
# 2019-2020 New Hampshire Coastal Flood Risk Summary

**Webinar Training for the General Public**
Monday, March 30, 2020

*Presented by:*
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New Hampshire Department of Environmental Services

# Webinar Training | Meet the Organizers

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University of New Hampshire Cooperative Extension

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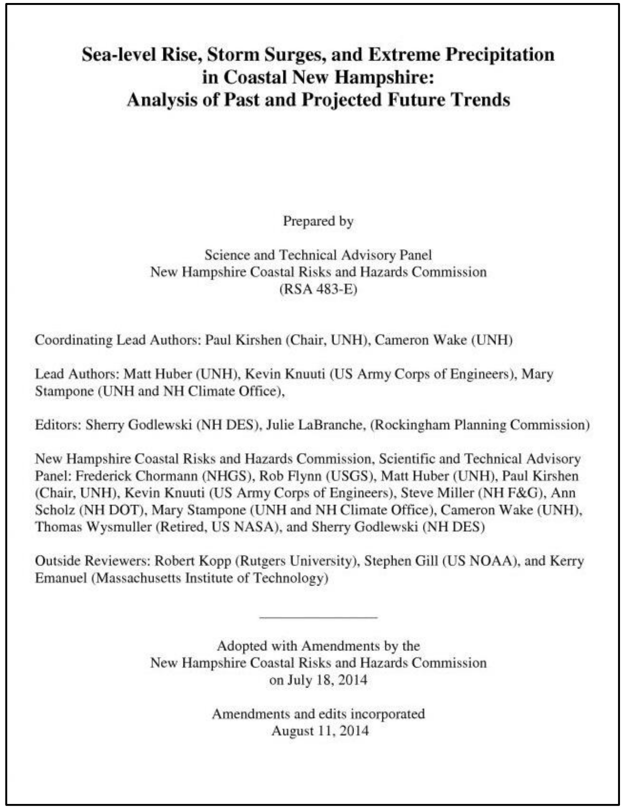
# Webinar Training | Agenda

- Background & Context
- Part I: Science
- Part II: Guidance for Using Scientific Projections
- How You Might Use the Science & Guidance
- Q & A

# New Hampshire Coastal Flood Risk Summary
## Background & Context



**Sea-level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends**

Prepared by

Science and Technical Advisory Panel
New Hampshire Coastal Risks and Hazards Commission
(RSA 483-E)

Coordinating Lead Authors: Paul Kirshen (Chair, UNH), Cameron Wake (UNH)

Lead Authors: Matt Huber (UNH), Kevin Knuuti (US Army Corps of Engineers), Mary Stampone (UNH and NH Climate Office),

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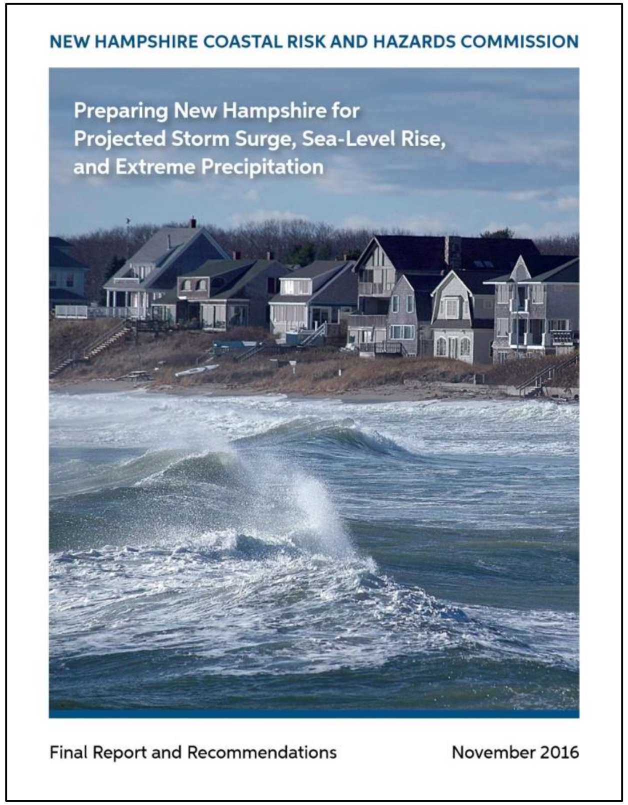
Adopted with Amendments by the
New Hampshire Coastal Risks and Hazards Commission
on July 18, 2014

Amendments and edits incorporated
August 11, 2014

https://www.nhcrhc.org/stap-report/

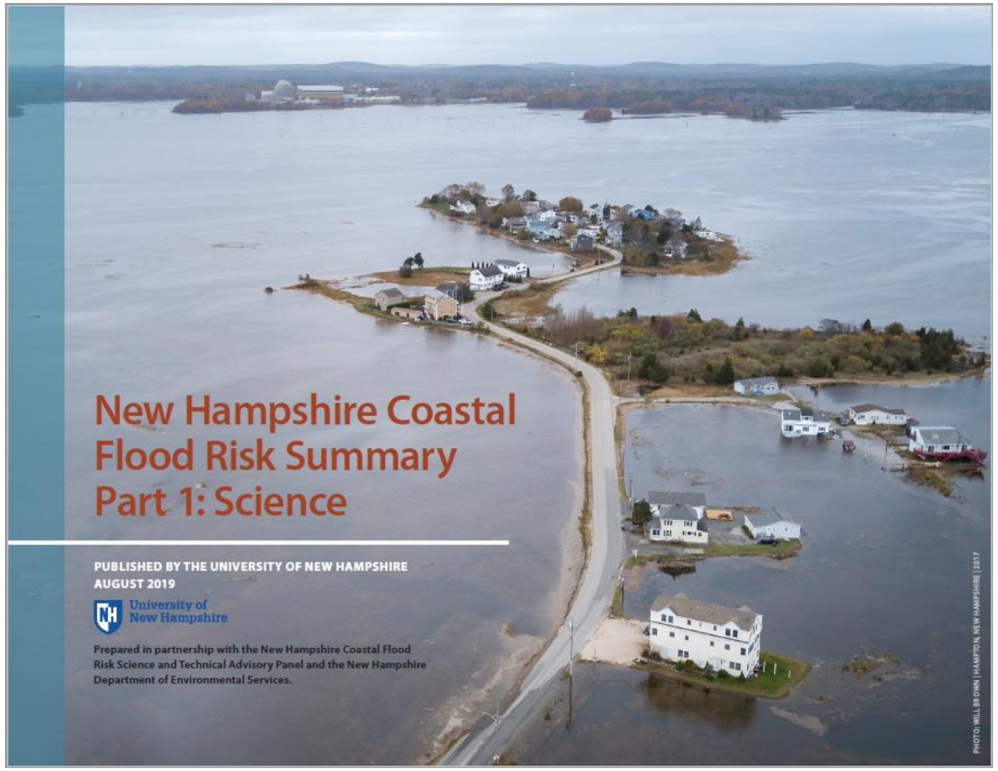



https://www.nhcrhc.org/final-report/

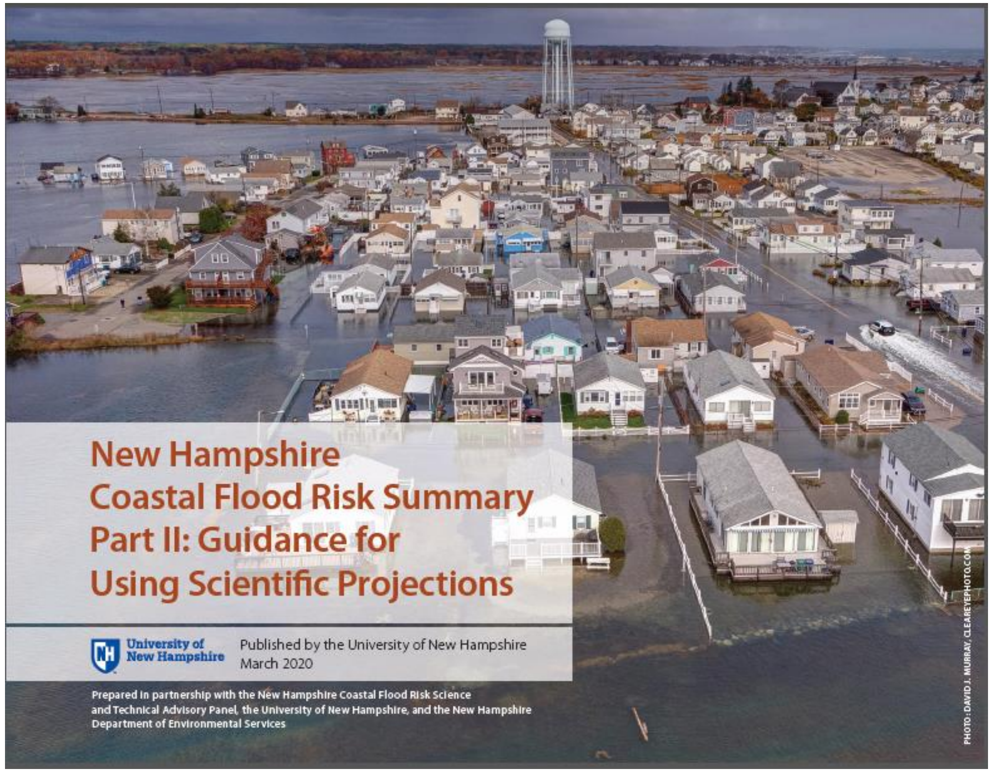
**RSA 483-B:22**
**COASTAL AND GREAT BAY REPORTS**

"The commissioner of the department of environmental services shall convene representatives of the department of transportation, the division of homeland security and emergency management, the office of strategic initiatives, and other agencies as he or she deems appropriate, at least every five years, commencing July 1, 2019 to supervise an updating of storm surge, sea-level rise, precipitation, and other relevant projections recommended in the coastal risks and hazards commission 2014 report "Sea-Level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Trends." This report shall be distributed to all state agencies, municipalities in the coastal and Great Bay region, the governor, the speaker of the house of representatives, the president of the senate and the chairs of the house and senate committees with jurisdiction over issues related to such projections."

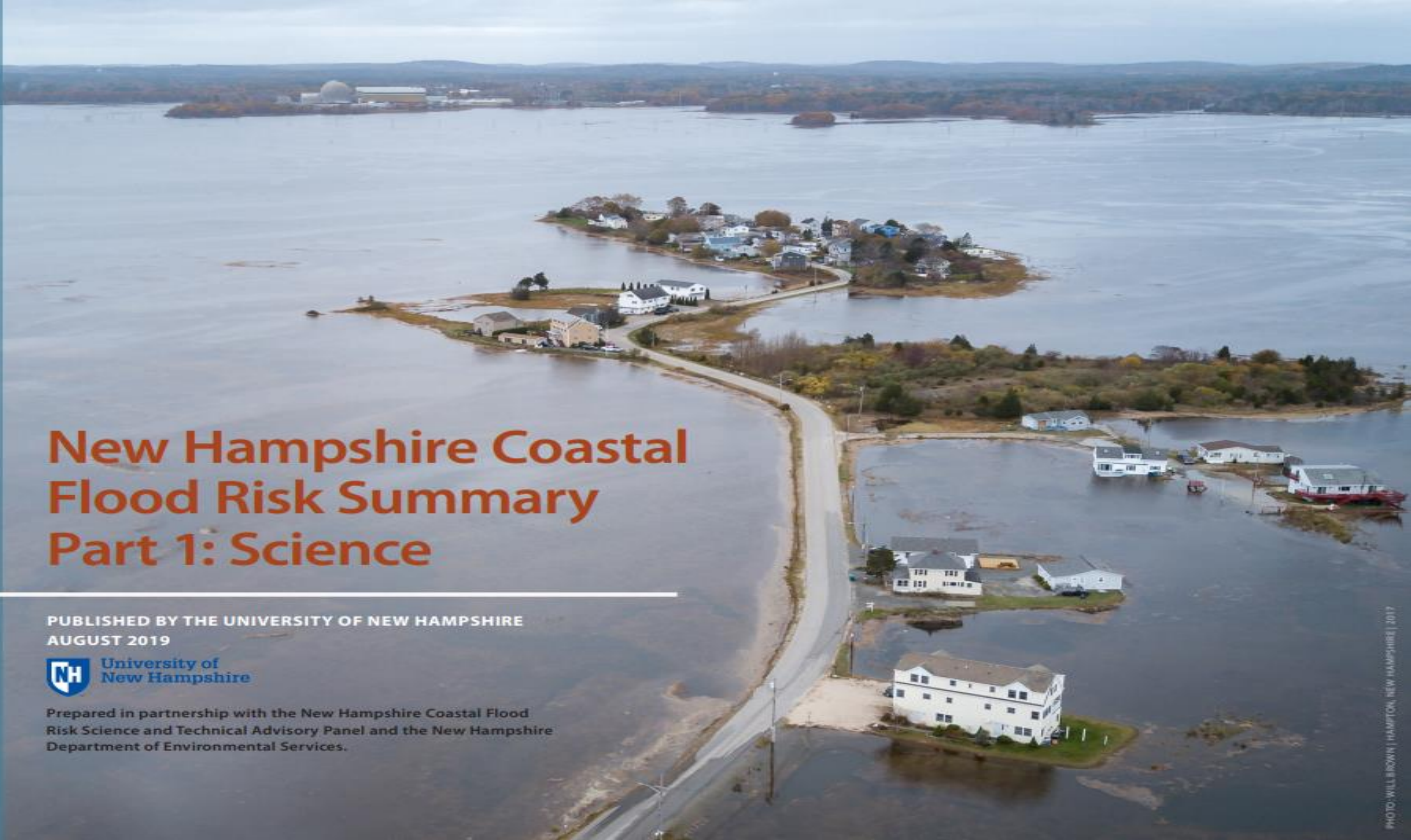
# New Hampshire Coastal Flood Risk Summary
## Background & Context




**Part I: Science**
Released August 2019
https://scholars.unh.edu/ersc/210/




**Part II: Guidance for Using Scientific Projections**
Released March 2020
https://scholars.unh.edu/ersc/211/



# New Hampshire Coastal Flood Risk Summary Part 1: Science

PUBLISHED BY THE UNIVERSITY OF NEW HAMPSHIRE
AUGUST 2019

University of New Hampshire

Prepared in partnership with the New Hampshire Coastal Flood Risk Science and Technical Advisory Panel and the New Hampshire Department of Environmental Services.

PHOTO: WILL BROWN | HAMPTON, NEW HAMPSHIRE | 2017

# Part I: Science | Key Findings
## Relative Sea-Level Rise (RSLR)

- Relative sea level in New Hampshire is rising and projected to rise for centuries
- Melting land based glaciers and ice sheets are now the major contributor to sea-level rise

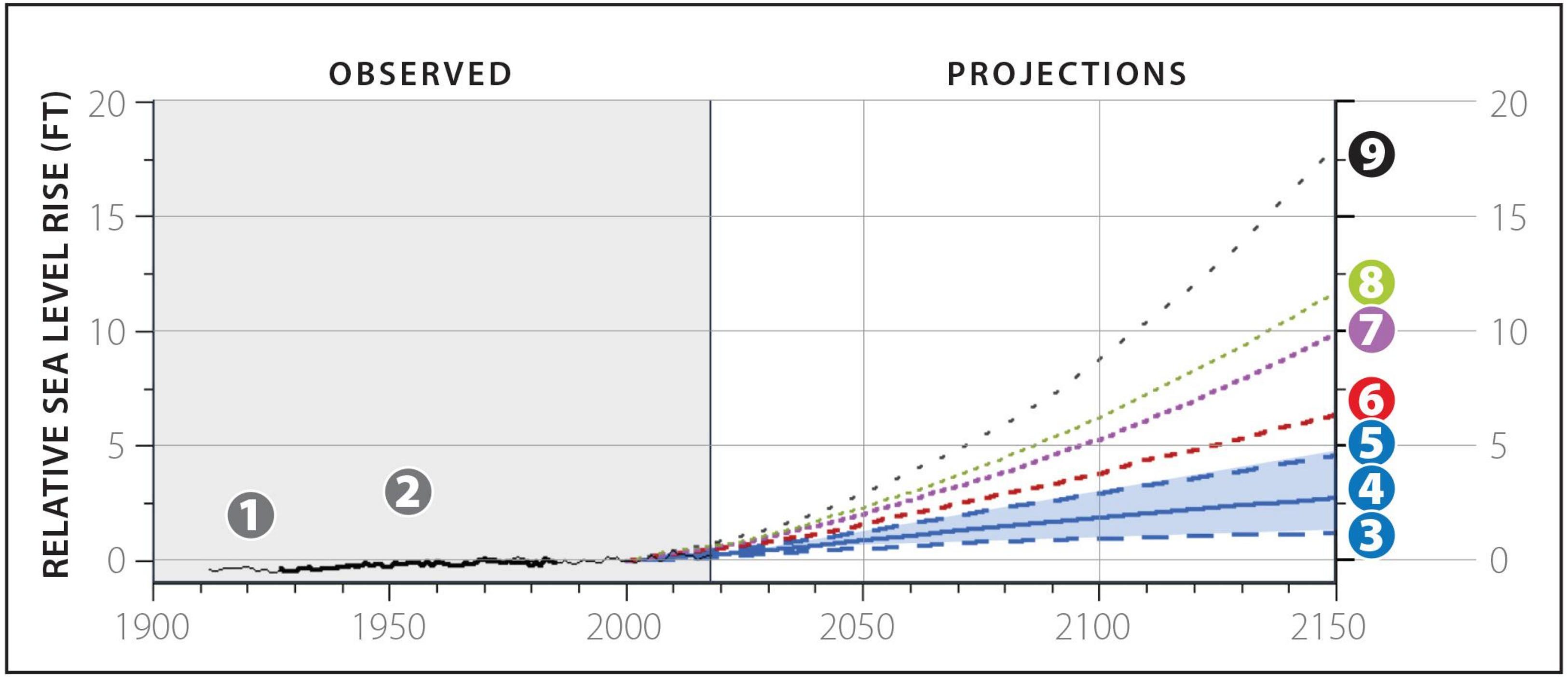



**Figure 4.5.** Observed and Projected Relative Sea-Level Rise for Seavey Island Tide Gauge K14 Projections | Stabilized Greenhouse Gas Concentrations (RCP 4.5).

1. Historical data for Portland, ME (1912-2018; thin black line)
2. Historical data for Seavey Island, ME (1927-1986; thick black line)
3. Lower end of "likely range"
4. Central estimate
5. Upper end of "likely range"
6. 1-in-20 chance estimate
7. 1-in-100 chance estimate
8. 1-in-200 chance estimate
9. 1-in-1000 chance estimate

# Part I: Science | Key Findings
## Relative Sea-Level Rise (RSLR)

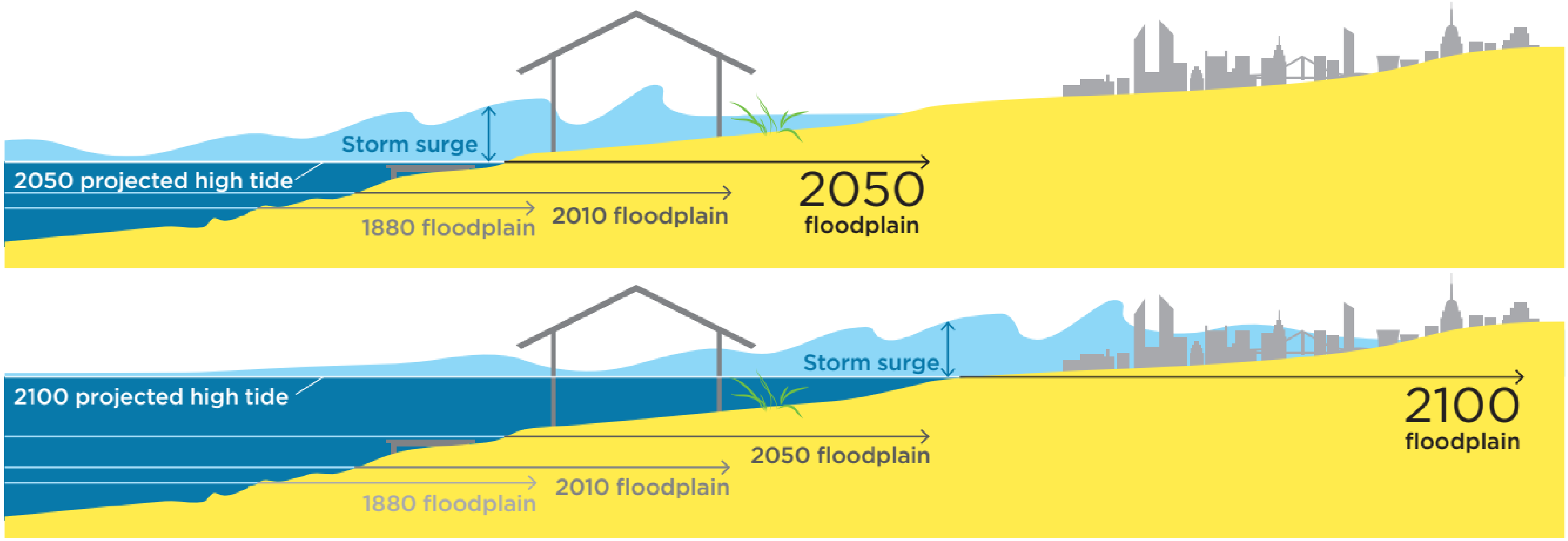
Assuming global greenhouse gas concentrations stabilize by 2100, relative sea level in coastal New Hampshire is "likely" to rise by:

- **0.5 – 1.3 feet by 2050** (but could exceed 2.9 feet)
- **1.0 – 2.9 feet by 2100** (but could exceed 8.7 feet)
- **1.2 – 4.6 feet by 2150** (but could exceed 18.1 feet)

Note that RSLR estimates are much higher if we assume that global greenhouse gas concentrations will continue to grow through 2100 and the rate of ice mass loss from Antarctica accelerates rapidly.

# Part I: Science | Key Findings
## Coastal Storms

- Projected changes in coastal storms remain uncertain
- Impacts from storm surge in coastal New Hampshire will increase with RSLR




Source: Adapted from Union of Concerned Scientists

# Part I: Science | Key Findings
## RSLR-Induced Groundwater Rise

- Average groundwater levels are projected to rise as a percentage of RSLR up to 3 miles inland from the coast:
  - 66% of RSLR between 0-0.6 miles from the coast
  - 34% of RSLR between 0.6-1.2 miles from the coast
  - 7% of RSLR between 1.9-2.5 miles from the coast
  - 3% of RSLR between 2.5-3.1 miles from the coast

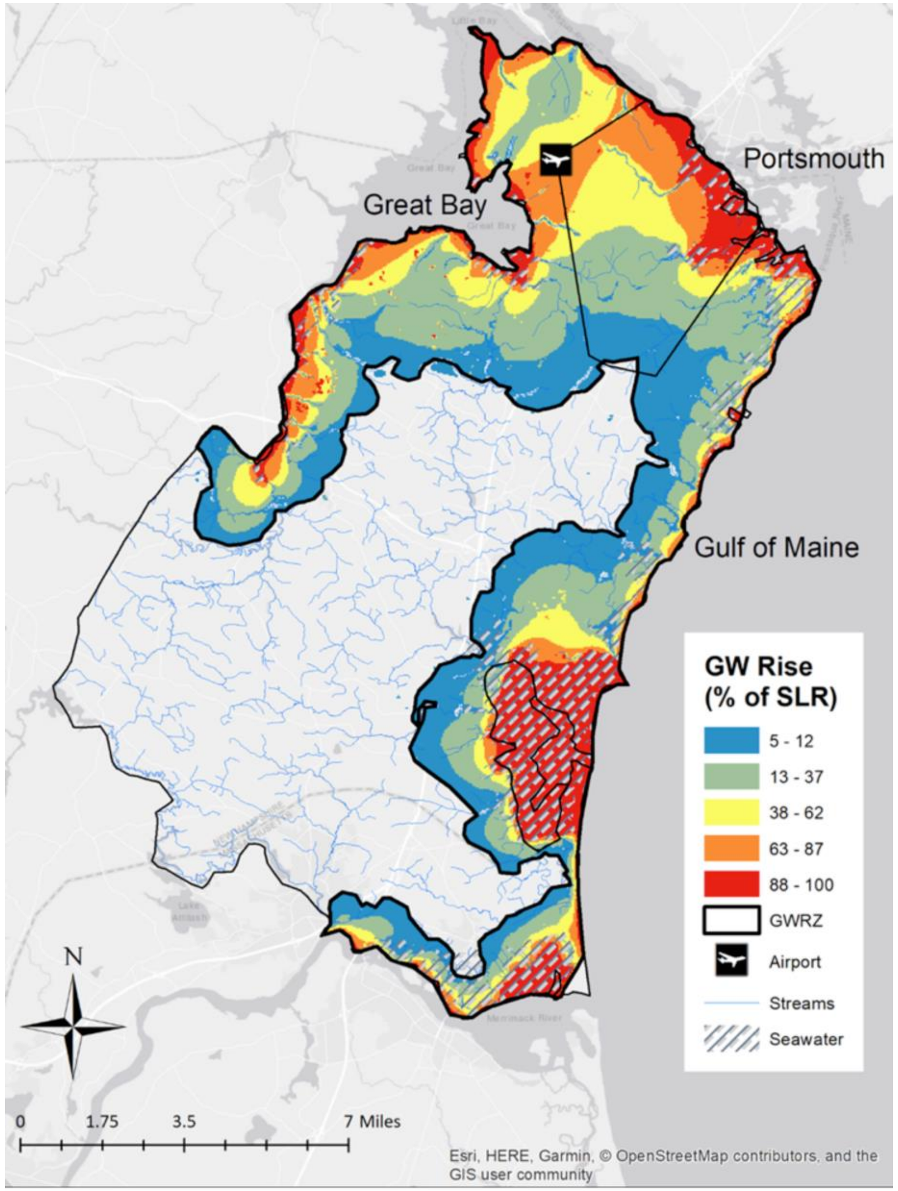
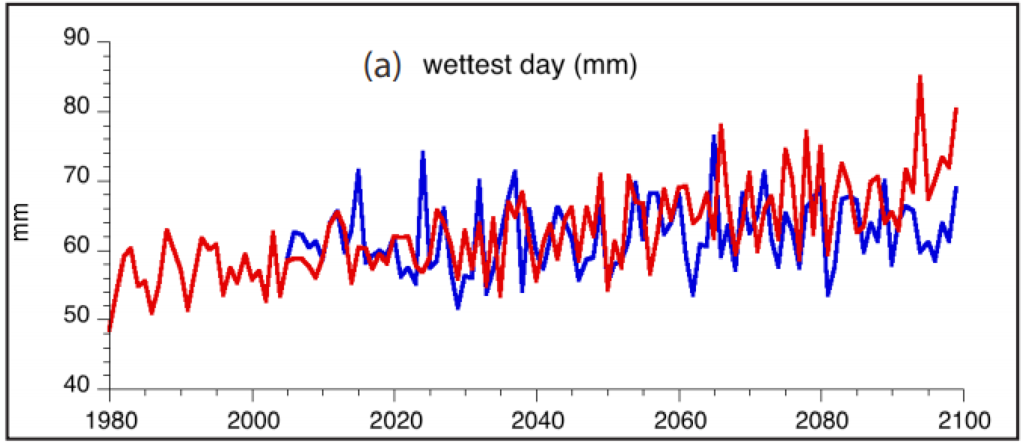



**Figure 6.5.** Projected groundwater rise as a percent of RSLR in the coastal New Hampshire study area. **Source: Modified from Knott et al. (2018a).**

# Part I: Science | Key Findings
## Extreme Precipitation

- The frequency and magnitude of extreme precipitation events is projected to increase, especially in the springtime



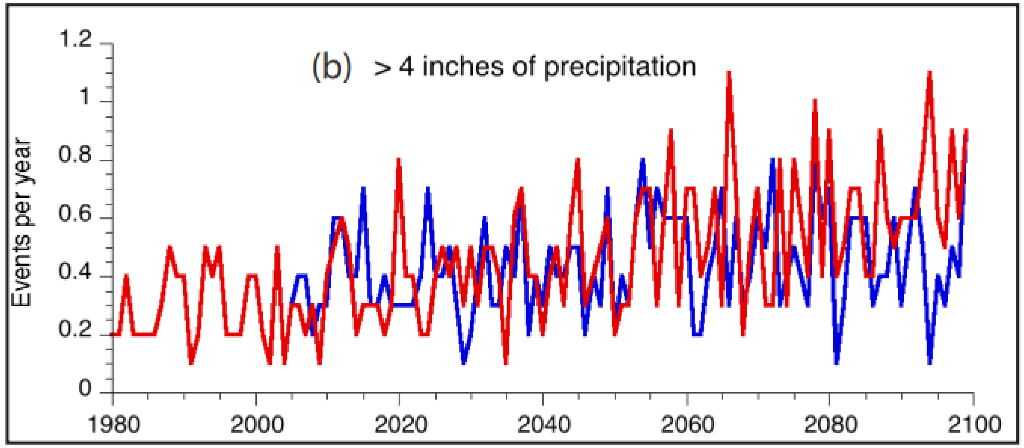




**Figure 7.6.** CMIP5 mean modeled historical (1980-2005) and projected future (2006-2099) for (a) annual maximum daily precipitation and (b) events greater than 4" at Portsmouth, NH under RCP4.5 (blue) and RCP8.5 (red) (from Burakowski et al., 2019). Ensemble means are weighted following (Sanderson et al., 2017)

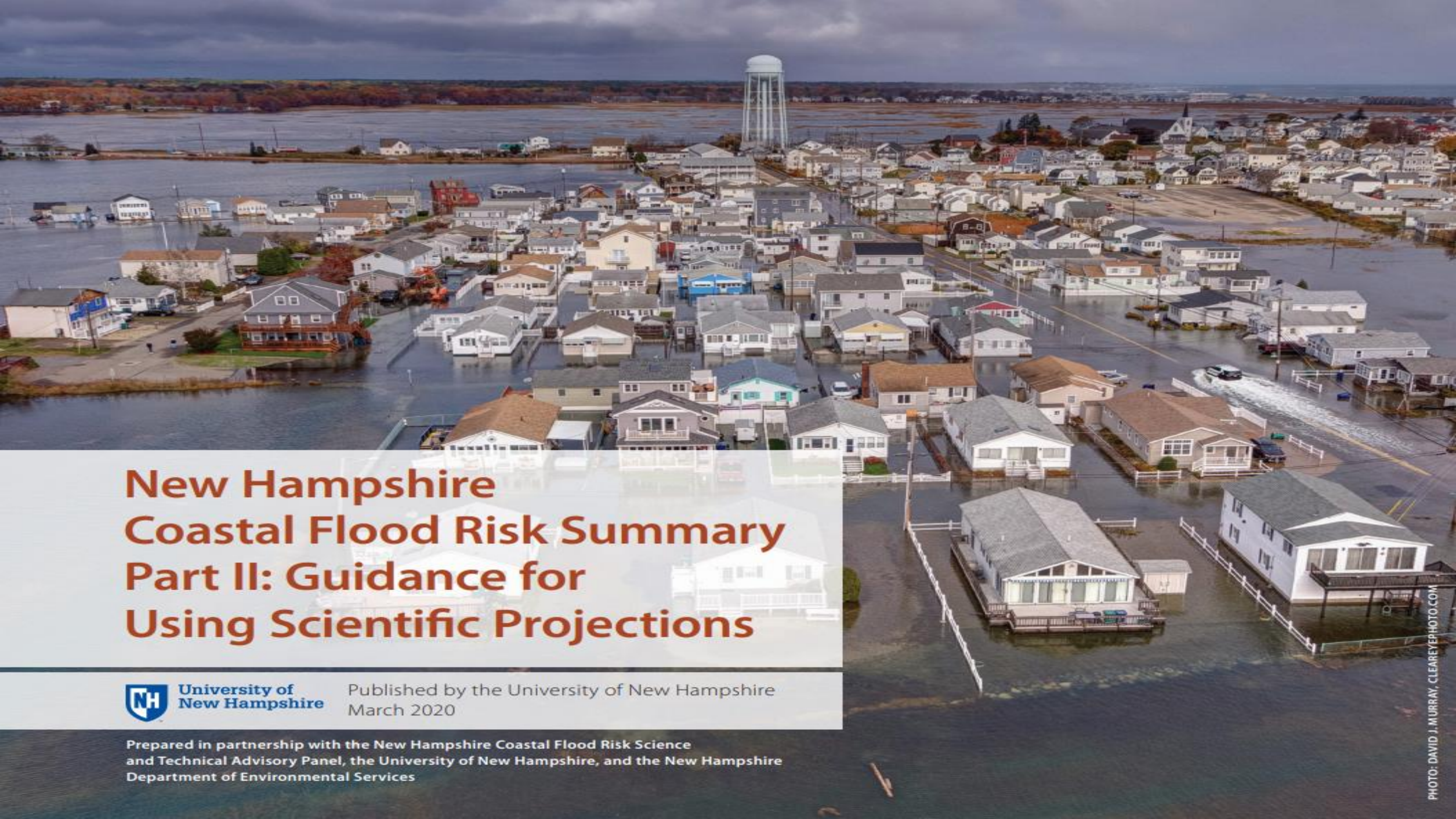


PHOTO: DAVID J. MURRAY, CLEAREYEPHOTO.COM

# New Hampshire Coastal Flood Risk Summary Part II: Guidance for Using Scientific Projections

University of New Hampshire

Published by the University of New Hampshire
March 2020

Prepared in partnership with the New Hampshire Coastal Flood Risk Science and Technical Advisory Panel, the University of New Hampshire, and the New Hampshire Department of Environmental Services

# Part II: Guidance for Using Scientific Projections

## Guiding Principles for Enhancing Coastal Resilience

- Support greenhouse gas reduction policies
- Determine tolerance for flood risk
- Prioritize equity and justice
- Protect natural/cultural/historic resources and public access
- Create a bold vision, start immediately, and act incrementally and opportunistically
- Consider the full suite of actions
- Adopt a flexible adaptation approach and continuously monitor performance
- Coordinate and collaborate
- Consider the liability of not taking action

# Part II: Guidance for Using Scientific Projections

## Step-by-Step Approach

STEP 1. DEFINE PROJECT GOAL, TYPE, LOCATION, AND TIMEFRAME(S)

STEP 2. DETERMINE TOLERANCE FOR FLOOD RISK

STEP 3. SELECT AND ASSESS RELATIVE SEA-LEVEL RISE (RSLR)

STEP 4. IDENTIFY AND ASSESS RSLR-ADJUSTED COASTAL STORMS

STEP 5. IDENTIFY AND ASSESS RSLR-INDUCED GROUNDWATER RISE

STEP 6. IDENTIFY AND ASSESS PROJECTED EXTREME PRECIPITATION

STEP 7. ASSESS CUMULATIVE RISK AND EVALUATE ADAPTATION OPTIONS

PHOTO: KEVIN LUCEY, NHDES COASTAL PROGRAM

# Part II: Guidance for Using Scientific Projections

## Step-by-Step Approach

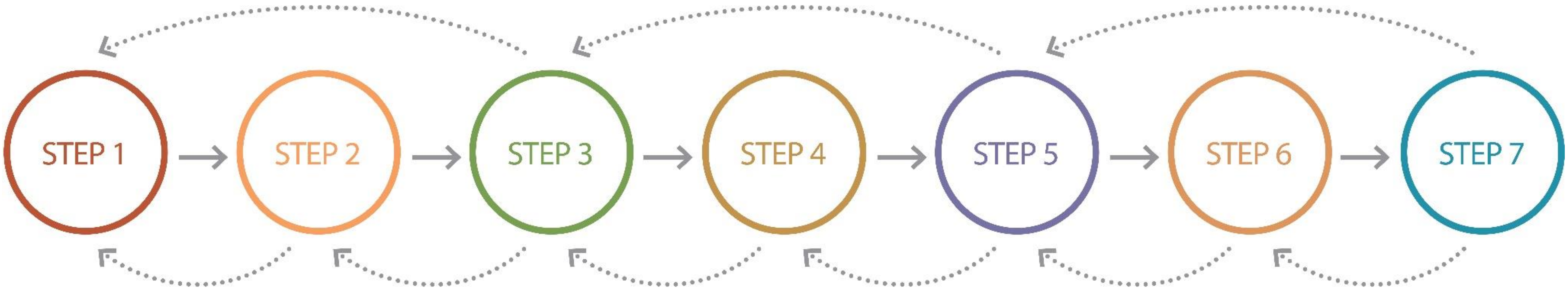



Figure 1. The seven step approach for selecting and incorporating updated coastal flood risk projections into projects is intended to be iterative.

# STEP 1. DEFINE PROJECT GOAL, TYPE, LOCATION, AND TIMEFRAME(S)

**PROJECT**

For the purposes of this Guidance, the term "project" refers broadly to any private, local, state, and federal planning, regulatory, or site-specific efforts that should consider and incorporate coastal flood risk projections. Examples of applicable private, local, state, or federal projects include, but are not limited to:

**Planning projects:** master plans; hazard mitigation plans; post-disaster redevelopment/relocation/recovery plans; emergency operations and evacuation plans; capital improvement plans; transportation improvement plans; economic development plans; open space plans; etc.

**Regulatory projects:** zoning ordinances; site plan and/or subdivision regulations; wetlands and shoreland regulations; alteration of terrain regulations; waste management regulations; etc.

**Site-specific projects:** new construction and redevelopment or relocation of buildings and structures; road, bridge, culvert construction, maintenance, or relocation; shoreline stabilization projects; wetland restoration; land conservation; etc.

Step 1.1 | Define the project goal and project type.

Step 1.2 | Define and inventory the project area.

Step 1.3 | Define the timeframe(s) for the project.

PHOTO: JO-ANN THERIAULT

# STEP 1. DEFINE PROJECT GOAL, TYPE, LOCATION, AND TIMEFRAME(S)

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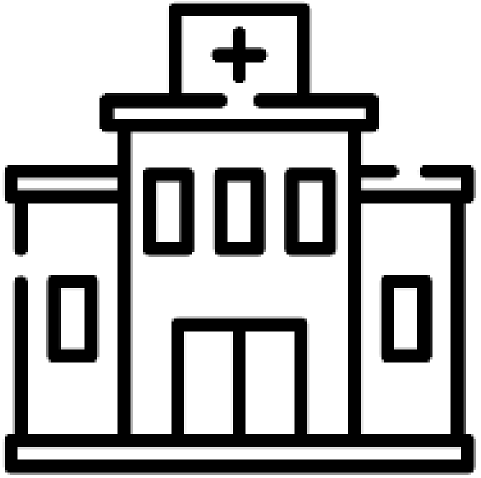
Step 1.1 | Define the project goal and project type

Step 1.2 | Define and inventory the project area

Step 1.3 | Define the timeframe(s) for the project

**For Example:**



**Project goal:** Build a new hospital
**Project type:** Site-specific
**Useful life:** 100 years (2120)
***Incremental action point:*** *30 years (2050)*

# STEP 2. DETERMINE TOLERANCE FOR FLOOD RISK

Step 2.1 | Identify project characteristics that influence tolerance for flood risk

Step 2.2 | Determine tolerance for flood risk based on project characteristics

**The willingness of decision makers to accept a higher or lower probability of flood impacts, based on relevant project characteristics such as:**

- project value or replacement cost
- capacity to adapt
- importance for public function or safety
- sensitivity to inundation

**HIGH TOLERANCE FOR FLOOD RISK**

**Example:**

**VERY LOW TOLERANCE FOR FLOOD RISK**

# STEP 2. DETERMINE TOLERANCE FOR FLOOD RISK

**STEP 2 TABLE. FRAMEWORK FOR DETERMINING PROJECT TOLERANCE FOR FLOOD RISK.**

| | | HIGH TOLERANCE FOR FLOOD RISK | MEDIUM TOLERANCE FOR FLOOD RISK | LOW TOLERANCE FOR FLOOD RISK | VERY LOW TOLERANCE FOR FLOOD RISK |
|---|---|---|---|---|---|
| **DESCRIPTION** | | Decision makers have a High tolerance for flood risk to the project | Decision makers have a Medium tolerance for flood risk to the project | Decision makers have a Low tolerance for flood risk to the project | Decision makers have a Very Low tolerance for flood risk to the project |
| **POSSIBLE PROJECT CHARACTERISTICS** *Tolerance for flood risk will depend on the mix and importance of these project characteristics.* | | Low value or cost | Medium value or cost | High value or cost | Very high value or cost |
| | | Easy or likely to adapt | Moderately easy or somewhat likely to adapt | Difficult or unlikely to adapt | Very difficult or very unlikely to adapt |
| | | Little to no implications for public function and/or safety | Moderate implications for public function and/or safety | Substantial implications for public function and/or safety | Critical implications for public function and/or safety |
| | | Low sensitivity to inundation | Moderate sensitivity to inundation | High sensitivity to inundation | Very high sensitivity to inundation |
| **PROJECT EXAMPLES** | **PLANNING** | Updating a local master plan<br>Developing a capital improvement plan | | | |
| | **REGULATORY** | Updating a floodplain zoning ordinance<br>Updating a subdivision site plan regulation<br>Updating state alteration of terrain rules | | | |
| | **SITE-SPECIFIC** | Designing a walking path; Siting a temporary or accessory structure; Upgrading a minor storage facility | Replacing a local culvert; Constructing a residential, commercial, or industrial building | Maintaining a school; Siting a community center or recreational facility; Upgrading a wastewater treatment plant | Renovating a hospital or police/fire station; Siting an emergency shelter or response center; Repairing a power station |
| **CORRESPONDING ASCE 24-14[14,15] FLOOD DESIGN CLASS** | | 1 | 2 | 3 | 4 |
| **RECOMMENDED COASTAL FLOOD RISK PROJECTIONS** | | Lower magnitude, Higher probability | ⟷ | | Higher magnitude, Lower probability |

# STEP 3. SELECT AND ASSESS RSLR

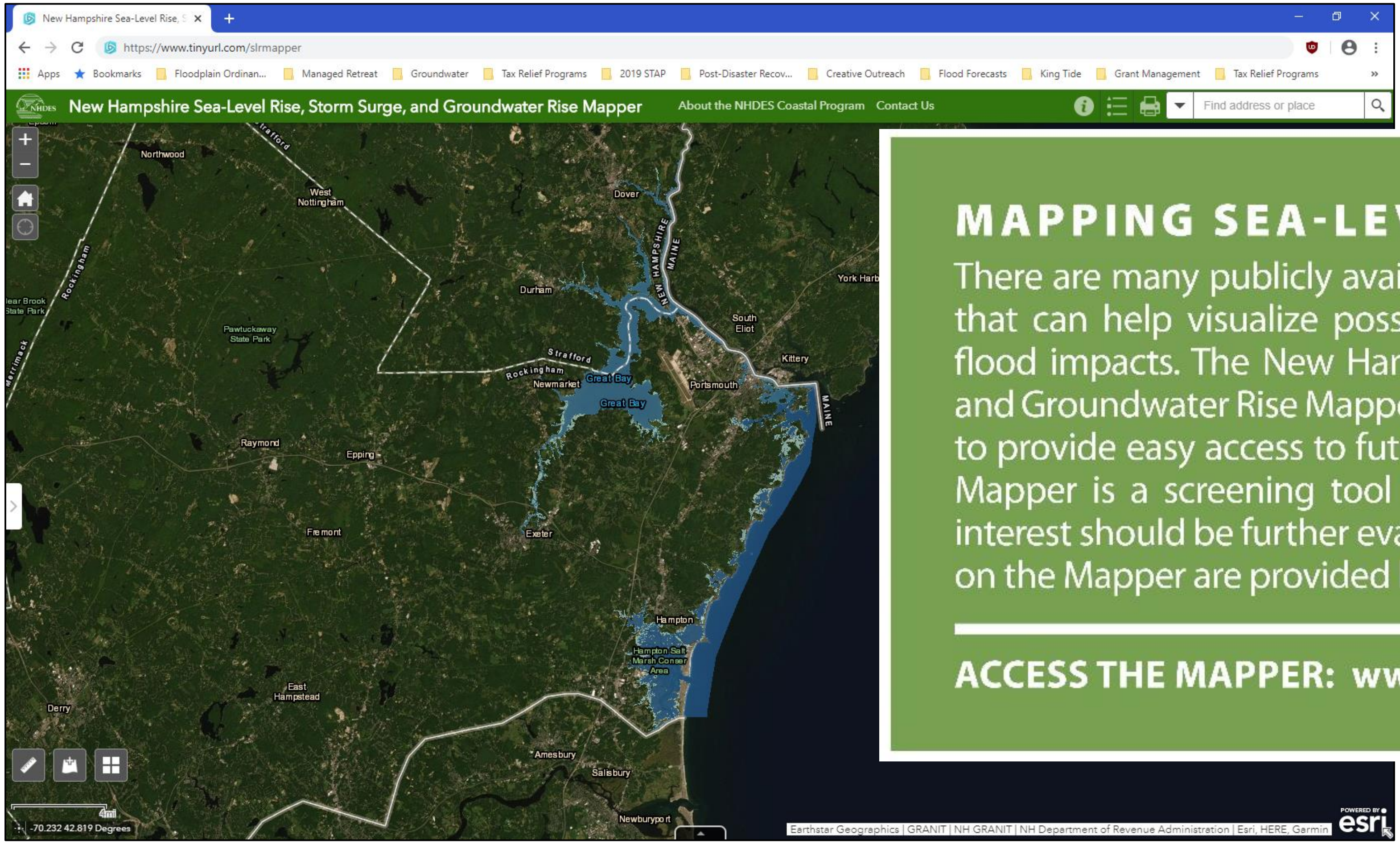
## Step 3.1 | Select RSLR estimate(s) for the project

**STEP 3 TABLE A. RECOMMENDED DECADAL RSLR ESTIMATES (IN FEET ABOVE 2000 LEVELS) BASED ON RCP 4.5, PROJECT TIMEFRAME, AND TOLERANCE FOR FLOOD RISK.**

| TIMEFRAME | HIGH TOLERANCE FOR FLOOD RISK | MEDIUM TOLERANCE FOR FLOOD RISK | LOW TOLERANCE FOR FLOOD RISK | VERY LOW TOLERANCE FOR FLOOD RISK |
|---|---|---|---|---|
| | Plan for the following RSLR estimate (ft)* *compared to sea level in the year 2000* | | | |
| | Lower magnitude, Higher probability | ⟵ | ⟶ | Higher magnitude, Lower probability |
| 2030 | 0.7 | 0.9 | 1.0 | 1.1 |
| 2040 | 1.0 | 1.2 | 1.5 | 1.6 |
| 2050 | 1.3 | 1.6 | 2.0 | 2.3 |
| 2060 | 1.6 | 2.1 | 2.6 | 3.0 |
| 2070 | 2.0 | 2.5 | 3.3 | 3.7 |
| 2080 | 2.3 | 3.0 | 3.9 | 4.5 |
| 2090 | 2.6 | 3.4 | 4.6 | 5.3 |
| 2100 | 2.9 | 3.8 | 5.3 | 6.2 |
| 2110 | 3.3 | 4.4 | 6.1 | 7.3 |
| 2120 | 3.6 | 4.9 | 7.0 | 8.3 |
| 2130 | 3.9 | 5.4 | 7.9 | 9.3 |
| 2140 | 4.3 | 5.9 | 8.9 | 10.5 |
| 2150 | 4.6 | 6.4 | 9.9 | 11.7 |

# STEP 3. SELECT AND ASSESS RSLR

## Step 3.2 | Assess RSLR impacts to the project




### MAPPING SEA-LEVEL RISE

There are many publicly available datasets and visualization tools that can help visualize possible sea-level rise and other coastal flood impacts. The New Hampshire Sea-Level Rise, Storm Surge, and Groundwater Rise Mapper (Sea-Level Rise Mapper) is intended to provide easy access to future coastal inundation scenarios. The Mapper is a screening tool for planning purposes, and sites of interest should be further evaluated with a site-based survey. Data on the Mapper are provided by New Hampshire GRANIT.

**ACCESS THE MAPPER: www.tinyurl.com/slrmapper**

# Part II: Guidance for Using Scientific Projections

## Step-by-Step Approach

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PHOTO: KEVIN LUCEY, NHDES COASTAL PROGRAM

# New Hampshire Coastal Flood Risk Summary
# How you might use the Science & Guidance

- Use for your own property
- Use for your neighborhood or for places you care about
- Advocate for its use by your community
- Expected to be used by NHDES and other state agencies in permitting and best practices

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# New Hampshire Coastal Flood Risk Summary
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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

NEW HAMPSHIRE COASTAL PROGRAM

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

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