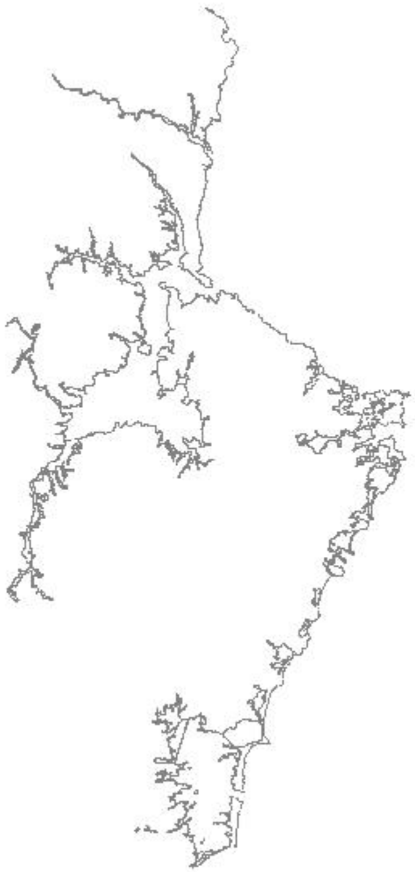
Smart Shoreline Stabilization for Coastal New Hampshire



A living shorelines workshop for municipal officials and volunteers

April 18, 2018

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Department of Environmental Services

Coastal Training Program Great Bay National Estuarine Research Reserve

NHCP

New Hampshire Department of Environmental Services

University of New Hampshire

University of New Hampshire Coastal Habitat Restoration Team CHaRT

National Oceanic and Atmospheric Administration U.S. Department of Commerce NOAA

BY THE NUMBERS

17
coastal
communities

~400,000
people

18
miles coastal
shoreline

326
miles tidal
shoreline

6,000
acres
salt marsh

39
miles shoreline
structures

88% of NH tidal shoreline is natural 'living shoreline'

12% of NH tidal shoreline is 'armored shoreline'

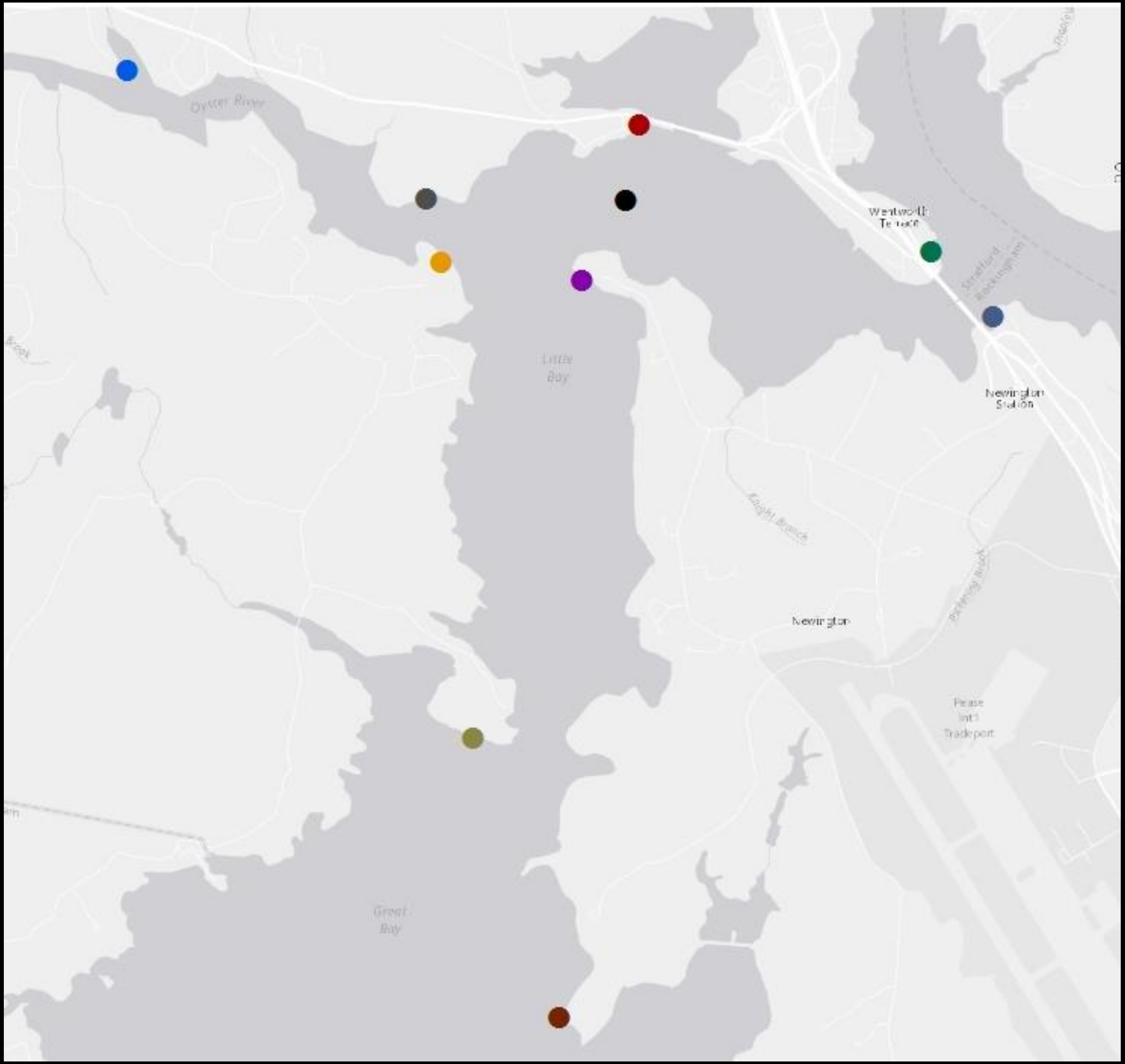
Our habitats are valuable for lots of reasons.

Erosion is primarily a **natural** process.

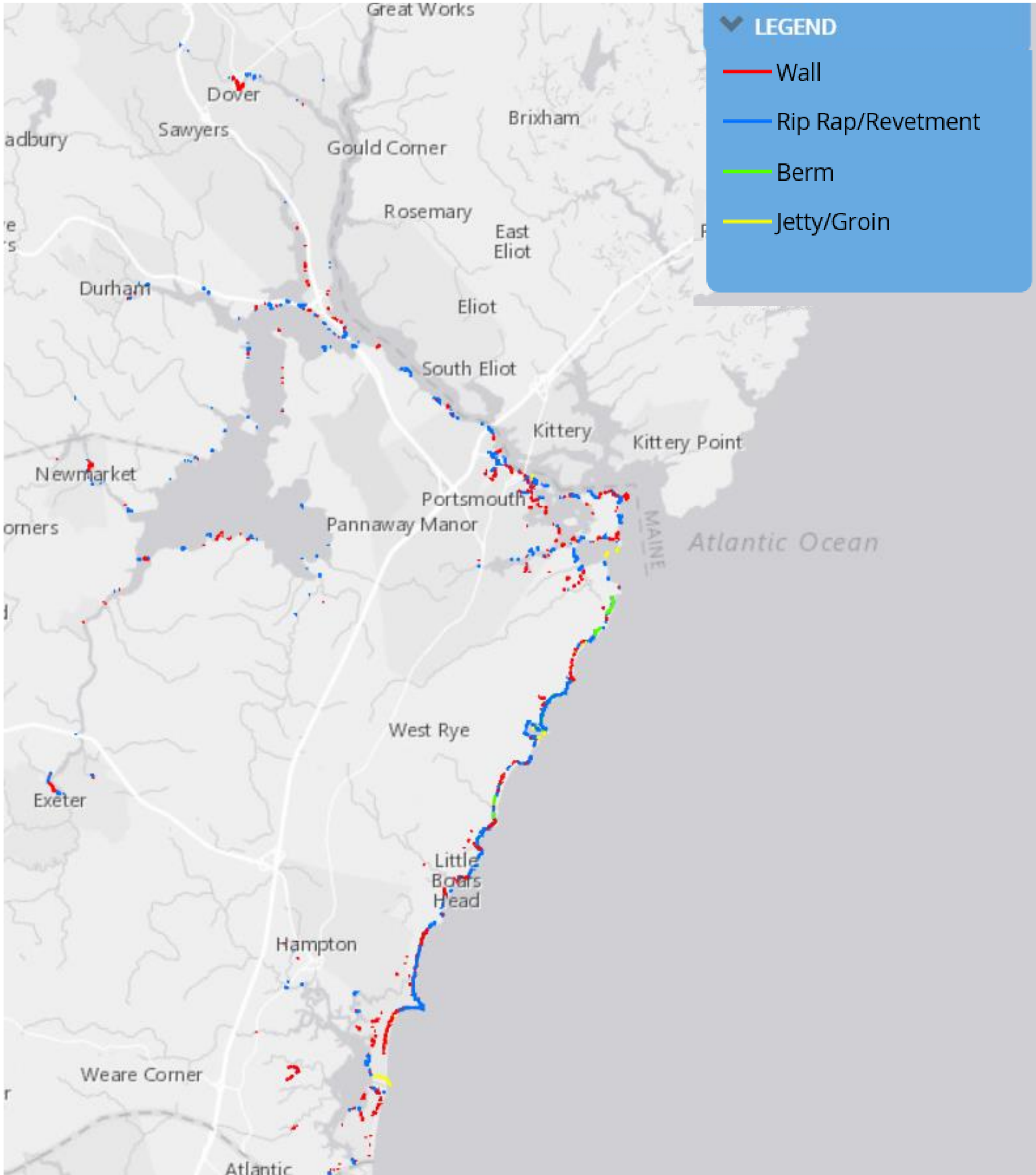
Desire protect property is a
natural human inclination.

(In other words: our shorelines want to change and we don't want them to.)

EROSION HOTSPOTS



SRPC 1978.



SHORELINE TODAY

12% total armored

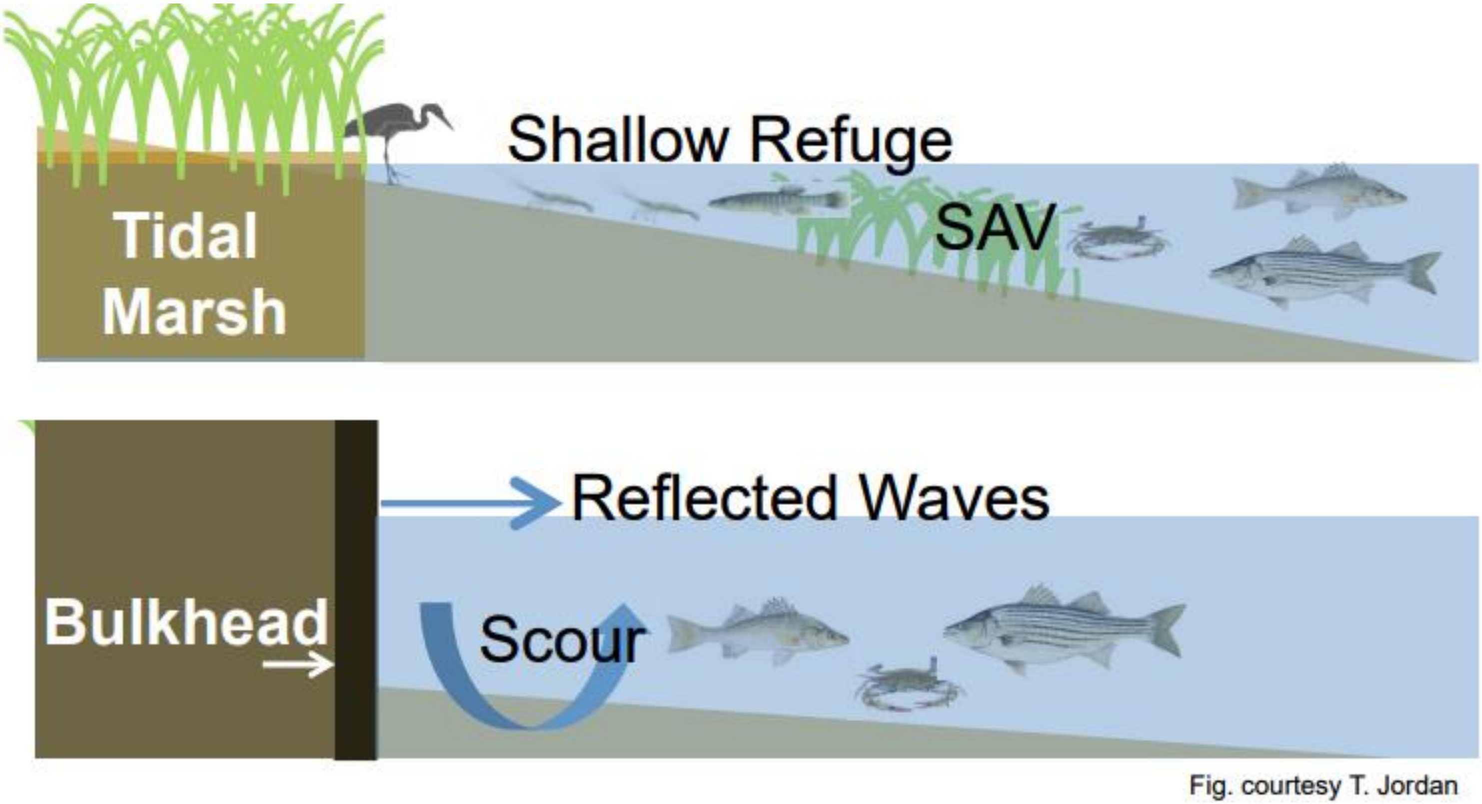
70% Atlantic Coast

5% Great Bay

Blondin & Howard 2014

Why do people turn to armor?

But research is showing us that structural stabilization is not great for our natural systems…



Gittman et al. 2016

Research is also telling us that armor doesn’t always work as well as our natural systems.

Gittman et al. 2014

Hampton seawall in 1978

March 2018 Nor’easter (Riley)

THE DRIVE TO STABILIZE

Stabilization demand is increasing.

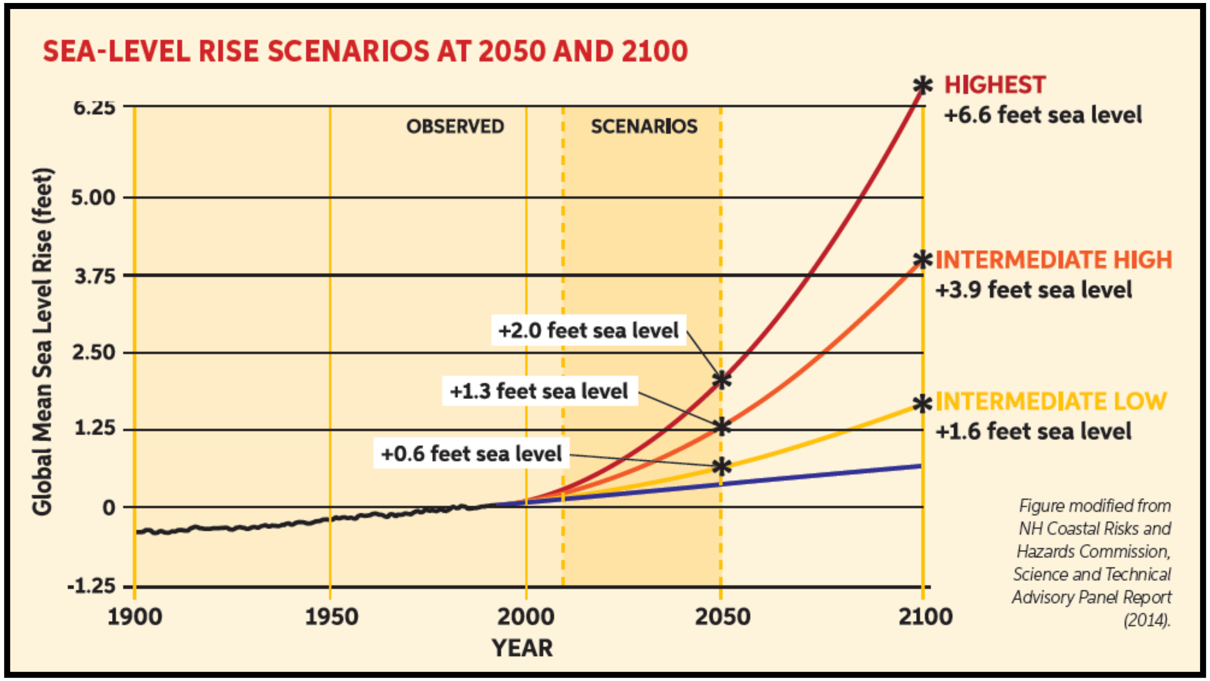
Over 550 permits 00's

Survey found 22% CT shorefront property owners are likely to armor in next 20 years.

(Field 2017)

SHORELINE **TOMORROW**

SEA-LEVEL RISE



PROJECTIONS

- 0.6 – 2.0 ft. by 2050
- 1.6 – 6.6 ft. by 2100

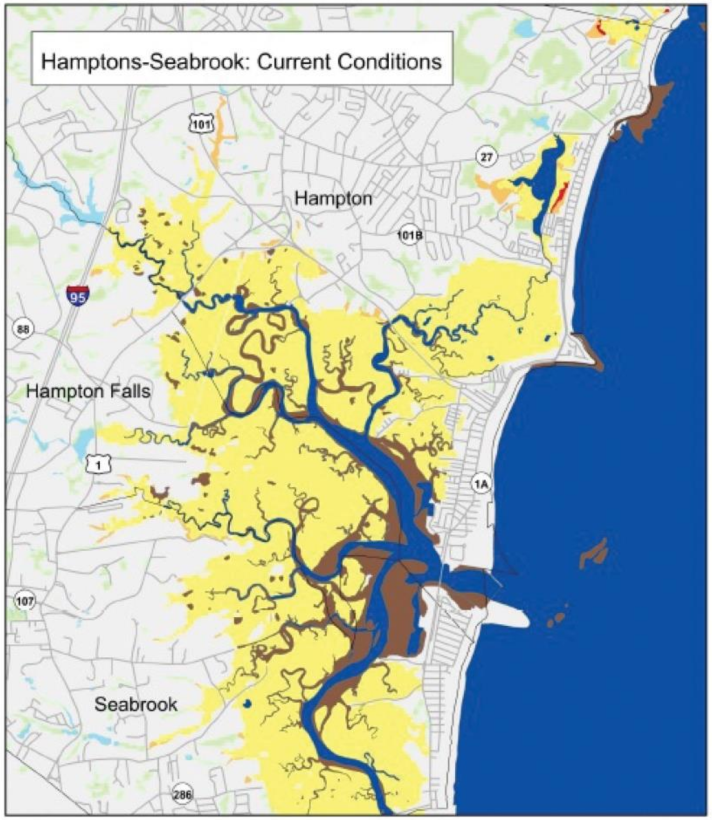
HOW TO PREPARE

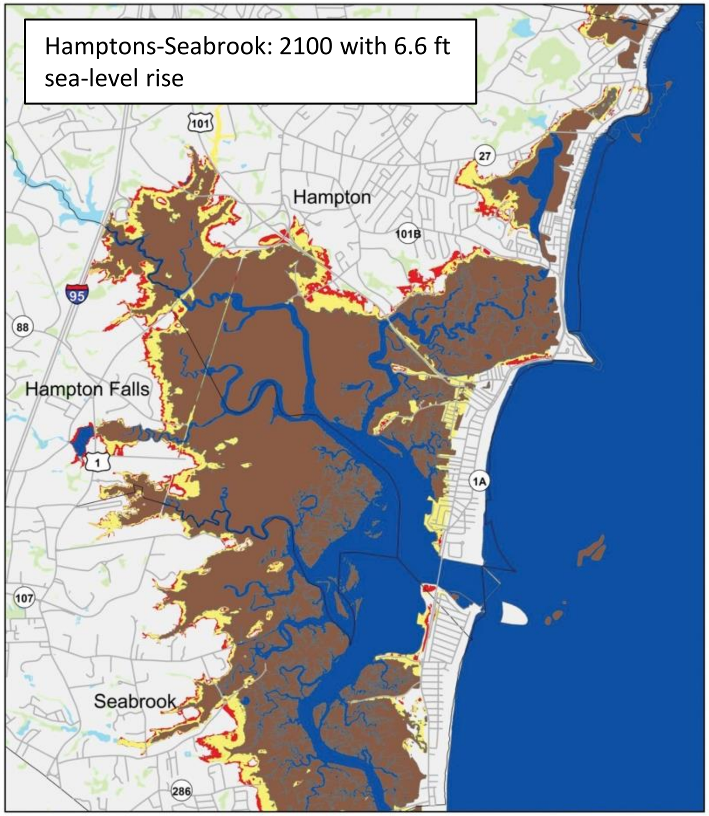
1. Select time period
2. Commit to manage ***intermediate high***
3. Adjust if necessary

Example: If the design time period is 2050-2100, commit to manage 3.9 ft. of sea-level rise, but be prepared to manage and adapt to 6.6 ft. if necessary.

www.nhcrhc.org

SHORELINE **TOMORROW**





NH Fish & Game 2014

95 percent of existing salt marsh could be lost with 6.6 feet of sea-level rise

www.nhcrhc.org

THE SALT MARSH SQUEEZE

marsh migration

+

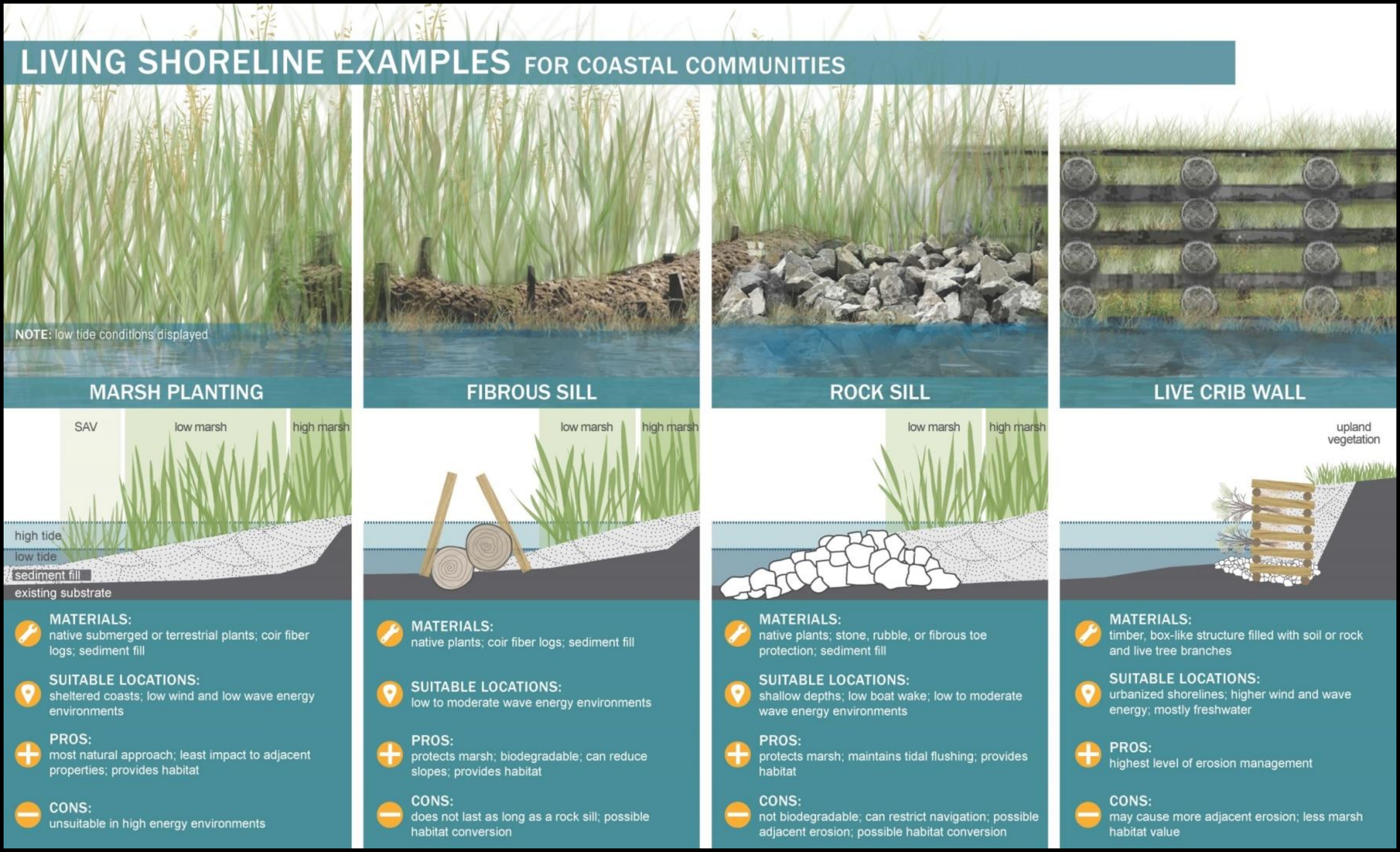
stabilization

=

salt marsh squeeze

{living shoreline}

A combination of mostly natural materials including plants, fiber, shell and rock or manufactured rock-like surfaces that are used along a shoreline exhibiting erosion to dissipate wave energy and to collect naturally deposited sediment. Living shorelines maintain continuity of the natural land–water interface while providing habitat value and protecting against coastal hazards.



Liz Podowski King 2015.

Esopus Meadows, NY

case study: Esopus Meadows

before

after

A degrading bulkhead was replaced with softer stabilizing alternatives that still provide shoreline protection. A stone toe was placed at the high tide line and soft gabions positioned above it help hold the soil in place.

Source: Hudson River Sustainable Shorelines

Living Shorelines in New England: State of the Practice

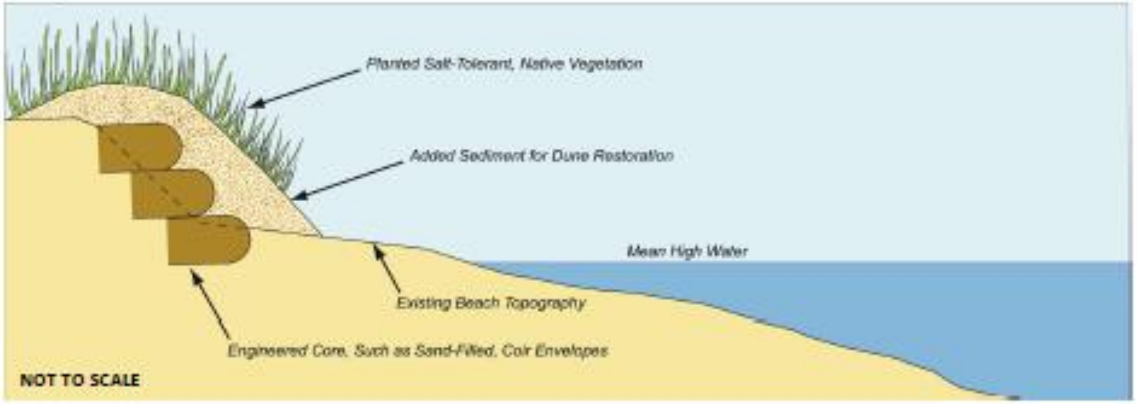
Prepared For:
The Nature Conservancy

Prepared By:
Woods Hole Group, Inc.

July 2017

Dune - Engineered Core

Design Schematics



Case Study

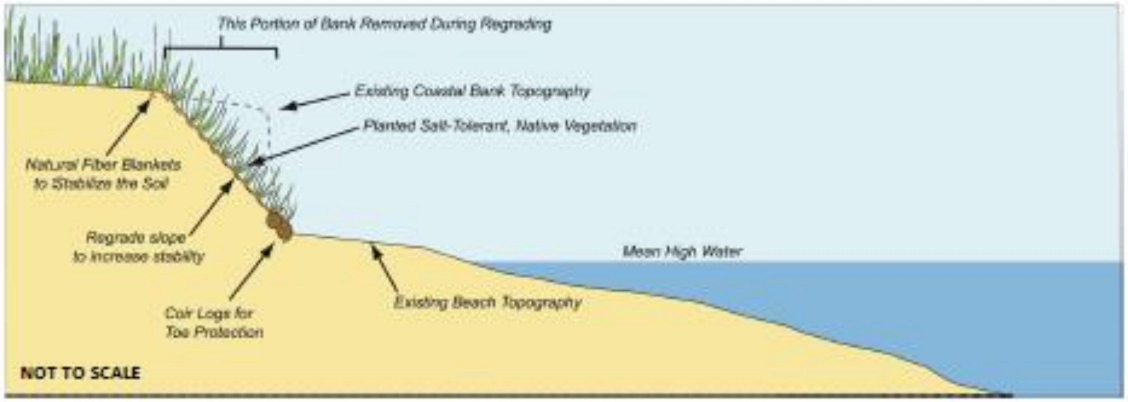
Jerusalem Dune, Narragansett, RI

Homeowners along an eroding shoreline were interested in increased shoreline protection. The houses were located 12 to 25 feet from the dune scarp. This shoreline has an average annual erosion rate (AAER) of just less than 2 feet per year.

Project Proponent	Three private homeowners with contiguous properties
Status	Completed in November 2011; Maintained (added sand and plantings) after Sandy in 2012.
Permitting Insights	Using sand filled coir envelopes as the dune core is considered a non-structural technique in the RI Coastal Resources Management Program because the coir is biodegradable and sand compatible with beach and dune sediment, so allowed where revetments and bulkheads are not. Applicants required to maintain lateral beach access.
Construction Notes	The project extended 135 linear feet across 3 properties – 45 feet each. Ends of the coir structure were gradually returned to the slope of the feature in order to minimize erosion on adjoining properties.
Maintenance Issues	Significant repairs were necessary after Hurricane Sandy.
Final Cost	Permitting :$750 ($250 per property) Construction: $46,650 (2 properties each cost $14,950 and a third property cost $16,750) Maintenance: Costs are storm dependent
Challenges	The dune and coir core is not likely to withstand a major storm leaving the properties are at risk.

Coastal Bank - Natural

Design Schematics



Case Study

Coastal Bank Stabilization, Orleans, MA

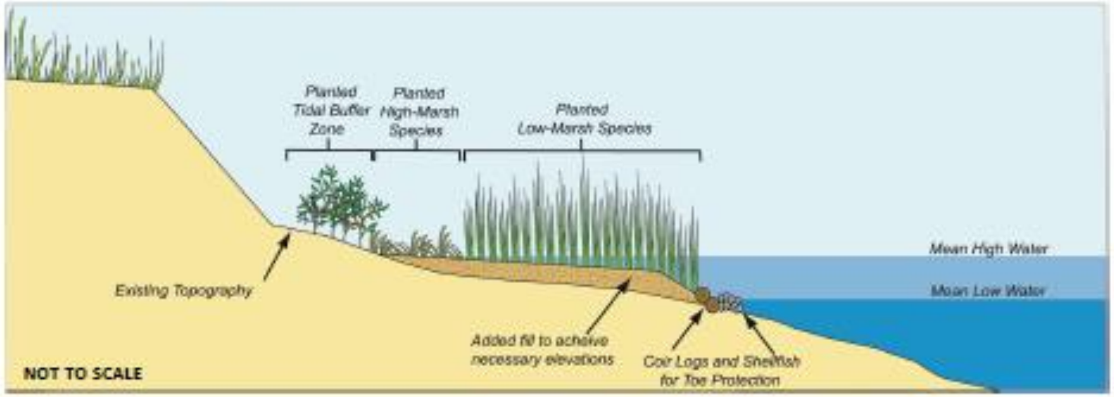
Wilkinson Ecological Design developed a plant-focused coastal bioengineering project, determined not to be a coastal engineering structure by the local municipality and MA DEP. The project included a robustly anchored fiber roll array at the bottom of the bank and intensive planting and stabilization through the remainder of their coastal bank, which falls within a mapped FEMA Velocity Zone.

Pleasant Bay Bank Stabilization, Orleans, MA
Photos courtesy of Wilkinson Ecological Design

Project Proponent	Private property owners. The project spans three properties with multiple owners.
Status	Phase 1 constructed in 2010, Phase 2 constructed in 2013 and Phase 3 constructed in 2015.
Permitting Insights	The project involved one permit under the MA Wetlands Protection Act for each phase, three wetland permits in total.
Construction Notes	Regraded the over steepened bank, installed six rows of coir rolls at the toe of bank, installed natural fiber blankets on the bank face above the coir rolls, planted the bank face with native, salt-tolerant grasses and shrubs, and covered fiber rolls with sand.
Maintenance Issues	Monitor vegetation monthly throughout the growing season to ensure plant success; temp-orary irrigation for first three years; monitor coir rolls twice annually and after storms. Replant and retighten fiber roll anchoring system as needed.
Final Cost	Permitting: $10,000 Construction: $1,000/ linear foot Maintenance : $8,000/yr
Challenges	No substantial challenges in the permitting, construction or maintenance phases of work and has performed well through storms.

Marsh Creation/Enhancement w/Toe Protection

Design Schematics



Case Study

North Mill Pond, Portsmouth, NH

This project involved restoration of low and high marsh along North Mill Pond, with about half of the area consisting of new marsh creation, and the other half of the area consisting of restoration of degraded low and high marsh through sediment addition (thin layer deposition).

North Mill Pond Marsh Restoration, Portsmouth, NH
Photo courtesy of David Burdick (UNH)

Project Proponent	City of Portsmouth, Stantec (wetlands consultant), UNH (assisted plan development)
Status	Construction complete May 2016. Beginning year two of monitoring in 2017.
Permitting Insights	NHDES and USACOE permits needed for drainage outfall into pond. Project impacted 600 sf of coastal wetland. Salt marsh restoration was compensatory mitigation.
Construction Notes	Imported fill to raise 12,060 sf to suitable elevation for salt marsh (low marsh); planted 3,055 sf of high marsh area. Created micro-topography and interior drainage channels. 12-in diameter coir logs staked at seaward edge of marsh to stabilize toe. Placed large boulders to break-up winter ice sheets.
Maintenance Issues	Long term monitoring and maintenance efforts are scheduled. Survival of low marsh plants is good; survival of high marsh salt hay is fair to poor. Survived 2016-2017 winter well.
Final Cost	$60,000 (construction, monitoring & maintenance)
Challenges	Construction did not have a provision for within plot drainage; many plants were washed out by runoff gullies in the first year. More time needed for filled sediment to settle before planting.

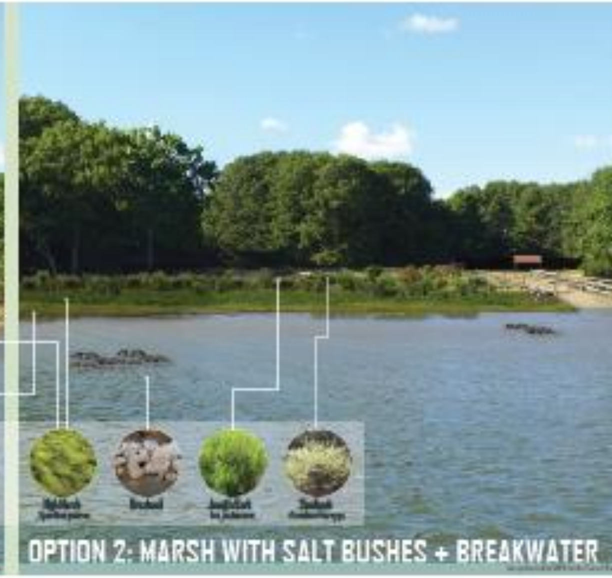
PRIORITIZING SMART SHORELINES

Future living shoreline at Wagon Hill Farm, Durham

What Could A Living Shoreline at Wagon Hill Farm Look Like?

LIVING SHORELINE: A shoreline stabilization technique that utilizes a variety of structural and organic materials such as wetland plants, submerged aquatic vegetation, oyster reefs, coir fiber logs, sand fill, and stone (NOAA).

View of the Wagon Hill Farm Shoreline from the Oyster River



The Problem + Potential Solution

The shoreline of Wagon Hill Farm is retreating. A living shoreline may help stabilize the bank and reduce erosion.

The Town of Durham has owned Wagon Hill Farm and maintained public access to the shoreline at the mouth of the Oyster River for 27 years. Over this time, officials noticed erosion along the property adjacent to the River. Loss of salt marsh vegetation and erosion of marsh sediments have resulted in shoreline retreat at a rate of up to 1 foot/year along almost 2,000 feet of shoreline.

The Town is working with the University of New Hampshire and the New Hampshire Coastal Program to design, pilot, build, and monitor a living shoreline in order to minimize erosion and adapt to expected increases in water levels. The project will include shoreline stabilization, habitat enhancement, and flood damage protection by incorporating natural, green, "soft" infrastructure.

The Town has had to move the fence back a total of 10 feet over multiple occasions due to the eroding shoreline. The image above shows how the fence was moved away from the shore and the water level at high tide.

What Causes Erosion?

- Human and animal traffic
- Boat wake
- Tree shade that inhibits marsh vegetation
- Sea level rise
- Ice rafting

Benefits of Living Shorelines

- Stabilization of the shoreline
- Protection of surrounding riparian and intertidal environment
- Improvement of water quality via filtration of upland run-off
- Creation of habitat for aquatic and terrestrial species (NOAA)

Living Shoreline Management Options

Shoreline management options range from vegetation only to combinations of vegetation and structures to a completely hardened bulkhead. It is likely that the best type of living shoreline for Wagon Hill Farm will be a hybrid type that includes marsh, coir logs or fibrous sill, rip-rap, and breakwaters.

Nature-Based → Hybrid Structural + Non-Structural → Hard/Structural

Project Partners + Credits

Newington Residents are invited to the

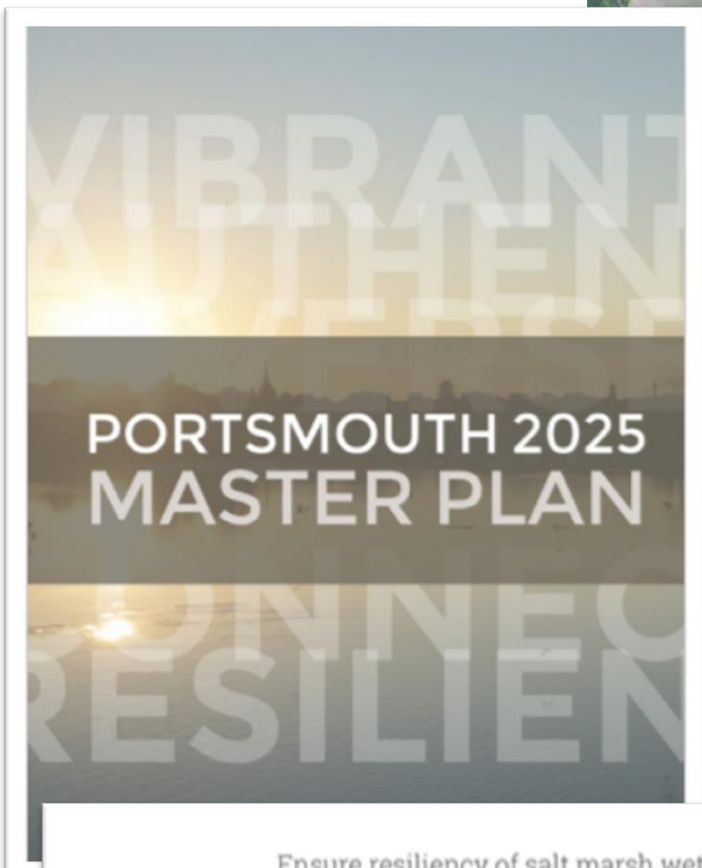
SPRING FOR THE BAY 4

April 24, 2018

5:30 to 8 PM

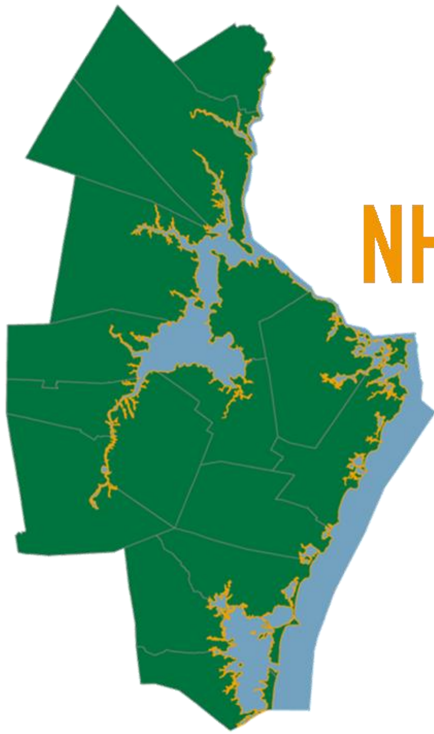
Newington's Langdon Library

LIVING SHORELINES: CHANCE for LITTLE & GREAT BAY



5.3.4	Ensure resiliency of salt marsh wetlands to sea level rise and fund "living shore" techniques and other protective measures.

But Where Should We Build Them?



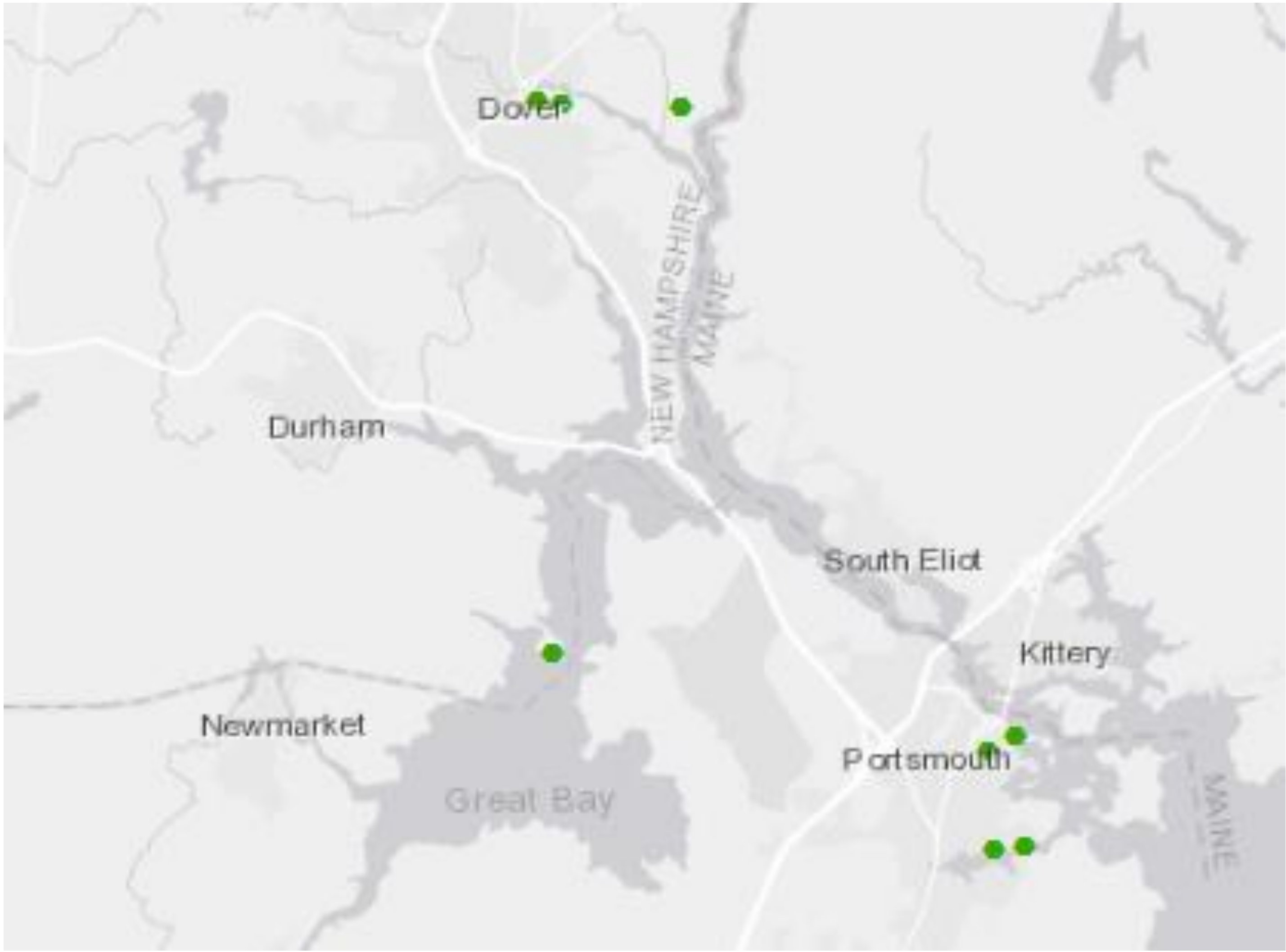
NH Smart Shorelines

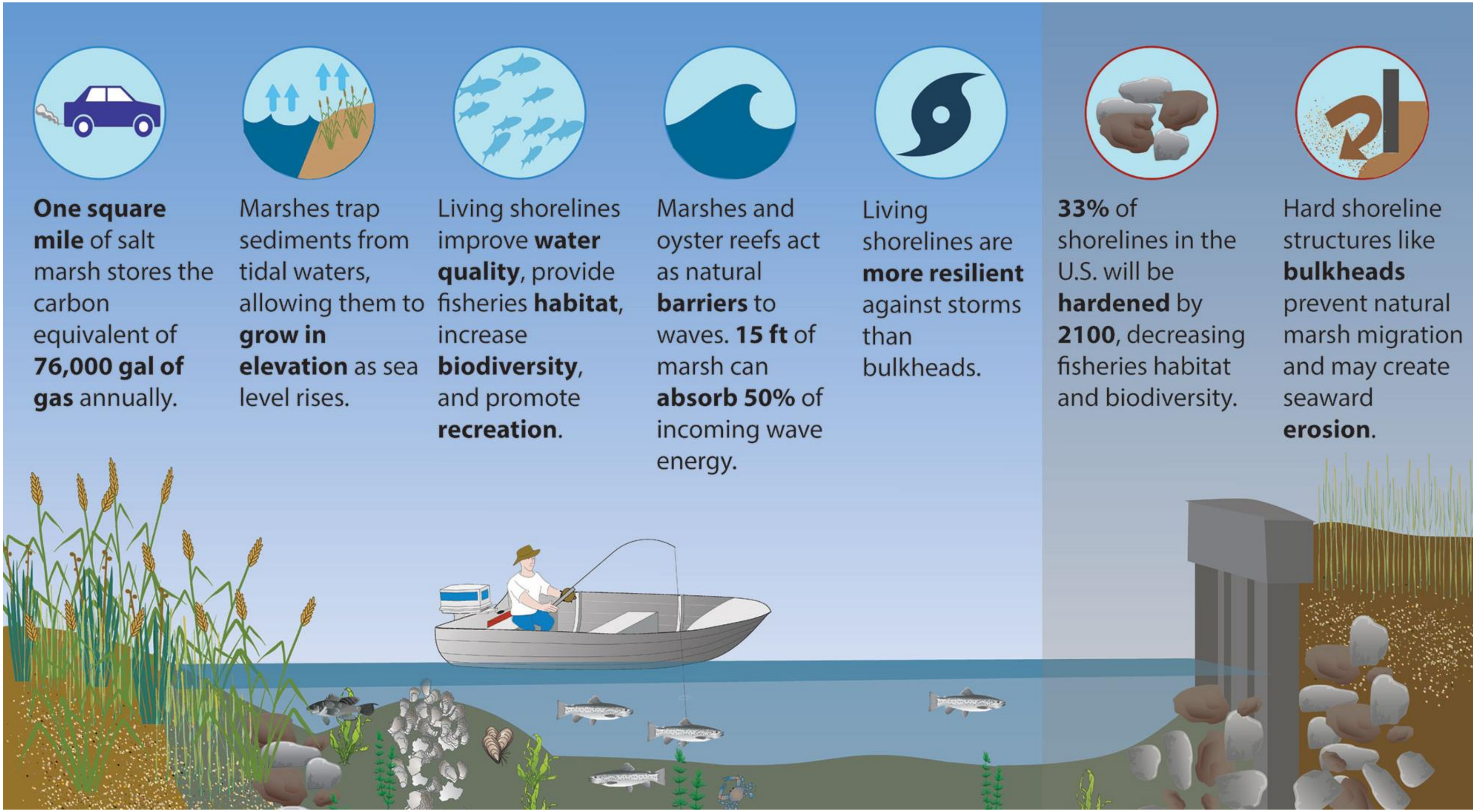
Protecting our coast

for People + Nature

Project goal: to identify suitable sites for living shoreline approaches in tidally-influenced NH shorelines

Anecdotal Potential Sites (from workshop participants like you!)



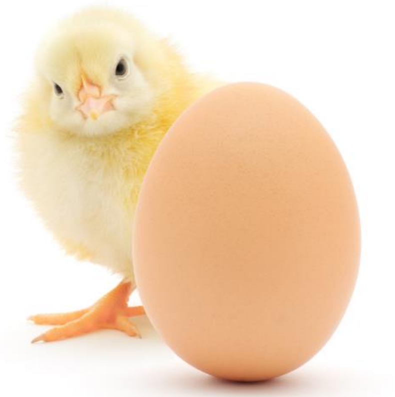

One square mile of salt marsh stores the carbon equivalent of **76,000 gal of gas** annually.
Marshes trap sediments from tidal waters, allowing them to **grow in elevation** as sea level rises.
Living shorelines improve **water quality**, provide fisheries **habitat**, increase **biodiversity**, and promote **recreation**.
Marshes and oyster reefs act as natural **barriers** to waves. **15 ft** of marsh can **absorb 50%** of incoming wave energy.
Living shorelines are **more resilient** against storms than bulkheads.
33% of shorelines in the U.S. will be **hardened** by **2100**, decreasing fisheries habitat and biodiversity.
Hard shoreline structures like **bulkheads** prevent natural marsh migration and may create seaward **erosion**.

A FEW MORE TIDBITS ABOUT LIVING SHORELINES

20 YEARS BEHIND RIVER
RESTORATION AND STABILIZATION
IN NEW HAMPSHIRE

NOT NEW TO
PERMITTING,
BUT PERMITTING
IS SHIFTING TO FAVOR

WE ALL WANT MORE
INFO BUT
NEED MORE
PILOTS PROJECTS



Intro to living shorelines video

Coastal Training Program Great Bay National Estuarine Research Reserve

NHCP

New Hampshire Department of Environmental Services

National Oceanic and Atmospheric Administration NOAA U.S. Department of Commerce

University of New Hampshire

University of New Hampshire Coastal Habitat Restoration Team CHaRT