

Climate Change in Winthrop

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Mass Audubon

Key changes already observed in Massachusetts.

Temperature:  **2.9°F**
Since 1895

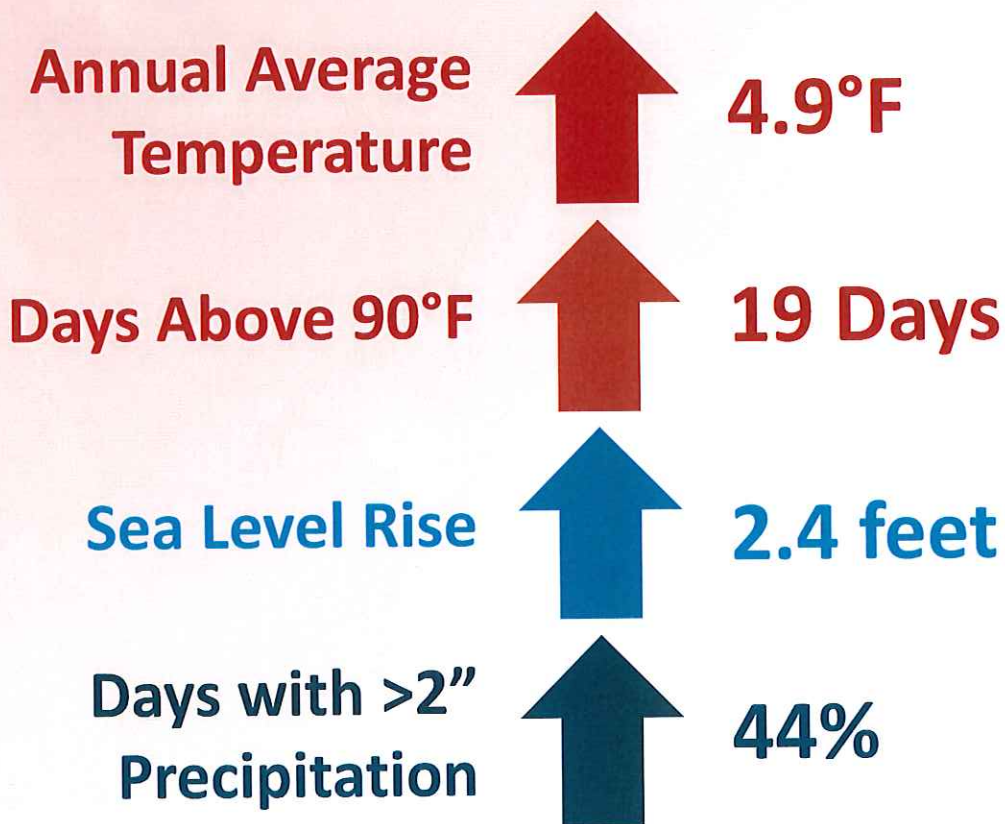
Growing Season:  **11 Days**
Since 1950

Sea Level Rise:  **11 inches**
Since 1922

Strong Storms:  **55%**
Since 1958

Source: Climate Science Special Report, 2017; NOAA NCEI nClimDiv; NOAA Ocean Service

Suffolk County Projected Changes (2040-2069)



Source: Northeast Climate Science Center, MassClimateChange.org, Values shown for the Blackstone River Watershed.

What's in a degree?



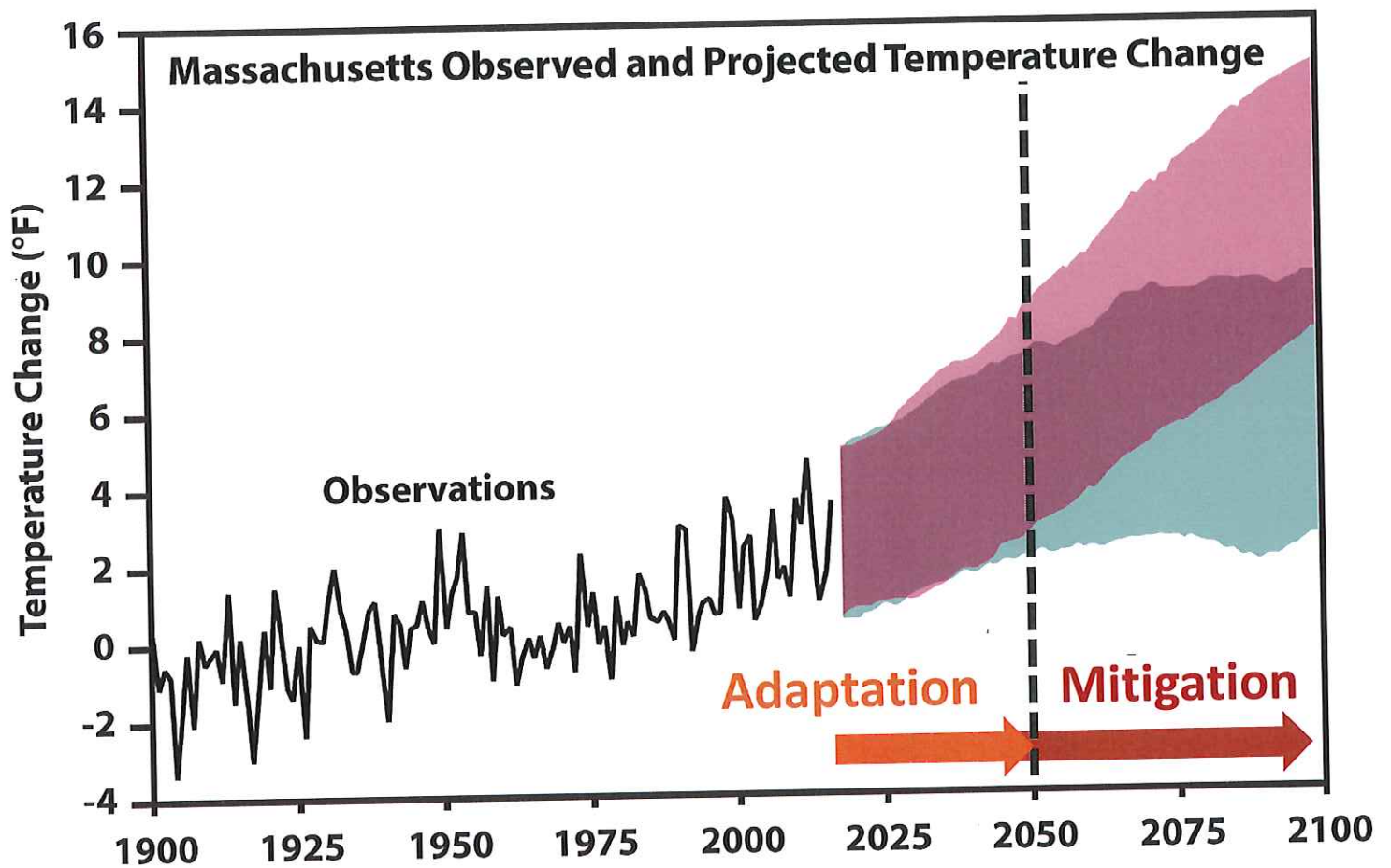
During the last ice age, temperatures were 9°F cooler than today.

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2010 Tele Atlas
© 2010 Europa Technologies
US Dept of State Geographer

lat 50.947167 lon -111.119514 elev 163 m

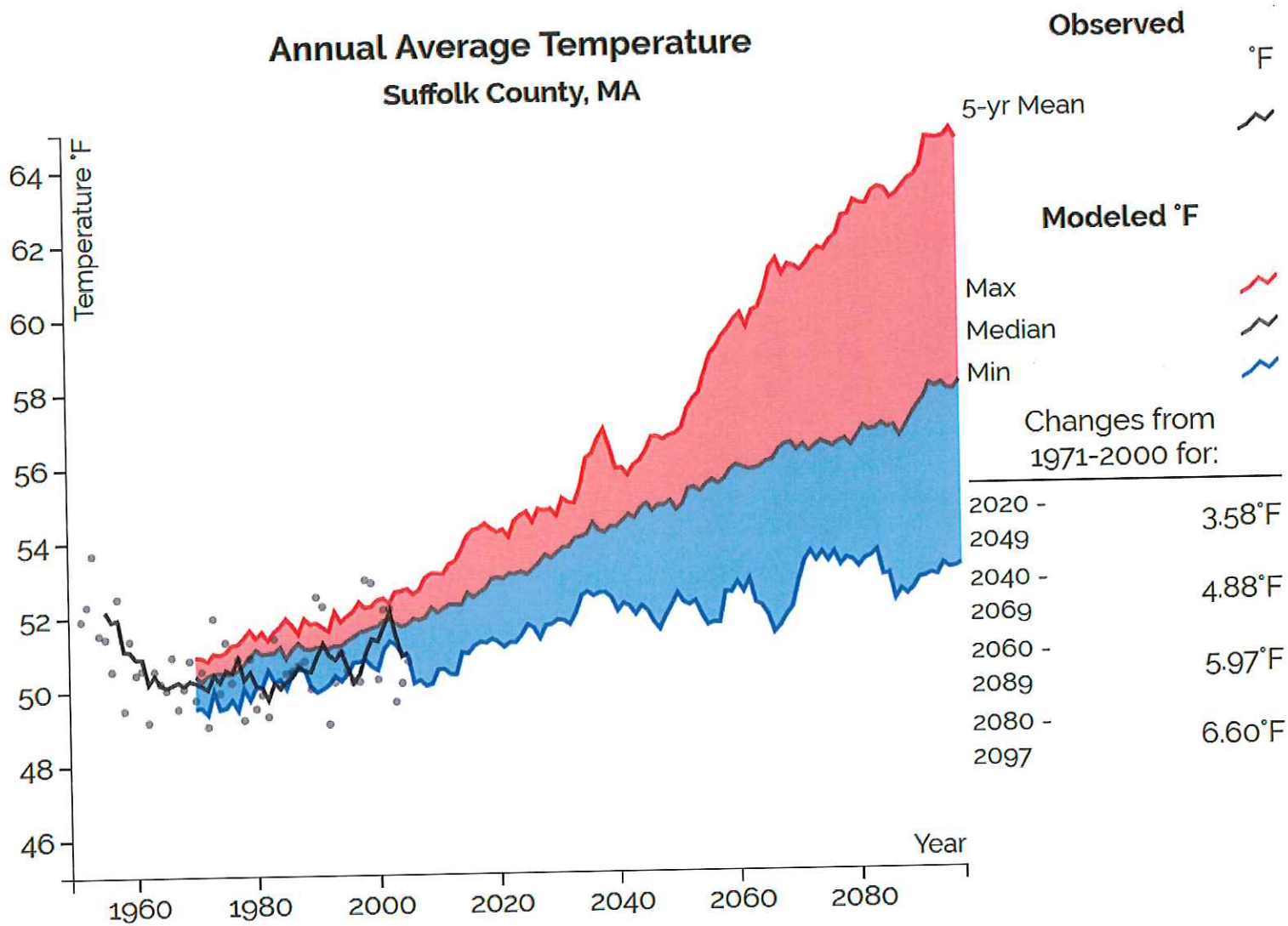
Google

Eye alt 6640.61 km



Source: NCICS State Climate Summaries. Observational data from NOAA nClimDiv dataset. Accessed 2017.

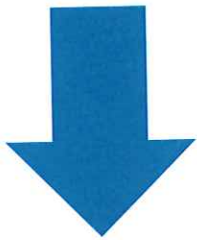
Annual Average Temperature Suffolk County, MA



Source: Northeast Climate Science Center, MassClimateChange.org, accessed 2018.

Changing Energy Use and Demand

More Warm Winter Days, Less Heating Demand (based on annual Heating Degree-Days, base 65)



11 – 24%
by the 2050s

1971-2000
6079 Heating Degree-days

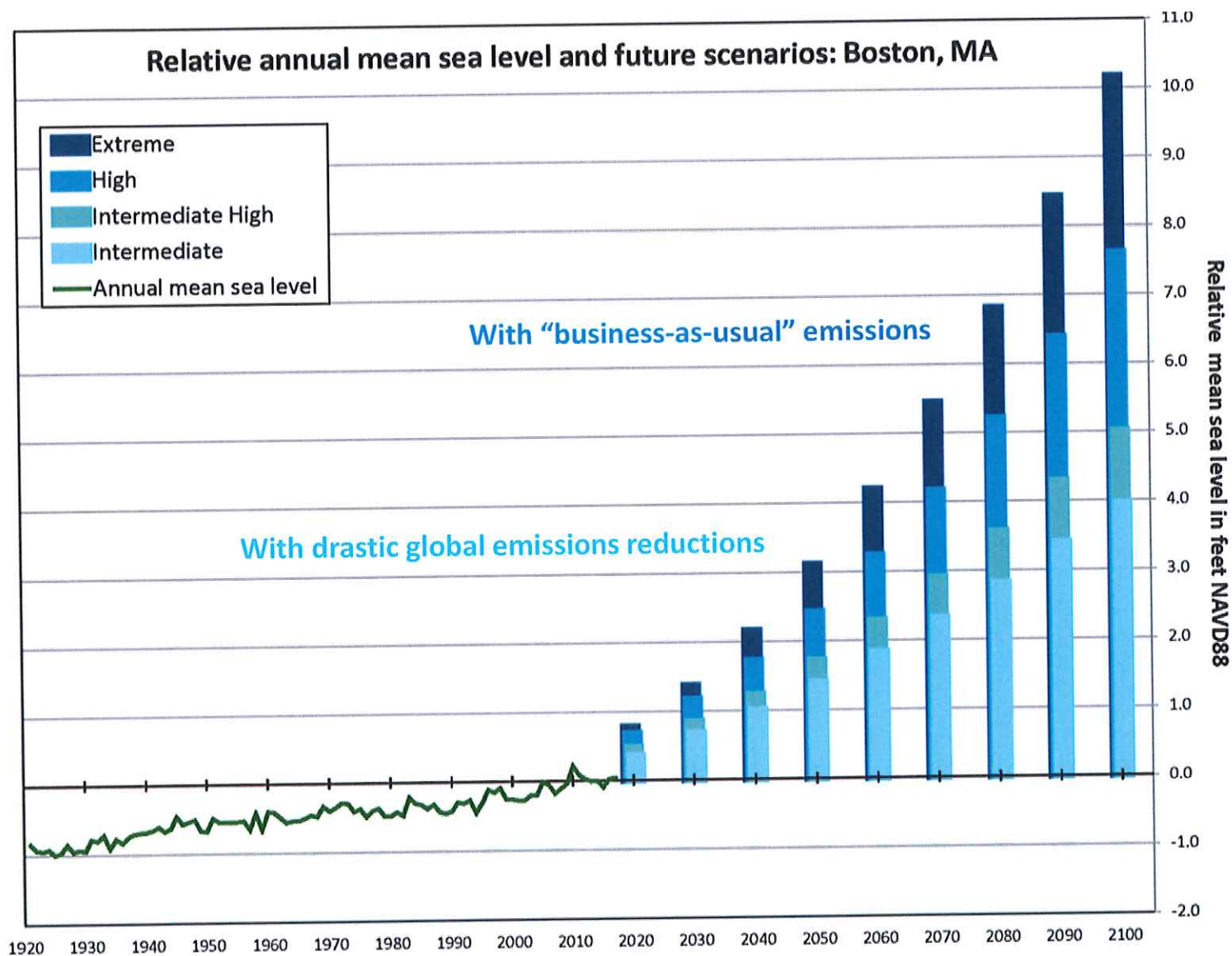
More Warm Summer Days, More Cooling Demand (based on annual Cooling Degree-Days, base 65)



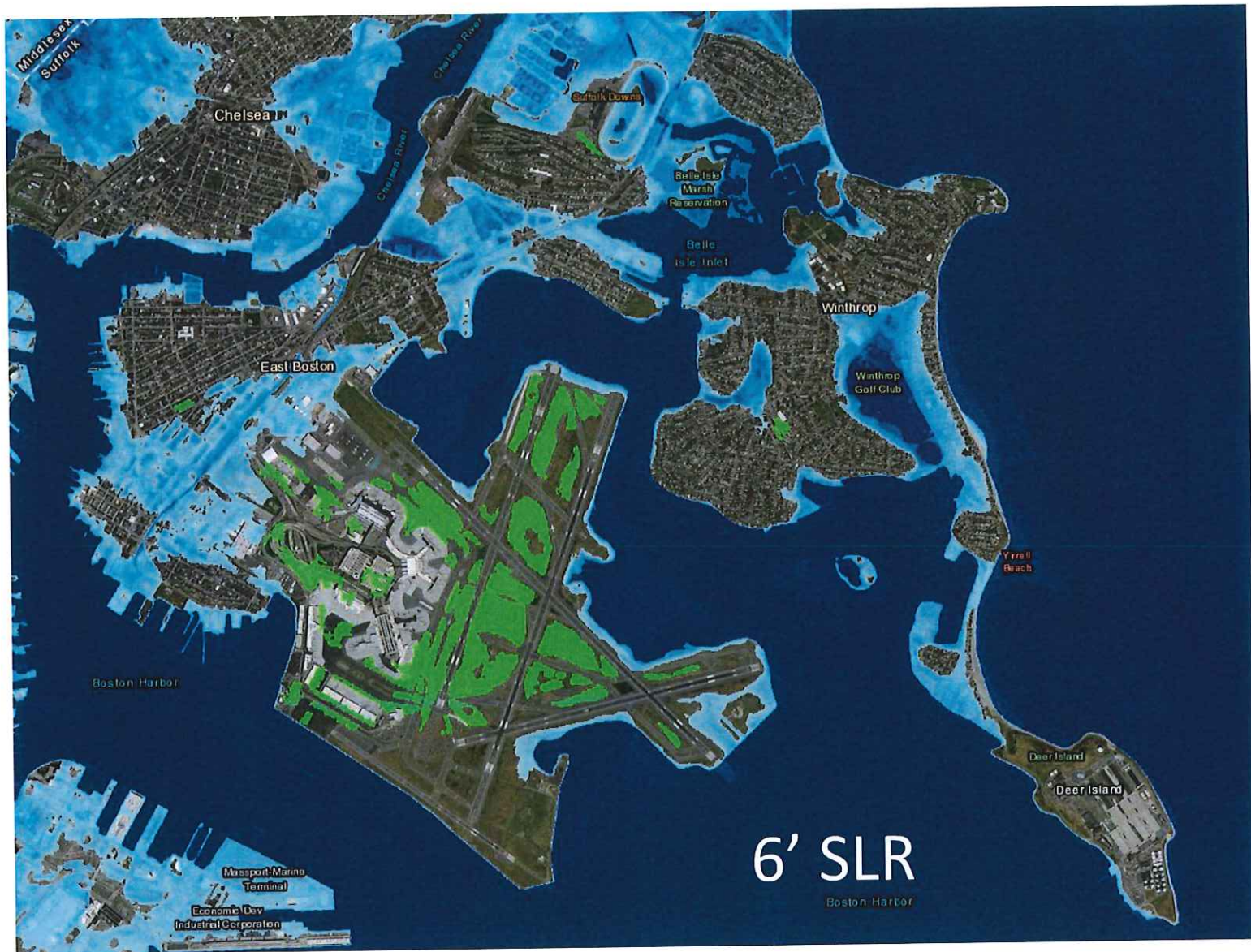
44 – 120%
by the 2050s

1971-2000
636 Cooling Degree-days

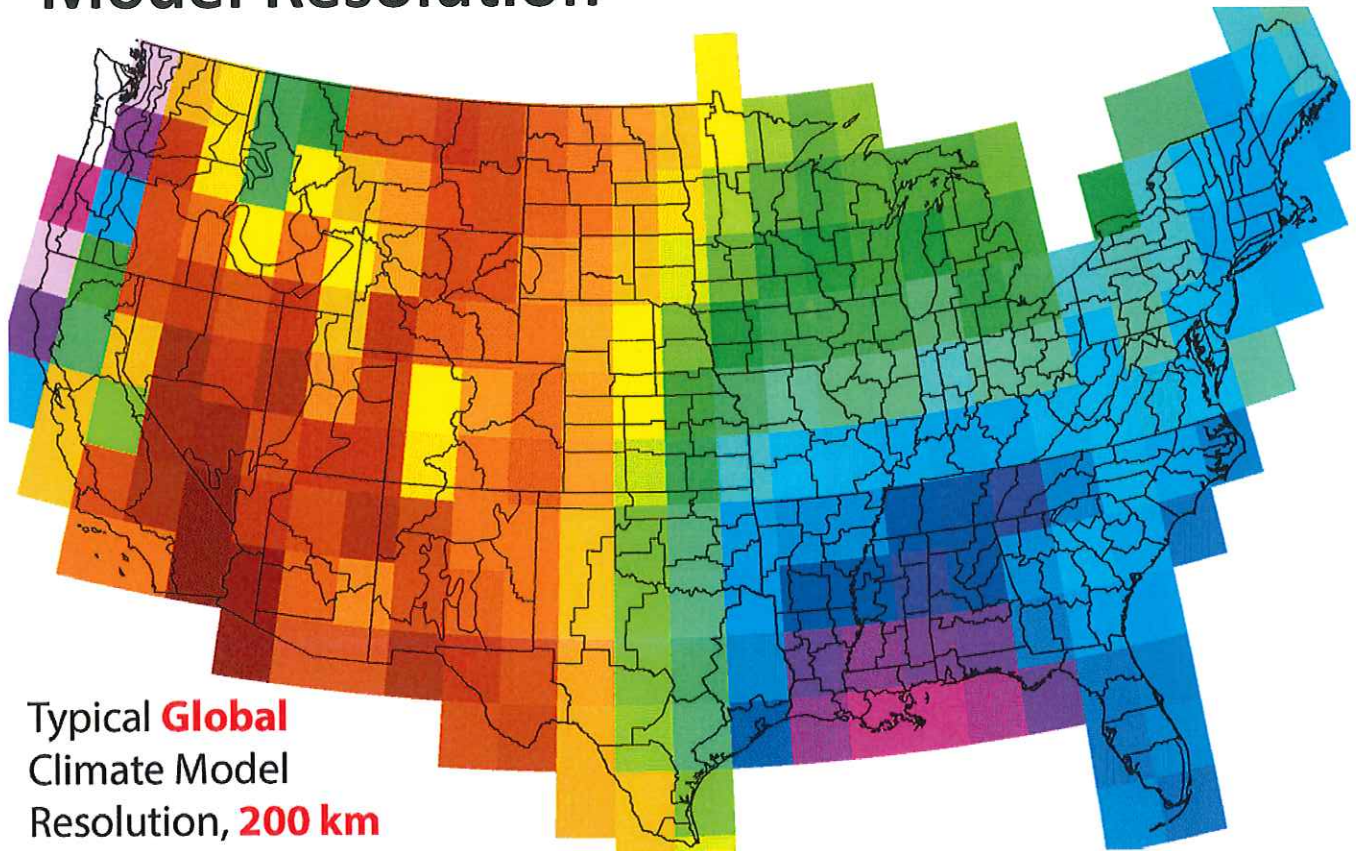
Source: Northeast Climate Science Center, MassClimateChange.org, accessed 2018.







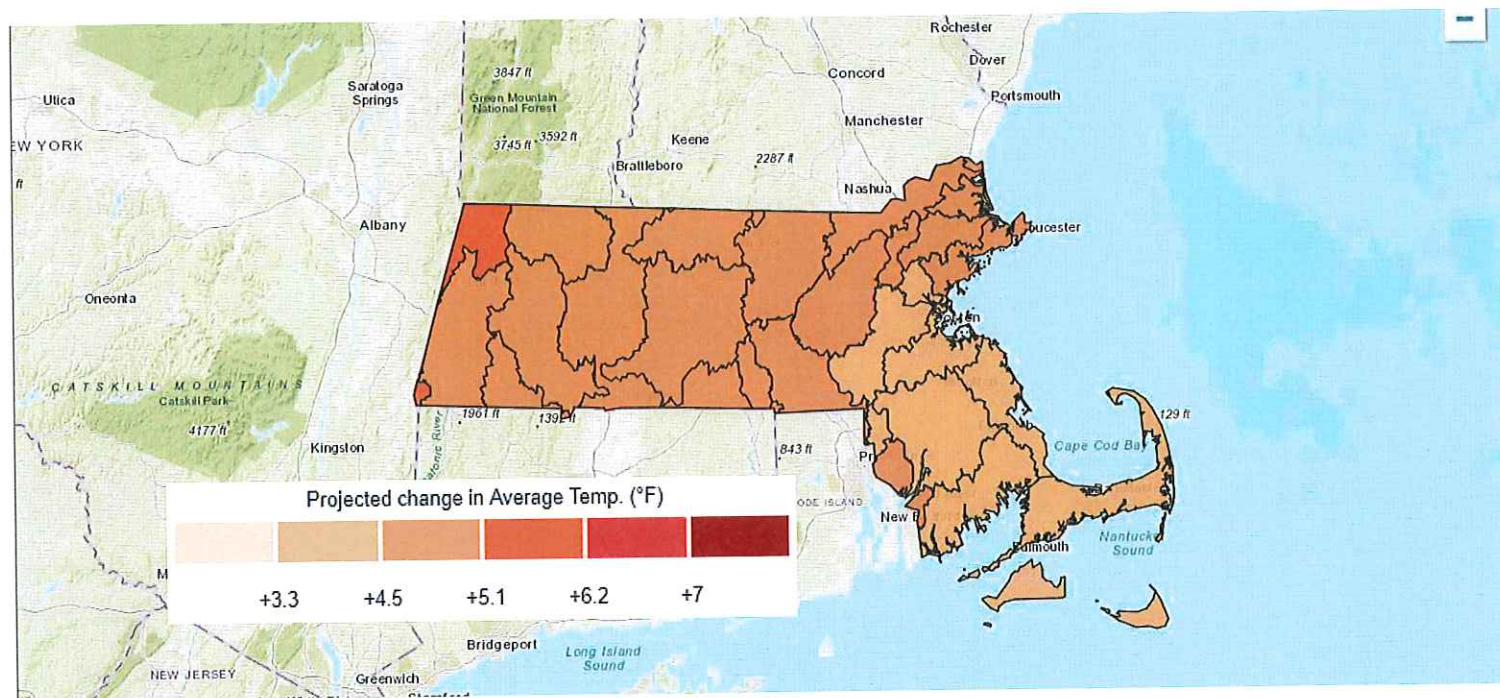
Typical Downscaled and Global Climate Model Resolution



Elevation data from PRISM, shown at 200 km and 24 km resolutions. Elevation profile is a key local and regional factor on climate.

Climate Change Indicators by Geographic Scale

2050s Annual Average Temperature Change



HUC-8 Watersheds

Climate Data and Planning

- The current and projected trajectory of many changes in climate are clear.
- Local variations are most often within the projected margin of error of climate models. Local variations are usually not practically significant.
- The resolution of climate data is not usually a limiting factor in planning. At the local scale, other factors may play a larger role.

More Precipitation

Total annual precipitation
has increased by:

15%

1.2 trillion more gallons of
water equivalent falling on
Massachusetts each year.

~9,700 filled Prudential Towers

Changes are calculated from a linear regression of annual totals from 1895-2015, 1901-2000 reference period.

Source: NOAA

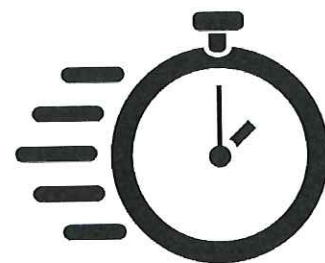
Change in 24-hour, 100-year Design Storms (inches)

	NOAA TP-40	NOAA Atlas 14	Change
Taunton	6.9"	7.7"	12%
Boston	6.6"	7.8"	18%
Worcester	6.5"	7.6"	17%

NOAA Atlas 14: <http://hdsc.nws.noaa.gov/hdsc/pfds/>

An anecdotal rule of thumb for anticipating changes in extreme precipitation...

Models often project a return period shorter by a factor of 2 to 4.



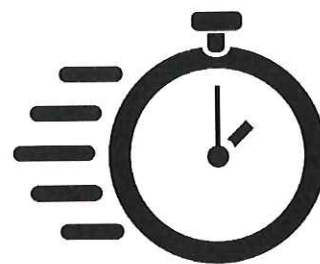
Often:



But projections vary place-to-place.

An anecdotal rule of thumb for anticipating changes in extreme precipitation...

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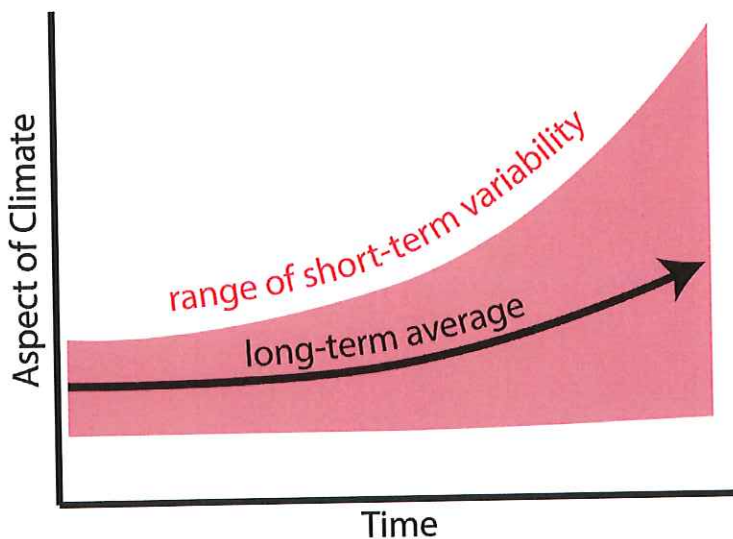
Often:



But projections vary place-to-place.

Long-term change doesn't rule out shorter-term variability.

Example: Even as average temperatures warm, we will still experience winter storms.



Impact Example: Water Infrastructure Freeze Vulnerability

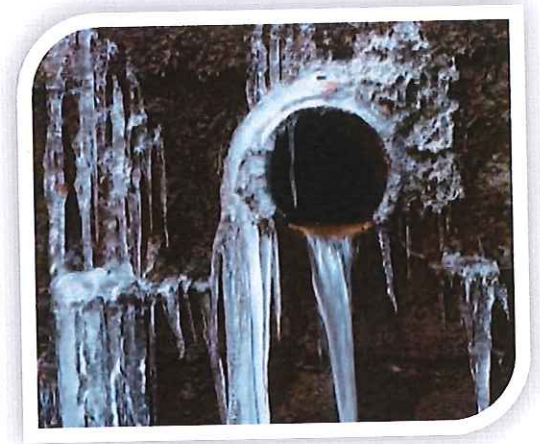
**Rising winter temperatures
reduce spring snow cover.**

+

**Risk of spring cold snaps
remains relatively stable.**

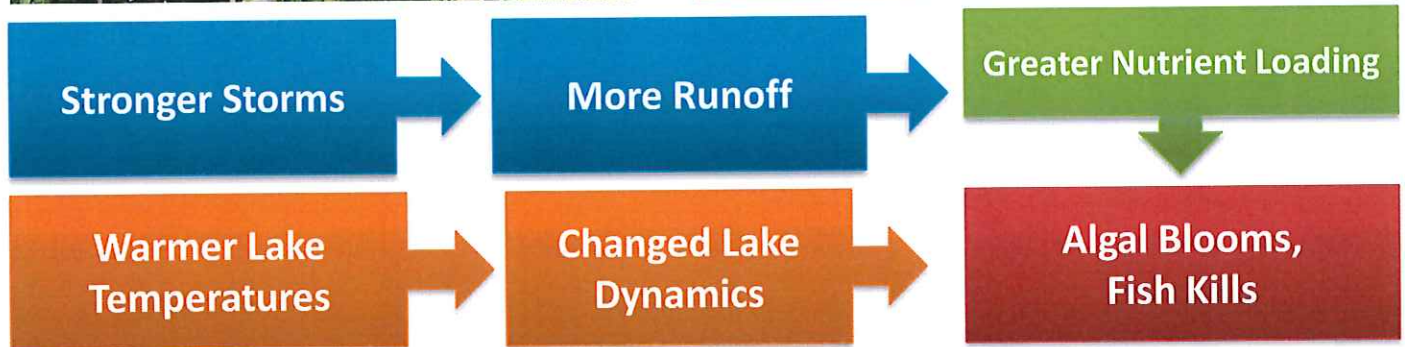
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**Increased subsurface
freeze risk**



Impact Example: Public Health Algal Blooms

West Monponsett Pond, Halifax, Massachusetts



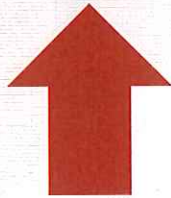
Suffolk County Projected Changes (2040-2069)

**Annual Average
Temperature**



4.9°F

Days Above 90°F



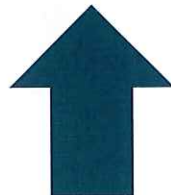
19 Days

Sea Level Rise



2.4 feet

**Days with >2"
Precipitation**



44%

Source: Northeast Climate Science Center, MassClimateChange.org, Values shown for the Blackstone River Watershed.



NATURAL & NATURE-BASED SOLUTIONS FOR VULNERABILITY REDUCTION & RESILIENCE

The Nature Conservancy 
Protecting nature. Preserving life.®

Sara Burns
Sara.burns@tnc.org



What We've Learned Today



- **We are all here to be proactive and find solutions!**
- **Climate change is already affecting how we experience storms.**
- **Winthrop is a great place with many strengths and coming challenges.**

Key Observed Climate Changes in Suffolk County

**Annual Average
Temperature**



4.9°F

Days Above 90°F



19 Days

Sea Level Rise



2.4 feet

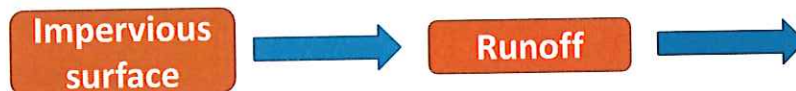
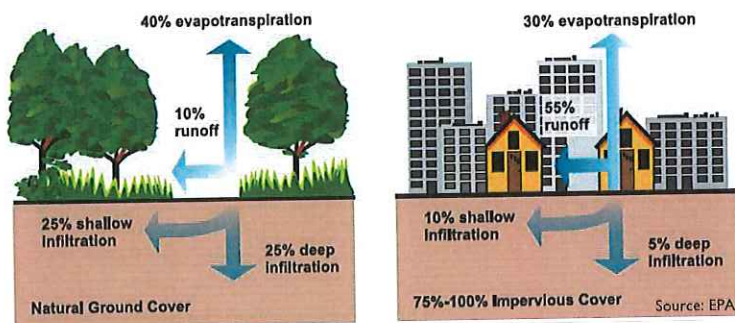
**Days with >2"
Precipitation**

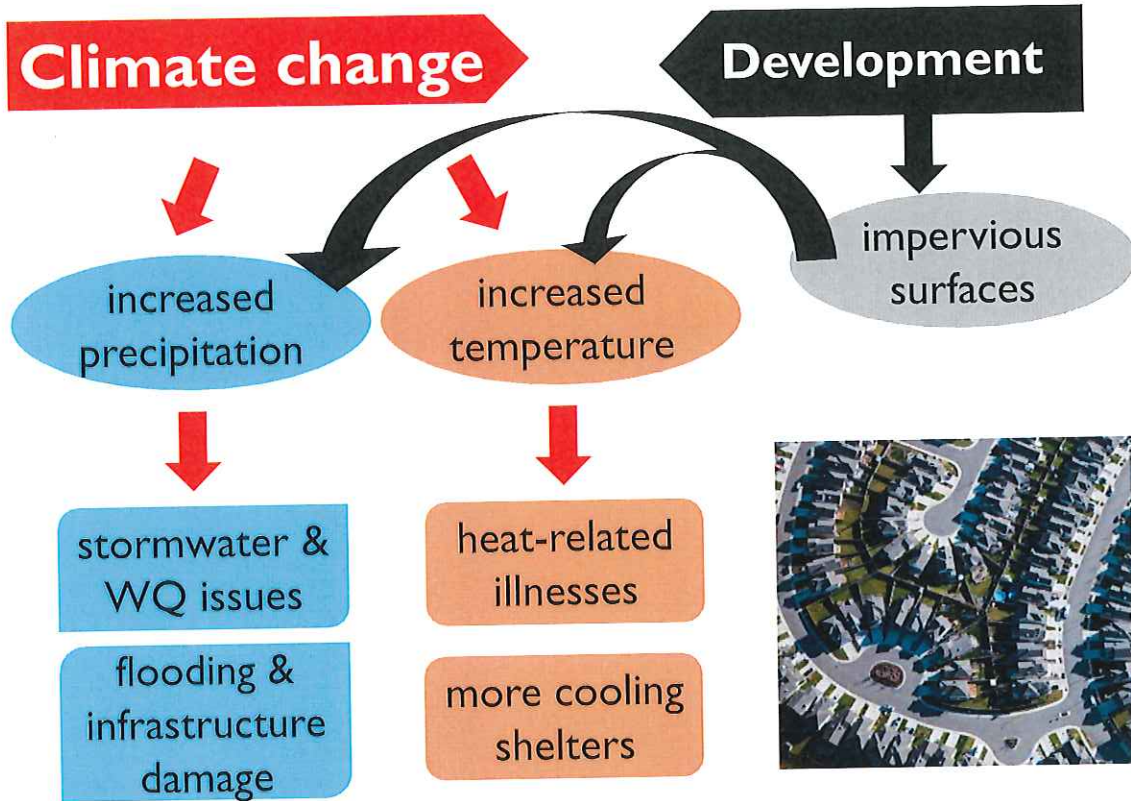


44%

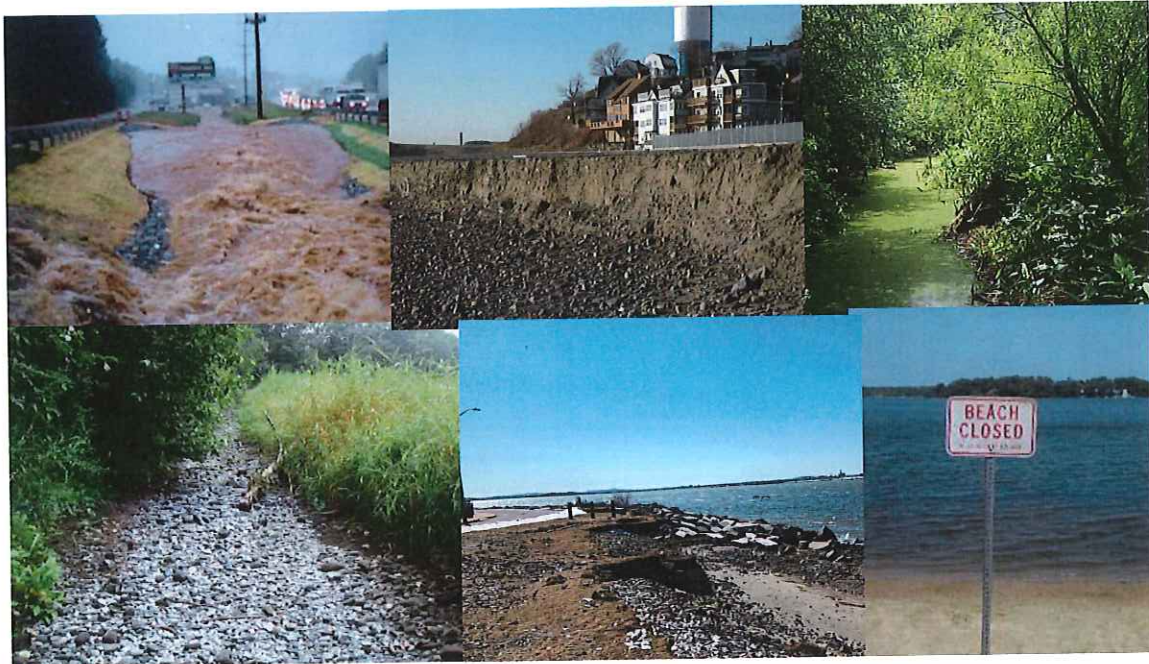
Source: Northeast Climate Science Center, MassClimateChange.org, Values shown for the Blackstone River Watershed.

What's the problem?





Impacts: dry rivers, flooding, algae blooms, erosion, beach closures



A landscape photograph showing a body of water on the left, a marshy area with green vegetation in the foreground and middle ground, and a cloudy sky in the background. The text is overlaid on the image.

There are real solutions.

One of the best adaptation practices is preserving natural areas.

Nature-Based Solutions

Nature-Based Solutions use natural systems, *mimic* natural processes, or *work in tandem with* traditional approaches to address natural hazards like **flooding**, **erosion**, **drought**, and **heat islands**.



↓
**Green
Infrastructure**

↓
**Low Impact
Development (LID)**



Solutions for Every Place

Conserve the natural green infrastructure already providing free ecosystem services

Integrate LID and green infrastructure design into development

Restore the resiliency of landscapes through LID



Conserve

Conserve the natural green infrastructure already providing free ecosystem services

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Integrate

Conserve the natural green infrastructure already providing free ecosystem services

Integrate LID and green infrastructure design into development

Restore the resiliency of landscapes through LID

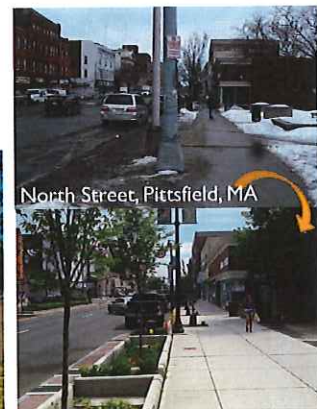


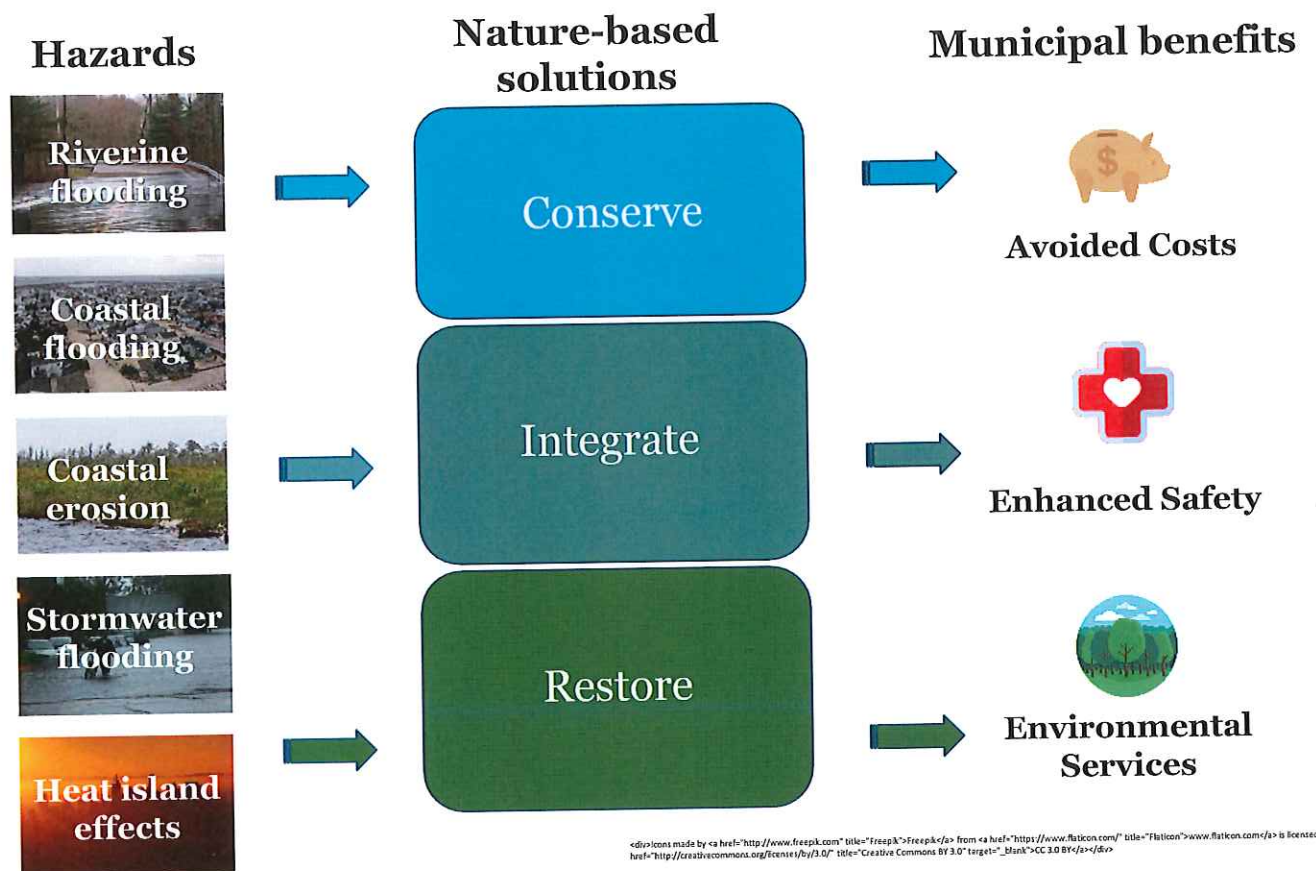
Restore

Conserve the natural green infrastructure already providing free ecosystem services













































































































Integrate LID and green infrastructure design into development

Restore resiliency of landscapes through nature based solutions





Co-benefits

Benefit	Reduces Stormwater Runoff				Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO ₂	Reduces Urban Heat Island	Improves Community Livability						Improves Habitat	Cultivates Public Education Opportunities
	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding								Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture			
Practice																			
Green Roofs																			
Tree Planting																			
Bioretention & Infiltration																			
Permeable Pavement																			
Water Harvesting																			

● Yes

○ Maybe

○ No

Source: Center for Neighborhood Technology's The Value of Green Infrastructure

Avoided costs

Land Protection as Water Protection

- Quabbin & Wachusett Reservoirs serve 2.5 million
- Over 20 years, Massachusetts Water Resources Authority spent \$130M to protect 22,000 acres of watershed lands
- Avoided ratepayer cost of \$250M on a filtration plant and \$4M/yr in operations



Avoided Costs

Enhance Safety: Charles River Natural Valley Storage Area. US Army Corps of Engineers

- 8,095 Acres Conserved
- From 1977 - 2016, the project has provided \$11,932,000 in flood protective services
- Co-benefits include recreation and natural resource benefits



Environmental Services

Massachusetts Forests Mitigate Climate Change

- MA forests **sequester 14%** of the state's gross annual carbon emissions
- Average acre stores **85 tons carbon**
- Capacity **increases** over time as forests mature

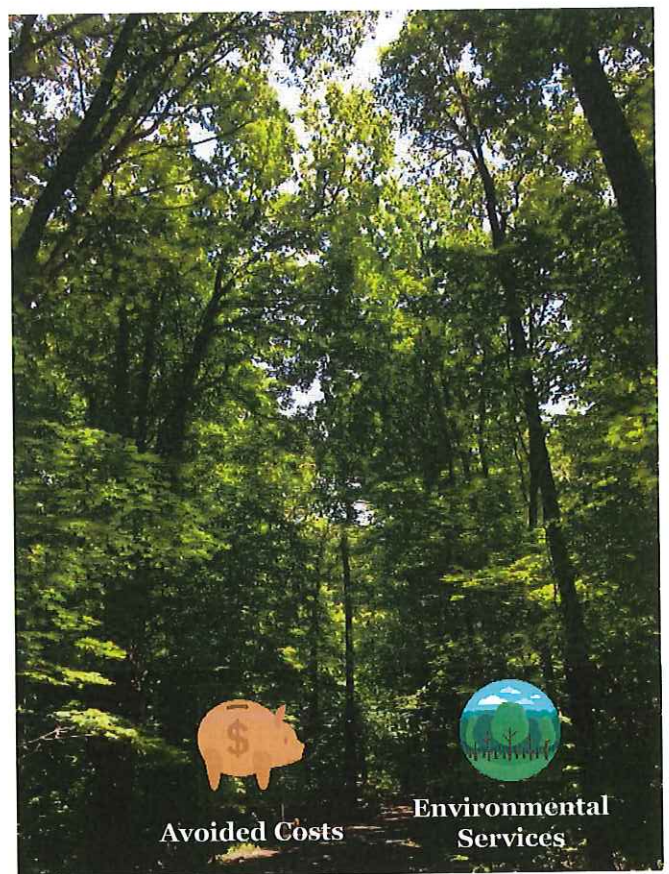


**Environmental
Services**

Return on Investment Studies in MA

Trust for Public Land

- Outdoor recreation generates:
 - \$10 billion in consumer spending
 - \$739 million in state and local tax revenue
 - 90,000 jobs
 - \$3.5 billion in annual wages and salaries
- Agriculture, forestry, commercial fishing, and related activities generate:
 - \$13 billion in output
 - 147,000 MA Jobs
- **Conservation Projects Return \$4 : \$1 spent**



Return on Investment Studies in MA

Div. of Ecological Restoration



Restoration results in

- **12.5 jobs** and
- **\$1.75 Million economic output**
- “Restoration economy” in Massachusetts



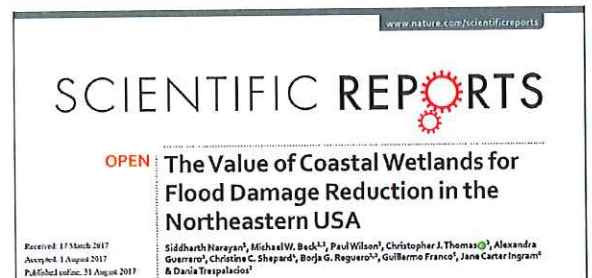
Return on Investment Studies Northeast US Scientific Reports

- **Wetlands** saved \$625,000,000 in direct flooding damages in New Jersey
- In New England, **wetlands** reduce storm damage by approximately 16%


Environmental
Services


Enhanced
Safety


Avoided
Costs



<https://www.nature.com/articles/s41598-017-09269-z>

Resources for Nature-Based Solutions

Guidance/Case Studies

- [Naturally Resilient Communities](#) successful project case studies from across the country to help communities learn and identify nature-based solutions
- [EPA's Soak Up the Rain](#) stormwater outreach tools, how-to guides and resources
- [EPA's RAINE](#) database of vulnerability, resilience and adaptation reports, plans and webpages at the state, regional and community level.
- [Climate Action Tool](#) explore adaptation strategies and actions to help maintain healthy, resilient wildlife communities in the face of climate change.

Mapping/Planning

- [Mapping and Prioritizing Parcels for Resilience \(MAPPR\)](#) ID priority parcels for protection and climate change resilience
- [Living Shorelines in New England: State of the Practice](#) and [Profile Pages for Solutions](#) are case studies, siting criteria, and regulatory challenges for coastal resilience in New England.
- [Low Impact Development Fact Sheets](#) cover valuing green infrastructure, conservation design, development techniques, regulations, urban waters, and cost calculations.

Cost/Benefit

- [EPA's Green Infrastructure cost/cost-benefit/tools](#) Database of tools for comparing solution costs
- [Massachusetts Division of Ecological Restoration's](#) economic benefits of aquatic restoration based on MA case studies

Bylaws/Ordinances

- [EEA's Smart Growth Toolkit](#) access to information on planning, zoning, subdivision, site design, and building construction techniques
- [Guide for Supporting LID in Local Land Use Regulations](#) provides a framework for communities to review their zoning, rules, and regulations for a number of factors.

HELP ME CHOOSE

Hazard Types

☐ Coastal Erosion
 ☐ Tidal Flooding
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding

Region

☐ Coastal West
 ☐ Great Lakes
 ☐ Gulf of Mexico
 ☐ Mid-Atlantic
 ☐ Midwest
 ☒ Northeast
 ☐ Pacific Northwest
 ☐ Rocky Mountain West
 ☐ Southeast
 ☐ Southwest

Community Type

☐ Rural
 ☐ Suburban
 ☒ Urban

Scale

☐ Community
 ☐ Neighborhood
 ☒ Site

Cost

☒ \$
 ☐ \$\$
 ☐ \$\$\$
 ☐ \$\$\$\$

CLEAR ALL

DOWNLOAD PDF

SOLUTIONS


14 Results

CASE STUDIES

0 Results

Coastal Marshes


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Coastal wetlands occur along marine, estuarine, and freshwater coastlines and may be...

Beaches and Dunes


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Beaches and dunes occur in a variety of shapes, sizes, compositions, and...

Restoring Offshore Features


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Restoration is the process of establishing or reestablishing a habitat that closely...

Living Shorelines


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Living shorelines are a suite of shoreline erosion control techniques that combine...

Green Roofs


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



A green roof is a contained vegetated space that is built on top...

Restoring Coastal Features


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Natural coastlines have evolved to absorb wave energy and provide a buffer...

Open Space Preservation through Land Acquisition


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



This strategy focuses on the public acquisition of undeveloped land to lessen...

Moving People Out of Harm's Way: Property Buyouts


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Property buyouts are a means by which communities can remove development from...

Daylighting Rivers and Streams


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Daylighting rivers or streams is the process of removing obstructions (such as...

Bioswales


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Bioswales are an aesthetically-pleasing alternative to concrete gutters and storm sewers, employing...

Waterfront Parks


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Waterfront parks are communal recreational spaces that are intentionally designed to be...

Living Breakwaters


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Breakwaters are offshore structures designed to limit wave energy by creating a...

Rain Gardens


☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



Rain gardens are planted basins which have several key purposes including: increasing...

Green Parking Lots

☒ Coastal Erosion
 ☐ Coastal Flooding
 ☐ Riverine Flooding
 ☐ Stormwater Flooding



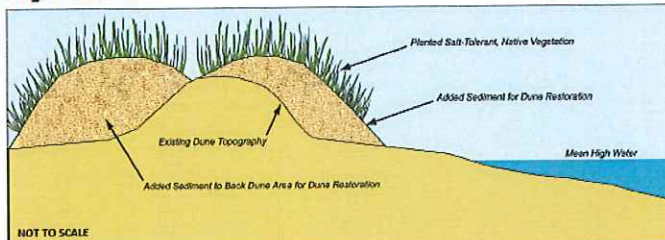
Green parking lots incorporate permeable or semi-permeable paving and porous design techniques...

Dune - Natural

Dune building projects involve the placement of compatible sediment on an existing dune, or creation of an artificial dune by building up a mound of sediment at the back of the beach.⁴ This may be a component of a beach nourishment effort or a stand alone project.

Objectives: erosion control; shoreline protection; dissipate wave energy; enhanced wildlife and shorebird habitat.

Design Schematics



Case Study

Ferry Beach, Saco, Maine

Relatively high beach and dune erosion (approximately 3 feet per year) prompted the FBPA to undertake a dune restoration project to help protect roads and homes from flooding and erosion. Given the relatively high erosion rate, it was decided that placing sediment for restoration seaward of the existing dune would be short-lived. A secondary frontal dune ridge landward of the existing dune crest was constructed instead, allowing native vegetation to establish.



Ferry Beach, Saco, ME
Photo courtesy of Peter Slovinsky

Project Proponent	Ferry Beach Park Association (FBPA)
Status	Completed 2009
Permitting Insights	Permit-by-Rule needed from Maine DEP
Construction Notes	An 800 foot long secondary dune was built to 1 foot above the effective FEMA 100-year BFE. A secondary dune was built because erosion of the front dune was considered too high (>3 feet per year) to have a successful project. 1,800 cu yd of dune-compatible sediment was delivered via truck from a local gravel pit. Construction and planting occurred in early spring. Volunteers planted native American beach grass.
Maintenance Issues	Sand fencing was used to help trap sediment in the constructed dune, and to help maintain the seaward edge of the original dune. However, shoreline erosion has continued; as of May 2017 the restored dune has started to erode.
Final Cost	\$29,000 and volunteer hours
Challenges	Trucking 90 dump-truck loads of sediment through the community. Construction and planting timing windows associated with piping plover nesting. Continued erosion.

Overview of Technique

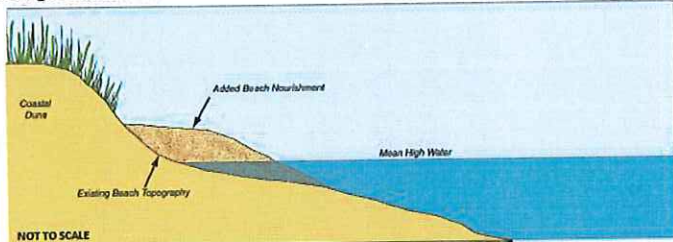
Materials	Sediment is brought in from an offsite source, such as a sand and gravel pit or coastal dredging project. ⁴ Planting the dune with native, salt-tolerant, erosion-control vegetation (e.g., beach grass <i>Ammophila brevifoliate</i>) with extensive root systems is highly recommended to help hold the sediments in place. ^{4,11} Sand fencing can also be installed to trap windblown sand to help maintain and build the volume of a dune. ^{4,11}
Habitat Components	Dunes planted with native beach grass can provide significant wildlife habitat. ⁹
Durability and Maintenance	The height, length, and width of a dune relative to the size of the predicted storm waves and storm surge determines the level of protection the dune can provide. ⁴ To maintain an effective dune, sediment may need to be added regularly to keep dune's height, width, and volume at appropriate levels. ⁴ The seaward slope of the dune should typically be less steep than 3:1 (base:height). ^{4,9} Dunes with vegetation perform more efficiently, ensuring stability, greater energy dissipation, and resistance to erosion. ¹⁰ If plantings were included, plants should be replaced if they are removed by storm or die. ⁴
Design Life	Dunes typically erode during storm events. In areas with no beach at high tide, dune projects will be short lived as sediments are rapidly eroded and redistributed to the nearshore. ⁴ Designs should consider techniques that enhance or maintain the dune (e.g. sand fencing and/or vegetation to trap wind blown sand).
Ecological Services Provided	The added sediment from dune projects supports the protective capacity of the entire beach system (i.e., dune, beach, and nearshore area). Any sand eroded from the dune during a storm, supplies a reservoir of sand to the fronting beach and nearshore area. ^{4,9} Dunes dissipate rather than reflect wave energy, as is the case with hard structures. ⁴ Dunes also act as a barrier to storm surges and flooding, protecting landward coastal resources, ⁹ and reducing overwash events. ¹⁰ Sand dunes provide a unique wildlife habitat. ⁹
Unique Adaptations to NE Challenges (e.g. ice, winter storms, cold temps)	Shorter planting and construction window due to shorter growing season. Utilization of irrigation to establish plants quickly. Presence of sensitive species may require design (e.g. slope, plant density) and timing adjustments.

Beach Nourishment

Beach nourishment is the placement of sediment along the shoreline of an eroding beach from outside source. It widens and/or elevates the beach and usually moves the shoreline seaward, increasing the natural protection that a beach can provide against wave energy and storms. This may be a component of a dune restoration/creation effort or a stand alone project.

Objectives: erosion control; shoreline protection; enhance recreation; increased access; dissipate wave energy; enhanced wildlife and shorebird habitat.

Design Schematics



Case Study

Winthrop, MA Beach Nourishment

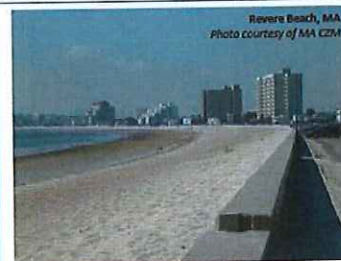
Applied Coastal Research & Engineering, Inc. designed the Winthrop Beach Nourishment Program to provide storm protection to an upland urban area fronted by a seawall originally constructed in 1899. The project utilized 460,000 cy of compatible sediment to nourish approximately 4,200 linear feet and to create the equilibrated designed berm width of 100 feet. Once the beach nourishment was completed in late 2014, the high tide shoreline was pushed more than 150 feet from the seawall, with a gradual slope extending approximately 350 feet offshore.



Project Proponent	Massachusetts Division of Conservation and Recreation (DCR)
Status	Phase 1: 2013, Phase 2: 2014
Permitting Insights	Offshore sediment source was denied by Army Corps after a 12-year permitting process. Conservation Permit required from NIMESP to address potential impacts to Piping Plovers.
Construction Notes	Upland derived mix of sand, gravel and cobble to match the existing beach sediments was required, where the nourishment was provided from two sources: sand borrow (80%) and naturally rounded cobble & gravel (20%).
Maintenance Issues	Cobble berms have begun forming along the beach, which conflicts with community recreation goals, requiring additional sand for aesthetics.
Final Cost	Permitting: \$2,000,000 (including attempt to permit offshore borrow site). Construction: \$22,000,000 (included work on coastal engineering structures).
Challenges	Trucking through the community: urban community with two roads in and out, as well as roadway damage and air quality impacts associated with 16,000+ truck trips. Public perception of compatible sediment.

Design Overview

Materials	Sediment is brought in from an offsite source, such as a sand and gravel pit or coastal dredging project. ¹
Habitat Components	Beaches nourished with compatible sediments can provide significant wildlife habitat. ^{2,4}
Durability and Maintenance	A coarser sand may erode more slowly than a finer sand. ⁴ To maintain an effective beach berm, sediment may need to be added regularly maintain the desired beach profile. ^{4,11} The need to replenish the beach depends upon the rate of erosion at the particular site, but is typically once every 1-5 years. ⁴
Design Life	To increase erosion and flooding protection, nourished beaches are frequently built higher and wider than would occur naturally. ¹¹ Grain size (e.g. sand, gravel, cobble) drives appropriate design slopes; gentler slopes generally perform better than steep areas. However, coarser grain sizes allow for steeper project slopes.
Ecological Services Provided	A nourishment beach can provide additional beach habitat area. Added sediment used for the nourishment can also provide a sand source for surrounding areas. The increased width and height of the beach berm can help attenuate wave energy. ¹⁰
Unique Adaptations to NE Challenges (e.g. ice, winter storms, cold temps)	Beach nourishment sites subject to ice impacts are generally most successfully stabilized with gentler slopes (e.g., 6:1-10:1). ¹¹ Presence of sensitive species may require design (e.g. slope, plant density) and timing adjustments.

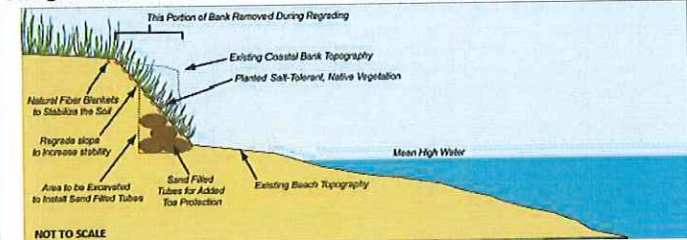


Coastal Bank – Engineered Core

Coastal bank protection, including slope grading, terracing, and toe protection and vegetation planting will reduce the steepness and protect the toe of the bank from further erosion. Engineered cores, of sand filled tubes, provide added protection from future bank erosion.

Objectives: erosion control; shoreline protection; dissipate wave energy; enhanced wildlife habitat.

Design Schematics



Case Study

Stillhouse Cove, Cranston, RI

Stillhouse Cove is the site of a public park and a previous salt marsh restoration project that was completed in 2007. Restoration of the coastal bank was initiated after Superstorm Sandy caused extensive erosion which oversteepened the bank and washed fill and soil into the adjacent marsh. Save The Bay and EWPA, working closely with the USDA Natural Resources Conservation Service, developed a design to reinforce and protect the eroding bank by reconfiguring the slope and using natural materials and vegetation.



Project Proponent	City of Cranston, RI, Edgewood Waterfront Preservation Association (EWPA), Save The Bay, Natural Resources Conservation Service (NRCS).
Status	Completed in 2013. Maintained in 2014 (added coir logs and plantings).
Permitting Insights	The project had several iterations but was finally permitted as a Sandy Emergency Assent. An extension was required due to challenges of securing funding within the permit time frame.
Construction Notes	A key component of this project was regrading the bank from a vertical cut to create a more gradual slope. Once the slope was regraded, sand filled coir envelopes were installed, covered with soil and planted with salt tolerant vegetation.
Maintenance Issues	3 coir logs were installed at the southern end of project and planted with warm season grasses as part of the Dept. of Interior Hurricane Sandy Relief Grant Program. The base of the bank will be more frequently inundated as sea levels rise.
Final Cost	Permitting: No permit fee for municipalities Construction: \$59,006 plus volunteer labor.
Challenges	Funding and coordination with partners and volunteers.

Design Overview

Materials	An engineered core could be constructed using coir envelopes, which are coir fabric filled with sand. Cutback/excavated material should be used to fill the coir envelopes but supplemental offsite material may be required. Anchors are necessary to secure the envelopes. Native vegetation with extensive root systems are often used in conjunction with coir envelopes to help stabilize the site. Also, natural fiber blankets can also be used to stabilize the ground surface while plants become established. (Blankets should be run up and down the slope rather than horizontally across it.)
Habitat Components	Because they are made with natural fibers and planted with vegetation, natural fiber blankets also help preserve the natural character and habitat value of the coastal environment.
Durability and Maintenance	A veneer of sand/sediment should be maintained over the sand filled tubes to prolong their lifetime. Regular maintenance, such as resetting, anchoring, replacement, or recovering, can increase the effectiveness of the project. ⁴ Invasive species management should be incorporated into the project. Runoff management and groundwater will also be crucial to project success. ⁴
Design Life	As the sand tube material and natural fiber blankets disintegrate, typically over 5-10 years, the plants take over the job of site stabilization.
Ecological Services Provided	Upland plantings stabilize bluffs and reduce rainwater runoff. ¹¹
Unique Adaptations to NE Challenges (e.g. ice, winter storms, cold temps)	Shorter planting and construction window due to shorter growing season. Utilization of irrigation to establish plants quickly. Freeze and thaw processes can damage this design. Consideration should be given to the slope aspect and the implications on plant growth and microbiome from shading and sun exposure.



SOLUTIONS

10 Results

CASE STUDIES

0 Results

HELP ME CHOOSE

Hazard Types

- ☒ Coastal Erosion
- ☐ Tidal Flooding
- ☐ Coastal Flooding
- ☐ Reverse Erosion
- ☐ Reverse Flooding
- ☐ Stormwater Flooding

Region

- ☐ Coastal West
- ☐ Great Lakes
- ☐ Gulf of Mexico
- ☐ Mid-Atlantic
- ☐ Midwest
- ☒ Northeast
- ☐ Pacific Northwest
- ☐ Rocky Mountain West
- ☐ Southeast
- ☐ Southwest

Community Type

- ☐ Rural
- ☐ Suburban
- ☒ Urban

Scale

- ☒ Community
- ☐ Neighborhood
- ☐ Site

Cost

- ☒ \$
- ☐ \$\$
- ☐ \$\$\$
- ☐ \$\$\$\$

CLEAR ALL

DOWNLOAD PDF



Regulatory and Policy Approaches to Address Hazards

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

Flooding is a natural process that, in the absence of human settlements...



Planning Approaches to Reduce Natural Hazards

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

Flooding is a natural process that, in the absence of human settlements...



Enhanced Floodplain Mapping

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

Flooding is a natural process that, in the absence of human settlements...



Open Space Preservation through Land Acquisition

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

This strategy focuses on the public acquisition of undeveloped land to lessen...



Urban Trees + Forests

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

Urban forestry is the planned installation and management of trees within an...



Rain Gardens

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

Rain gardens are planted basins which have several key purposes including, increasing...



Green Roofs

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

A green roof is a contained vegetated space that is built on top...



Green Parking Lots

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

Green parking lots incorporate permeable or semi-permeable paving and porous design techniques...



Daylighting Rivers and Streams

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

Daylighting rivers or streams is the process of removing obstructions (such as...

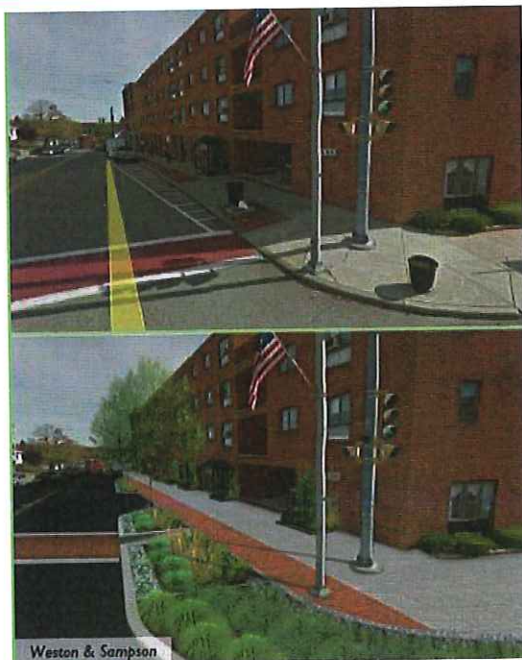


Bioswales

Coastal Erosion Coastal Flooding Reverse Erosion Reverse Flooding Stormwater Flooding

Bioswales are an aesthetically-pleasing alternative to concrete gutters and storm sewers, employing...

MVP Example: identified intersection that floods?



Bioretention bump outs & street trees can help to...

- capture & filter excess water – alleviate pressure on MS4
- improved pedestrian safety – better visibility, shorter walkway
- enhance aesthetics to encourage visitors & walking

without altering existing parking or bus stops



Environmental Services



Enhanced Safety

Funding

Certified MVP Communities Receive Priority Ranking

- MA Clean Water State Revolving Fund Program (CWSRF)
- MA Office of Coastal Zone Management (CZM)
- MA Department of Agricultural Resources (MDAR)
- MA Executive Office of Energy and Environmental Affairs (EEA)
- MA Department of Environmental Protection (DEP)
- Mass Environmental Trust (MET)



Environmental
Protection



Ten things local homeowners & citizens can do

1. Divert your downspouts

2. Plant a rain garden

3. Replace impervious surfaces

4. Adopt a drain – and encourage others to

5. Don't wash your car in the driveway



6. Pick up pet waste

7. Reduce fertilizer and pesticide use

8. Replace lawn with native plants

9. Reduce lawn watering and mowing

10. Pick up leaf litter (compost/dispose of properly)



Thank you!
Questions!

The Nature
Conservancy 
Protecting nature. Preserving life.

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COMMITMENT & INTEGRITY DRIVE RESULTS