NATURAL & NATURE-BASED SOLUTIONS FOR VULBERABILITY REDUCTION & RESILIENCE

The Nature Conservancy
Protecting nature. Preserving life.

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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)

Hazards

Nature-based solutions

- Open space preservation
- Ecosystem restoration
- Low Impact Development

Municipal benefits

Avoided Costs

Enhanced Safety

Environmental Services

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MVP Action Grant

- To implement priority climate adaptation actions identified by MVP Communities
- Preference for nature-based solutions
- 82 Communities funded for $5 million in year one

MVP Action Grant: Eligible Projects

- Further vulnerability and risk assessment
- Community Education and Outreach – translation and other EJ communication strategies encouraged
- Local Bylaws, Ordinances, Plans, and Other Management Measures
- Redesigns and Retrofits (all phases)
- Energy Resilience Strategies
- Chemical Safety & Climate Vulnerabilities
- Nature-Based Hazard Reductions
- Acquisition of Land
- Ecological Restoration and habitat management to increase resiliency

MVP Action Grant: Priority Projects

Climate Resilience Projects (from MVP Plan) that:

- Propose Nature Based Solutions
- Rely on Green Infrastructure
- Rely on Conservation and Enhancement of Natural Systems to improve community resilience

Why Nature Based Solutions

- Every $1 invested in Disaster Mitigation saves $6.
- NBS projects can be cheaper – especially over the lifespan of a project
  - "well planned restoration (NBS) activities can provide benefit cost ratios of 3-75 (benefit) to 1 (cost)."
- NBS projects provide multiple benefits.

The Trinity River Corridor will be a didactic landscape unlike any other—where art and sustainability will coexist throughout the built form, advancing the city's most progressive goals and values; where infrastructure will be rendered green infrastructure; where vastness will be sensed and understood alongside the minute; and where Dallas will rediscover and redefine itself.

Strategic Planning for Nature Based Solutions:

Increase potential funding streams and Incorporate Climate Resilience in all Municipal plans

Planning Document	Regional Capacity	Funding Opportunities	Opportunity to strategize NBS
MVP	Possible	Action Grant	Yes
Hazard Mitigation	Possible	Pre Disaster Hazard Mitigation Grant	Yes
Open Space and Recreation Plan	Possible	Local Budgets, State and Federal Grants	Yes
Master Plan	Possible	Local Budgets, State and Federal Grants	Yes

NBS in Local Hazard Mitigation View EPA Pilot

- Cross walk stormwater or other permits/ plans into hazard mitigation plans
- Incorporate both climate change impacts and NBS projects
- Highlight multiple benefits of NBS projects in this plan as well

NBS Anywhere - At Any Scale

Conserve

Rural

Integrate

Suburban

Restore

Urban

Naturally Resilient Communities

Yelp for Nature Based Solutions

HELP ME CHOOSE

Hazard Types
- [ ] Coastal Erosion
- [ ] Tidal Flooding
- [ ] Coastal Flooding
- [ ] Riverine Erosion
- [ ] Riverine Flooding
- [ ] Stormwater Flooding

Region
- [ ] Coastal West
- [ ] Great Lakes
- [ ] Gulf of Mexico
- [ ] Mid-Atlantic
- [ ] Midwest
- [x] Northeast
- [ ] Pacific Northwest
- [ ] Rocky Mountain West
- [ ] Southeast
- [ ] Southwest

Community Type
- [ ] Rural
- [x] Suburban
- [ ] Urban

Scale
- [x] Community
- [x] Neighborhood
- [x] Site

Cost
- [x] $
- [x] $$
- [x] $$$
- [x] $$$$

CLEAR ALL

DOWNLOAD PDF

Rivers, Streams, and Floodplains

Riverine Flooding · Riverine Erosion

Floodplains are the areas of low-lying ground adjacent to rivers, formed mainly...

Restoring Floodplain Elements

Riverine Flooding · Riverine Erosion

Floodplains, and the wetlands and waterways that make them up, provide a...

Regulatory and Policy Approaches to Address Hazards

Coastal Erosion · Riverine Flooding · Riverine Erosion · Coastal Flooding · Stormwater Flooding · Tidal Flooding

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

Planning Approaches to Reduce Natural Hazards

Coastal Erosion · Riverine Flooding · Riverine Erosion · Coastal Flooding · Stormwater Flooding · Tidal Flooding

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

Enhanced Floodplain Mapping

Coastal Erosion · Riverine Flooding · Riverine Erosion · Coastal Flooding · Stormwater Flooding · Tidal Flooding

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

Open Space Preservation through Land Acquisition

Coastal Erosion · Riverine Flooding · Riverine Erosion · Coastal Flooding · Stormwater Flooding · Tidal Flooding

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

Moving People Out of Harm's Way: Property Buyouts

Coastal Erosion · Riverine Flooding · Riverine Erosion · Coastal Flooding · Stormwater Flooding · Tidal Flooding

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

Flood Friendly Culverts

Riverine Flooding · Riverine Erosion · Coastal Flooding · Tidal Flooding

Culverts are essential pieces of infrastructure that allow water – whether from...

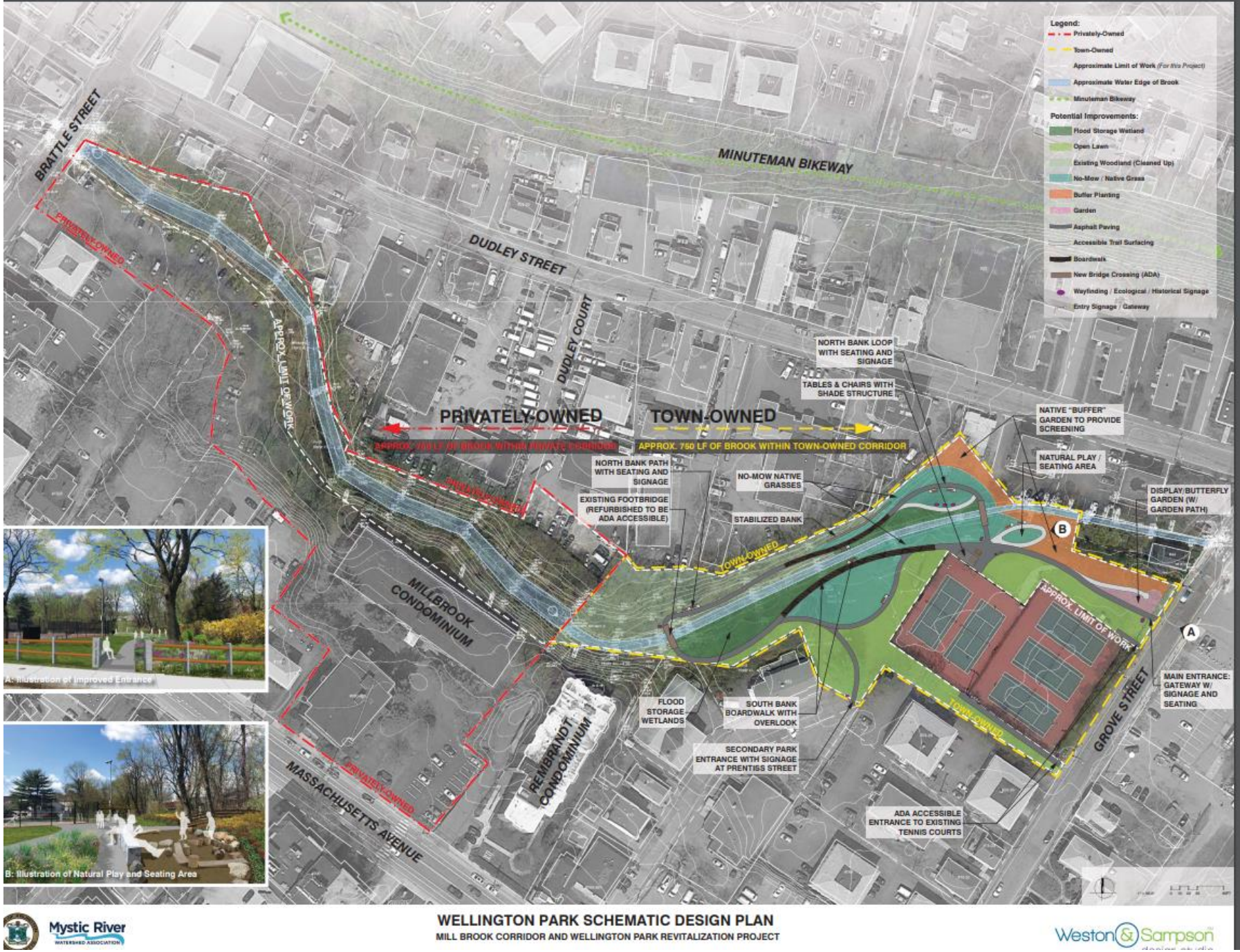
Action Grant Example

Mill Brook Corridor Project – Arlington

- Flooding
- Unstable Banks
- Inaccessible
- Mixed Ownership

Restoration Will Improve:

- Flood Resilience
- Ecology, Aesthetics
- Outdoor Recreation
- Leverages CPA Funds



https://www.mass.gov/files/documents/2018/10/19/2017-2018-mvp-planning-grant-report-arlington.pdf
https://mysticriver.org/news/2019/4/22/improvements-coming-to-mill-brook-and-wellington-park

Action Grant Example

Town-wide Road Stream Crossing Assessment and Climate Change Adaptation Plan- Belchertown

- Flooding
- Impassable Roads
  - Culverts, bridges, dams

https://www.mass.gov/files/documents/2018/10/19/2017-2018-mvp-planning-grant-report-belchertown.pdf

Mill River: Whittenton Dam Removal, Taunton, MA –
Case study

Whittenton Mill Dam was removed in 2013

- Costs
  - Estimated Cost of Dam Repair = $1.9 Million
  - Ongoing Cost of Dam maintenance = variable
  - 2005 Evacuation Costs = $1.5 Million
  - Dam Removal Costs = $440,000
- Benefits
  - Increased revenue from river based recreation
  - Increased Property Values
  - Water quality benefits
  - Base Flood Elevation dropped between 6 inches and 10 ft.

Action Grant Example

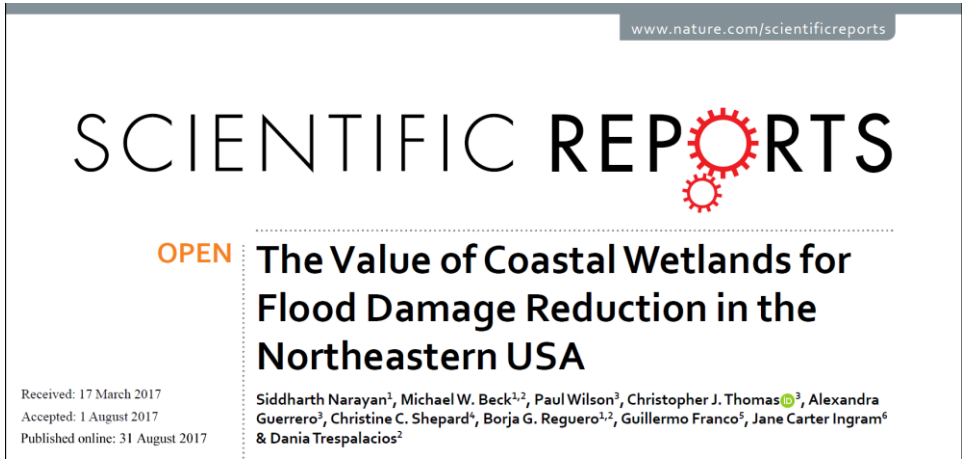
Living Shoreline Feasibility – Essex

- Stablize shoreline edges
- **Explore offshore shellfish reefs**
- Restore barrier beaches and dunes
- Restore vegetation

Essex Causeway/Main Street and businesses showing inundation from the Essex River.
Photo credit: Abby Manzi, DeRosa Environmental

https://www.mass.gov/files/documents/2018/10/19/2017-2018-planning-grant-report-essex.pdf
https://static1.squarespace.com/static/59cbe1e04c326dc7d7bfa01c/t/5beb329e40ec9a5063154e4e/1542140578345/ECAN+MVP+2+Essex.pdf

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

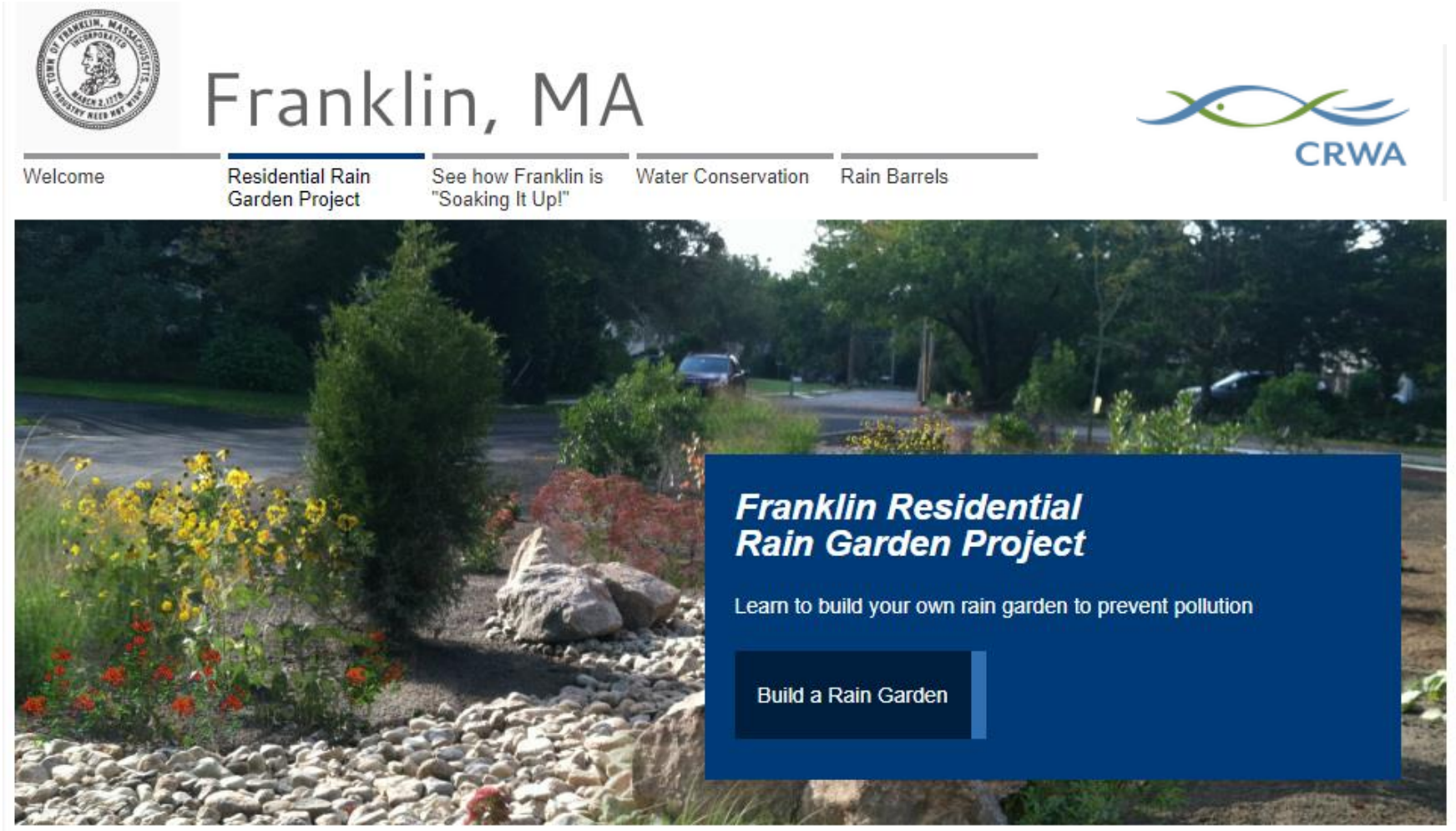
Avoided Costs

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

Drought Remediation with LID - Franklin

Range of BMPs from urban to rural reduce groundwater depletion in Franklin:

- Tree boxes
- Bioswales
- Road Narrowing
- Sidewalk Removal
- Public Education

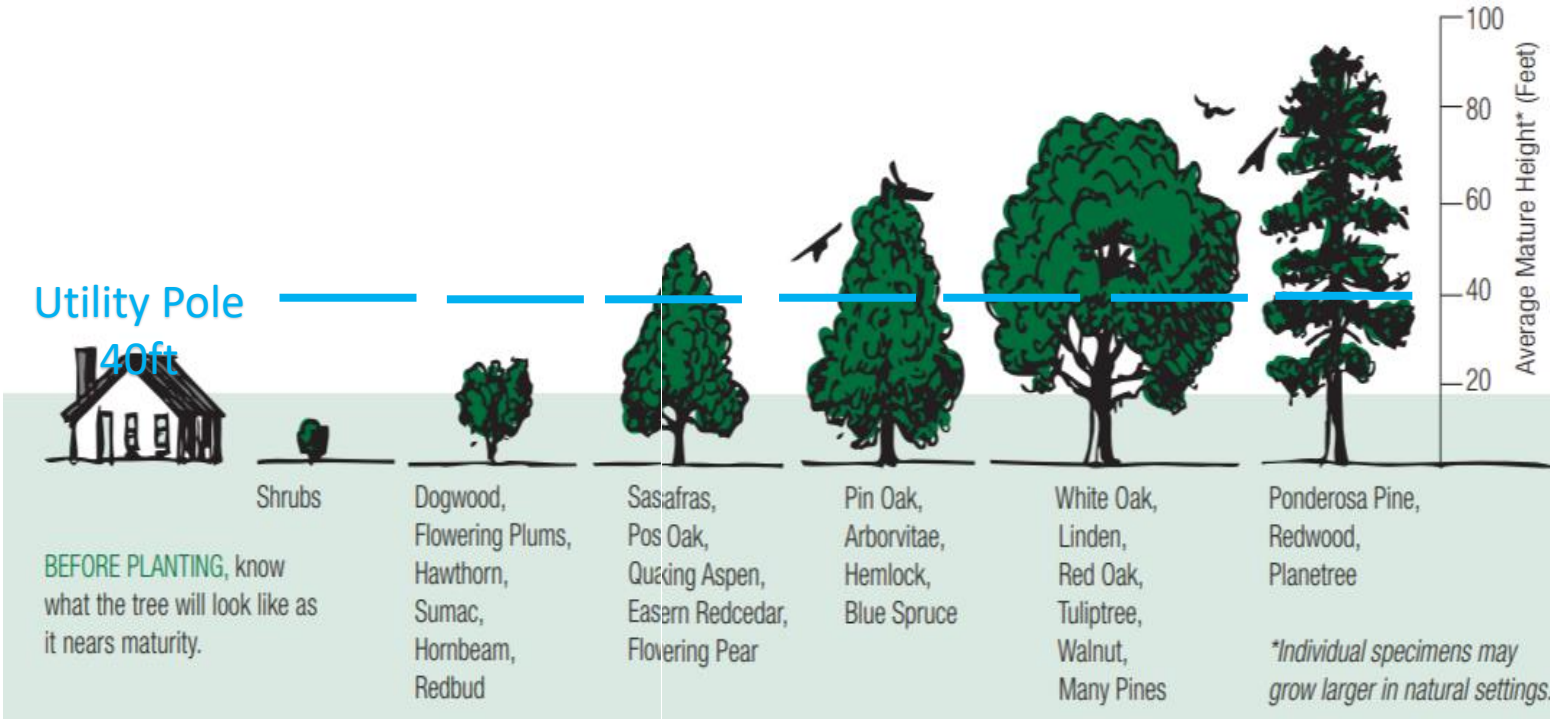


https://www.soakitupfranklinma.org/

Develop Forest Management Plan

Hazard Resilience

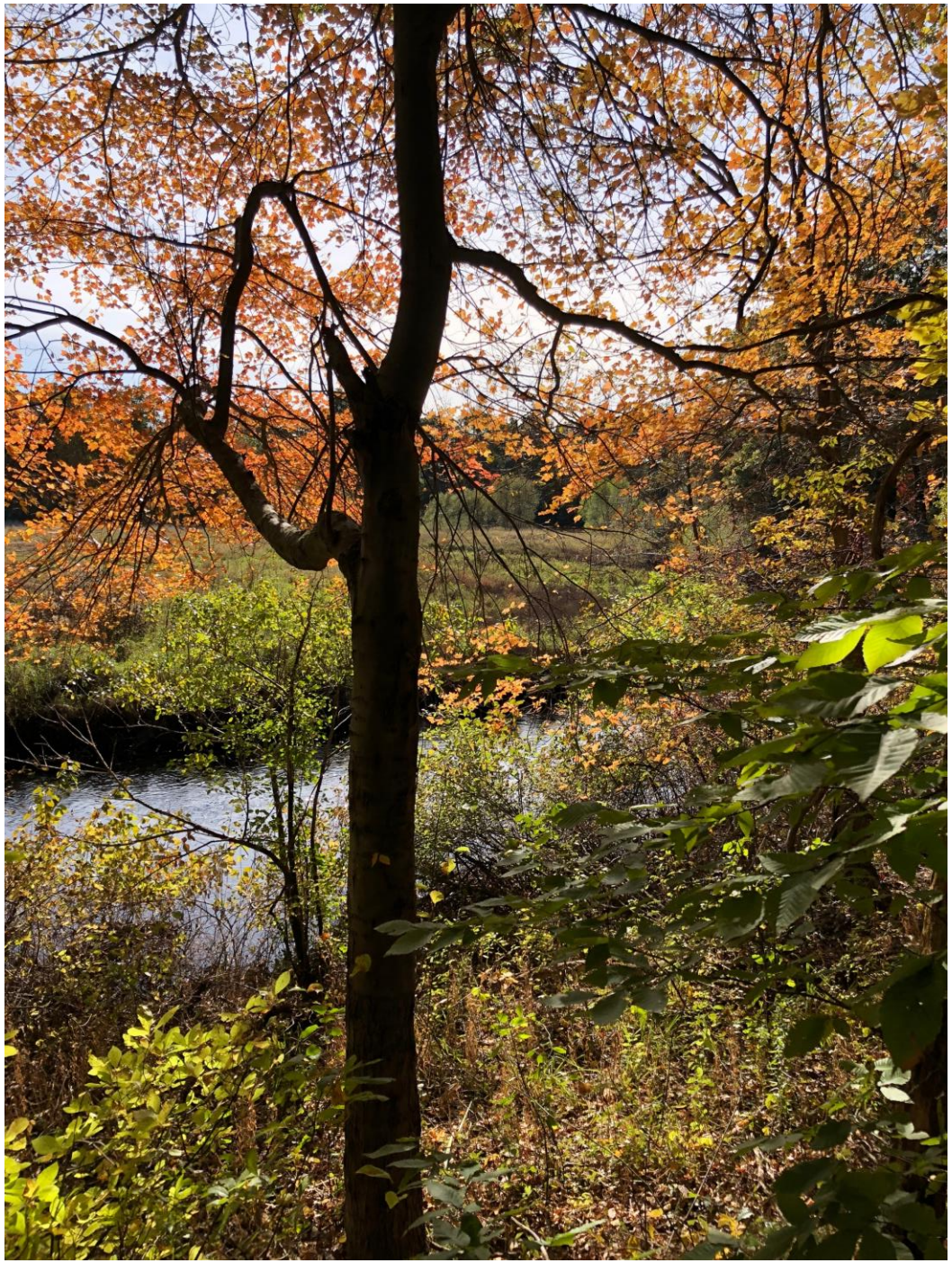
- Reduce Stormwater Flooding
- Protect Drinking water
- Cooling Benefits
- Reduce Impact to Utility
  - Utility Smart Plantings
  - Manage Dead wood
  - Detect pest invasions early



Comprehensive Bylaw Review - Regulations work for you!

Hazard and Community Resilience

- Preserve character and natural features
- Control Stormwater Flooding and Drainage
- Consider financial future of citizens



How to Compare Local Land Use Regulations with Best Practices

Key Areas of Analysis

The following analysis framework is designed to assist communities in Massachusetts in applying cost-effective Low Impact Development (LID) techniques. Specifically, this template enables you to evaluate local land use regulations in relation to models and examples from the Commonwealth of Massachusetts' Smart Growth/Smart Energy Toolkit and other sources in relation to the use of LID and Green Infrastructure (GI) techniques. The focus is primarily on residential development, but the concepts are also applicable to other forms of development and redevelopment.

Best practices minimize the alteration of natural green infrastructure such as forests; reduce creation of impervious surfaces; support retention of naturally vegetated buffers along wetlands and waterways; minimize grading and alterations to natural flow patterns; and support the use of LID techniques as the preferred, most easily permitted methods for managing stormwater.

Get more details on LID's many cost-savings and other benefits, and our customizable bylaw review chart, at: www.massaudubon.org/LIDCost.

Local coordination across municipal boards and permits is also important for supporting LID. Application of these practices can result in significant savings in infrastructure maintenance costs, as well as improved water quality and protection of water supplies, while supporting property values and overall quality of life. Sustainable development

1 Introduction | 2 OSRD Overview | 3 Zoning Subdiv SPR SW Overview | 4 Other Considerations | 5

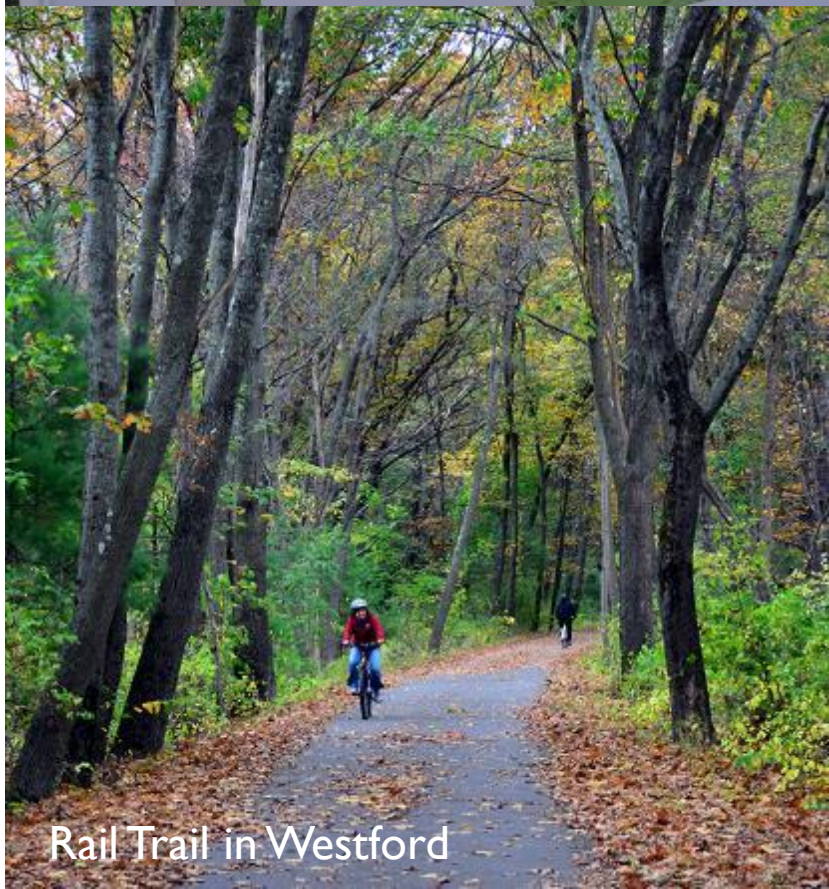
Review bylaws, ordinances, zoning, and other considerations for overall site design, LID project standards, and maintenance and operations considerations.

The power of a bylaw: Westford

- Adopted a Conservation Subdivision bylaw in 1978
- Requires conservation and conventional plans

<u>Benefits</u>

- 1,700 Acres of land Protected
- Preserved local habitat and water resources
- Created 13 miles of hiking trails & public recreation
- Town saved millions of dollars



Rail Trail in Westford

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
- Nature Based Solutions Procurement Guide framework for procurement to encourage responses for NBS projects
- 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) identify the 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 Opti-Tool Optimizes cost and stormwater management performance
- EPA's Green Infrastructure cost/cost-benefit/tools Database of tools for comparing costs between solutions
- Massachusetts Division of Ecological Restoration's economic benefits of aquatic restoration based on Massachusetts case studies

Bylaws and Ordinances

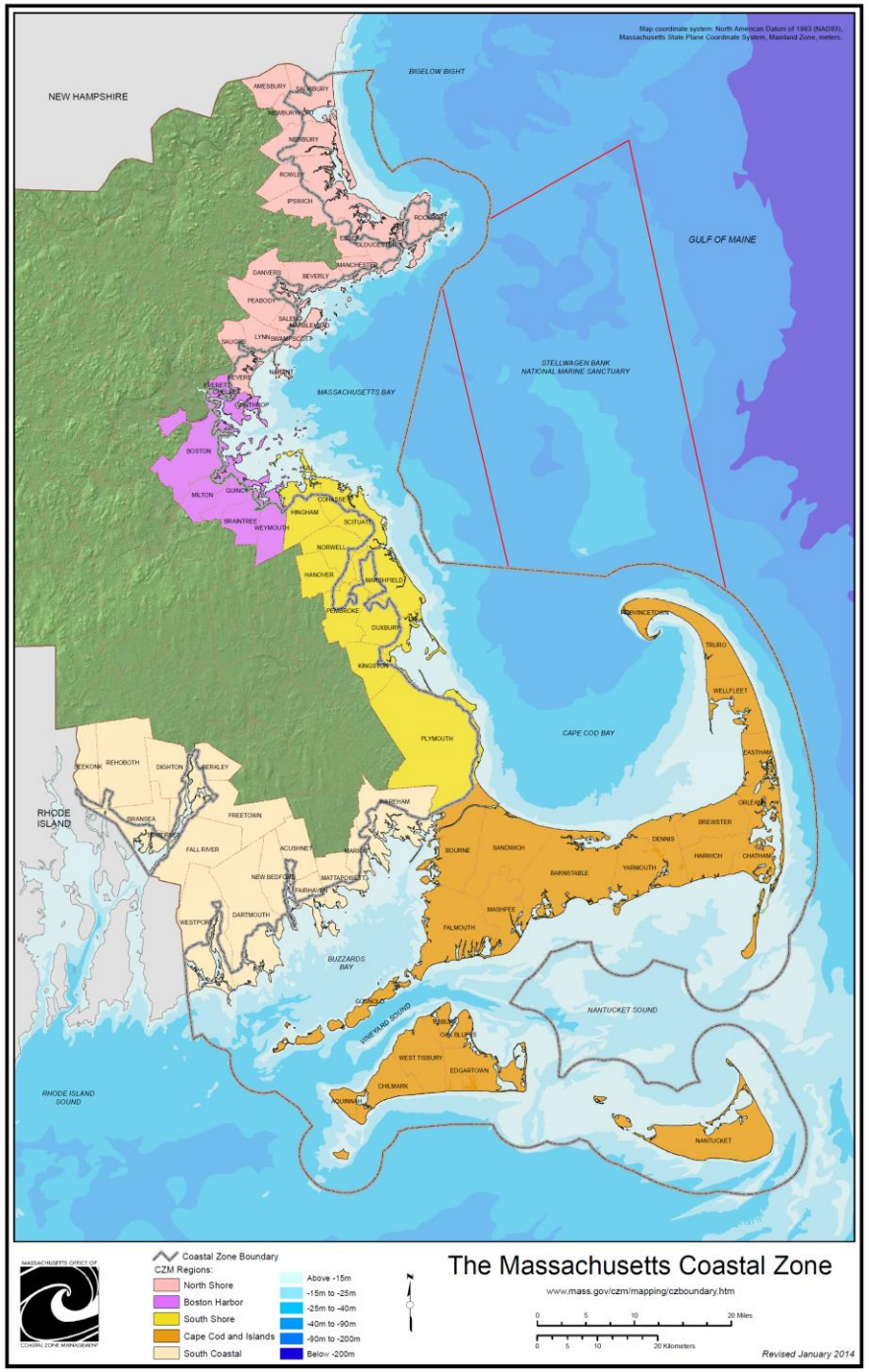
- EEA's Smart Growth Toolkit access to information on planning, zoning, subdivision, site design, and building construction techniques
- Guide for Supporting LID in Local Land Use Regulations provides a framework for communities to review their zoning, rules, and regulations for a number of factors.

Potential Partners, cont'd:

CZM Regional Offices:

- North Shore
- Boston Harbor
- South Shore
- Cape and Islands
- South Coastal

http://www.mass.gov/eea/agencies/czm/regional-offices/



Ensuring Success Webinars MVP Tool Box

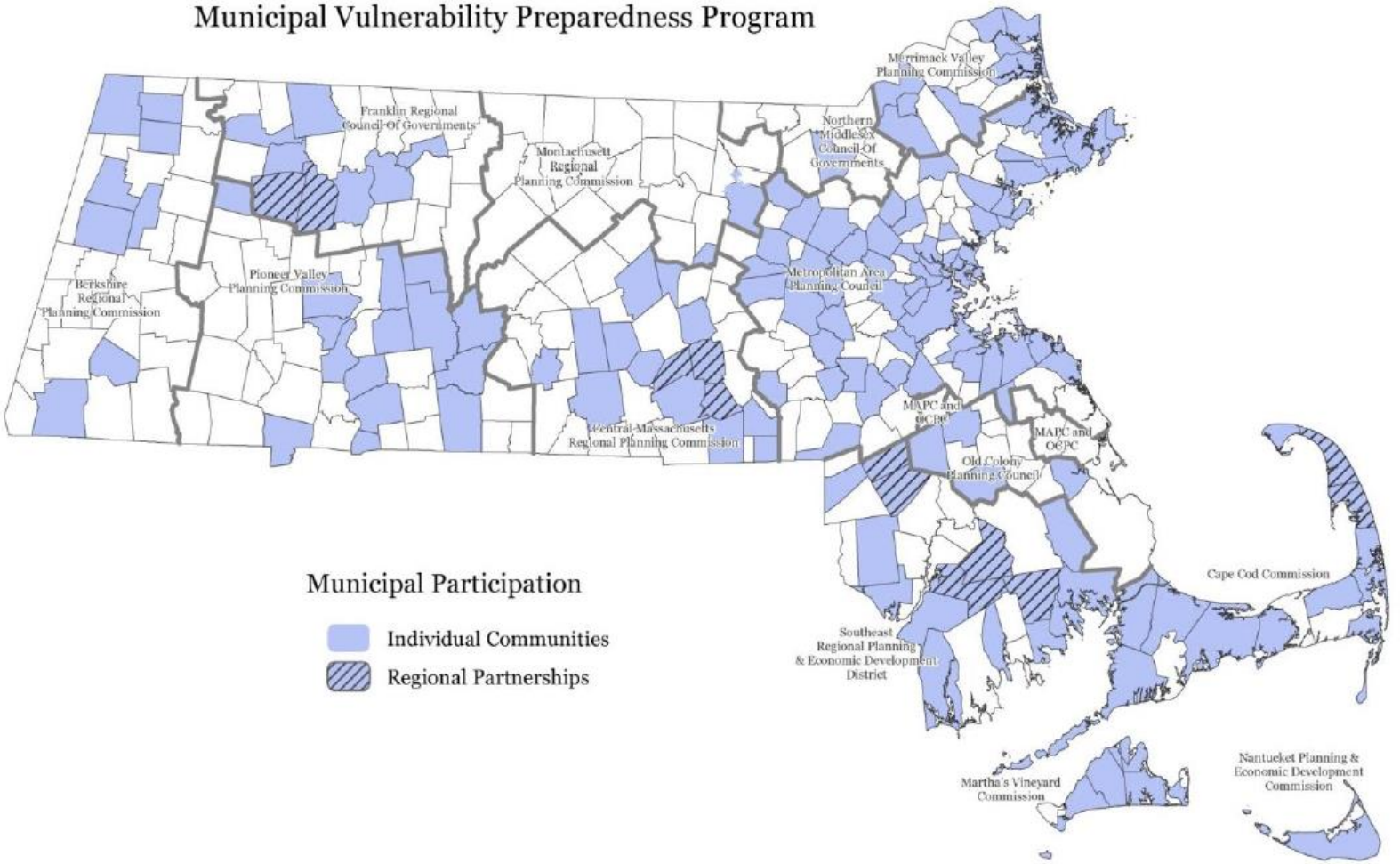
mass.gov/municipal-vulnerability-preparedness-program

- Working with MVP Service Providers: View recording
- Advancing Social Equity in Climate Adaptation Planning: View recording
- Alternatives for engaging your community: View presentation slides
- The importance of listening: View recording
- Bylaw Review –Encouraging Nature Based Solutions: View recording
- Nature Based Solutions: View recording
- Characterizing coastal flood hazards and increasing resilience: View recording

Potential Partners:

- **Land Trust – Mass Land Trust Coalition**
- **Watershed Associations – Mass Rivers Alliance**
- **Local Conservation Agent**
- **Massachusetts Ecosystem Climate Adaptation Network**

https://www.massecan.org/



Thank You!