

# FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

*Seabrook - Hampton Falls - Hampton - North Hampton - Rye - New Castle - Portsmouth*

Assessing the Risk and Vulnerability of NH Coastal Communities to  
Sea Level Rise and Storm Surge

## New Castle Planning Board

February 24, 2016



This project is funded by New Hampshire Homeland Security and Emergency Management (HSEM) through a Pre-Disaster Mitigation Grant from the Federal Emergency Management Agency (FEMA).

**Julie LaBranche**  
Senior Planner  
**Theresa Walker**  
Planning Consultant





## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

### **Climate Science & Researchers**

Science based information, presentations

### **Coastal Adaptation Workgroup**

Workshop series, grant funded projects, advocacy, information

### **Portsmouth Coastal Resilience Initiative**

### **Tides to Storms (RPC)**

Coastal Hazards Chapter, Master Plan - Rye, Seabrook, Portsmouth

### **Coastal Resilience in the Seacoast**

Vulnerability assessment for 10 inland municipalities

### **RPC Regional Master Plan**

*NEW* - Natural Hazards, Climate Change, Energy Chapters



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

# NH Coastal Risks and Hazards Commission

The State Legislature established the Commission in 2013 to:

“recommend legislation, rules and other actions to prepare for projected sea-level rise and other coastal watershed hazards such as storms, increased river flooding and stormwater runoff, and the risks such hazards pose to municipalities and state assets in New Hampshire.”



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

**Goal:** Assess and plan for projected future impacts to NH's coastal resources and assets from sea level rise and storm surge

### Vulnerability Assessment Results

- Critical Infrastructure
- State and Local Roads
- Utilities and Infrastructure
- Natural Resources - Environment

### Regional Planning Recommendations

- Policy and Planning Recommendations
- Regulatory Strategies
- Non-Regulatory Approaches

*Local  
Hazard Mitigation  
Plans*

*State Agency  
Plans*

*Regional  
Master Plan*

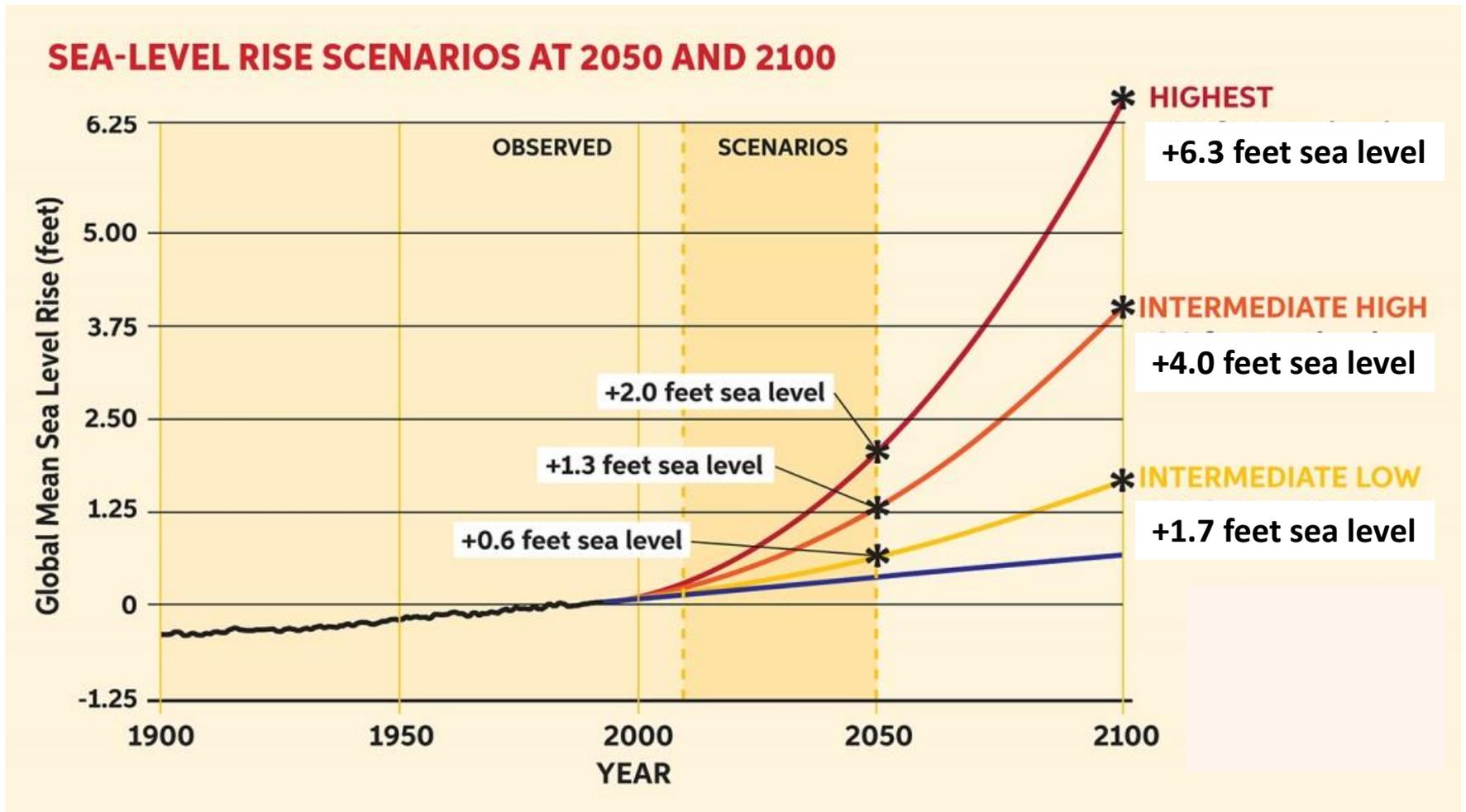
*Natural Resource  
Conservation*



# FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

Sources: 1) Wake CP, E Burakowski, E Kelsey, K Hayhoe, A Stoner, C Watson, E Douglas (2011) *Climate Change in the Piscataqua/Great Bay Region: Past, Present, and Future*. 2) Wake CP, Kirshen P, Huber M, Knuuti K, and Stampone M (2014) *Sea-level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends*.

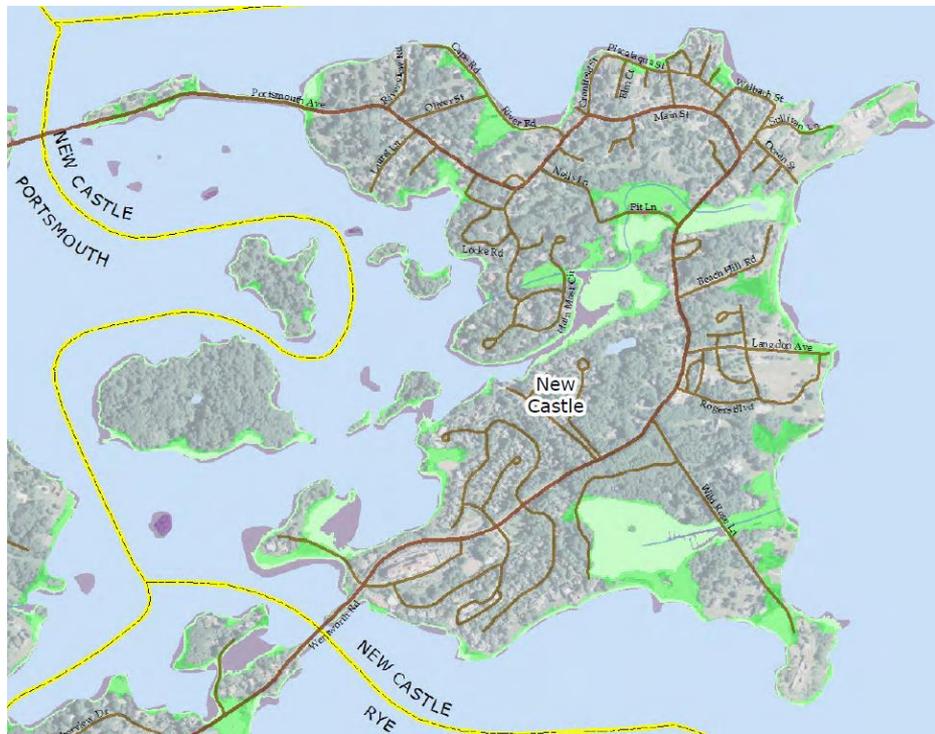
## Scenarios for Mapping and Analysis: Sea-Level Rise and Storm Surge



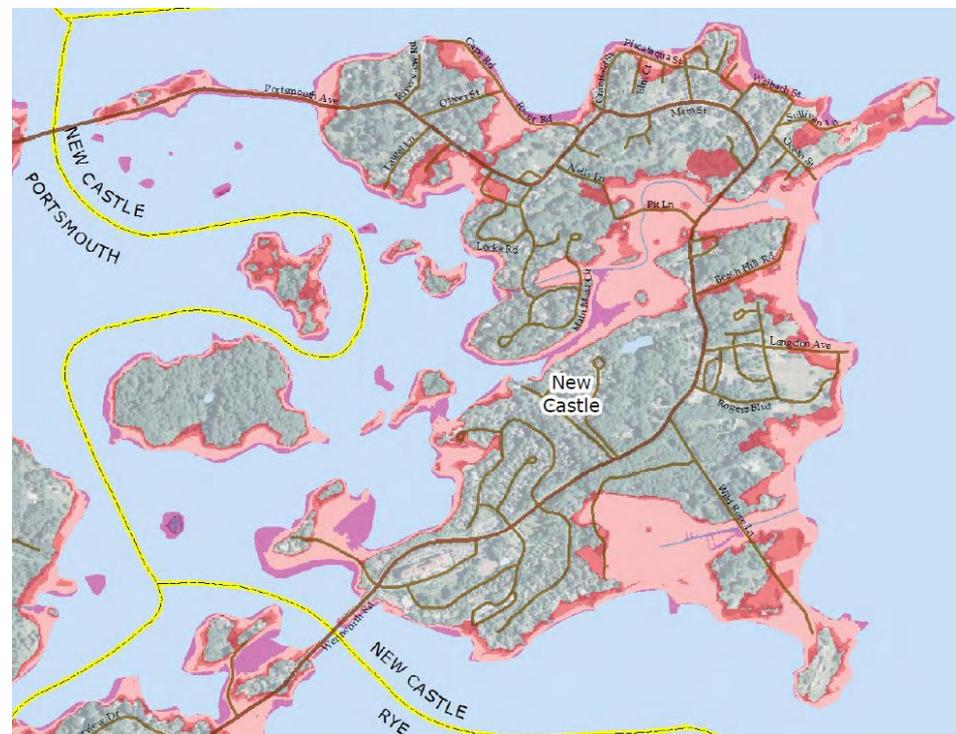


# FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

## Map Examples for New Castle



+1.7, 4.0 and 6.3 feet sea-level rise



+1.7, 4.0 and 6.3 feet sea-level rise + storm surge



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

**TABLE 2. SUMMARY OF ASSESSMENT DATA  
(from Tides to Storms)**

Sea-Level Rise (SLR) Scenarios	SLR 1.7 feet	SLR 4.0 feet	SLR 6.3 feet	SLR 1.7 feet + storm surge	SLR 4.0 feet + storm surge	SLR 6.3 feet + storm surge
Infrastructure (# of sites)	5	11	17	17	17	21
Critical Facilities (# of sites)	1	3	4	4	4	5
Roadways (miles)	0.0	0.7	1.3	1.3	2.6	3.3
Upland (acres)	33.6	64.5	96.4	94.7	126.0	159.7
Freshwater Wetlands (acres)	15.7	20.8	23.8	24.1	25.4	26.6
Tidal Wetlands (acres)	14.5	21.5	24.0	24.7	25.2	25.4
Conserved and Public Lands (acres)	12.2	17.9	25.4	26.1	31.9	38.5
100-year floodplain (acres)	36.7	36.7	36.7	36.7	36.7	36.7
500-year floodplain (acres)	68.0	68.0	68.0	68.0	68.0	68.0



# FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

**UPLAND** above mean higher high water  
Impacted by Sea-Level Rise and Sea-Level Rise + Storm Surge  
(reported in acres)

	Scenario 1	Scenario 2	Scenario 3	Scenario 1F	Scenario 2F	Scenario 3F
Town	MHHW + 1.7 feet SLR	MHHW + 4.0 feet SLR	MHHW + 6.3 feet SLR	100-year/1% + 1.7 feet SLR	100-year/1% + 4.0 feet SLR	100-year/1% + 6.3 feet SLR
Hampton	319.4	632.3	897.8	879.7	1,123.5	1,321.1
Hampton Falls	121.3	187.4	252.3	237.4	305.6	383.7
<b>New Castle</b>	<b>33.6</b>	<b>64.5</b>	<b>96.4</b>	<b>94.7</b>	<b>126.0</b>	<b>159.7</b>
North Hampton	67.8	135.3	215.9	193.5	283.9	358.6
Portsmouth	104.5	197.3	313.9	287.7	406.6	534.6
Rye	567.7	945.8	1,223.7	1,200.6	1,465.9	1,690.6
Seabrook	270.4	439.7	613.6	580.0	727.6	850.1
<b>Total</b>	<b>1,484.6</b>	<b>2,602.2</b>	<b>3,613.5</b>	<b>3,473.5</b>	<b>4,439.0</b>	<b>5,298.4</b>

100-year flood or 1% chance flood



## Regional Considerations – Critical Facilities and Infrastructure

- Water conveyance and drainage infrastructure particularly impacted by all flood scenarios
- Infrastructure management plans to determine future costs
- Impacts to regional and municipal drinking water supplies and waste water systems
- Adjustments to state highways affect connecting local roads, driveways, access points
- Flood impacts to Routes 1A and 1B make east-west evacuation routes more critical



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

# Regional Considerations – Natural Resources

- Impacts to private drinking water wells and septic systems
- Significant tidal inundation of freshwater wetlands and surface waters
- Conversion of freshwater systems to tidal/saltwater systems and habitats
- Impacts to fisheries, recreation and tourism economies
- Combined effects of coastal and freshwater flooding, importance of flood storage



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

# Overview of Assessment Findings

- 3 sea-level rise scenarios lie within/equal to extent of the current 100-year floodplain
- Designing for resiliency in the current 100-year floodplain will protect against long term sea-level rise
- Overall impacts increase dramatically at 4.0 feet of flooding
- Roadways and culverts are most heavily impacted parts of the municipal “built landscape”
- Land adjacent to freshwater and tidal wetlands will be critical flood storage and wetland/salt marsh migration areas
- Adaptation strategies customized to address vulnerability



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

# Tides to Storms Recommendations

- Regulatory, Policy and Planning, Non-Regulatory/Outreach
- Short-term actions (1-5 years) that address current threats
- Low cost, high return actions
- 'No Regrets' actions that build resilience to future conditions
- Stepping stones to longer-term investment strategies, land use decisions and public awareness



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

### Project Materials

- Regional Assessment and Maps
- Municipal Assessment and Maps

[http://www.rpc-nh.org/Tides\\_to\\_Storms.htm](http://www.rpc-nh.org/Tides_to_Storms.htm)

- How can the project results be useful? (RPC, CRHC, others)
  - Inform recommendations in the CRHC Final Report
  - Assist with technical assistance and outreach to municipalities
  - Guide policy changes by state agencies



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST



Julie LaBranche, Senior Planner

Phone: (603) 778-0885

Email: [jlabranche@rpc-nh.org](mailto:jlabranche@rpc-nh.org)

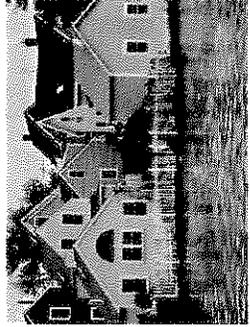
Theresa Walker, Planning Consultant

Phone: (603) 534-3913

Email: [twalker@comcast.net](mailto:twalker@comcast.net)

# How can New Castle be better prepared for coastal flooding and extreme weather events?

- Learn what wetland buffers are - and why they are critical to protect against the impacts of impervious surfaces, nutrients, and erosion.
- Understand how wetland buffers can mitigate the potential damage of extreme weather events and flooding.
- Learn about the Lavenger Creek salt marsh area as an example of a pristine wetland resource, and ways to help keep it unspoiled.
- Review existing wetland regulations, and updated recommendations from a 2015 analysis.



The New Castle Conservation Commission will be hosting multiple workshops this spring.

We encourage everyone in our community to attend.

**Sunday, April 3rd at 4pm at the New Castle Public Library**

**Tuesday, April 12th at 7pm at the New Castle Public Library**

This meeting will include a preparedness activity sponsored by FEMA as part of America's PreparaAthon – get tips on how to survive a natural disaster!

**Monday, May 2nd at 4pm at the Portsmouth Yacht Club**



For more information, please contact Theresa Walker of the Rockingham Planning Commission at 603-534-3913, [twalker@rpc-nh.org](mailto:twalker@rpc-nh.org) or Tracy Degnan at the Rockingham County Conservation District at 603-679-2790 x 59; [rcdctd@comcast.net](mailto:rcdctd@comcast.net)

### **Samples of Definitions of Impervious Surface and Lot Coverage**

Impervious Surface (Town of Durham Zoning Ordinance) – A material with low permeability that impedes the natural infiltration of moisture into the ground so that the majority of the precipitation that falls on the surface runs off of is not absorbed into the ground. Common impervious surfaces include, but are not limited to, roofs, concrete or bituminous paving such as sidewalks, patios, driveways, road, parking spaces or lots, and storage areas, compacted gravel including drives and parking areas, oiled or compacted earthen materials, stone, concrete or composite pavers, wood, and swimming pools.

Impervious Surface Area (Town of Durham Zoning Ordinance) – The total area of a site or parcel that is covered by impervious surfaces. The area covered by a deck or similar structure shall be included in the impervious surface area unless the surface of the deck or structure provides for precipitation to pass through it and reach the ground in a dispersed pattern and the material under the deck or structure is not an impervious surface.

Impervious Surface Ration (Town of Durham Zoning Ordinance) – The impervious surface area of a site or parcel divided by the total area of the site or parcel expressed as a percentage.

Impervious Surface (Town of Exeter Zoning Ordinance) – A modified surface that cannot effectively absorb or infiltrate water, including roofs, decks, patios, driveways (paved, gravel, or crushed stone), parking areas and walkways, unless designed to absorb or infiltrate water.

Impervious Surface (City of Portsmouth Zoning Ordinance) – A modified surface that cannot effectively absorb or infiltrate water. Impervious surfaces include, but are not limited to, roofs and paved areas such as driveways, parking areas and walkways. Impervious surfaces also include decks, patios, and gravel or crushed stone surfaces unless structures or surfaces have been designed to effectively absorb or infiltrate water.

Impervious Coverage or Impervious (Town of Rye Zoning Ordinance) – Any modified surface that cannot effectively absorb or infiltrate water. Examples of impervious surfaces include, but are not limited to, roofs, and unless designed to effectively absorb or infiltrate water, decks, patios, paved, gravel, or crushed stone driveways, parking areas, and walkways, storage areas, compacted gravel including drives and parking areas, oiled or compacted earthen materials, stone, concrete, or composite pavers and wood.

Impervious Cover (NH Southeast Watershed Alliance Model Stormwater Standards for Coastal Communities) – Those surfaces that cannot effectively infiltrate rainfall consisting of surfaces such as building rooftops, pavement, sidewalks, driveways, compacted gravel (e.g. driveways and parking lots).

Suggested for New Castle:

Impervious Surface – A modified surface that cannot effectively absorb or infiltrate water, including, but not limited to, roofs, decks, patios, sheds, detached garages, driveways (paved, gravel, crushed stone or earthen materials), parking areas, walkways, tennis courts, and swimming pools, unless such structures or surfaces have been designed to effectively allow for water to infiltrate or be absorbed.

Lot Coverage (Town of New Castle Zoning Ordinance) – That percentage of the plot or land area covered by the principal and accessory building areas. This includes the area of in-the-ground pools as well as above-the ground pools that are more than 18” high and are enclosed with a deck or platform.

Density and Dimensional Regulations:

- Lot size less than 3500 sq. ft. = 30% is the maximum % of the lot covered
- Lot size 3500 to 8000 sq. ft. = 1050 sq. ft. or 25% of the lot size, which is greater
- Lot size more than 8000 sq. ft. = 2000 sq. ft. or 20% of the lot size, whichever is greater

Lot Coverage (Town of Exeter Zoning Ordinance) – All impervious and pervious paved surfaces on a given lot, including: paved, bricked, or gravel areas, buildings or other structures, decks and patios, recreational facilities such as tennis courts, in-ground pools, or similar amenities.

Lot Coverage (Town of Durham Zoning Ordinance) – The aggregate gross ground floor area of all buildings on a lot expressed as a percentage of the total lot area, excluding parking facilities, sidewalks and driveways.

Suggested for New Castle:

Lot Coverage – That percentage of the plot or land area covered by impervious and pervious paved surfaces, including, but not limited to, paved, bricked or gravel areas, buildings or other structures, decks, patios, driveways, walkways, sheds, tennis courts, and swimming pools.

**Water Quality and Natural Resource Protection Checklist**

- \_\_\_\_\_ Identify wetlands, vernal pools, marshes, ponds, streams and coastal shoreline on or adjacent to the site and required buffers and setbacks
- \_\_\_\_\_ Calculate total area of proposed impacts to wetlands, expressed in square feet
- \_\_\_\_\_ Document undisturbed buffers for wetlands, vernal pools, marshes, and surface waters
- \_\_\_\_\_ Identify areas of high infiltration potential on the site
- \_\_\_\_\_ Document preservation of natural drainage ways
- \_\_\_\_\_ Identify and calculate existing impervious area within the site boundary, expressed in square feet and as a percentage of the total area
- \_\_\_\_\_ Identify and calculate planned (existing and new) impervious area within the site boundary, expressed in square feet and as a percentage of the total area
- \_\_\_\_\_ Calculate total lot coverage, existing and new, expressed as a percentage of the total area
- \_\_\_\_\_ Document erosion and sediment controls during construction
- \_\_\_\_\_ Describe Low Impact Design (LID) features on the site or proposed for the site, such as rain gardens, bio swales, pervious pavement
- \_\_\_\_\_ Incorporate bioretention or infiltration features into landscaping plan
- \_\_\_\_\_ Document downspouts directed to turf or landscaped areas
- \_\_\_\_\_ Identify boundaries of existing predominant vegetation and proposed limits of clearing
- \_\_\_\_\_ Use native trees and bushes to be planted to reduce runoff volume and increase nutrient uptake
- \_\_\_\_\_ Enable driveway to be graded to pervious areas

- \_\_\_\_\_ Use grassed or landscaped swales instead of curb and gutter
- \_\_\_\_\_ User pervious alternatives for low-traffic areas (e.g. gravel, pavers, porous pavement, grassed parking)
- \_\_\_\_\_ Identify areas prone to flooding or coastal storm surge as delineated by the Town of New Castle NH Vulnerability Assessment, 2015
- \_\_\_\_\_ Document location of floodplain as delineated by FEMA
- \_\_\_\_\_ Identify land prioritized for conservation as identified in the Land Conservation Plan for New Hampshire's Coastal Watershed, 2006
- \_\_\_\_\_ Identify critical wildlife habitat as identified in the NH Fish and Game Wildlife Action Plan, 2015 Revised

DRAFT



# FROM TIDES TO STORMS 2: CLIMATE ADAPTATION IMPLEMENTATION

## Addressing the Risk and Vulnerability of Sea Level Rise and Storm Surge

*Seabrook - Hampton Falls – Hampton - North Hampton – Rye - New Castle - Portsmouth*

## New Castle, New Hampshire



This project is funded by a grant from the Northeast Region Ocean Council.

**Theresa Walker**  
**Planning Consultant**





## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

**Goal: Assess and plan for projected future impacts to NH's coastal resources and assets from sea level rise and storm surge**

### **What's impacted in New Castle?**

- State and Local Roads
- Utilities and Infrastructure
- Natural Resources

### **How can New Castle prepare?**

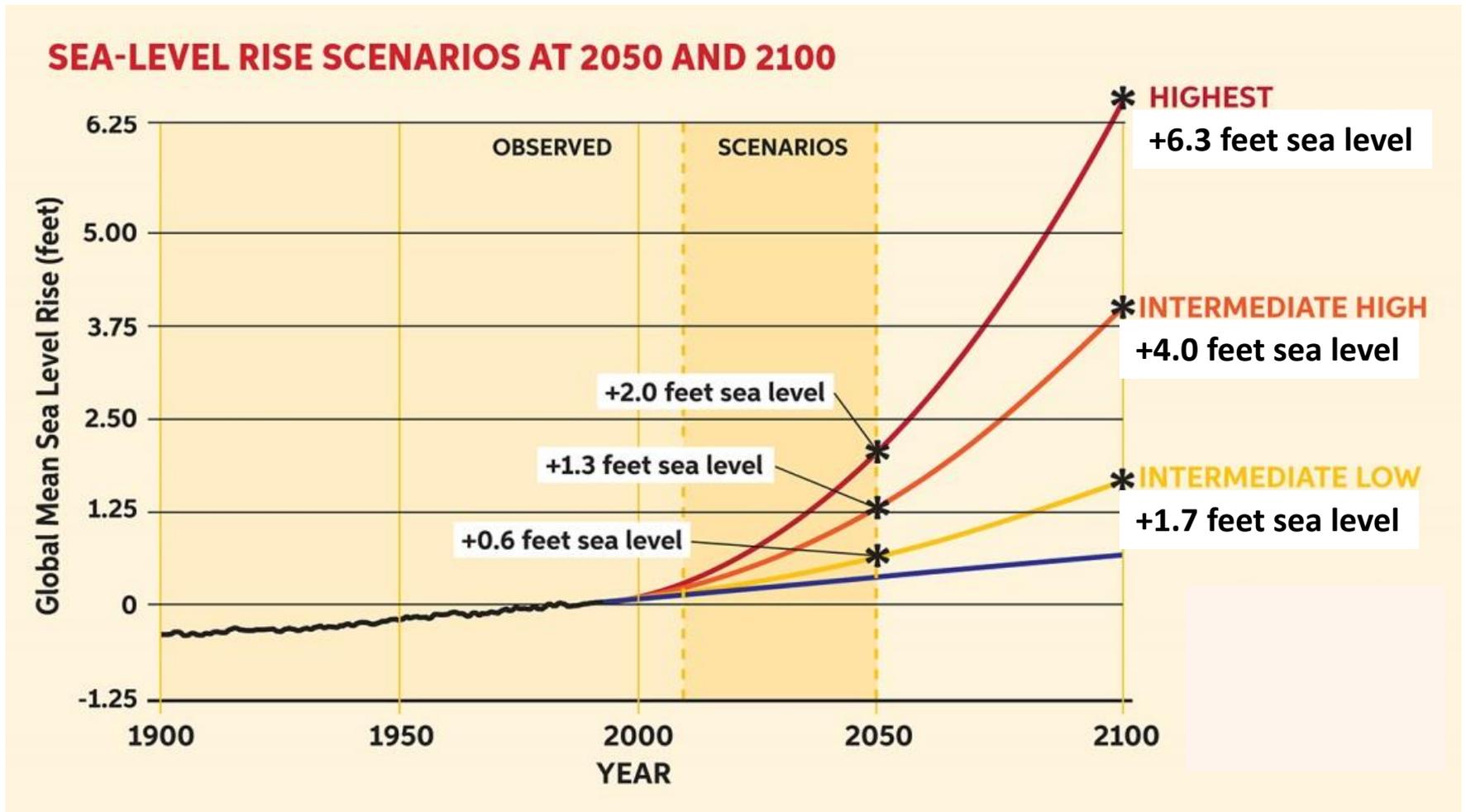
- Regulatory Strategies
- Non-Regulatory Strategies



# FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

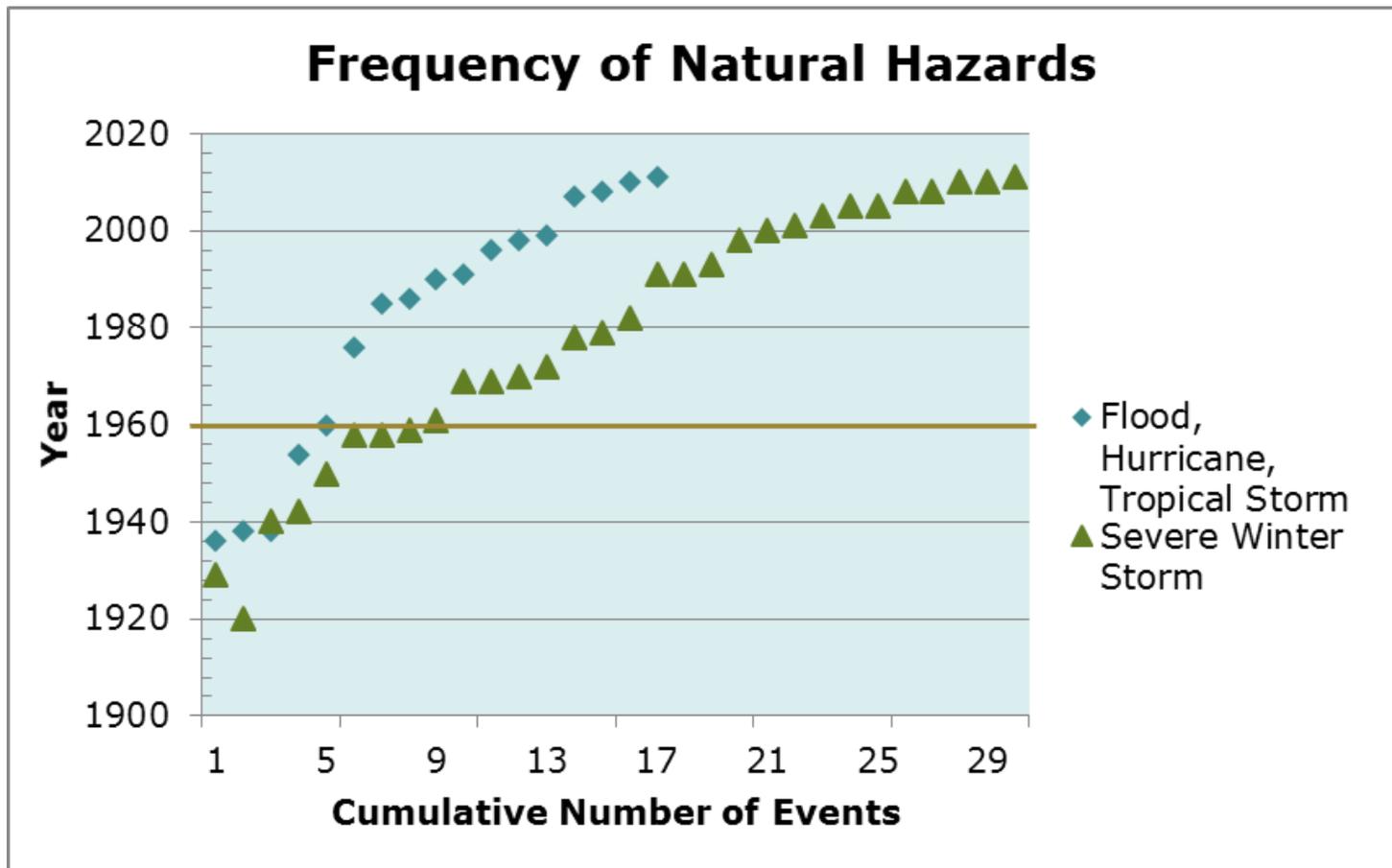
Sources: 1) Wake CP, E Burakowski, E Kelsey, K Hayhoe, A Stoner, C Watson, E Douglas (2011) *Climate Change in the Piscataqua/Great Bay Region: Past, Present, and Future*. 2) Wake CP, Kirshen P, Huber M, Knuuti K, and Stampone M (2014) *Sea-level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends*.

## Scenarios for Mapping and Analysis: Sea-Level Rise and Storm Surge





## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

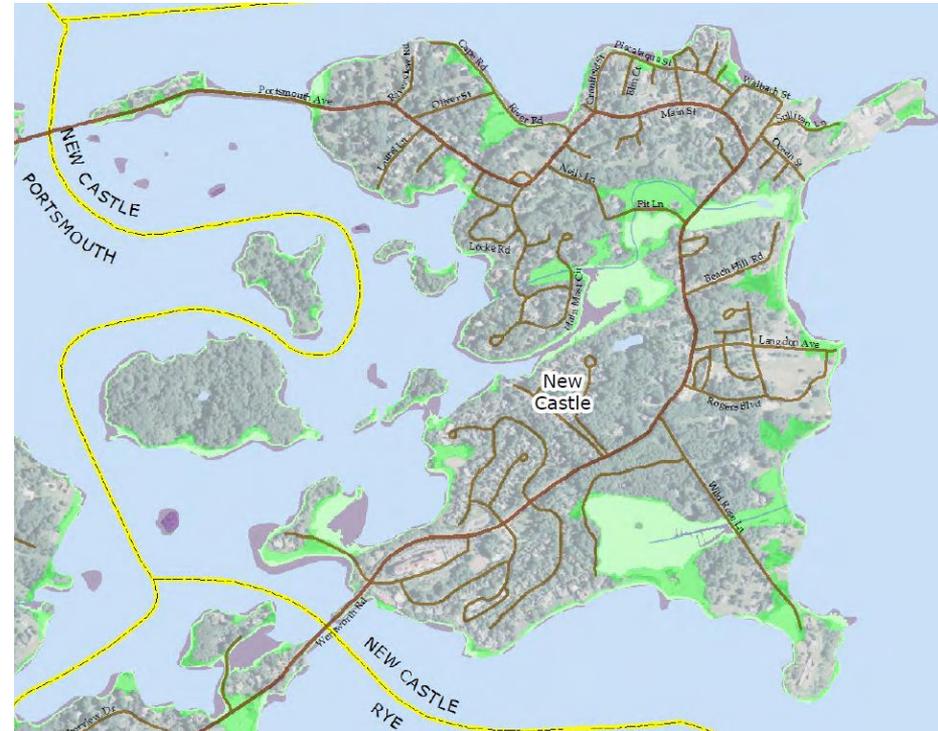


Year and cumulative number of natural hazard events in the region: Severe Winter Storms and Flood, Hurricane, Tropical Storms. Source: State of NH Multi-Hazard Mitigation Plan (2013)

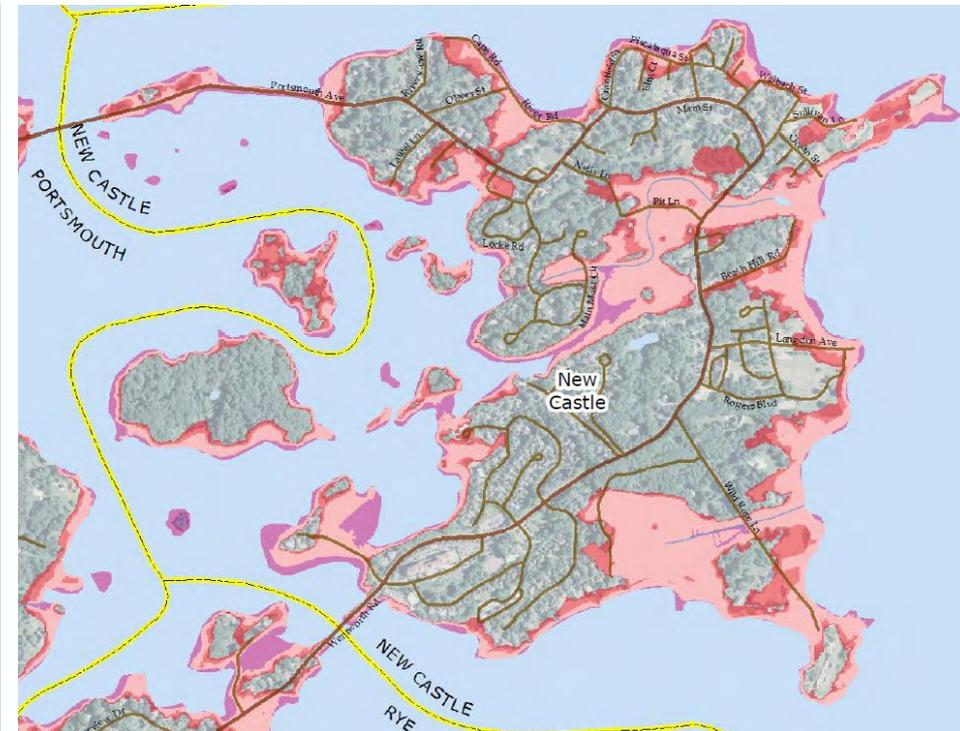


# FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

## Map Examples for New Castle



+1.7, 4.0 and 6.3 feet sea-level rise



+1.7, 4.0 and 6.3 feet sea-level rise + storm surge



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

### Overview of Vulnerability Assessment Findings:

- Local tide gauge data shows that sea level has risen 0.7 inches/decade since 1900, with an increase of 1.3 inches/decade since 1993.
- 3 sea-level rise scenarios lie within the extent of the current 100-year floodplain
- Designing for resiliency in the current 100-year floodplain will protect against long term sea-level rise
- Roadways and culverts are most heavily impacted parts of the municipal “built landscape”, Routes 1A and 1B
- Land adjacent to freshwater and tidal wetlands will be critical flood storage and wetland/salt marsh migration areas



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

# Tides to Storms Recommendations

- Regulatory, Policy and Planning, Non-Regulatory/Outreach
- Short-term actions (1-5 years) that address current threats
- Low cost, high return actions
- 'No Regrets' actions that build resilience to future conditions
- Longer-term investment strategies, land use decisions and public awareness



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

# What is the State of New Hampshire doing?

- New Hampshire Coastal Risk and Hazards Commission created in August 2013 by State Legislature
- Draft Report released March 2016: *Preparing New Hampshire for Projected Storm Surge, Sea-Level Rise, and Extreme Precipitation*
- Impacts to Economy, Built Landscape, Natural Resources, and Heritage
- Response Options: Defend, Accommodate, Retreat



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

# What is New Castle doing?

## Town of New Castle Master Plan:

“Town ordinances and other measures should maintain a just balance between the rights to the enjoyment of private property and **the community’s obligation to meet its existing and probable future needs to protect the general welfare of its inhabitants**, including, but not limited to, health, safety, order, convenience and prosperity, and to protect the character of the town including, but not limited to, conservation and preservation of natural and man-made resources.”



## FROM TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

### **Town of New Castle Hazard Mitigation Plan:**

#### Identifies Storm Surge and Flood Hazards Areas:

- Storm surge and flooding washing over Rt. 1B at Goat Island, Pit Lane and in Rye near Heather Road, blocking evacuation routes.
- Flooding of Cape Road, River Road, Oliver Street, Piscataqua Road, Atkinson Street, Main Street, Quarter Deck Lane and Wild Rose Lane

#### Identifies Hazard Mitigation Strategies and Actions:

- Mitigate current and future flooding of culverts at Pit Land and Rt. 1B
- Educate residents of storm and flood inundation areas
- Work with RPC to evaluate impacts from sea level rise and storm surge and review adaptation strategies to help mitigate impacts



Climate is what  
we expect.

Weather is what  
we get.

