

Climate Adaptation for Coastal Communities



Helping Municipalities with Climate Change Adaptation and Mitigation

March 11, 2017, RI Land and Water Summit, Kingston, RI

Thomas Ardito, Executive Director, Aquidneck Island Planning Commission

Teresa Crean, AICP URI Coastal Resources Center / RI Sea Grant



Aquidneck Island
PLANNING COMMISSION

THE
UNIVERSITY
OF RHODE ISLAND



COASTAL
RESOURCES
CENTER
URI • GSO

Sea Grant
Rhode Island

Overview

•Tom

- Case for Local Action
- Opportunities & Challenges
- Case Studies
- Considerations -- Effectiveness

•Teresa

- Communication of Risk to Municipalities
 - Tools to Assess Coastal Risk in RI
 - Coastal Adaptation Strategies

Potential Goals

- **Protect Life & Property**
 - Disaster planning, preparation and recovery
 - Housing & neighborhood protection
 - Shoreline protection & resilience, etc.
- **Minimize Economic Disruption**
 - Floods, evacuation, power outages, transportation disruptions, dam failures, etc.
- **Maintain Ecological Integrity**
 - River & wetland restoration, forest management, etc.
 - Stormwater & water quality restoration
 - Fish & wildlife restoration, invasives control, etc.
- **Proactive Solutions**
 - Renewable energy

Case for Local Action

- State and Federal resources are insufficient;
- Politics appear incapable of adequately address pressing problems like flood preparedness (coastal & inland)
- At its best, local control is most democratic
- Home rule

Limitations

- Diffuse leadership -- personalities
- Municipalities inherently conservative – change is hard
- Local resources & capacity limited
- Special interests; NIMBY or “hijack” factor
- Scale issues
- Non-uniform processes, ordinances, etc.

Local Successes

- Renewable energy
- Bag bans
- Stormwater utilities (soon/not so soon)
- Anti-idling ordinance (Newport)
- Ecological restoration – rivers, wetlands, beaches, etc.

Case Studies

- **Roger Williams Park, Providence**
- **Solarize Aquidneck**
- **Hurricane Sandy Restoration,
Middletown**
- **Island Waters (Aquidneck Island)**

Roger Williams Park



Solarize Aquidneck



Hurricane Sandy Sachuest Bay



Island Waters



Achieving Results

- Build local support first
- Address local needs
- Know where decisions happen – and adapt
- Be patient
- Count to 4
- Consider CIP
- Local match?
- Bring money – preferably large quantities –
or at least resources

Parting Thoughts

- **Local action is necessary but not sufficient**
- **Needed:**
 - **Better state/federal support for stormwater,**
 - **Comprehensive approach to dam removal & river restoration – MA & PA**
 - **Fed/state/local/private, comprehensive approach for coastal neighborhoods**

Drivers to Plan for Natural Hazards & Climate Change

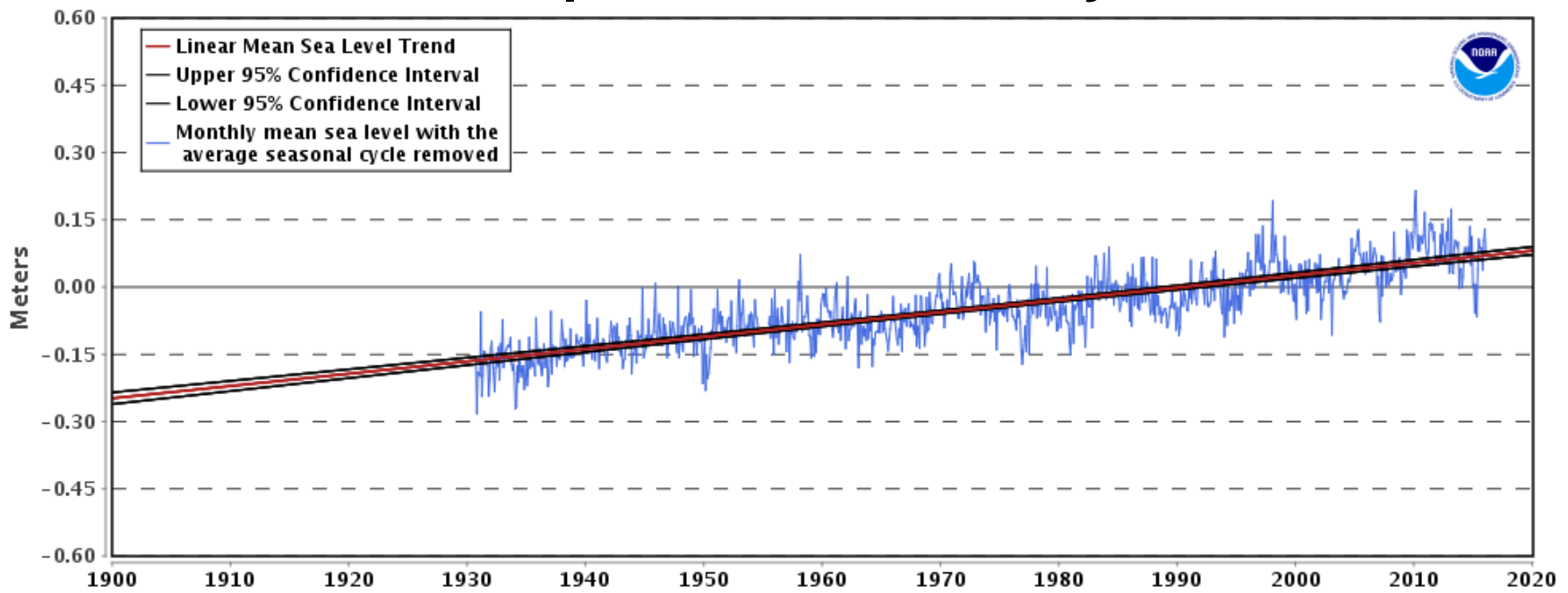
- Public Health, Safety & Welfare
- Investment of Public Funds for Infrastructure
- State Mandate
- Impacts Felt at Local Level from Multiple Hazards



Photo credit: Melissa Devine, Rhode Island Sea Grant

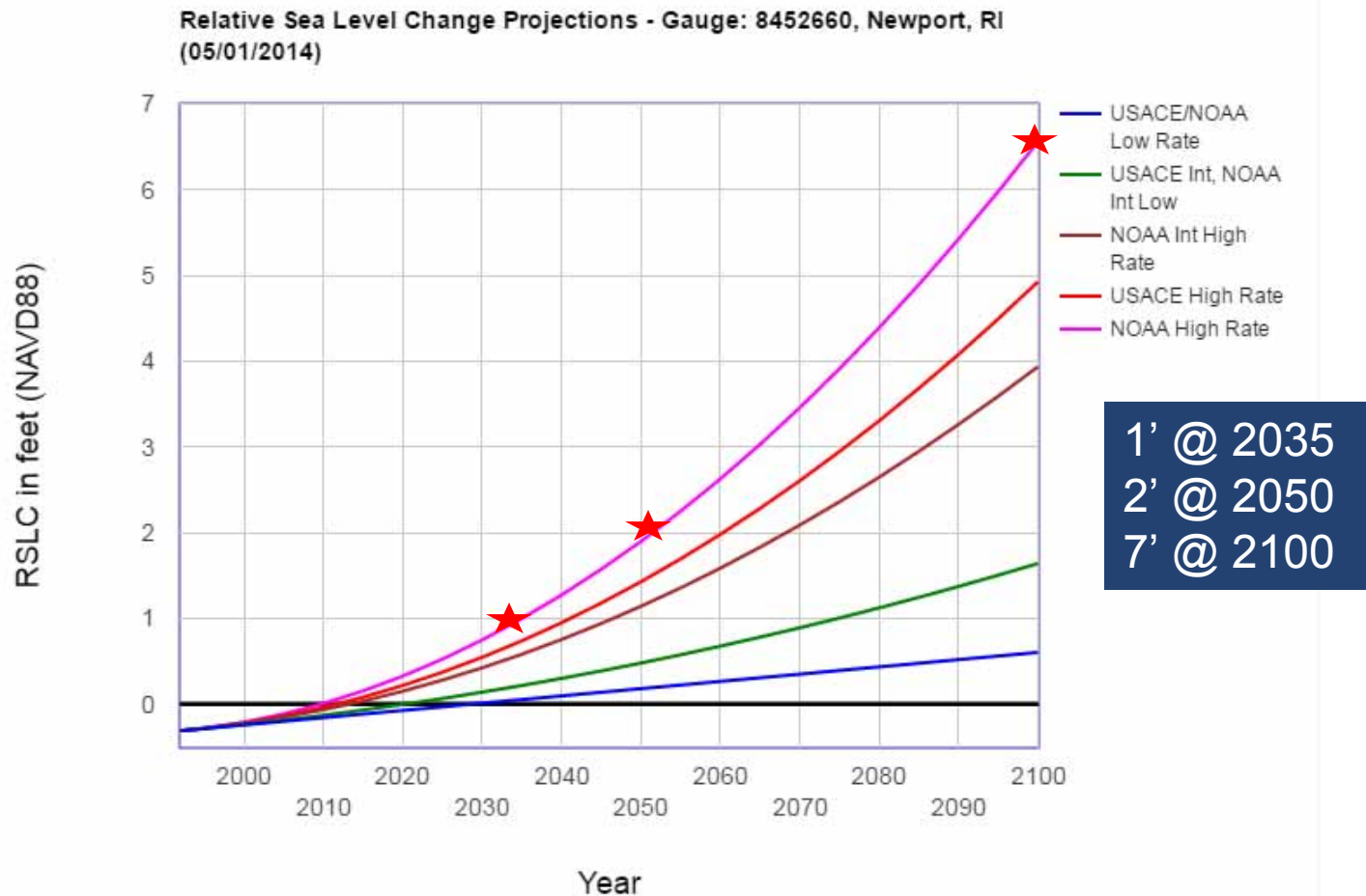
SEA LEVELS ARE RISING

Newport 2.74 +/- .17mm/year



<http://tidesandcurrents.noaa.gov/sltrends/>

SLR IS ACCELERATING



<http://www.corpsclimate.us/ccaceslcurves.cfm>

Differentiating between :

Storm Flooding

(Periodic/Infrequent)

- Coastal & Storm Surge Driven
- Precipitation Driven

Sea Level Rise Flooding

(Daily; 2 times each day at high tide)



[HOME](#)

[FLOOD RISKS](#)

[UNDERSTANDING FLOOD MAPS](#)

[RESIDENTIAL COVERAGE](#)

[COMMERCIAL COVERAGE](#)

[POLICYHOLDER RESOURCES](#)

[PARTNER RESOURCES](#)

[INSURANCE AGENT
RESOURCES](#)

[ABOUT THE NFIP](#)

LATEST NEWS

Learn what you can do to keep your family and property safe before, during, and after a flood.

Typically, there's a 30-day waiting period from date of purchase before your policy goes into effect.

A Single Storm Can Ruin Your Financial Future.

It doesn't matter if the storm season is active or quiet! It only takes one tropical storm or hurricane to cause thousands of dollars in flood damage.

[LEARN MORE ABOUT HURRICANES](#)

[Hurricane Season](#) [National Preparedness Month](#) [Get the FEMA App](#) [Protect What Matters](#) [About Flood Maps](#)

WHAT'S MY FLOOD RISK

Visit FEMA's [Flood Map Service Center](#) to locate your flood map to help determine your flood risk.



FIND FLOOD INSURANCE AGENTS IN YOUR AREA

Before you can protect your home, you'll need to find an agent who lives near it.

[FIND AN AGENT](#)



Winter Weather Preparedness

Are you prepared for winter weather? Click [here](#) for winter preparedness tips.

RI FLOODPLAIN MAPPING TOOL



[View larger map](#)

Weather & Transportation Updates

RESOURCES FOR



RESOURCES FOR



RESOURCES FOR



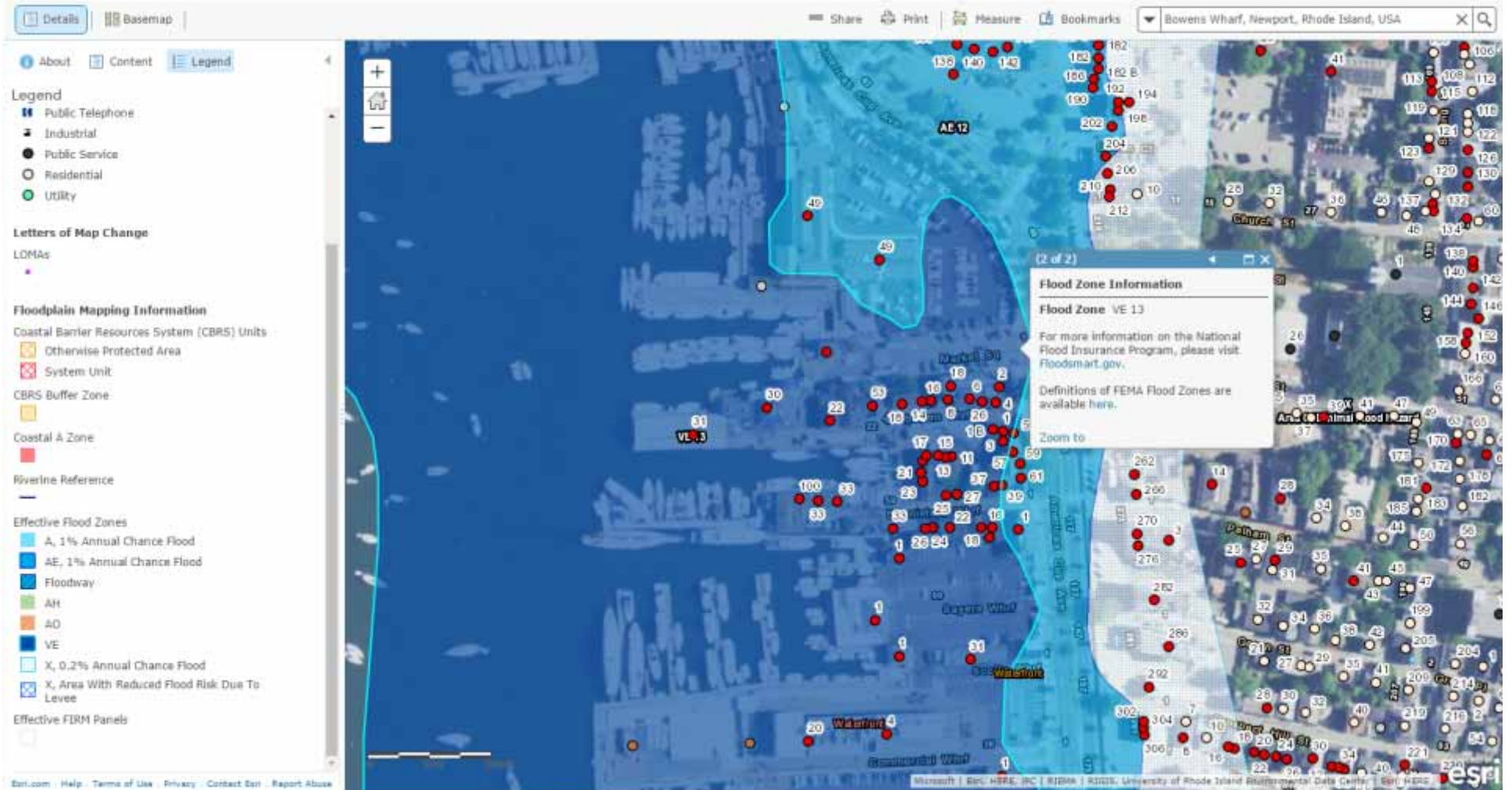
RESOURCES FOR



FEMA National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRMs)

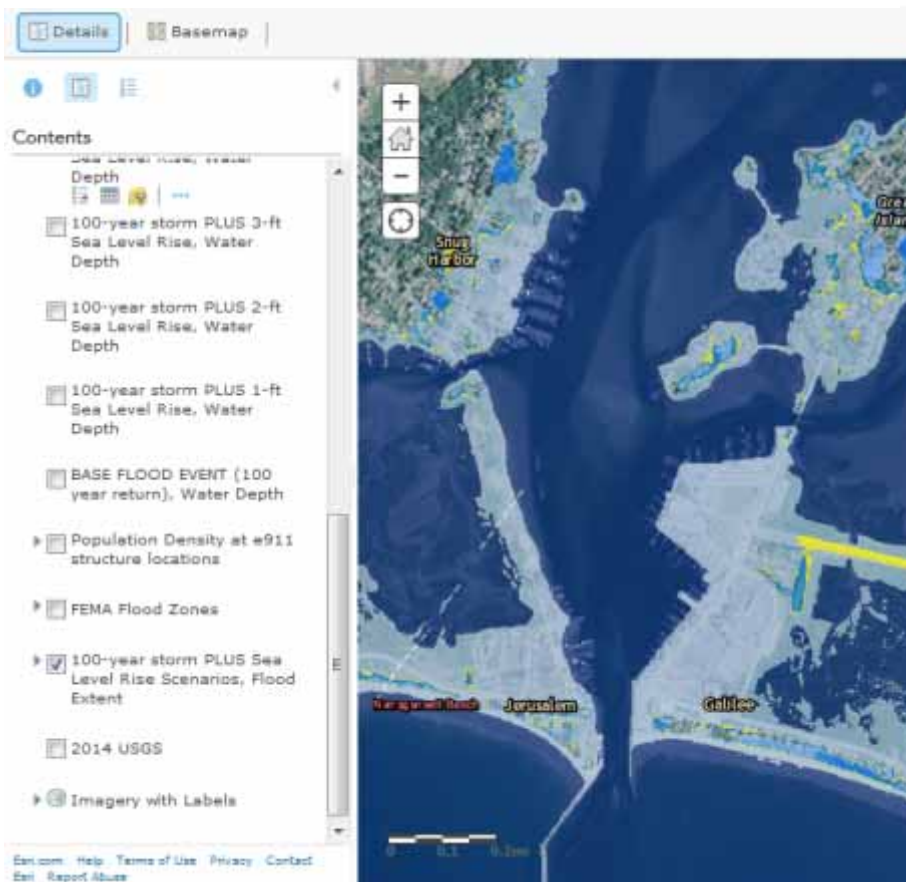
Home ▾ Rhode Island Floodplain Mapping Tool

Sign In



TOOLS TO UNDERSTAND RISK

STORMTOOLS



www.beachsamp.org



Quick & powerful coastal-incident reporting

As of March 9th, 2016, MyCoast has:

3632 Reports & 5889 Photos

Including 941 new reports in the past 6 months

MyCoast allows anybody to quickly submit photos of coastal events, such as storm damage or nuisance flooding, especially when caused by [king tides](#). Our servers automatically geolocate each photo and assign metadata to it, including meteorological and tidal conditions. A small selection of that information is then displayed on the public site, where visitors can view the reports on a map, photo gallery, or list. ([Here's an example of a storm damage report.](#)) Much more data is available to participating state partners.

⚠ You're going to love the new (FREE!) MyCoast App



www.mycoast.org

RI Shoreline Change Special Area Management Plan



Coastal Flooding in Rhode Island



Scroll down through this panel to see the tour or click on the side buttons to jump ahead.

- Coastal Flooding
- Coastal Flooding 2010
- Coastal Flooding 2011
- Coastal Flooding 2012
- Coastal Flooding 2013
- Coastal Flooding 2014
- Coastal Flooding 2015
- Coastal Flooding 2016



STORMTOOLS COASTAL FLOODING IN RHODE ISLAND: A Map Journal

COASTAL FLOODING IN RHODE ISLAND: A Map Journal

[Read more »](#)

News & Updates



Beach SAMP Stakeholder Meeting, December 1, 2016

Upcoming King Tide Event: Snap the Shore, See the Future

See how the URI Coastal Resources Center and Rhode Island Sea Grant are building industry-public relationships to provide resiliency options to coastal property owners:



North Kingstown Sea Level Rise Adaptation Pilot Project

Search

Recent Posts

- Beach SAMP Stakeholder Meeting: December 1, 2016, 6-8pm November 15, 2016
- COASTAL FLOODING IN RHODE ISLAND: A Map Journal September 29, 2016
- Beach SAMP Stakeholder Meeting, December 1, 2016 September 29, 2016
- Upcoming King Tide Event: Snap the Shore, See the Future August 19, 2016
- Beach SAMP Stakeholder Meeting, August 25, 2016 August 12, 2016
- King tides as a predictor of future sea level rise May 17, 2016
- See how the URI Coastal Resources Center and Rhode Island Sea Grant are building industry-public relationships to provide resiliency options to coastal property owners: May 11, 2016
- North Kingstown Sea Level Rise Adaptation Pilot Project May 11, 2016
- Upcoming King Tide Event: Snap the Shore, See the Future May 4, 2016
- Dr. Michael Oppenheimer to speak at Beach SAMP Meeting, May 3rd at 6:00pm April 22, 2016

Categories

- beachSAMP (27)
- Climate Change (66)

RI Shoreline Change Special Area Management Plan

STORMTOOLS Map Gallery

STORMTOOLS live maps gallery



STORMTOOLS Map Journals

Map Journals

Coastal Flooding in Rhode Island



STORMTOOLS 101



Touring Historic Storms in Rhode Island



(1) MAP JOURNAL: STORMTOOLS 101

A story map

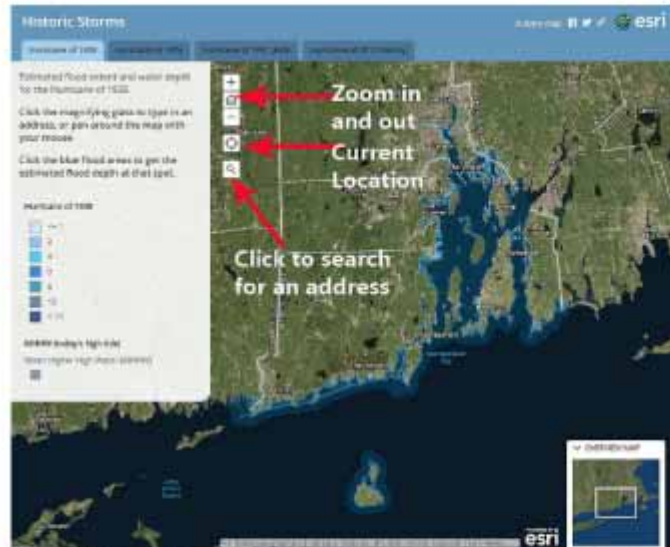


STORMTOOLS 101

How to Use the App

On the right is an example of one of our STORMTOOLS apps. They are designed to be streamlined and easy to use.

Below are instructions - try it out yourself! (scroll down)



Use the buttons on the map or use your mouse to scroll and pan around the map.



Historic Storms

A story map



Hurricane of 1938

Hurricane of 1954

Hurricane of 1991 (Bob)

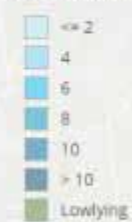
Superstorm of 2012 (Sandy)

Estimated flood extent and water depth for the Hurricane of 1938.

Click the magnifying glass to type in an address, or pan around the map with your mouse.

Click the blue flood areas to get the estimated flood depth at that spot.

Hurricane of 1938 (flooding in feet)



(1) MAP JOURNAL: STORMTOOLS 101

A Web Map



STORMTOOLS Maps and Apps



Sort by



Layout



Sign in



STORMTOOLS 101

Other STORMTOOLS Maps and Apps

There are two main ways to access STORMTOOLS: through interactive maps, or through map journals. Interactive maps give you the flexibility of turning on and off layers as you wish. Map journals provide more information and photos and guide you through the tool (while still allowing you to interact with the map by searching for addresses or zooming around the state).

Our two Interactive Maps are **STORMTOOLS For Beginners** and **Advanced STORMTOOLS**. **STORMTOOLS for Beginners** asks the user three main questions: Is my property vulnerable to sea level rise?; Is my property in the 100 year storm floodplain?; and Is my property vulnerable to a 100 year storm in 2050?. **Advanced STORMTOOLS** is a map gallery that offers detailed STORMTOOLS flood layers, with clickable flood extents showing water depths at specific locations, as well as other useful GIS layers that may help in coastal planning decision making. Maps are organized by planning horizon (time) and severity of storms (nuisance or extra/tropical storms).

The Map Journals include **STORMTOOLS 101**, **Touring Historic Storms**, and **Coastal Flooding in Rhode Island**. You already know **STORMTOOLS 101** and it is highly recommended particularly if this is your first time using STORMTOOLS. **Touring Historic Storms** takes you on a tour through Rhode Island looking at photographs from four major hurricane events (1938, 1954, 1991, 2012) overlaid with the flood extent on the map from that storm. **Coastal Flooding in Rhode Island** brings all the flooding layers under one roof. From historic storms, to present day, and into the future with each sea level rise scenario, users can look at the 25, 50, and 100 year storm events now and in the future.

STORMTOOLS Live Maps

In unparalleled resolution (6 in. vertical and 3.3 ft. horizontal accuracy), STORMTOOLS uses the most recent Digital Elevation Models.

Tags

Advanced STORMTOOLS
BeachSAMP Coastal
Flooding FEMA FIRMS Flood
Flood Insurance Rate Maps Floodplain
Hurricanes Inundation Mapping
NACCS Rhode Island RI RIEMA
Scaled SLR Sea Level Rise
Storm Surge STORMTOOLS



Rhode Island
Floodplain Mapping

Web Map



Coastal Flooding in
Rhode Island

Web Mapping Application



STORMTOOLS 101

Web Mapping Application



Advanced
STORMTOOLS Gallery

Web Mapping Application



Touring Historic
Storms in Rhode Island

Web Mapping Application



STORMTOOLS for
Beginners

Web Map



Science Behind
STORMTOOLS

PDF




 Details

 Basemap

 Share

 Print

 Measure

Seamens Church Institute of Newport, Newport, Rho X 

Legend

Will future SEA LEVEL RISE affect my property?

Sea Level Rise Scenarios:

MHHW Plus 1' SLR



MHHW Plus 2' SLR



MHHW Plus 3' SLR



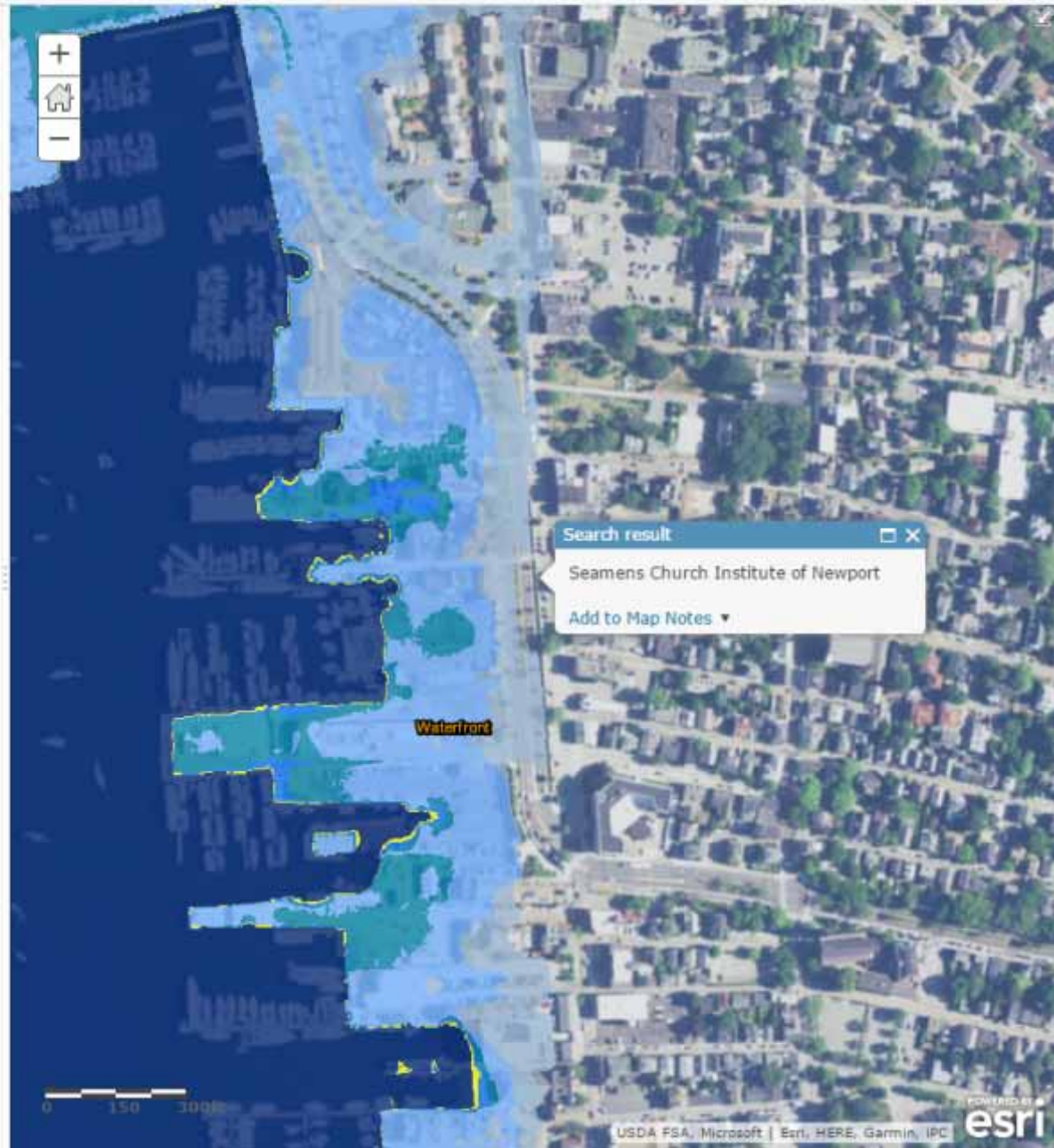
MHHW Plus 5' SLR



MHHW Plus 7' SLR



Mean Higher High Water (MHHW)



Details

Basemap

Share

Print

Measure

Seamens Church Institute of Newport, Newport, Rhode Island



Legend

Is my property vulnerable to a 100 year coastal storm (1% annual chance) and how DEEP will the water be?

- <= 1
- 2
- 4
- 6
- 8
- 10
- >10
- Adjacent Lowlying Area




 Details |  Basemap |  Share |  Print |  Measure | 

Legend

Is my property vulnerable to a 100 year coastal storm in 2050 (with 2' of sea level rise)?

-  <= 2
-  4
-  6
-  8
-  10
-  > 10
-  Lowlying



(2) MAP JOURNAL: Touring Historic Storms in Rhode Island

Touring Historic Storms in Rhode Island



Brought to you by the Rhode Island Coastal Resources Management Council, University of Rhode Island Environmental Data Center, University of Rhode Island Department of Ocean Engineering and Graduate School of Oceanography, Rhode Island Sea Grant and the Coastal Resources Center.

Scroll down through this panel to see the tour or click on the side buttons to jump ahead.

Zoom in and out on the map by scrolling your mouse. Click and drag your mouse on the map to pan around.

DISCLAIMER:

The user should recognize that these maps are based on simplified methods to estimate coastal inundation. The maps may be inaccurate or contain errors or omissions. More information on how these maps were developed is available at <http://www.edc.uri.edu/ftp/data/kowakowabdr/>

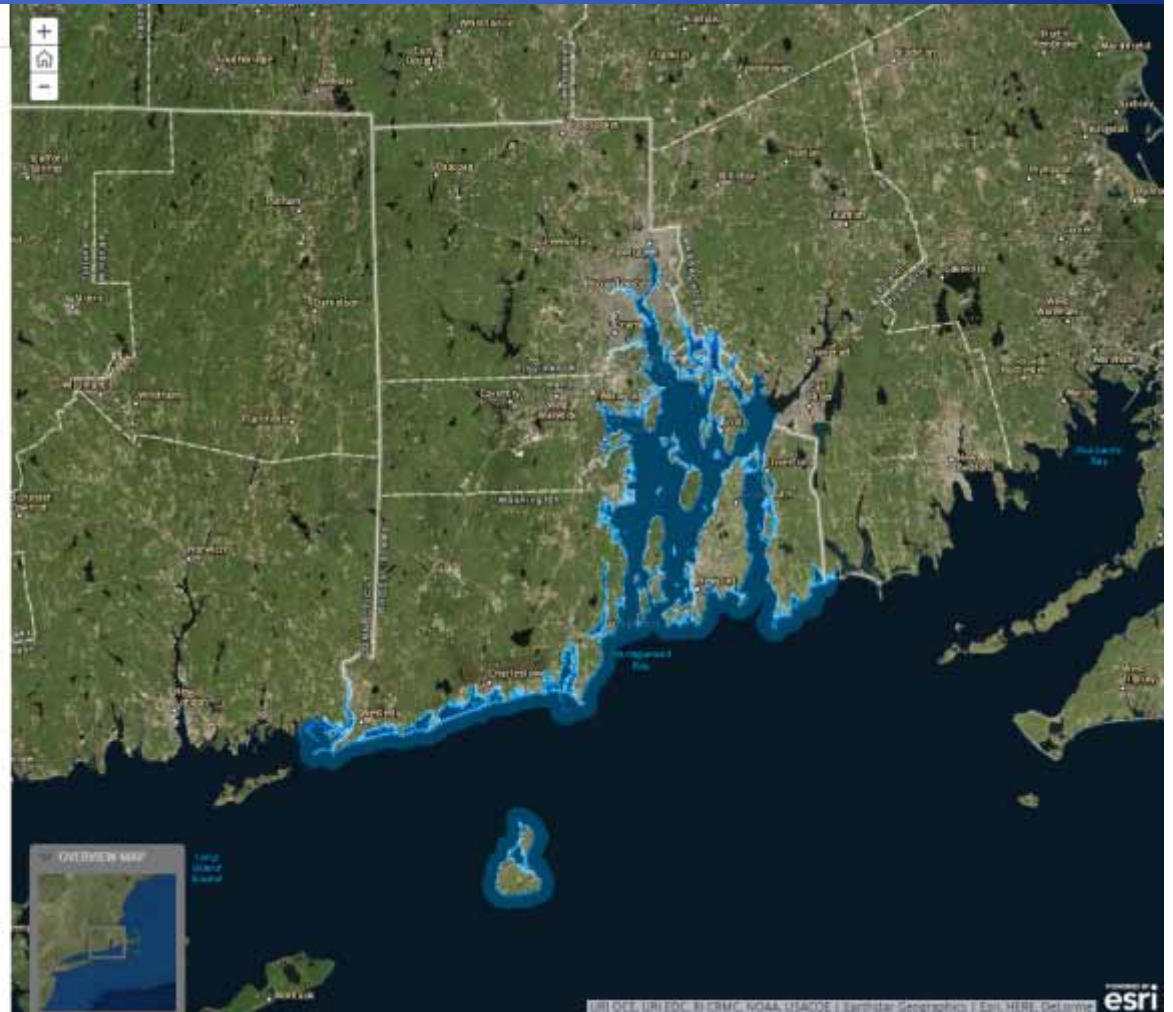
These maps were created for general reference, informational, planning or guidance use, and are not a legally authoritative source as to location of natural or man-made features. Proper interpretation of this map may require the assistance of appropriate professional services.

The University of Rhode Island's Environmental Data Center (EDC), which serves these maps, does not guarantee the accuracy or reliability of the data generated from this service. The user assumes full responsibility for the risks and damages that might result from using these maps or the underlying data.

These maps are not flood insurance rate maps and should not be used in place of them. Official FEMA Flood Insurance Rate Maps for RI are provided at:

<http://www.fema.gov/protection/flood/mapping.php>

STORMTOOLS



(2) MAP JOURNAL: Touring Historic Storms in Rhode Island

A story map from CRC

Touring Historic Storms in Rhode Island

Hurricane Carol (1954)

Hurricane Carol formed near the Bahamas on August 25th, 1954 and by August 30th the hurricane was about 130 miles east of Charleston, SC. It then accelerated and made landfall as a Category 3 hurricane over Long Island and Connecticut on the 31st.

Sustained winds of 80-100 mph were reported over much of eastern Connecticut, all of Rhode Island, and eastern Massachusetts. A peak gust of 130 mph was reported at Block Island.

Storm surge flooding occurred all along the New England Coast with water depths of 8-10 ft reported in downtown Providence.

Hurricane Carol caused \$3.7 billion in damage in 2010 dollars and was responsible for 60 deaths.

National Hurricane Center, NOAA

1954 Hurricane (Carol) - Westerly

Carol caused widespread destruction along our coasts. Towns from Westerly to Narragansett were almost completely destroyed with high winds and an incredibly high storm surge.



(2) MAP JOURNAL: Touring Historic Storms in Rhode Island

A Story Map from CH2M

Touring Historic Storms in Rhode Island

1954 Hurricane (Carol) - Westerly

Carol caused widespread destruction along our coasts. Towns from Westerly to Narragansett were almost completely destroyed with high winds and an incredibly high storm surge.



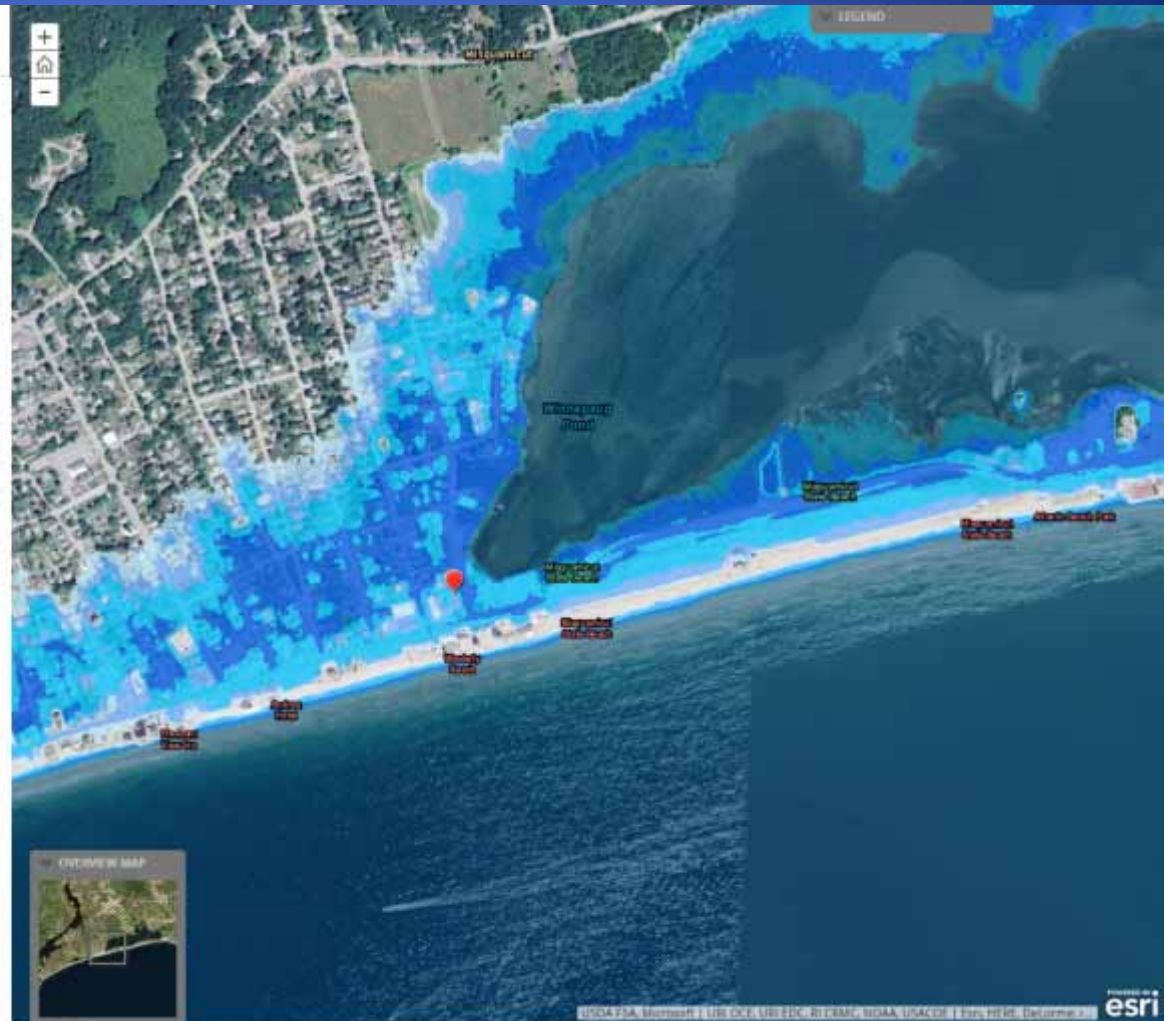
1954 Winnapaug pond (Janet Freedman, CRMQ)

Click on the blue flood areas to get a pop-up of the estimated flood depths in Hurricane Carol.

If you'd like to see how these historical storms affected your house, [click here](#).

1954 Hurricane - Charlestown

As you can see in the aerial photograph, East Charlestown is 1/2 a mile from the beach by road, and the area was almost completely destroyed.



(3) MAP JOURNAL: Coastal Flooding in Rhode Island

Coastal Flooding in Rhode Island

Future Flooding: 2050

Rhode Island may experience 2 feet of sea level rise by 2050 (NOAA).

Estimated Relative Sea Level Change Projections From 2010 To 2100 - Gauge: 8452860, Newport, RI (2.58 mm/yr)

Year	NOAA Low	NOAA In Low	NOAA In High	NOAA High
2010	0.0	0.0	0.0	0.0
2050	0.5	1.0	2.0	2.5
2100	1.0	2.0	4.0	6.5

This will mean not only a 2 foot higher high tide, 2 times per day, but it will also mean that flooding from storm surge will be worse.

Future Flooding in 2065

Rhode Island may experience about 3 feet of sea level rise by 2065.

Coastal Flooding in 2050

2 Feet of Sea Level Rise: The New High Tide | 25 Year Storm | 50 Year Storm | 100 year Storm

100 Year Coastal Storm with 2' Sea Level Rise (flooding in feet)

- <= 2
- 4
- 6
- 8
- 10
- > 10
- Lowlying

Today's High Tide (MHW)

Mean Higher High Water (MHHW)

Estimated Flood Depth During a 100 year coastal storm with 2' of Sea Level Rise

The flood depth at this point is estimated to be 10.62 ft.

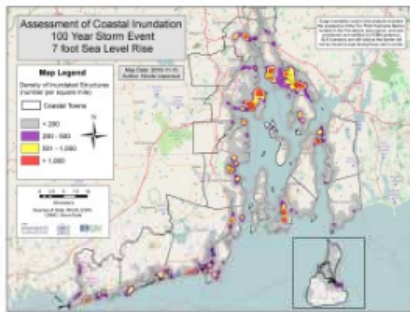
USDA FSA, Microsoft | URI OCE, RPS/ASA, URI EDC, RI CRMC, URI CRC

esri

RI Shoreline Change Special Area Management Plan



Rhode Island e911 Exposure Assessment



This page offers a summary of all exposed structures in each of the 21 coastal municipalities in Rhode Island within a variety of coastal flooding scenarios: (1) from twice-daily tides based on sea level rise projections to the year 2100; and, (2) from coastal storm events with and without sea level rise scenarios. The data contained in the spreadsheets below present the e911 structure type data sorted by coastal flooding scenario.

PLEASE SCROLL DOWN THE PAGE TO VIEW AND/OR DOWNLOAD THE SPREADSHEETS FOR YOUR AREA OF INTEREST.

About the e-911 data:

The "e911" dataset represents the locations of all structures in Rhode Island with known street addresses. Data have been summarized for this map based upon their primary usage at the time when the location of the structure was assessed in the field by a Rhode Island Enhanced 911

Uniform Emergency Telephone System contractor.

The map shown here illustrates one way to analyze these data. This map identifies coastal "hot spots" across Rhode Island where the highest number of structures per square mile are estimated to be exposed to flooding from a 100-year return period storm with 7-feet of sea level rise. Section 145 of RI CRMC's Coastal Resources Management Program "Red Book" identifies this 7-foot sea level rise scenario as a planning target for the year 2100 based on the US Army Corps of Engineers' Sea Level Change Curve Calculator, and the National Oceanic and Atmospheric Administration's "high curve" for projecting sea level rise in the future.

Excel Spreadsheet Table Information

Description: Verbal description of what each site type code represents.

Exposed Structures: Number of structures exposed by greater than 0 feet of water.

Total Structures (Municipality): Number of structures total in the town.

Total Structures (SLR7_100YR): Total number of structures exposed in the worst case scenario (maximum flood envelope) of sea level rise of 7 with a 100 year storm surge.

Percent (Municipality): Percent of structures exposed out of total structures in town.

Assessment of Coastal Inundation 100 Year Storm Event 7 foot Sea Level Rise

Surge inundation used in this analysis excludes the existence of the Fox Point Hurricane Barrier, located in the Providence area upriver, and was considered non-certified (in FEMA parlance). SLR scenarios are still valid as the barrier will not be closed except during these storm events.

Map Legend

Density of Inundated Structures
(number per square mile)

- Coastal Towns
- < 200
- 200 - 500
- 501 - 1,000
- > 1,000



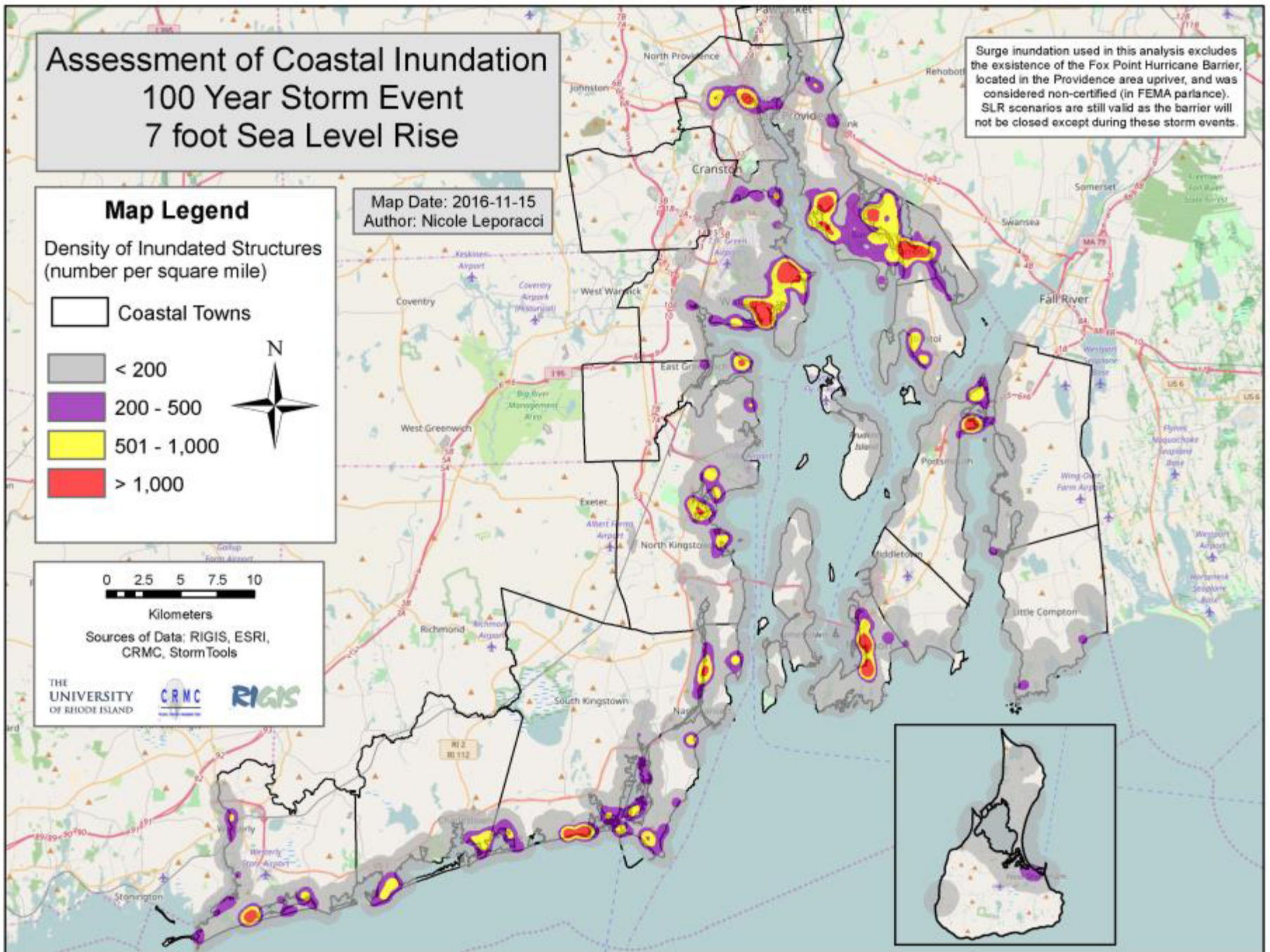
Map Date: 2016-11-15
Author: Nicole Leporacci

0 2.5 5 7.5 10

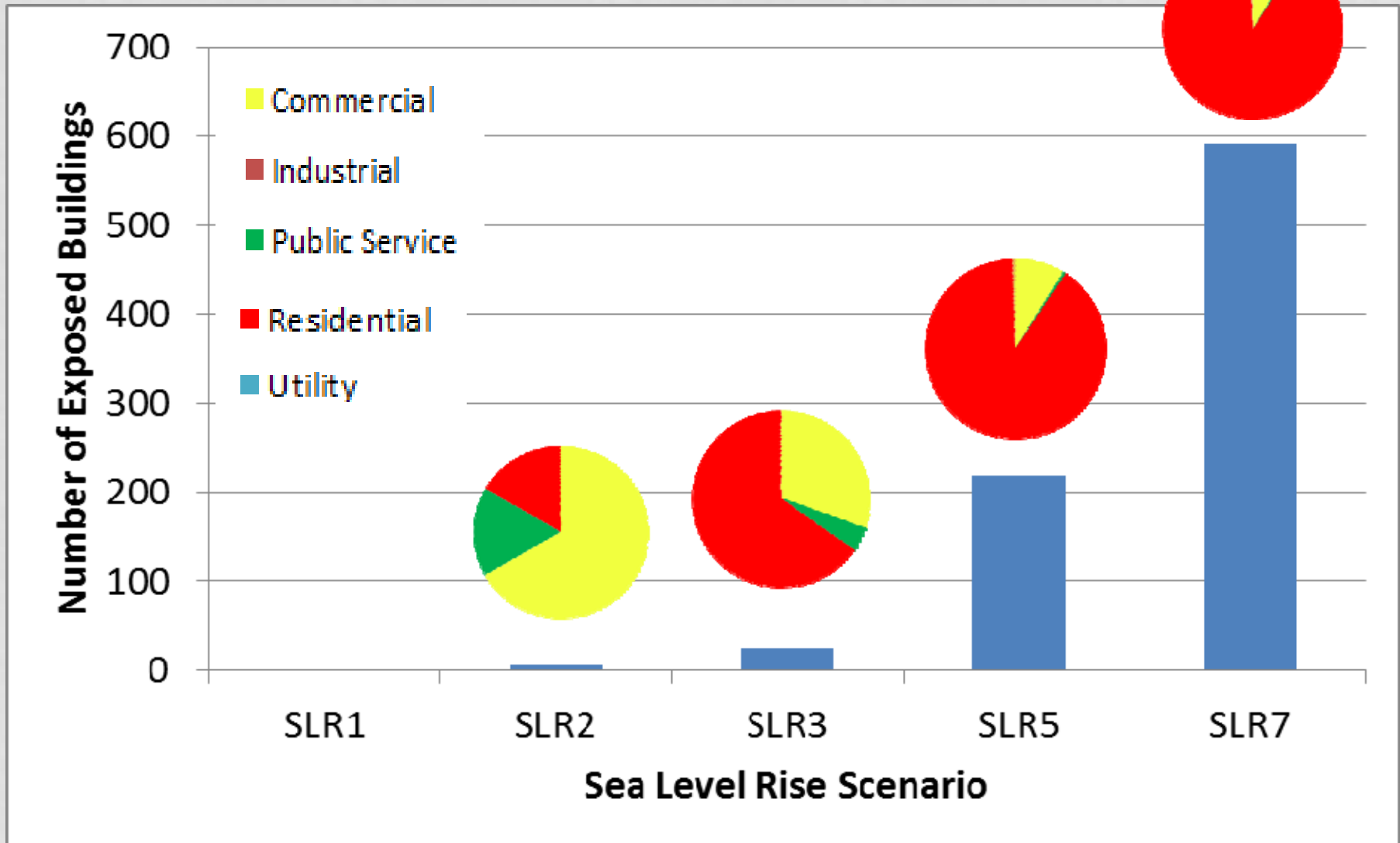
Kilometers

Sources of Data: RIGIS, ESRI,
CRMC, StormTools

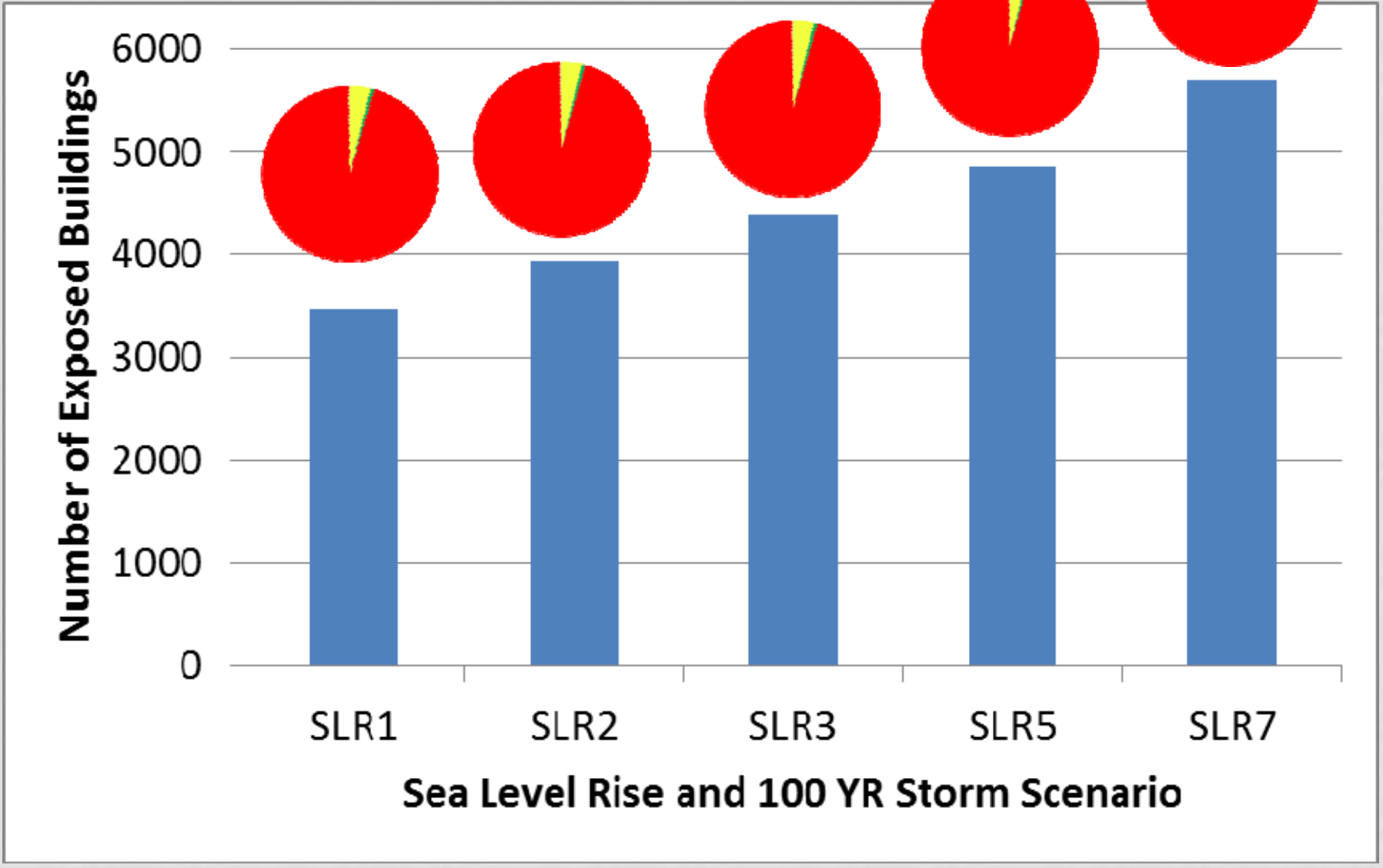
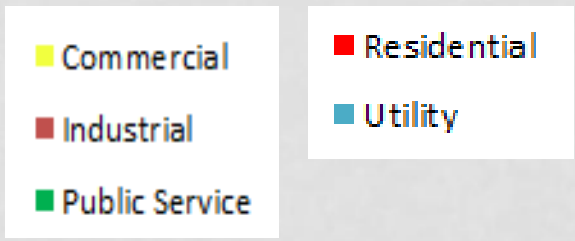
THE
UNIVERSITY
OF RHODE ISLAND



WARWICK



WARWICK



Sea Level Rise and 100 YR Storm Scenario

RI Shoreline Change Special Area Management Plan



[www.beachsamp.org/stormtools/e911/](#)

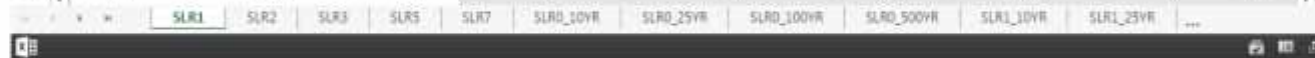
Newport

	A	B	C	D	E	F	G	H	I	J
1	Site	Descrip.	Exposed Buildings	Total Buildings (Town)	Total Buildings (SLR7_100YR)	Percent (Town)	Percent (SLR7_100YR)	0-2ft	2-4ft	4-6ft
13	CL	Lodging	0	98	28	0.0%	0.0%	0	0	0
14	DV	Development Site	0	15	7	0.0%	0.0%	0	0	0
15	ED	Dry Hydrant	0	0	0	0.0%	0.0%	0	0	0
16	ET	Public Telephone	0	0	0	0.0%	0.0%	0	0	0
17	G1	Gated w/o Building	0	4	1	0.0%	0.0%	0	0	0



North Kingstown

	A	B	C	D	E	F	G	H	I	J
1	Site	Descrip.	Exposed Buildings	Total Buildings (Town)	Total Buildings (SLR7_100YR)	Percent (Town)	Percent (SLR7_100YR)	0-2ft	2-4ft	4-6ft
15	ED	Dry Hydrant	0	0	0	0.0%	0.0%	0	0	0
16	ET	Public Telephone	0	0	0	0.0%	0.0%	0	0	0
17	G1	Gated w/o Building	0	14	12	0.0%	0.0%	0	0	0
18	G2	Gated w/Building	0	26	6	0.0%	0.0%	0	0	0
19	H1	House	0	17	17	0.0%	0.0%	0	0	0



Pawtucket

	A	B	C	D	E	F	G	H	I	J
1	Site	Descrip.	Exposed Buildings	Total Buildings (Town)	Total Buildings (SLR7_100YR)	Percent (Town)	Percent (SLR7_100YR)	0-2ft	2-4ft	4-6ft
15	ED	Dry Hydrant	0	0	0	0.0%	0.0%	0	0	0
16	ET	Public Telephone	0	0	0	0.0%	0.0%	0	0	0
17	G1	Gated w/o Building	0	1	0	0.0%	0.0%	0	0	0
18	G2	Gated w/Building	0	1	1	0.0%	0.0%	0	0	0
19	H1	House	0	0	0	0.0%	0.0%	0	0	0



Portsmouth

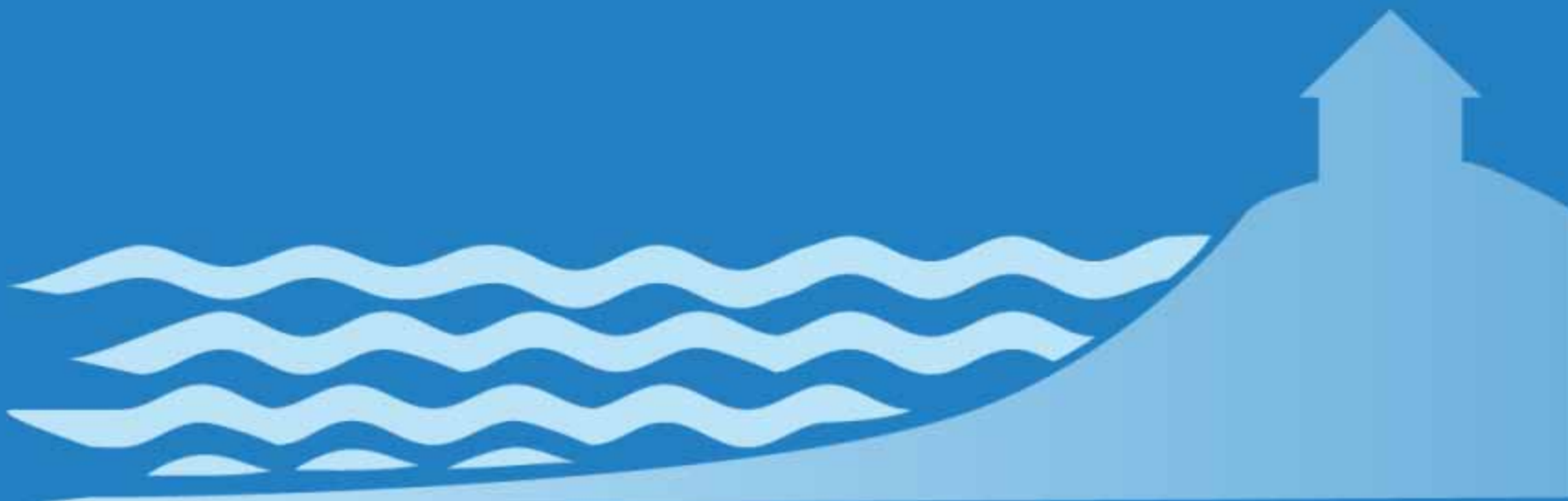
	A	B	C	D	E	F	G	H	I	J
1	Site	Descrip.	Exposed Buildings	Total Buildings (Town)	Total Buildings (SLR7_100YR)	Percent (Town)	Percent (SLR7_100YR)	0-2ft	2-4ft	4-6ft
13	CL	Lodging	0	17	0	0.0%	0.0%	0	0	0
14	DV	Development Site	0	36	1	0.0%	0.0%	0	0	0
15	ED	Dry Hydrant	0	0	0	0.0%	0.0%	0	0	0
16	ET	Public Telephone	0	0	0	0.0%	0.0%	0	0	0
17	G1	Gated w/o Building	0	8	0	0.0%	0.0%	0	0	0



Help Chronicle Our Changing Coast

[REGISTER](#)

Use MyCoast to document tides, storm damage, beach cleanups, and more. Coastal decision makers, emergency managers, and others use your reports to make better decisions.

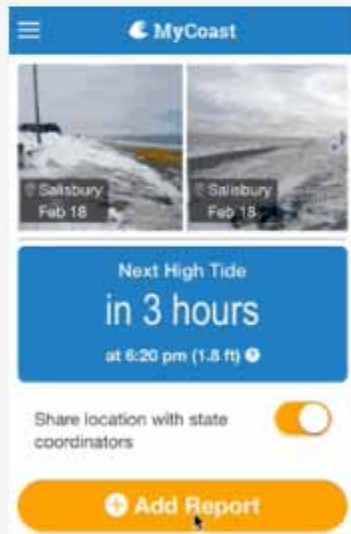




Of Course There's An App For That.

Our free apps (iOS and Android) make it effortless to add your data to MyCoast.

Download via the buttons below.



Ocean Ave | Newport County

[VIEW ON STORMTOOLS](#)

King Tide Report by **Katie Zilgme**



05/06/2016 | 8:11 pm

(0 hours 7 minutes before high tide)



Weather Overview



Wind Speed: 5.8 MPH
Wind Direction: 62°
Temperature: 47°F
Rainfall (Calendar Day): 0.16"
Rainfall (Past 24 Hours): 0.06"

[\(Click here for full weather details\)](#)

Tidal Overview

Data from **Newport** (4.1 miles away)

Water Level: 5.6' (observed MLLW)
Closest High Tide: 8:18 pm, 5.6' (observed)



Details | Basemap

Share | Print | Measure | Find address or place

About | Content | Legend

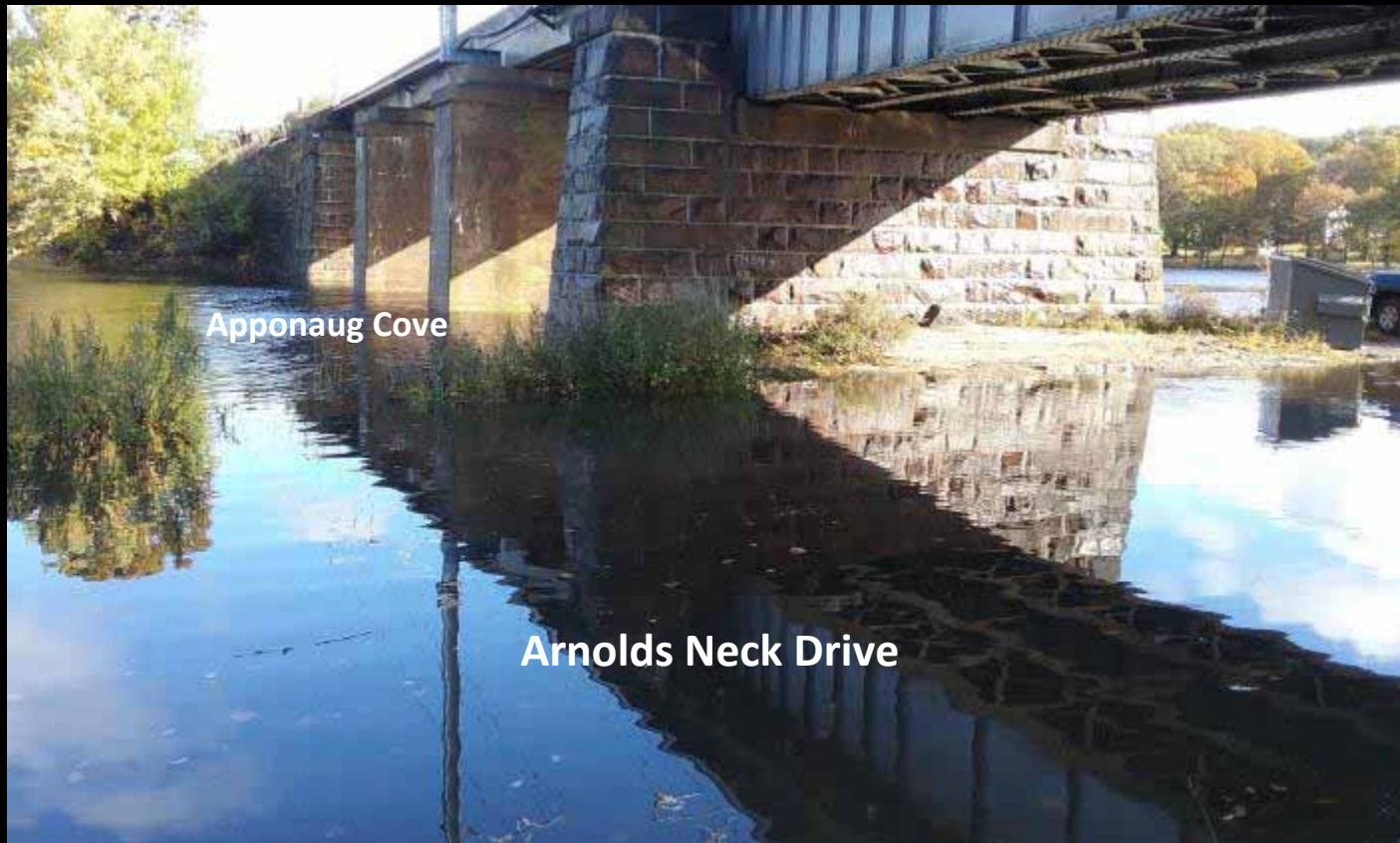
Legend

Will future SEA LEVEL RISE affect my property?

Sea Level Rise Scenarios

- MHHW Plus 1' SLR
- MHHW Plus 2' SLR
- MHHW Plus 3' SLR
- MHHW Plus 5' SLR
- MHHW Plus 7' SLR

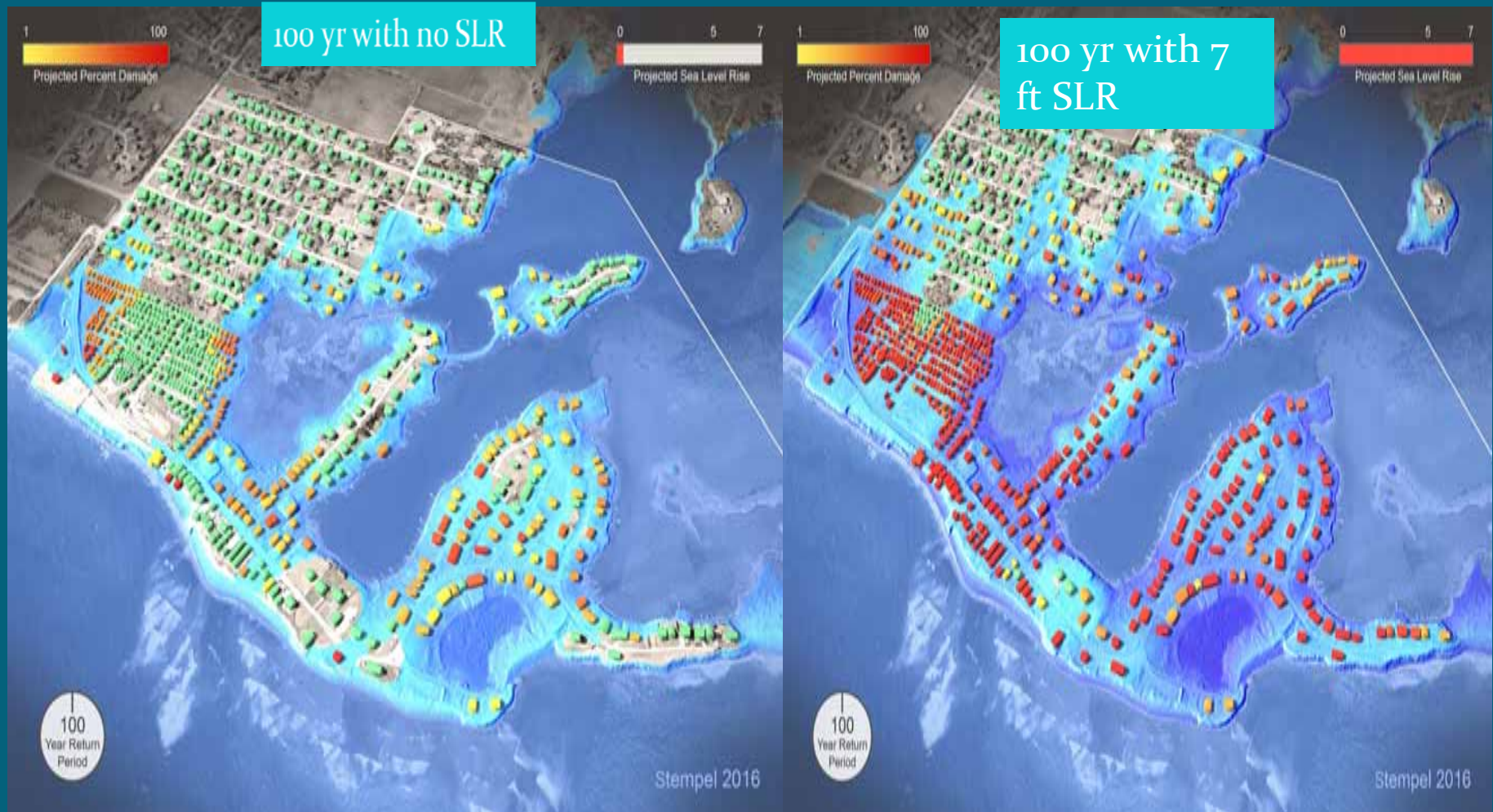




- NWS coastal flood warnings
- Identify places susceptible to flooding
 - For road closures
 - For planning initiatives
- Verify SLR modeling - STORMTOOLS
- Visualize impacts of future sea levels

Visualization Tools in Progress

(Stempel, 2016)





Coastal Adaptation Strategies

Planning for the Storm Ahead



Adaptation Categories

Protect



Photo: ecoRI News, Frank Carini

Accommodate

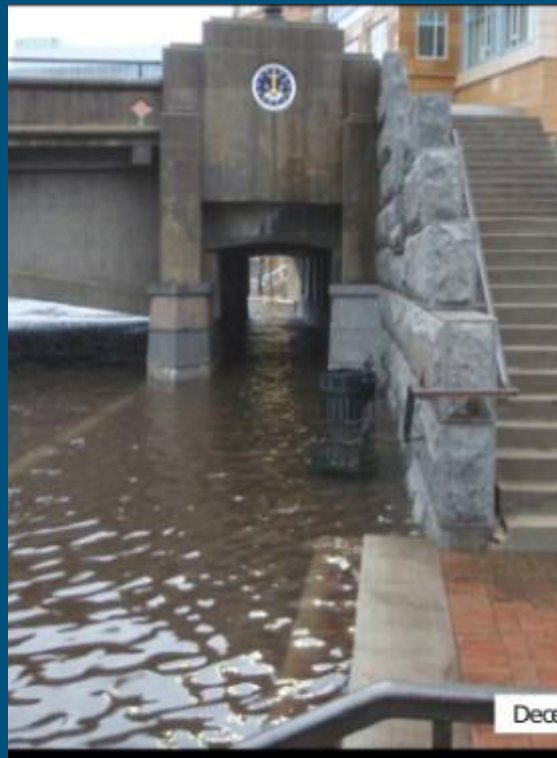


Photo: RISG SlideShare

Avoid



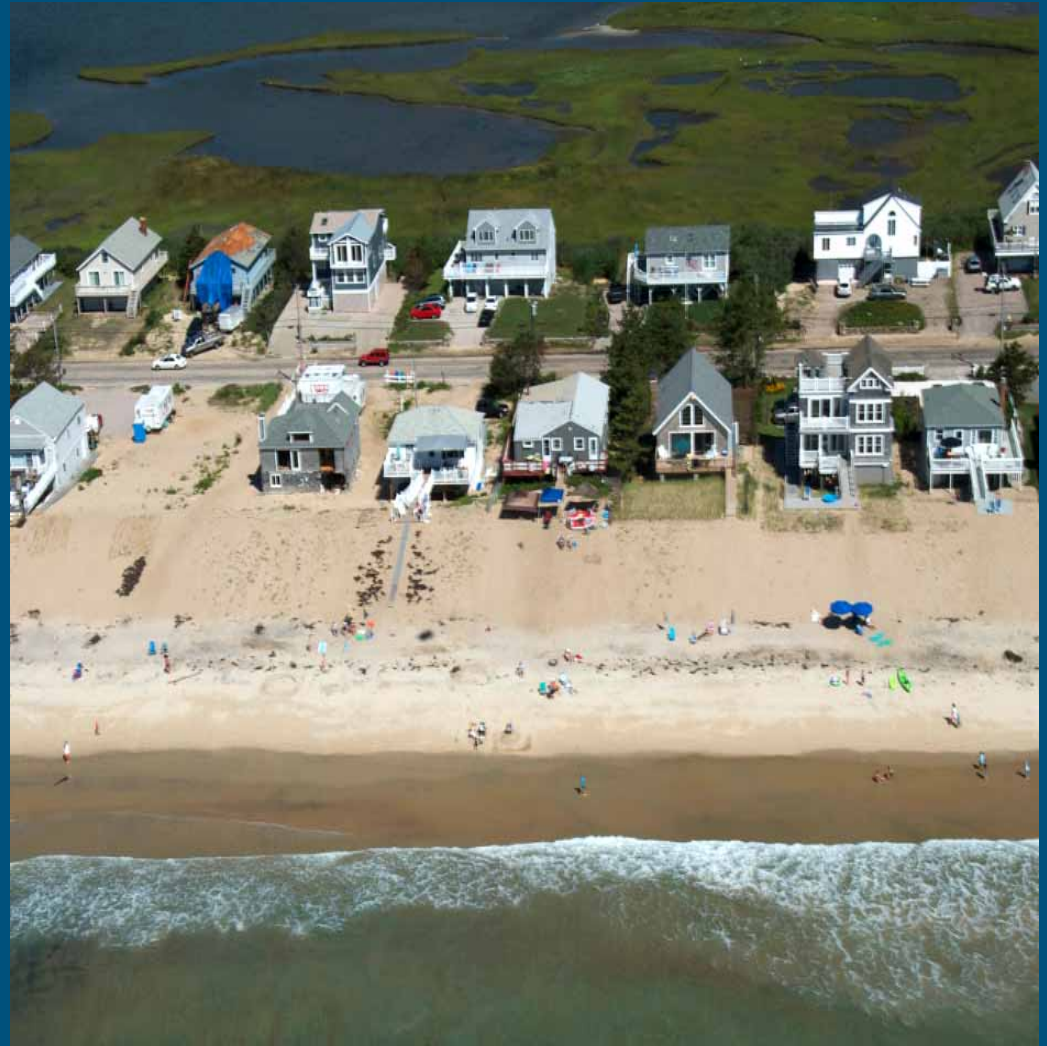
Photo: RISG Flickr

Town Planning, Operations, and Decision Making: Land Use Decision Making

Managed Retreat

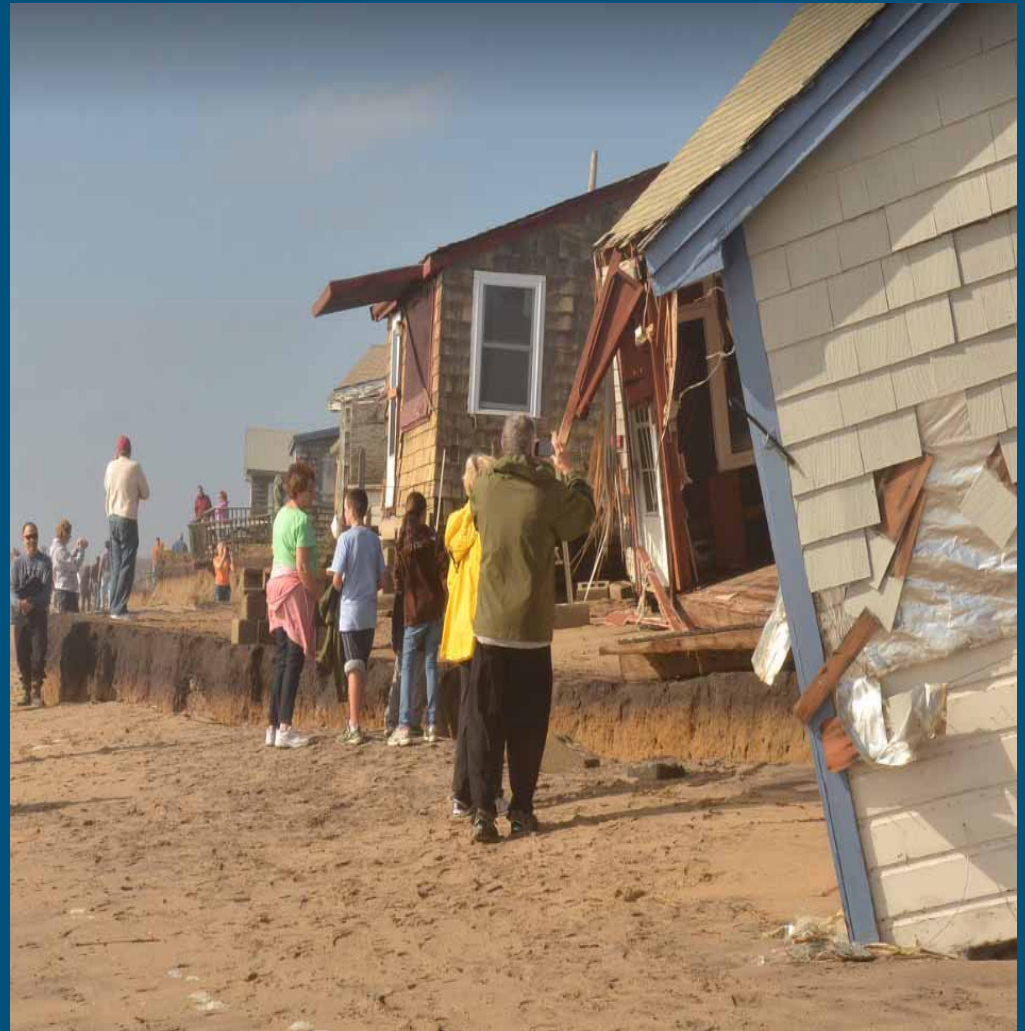
- avoid developing hazardous locations, allow ecosystems to migrate landward as sea level rises

Image: RISG Flickr



Town Planning, Operations, and Decision Making: Storm Planning and Recovery

Image: Hurricane Sandy Damage, RISG
Flickr



Transportation Infrastructure: Emergency Vehicles

- A fire truck navigates a flooded road to reach an emergency during Hurricane Sandy

Image: RISG Flickr



Green Infrastructure: Shoreline Protection and Erosion

Photo: RISG Flickr, Post-Sandy



Green Infrastructure: Stormwater and Flooding

text and image - NOAA - <http://www.floodsafety.noaa.gov/states/ri-flood.shtml>

Inundation surrounding and through the Warwick Mall due to floodwaters from the Pawtuxet River.

Increases in impervious surface exacerbate stormwater and flooding especially in low-lying urban areas



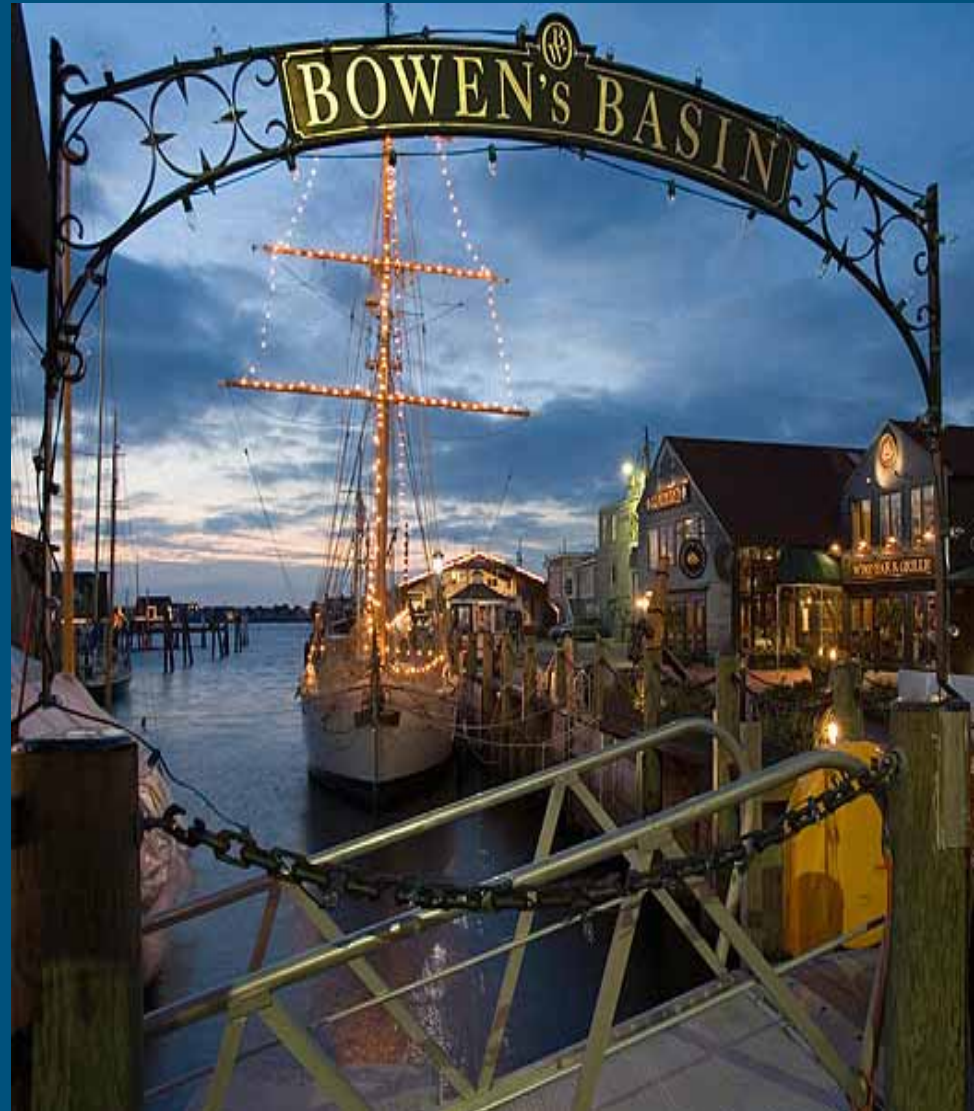
Wetland Restoration

Image: RISG?



Waterfront and Coastal Businesses: Business Continuity

Image: www.BowensWarf.com gallery



Waterfront and Coastal Businesses: Marina Assessment Tool



Image: Watch Hill, Westerly, RISG Flickr

Call to Proactive Work at State Level

“Lead By Example”

1. Leadership

- RI Executive Climate Change Coordinating Council (EC4)
- RI CRMC Beach SAMP
- RI Statewide Planning Program – transportation vulnerability assessment & socioeconomic analysis

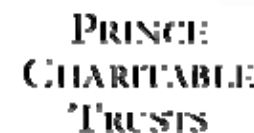
2. Money & funding mechanisms

- Federal Grants – NOAA, HUD, FEMA, DOI/NFWF, DHS
- State TIP (FHWA)
- Municipal Capital Improvement Programs

3. Implementation

- Monitoring & Evaluation

Building Tools in Partnership



Climate Adaptation for Coastal Communities



Helping Municipalities with Climate Change Adaptation and Mitigation

March 11, 2017, RI Land and Water Summit, Kingston, RI

Thomas Ardito, Executive Director, Aquidneck Island Planning Commission

Teresa Crean, AICP URI Coastal Resources Center / RI Sea Grant



Aquidneck Island
PLANNING COMMISSION

THE
UNIVERSITY
OF RHODE ISLAND



COASTAL
RESOURCES
CENTER
URI • GSO

Sea Grant
Rhode Island