Nature Based Solutions in FEMA Hazard Mitigation

Introductory Workshop

Massachusetts Emergency Management Agency
May 2021

Objectives for the Day

- CONTEXTUALIZING FEMAs approach to Nature Based Solutions
- UNDERSTANDING how communities can successfully take advantage
- KNOWING where to access information and resources

TAKE AWAY

Start with Massachusetts Emergency Management Agency (MEMA)

Agenda

- FEMA Hazard Mitigation Assistance
- FEMA/HMA Context for Nature Based Solutions
- Examples and Opportunities
- Federal Program
- Restrictions to Adaptation

Opportunities for Questions and Discussion
Between Every Section

FEMA Hazard Mitigation Assistance

"FEMA Hazard Mitigation Assistance grant programs provide funding for eligible activities that reduce or eliminate long-term risk to people and property from future disasters…Eligible applicants of these grants include states, local, tribal and territorial governments"

Hazard Mitigation Assistance Programs

- Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance (FMA)
- Building Resilient Infrastructure and Communities (BRIC)
  - Replaces Pre-Disaster Mitigation(PDM)
- Hazard Mitigation Grant Program Post Fire (HMGP Post Fire)

- *Rehabilitation of High Hazard Potential Dam (HHPD) Grant Program*

Guidance

2015: Hazard Mitigation Assistance Guidance

2015: Hazard Mitigation Assistance Guidance Addendum

2015-2021: Job Aids, Fact Sheets, Circulars, Notice of Funding Opportunities (NOFOs), Specific Guidance

State Hazard Mitigation Officer (SHMO)

The official representative of State government who is the primary point of contact with FEMA, other Federal agencies, and local governments in mitigation planning and implementation of mitigation programs and activities required under the Stafford Act.

Massachusetts Emergency Management Agency (MEMA) includes the State Hazard Mitigation Officer.

Questions on HMA Regulation and Guidance

Building Resilient Infrastructure and Communities (BRIC)

- Hazard mitigation funding for states, tribal governments, and local communities
- Replaces Pre-Disaster Mitigation (PDM) Program
- Establishes an annual national competitive award
  - Qualitative and quantitative evaluation criteria
  - ~$500 Million in grant funding awarded annually
  - Funds projects up to $50 Million
  - Projects can be up to 36 (or 48) months
- Annual Notice of Funding Opportunity (NOFO)

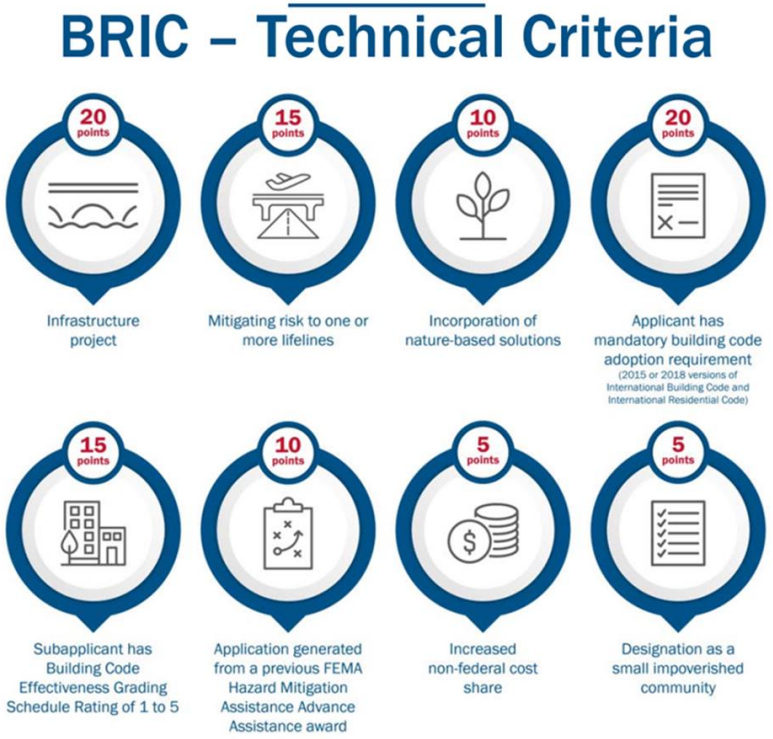
Why BRIC

- Intended to create consistent predictable funding stream and promote local investment
- BRIC Priorities:
  - Public infrastructure projects
  - Projects that mitigate risk to one or more FEMA lifelines
  - **Projects that incorporate nature-based approaches**
- Reducing the risk to vulnerable populations
- Building code updates (2015/2018 IBC standards) and enforcement

FY2020 BRIC Priorities

- FEMA BRIC Technical Evaluation Criteria (NOFO)
  - Incorporation of Nature-Based Solutions
  - 10 points out of a possible 100 (10% of score)

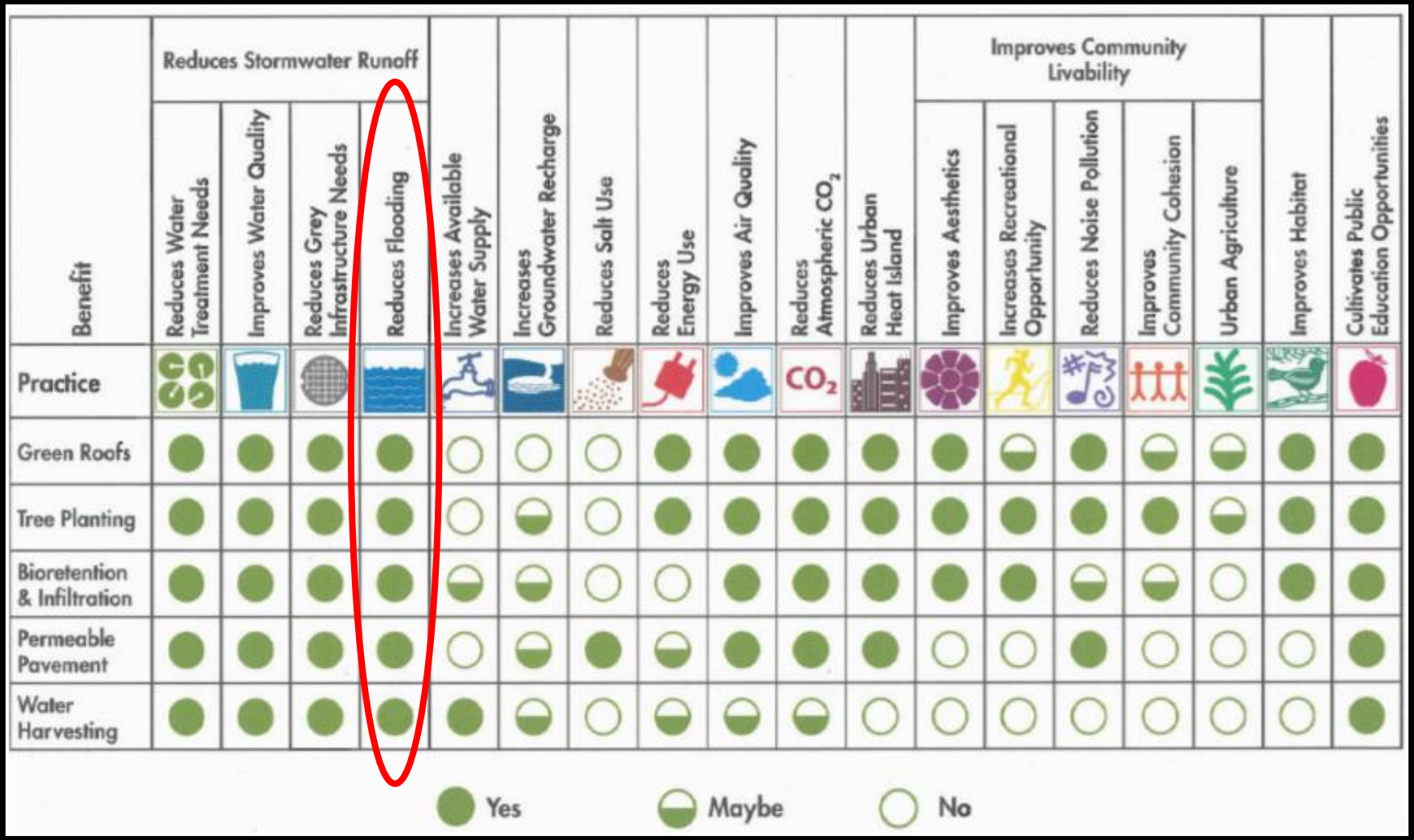
- Massachusetts Mitigation Project Review Criteria
  - Nature-Based Approaches. The project promotes utilization of nature-based approaches and provides environmental benefits
  - 10 points, out of possible 100 (10% of score)



Questions on the BRIC Program

Nature Based Approaches

- The conservation, enhancement, and restoration of nature to reduce emissions, adaptation, and enhance resiliency. These types of solutions use natural systems, mimic natural processes, or work in tandem with traditional engineering approaches to address natural hazards like flooding, erosion, drought, and heat islands.
- Green infrastructure, natural infrastructure, or Engineering with Nature (USACE)



Co-Benefits of Nature Based Approaches

FEMA Context

U.S. Government Accountability Office (GAO)

- Following Hurricane Sandy 2015
- GAO found that mitigation investments had not been coordinated, even within the Federal Government. This lack of coordination reduced the effectiveness of investments.

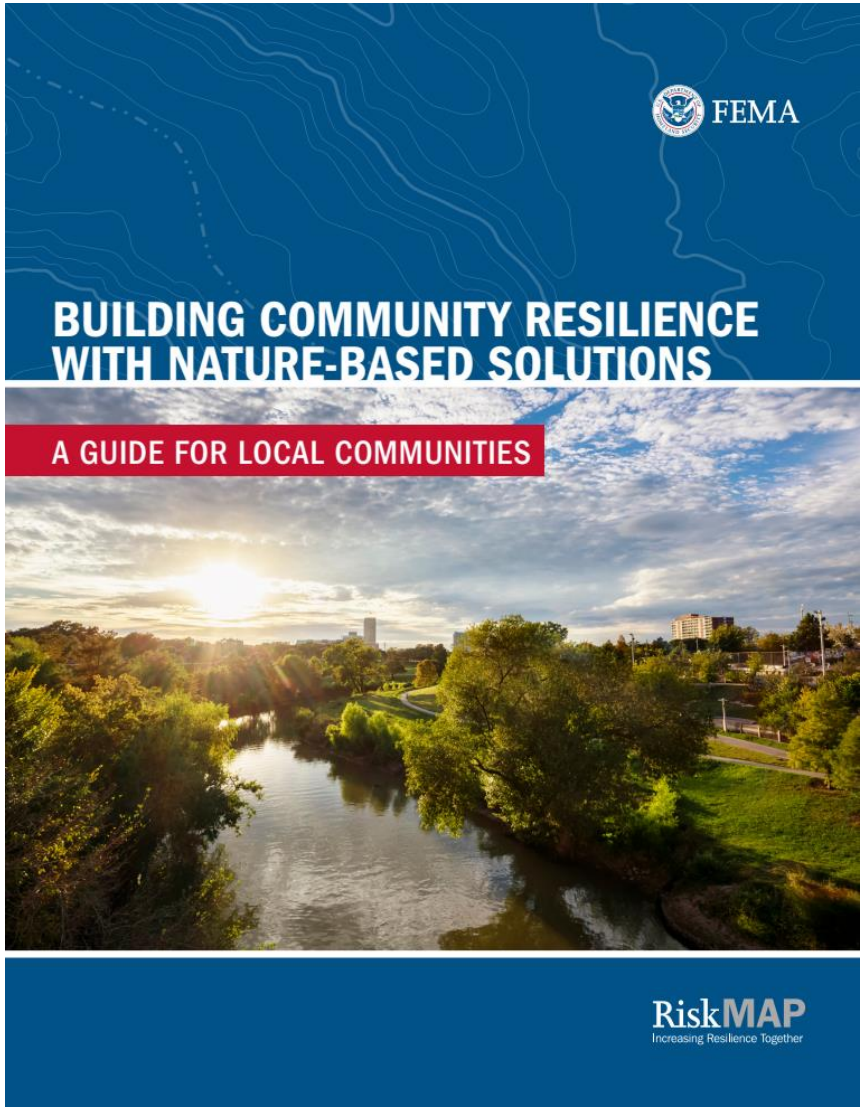
FEMA Context

FEMA National Mitigation Investment Strategy (August 2019)

- "…support mitigation investment decision making that involves - Nature-based solutions and natural assets. The whole community should consider nature-based solutions, such as green infrastructure, for cost-effectively managing the impacts of natural hazards. These solutions may provide additional environmental, social, and economic benefits. The whole community should also consider protecting natural assets that help with mitigation (for example, wetlands that reduce the impact of waves on coastal land)"
- Key Related Goals
  - Motivate communities to invest in mitigation
  - Shrink barriers to investing in mitigation
  - Make investment in mitigation standard practice

FEMA Guidance

- Building Community Resilience with Nature-Based Solutions – A Guide for Local Communities (RiskMAP 2020)
- Categories of Nature Based Solutions
- The Business Case
- Planning and Policy-Making Phase
- Implementation Phase
- Federal Funding Opportunities
- Key Takeaways and Resources



Categories of Nature Based Solutions

Watershed or Landscape Scale

- Interconnected systems of natural areas and open space
- Require long-term planning and coordination

Neighborhood or Site Scale

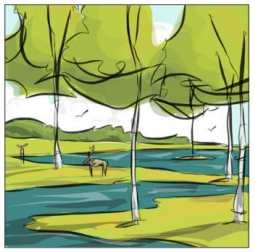
- Distributed stormwater management practices that manage rainwater where it falls
- Built into a site, corridor, or neighborhood without requiring additional space

Coastal Areas

- Stabilize the shoreline, reducing erosion and buffer the coast from storm impacts

Watershed Scale

- Interconnected systems of natural areas and open space
- Require long-term planning and coordination



WETLAND RESTORATION AND PROTECTION

Restoring and protecting wetlands can improve water quality and reduce flooding. Healthy wetlands filter, absorb, and slow runoff.

Wetlands also sustain healthy ecosystems by recharging groundwater and providing habitat for fish and wildlife.

STORMWATER PARKS

Stormwater parks are recreational spaces that are designed to flood during extreme events and to withstand flooding.

By storing and treating floodwaters, stormwater parks can reduce flooding elsewhere and improve water quality.

FLOODPLAIN RESTORATION

Undisturbed floodplains help keep waterways healthy by storing floodwaters, reducing erosion, filtering water pollution, and providing habitat.

Floodplain restoration rebuilds some of these natural functions by reconnecting the floodplain to its waterway.


Floodplain Buyout
Greenfield MA

Neighborhood or Site Scale

RAIN GARDENS

A rain garden is a shallow, vegetated basin that collects and absorbs runoff from rooftops, sidewalks, and streets.

Rain gardens can be added around homes and businesses to reduce and treat stormwater runoff.

VEGETATED SWALES

A vegetated swale is a channel holding plants or mulch that treats and absorbs stormwater as it flows down a slope.

Vegetated swales can be placed along streets and in parking lots to soak up and treat their runoff, improving water quality.

GREEN ROOFS

A green roof is fitted with a planting medium and vegetation. A green roof reduces runoff by soaking up rainfall. It can also reduce energy costs for cooling the building.

Intensive green roofs, which have deeper soil, are more common on commercial buildings. Extensive green roofs, which have shallower soil, are more common on residential buildings.

RAINWATER HARVESTING

Rainwater harvesting systems collect and store rainfall for later use. They slow runoff and can reduce the demand for potable water.

Rainwater systems include rain barrels that store tens of gallons and rainwater cisterns that store hundreds or thousands of gallons.

Neighborhood or Site Scale (Cont.)

PERMEABLE PAVEMENT

Permeable pavements allow more rainfall to soak into the ground. Common types include pervious concrete, porous asphalt, and interlocking pavers.

Permeable pavements are most commonly used for parking lots and roadway shoulders.

TREE CANOPY

Tree canopy can reduce stormwater runoff by catching rainfall on branches and leaves and increasing evapotranspiration. By keeping neighborhoods cooler in the summer, tree canopy can also reduce the "urban heat island effect."

Because of trees' many benefits, many cities have set urban tree canopy goals.

TREE TRENCHES

A stormwater tree trench is a row of trees planted in an underground infiltration structure made to store and filter stormwater.

Tree trenches can be added to streets and parking lots with limited space to manage stormwater.

GREEN STREETS

Green streets use a suite of green infrastructure practices to manage stormwater runoff and improve water quality.

Adding green infrastructure features to a street corridor can also contribute to a safer and more attractive environment for walking and biking.

Urban Drainage Upgrade: Fall River

This project included partial combined sewer separation and drainage piping upgrades, new tree-box filters and bioswales, reducing neighborhood stormwater & critical facility flooding.

Project was funded through the HMGP program.

Completed Spring 2020.

Middle Street Fall River

Soil Stabilization: Chelmsford

Merrimack Riverbank Stabilization project that focused on the protection of a critical sewer line.

Project was funded through the HMGP program.

Completed Summer 2019.

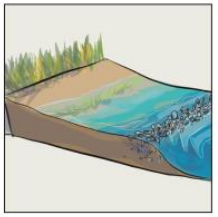
Coastal Areas

- Stabilize the shoreline, reducing erosion and buffer the coast from storm impacts

COASTAL WETLANDS

Coastal wetlands are found along ocean, estuary, or freshwater coastlines.

They are often referred to as "sponges" because of their ability to absorb wave energy during storms or normal tide cycles.



OYSTER REEFS

Oysters are often referred to as "ecosystem engineers" because of their tendency to attach to hard surfaces and create large reefs made of thousands of individuals.

In addition to offering shelter and food to coastal species, oyster reefs buffer coasts from waves and filter surrounding waters.

DUNES

Dunes are coastal features made of blown sand. Healthy dunes often have dune grasses or other vegetation to keep their shape.

Dunes can serve as a barrier between the water's edge and inland areas, buffering waves as a first line of defense.

WATERFRONT PARKS

Waterfront parks in coastal areas can be intentionally designed to flood during extreme events, reducing flooding elsewhere.

Waterfront parks can also absorb the impact from tidal or storm flooding and improve water quality.

LIVING SHORELINES

Living shorelines stabilize a shore by combining living components, such as plants, with structural elements, such as seawalls.

Living shorelines can slow waves, reduce erosion, and protect coastal property.

Dune Restoration Hurricane Sandy

Borough of Monmouth Beach, NJ

- streets were flooded with up to six linear feet of water and approximately 33% of homes were damaged or destroyed.
- Over $6 million of damage was inflicted on the borough's infrastructure, including sewer and stormwater systems, buildings, and waterfront structures.
- The Monmouth Beach Elementary School incurred over $2.5 million of damages, and over 300 students were displaced to neighboring schools for almost the entire year.

Scale of the impact is related, in part, to prior degradation and loss beach, dune, and marsh habitats that protected from storm surge

Monmouth Beach Dune Restoration

- Extensive program to construct and enhance costal dunes
- Subsequent nor’easters
  - damaged/eroded nearby beach
  - No impact on restored dune areas

Dune Restoration Great Marsh, MA

- Barrier Beach Dune Restoration
- Great Marsh Resiliency Partnership
  - National Fish and Wildlife Foundation
  - Office of Coastal Zone Management
  - Ipswich River Watershed Association
- Hurricane Sandy Coastal Resiliency Competitive Grant Program
- Native dune grass along six miles of beach
- Three nor’easters pass over restored dunes
- Dunes remained intact

Whole Community Projects

Federal Funding Integration

- NOAA's Community-Based Restoration Program
- National Coastal Resilience Fund
- HUD Community Development Block Grant (CDBG)
- EPA Section 319 Nonpoint Source Management Program
- EPA Clean Water State Revolving Fund (CWSRF)

State Funding Integration

- EEA Municipal Vulnerability Preparedness (MVP)

EPA – Green Infrastructure

Clean Water Act, Section 502

- "...the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters."

https://www.epa.gov/green-infrastructure/what-green-infrastructure

FEMA/EPA MOA (2016)

Sets up coordination of activities between EPA's sustainable communities, smart growth, environmental, and community technical assistance programs and FEMA's disaster recovery planning and hazard mitigation programs.

Seeks to provide lessons learned for EPA, FEMA, and other federal agencies that can be used to build a stronger federal framework for mitigation planning as well as pre- and post-disaster recovery planning and operations.

Seeks to provide a collaborative framework for policy work related to both hazard mitigation planning and climate change adaptation to create more resilient communities.

EPA/FEM A Pilot Programs

- EPA has funded projects integrating FEMA Hazard Mitigation Plans and water quality plans to reduce natural hazards, such as floods, landslides, and drought, while emphasizing water quality benefits, including in:
  - Ashland, OR
  - Albany, NY
  - State of Massachusetts
  - Huntington, WV
  - Mystic River Watershed, MA
  - Maricopa County, AZ

RECOVERY AND RESILIENCY PARTNERSHIP

MEXICO BEACH

STORMWATER MANAGEMENT AND GREENSPACE PROJECT

MEXICO BEACH, FLORIDA

DECEMBER 2019

Mexico Beach Recovery and Resiliency Partnership

Hurricane Michael (October 2018)

Stormwater Management and Greenspace Project

Nature Based Solutions Submitted to HMGP and BRIC

- Enlarged drainage channel and retention basin

Other Funding Sources

- Park and recreational elements

Engineering with Nature (USACE)

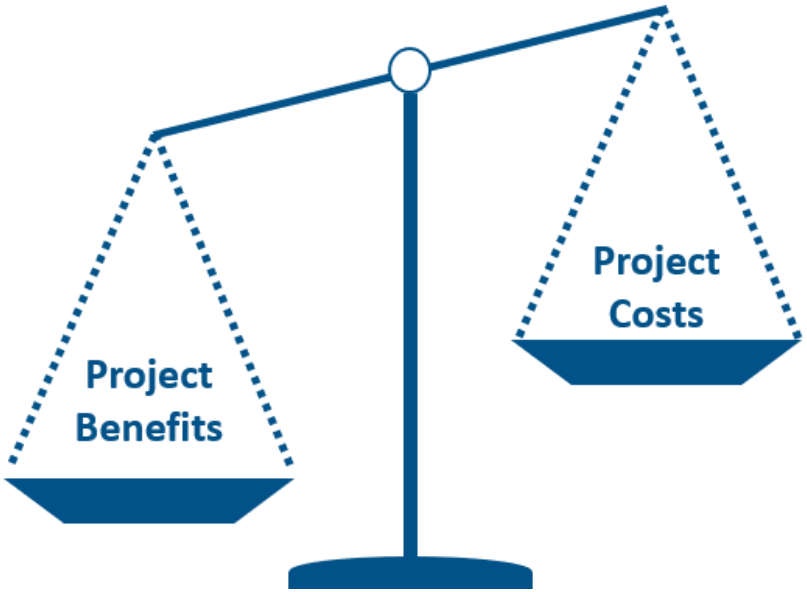
- The intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaborative processes.

- Sustainable development of water resources infrastructure is supported by solutions that beneficially integrate engineering and natural systems. With recent advances in the fields of engineering and ecology, there is an opportunity to combine these fields of practice into a single collaborative and cost-effective approach for infrastructure development and environmental management.

Questions on FEMA Nature Based Solutions Context

HMA Project Requirements

- Mitigate a Natural Hazard
- Improved Level of Protection (LOP)
- Feasible to Implement
  - Regulatory
  - Design
  - Construction
- Cost Effective
- Environmental and Historic Preservation (EHP)



What is a Benefit Cost Analysis (BCA) ?

- Benefit-Cost Analysis (BCA) is a method that quantifies the benefits of a mitigation project compared to its costs.
- Establishes Cost Effectiveness

Goal: break the cycle of damage, reconstruction, and repeated damage

BCA Ecosystem Service Benefit

Ecosystem Service Benefits in the BCA for FEMA's Mitigation Programs Policy (2013)

Remove of limitations on ecosystem service benefit (Sept 2020)

- Previously BCR had to be at least .75 prior to inclusions
- "…the natural environment is an important component of community resilience strategy."
- Align with Office of Management and Budget (OMB) Circular A-94

Calculating Ecosystem Service Benefits

- Identifying and quantifying land use types AFTER the proposed mitigation project is completed
- Applicable projects include acquisitions, relocations, and floodplain, stream, or coastal restoration
- Monetized value ($/acre/year) of the area

FEMA HMA ecosystem service benefits fact sheet (January 2021)

Ecosystem/Environmental Benefits

Type of space	FEMA Standard Value
Green open space	$8,308/acre/year
Riparian	$39,545/acre/year
Wetlands	$6010/acre/year
Forest	$554/acre/year
Marine & estuary	$1,799/acre/year

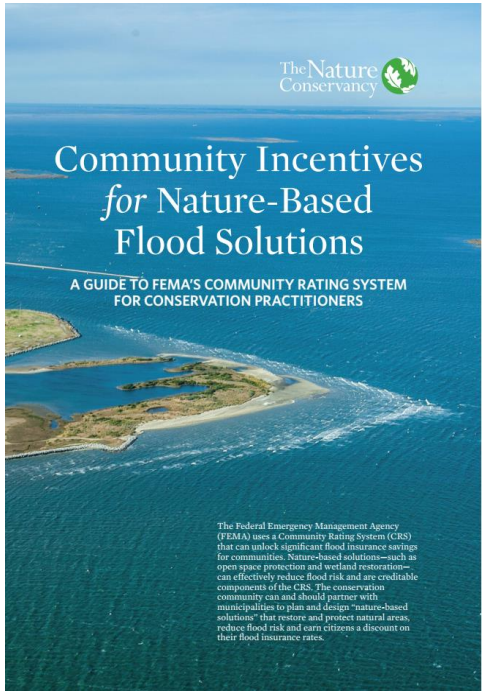
NOAA Nature Based Solutions Installation and Maintenance Costs

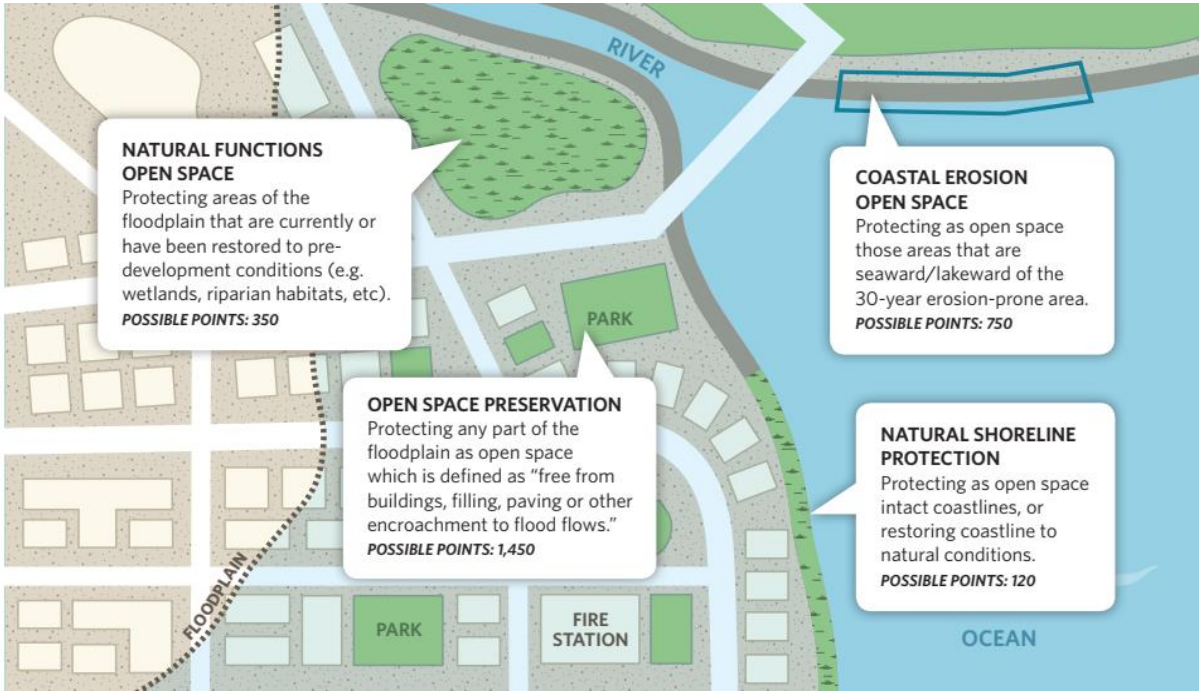
Quick Reference

Nature-Based Solution	Average Cost	Maintenance Cost	Cost Considerations
Tree Box Filters	$70-$600 per sq. foot	$3-$14 per sq. foot	Plant materials, installation (watering, backhoe, shovels, mulch, seedlings), maintenance materials (bucket truck, chipper, chainsaws), and maintenance including, pruning (especially near power lines), watering, pest control, removal and disposal of hazardous trees, and fringe landscaping.
Tree Planting	$13-$288 per tree	$15-$81 per tree	Plant materials, installation (watering, backhoe, shovels, mulch, seedlings), maintenance materials (bucket truck, chipper, chainsaws), and maintenance including, pruning (especially near power lines), watering, pest control, removal and disposal of hazardous trees, and fringe landscaping.
Green Streets	Varies based on the combination of practices used	Varies based on the combination of practices used	Considerations are based on a combination of practices used but may include removing sediment, leaves, or trash that can impede water flow, replacing plants, and watering. Costs are reduced if projects are part of an existing street improvement program.
Bioretention: Rain Garden	$5-$16 per sq. foot	$.31-$.61 per sq. foot	Design, engineering, permitting, materials (e.g., rocks, plants mulch), installation, and maintenance including watering, pruning, weeding, controlling invasive species, raking mulch, removing litter, and clearing flow pathways at least twice per year and after major storm events.
Bioswales	$5.50-$24 per sq. foot	$.06-$.21 per sq. foot	Design, engineering, permitting, materials (e.g., rocks, plants mulch), installation, and maintenance including watering, pruning, weeding, controlling invasive species, raking mulch, removing litter, and clearing flow pathways at least twice per year and after major storm events.

FEMAs Community Rating System (CRS)

- Voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the National Flood Insurance Program (NFIP)
  - Reduce and avoid flood damage to insurable property
  - Strengthen and support the insurance aspects of the National Flood Insurance Program
  - Foster comprehensive floodplain management
- Discounted Flood Insurance
- Used to evaluate Flood Mitigation Assistance (FMA) grant applications





CRS Credits for Nature Based Design/Natural Floodplain Functions

Questions on HMA Programs and Applications

Technical Assistance

Direct Technical Assistance Available

Now - June 30th

Submit a Statement of Interest (SOI) For BRIC/FMA

on MEMAs Website

MA Open/Rolling Statement of Interest (SOI) Period	Open and Ongoing
Sub-applicant Register with FEMA GO	Ongoing
Federal Notice of Funding Opportunity (NOFO)	August 2021
Federal Grant Application Period Opens	September 2021
Iterative State Pre-Application and Review	October - December 2021
Sub-application Final Submittal	Early December 2021
State Review Committee	December 2021 – January 2022
Submittal to FEMA for National Competitive Review	January 2022
Award Notification for FFY21 Cycle	Summer 2022
Project Initiation	~Spring 2023

Expected BRIC/FMA FFY21 Cycle

Resources - Federal

- Federal Emergency Management Agency. Innovative Drought and Flood Mitigation Projects (2017)
- National Oceanic and Atmospheric Administration. Natural Infrastructure. coast.noaa.gov/digitalcoast/topics/green-infrastructure.html
- U.S. Army Corps of Engineers. Engineering with Nature (EWN) Initiative. ewn.el.erdc.dren.mil/index.html
- U.S. Department of Homeland Security. (2019). National Mitigation Investment Strategy.
- U.S. Department of Transportation, Federal Highway Administration. Eco-Logical Approach. environment.fhwa.dot.gov/env_initiatives/eco-logical.aspx
- U.S. Department of Transportation, Federal Highway Administration. Nature-based Resilience for Coastal Highways. fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/green_infrastructure/
- U.S. Environmental Protection Agency. Green Infrastructure Website. epa.gov/green-infrastructure
- U.S. Environmental Protection Agency. (2019). Regional Resilience Toolkit. Retrieved from epa.gov/smartgrowth/regional-resilience-toolkit
- U.S. Environmental Protection Agency. (2017). Green Infrastructure in Parks: A Guide to Collaboration, Funding, and Community Engagement. Retrieved from: epa.gov/sites/production/files/2017-05/documents/gi_parksplaybook_2017-05-01_508.pdf
- U.S. Environmental Protection Agency. (2016). Summary of State Post Construction Stormwater Standards. Retrieved from epa.gov/sites/production/files/2016-08/documents/swstdsummary_7-13-16_508.pdf
- U.S. Environmental Protection Agency. (2009). Water Quality Scorecard. Retrieved from epa.gov/smartgrowth/water-quality-scorecard

Resources – Non-Federal

- American Planning Association. PAS 596: Planning for Resilient Infrastructure. planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/PAS-Report-596-rev.pdf
- Environmental and Energy Study Institute. Federal Resources for Nature-Based Solutions to Climate Change. (2020). Retrieved from: eesi.org/papers/view/fact-sheet-federal-resources-for-nature-based-solutions-to-climate-change
- Heckert, Meghan and Jeremy Mennis. (2012). The Economic Impact of Greening Vacant Urban Land: A Spatial Difference-In-Differences Analysis. Environment and Planning vol. 44, issue 12.
- Landscape Architecture Foundation. Landscape Performance Series Case Study Briefs. landscapeperformance.org/case-study-briefs
- Naturally Resilient Communities. Using Nature to Address Flooding. nrcsolutions.org
- University of Wisconsin Sea Grant Institute and Water Resources Institute. Tackling Barriers to Green Infrastructure: An Audit of Municipal Codes and Ordinances. publications.aqua.wisc.edu/product/tackling-barriers-to-green-infrastructure-an-audit-of-municipal-codes-and-ordinances/

Contact MEMA

Shelly O'Toole

MEMA Region 1 & 3

Michelle.OToole@mass.gov

(508) 820-1443

David Woodbury

MEMA Region 2 & 4

David.Woodbury@mass.gov

(508) 820-2034

MEMA Hazard Mitigation Website