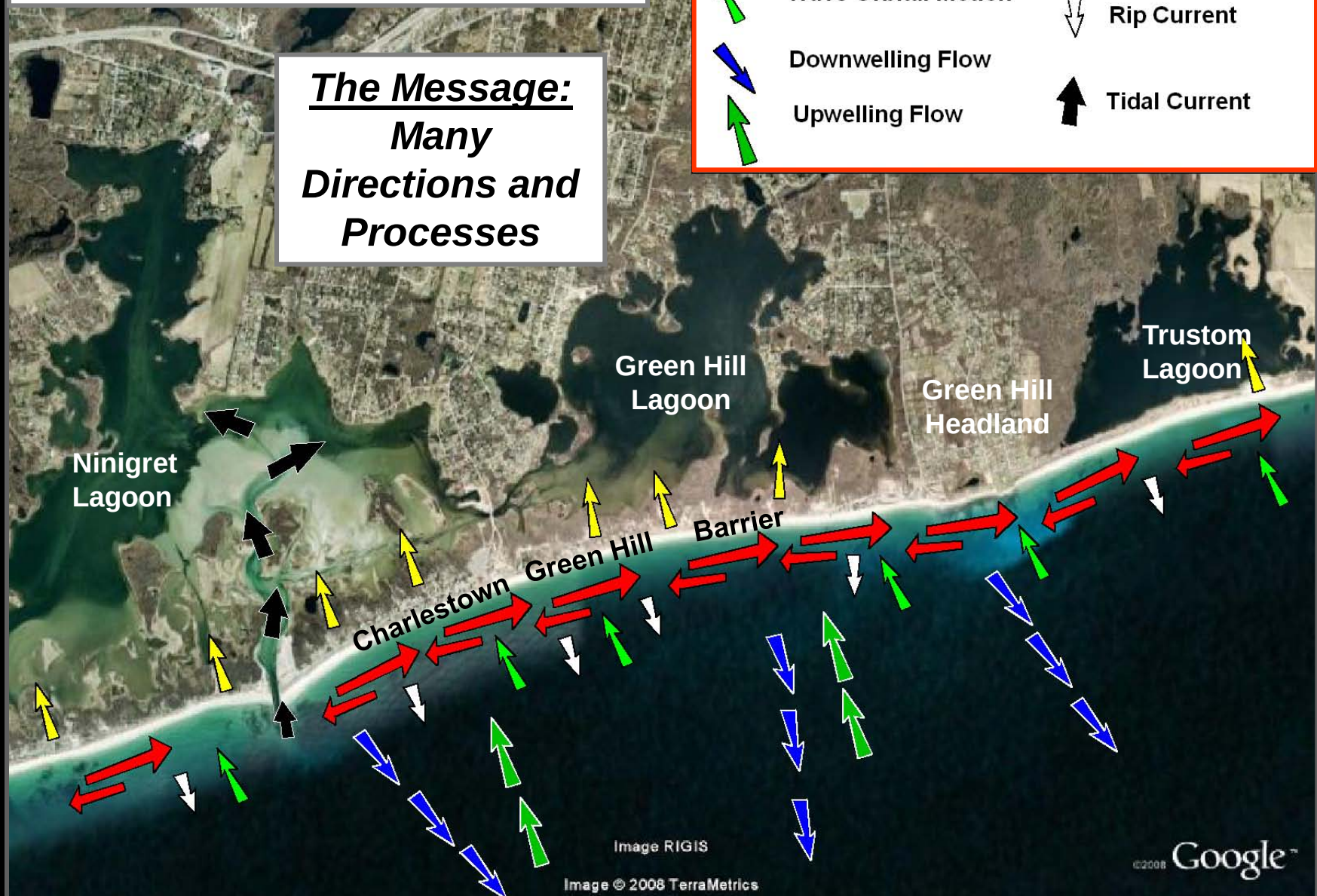
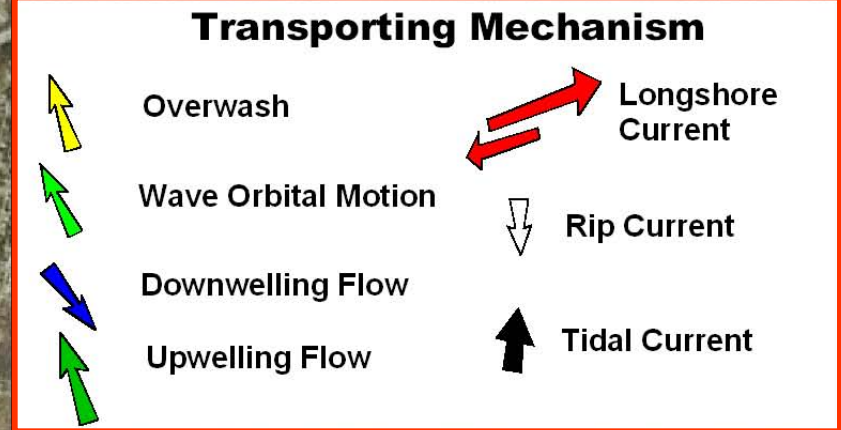
Eustatic Sea-Level Rise + Isostatic Rebound at Block Island RI

Oakley and Boothroyd,
July 2012



Sediment Transport Pathways Charlestown – Green Hill Barrier and Headland

The Message:
*Many
Directions and
Processes*



DIGITAL SIDE SCAN SONAR MOSAIC: MATUNUCK - GREEN HILL SHOREFACE

Jon C. Boothroyd, Bryan A. Oakley, Jon D. Alvarez

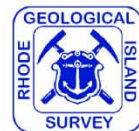
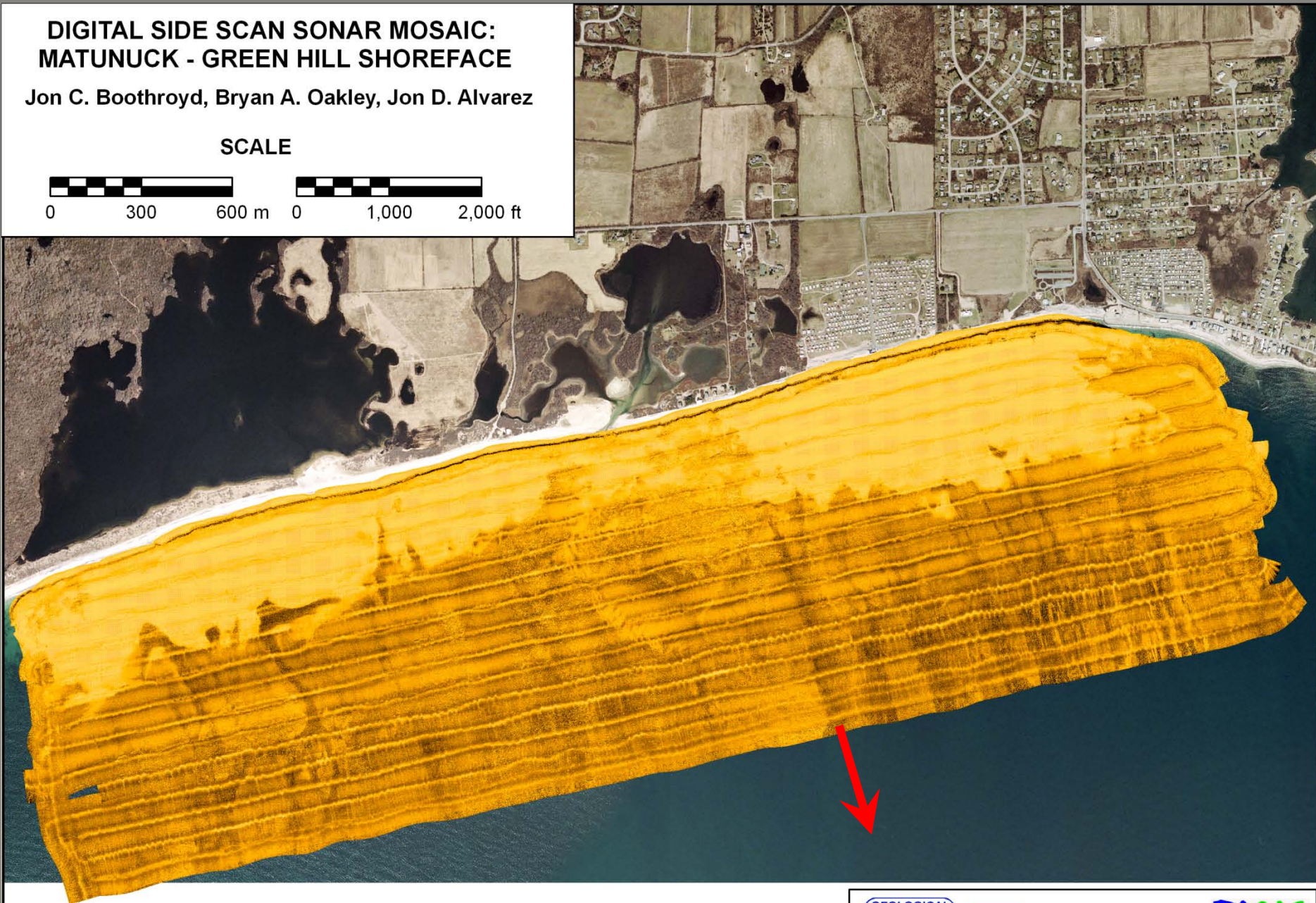
SCALE



0 300 600 m



0 1,000 2,000 ft



US Army Corps
of Engineers®
New England District

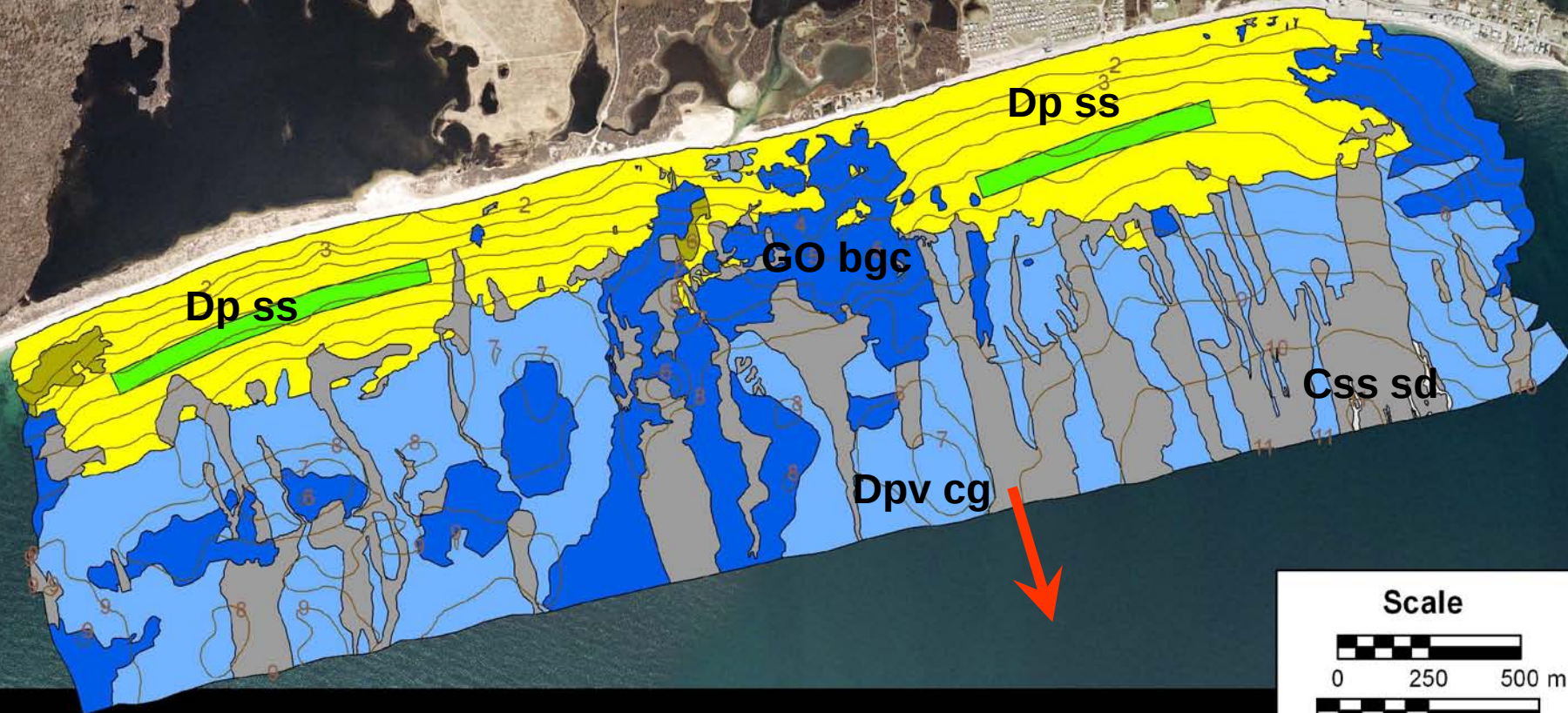


RIGIS



Depositional Environments

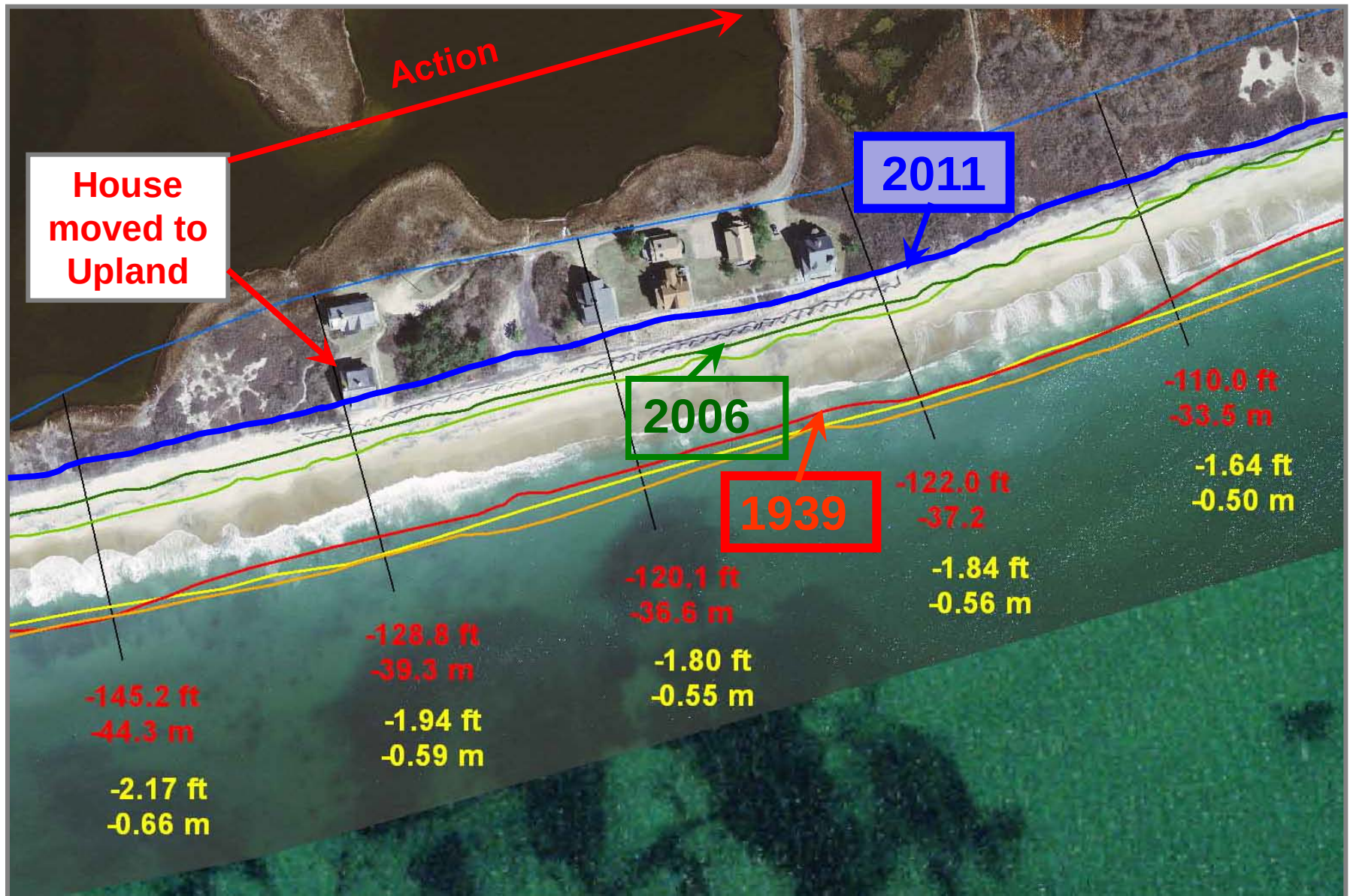
Moonstone-Matunuck Shoreface



Moonstone-Matunuck Barrier/Headland Shoreface



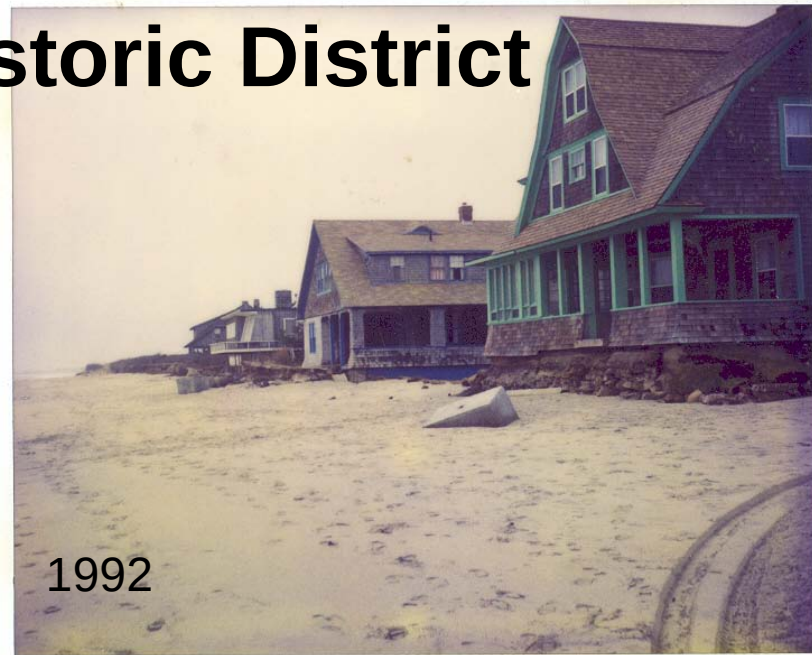
Frontal Erosion 1939-2011 - Browning Cottages, Moonstone Beach, RI



Browning's Cottages Historic District



1972



1992



Houses moved 50 feet landward

1999



Houses threatened again
ISDS damaged

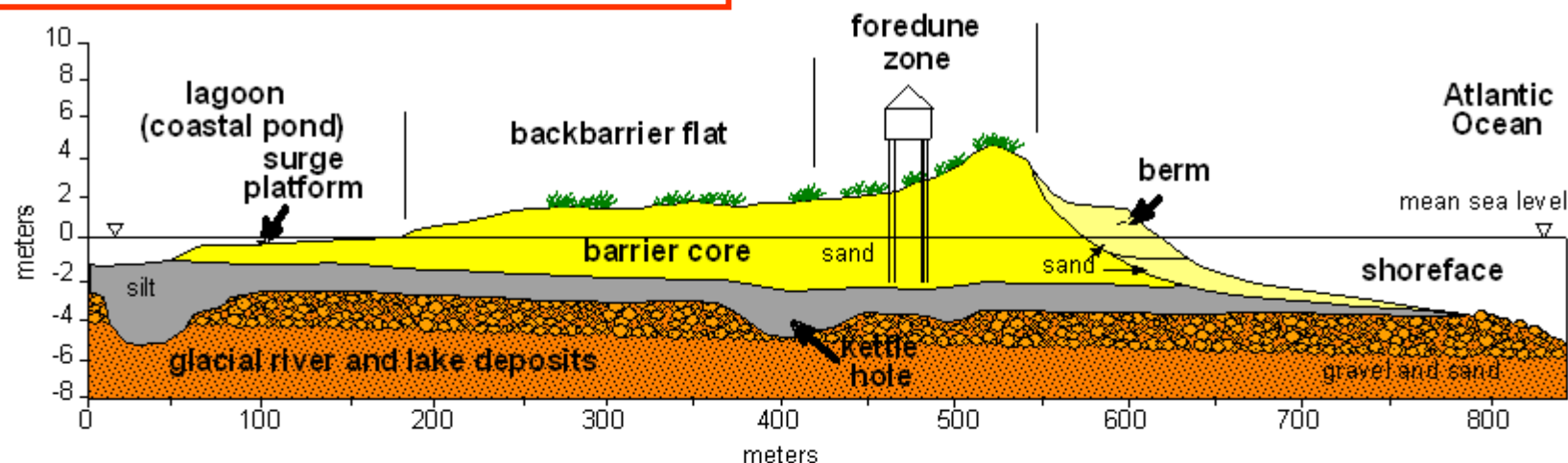
2007







Barrier Geologic Cross-Section



Headland Geologic Cross-Section

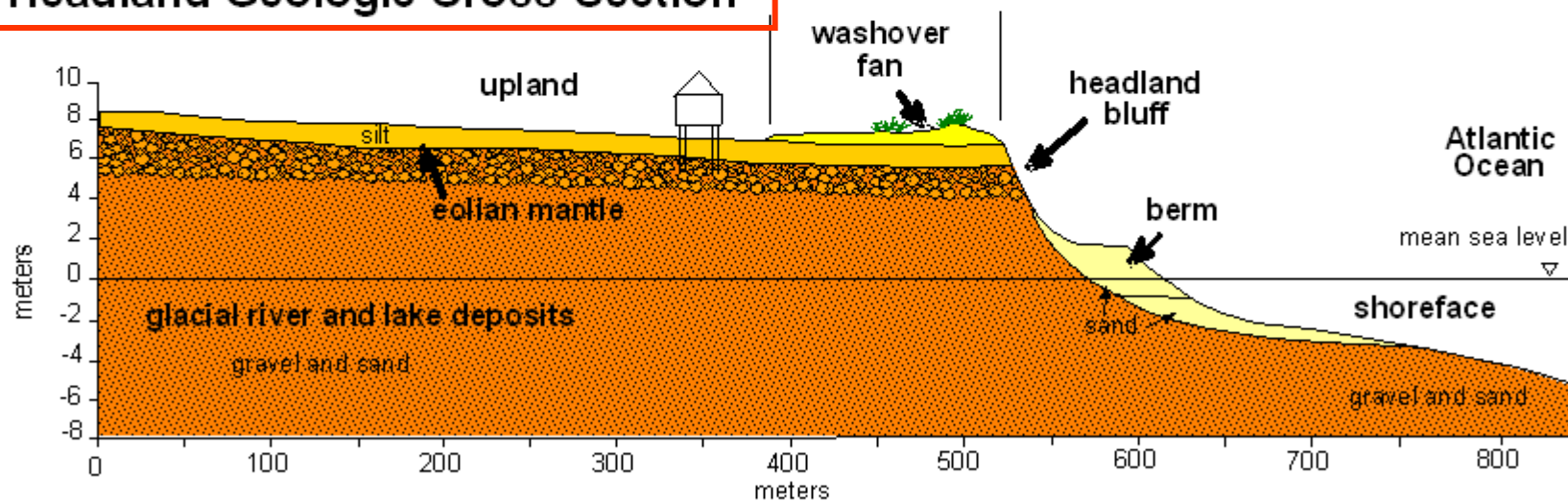


Figure 4-2

South Kingstown, RI – Town Beach

An Eroding Glacial Bluff Shore



BA Oakley

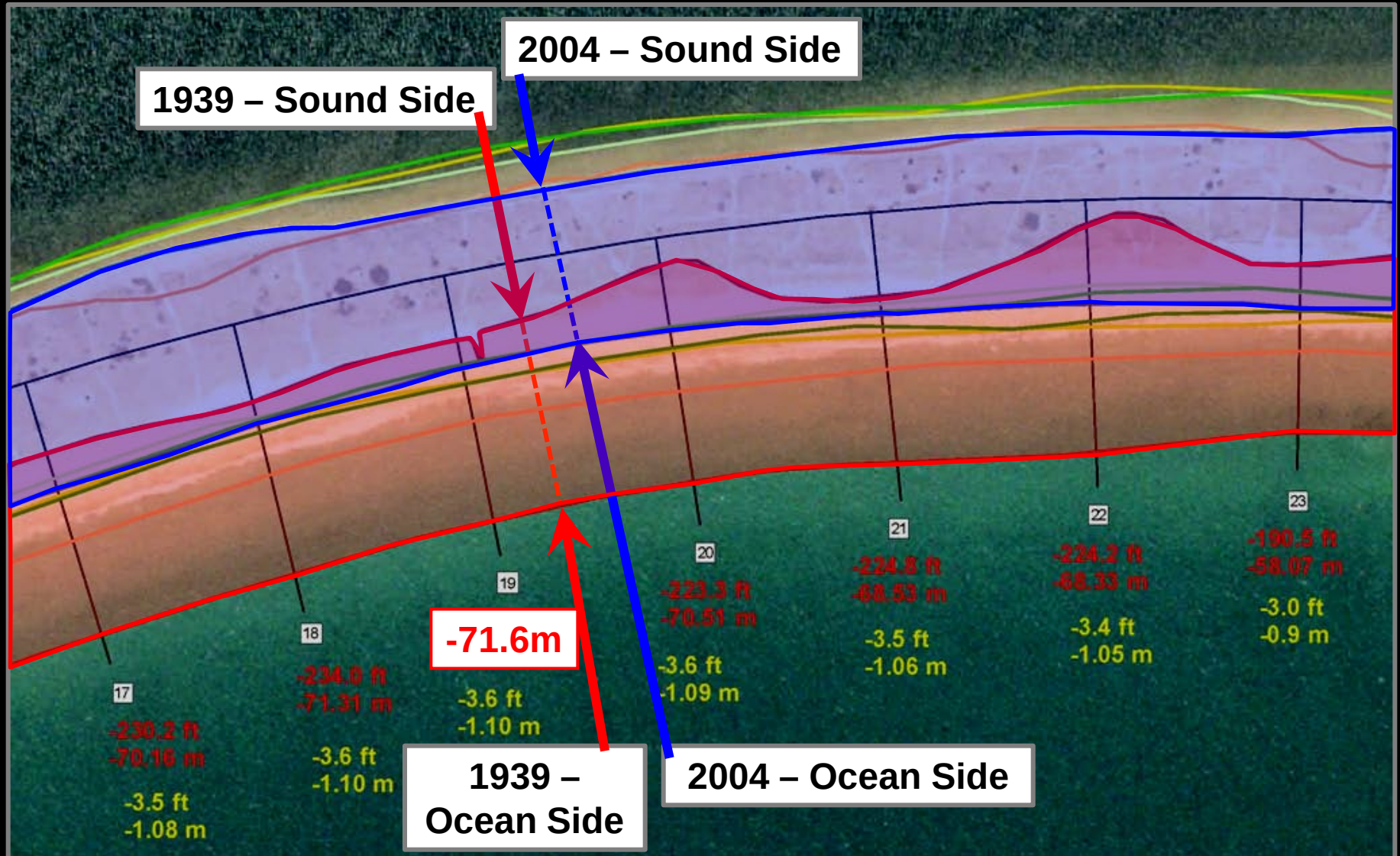
25 Oct 2005

Napatree Barrier – Westerly, RI

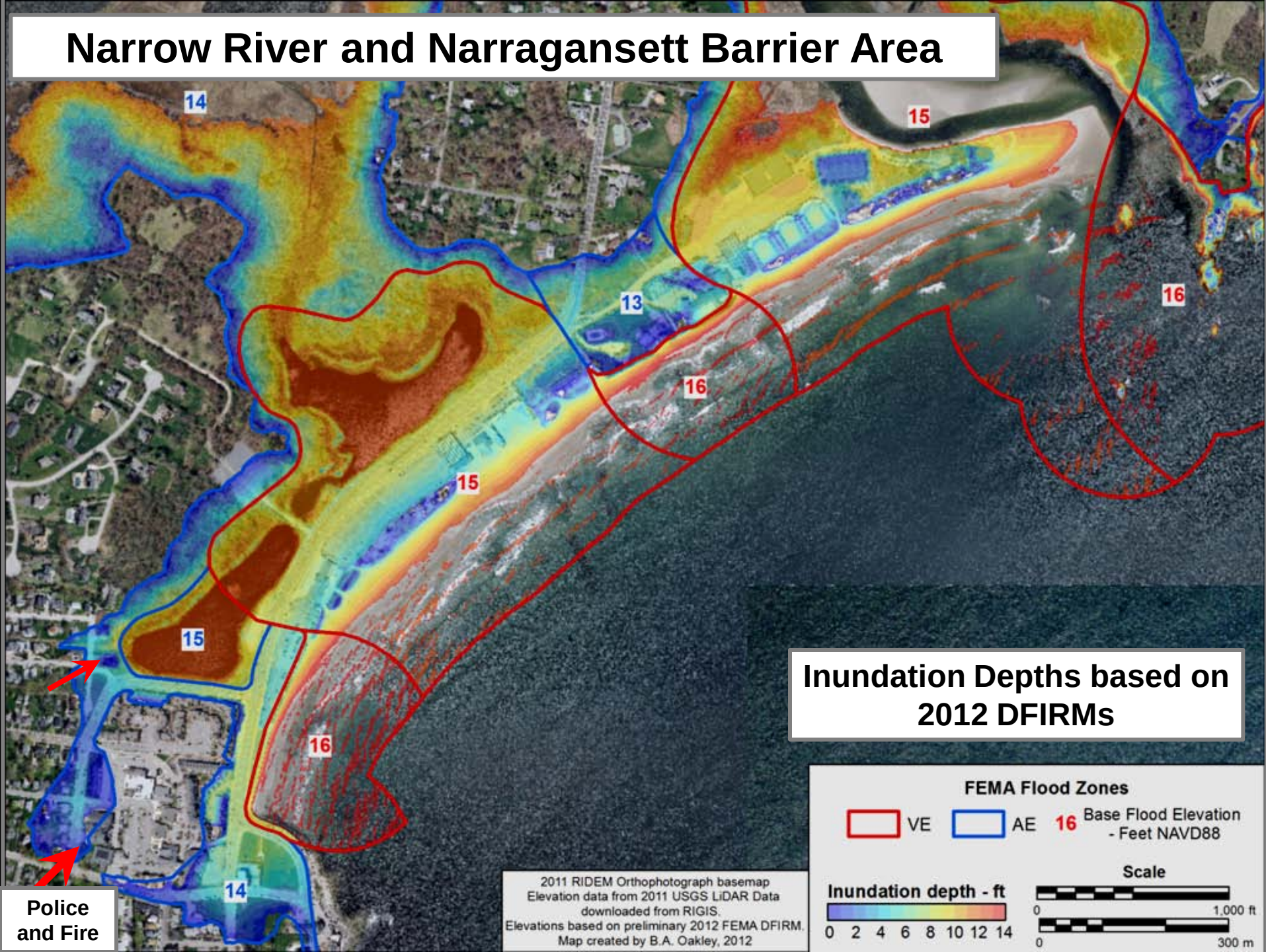


Hebre and Boothroyd, 2007

Napatree Barrier – Shoreline Change Map



Narrow River and Narragansett Barrier Area



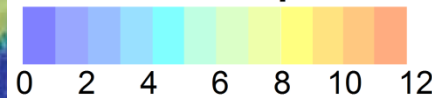
Narragansett Pier Area

Inundation Depths based on
2012 DFIRMs

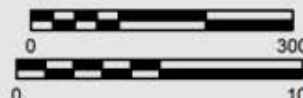
Wastewater
Pump
Station

2011 RIDEM Orthophotograph basemap
Elevation data from 2011 USGS LiDAR Data downloaded from RIGIS.
Elevations based on preliminary 2012 FEMA DFIRM.
Map created by B.A. Oakley, 2012

Inundation depth - ft

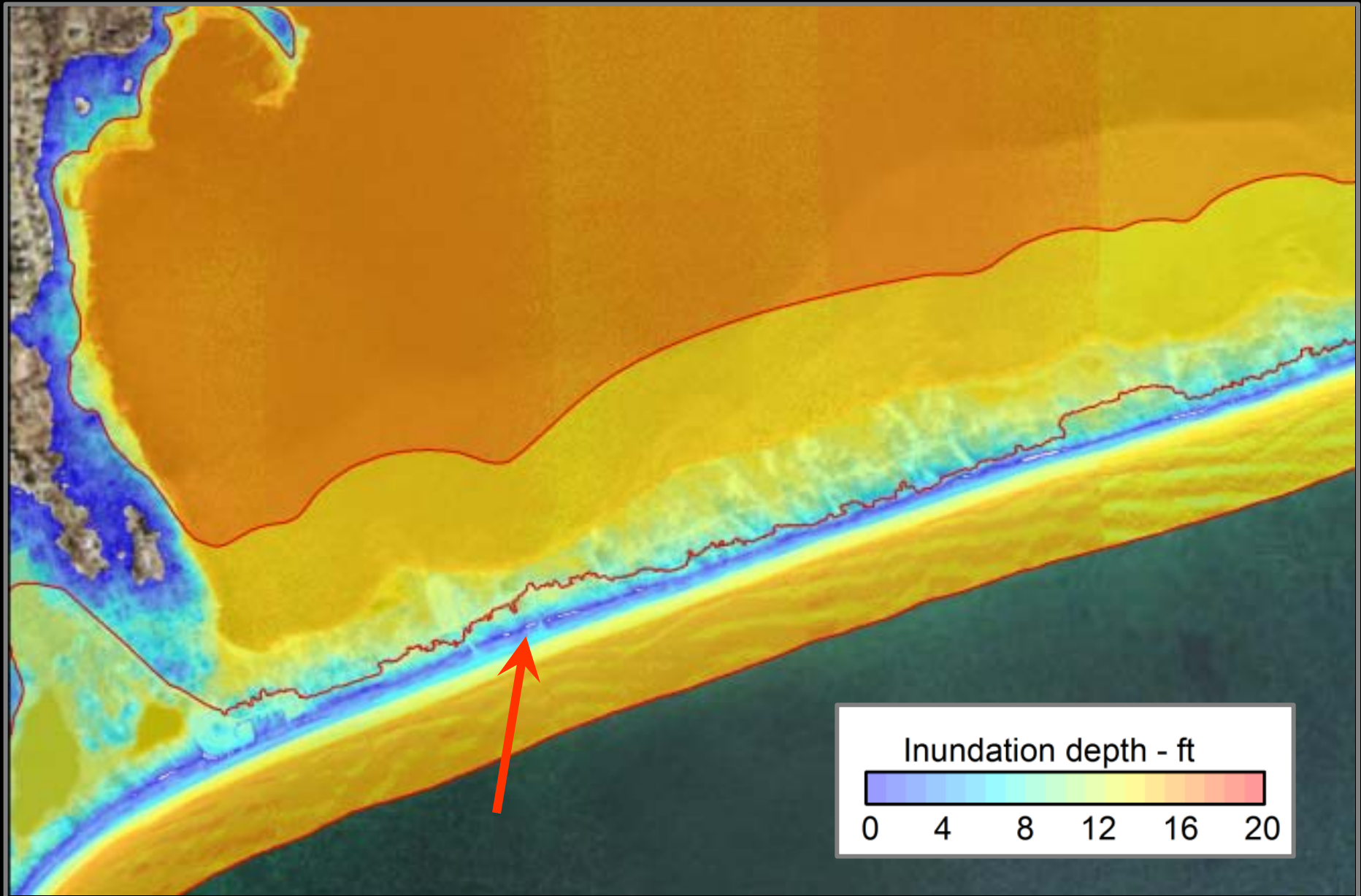


Scale



Ninigret Lagoon

Today

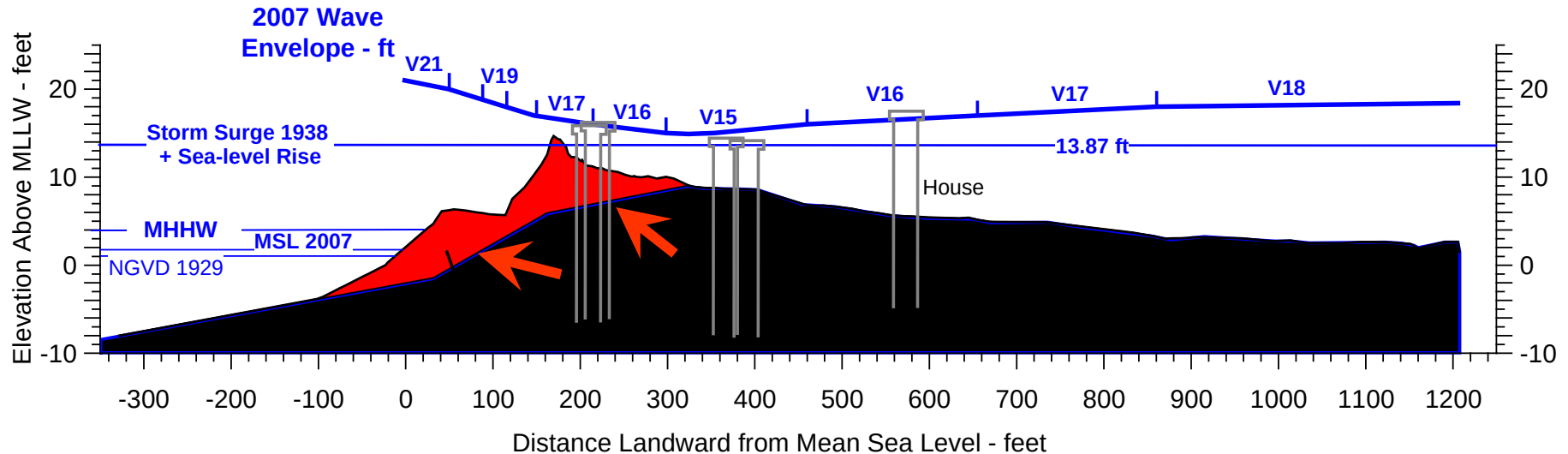


Charlestown Beach Storm Surge - 100 Year Event in 2008

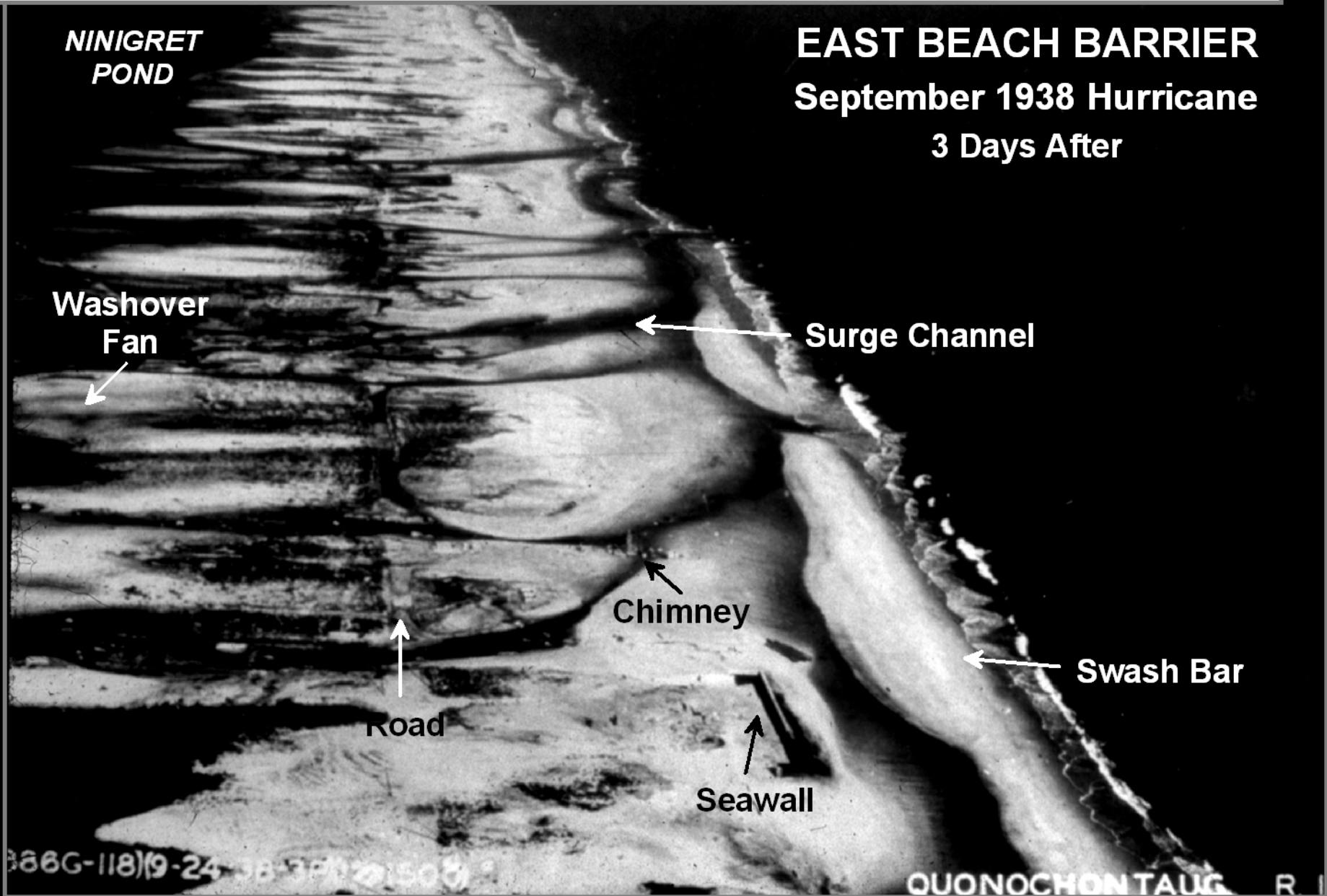
WAVE ENVELOPE and STORM SURGE for 100 YEAR EVENT

Charlestown Beach - CHA-EZ

Jon C Boothroyd, Bryan A Oakley, GEO 577 Class - 2007



East Beach Barrier – Ninigret Lagoon - View East



An aerial photograph of Rhode Island, showing its coastline, major cities like Providence and Pawtucket, and surrounding water bodies. The text is overlaid in the center of the image.

***Lastly,
Climate Change
and the
Future Shore Zone
of
Rhode Island***

Carbon Dioxide - CO₂ Levels

A Cause for Concern

Now 394+ ppm

Carbon Dioxide Levels Today are Higher than over the Past 650,000 Years

Atmospheric carbon dioxide record data sources: Keeling and Whorf (2004), Petit et al. (1999), IPCC (2001), Ahn et al. (2004).

Industrial CO₂ Levels

Pre-industrial CO₂ Levels

New Antarctic ice core data extends the record back to 650,000 years before the present and shows that CO₂ levels were below 300 ppmv.

First Moon Landing



First Production Model T



Pyramids

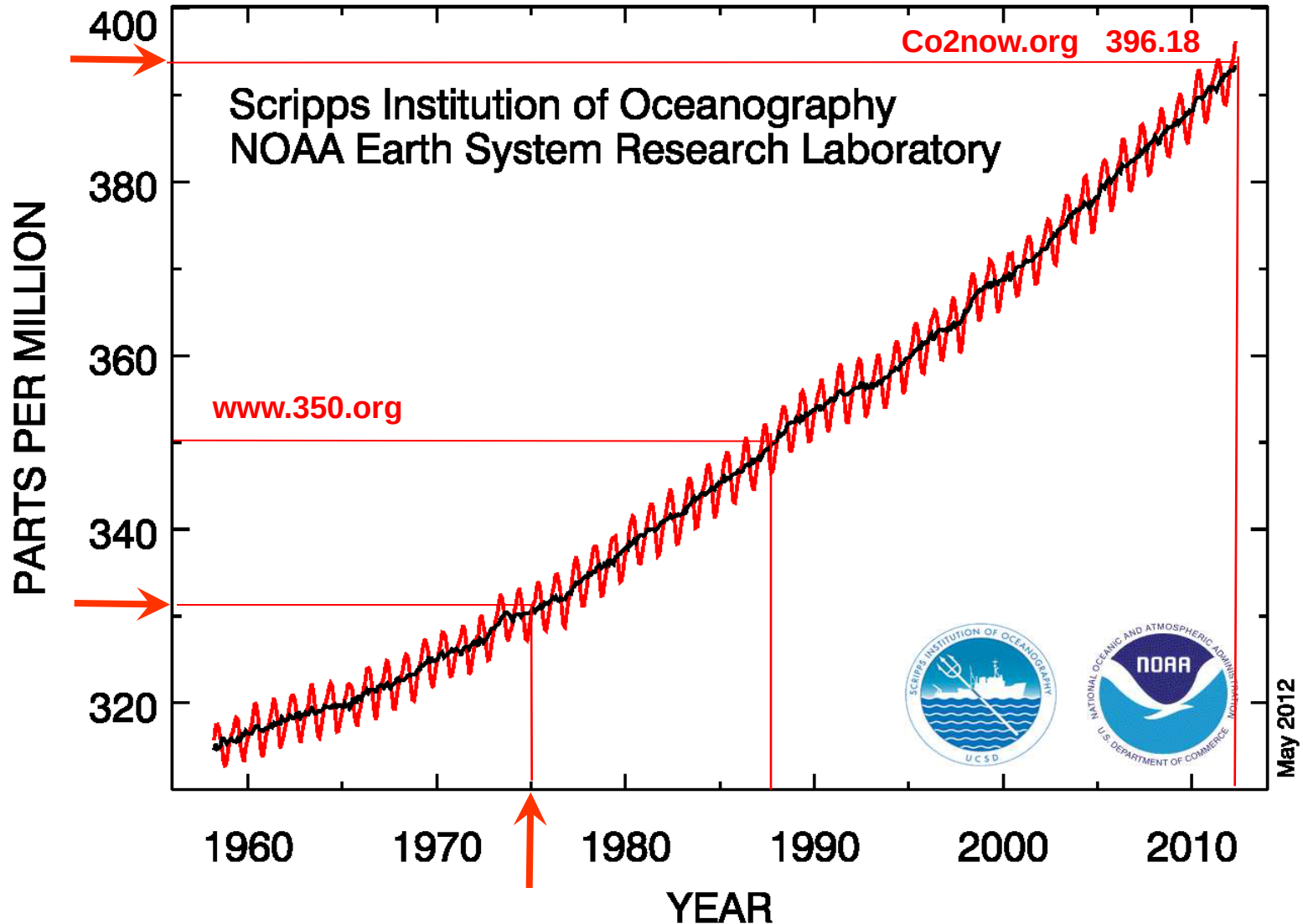


CO₂ (ppmv)

400,000 350,000 300,000 250,000 200,000 150,000 100,000 50,000 0

Years Before the Present

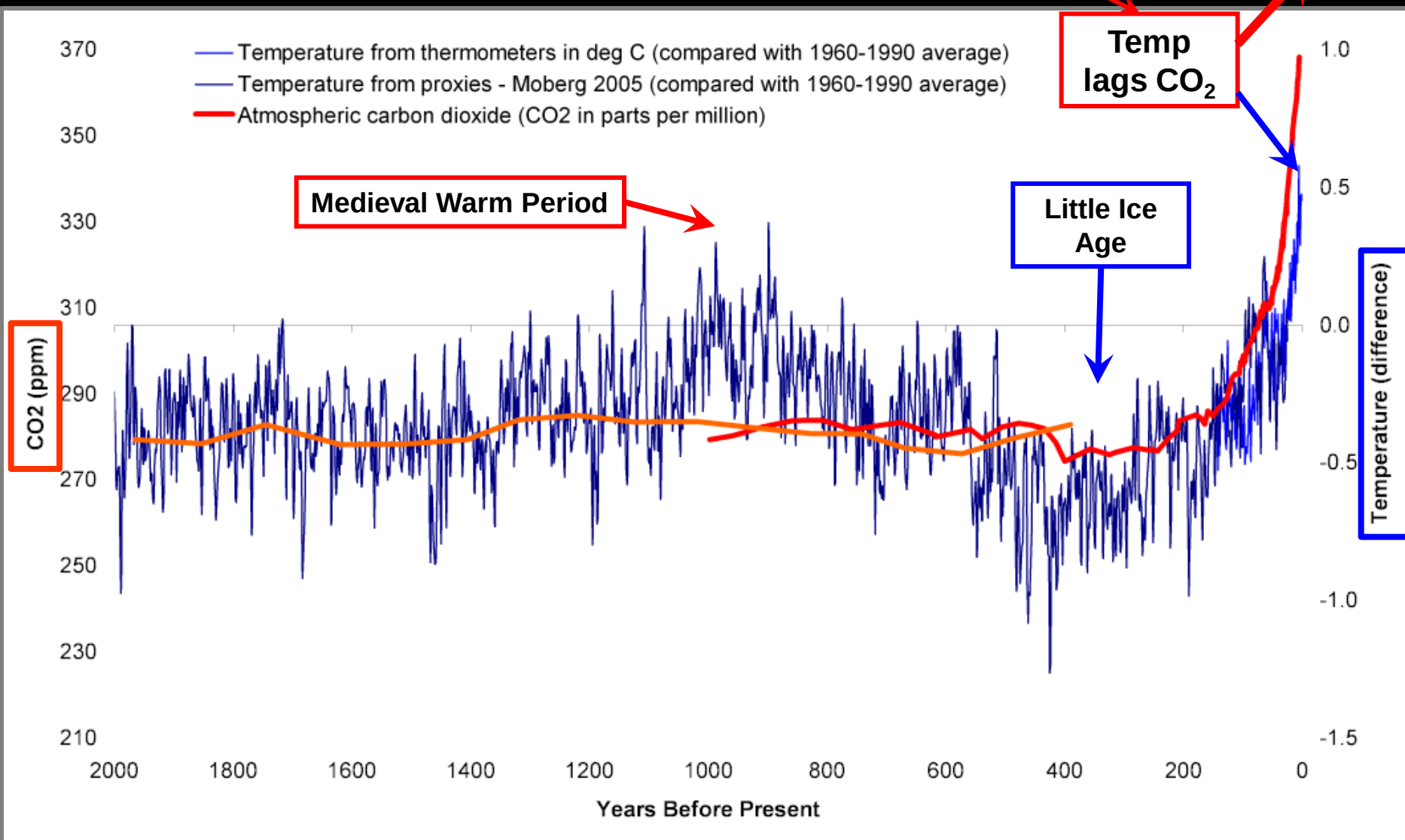
Atmospheric CO₂ at Mauna Loa Observatory



http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html

THE HOCKEY STICK

The Message



Rhode Island Possible Future Climate

North Jersey – Now Already ???

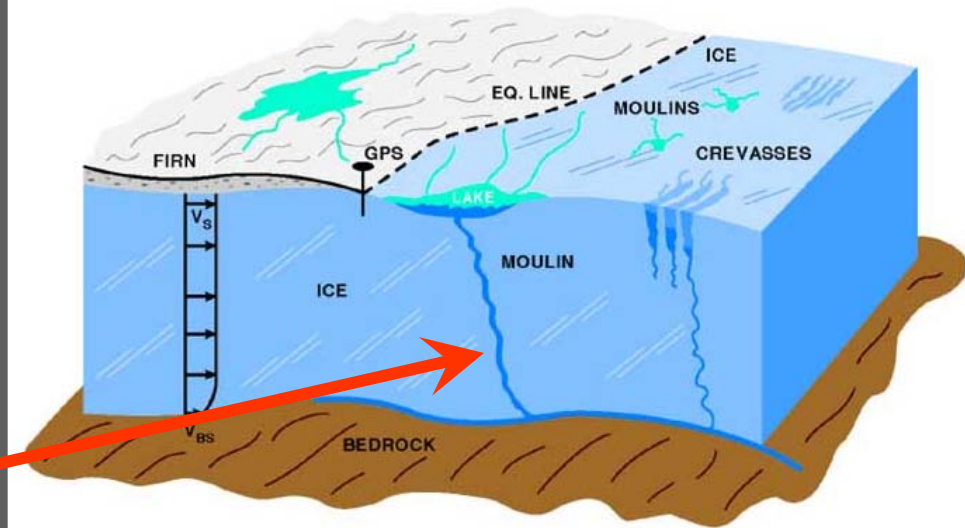
Rhode
Island



Confronting Climate Change in the
U.S. Northeast: Climate, Impacts,
and Solutions, NECIA, 2007

<http://www.northeastclimateimpacts.org/>

Greenland Outlet Glaciers
Change from Polythermal to Warm Based
A Key to Future Sea-Level Rise



6.1 ft

VR Max

185 cm

4.5 ft

VR A1F1

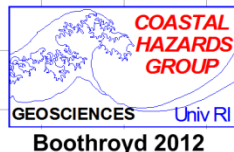
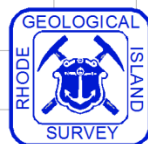
137 cm

ACCELERATED SEA-LEVEL RISE Newport RI

VR B1

100 cm

IPCC 2001
Land Ice



Height above NOW

IPCC 2007
Model Avg

1.4 ft

41

Height

HEIGHT NOW

MSL 1983-2001

NGVD 1929

1990-2009 TREND

HISTORIC TREND

(2010)

2050

1920 1940 1960 1980 2000 2020 2040 2060 2080 2100

Years

Height above Year 2010

150

120

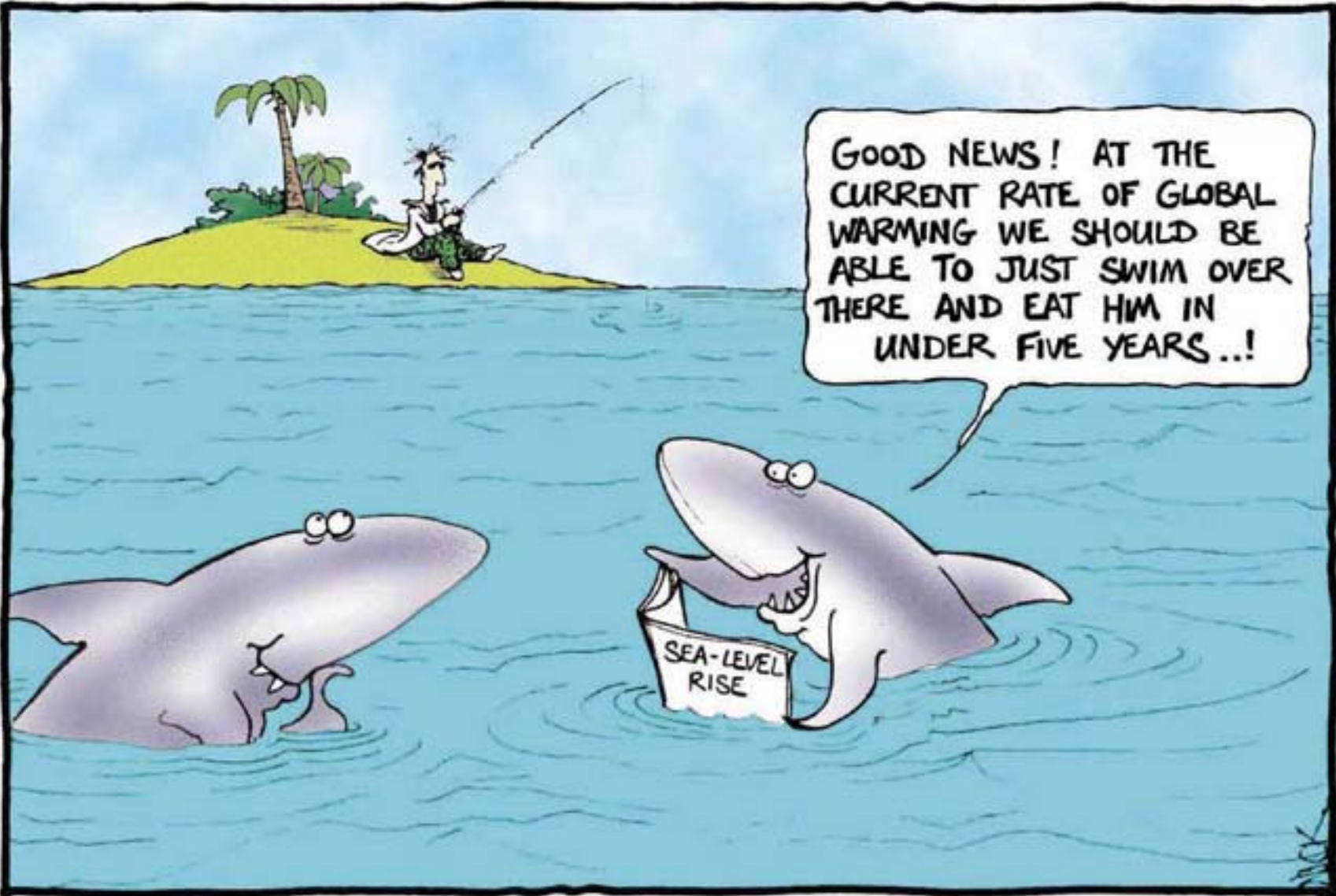
90

60

30

0

-30



A cartoon illustration set in a blue ocean under a light blue sky. In the background, a small green island with a palm tree and some bushes sits on the horizon. A man with spiky hair, wearing a white shirt and green shorts, is sitting on the island, fishing with a long rod. In the foreground, two purple sharks are in the water. The shark on the right is larger and has its mouth open, holding a white rectangular sign that reads "SEA-LEVEL RISE" in black capital letters. A speech bubble originates from this shark, containing the text "GOOD NEWS! AT THE CURRENT RATE OF GLOBAL WARMING WE SHOULD BE ABLE TO JUST SWIM OVER THERE AND EAT HIM IN UNDER FIVE YEARS...!". The shark on the left is smaller and looks on with wide, white eyes. The entire scene is framed by a thick black border.

GOOD NEWS! AT THE
CURRENT RATE OF GLOBAL
WARMING WE SHOULD BE
ABLE TO JUST SWIM OVER
THERE AND EAT HIM IN
UNDER FIVE YEARS...!

SEA-LEVEL
RISE