COASTAL GEOLOGIC HAZARDS AND SEA-LEVEL RISE: CLIMATE CHANGE IN RHODE ISLAND

Sakonnet Preservation Association Annual Meeting
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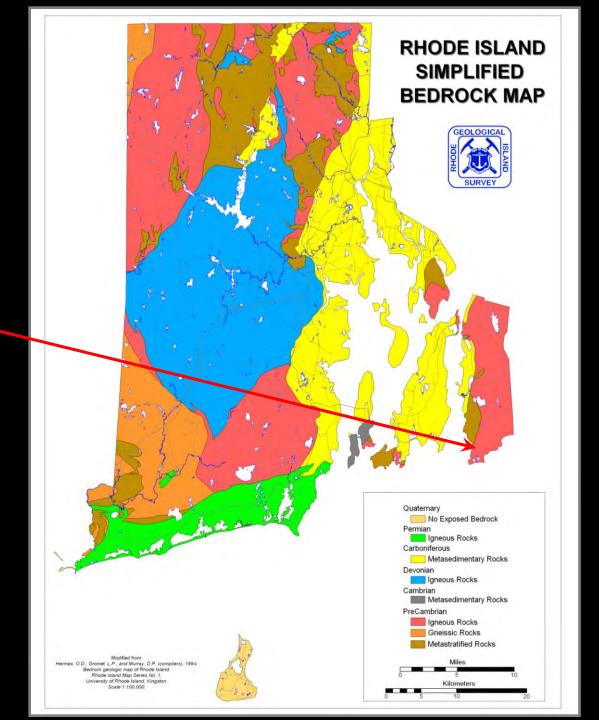




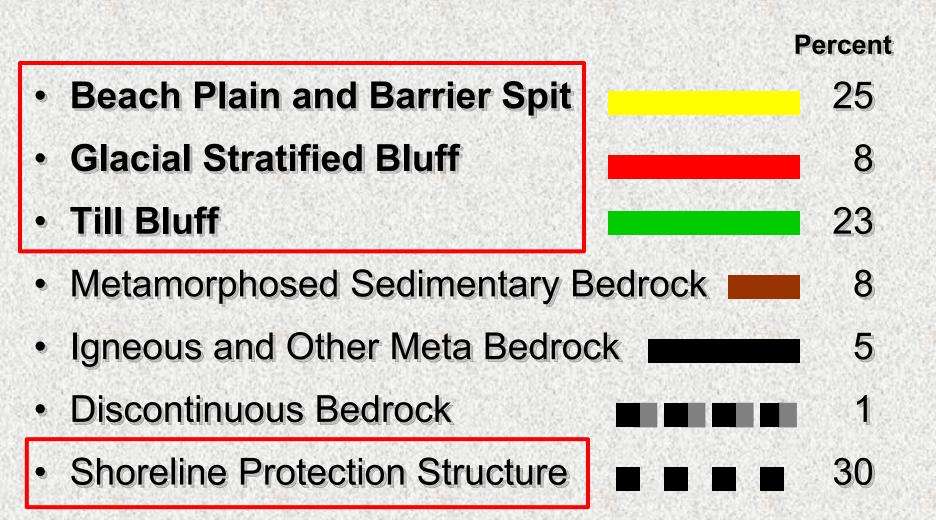
Summary for Rhode Island:

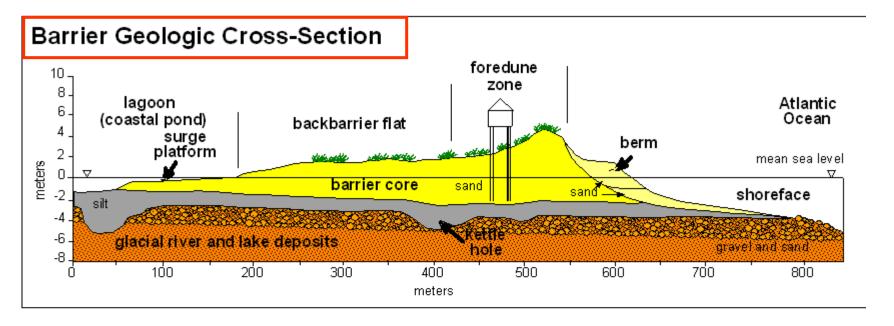
- Glacial Geology, Past and Present, the Underlying Key to Understanding Processes and Products
- Storms the Most Important Driver in Coastal Change Sea-Level Rise a Secondary Effect
- Shoreface Sediment Transport Not Well Understood at Present
- Future Major Storms Combined With Sea-Level Rise a Very Large Problem
- Accelerated Sea-Level Rise Resulting in Inundation also a Very Large Potential Problem
- RICRMC Planning for a <u>3-5 foot Rise by 2100</u> and a <u>1.0 to 1.5 foot Rise by 2050</u>

You are here



GEOLOGIC SHORE ZONE TYPES





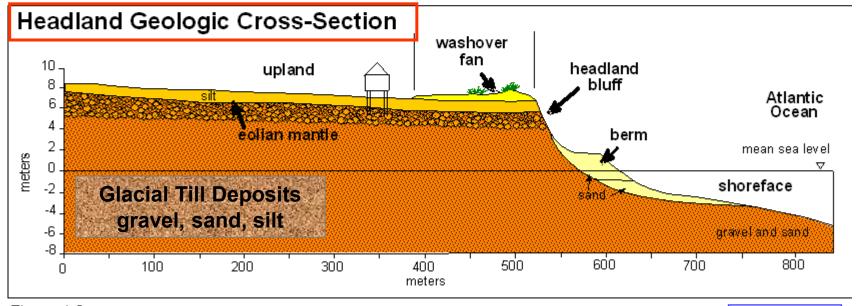
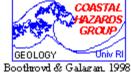


Figure 4-2



Till Bluff - Church Point, Little Compton



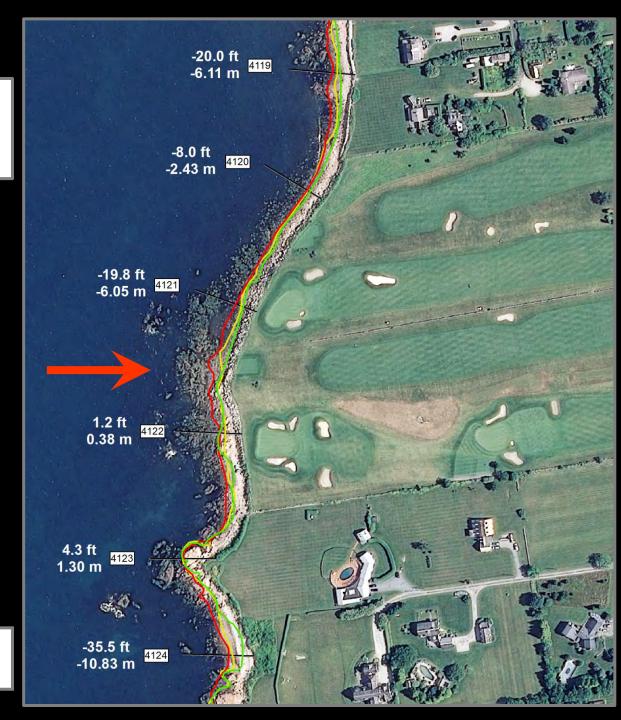
Discontinuous Bedrock - Church Point, Little Compton



Sakonnet Golf Club Area

Shoreline Change 1939 - 2004

Oakley, Hehre and Boothroyd 2013



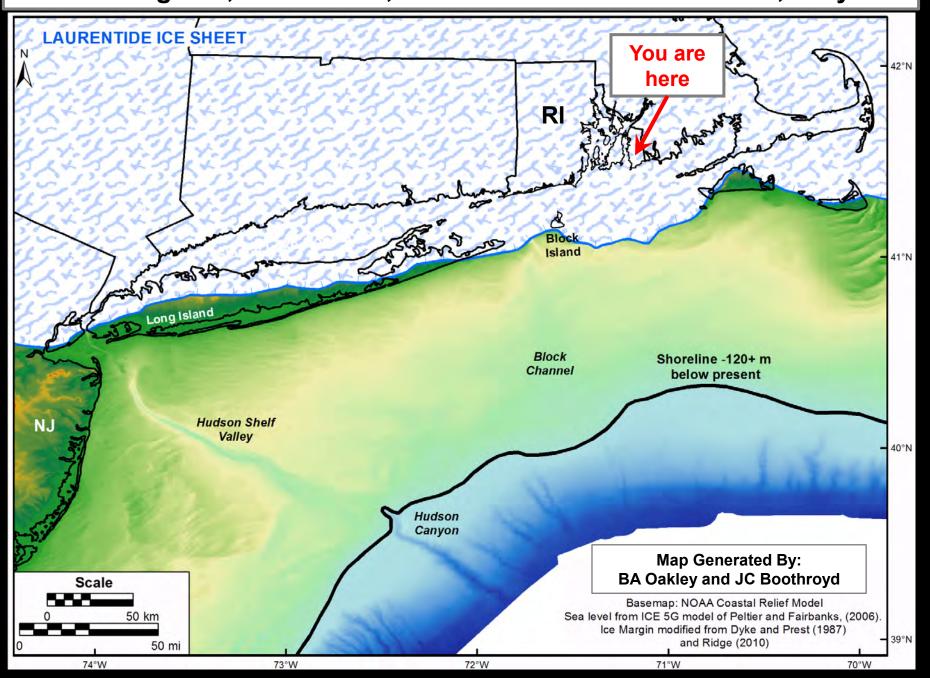
Sakonnet Golf Club Area

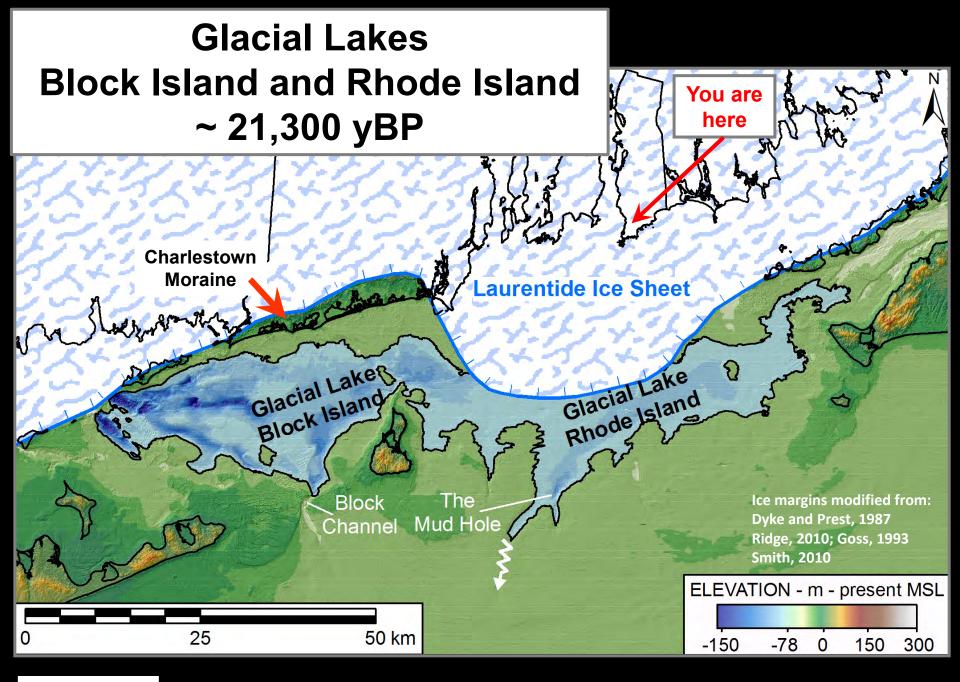


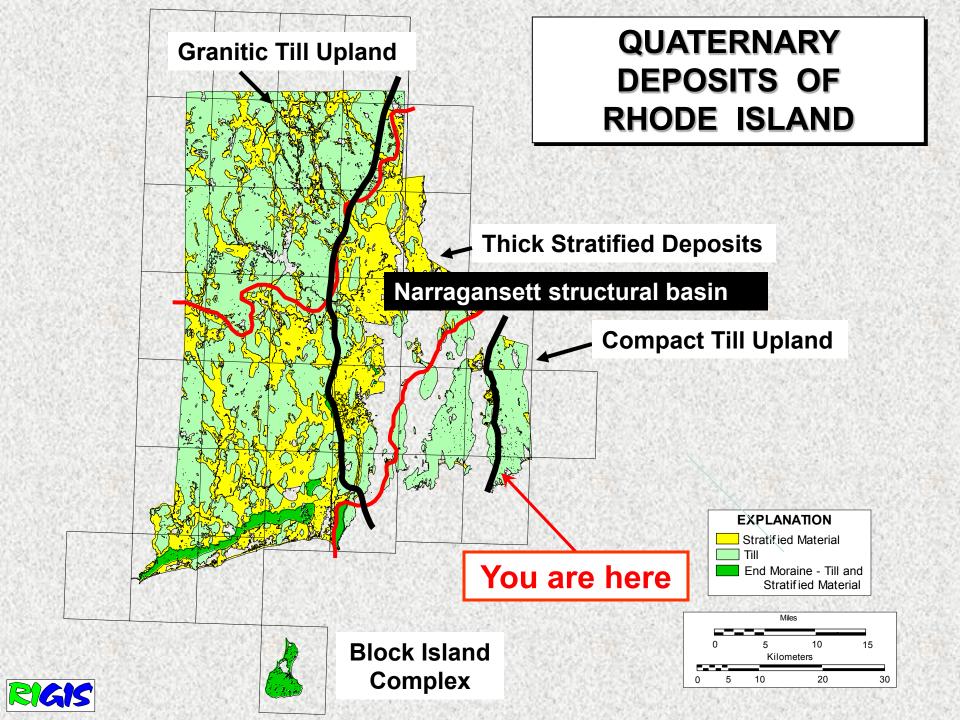
Bedrock

Bing Maps 2008

S New England, E New York, Continental Shelf at LGM ~ 26,000 yBP





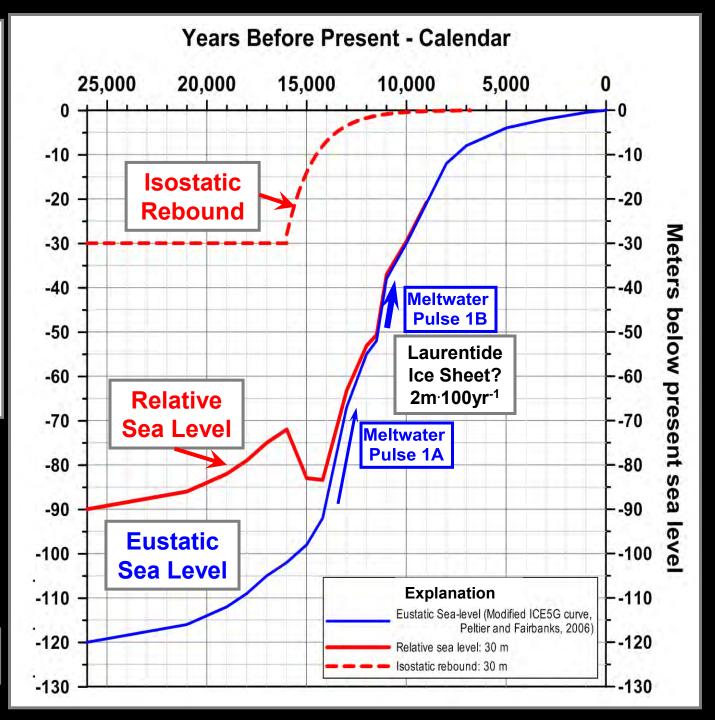


Eustatic Sea-Level Rise + Isostatic Rebound at

Block Island

RI

Oakley and Boothroyd, July 2012

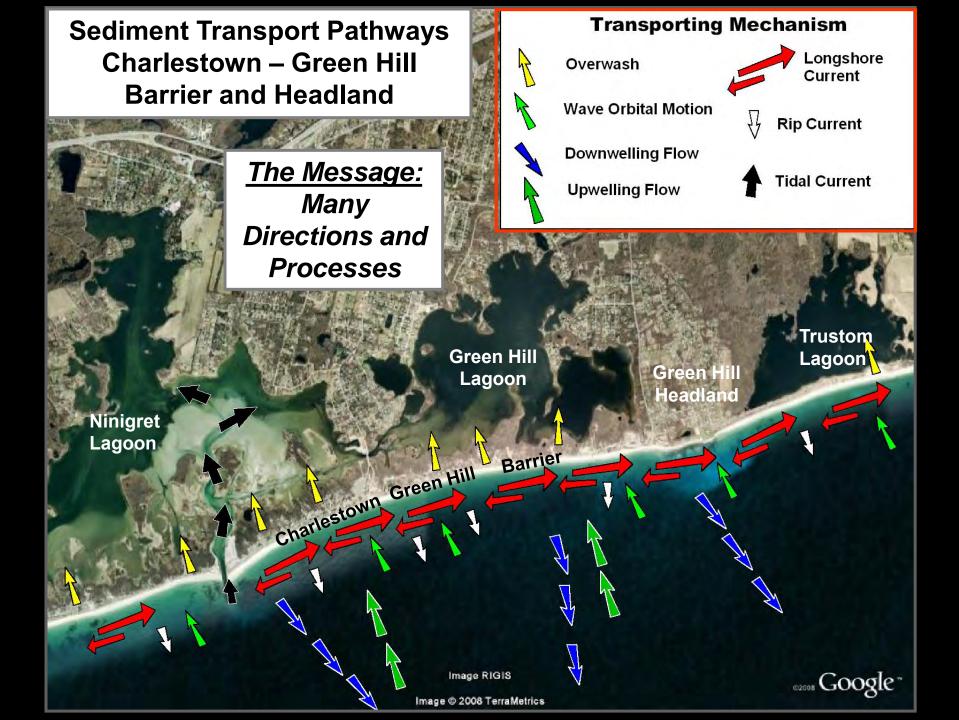


Narragansett Pier, RI Seawall - Tropical Storm Irene 2011



Narragansett Pier – Superstorm Sandy





Superstorm Sandy – Charlestown Beach



M Dowling

S McCandless
30 Oct 2012

Superstorm Sandy – Charlestown Beach

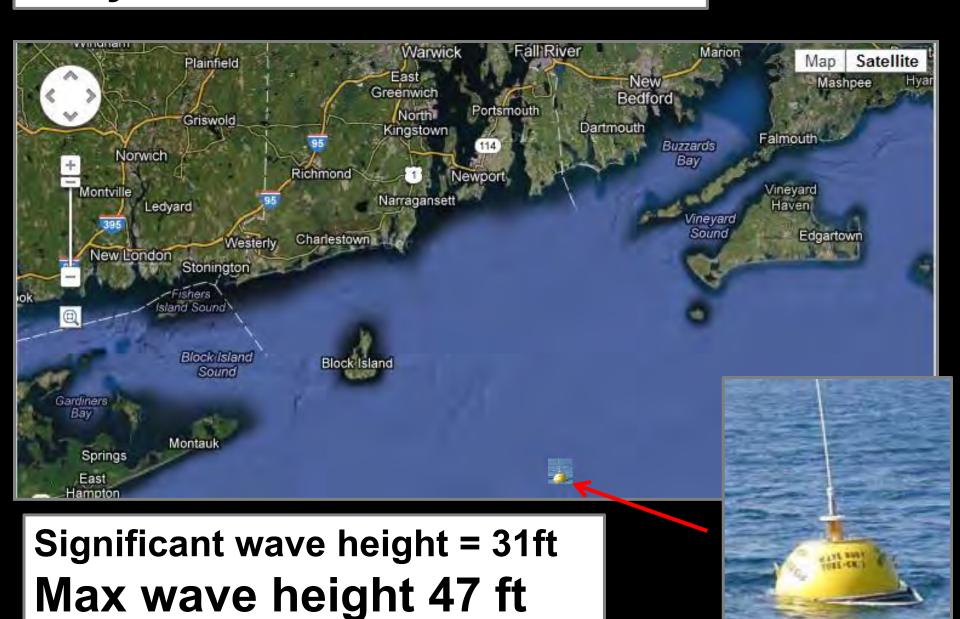
Washover Fan Deposition



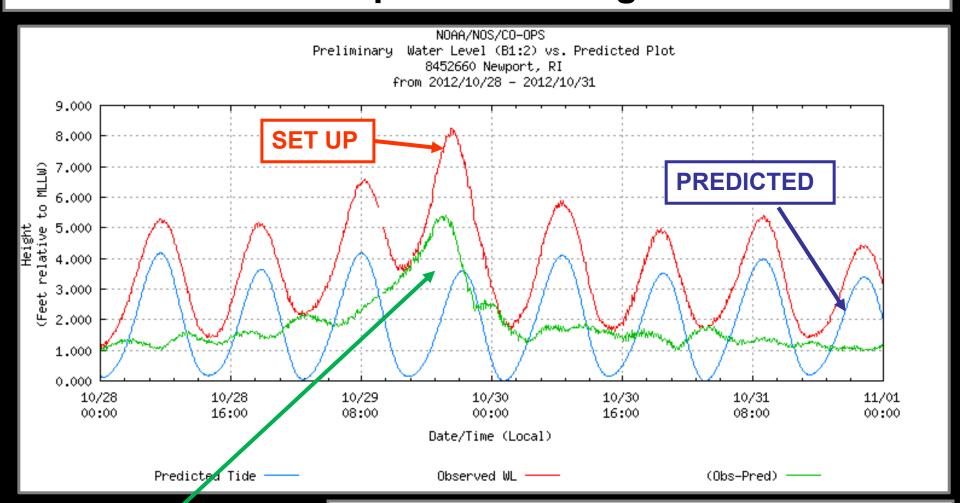
Sandy Geologic Summary:

- Sandy a Tropical Extratropical Hybrid
- Significant Wave Height 31 feet at Inner Shelf Buoy;
 Max Recorded Wave Height 47 feet
- RI Received a <u>Glancing Blow</u>; But <u>Public</u>
 <u>Misconception by Some</u> Believe it a 100 Year Event
- Greatest Geologic Change and Infrastructure Damage Since Hurricane Carol, 1954
- Washover Fan Deposition an <u>Underestimated</u>
 Problem
- Shoreline Change Special Area Management Plan Needed to Better Prepare for Next Event – Already Underway

Buoy 44097 – SE of Block Island



Superstorm Sandy – Tropical-Extratropical Hybrid 29 October 2012 Newport Tide Gauge

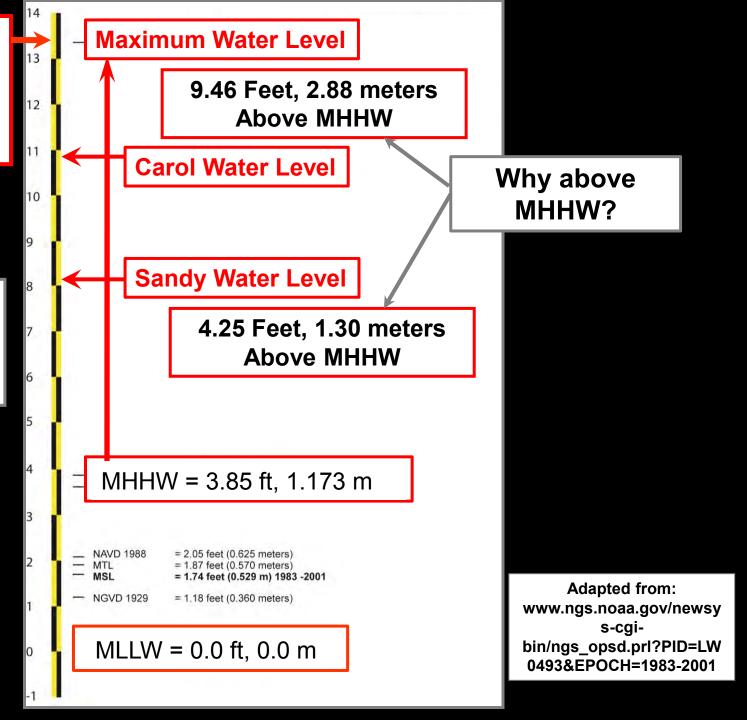


STORM SURGE

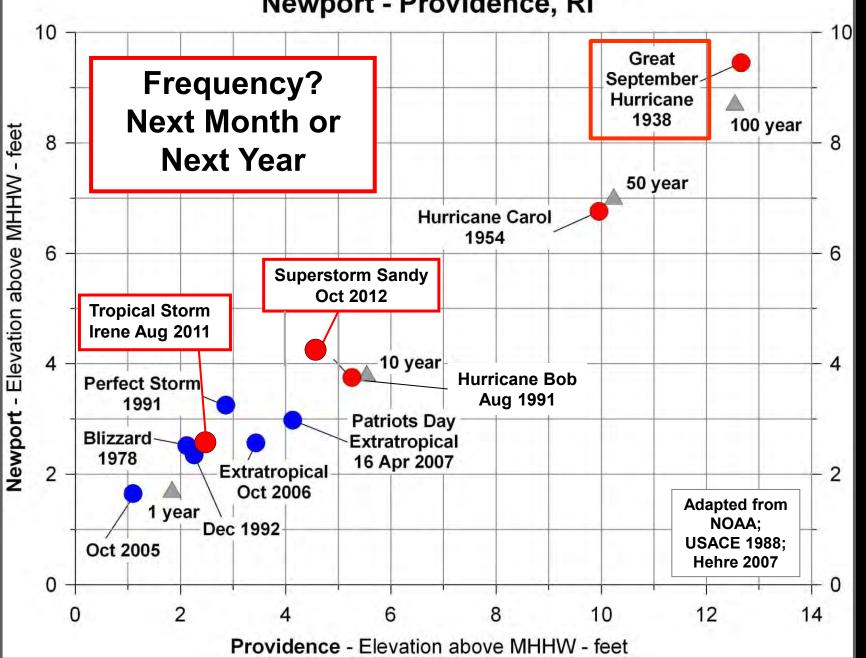
http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=8452660%20Newport,%20RI&type=Tide+Data

How High was the Water?

Water Levels Newport, RI



STORM-SURGE ELEVATION Newport - Providence, RI



Charlestown Beach – Superstorm Sandy



RI DOT 30 Oct 2012

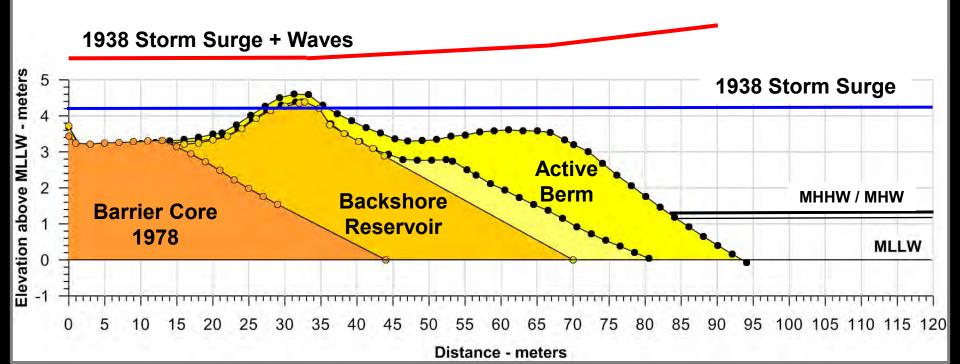
Measuring Shore Transects with: "2 Sticks and A String" or, the Modified Emery Method



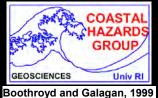


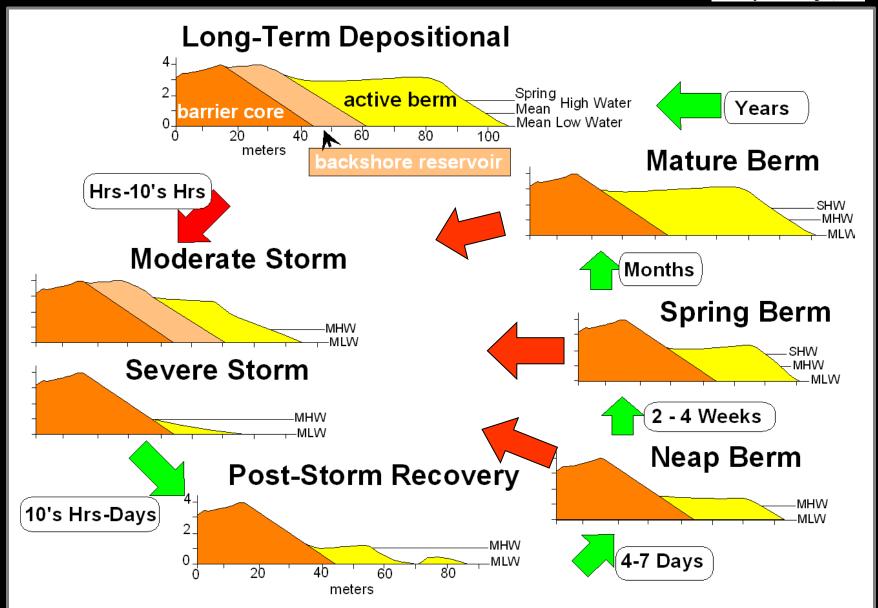
Date Volume m³·m

07 Feb 1978 93.3 11 July 2009 216.1 09 July 2010 288.8



Beach Cycles – RI Shore





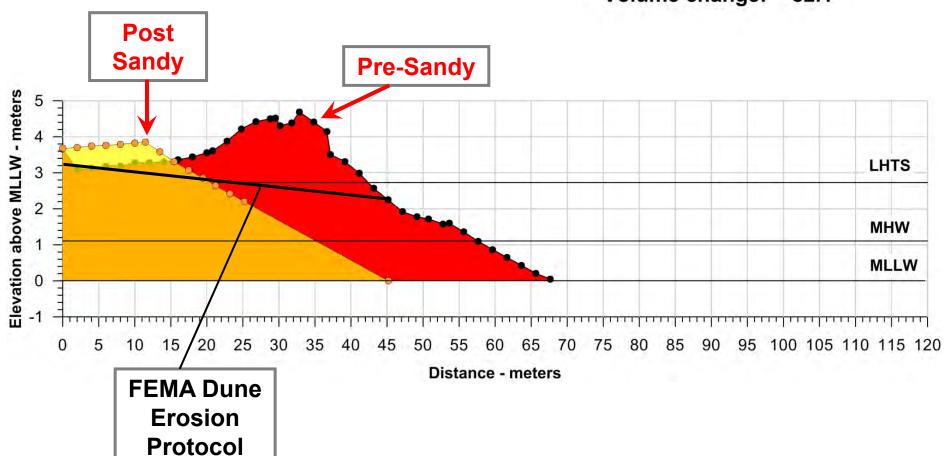
Cha-Ez Profile - Charlestown Barrier - Post Sandy



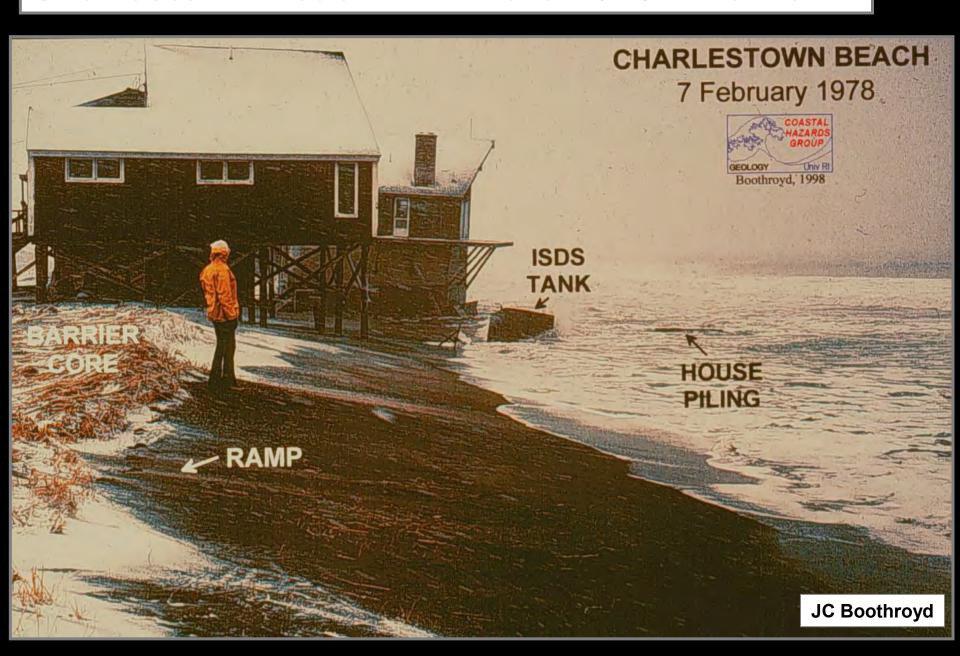
CHA-EZ Profile Plot

Date Volume m³·m

• 27 Oct 2012 188.3 ■ 30 Oct 2012 106.2 Volume change: -82.1



Charlestown Beach - Blizzard 1978 - No Berm



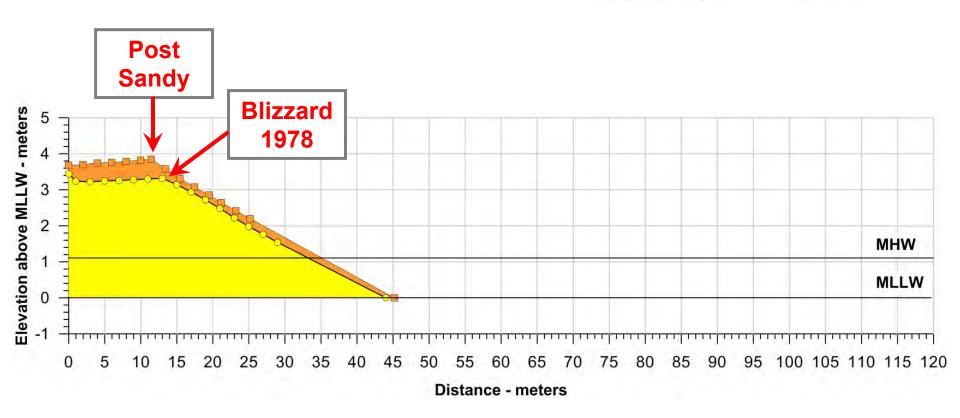
Barrier - Beach and Foredune Zone - 35 Year Reset

CHA-EZ Profile Plot

Date

Volume m³·m

● 07 Feb 1978 93.4 ■ 30 Oct 2012 106.2



Elevation
Difference –
USACE Post
Sandy and 2011
USGS LiDAR
DEMs

Charlestown Barrier

Washover Fan Deposition Fan Removed **Foredune** Removal Cha-Ez **Profile** Elevation Change - m

DRAFT FIGURE – PRELIMINARY RESULTS

<u>Pre-Sandy</u> – Quonochontaug Barrier Conservation Land





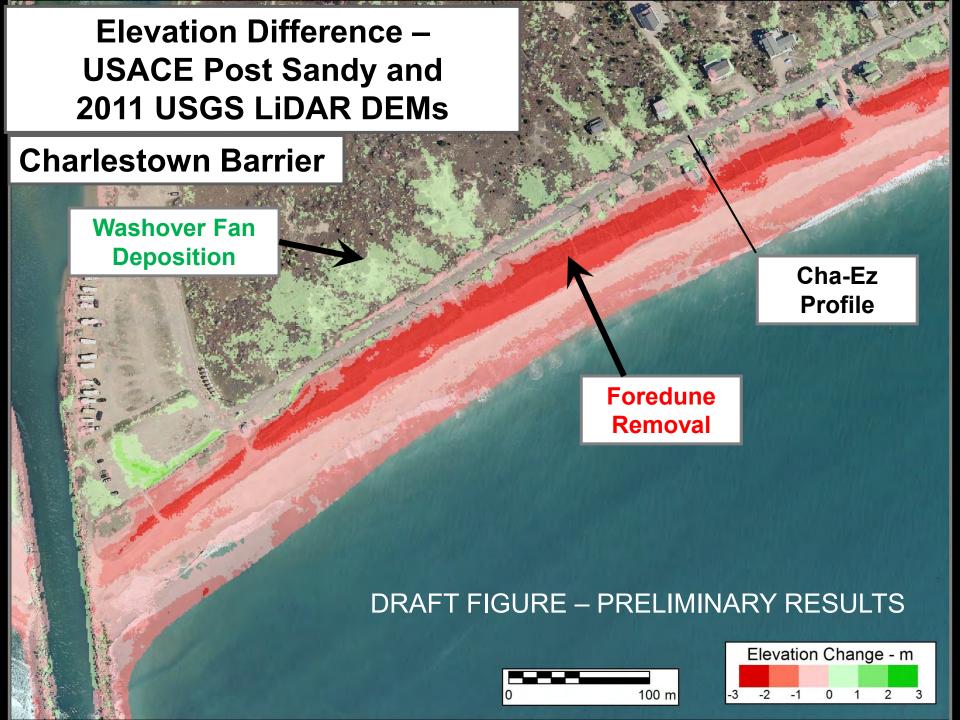
Charlestown Beach, RI



Superstorm Sandy – Charlestown Beach

Washover Fan Deposition





Washover Fan Deposition - Charlestown Beach



http://fema.maps.arcgis.com/home/webmap/viewer.html?webmap=

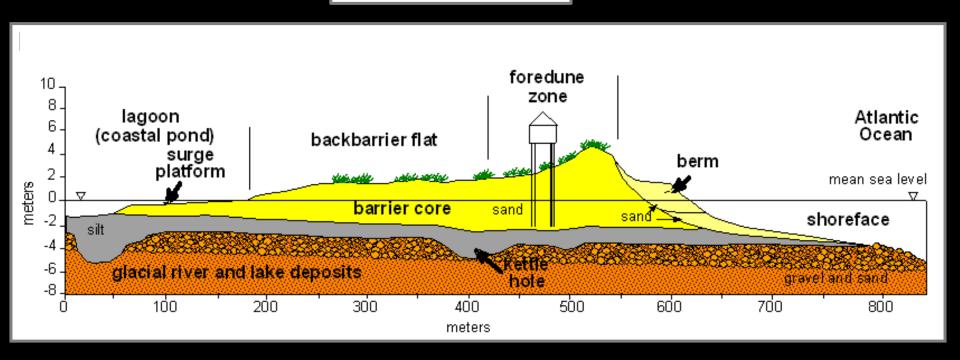


Charlestown Beach, RI – Hurricane Bob 1991 Washover Fan Deposition



A General Coastal Barrier Model for Rhode Island

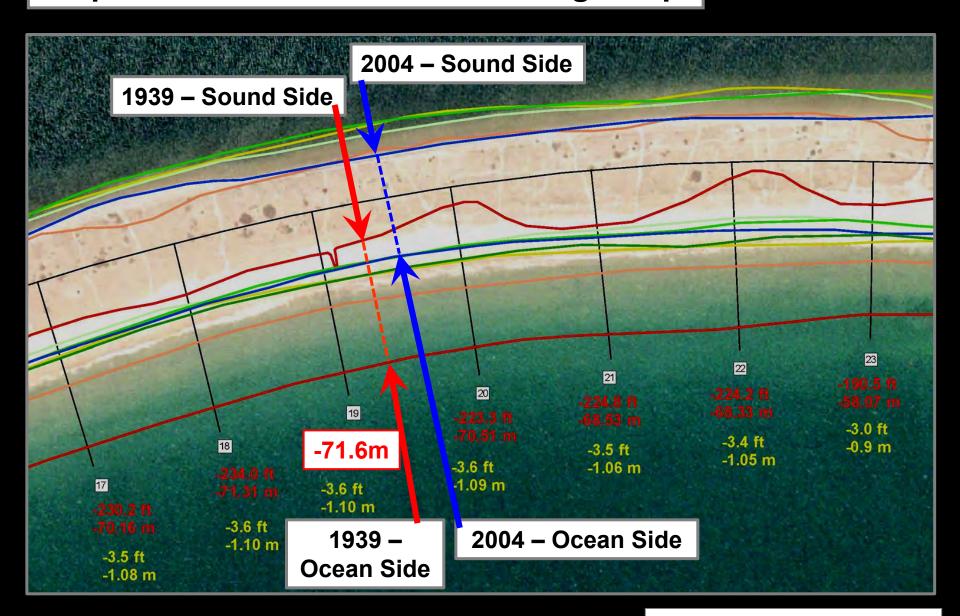
Very Transgressive



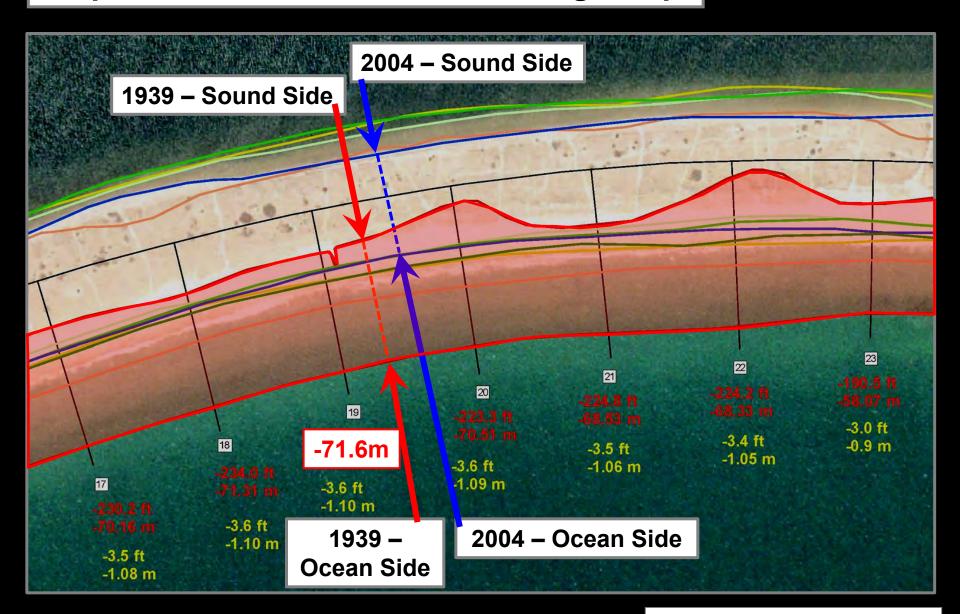
Napatree Barrier – Westerly, RI



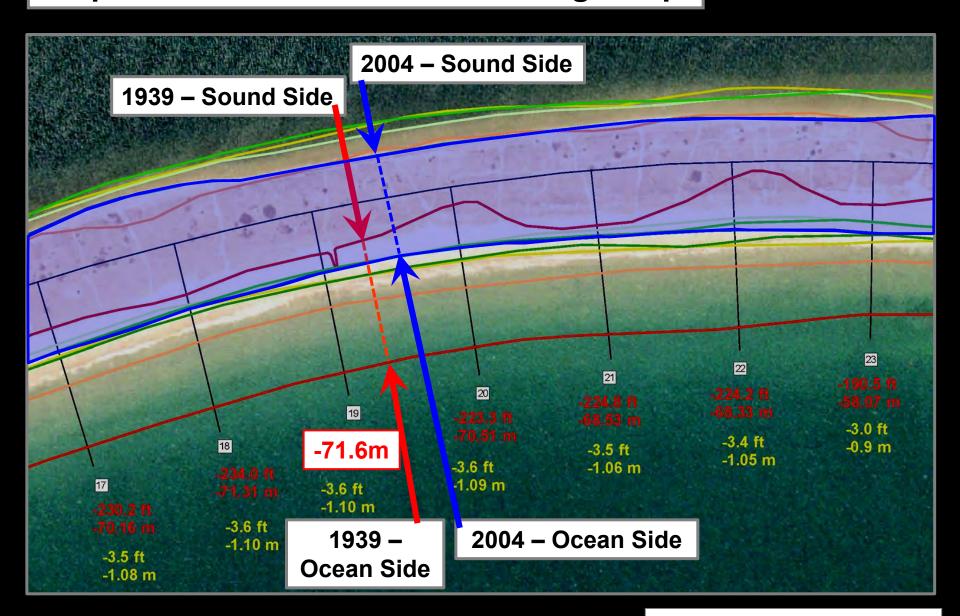
Napatree Barrier – Shoreline Change Map



Napatree Barrier – Shoreline Change Map



Napatree Barrier – Shoreline Change Map



South Kingstown, RI – Town Beach An Eroding Glacial Bluff Shore

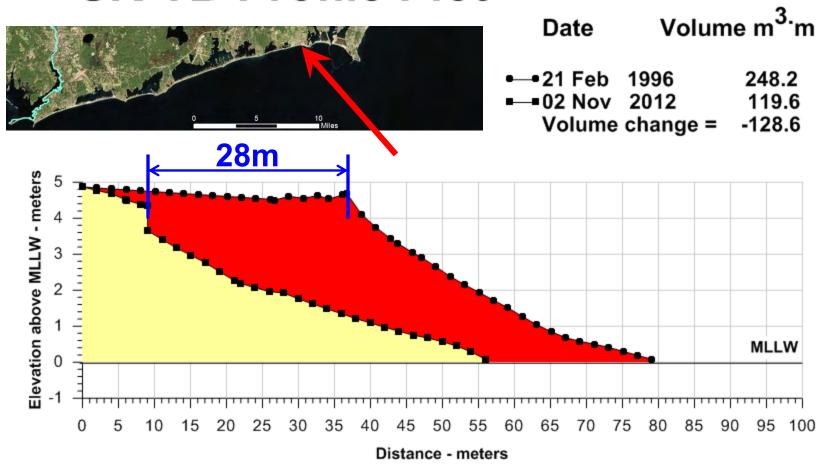


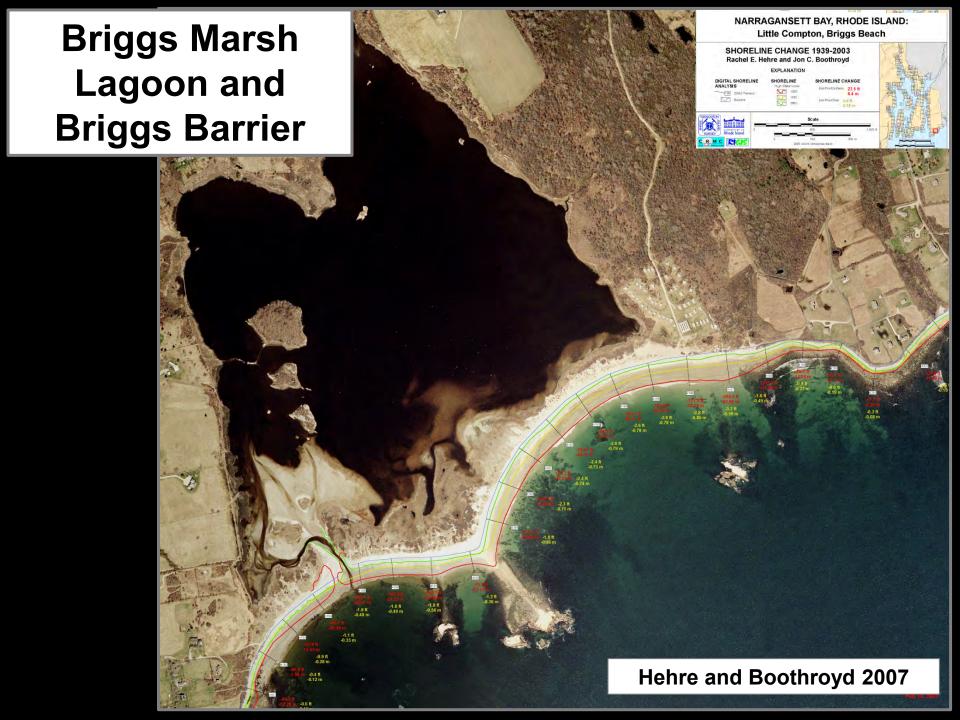
South Kingstown, RI – Town Beach An Eroding Glacial Bluff Shore



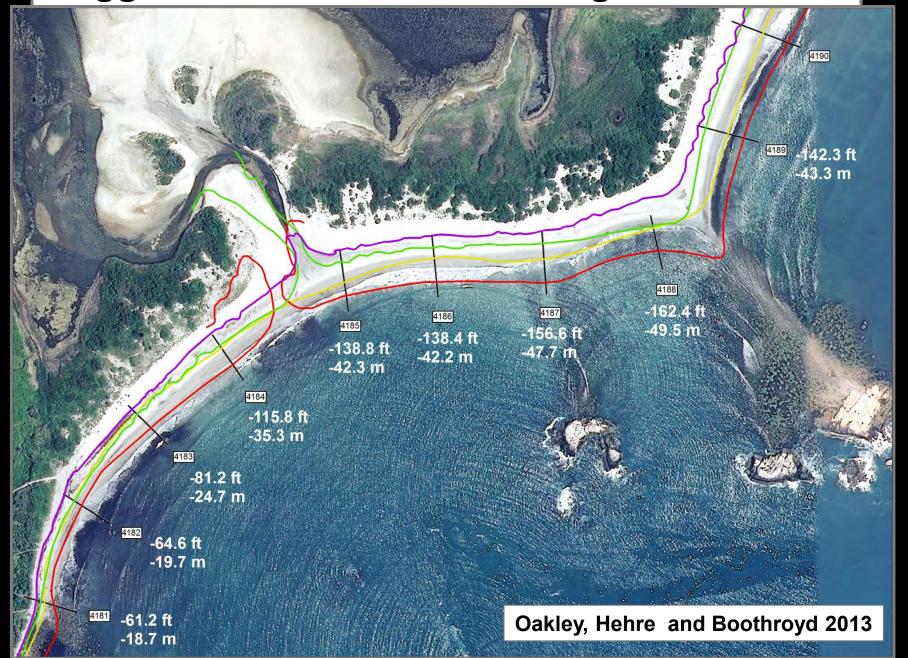
Headland Erosion – Glacial Stratified Bluff

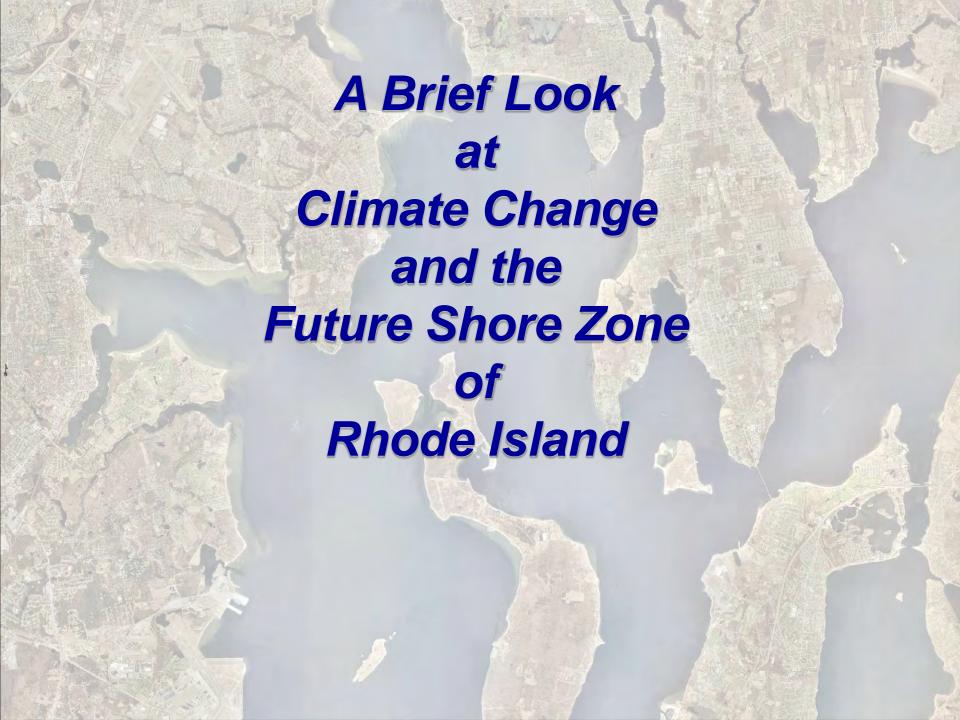
SK-TB Profile Plot





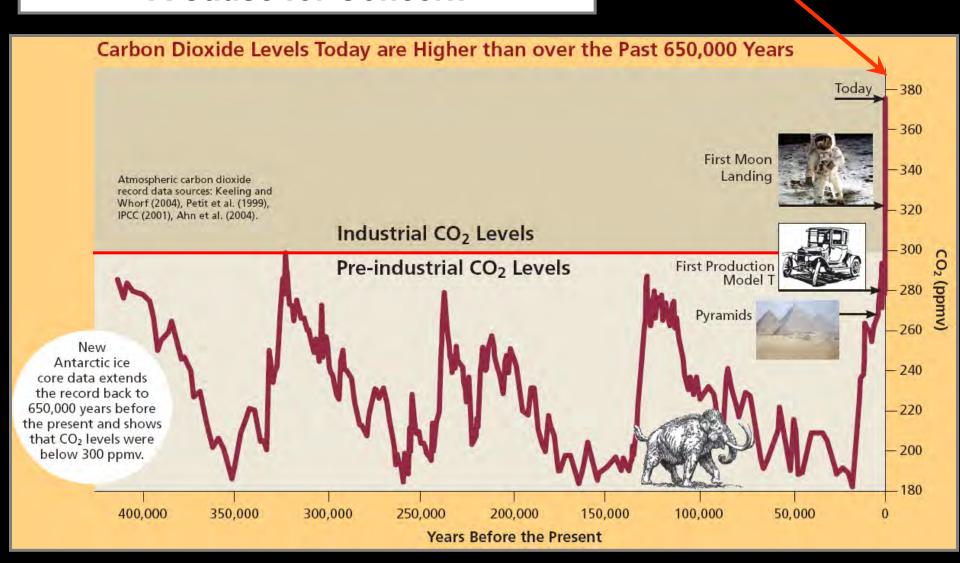
Briggs Barrier: Shoreline Change 1939 - 2012

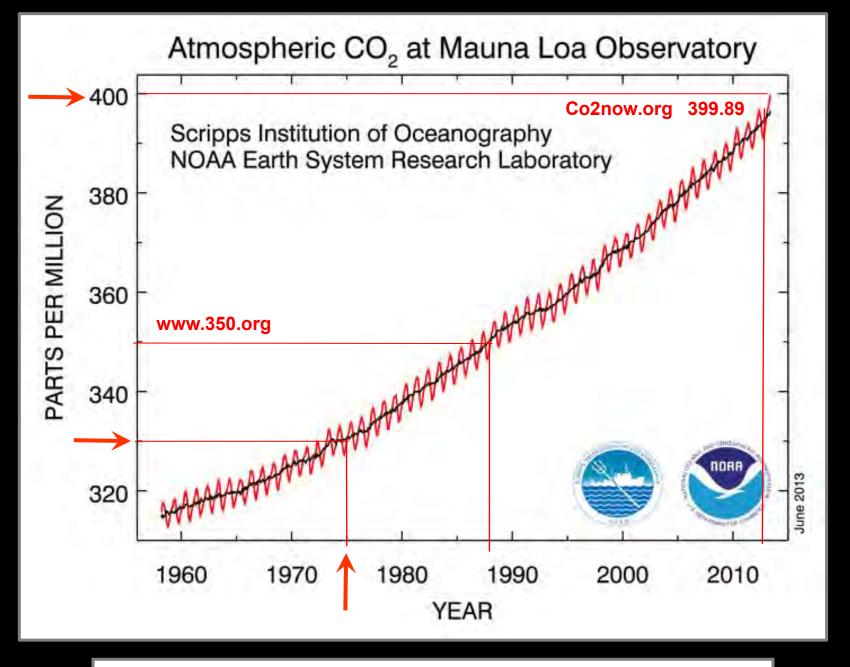




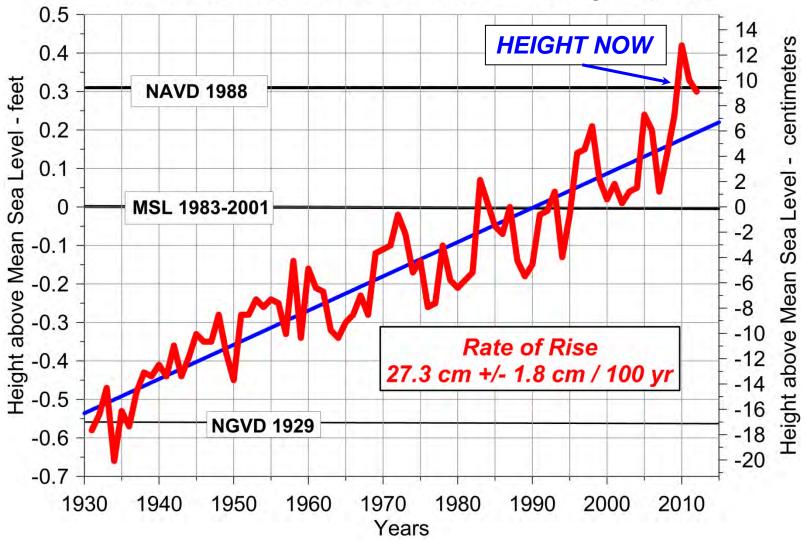
Carbon Dioxide - CO₂ Levels A Cause for Concern

Now 399+ ppm





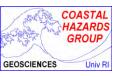
HISTORIC SEA-LEVEL RISE - Newport, RI

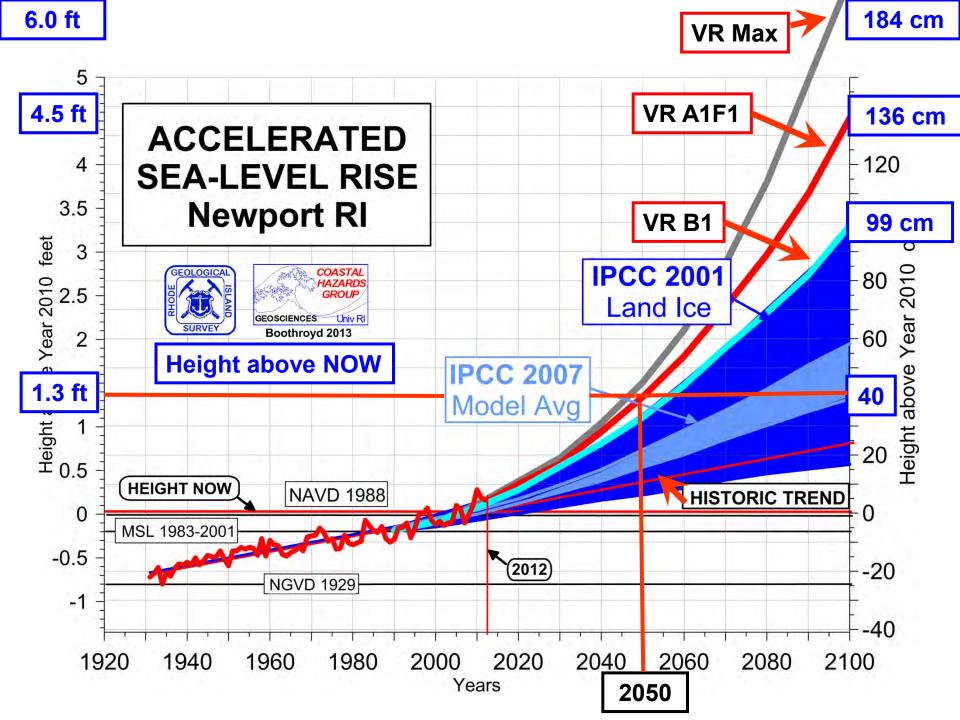


Adapted from:

http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8452660%20Newport,%20RI





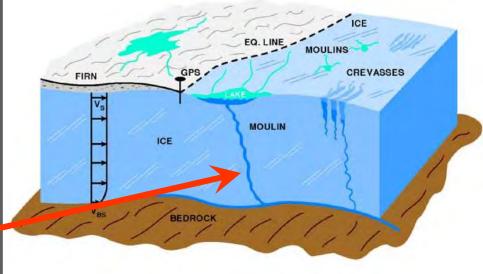


Greenland Outlet Glaciers Change from Polythermal to Warm Based means that the calving front is unstable

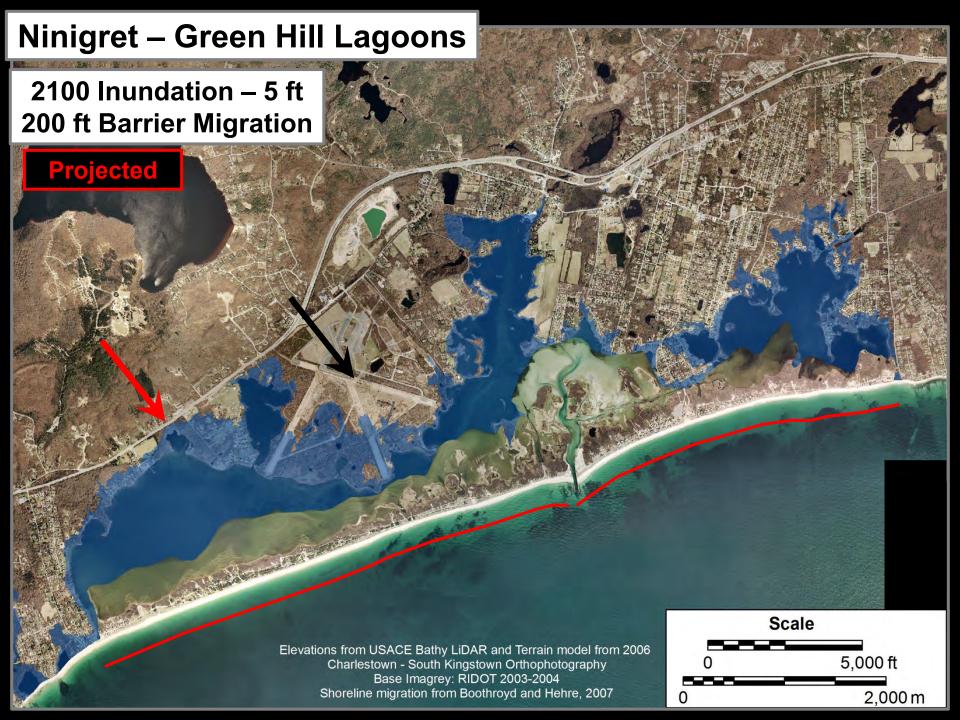
A Key to Future Sea-Level Rise

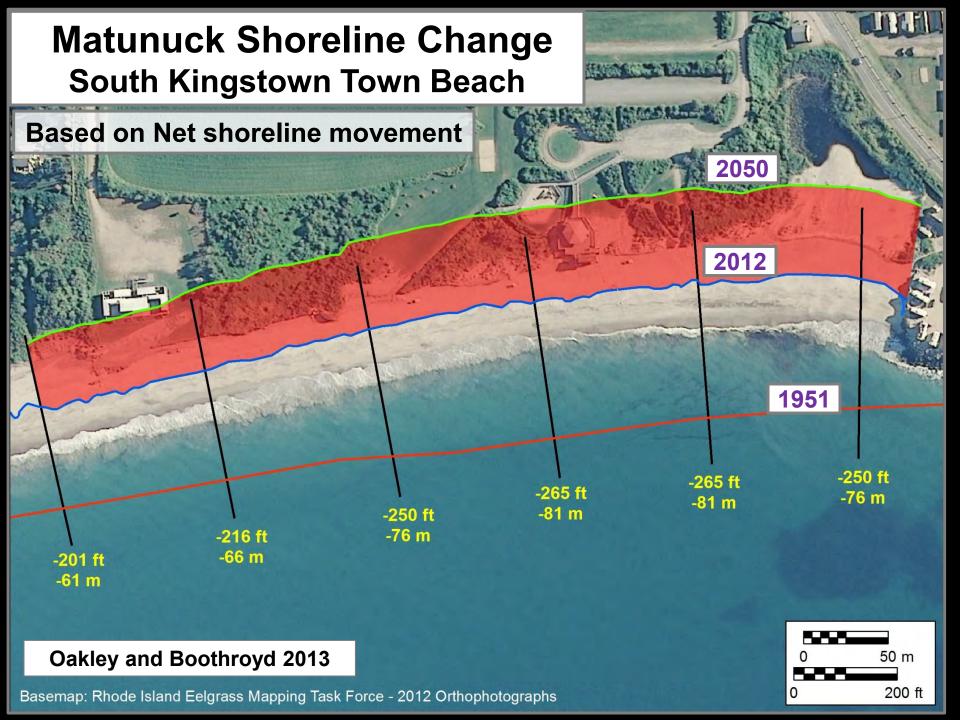


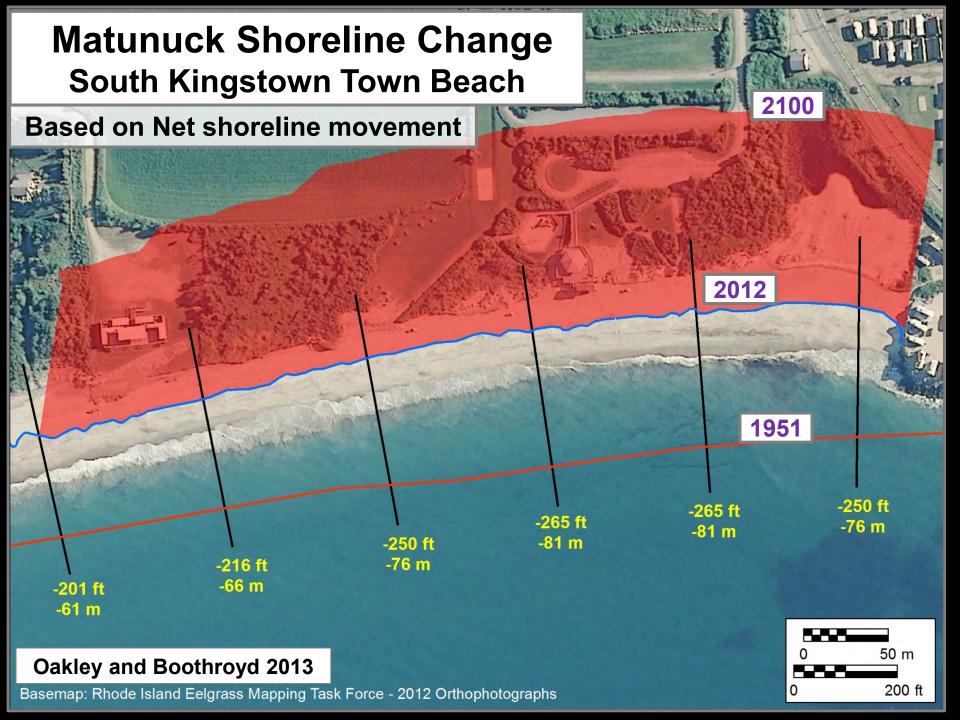


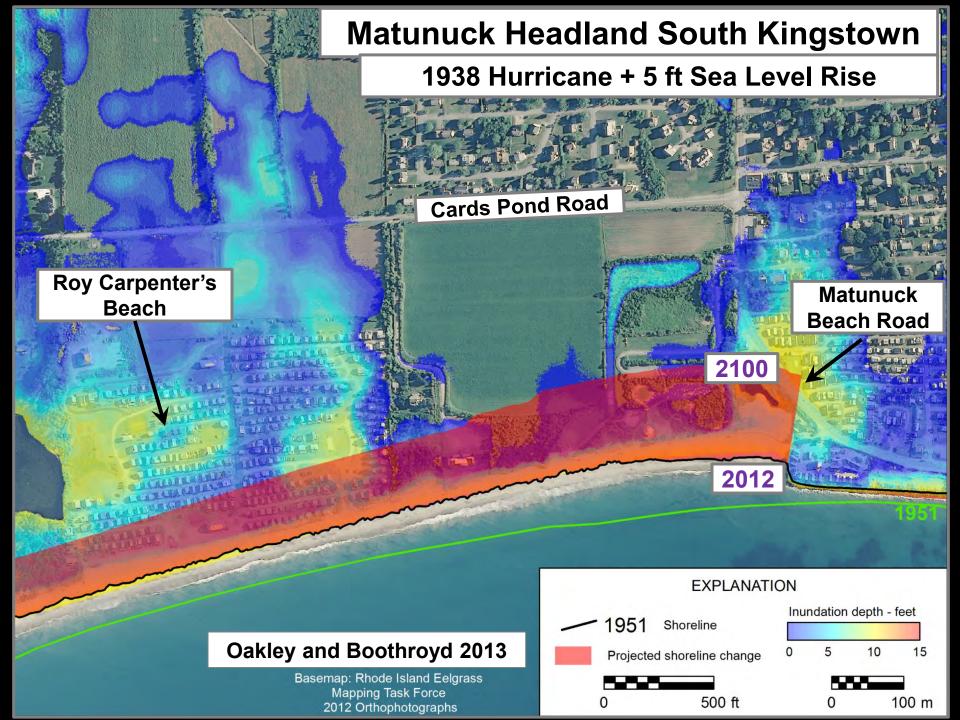


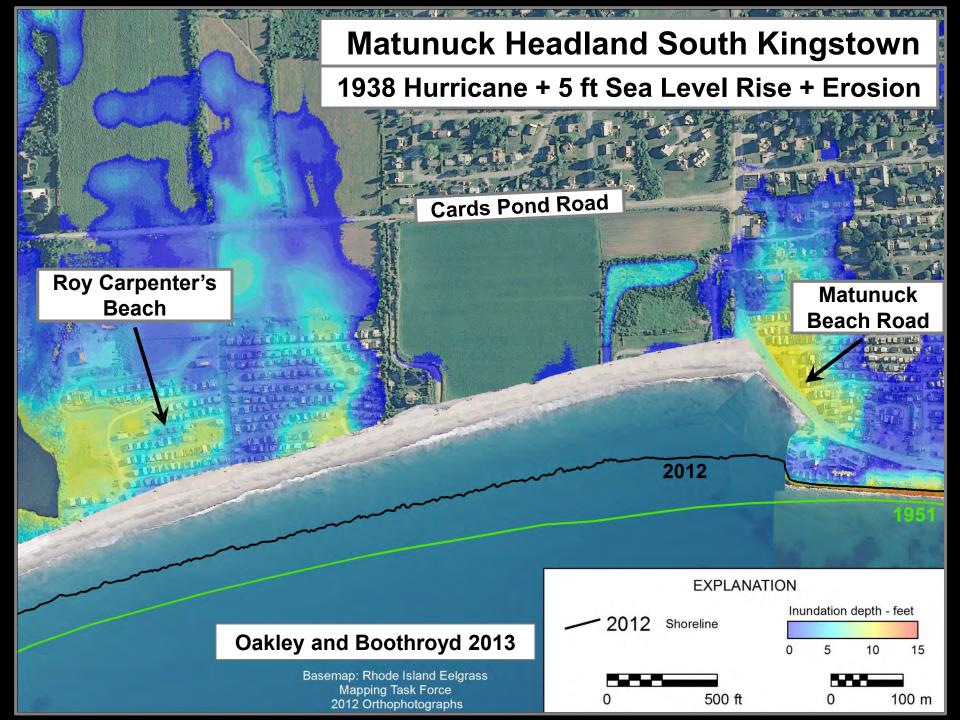








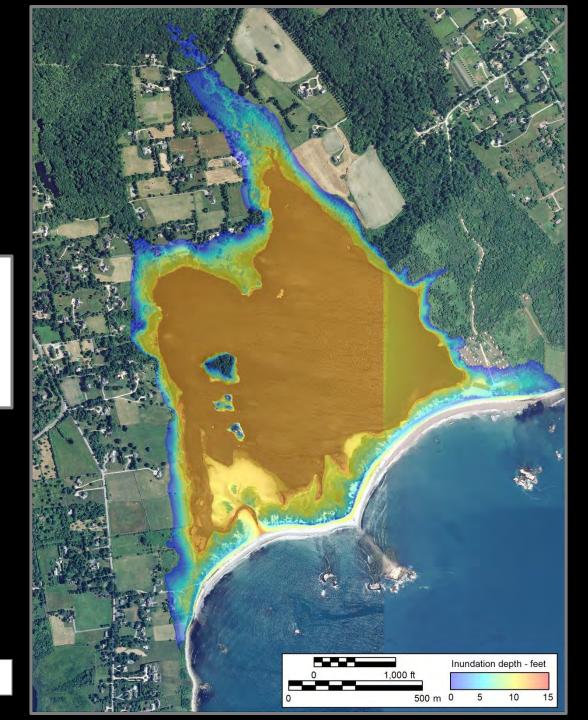




Briggs Marsh Lagoon Projected Inundation

1938 Hurricane + 5 ft Sea Level Rise

14.5 feet above MHHW



Oakley and Boothroyd 2013

Sakonnet Point Projected Inundation

1938 Hurricane + 5 ft Sea Level Rise

14.5 feet above MHHW

Inundation depth - feet

Oakley and Boothroyd 2013

Wickford Marketplace - In-Place Inundation "The Bathtub Ring"



End of Presentation