Municipal Work Session on Adaptation Planning for Coastal Hazards- New Shoreham, RI

Town Hall
October 22, 2015
1:00pm-4:00pm

Agenda

Meeting Purpose: Increase awareness of:

- RI Mapping tools & planning resources available, where to find them(particularly STORMTOOLS);
- New state planning requirements for climate change and natural hazards, as well as the linkages between comprehensive plans and local hazard mitigation plans; and
- Example municipal adaptation strategies and where to get more information.

1:00 **Welcome & Introductions**

- ***Please share one issues of concern of yours related to planning for natural hazards & climate change?***

1:15 **Overview of Issues and Ongoing Initiatives-**Teresa Crean, URI Graduate School of Oceanography Coastal Resources Center & RI Sea Grant (CRC/RISG)

- RI Shoreline Change Special Area Management Plan- Grover Fugate, *RI Coastal Resources Management Council*
- Shoreline Change Mapping & Monitoring on Block Island- *Bryan Oakley, Eastern Connecticut State Univ.*
- Natural Hazards & Climate Change in Local Comprehensive Plans- *Caitlin Greeley, RI Statewide Planning*
- Hazard Mitigation Planning- *Jess Stimson*, *RI Emergency Management Agency*

1:45 **Discussion** –

- *Where are you at currently with your Comp Plan and Haz Mit Plan?*
- *Have you started to plan for or adapt to sea level rise, storms, or erosion?*
- *Issues you are struggling with related to coastal hazards & adaptation?*

2:00 **Break**

2:20 **Overview of STORMTOOLS: A new RI tool developed to understand exposure to sea level rise & storm flooding** – Michelle Carnevale, CRC/RISG

2:30 **Review of Adaptation Strategies**– Teresa Crean, CRC/RISG

3:00 **Keypad Polling & Discussion**- Michelle Carnevale, CRC/RISG

3:30 **Roadway & Infrastructure Discussion**– Teresa Crean, CRC/RISG

3:50 **Wrap Up & Next Steps-** Dawn Kotowicz, CRC/RISG

- What are your challenges/barriers?
- What do you need help with?
- What are some actions that you can start working on in the short term? No regret actions?

4:00 **Adjourn**

This effort has been made possible through funding from the U.S. Department of Housing and Urban Development & the Rhode Island Community Development Block Grant – Hurricane Sandy Disaster Recovery

www.beachsamp.org

CRMC Coastal Resources Management Council

The University of Rhode Island Graduate School of Oceanography | CRC Coastal Resources Center

Sea Grant Rhode Island

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Town of New Shoreham - October 22, 2015

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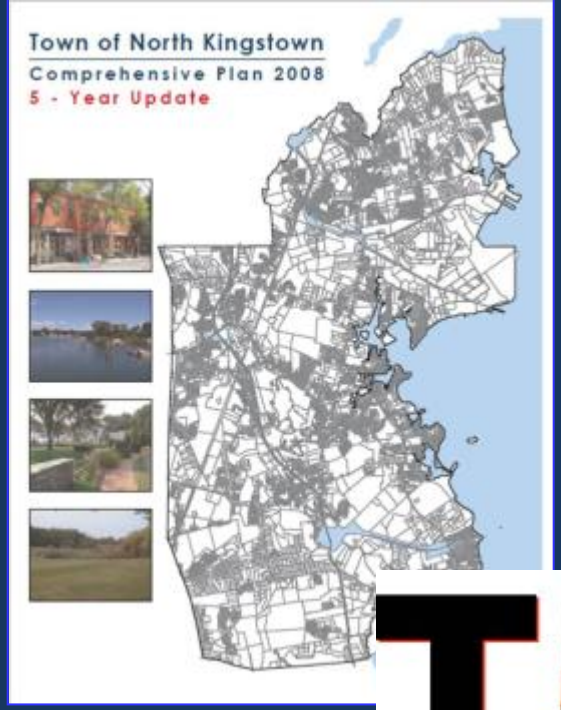
Drivers to Plan for Natural Hazards & Climate Change

- **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

Local Applications

- Comprehensive Plan / Regulatory
- Hazard Mitigation
- Municipal Capital Improvement Plan
- State of RI Transportation Improvement Program (TIP)
- Building Code
- Open space acquisition
- Incorporate into town GIS and IMS
- Community Rating System (CRS)



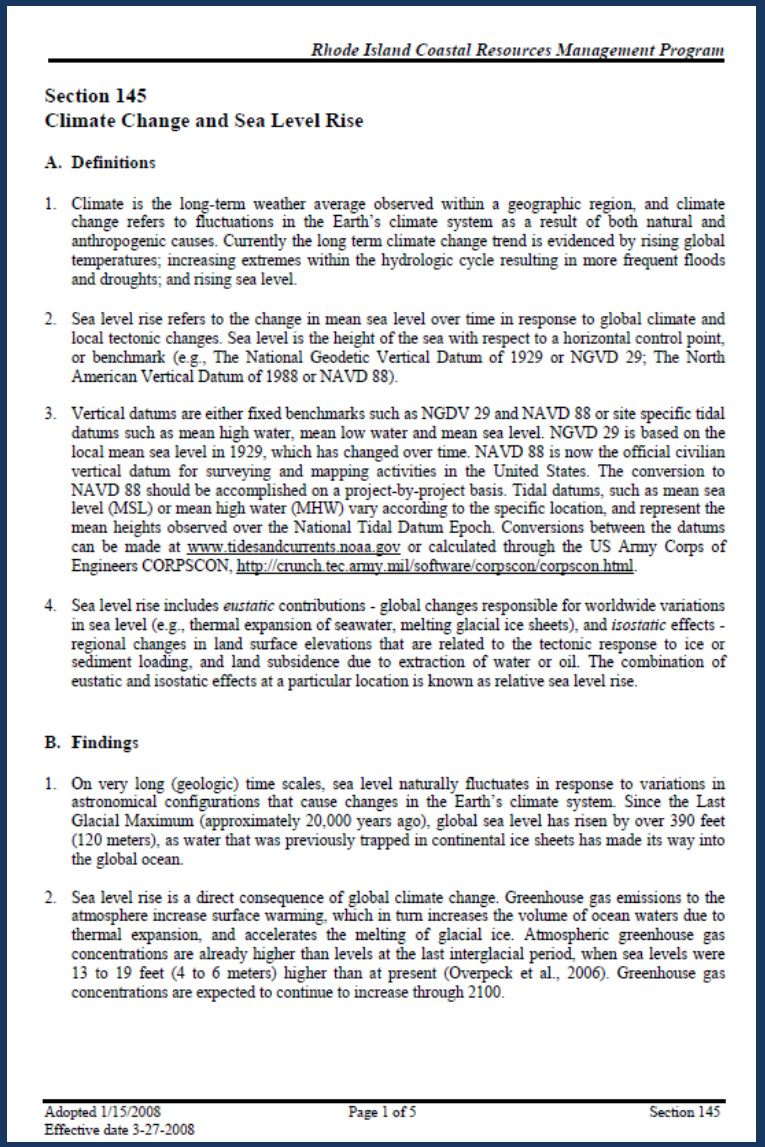
State Policies

RI Sea Level Rise Policy

- RI CRMC Red Book Section 145
- 3-5’ by 2100

Comprehensive Plans

- Rhode Island 2012 Comprehensive Planning and Land Use Act update
- Requirement for plans to address Natural Hazards



Section 145
Climate Change and Sea Level Rise

A. Definitions

1. Climate is the long-term weather average observed within a geographic region, and climate change refers to fluctuations in the Earth’s climate system as a result of both natural and anthropogenic causes. Currently the long term climate change trend is evidenced by rising global temperatures; increasing extremes within the hydrologic cycle resulting in more frequent floods and droughts; and rising sea level.

2. Sea level rise refers to the change in mean sea level over time in response to global climate and local tectonic changes. Sea level is the height of the sea with respect to a horizontal control point, or benchmark (e.g., The National Geodetic Vertical Datum of 1929 or NGVD 29; The North American Vertical Datum of 1988 or NAVD 88).

3. Vertical datums are either fixed benchmarks such as NGDV 29 and NAVD 88 or site specific tidal datums such as mean high water, mean low water and mean sea level. NGVD 29 is based on the local mean sea level in 1929, which has changed over time. NAVD 88 is now the official civilian vertical datum for surveying and mapping activities in the United States. The conversion to NAVD 88 should be accomplished on a project-by-project basis. Tidal datums, such as mean sea level (MSL) or mean high water (MHW) vary according to the specific location, and represent the mean heights observed over the National Tidal Datum Epoch. Conversions between the datums can be made at www.tidesandcurrents.noaa.gov or calculated through the US Army Corps of Engineers CORPSCON, http://crunch.tec.army.mil/software/corpscon/corpscon.html.

4. Sea level rise includes *eustatic* contributions - global changes responsible for worldwide variations in sea level (e.g., thermal expansion of seawater, melting glacial ice sheets), and *isostatic* effects - regional changes in land surface elevations that are related to the tectonic response to ice or sediment loading, and land subsidence due to extraction of water or oil. The combination of eustatic and isostatic effects at a particular location is known as relative sea level rise.

B. Findings

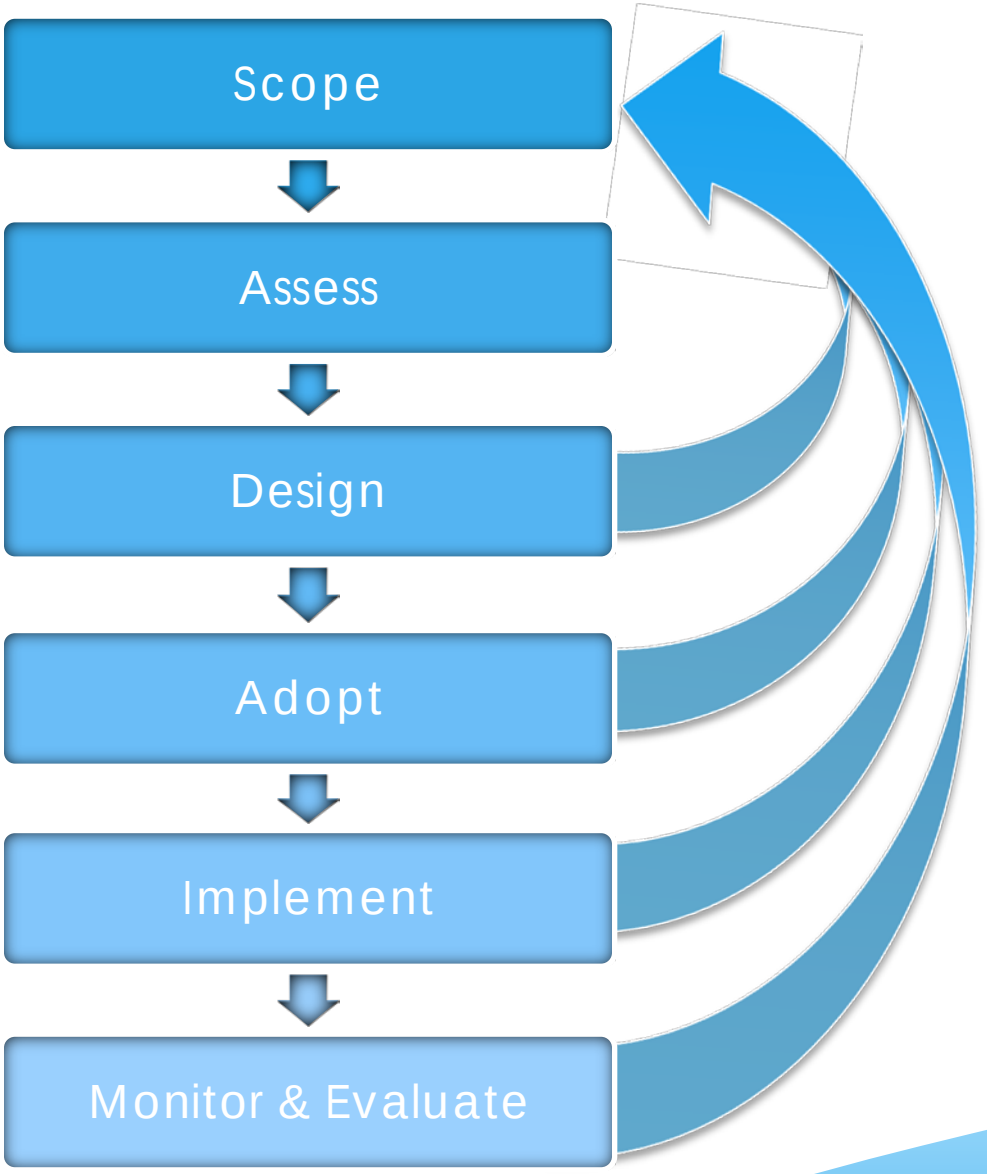
1. On very long (geologic) time scales, sea level naturally fluctuates in response to variations in astronomical configurations that cause changes in the Earth’s climate system. Since the Last Glacial Maximum (approximately 20,000 years ago), global sea level has risen by over 390 feet (120 meters), as water that was previously trapped in continental ice sheets has made its way into the global ocean.

2. Sea level rise is a direct consequence of global climate change. Greenhouse gas emissions to the atmosphere increase surface warming, which in turn increases the volume of ocean waters due to thermal expansion, and accelerates the melting of glacial ice. Atmospheric greenhouse gas concentrations are already higher than levels at the last interglacial period, when sea levels were 13 to 19 feet (4 to 6 meters) higher than at present (Overpeck et al., 2006). Greenhouse gas concentrations are expected to continue to increase through 2100.

New Federal Flood Risk Management Standard

Executive Order 11988 as amended by Executive Order 13690

- **Requires federal projects be constructed to a higher vertical elevation to address current and future flood risk and ensure that projects funded with taxpayer dollars last as long as intended.**
- **Draft standard - out for public comment until May 2015**
- **Applies to federal projects, including projects using federal funding**
- **Projects will need to comply with one of the following:**
  - **Conducting a full vulnerability assessment (using best available science);**
  - **Adding 2 or 3 feet of elevation/freeboard, (depending on criticality), above the 100-year, or 1% annual chance, flood elevation; or**
  - **Designing to the 500-year, or 0.2% annual chance, flood elevation.**



- ✓ Stakeholder engagement throughout
- ✓ Each step should be reviewed to see how it compares to initial scope & assessment

Process

Differentiating between :

Storm Flooding

(Periodic/Infrequent)

- Coastal & Storm Surge Driven
- Precipitation Driven

Sea Level Rise Flooding

(Daily; 2 times each day at high tide)

Sea-Level Change Curve Calculator

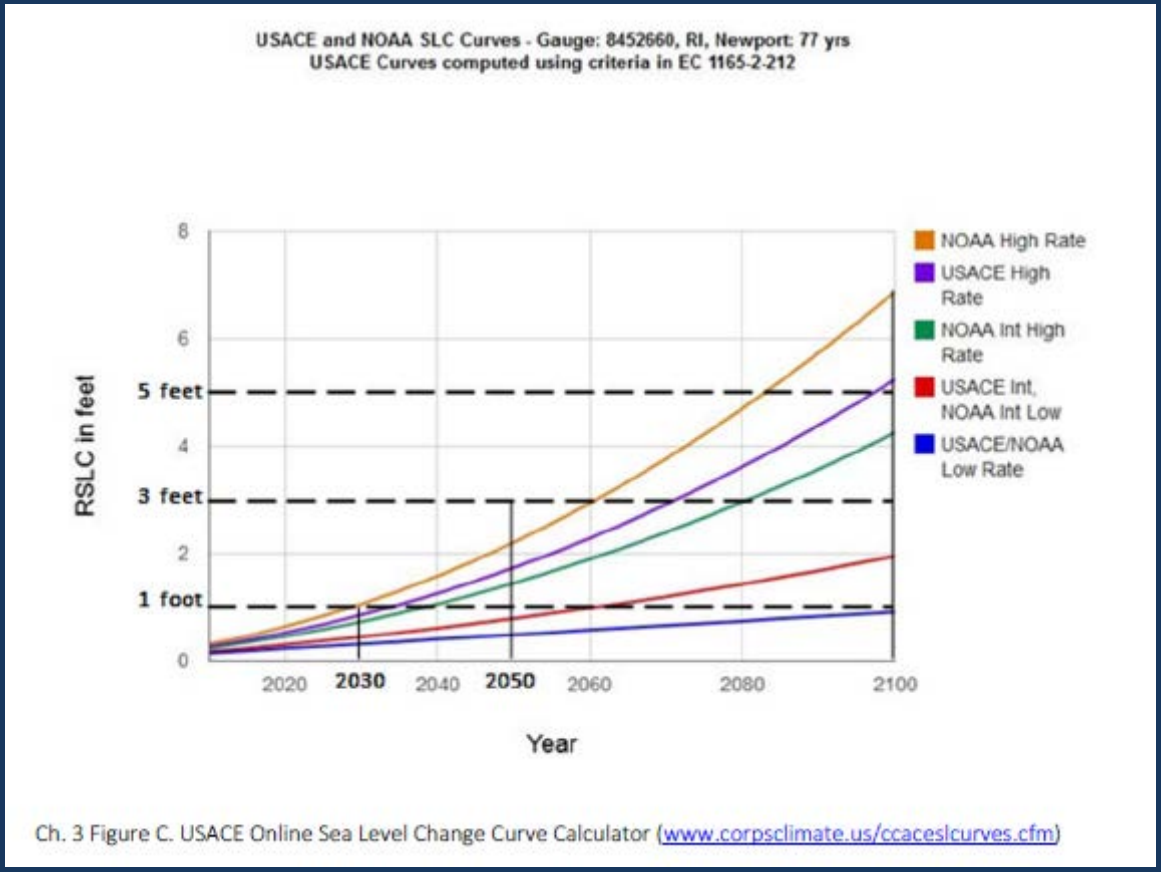
USACE Curves computed using criteria in USACE EC 1165-2-212

NOAA Curves computed using criteria in NOAA SLR Report 06-Dec-2012

Gauge: 8452660, RI, Newport: 77 yrs
All values are in feet

Year	NOAA Low	USACE Low	NOAA Int Low	USACE Int	NOAA Int High	USACE High	NOAA High
2010	0.15	0.15	0.18	0.18	0.24	0.27	0.32
2015	0.19	0.19	0.24	0.24	0.35	0.39	0.46
2020	0.24	0.24	0.31	0.31	0.46	0.53	0.64
2025	0.28	0.28	0.38	0.38	0.59	0.68	0.84
2030	0.32	0.32	0.45	0.45	0.73	0.86	1.06
2035	0.36	0.36	0.53	0.53	0.89	1.05	1.31
2040	0.41	0.41	0.61	0.61	1.06	1.26	1.58
2045	0.45	0.45	0.70	0.70	1.25	1.49	1.88
2050	0.49	0.49	0.79	0.79	1.45	1.74	2.21
2055	0.53	0.53	0.89	0.89	1.67	2.00	2.56
2060	0.58	0.58	0.99	0.99	1.90	2.29	2.94
2065	0.62	0.62	1.09	1.09	2.14	2.59	3.34
2070	0.66	0.66	1.20	1.20	2.40	2.92	3.77
2075	0.70	0.70	1.32	1.32	2.67	3.26	4.22
2080	0.74	0.74	1.43	1.43	2.96	3.62	4.70
2085	0.79	0.79	1.56	1.56	3.26	3.99	5.21
2090	0.83	0.83	1.68	1.68	3.57	4.39	5.74
2095	0.87	0.87	1.82	1.82	3.90	4.80	6.29
2100	0.91	0.91	1.95	1.95	4.25	5.24	6.87

Ch. 3 Figure B. USACE Online Sea Level Change Curve Calculator (www.corpsclimate.us/ccaceslcurves.cfm)



Ch. 3 Figure C. USACE Online Sea Level Change Curve Calculator (www.corpsclimate.us/ccaceslcurves.cfm)

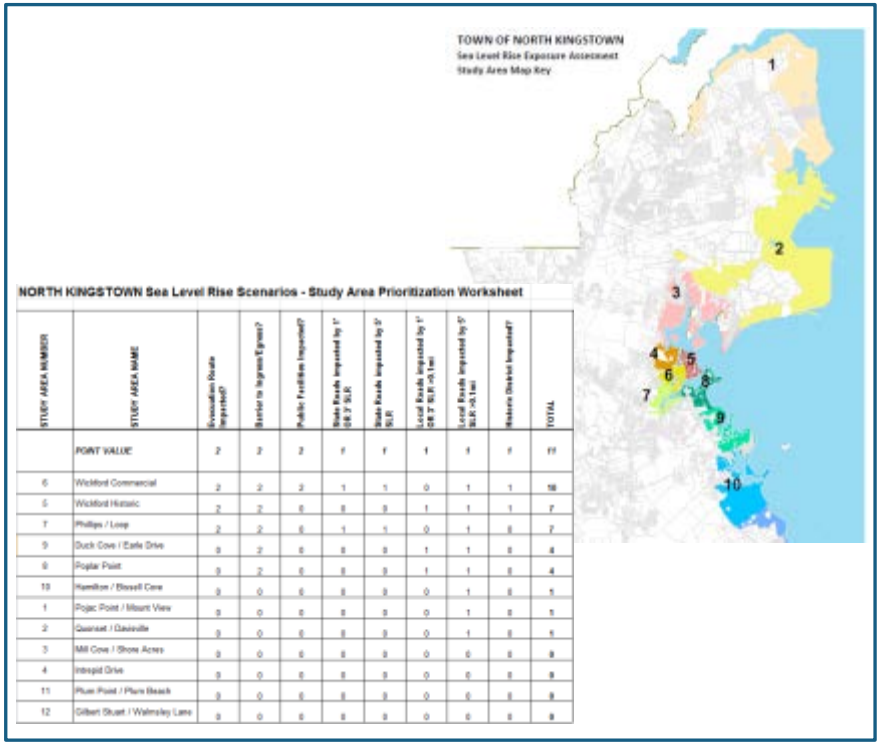
www.corpsclimate.us

Example- Synthesis of Exposed Assets:

ASSESS

SECTOR	Example of Quantitative or Qualitative Description of Impacts from Coastal Storm Flooding or Sea Level Rise Scenarios
Land Use	• # of properties impacted and % residential, commercial, vacant land, etc.
Transportation	• X linear feet (Y miles) of roadway • Evacuation Routes vulnerable include…
Publically Owned Properties	• # of properties impacted (federal; state; municipal)
Emergency Management Facilities	• Description of how emergency shelters, evacuation routes, police and fire stations are impacted
Wastewater	• Description of how sewers, onsite wastewater systems, wastewater outfalls are impacted
Stormwater Management	• Description of how catch basins, culverts or stormwater basins will be impacted
Drinking Water	• Impacts to municipal & residential wells, distribution systems. contamination of water table
Wetlands	• Acreage of wetlands lost, gain or shifted with sea level rise
Historic and Cultural	• # and type of sites impacted
Contaminated Sites	• # and type of sites impacted
Energy	• Summary of the # and type of critical utilities located in at risk areas

Prioritization Methodology



NORTH KINGSTOWN Sea Level Rise Scenarios - Study Area Prioritization Worksheet

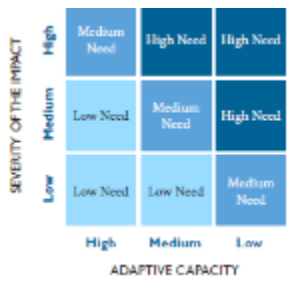
STUDY AREA NUMBER	STUDY AREA NAME	Evacuation Route Impacted?	Barrier to Ingress/Egress?	Public Facilities Impacted?	State Roads Impacted by 1' SLR	State Roads Impacted by 3' SLR	Local Roads Impacted by 1' SLR +0.1wi	Local Roads Impacted by 3' SLR +0.1wi	Historic District Impacted?	TOTAL
	POINT VALUE	2	2	2	1	1	1	1	1	11
6	Wickford Commercial	2	2	2	1	1	0	1	1	10
5	Wickford Historic	2	2	0	0	0	1	1	1	7
7	Phillips / Loop	2	2	0	1	1	0	1	0	7
9	Duck Cove / Eade Drive	0	2	0	0	0	1	1	0	4
8	Poplar Point	0	2	0	0	0	1	1	0	4
10	Hamilton / Bissell Cove	0	0	0	0	0	0	1	0	1
1	Pojac Point / Mount View	0	0	0	0	0	0	1	0	1
2	Quonset / Davisville	0	0	0	0	0	0	1	0	1
3	Mill Cove / Shore Acres	0	0	0	0	0	0	0	0	0
4	Intrepid Drive	0	0	0	0	0	0	0	0	0
11	Plum Point / Plum Beach	0	0	0	0	0	0	0	0	0
12	Gilbert Stuart / Walmsley Lane	0	0	0	0	0	0	0	0	0

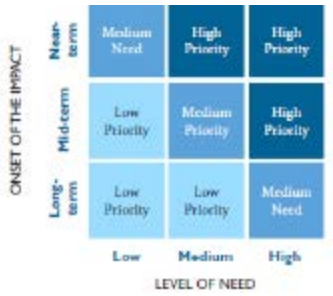
- Study areas/ neighborhoods to address

IMPACT PRIORITIZATION TOOL - SAMPLE

Impact Statement: "Bayfront Park" will be impacted by coastal erosion.

IMPACTS	IMPACT SEVERITY (high, medium, low)	ADAPTIVE CAPACITY (high, medium, low)	LEVEL OF NEED (high, medium, low)	ONSET	PRIORITY (high, medium, low)
Loss of bayfront walkway	Medium	High	Low Need	Near-term	Low
Loss of fishing area	Low	Low	Medium Need	Near-term	High
Interrupted use of only park in neighborhood	Medium	Low	High Need	Near-term	High





- Impacts to address

Local Adoption :

- Formal Adoption
- Guidance
- Incorporation into Standard Operating Procedures

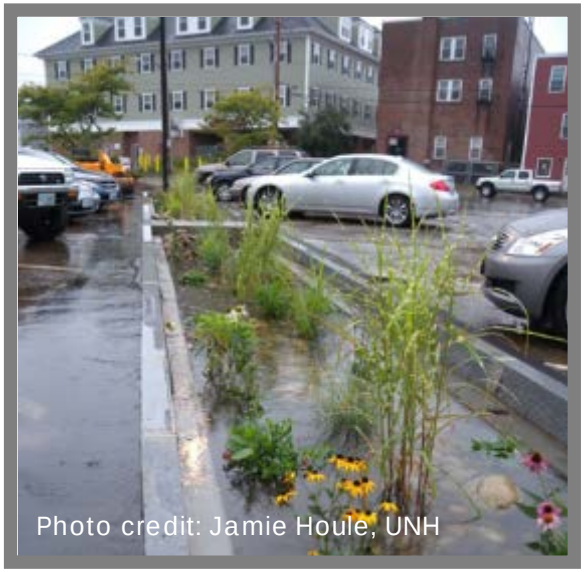


Photo credit: Jamie Houle, UNH


Photo credit: Save the Bay


Photo credit: Pam Rubinoff, RISG

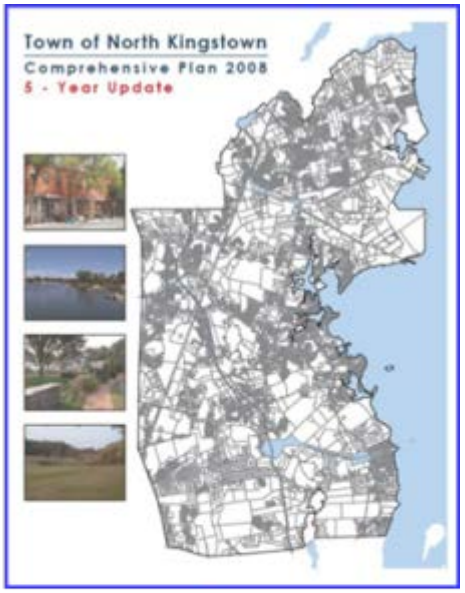

Photo credit: Pam Rubinoff, RISG

IMPLEMENT

Implementing Adaptation Measures:

- Adaptation Funding
- Governance
- Leadership
- Local Capacity Building
- Modify Municipal Operations, Departmental Duties & Processes

Emergency Management Cycle



MONITOR & EVALUATE

- **Mainstream Into Annual/Regular Updates**
  - Annual CIP or Biannual TIP, Hazard mitigation priorities
  - 5 year Comprehensive Plan Implementation Report
  - Hazard Mitigation Review
  - NFIP Community Rating System (CRS) Audit
- **Capture Lessons Learned**
- **Compare to State Policy**
- **Create database of impacts & losses**

Shoreline Change Special Area Management Plan (Beach SAMP)

Municipal Work Session on Adaptation Planning for Coastal Hazards

Town of Narragansett - October 1, 2015

CRMC Coastal Resources Management Council

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Sea Grant Rhode Island

RI CRMC Shoreline Change Special Area Management Plan

PROJECT GOAL:

- Through a public process help develop innovative and practical policies and tools for managing development along shorelines vulnerable to erosion and flooding


Melissa Devine, 2012


Melissa Devine, 2012


Hurricane Irene, RI Sea Grant


Lynne Harrington, Pawtuxet Cove 2012

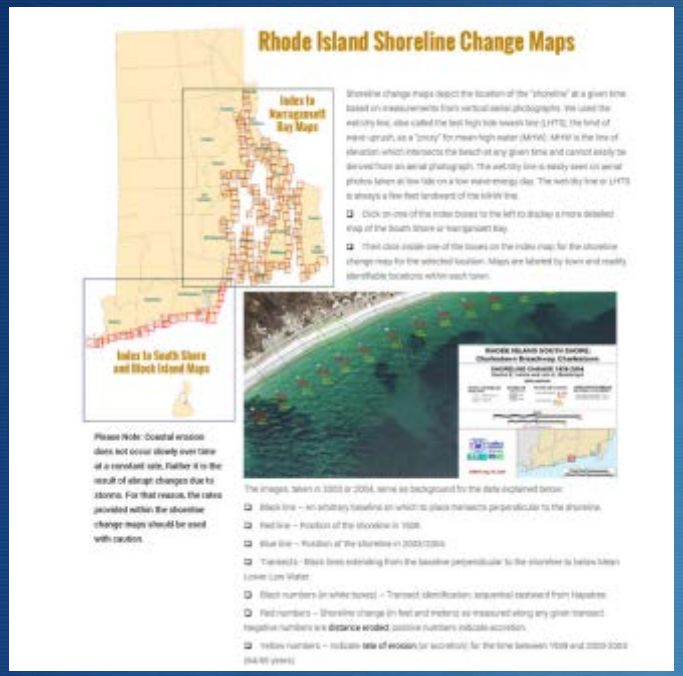
Long-term Outcomes

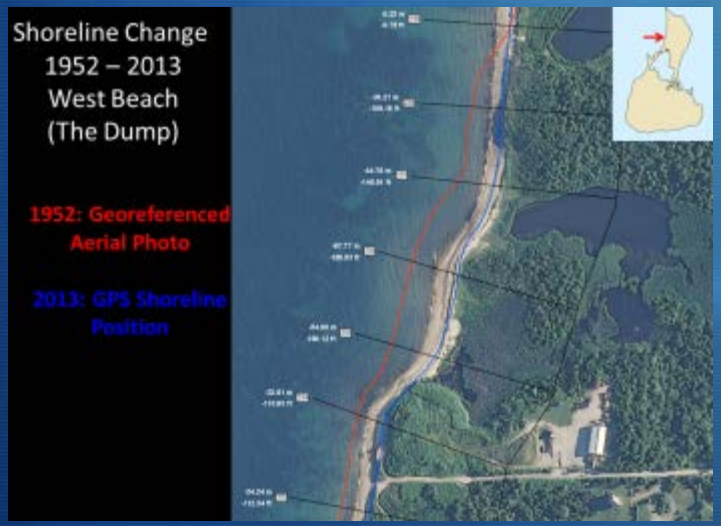
- Strong erosion and inundation polices that are publically supported and implemented at state and local levels
- Best available information is supporting sound decision making
- Improved understanding of potential impacts of erosion, flooding and sea level rise will spill over to other planning initiatives (state and local).


Photo Credit, RI DOT 2012

Process


New Data and Information
• Shoreline Change Mapping
• Sediment transport maps
• Inundation Modeling
• Salt marsh migration
• Economic analysis
• Identifying at risk areas and infrastructure
• Integration of other statewide vulnerability assessments:
o Drinking water supplies
o Waste water treatment facilities
o Transportation Infrastructure
Tools & Best Practices
• Legal review of Alternative Development Strategies
• Engineering evaluation of tools and techniques
• Review of techniques used elsewhere to address these issues
• Lessons learned in NY/NJ from Superstorm Sandy
Policy Development
• Guidance to Municipalities or other State Agencies on Best Practices or Policy
• New/Improved CRMC Policies
Education & Public Outreach
• Communication: targeted mailings, email listserv, social media
• Information: webpage, fact sheets, research
• Public Lectures & Stakeholder Meetings
• Reaching out to community leaders to help spread the message
• *Your Story*: videos and accounts of personal connection
Creating the
Shoreline Change Special Area Management Plan
Beach SAMP

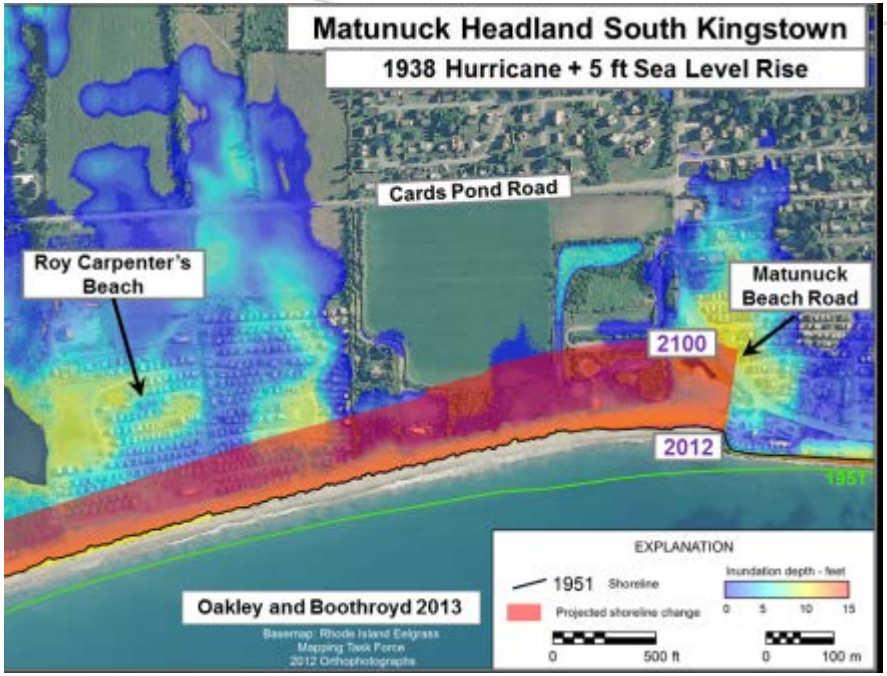


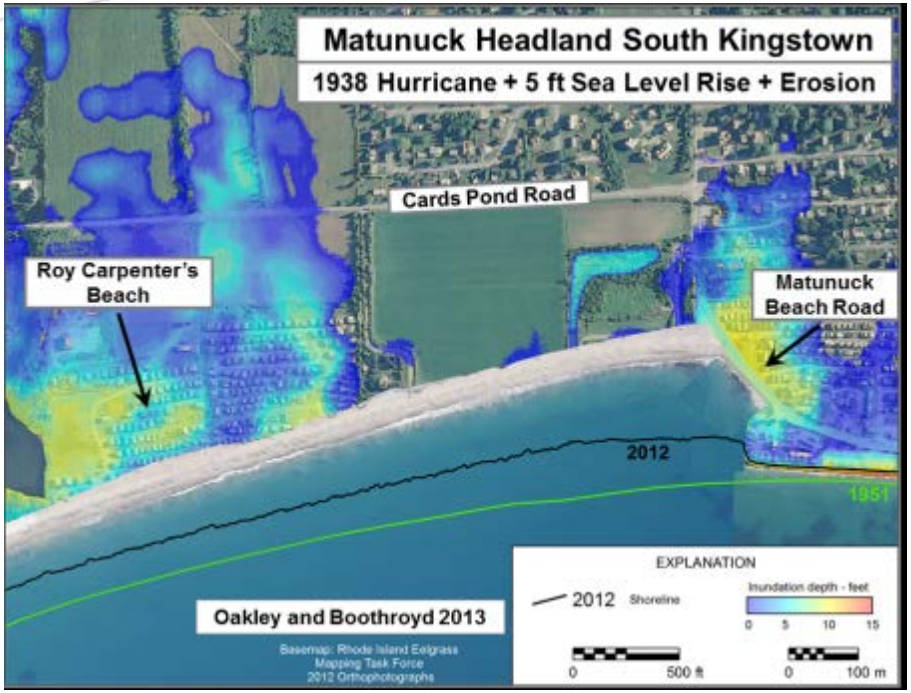


Shoreline Change Mapping

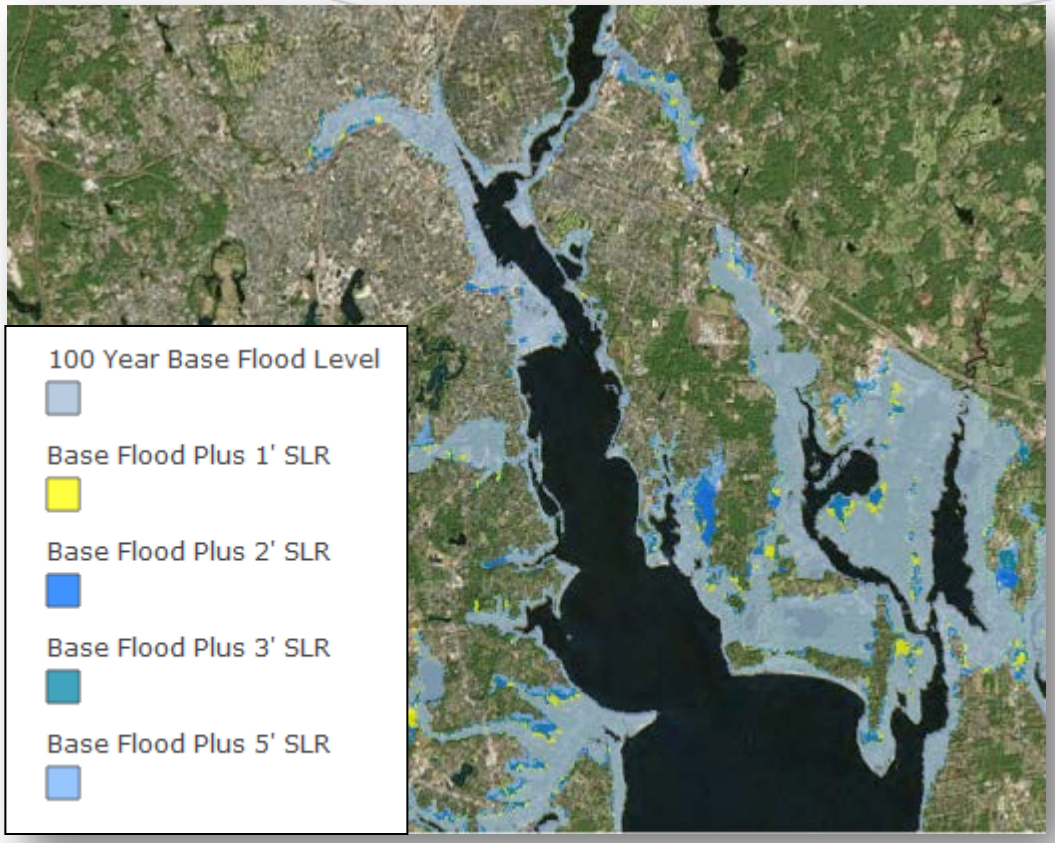
- New Shoreline Change Map Online Interface
- Block Island Shoreline Change Map
- Updating Washington County Maps currently
- Monitoring along South Shore including Misquamicut Beach Nourishment, & on Block Island
- UPCOMING- FUTURE SHORELINE PROJECTIONS

Future Shoreline Projections





StormTools:
Maps of Storms+Sea Level Rise



Visualizations

Maps flooding from a 25, 50, 100-year storm PLUS Sea Level Rise

More accurate depiction of future flooding risk

Applications

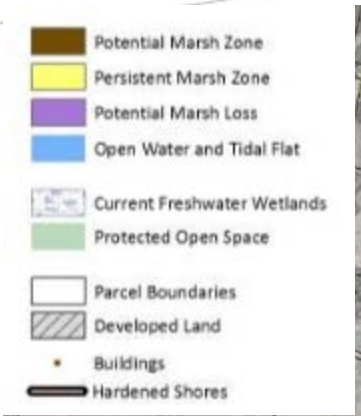
Day-to-Day operations

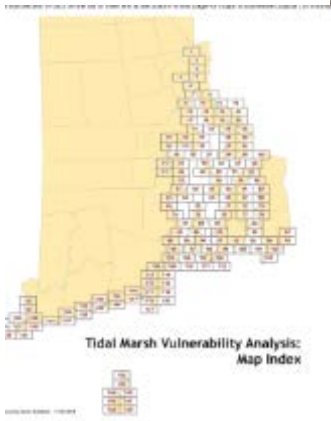
Long term planning/financing

http://www.beachsamp.org/maps/stormtools

Salt Marsh Migration

- **Maps <u>ADOPTED</u> by CRMC**

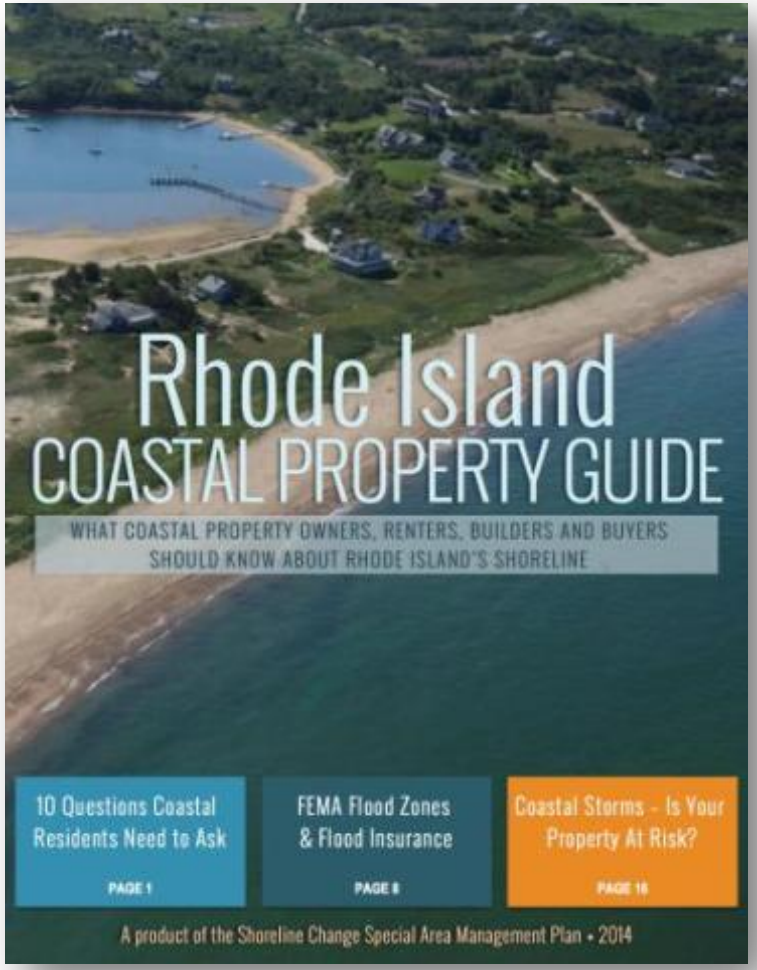




Salt Marsh Restoration

- Narrow River Estuary Restoration
  - Post-Sandy Dept. of Interior funding to US Fish and Wildlife Service Refuge System
  - Beneficial Re-use / Thin Layer Deposition
  - Micro-creek / runnel excavation
  - Marsh edge enhancement via living shoreline techniques

Coastal Property Guide Informs Landowners and Buyers



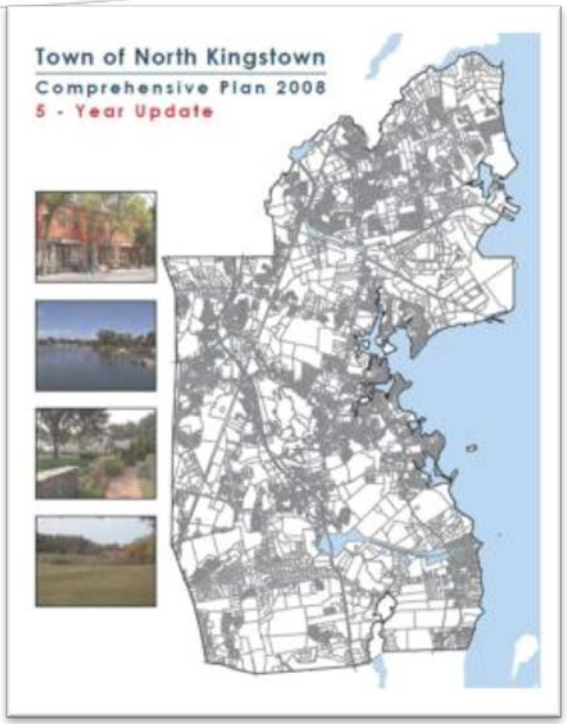
http://www.beachsamp.org/coastalpropertyguide/

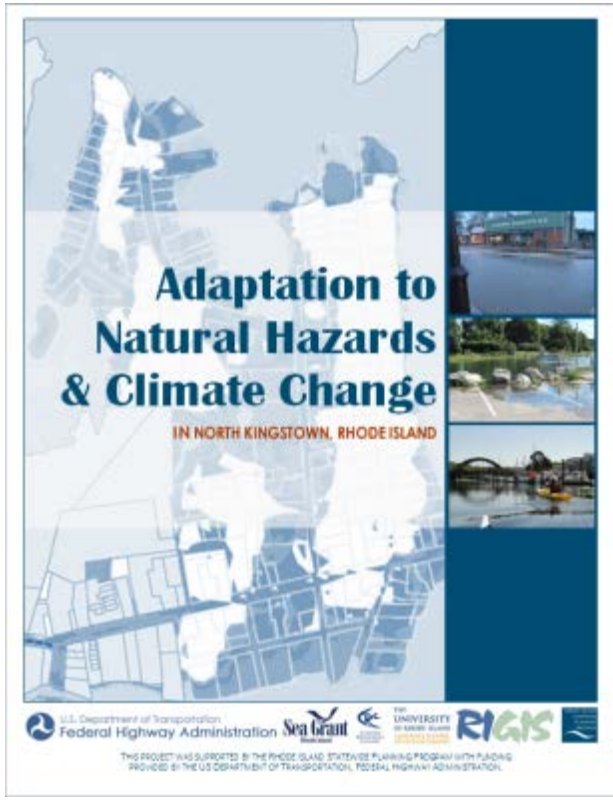
- Coastal features
- CRMC water type classifications
- FEMA flood zones
- Flood insurance, program/premiums
- Coastal hazards: sea-level rise and erosion
- Shoreline protection structures
- Coastal hazards: storms & floods
- Existing buildings
- Septic system requirements
- Structural resilience

Municipal Pilot Demonstrates: Local Process and Actions

Town of North Kingstown

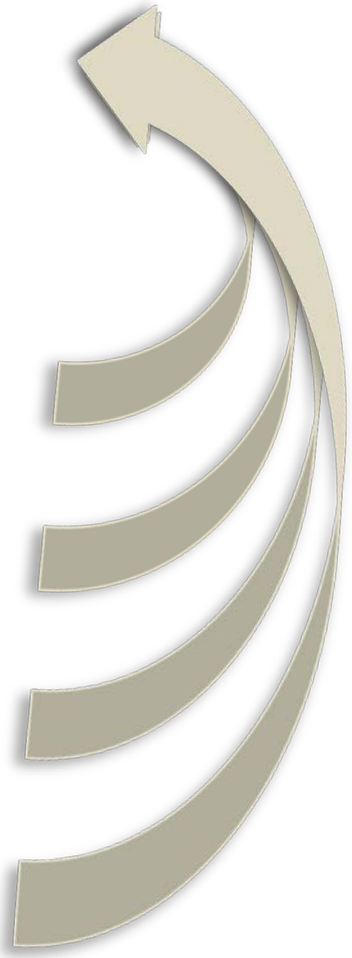
- Vulnerability Assessment
  - Sea Level Rise
  - Salt Marsh Migration
  - Infrastructure/ Roadways at risk
- Local Policy Recommendations
- Model for all other RI Coastal Communities



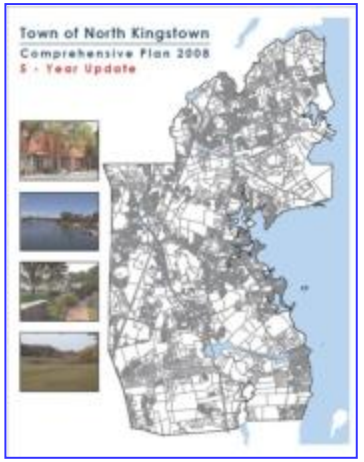


Adapting Municipal Decision Making

- Scope
- Assess
- Design
- Adopt
- Implement
- Monitor & Evaluate



Emergency Management Cycle



Business Resilience

Vulnerability
- ✓ Wind
- ✓ Storms, Flooding
- ✓ Tides, SLR

Best Management Practices
- ✓ Structural
- ✓ Non-Structural

Staying Afloat

FORTIFIED™ – Retrofit/Build to Reduce Potential Damage

https://www.disastersafety.org

Focus on Key Components

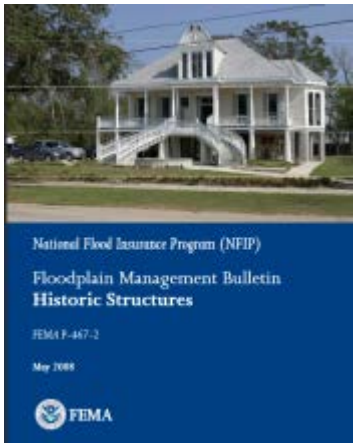
- Roof, walls, windows, doors, equipment
  - The right products and installation
    - Proper elevation

Green Infrastructure + Experiential Learning

- Green Infrastructure Design
  - Newport
  - Warwick
  - North Kingstown

Adapting Historic Structures

- Guidance on how to adapt historic structures or districts to SLR
- Tailored to Rhode Island



Landscape Architecture Studios

- Newport
- Wickford
- Focused on Adaptation Design

Design by Dennis Staton, URI LAR graduate, to illustrate his vision of Storer Park in 25 years.

Design by Amanda Gaal, URI LAR graduate, to depict what the park might look like in 25 years with her design of a boardwalk through a reconstructed marsh.

Engineering Senior Design Class

Assessment of Marinas to storms and sea level rise

Template for others to use

25 Year Return Period Water Level with SLR

Greenwich Bay South Yard Marina

Projected Date	Sea Level Rise	25 Year Return Period
--	None	8.26 ft (2.52 m)
2034	1 ft (0.30 m)	9.55 ft (2.91 m)
2071	3 ft (0.91 m)	12.12 ft (3.69 m)

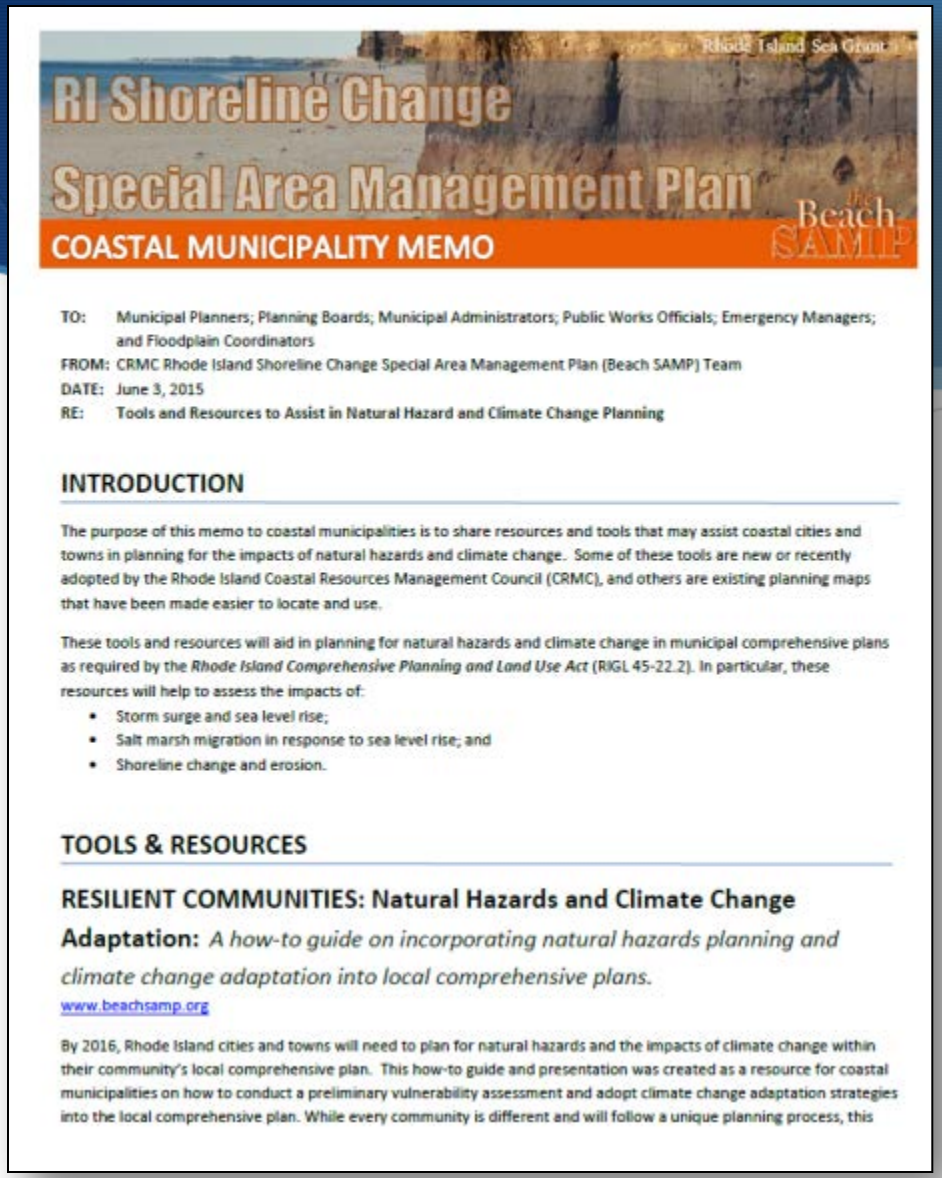
- Referenced to NAVD88
- At 1 ft (0.30 m) SLR and a 25 year return period, half of the marina would be inundated

Executive Climate Change Coordinating Council

- Local Guidance
- Promoting Decision Making Tools & Best Practices
- Recommendations at State and Local Level on adaptation/decision making

RIEC^4

Current Beach SAMP Tools & Resources



RI Shoreline Change Special Area Management Plan

COASTAL MUNICIPALITY MEMO

Beach SAMP

TO: Municipal Planners; Planning Boards; Municipal Administrators; Public Works Officials; Emergency Managers; and Floodplain Coordinators

FROM: CRMC Rhode Island Shoreline Change Special Area Management Plan (Beach SAMP) Team

DATE: June 3, 2015

RE: Tools and Resources to Assist in Natural Hazard and Climate Change Planning

INTRODUCTION

The purpose of this memo to coastal municipalities is to share resources and tools that may assist coastal cities and towns in planning for the impacts of natural hazards and climate change. Some of these tools are new or recently adopted by the Rhode Island Coastal Resources Management Council (CRMC), and others are existing planning maps that have been made easier to locate and use.

These tools and resources will aid in planning for natural hazards and climate change in municipal comprehensive plans as required by the *Rhode Island Comprehensive Planning and Land Use Act* (RIGL 45-22.2). In particular, these resources will help to assess the impacts of:

- Storm surge and sea level rise;
- Salt marsh migration in response to sea level rise; and
- Shoreline change and erosion.

TOOLS & RESOURCES

RESILIENT COMMUNITIES: Natural Hazards and Climate Change Adaptation: *A how-to guide on incorporating natural hazards planning and climate change adaptation into local comprehensive plans.*

www.beachsamp.org

By 2016, Rhode Island cities and towns will need to plan for natural hazards and the impacts of climate change within their community's local comprehensive plan. This how-to guide and presentation was created as a resource for coastal municipalities on how to conduct a preliminary vulnerability assessment and adopt climate change adaptation strategies into the local comprehensive plan. While every community is different and will follow a unique planning process, this

- Memo to municipalities
  - Planners
  - Council Presidents
  - Emergency Managers
  - Boards/Commissions
- Series of memos to share Beach SAMP tools/resources , findings and recommendations

Legal Workshop

- **DECEMBER 1, 2015** - day long workshop focused on RI
- Co-hosted with Roger Williams Law School & RI Sea Grant Legal Program
- Focused on legal issues & challenges related to shoreline change, sea level rise & storms
  - Liability associated with allowing development in at risk areas
  - Developing sea level rise overlay zones/ordinances
  - Etc.
- Audience- municipal staff; solicitors; emergency managers, etc.

CRMC Coastal Resources Management Council

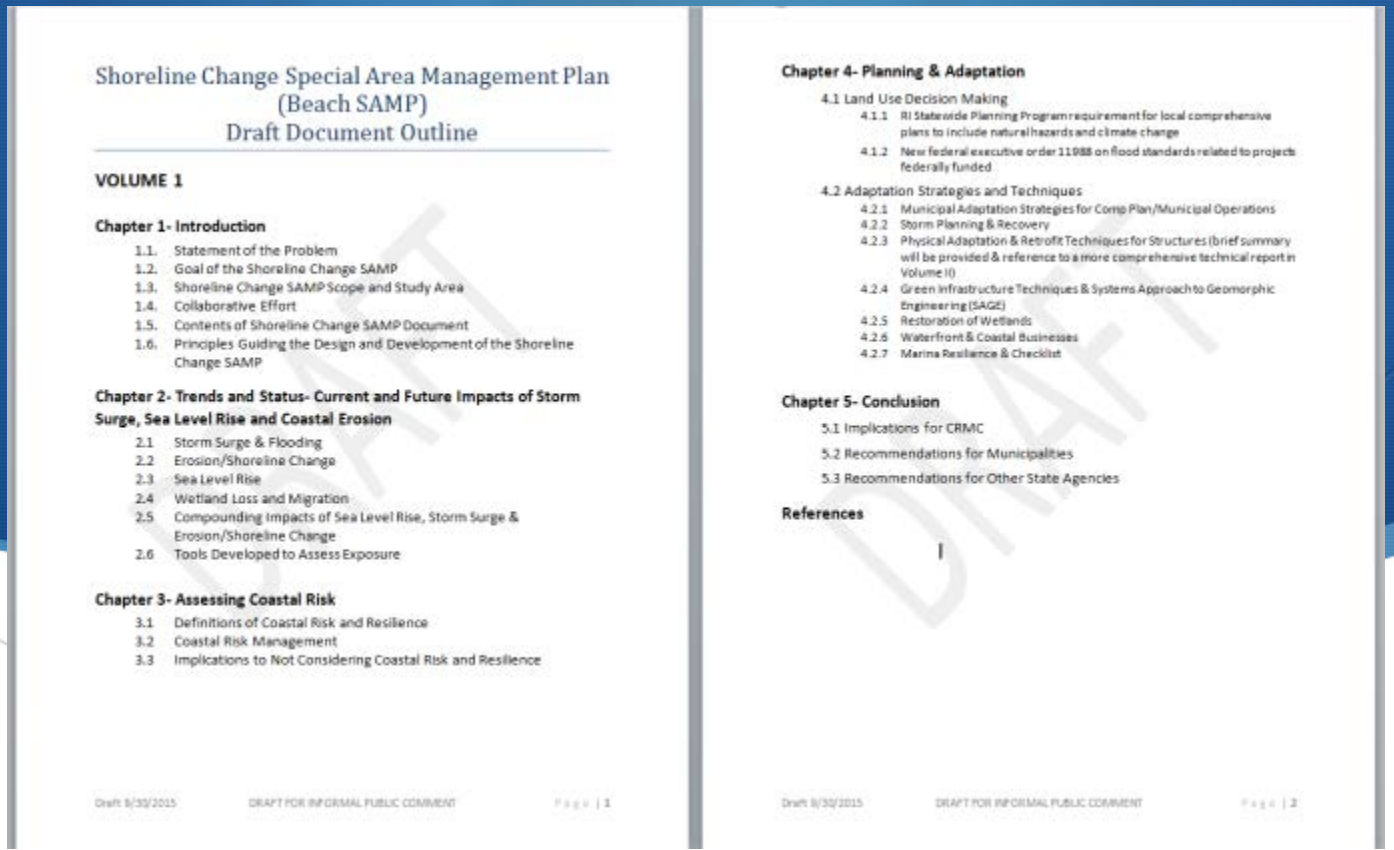
THE UNIVERSITY OF RHODE ISLAND GRADUATE SCHOOL OF OCEANOGRAPHY | CRC COASTAL RESOURCES CENTER

Sea Grant Rhode Island

Roger Williams University School of Law

Beach SAMP Document

- Components of SAMP
  - Volume 1- Overview/Summary
  - Volume 2- Research & Technical Reports
  - Proposed policy & regulatory changes to RICRMP "Red Book"



Shoreline Change Special Area Management Plan
(Beach SAMP)
Draft Document Outline

VOLUME 1

Chapter 1- Introduction

1.1. Statement of the Problem
1.2. Goal of the Shoreline Change SAMP
1.3. Shoreline Change SAMP Scope and Study Area
1.4. Collaborative Effort
1.5. Contents of Shoreline Change SAMP Document
1.6. Principles Guiding the Design and Development of the Shoreline Change SAMP

Chapter 2- Trends and Status- Current and Future Impacts of Storm Surge, Sea Level Rise and Coastal Erosion

2.1 Storm Surge & Flooding
2.2 Erosion/Shoreline Change
2.3 Sea Level Rise
2.4 Wetland Loss and Migration
2.5 Compounding Impacts of Sea Level Rise, Storm Surge & Erosion/Shoreline Change
2.6 Tools Developed to Assess Exposure

Chapter 3- Assessing Coastal Risk

3.1 Definitions of Coastal Risk and Resilience
3.2 Coastal Risk Management
3.3 Implications to Not Considering Coastal Risk and Resilience

Draft 8/30/2015 DRAFT FOR INFORMAL PUBLIC COMMENT Page | 1

Chapter 4- Planning & Adaptation

4.1 Land Use Decision Making
4.1.1 RI Statewide Planning Program requirement for local comprehensive plans to include natural hazards and climate change
4.1.2 New federal executive order 11988 on flood standards related to projects federally funded

4.2 Adaptation Strategies and Techniques
4.2.1 Municipal Adaptation Strategies for Comp Plan/Municipal Operations
4.2.2 Storm Planning & Recovery
4.2.3 Physical Adaptation & Retrofit Techniques for Structures (brief summary will be provided & reference to a more comprehensive technical report in Volume II)
4.2.4 Green Infrastructure Techniques & Systems Approach to Geomorphic Engineering (SAGE)
4.2.5 Restoration of Wetlands
4.2.6 Waterfront & Coastal Businesses
4.2.7 Marina Resilience & Checklist

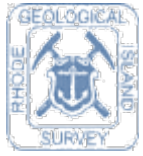
Chapter 5- Conclusion

5.1 Implications for CRMC
5.2 Recommendations for Municipalities
5.3 Recommendations for Other State Agencies

References

Draft 8/30/2015 DRAFT FOR INFORMAL PUBLIC COMMENT Page | 2

Building Tools in Partnership



Municipal Work Session on Adaptation Planning for Coastal Hazards

Town of New Shoreham- October 22, 2015

CRMC Coastal Resources Management Council

The University of Rhode Island Graduate School of Oceanography | CRC Coastal Resources Center

Sea Grant Rhode Island

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

Corn Neck Road, Post-Sandy, 2012

Photo: J.Gray

RI MyCoast | King Tides | StormReporter | Register | Log in

New Shoreham, RI

Corn Neck Rd | Washington County

King Tide Report by Kevin Hoyt

"Corn Neck Road revetment"

09/30/2015 | 10:03 am

NEAR HIGH TIDE (0 hours 51 minutes before high tide)

WEATHER OVERVIEW

Wind Speed: 18 MPH
Wind Direction: 160°
Temperature: 71°F

September 2015 perigean spring tide – mycoast.org

SCOPE

Differentiating between :

Storm Flooding

(Periodic/Infrequent)

- Coastal & Storm Surge Driven
- Precipitation Driven

Sea Level Rise Flooding

(Daily; 2 times each day at high tide)

Sea-Level Change Curve Calculator

Estimated Relative Sea Level Change from 2015 To 2100
8452660, Newport, RI
NOAA's Published Rate: 0.00846 feet/yr
All values are expressed in feet

Year	NOAA Low	USACE Low	NOAA Int Low	USACE Int	NOAA Int High	USACE High	NOAA High
2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2020	0.04	0.04	0.07	0.07	0.12	0.14	0.17
2025	0.09	0.09	0.13	0.13	0.25	0.29	0.37
2030	0.13	0.13	0.21	0.21	0.39	0.47	0.59
2035	0.17	0.17	0.29	0.29	0.55	0.66	0.84
2040	0.21	0.21	0.37	0.37	0.72	0.87	1.12
2045	0.25	0.25	0.46	0.46	0.91	1.10	1.42
2050	0.30	0.30	0.55	0.55	1.11	1.35	1.74
2055	0.34	0.34	0.64	0.64	1.32	1.61	2.10
2060	0.38	0.38	0.75	0.75	1.55	1.90	2.47
2065	0.42	0.42	0.85	0.85	1.80	2.20	2.88
2070	0.47	0.47	0.96	0.96	2.05	2.53	3.30
2075	0.51	0.51	1.07	1.07	2.33	2.87	3.76
2080	0.55	0.55	1.19	1.19	2.61	3.23	4.24
2085	0.59	0.59	1.31	1.31	2.91	3.60	4.74
2090	0.64	0.64	1.44	1.44	3.23	4.00	5.27
2095	0.68	0.68	1.57	1.57	3.56	4.41	5.83
2100	0.72	0.72	1.71	1.71	3.90	4.85	6.41

Print Table

www.corpsclimate.us

1) MUNICIPAL PILOT PROJECT – NORTH KINGSTOWN

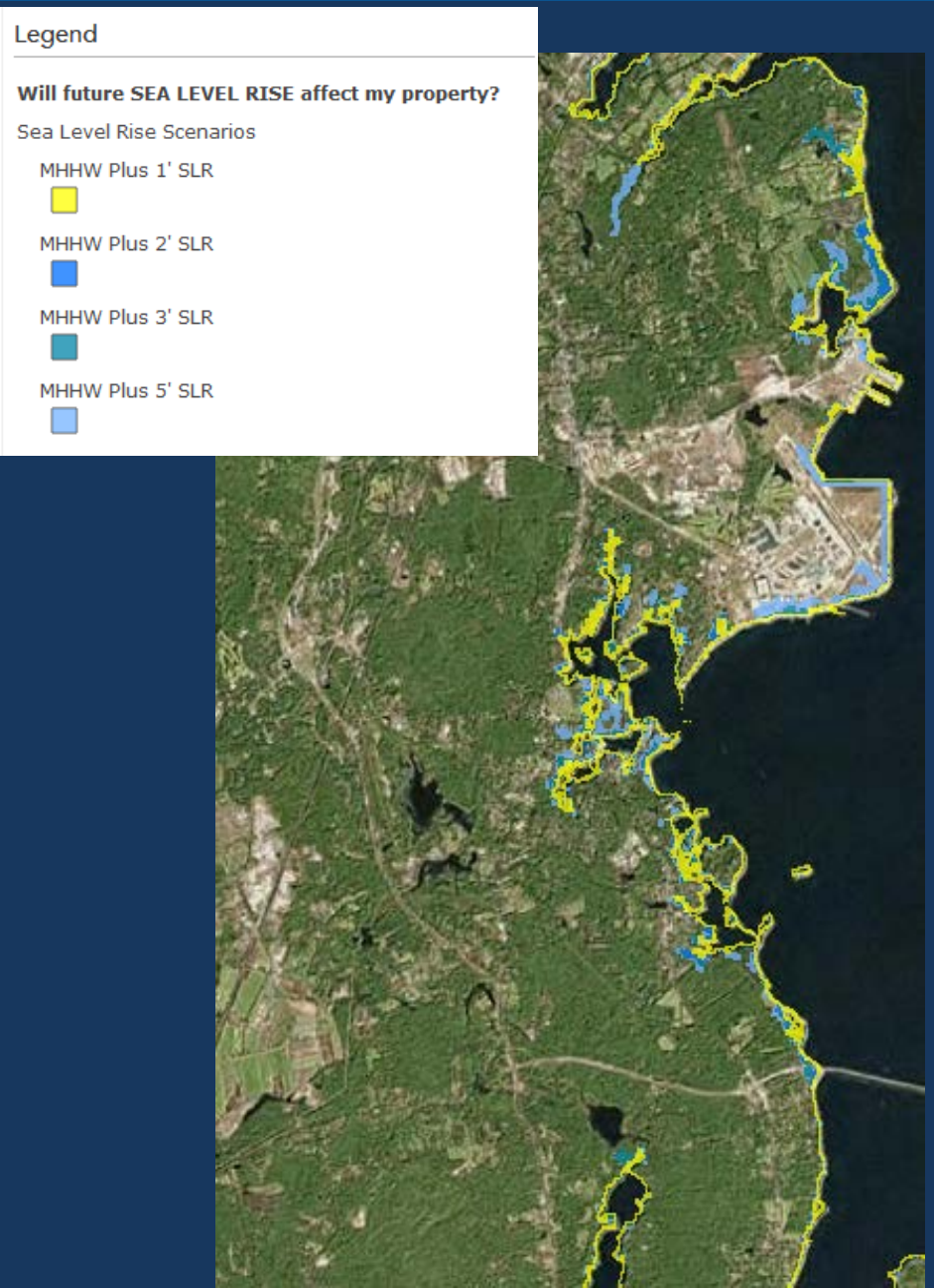
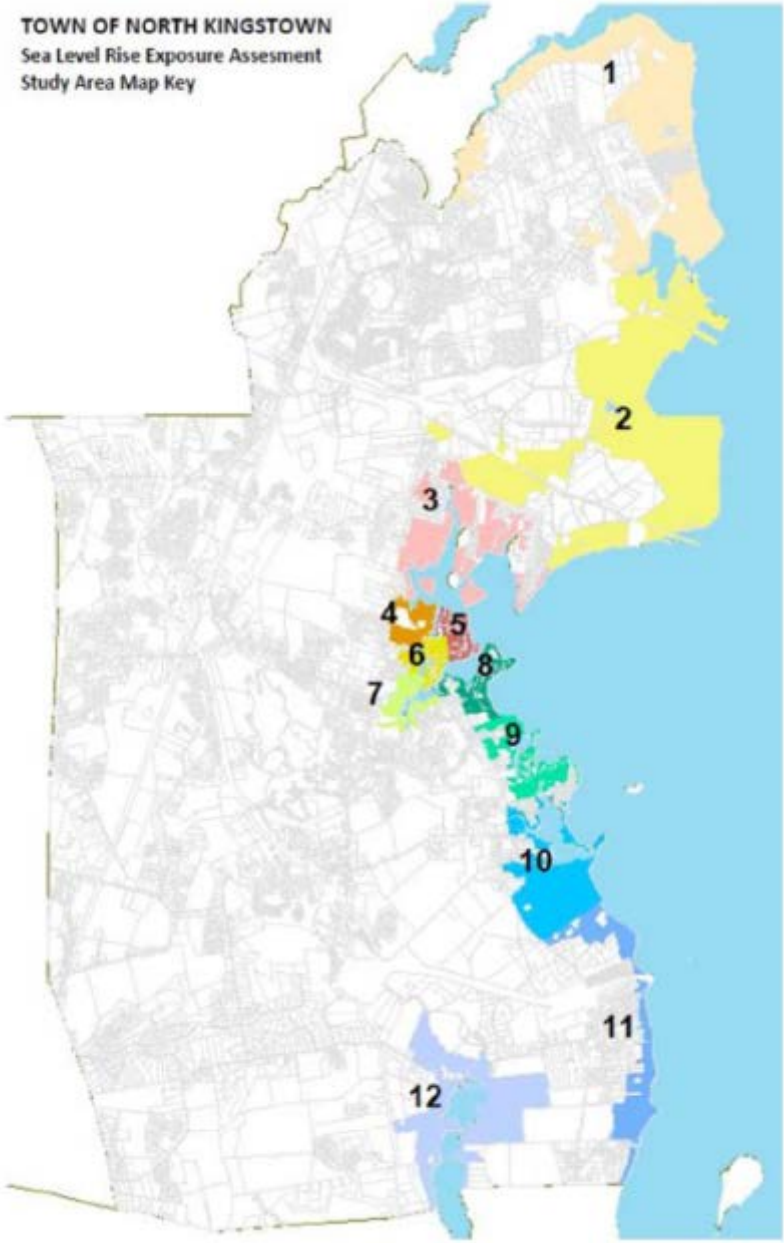


Figure 4. North Kingstown study areas.



1) MUNICIPAL PILOT PROJECT – NORTH KINGSTOWN

Table 5. Land Use and Parcel Data: exposed assets considering storm and sea level rise simulations created using a GIS-based bathtub model.

Land Use	Coastal Storm Scenario (single event)	Future Sea Level Rise Scenarios (Daily tides)		
Scenario	*1938 Hurricane Flood Levels: Mean Higher High Water (MHHW) + 9.5ft*	*Sea level rise (SLR) at 1 foot above MHHW*	*SLR at 3 feet above MHHW*	*SLR at 5 feet above MHHW*
Exposed Assets (Properties)*	**1564** properties are within or adjacent to the boundary of the storm surge	**500** properties are within or adjacent to the boundary of MHHW +1 foot	**772** properties are within or adjacent to the boundary of MHHW +3 feet	**1041** properties are within or adjacent to the boundary of MHHW +5 feet
Property Categories By Parcel Tax Code*	**72%** Residential **6%** Business **9%** Civic **12%** Undeveloped **2%** Other	**63%** Residential **7%** Business **14%** Civic **14%** Undeveloped **2%** Other	**69%** Residential **6%** Business **10%** Civic **13%** Undeveloped **2%** Other	**70%** Residential **6%** Business **10%** Civic **12%** Undeveloped **2%** Other
Owned by	**Publicly Owned Properties***			
Federal	9	6	8	9
State	65	25	28	37
Municipality	27	17	19	21
Total	**101**	**48**	**55**	**67**
	Historic District Properties Among Exposed Assets*			
Historic District Properties	**87**	**38**	**64**	**86**

**Refer to Appendix E for property and parcel data for North Kingstown.*

1) MUNICIPAL PILOT PROJECT – NORTH KINGSTOWN

Wickford Sea Level Rise Scenarios: 1 foot, 3 feet, and 5 feet

The three maps on the right illustrate sea level rise scenarios for the Wickford Historic area of North Kingstown, RI using a digital elevation model and an aerial photograph with a "bathtub model" approach to show the projected boundaries of two high tides per day on the municipal landscape.

The accompanying illustrated maps (underneath each SLR scenario map) show the individual parcels and properties that intersect each sea level rise scenario, as well as specific segments of roads and bridges that are projected to be at risk from projected sea level rise scenarios in North Kingstown.

The green map below shows the FEMA flood zones for the Wickford Historic area.

These draft maps are intended for illustrative purposes only.

2) MUNICIPAL MODEL PROCESS

RI CRMC Shoreline Change Special Area Management Plan

Home | News | Events | Resources & Tools | Coastal Property Guide | Management Plan | Get Involved

Search ...

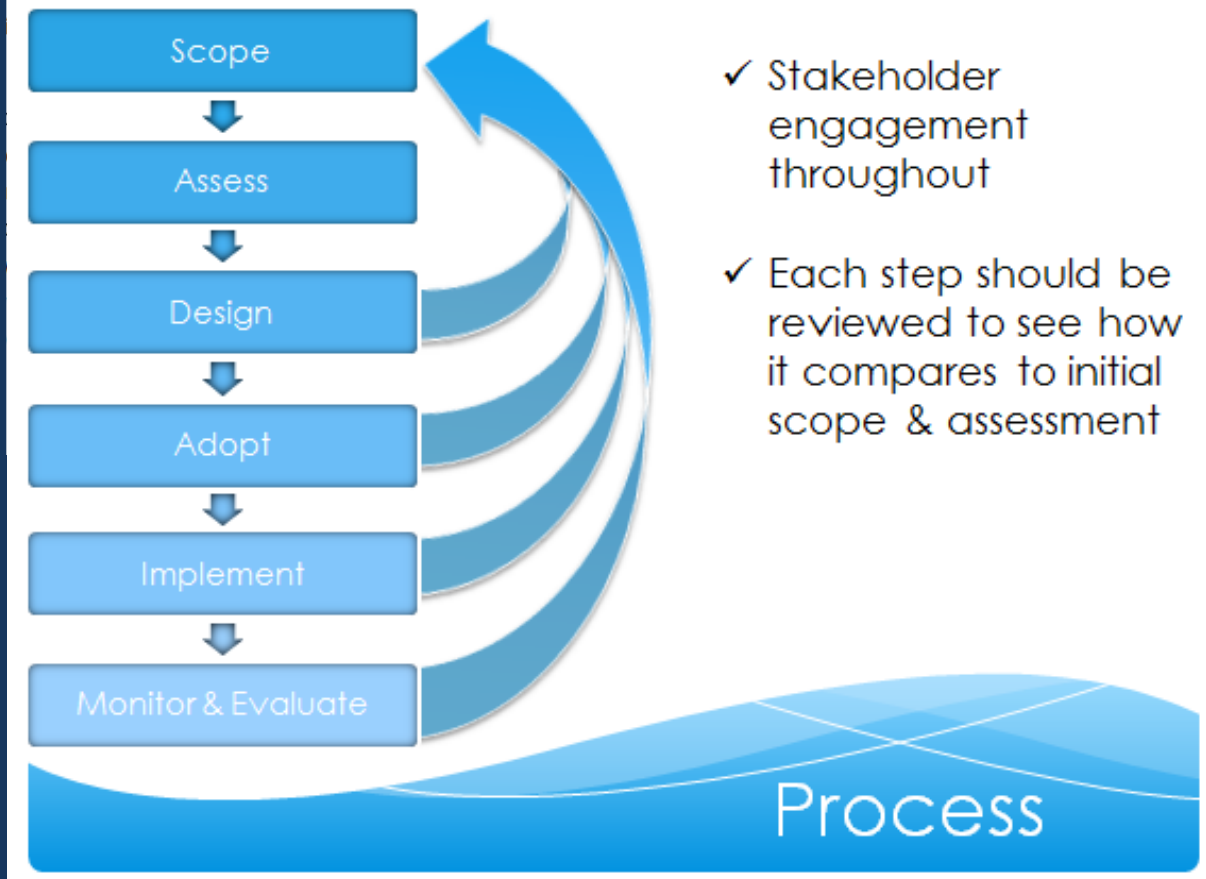
Municipal Webinar: Resilient Communities Model Process

July 24, 2015 Alena Normann Meeting Information, Regional Events, update

Watch our Mur
municipalities.

The University
Coastal Resou
Municipal Web
coastal munici
Change into local comprehensive plans. Presenters from the Un
Rhode Island Sea Grant at the Graduate School of Oceanography
assessments, links to key state data sets and example adaptati
pilot project.

Click here to see the recording of the webinar.



2) MUNICIPAL MODEL PROCESS

SCOPE

- Identify Purpose
- Clarify Assessmer Outcome
- Define Scale
- Data Needs and S
- Select a Planning Team

ASSESS

Example- Synthesis of Exposed Assets:

SECTOR	Example of Quantitative or Qualitative Description of Impacts from Coastal Storm Flooding or Sea Level Rise Scenarios
Land Use	• # of properties impacted and % residential, commercial, vacant land, etc.
Transportation	• X linear feet (Y miles) of r • Evacuation Routes vulner
Publically Owned Properties	• # of properties impacted i
Emergency Management Facilities	• Description of how emer stations are impacted
Wastewater	• Description of how sewe are impacted
Stormwater Management	• Description of how catch impacted
Drinking Water	• Impacts to municipal & n of water table
Wetlands	• Acreage of wetlands lost
Historic and Cultural	• # and type of sites impac
Contaminated Sites	• # and type of sites impac
Energy	• Summary of the # and ty

DESIGN

Prioritization Methodology

- Study areas/ neighborhoods to address

ADOPT

Local Adoption :

- Formal Adoption
- Guidance
- Incorporation into Stanc Operating Procedures

IMPLEMENT

Implementing Adaptation Measures:

- Adaptation Funding
- Governance
- Leadership
- Local Capacity Building
- Modify Municipal Operations, Departmental Duties & Processes

MONITOR & EVALUATE

- Mainstream Into Annual/Regular Updates
  - Annual CIP or Biannual TIP, Hazard mitigation priorities
  - 5 year Comprehensive Plan Implementation Report
  - Hazard Mitigation Review
  - NFIP Community Rating System (CRS) Audit
- Capture Lessons Learned
- Compare to State Policy
- Create database of impacts & losses

3) COASTAL MUNICIPAL WORKSESSIONS – WASHINGTON COUNTY

TO: Municipal Planners; Planning Boards; Municipal Administrators; Public Works Officials; Emergency Managers; and Floodplain Coordinators
FROM: CRMC Rhode Island Shoreline Change Special Area Management Plan (Beach SAMP) Team
DATE: June 3, 2015
RE: **Tools and Resources to Assist in Natural Hazard and Climate Change Planning**

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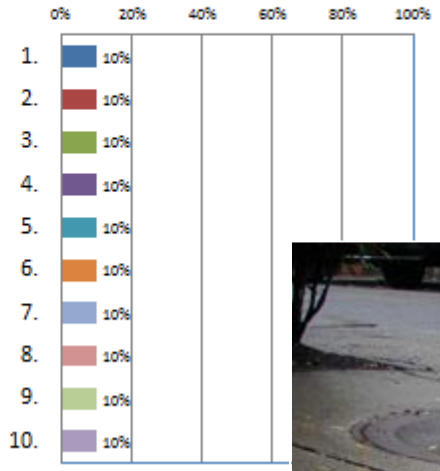
- **Memo to municipalities**
  - Planners
  - Council Presidents
  - Emergency Managers
  - Boards/Commissions
- **Series of memos to share Beach SAMP tools/resources , findings and recommendations**

3) COASTAL MUNICIPAL WORKSESSIONS – WASHINGTON COUNTY

Review of Adaptation Strategies

What are the top 3 strategies that you would like more information about?

1. Identify Areas at Risk
2. Develop a database of at risk property/infrastructure
3. Integrate into municipal permitting
4. Zoning changes for height variances
5. Require CIP & TIP evaluate for SLR impacts
6. Develop incentives for voluntary adaptation
7. Emergency Permitting Process
8. Planning process for impacts to transportation infrastructure
9. Apply & advance in CRS
10. Increase open space/reduce density in at risk areas



www.beachsamp.org

RI CRMC Shoreline Change Special Area Management Plan

Home | News | Events | Resources & Tools | Coastal Property Guide | Management Plan | Get Involved

- Understand Risk
- Plan and Act
- Meeting Videos

Plan and Act

Resources to Inform Adaptation Planning & Actions

Municipalities

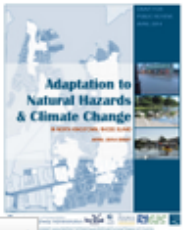
Resilient Communities: Natural Hazards & Climate Change Adaptation

A how-to guide on incorporating natural hazards planning and climate change adaptation into local comprehensive plans.

View guide.

Download Powerpoint presentation file

Adaptation to Natural Hazards & Climate Change in North Kingstown, RI



A pilot project of how natural hazards & climate change planning and adaptation can be incorporated into local comprehensive plans.

View chapters

sources/

www.beachsamp.org

RI CRMC Shoreline Change Special Area Management Plan

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Waterfront & Coastal Businesses

Staying Afloat: Adapting Waterfront Business to Rising Seas and Extreme Storms

Proceedings from the 2014 Ronald C. Baird Sea Grant Science Symposium.

View Proceedings.

Catalog of Adaptation Techniques for Coastal and Waterfront Businesses

A catalog of actions businesses can take to be more resilient t

View Catalog

Newport Resilience Assessment Tour: Newport Waterfront Overview Summary

Overview of the risks and vulnerabilities of the Newport waterfront
management practices & actions to increase resiliency.

Download the report

Residents & Coastal Property Owners

Rhode Island Coastal Property Guide

What coastal property owners, renters, builders and buyers should know about the Rhode Island shoreline.

Read on-line or download the guide.

Protecting Rhode Island's shorelines from Flooding and Erosion

A factsheet about construction of new sea walls in Rhode Island.

Download factsheet

About The Shoreline Change Special Area Management Plan

A document which explains what the RI Shoreline Change project is.

Download document.

Shoreline Change Special Area Management Plan (Beach SAMP)

Municipal Work Session on Adaptation Planning for Coastal Hazards

Town of New Shoreham- October 22, 2015

CRMC Coastal Resources Management Council

The University of Rhode Island Graduate School of Oceanography | CRC Coastal Resources Center

Sea Grant Rhode Island

RI CRMC Shoreline Change Special Area Management Plan

PROJECT GOAL:

- Through a public process help develop innovative and practical policies and tools for managing development along shorelines vulnerable to erosion and flooding


Melissa Devine, 2012


Melissa Devine, 2012


Hurricane Irene, RI Sea Grant


Lynne Harrington, Pawtuxet Cove 2012

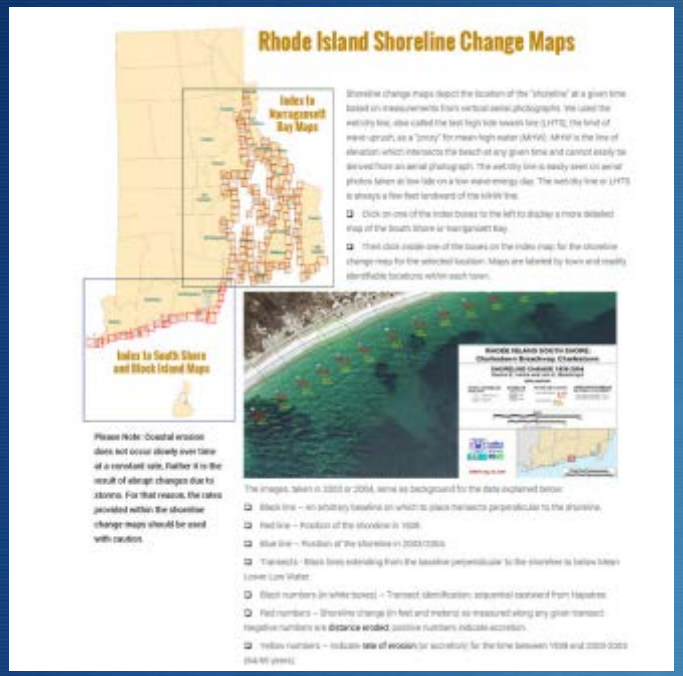
Long-term Outcomes

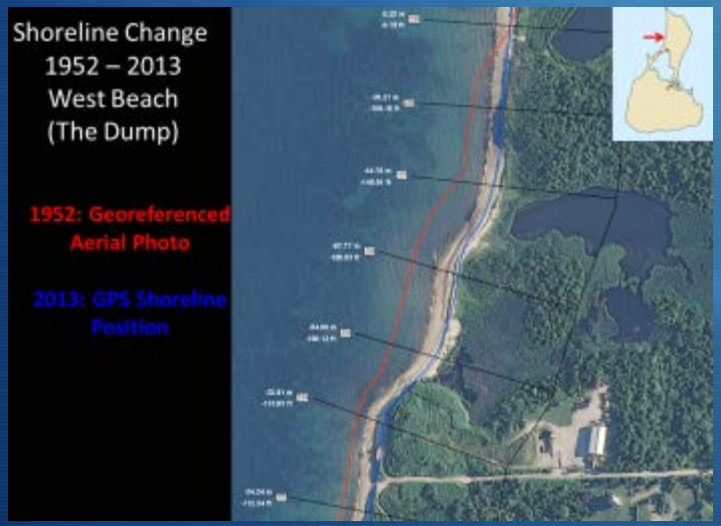
- Strong erosion and inundation polices that are publically supported and implemented at state and local levels
- Best available information is supporting sound decision making
- Improved understanding of potential impacts of erosion, flooding and sea level rise will spill over to other planning initiatives (state and local).


Photo Credit, RI DOT 2012

Process


New Data and Information
• Shoreline Change Mapping
• Sediment transport maps
• Inundation Modeling
• Salt marsh migration
• Economic analysis
• Identifying at risk areas and infrastructure
• Integration of other statewide vulnerability assessments:
o Drinking water supplies
o Waste water treatment facilities
o Transportation Infrastructure
Tools & Best Practices
• Legal review of Alternative Development Strategies
• Engineering evaluation of tools and techniques
• Review of techniques used elsewhere to address these issues
• Lessons learned in NY/NJ from Superstorm Sandy
Policy Development
• Guidance to Municipalities or other State Agencies on Best Practices or Policy
• New/Improved CRMC Policies
Education & Public Outreach
• Communication: targeted mailings, email listserv, social media
• Information: webpage, fact sheets, research
• Public Lectures & Stakeholder Meetings
• Reaching out to community leaders to help spread the message
• *Your Story*: videos and accounts of personal connection
Creating the
Shoreline Change Special Area Management Plan
Beach SAMP

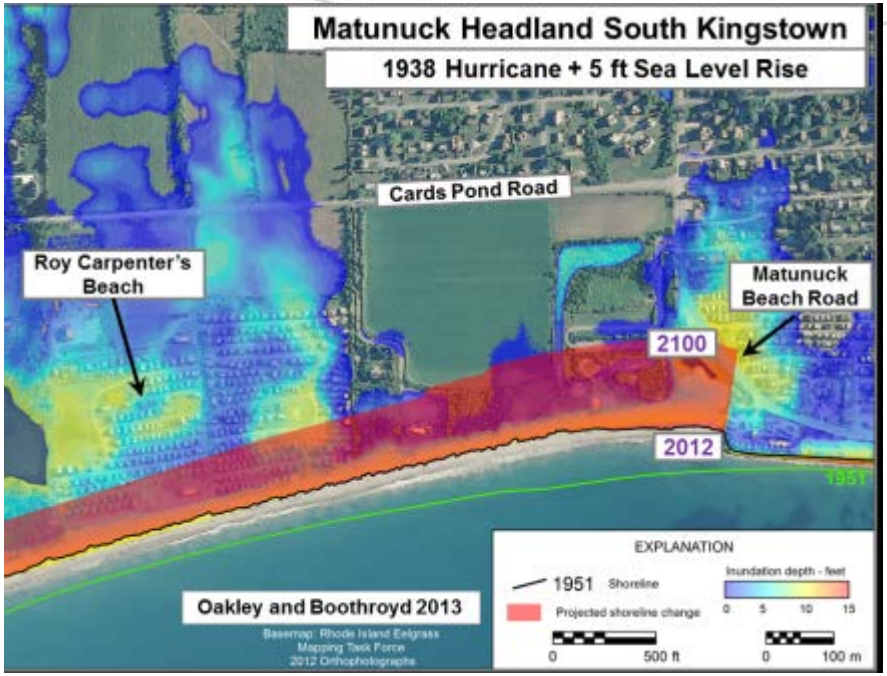


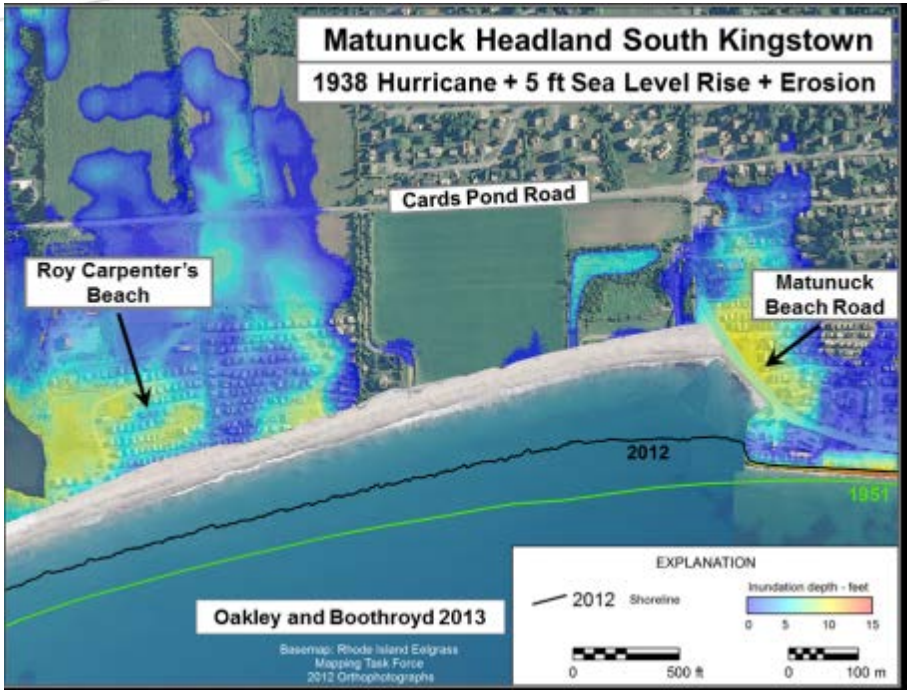


Shoreline Change Mapping

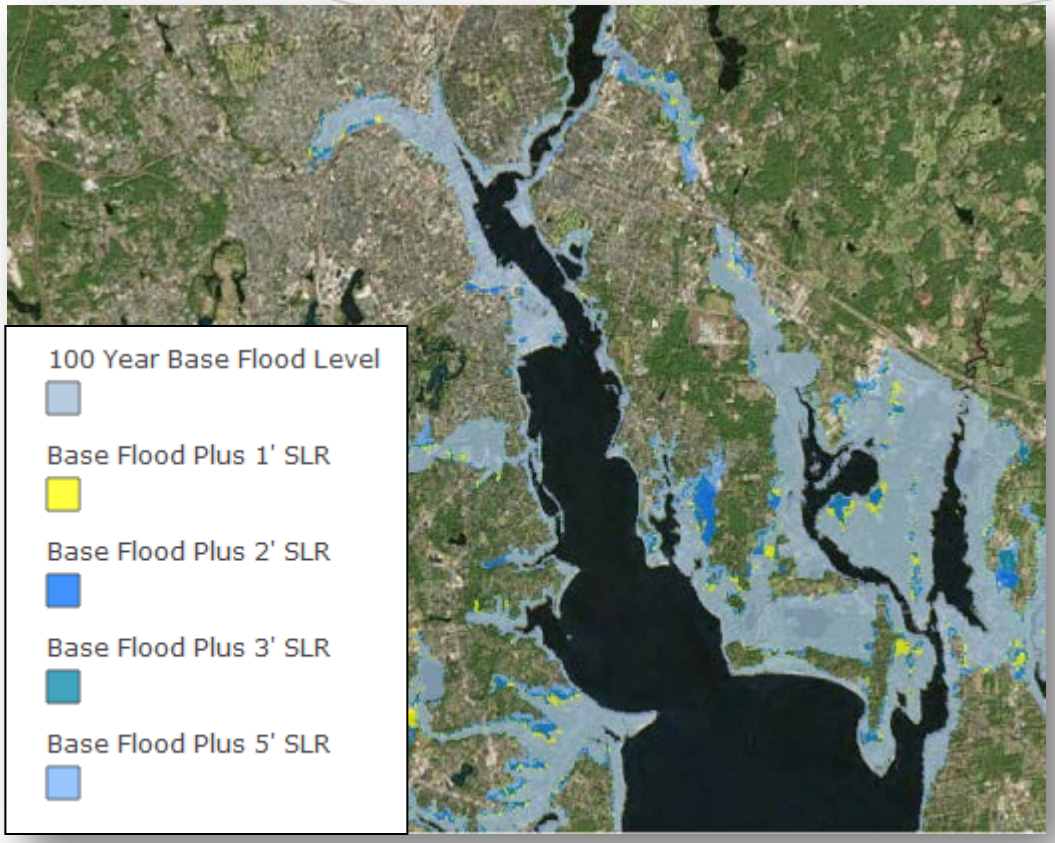
- New Shoreline Change Map Online Interface
- Block Island Shoreline Change Map
- Updating Washington County Maps currently
- Monitoring along South Shore including Misquamicut Beach Nourishment, & on Block Island
- UPCOMING- FUTURE SHORELINE PROJECTIONS

Future Shoreline Projections





StormTools:
Maps of Storms+Sea Level Rise



Visualizations

Maps flooding from a 25, 50, 100-year storm PLUS Sea Level Rise

More accurate depiction of future flooding risk

Applications

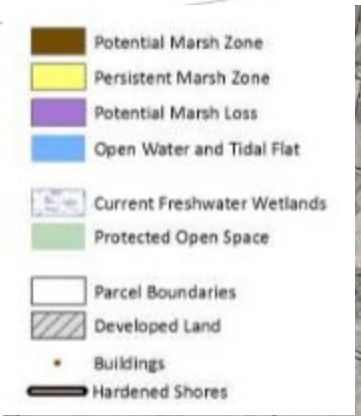
Day-to-Day operations

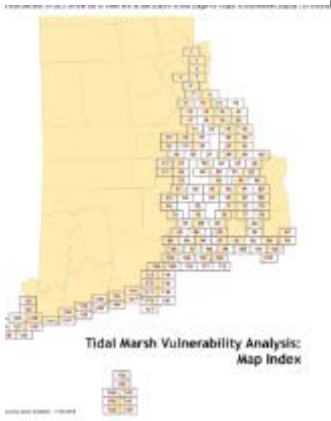
Long term planning/financing

http://www.beachsamp.org/maps/stormtools

Salt Marsh Migration

- **Maps <u>ADOPTED</u> by CRMC**

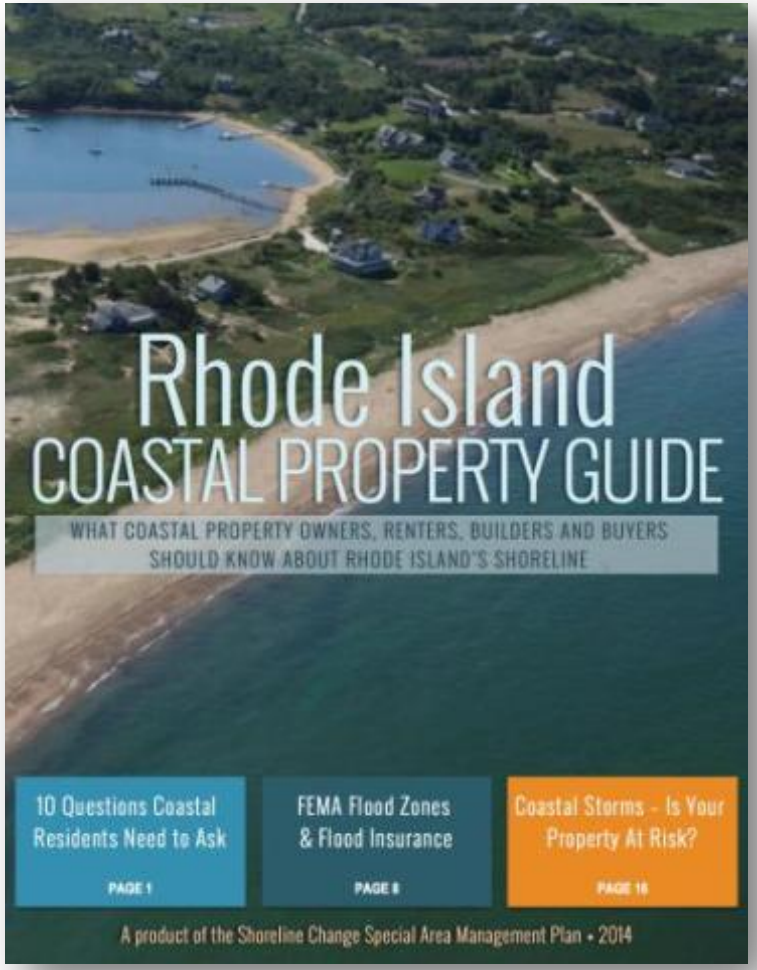




Salt Marsh Restoration

- Narrow River Estuary Restoration
  - Post-Sandy Dept. of Interior funding to US Fish and Wildlife Service Refuge System
  - Beneficial Re-use / Thin Layer Deposition
  - Micro-creek / runnel excavation
  - Marsh edge enhancement via living shoreline techniques

Coastal Property Guide Informs Landowners and Buyers



http://www.beachsamp.org/coastalpropertyguide/

- Coastal features
- CRMC water type classifications
- FEMA flood zones
- Flood insurance, program/premiums
- Coastal hazards: sea-level rise and erosion
- Shoreline protection structures
- Coastal hazards: storms & floods
- Existing buildings
- Septic system requirements
- Structural resilience

FORTIFIED™ – Retrofit/Build to Reduce Potential Damage

https://www.disastersafety.org

Focus on Key Components

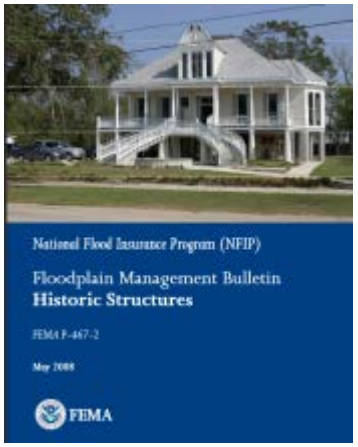
- Roof, walls, windows, doors, equipment
  - The right products and installation
    - Proper elevation

Green Infrastructure + Experiential Learning

- Green Infrastructure Design
  - Newport
  - Warwick
  - North Kingstown

Adapting Historic Structures

- Guidance on how to adapt historic structures or districts to SLR
- Tailored to Rhode Island



Landscape Architecture Studios

- Newport
- Wickford
- Focused on Adaptation Design

Design by Dennis Staton, URI LAR graduate, to illustrate his vision of Storer Park in 25 years.

Design by Amanda Gaal, URI LAR graduate, to depict what the park might look like in 25 years with her design of a boardwalk through a reconstructed marsh.

Engineering Senior Design Class

Assessment of Marinas to storms and sea level rise

Template for others to use

25 Year Return Period Water Level with SLR

Greenwich Bay South Yard Marina

Projected Date	Sea Level Rise	25 Year Return Period
--	None	8.26 ft (2.52 m)
2034	1 ft (0.30 m)	9.55 ft (2.91 m)
2071	3 ft (0.91 m)	12.12 ft (3.69 m)

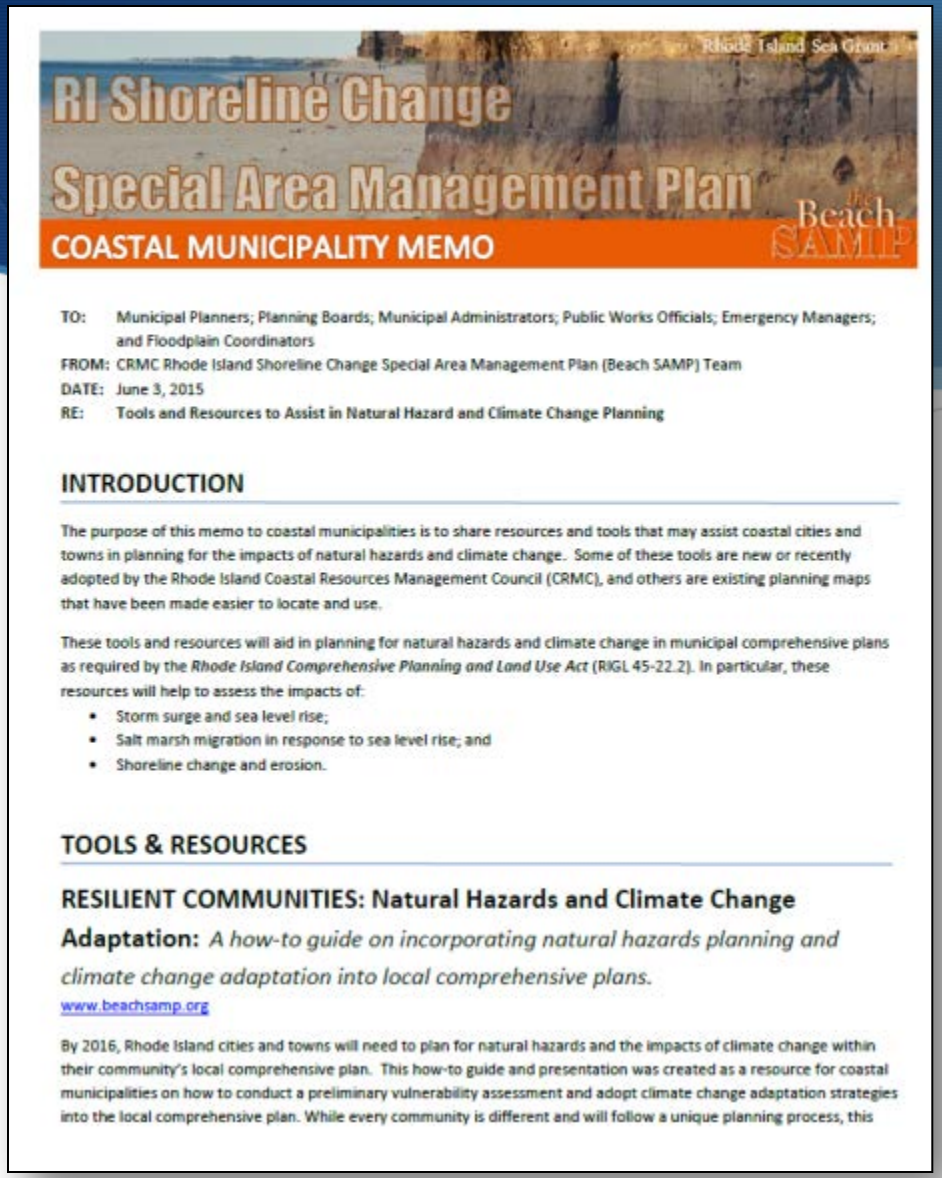
- Referenced to NAVD88
- At 1 ft (0.30 m) SLR and a 25 year return period, half of the marina would be inundated

Executive Climate Change Coordinating Council

- Local Guidance
- Promoting Decision Making Tools & Best Practices
- Recommendations at State and Local Level on adaptation/decision making

RIEC^4

Current Beach SAMP Tools & Resources



RI Shoreline Change Special Area Management Plan

COASTAL MUNICIPALITY MEMO

Beach SAMP

TO: Municipal Planners; Planning Boards; Municipal Administrators; Public Works Officials; Emergency Managers; and Floodplain Coordinators

FROM: CRMC Rhode Island Shoreline Change Special Area Management Plan (Beach SAMP) Team

DATE: June 3, 2015

RE: Tools and Resources to Assist in Natural Hazard and Climate Change Planning

INTRODUCTION

The purpose of this memo to coastal municipalities is to share resources and tools that may assist coastal cities and towns in planning for the impacts of natural hazards and climate change. Some of these tools are new or recently adopted by the Rhode Island Coastal Resources Management Council (CRMC), and others are existing planning maps that have been made easier to locate and use.

These tools and resources will aid in planning for natural hazards and climate change in municipal comprehensive plans as required by the *Rhode Island Comprehensive Planning and Land Use Act* (RIGL 45-22.2). In particular, these resources will help to assess the impacts of:

- Storm surge and sea level rise;
- Salt marsh migration in response to sea level rise; and
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TOOLS & RESOURCES

RESILIENT COMMUNITIES: Natural Hazards and Climate Change Adaptation: *A how-to guide on incorporating natural hazards planning and climate change adaptation into local comprehensive plans.*

www.beachsamp.org

By 2016, Rhode Island cities and towns will need to plan for natural hazards and the impacts of climate change within their community's local comprehensive plan. This how-to guide and presentation was created as a resource for coastal municipalities on how to conduct a preliminary vulnerability assessment and adopt climate change adaptation strategies into the local comprehensive plan. While every community is different and will follow a unique planning process, this

- Memo to municipalities
  - Planners
  - Council Presidents
  - Emergency Managers
  - Boards/Commissions
- Series of memos to share Beach SAMP tools/resources , findings and recommendations

Legal Workshop

- **DECEMBER 1, 2015** - day long workshop focused on RI
- Co-hosted with Roger Williams Law School & RI Sea Grant Legal Program
- Focused on legal issues & challenges related to shoreline change, sea level rise & storms
  - Liability associated with allowing development in at risk areas
  - Developing sea level rise overlay zones/ordinances
  - Etc.
- Audience- municipal staff; solicitors; emergency managers, etc.

CRMC Coastal Resources Management Council

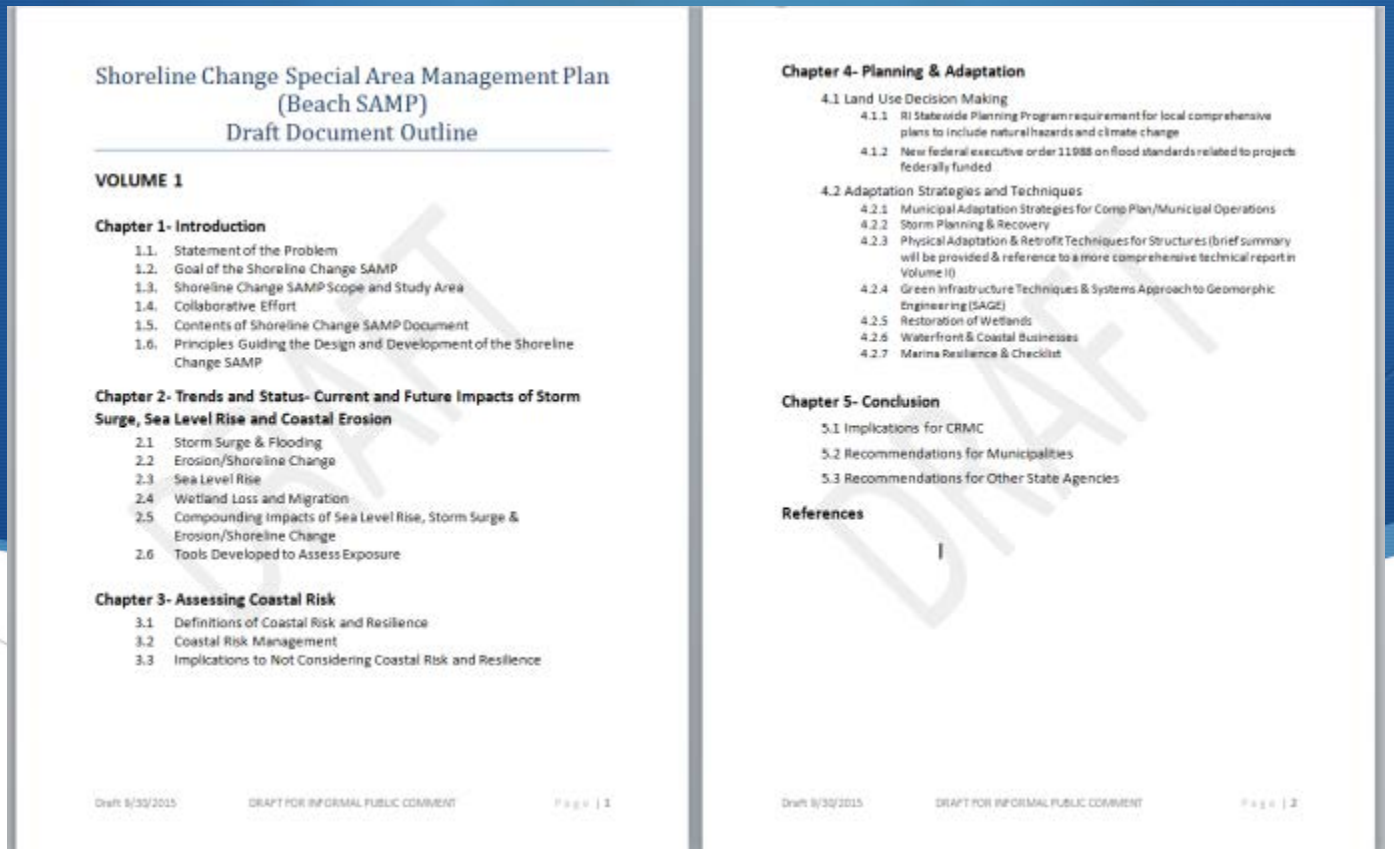
The University of Rhode Island Graduate School of Oceanography | CRC Coastal Resources Center

Sea Grant Rhode Island

Roger Williams University School of Law

Beach SAMP Document

- Components of SAMP
  - Volume 1- Overview/Summary
  - Volume 2- Research & Technical Reports
  - Proposed policy & regulatory changes to RICRMP "Red Book"



Shoreline Change Special Area Management Plan
(Beach SAMP)
Draft Document Outline

VOLUME 1

Chapter 1- Introduction

1.1. Statement of the Problem
1.2. Goal of the Shoreline Change SAMP
1.3. Shoreline Change SAMP Scope and Study Area
1.4. Collaborative Effort
1.5. Contents of Shoreline Change SAMP Document
1.6. Principles Guiding the Design and Development of the Shoreline Change SAMP

Chapter 2- Trends and Status- Current and Future Impacts of Storm Surge, Sea Level Rise and Coastal Erosion

2.1 Storm Surge & Flooding
2.2 Erosion/Shoreline Change
2.3 Sea Level Rise
2.4 Wetland Loss and Migration
2.5 Compounding Impacts of Sea Level Rise, Storm Surge & Erosion/Shoreline Change
2.6 Tools Developed to Assess Exposure

Chapter 3- Assessing Coastal Risk

3.1 Definitions of Coastal Risk and Resilience
3.2 Coastal Risk Management
3.3 Implications to Not Considering Coastal Risk and Resilience

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Chapter 4- Planning & Adaptation

4.1 Land Use Decision Making
4.1.1 RI Statewide Planning Program requirement for local comprehensive plans to include natural hazards and climate change
4.1.2 New federal executive order 11988 on flood standards related to projects federally funded

4.2 Adaptation Strategies and Techniques
4.2.1 Municipal Adaptation Strategies for Comp Plan/Municipal Operations
4.2.2 Storm Planning & Recovery
4.2.3 Physical Adaptation & Retrofit Techniques for Structures (brief summary will be provided & reference to a more comprehensive technical report in Volume II)
4.2.4 Green Infrastructure Techniques & Systems Approach to Geomorphic Engineering (SAGE)
4.2.5 Restoration of Wetlands
4.2.6 Waterfront & Coastal Businesses
4.2.7 Marina Resilience & Checklist

Chapter 5- Conclusion

5.1 Implications for CRMC
5.2 Recommendations for Municipalities
5.3 Recommendations for Other State Agencies

References

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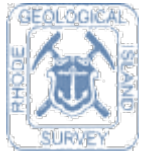
Building Tools in Partnership



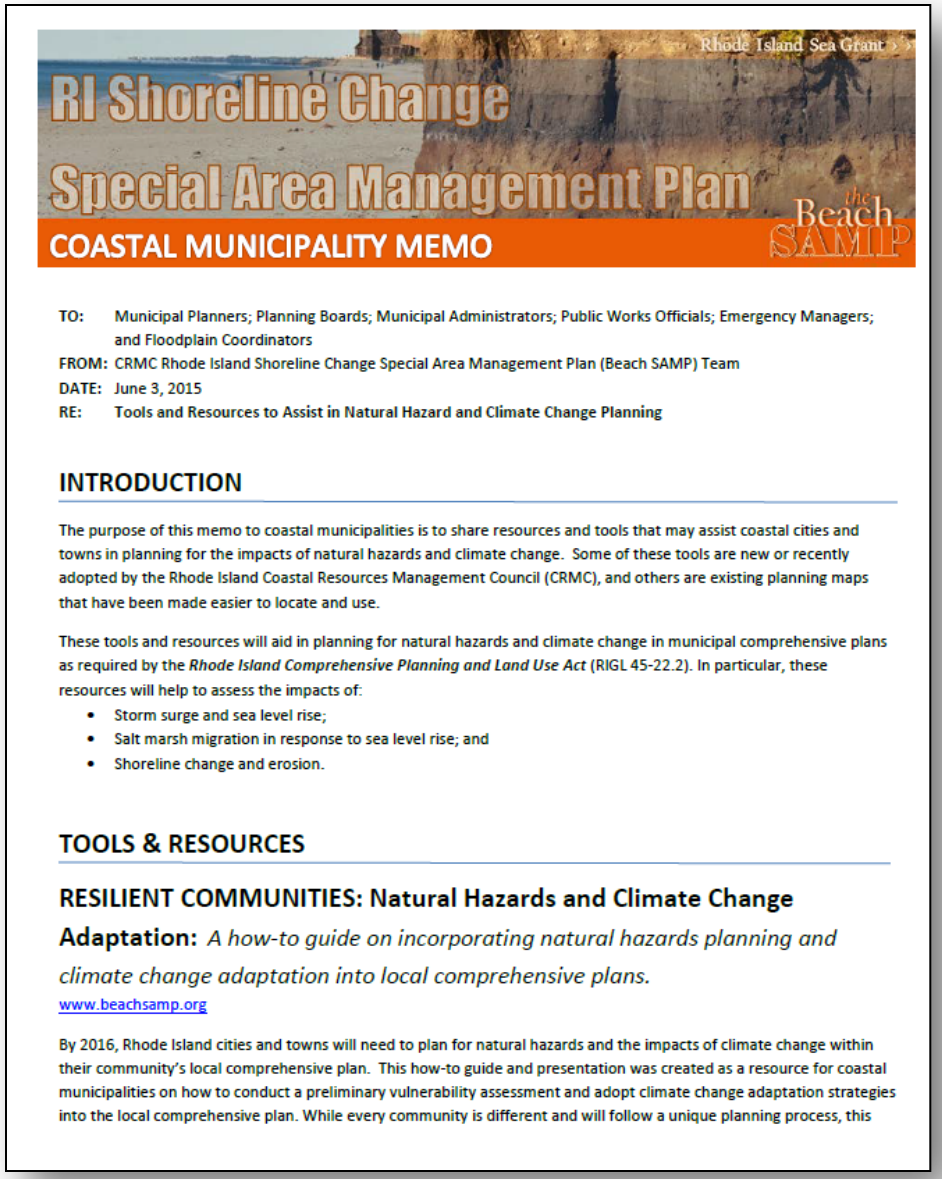
Municipal Work Session on Adaptation Planning for Coastal Hazards

Town of New Shoreham - October 22, 2015

CRMC
Coastal Resources Management Council

The University of Rhode Island
Graduate School of Oceanography
CRC Coastal Resources Center

Sea Grant
Rhode Island



Rhode Island Sea Grant

RI Shoreline Change Special Area Management Plan

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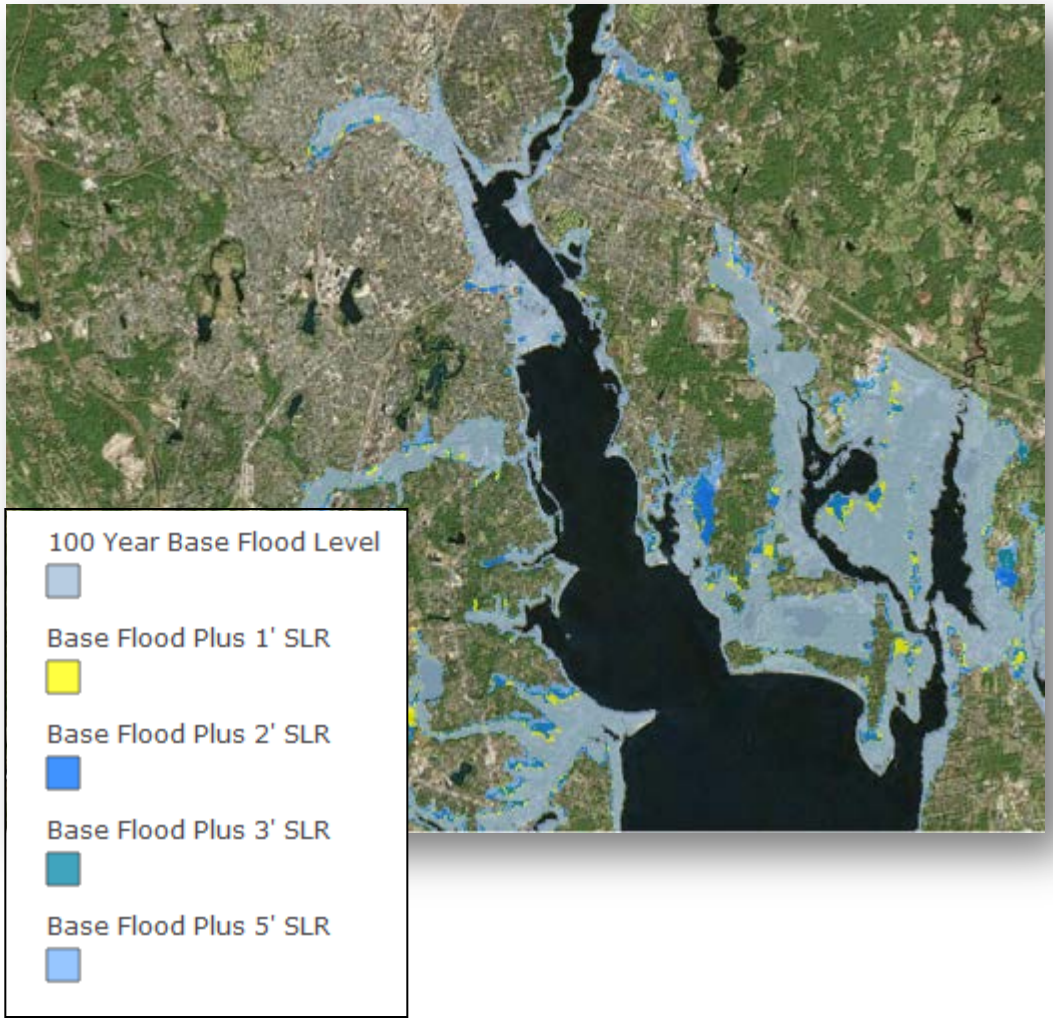
StormTools:

Maps of Storms+Sea Level Rise



Visualizations

Maps flooding from a 25, 50, 100-year storm PLUS Sea Level Rise

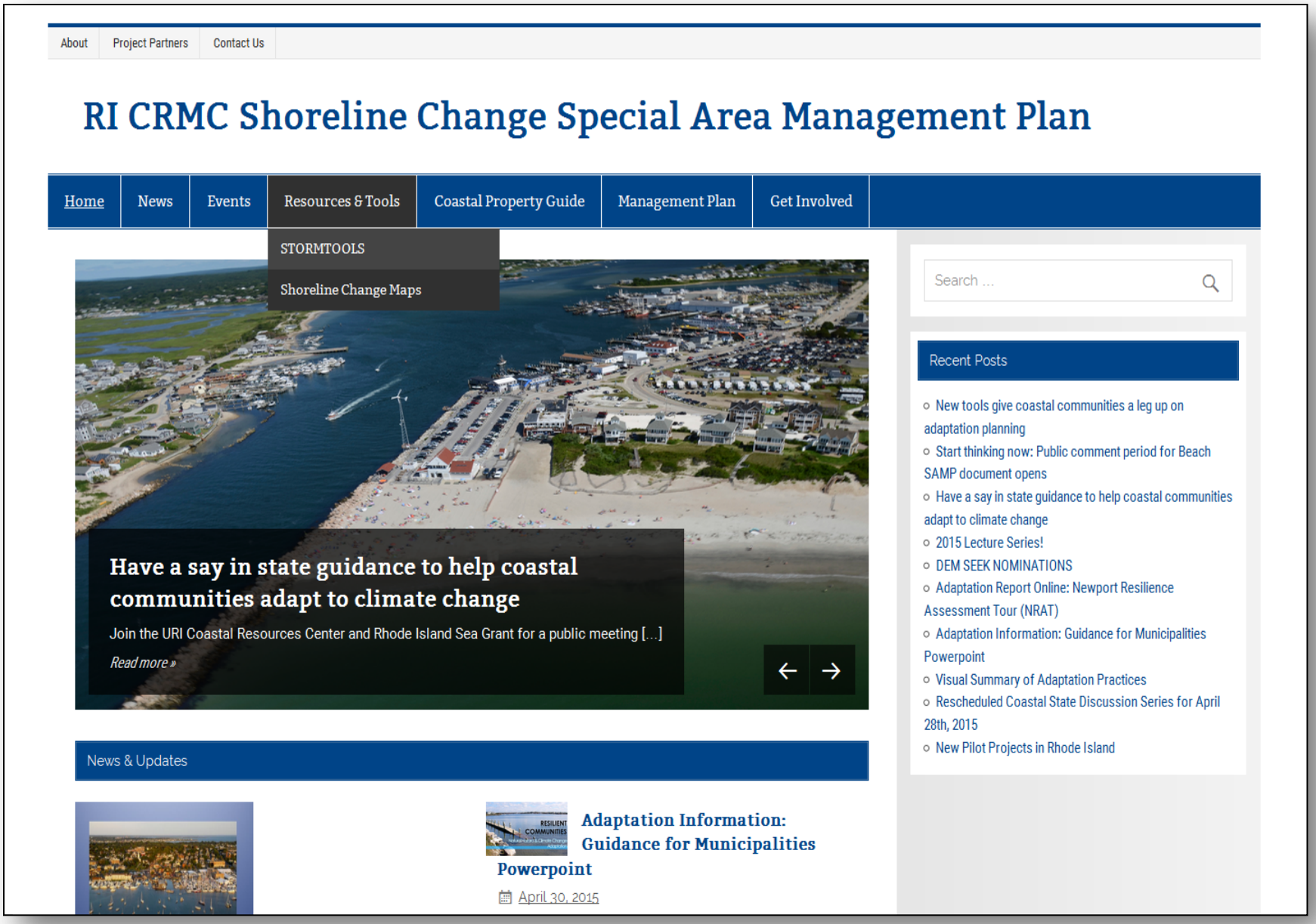
More accurate depiction of future flooding risk

Applications

Day-to-Day operations

Long term planning/financing

www.beachsamp.org



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Open ▾ Details

STORMTOOLS for Beginners

STORMTOOLS for Beginners is a one-map stop for all residents of Rhode Island to better understand their risk from coastal inundation. This map allows you to enter an address in Rhode Island, and get answers to 3 questions about your property:

1. Is my property vulnerable to STORM SURGE?;
2. How DEEP will the water be on my property during a 100-year (1% chance) coastal storm?; and
3. Will projected SEA LEVEL RISE affect my property?

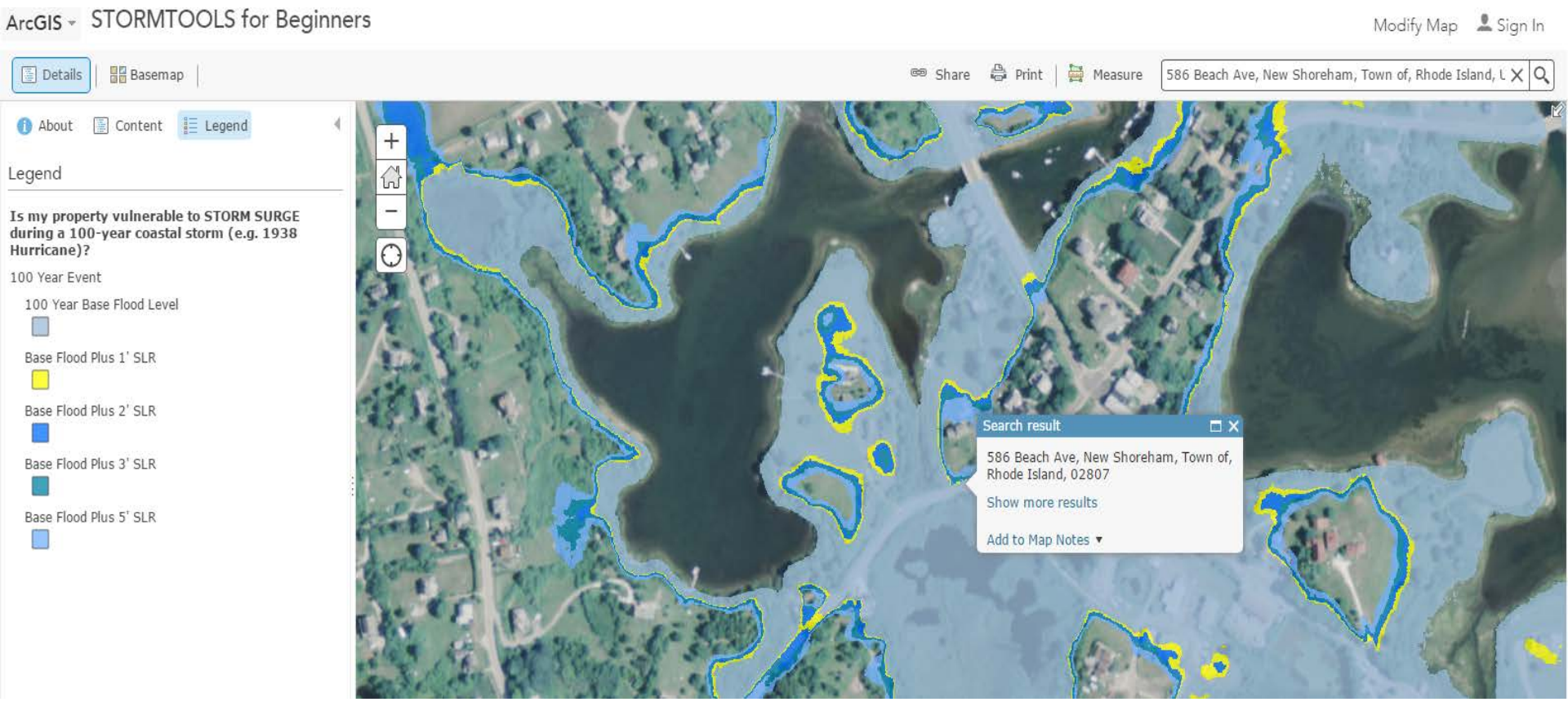
"STORMTOOLS FOR BEGINNERS"

Step 1: Enter an address

Step 2: Click on the question you want to answer

"Is my property vulnerable to STORM SURGE during a 100-year coastal storm (e.g. 1938 Hurricane)?"

(flood extent map)



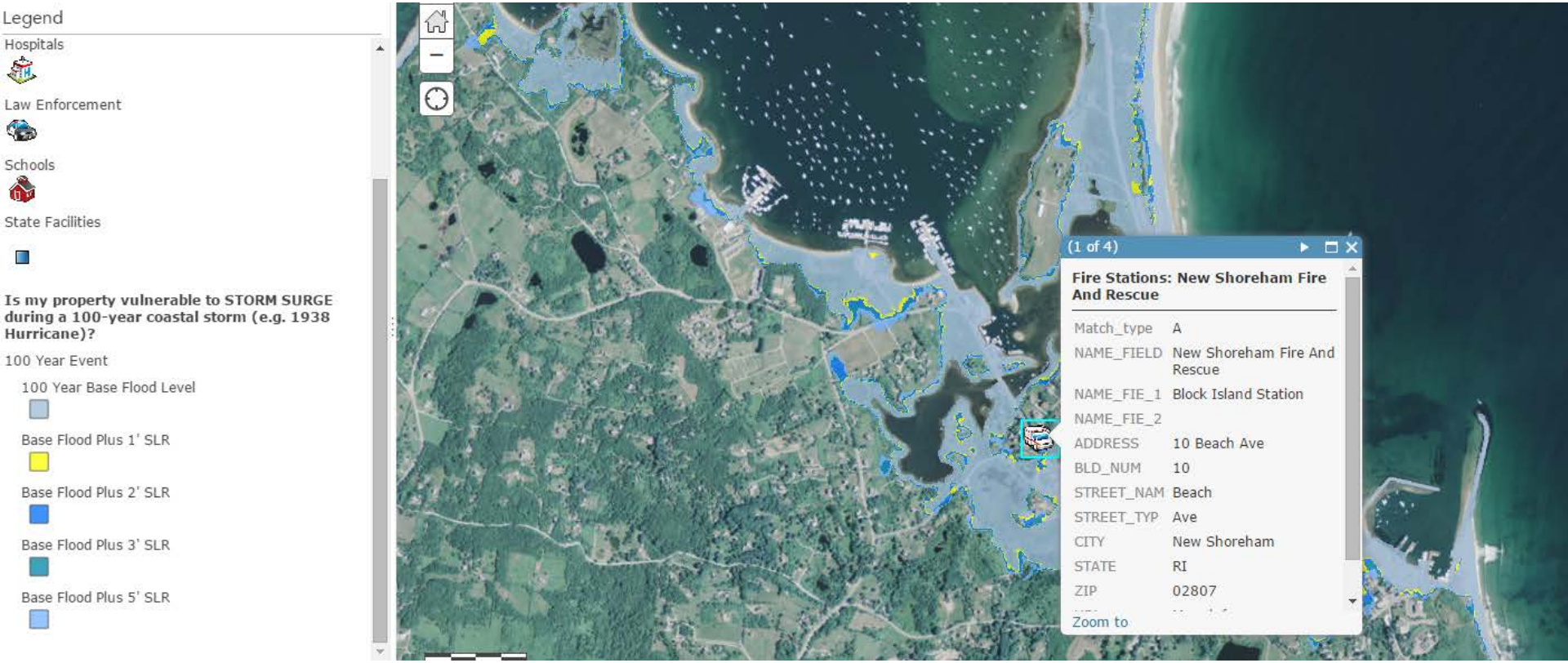
STORMTOOLS
100-year Storm Event
+SLR

Police / Fire / EMA

- Service areas cutoff or limited by flooding?
- Facilities at risk of being offline from flooding?

- Transportation

- Evacuation routes
- Functionality and service areas
- Alternate routes / road relocations
- Design life of infrastructure/assets



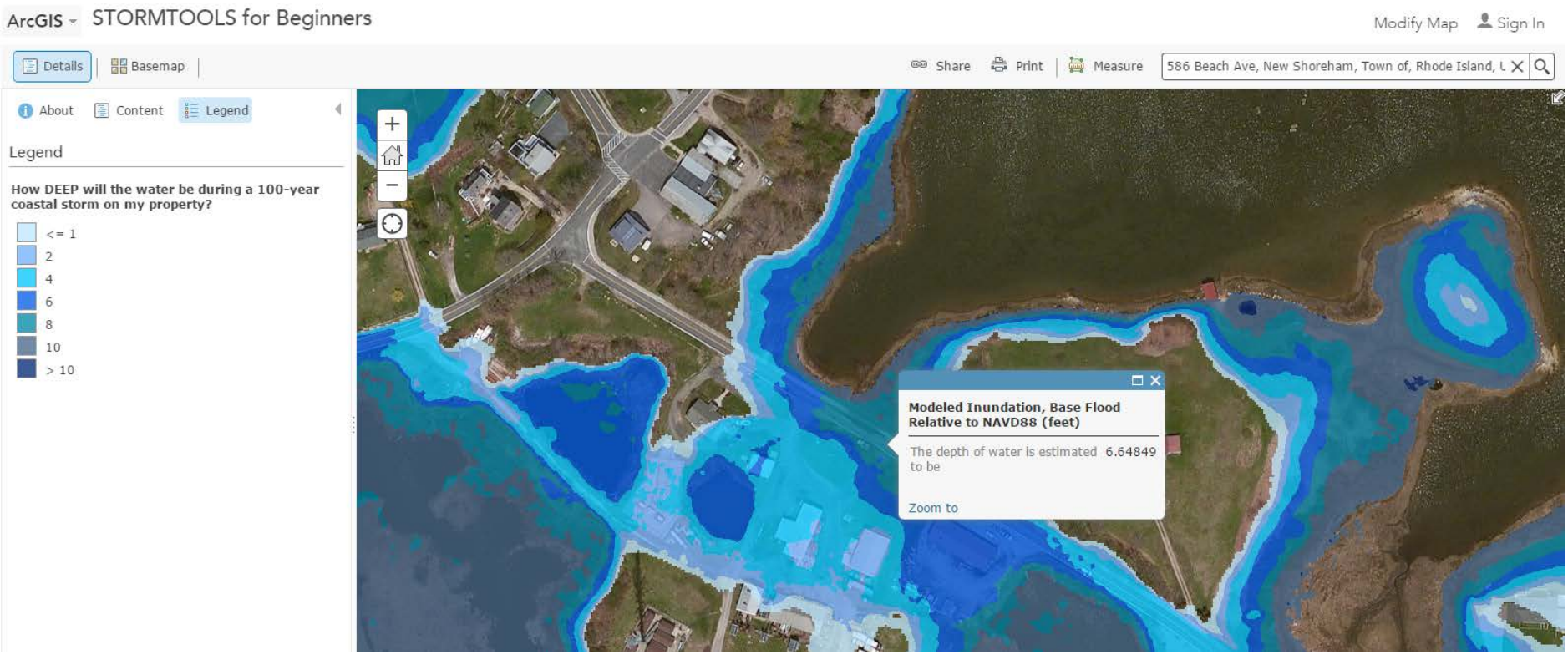
“STORMTOOLS FOR BEGINNERS”

Step 1: Enter an address

Step 2: Click on the question you want to answer

“How DEEP will the water be during a 100-year coastal storm on my property?”

(water depth map)



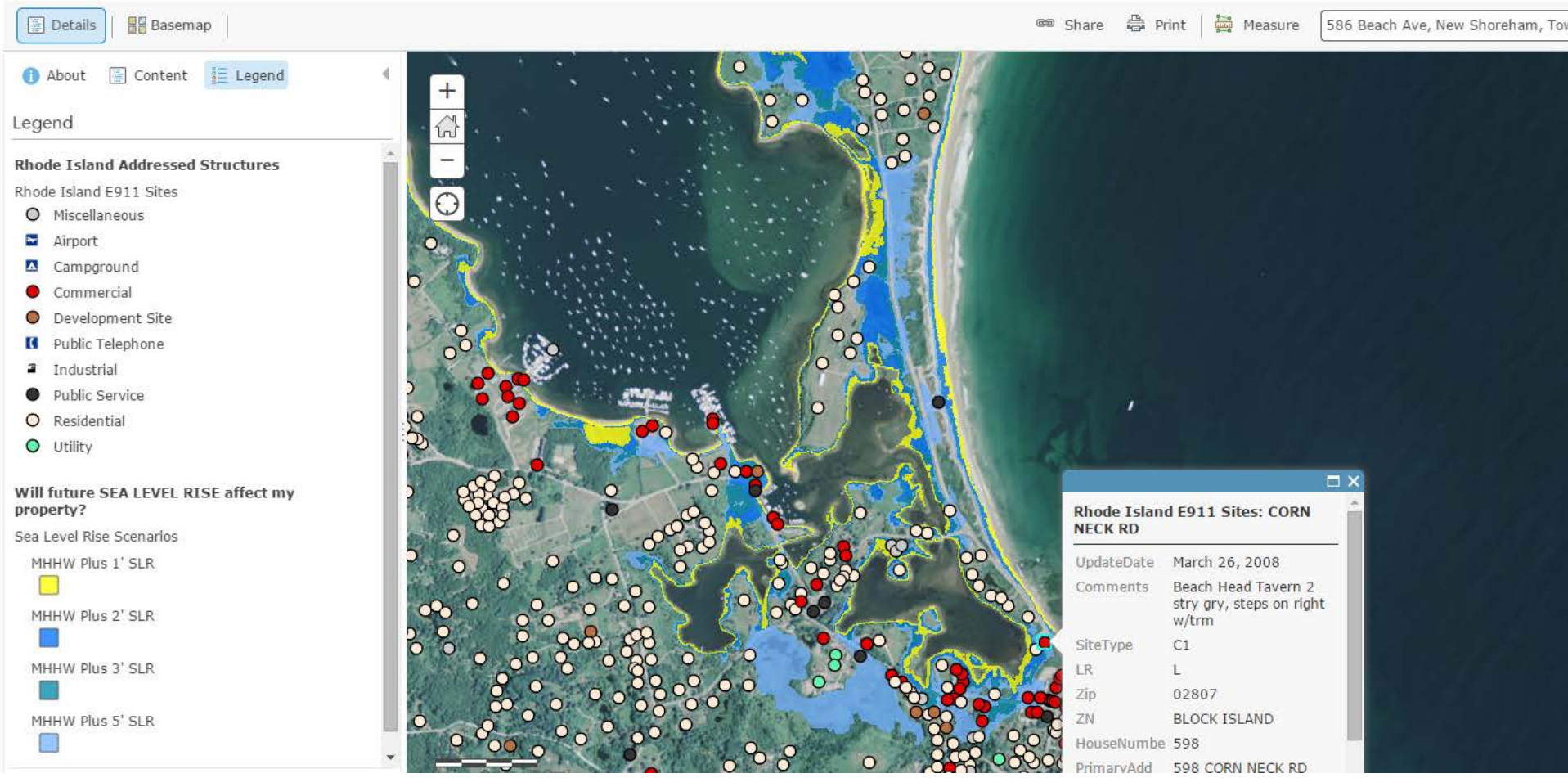
"STORMTOOLS FOR BEGINNERS"

Step 1: Enter an address

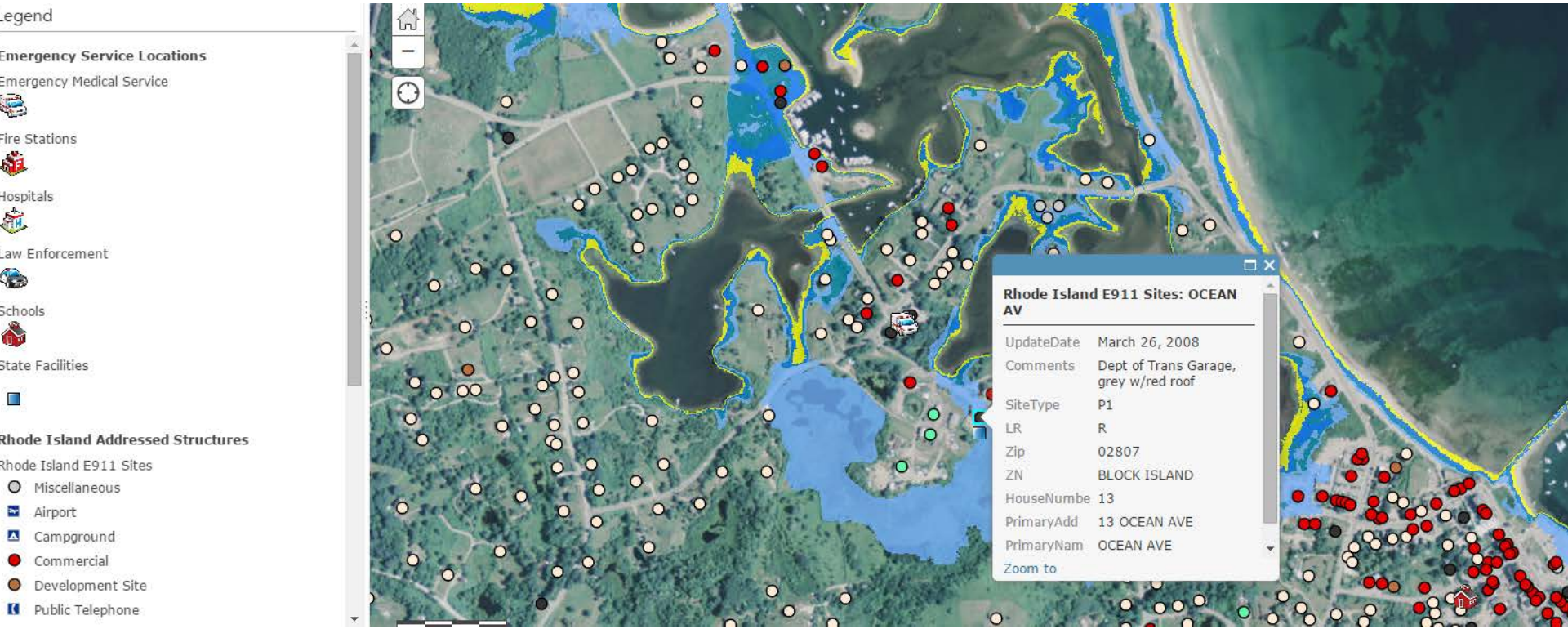
Step 2: Click on the question you want to answer

"Will future SEA LEVEL RISE affect my property (with 2 tides per day, every day)?"

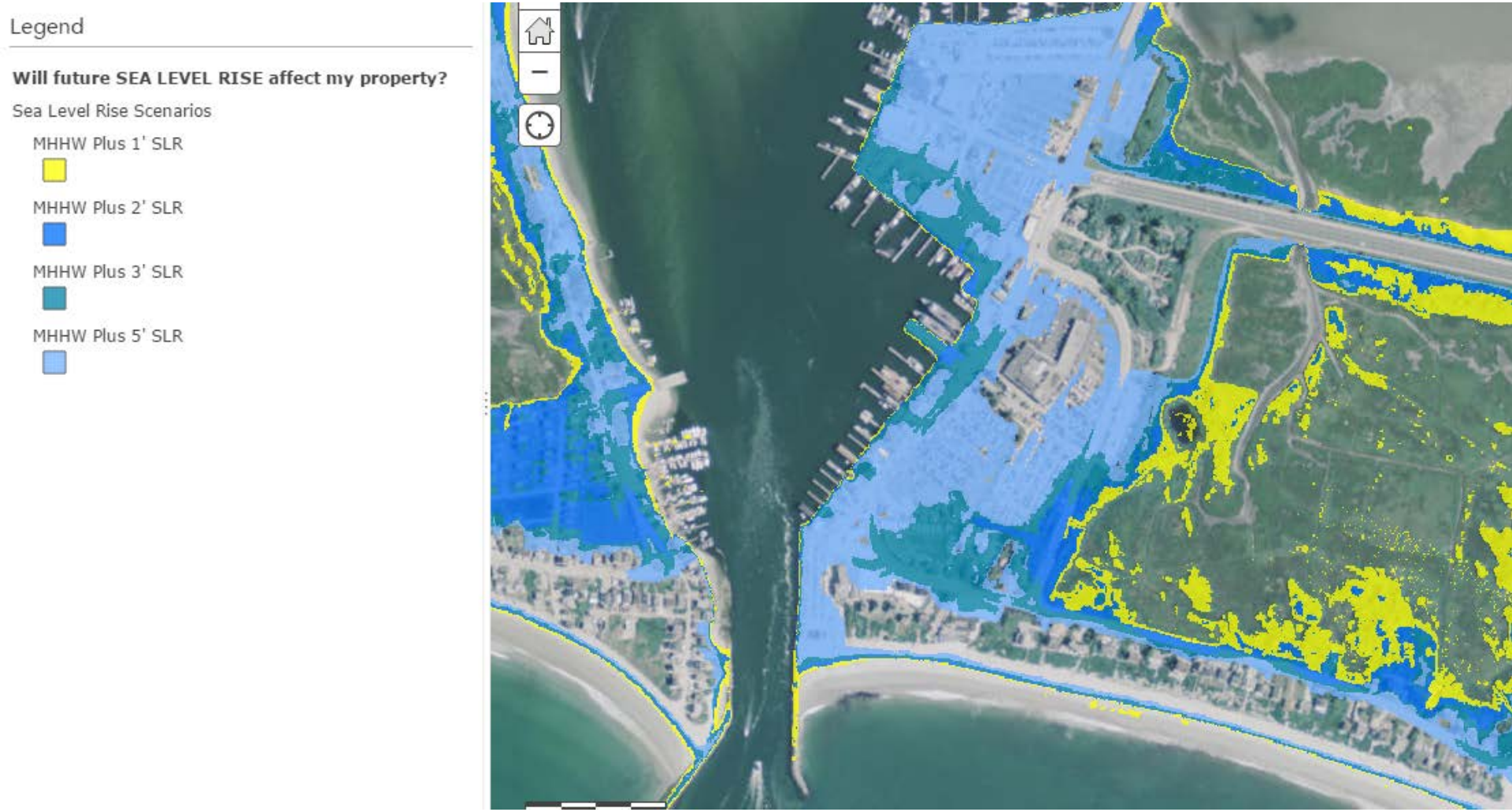
(sea level rise scenario map)



Sea Level Rise Impacts to Municipal Facilities

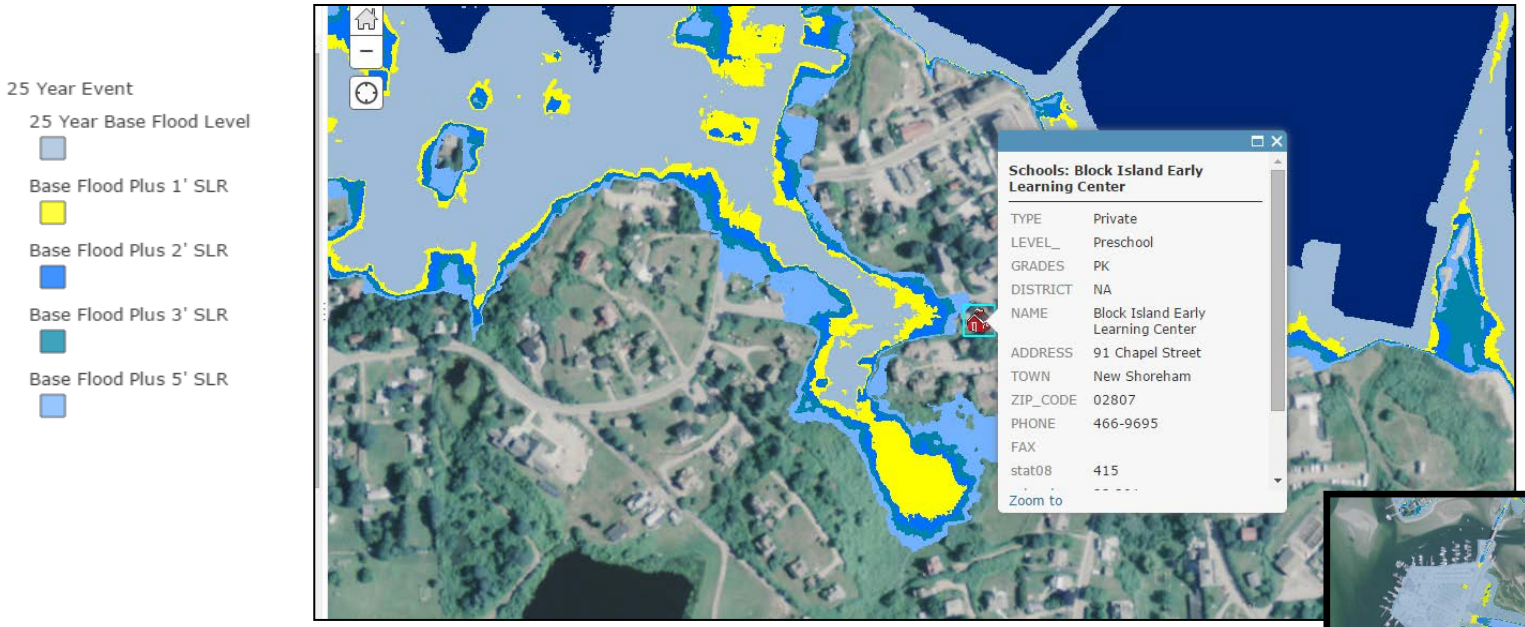


Sea Level Rise Impacts in Pt Judith

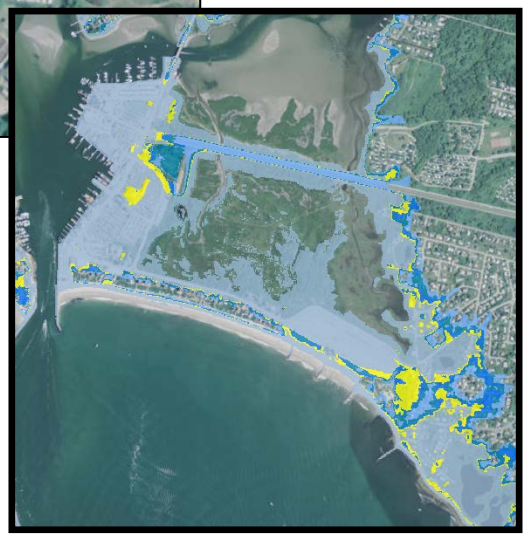


Provides Maps of Flood Extent with Population Density Data

Additional Storm Events
25-year or 4% Annual Chance Storm Event (comparable to a Nor'easter) +SLR



Pt Judith



STORMTOOLS also has maps for:
-10 year or 10% Annual Change Storm Event- Nuisance Flooding
-Wave height data for different storm events

Questions?