



Utilizing Nature-Based Solutions to Enhance Flood Resilience & Recovery

October 24, 2017



FEMA

resilience**action**
partners
A JOINT VENTURE OF
OGILVY PUBLIC RELATIONS &
MICHAEL BAKER INTERNATIONAL



OFFICE FOR COASTAL MANAGEMENT
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Agenda

- Introduction to natural and nature-based solutions
- Approaches, case studies, and resources
- Considering natural and nature-based solutions for redevelopment and recovery
- How these approaches fit into FEMA programs



What are Nature-Based Solutions?



← Landscape



↗ Community and Site



↙ Shoreline



FEMA

Benefits Provided

- Buffer wave action and storm surge
- Store floodwaters, recharge aquifers
- Reduce runoff, improve water quality and clarity
- Stabilize shorelines
- Provide habitat for fish and wildlife
- Offer recreational, job opportunities
- Protect property and improve property value (aesthetics)
- Many more!



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**Community
and Site**

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Shoreline

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- Many more!

QUICK REFERENCE



Put Green Infrastructure between Your Community and the Next Coastal Storm.
There are many benefits.

Tidal and Forested Wetlands <ul style="list-style-type: none">• Slow waves• Filter and clean floodwaters• Provide food and jobs	Sand Dunes <ul style="list-style-type: none">• Buffer waves as a first line of defense• Build economy through tourism
Green Streets <ul style="list-style-type: none">• Capture and clean stormwater• Beautify streets and encourage economic development• Provide pedestrian-friendly walkways	Open Space and Parks <ul style="list-style-type: none">• Store floodwaters and recharge aquifers• Increase property values
Oyster and Coral Reefs <ul style="list-style-type: none">• Slow storm surge• Provide food• Clean water	Urban Trees <ul style="list-style-type: none">• Reduce runoff and absorb floodwaters• Shade and cool homes and businesses• Provide clean air and water
	Living Shorelines <ul style="list-style-type: none">• Slow waves and reduce erosion• Protect property

 Office for Coastal Management
Digital Coast

03/2017

See the reverse of this page to learn more.

coast.noaa.gov/digitalcoast/training/gi-benefits

Using Nature-Based Solutions to Reduce Hazard Impacts



Harvey, Texas



Maria, Puerto Rico



Irma, St. Thomas



Sandy, New Jersey



FEMA

Coastal Flood Exposure Mapper

Coastal Flood **Exposure Mapper**

Select the Flood Hazards Map or One of the Community Exposure Maps

Select a section below to view maps showing flood hazards or different aspects of community exposure to those flood hazards.

First-time user? Starting with Flood Hazards is a good idea.



Flood Hazards

Flooding events are among the more frequent, costly, and deadly hazards that can impact coastal communities. There are two types:

- Short-term (episodic) – Temporary flooding caused by extreme conditions, including storm surge, tsunamis, inland flooding, and shallow coastal flooding.
- Long-term (chronic) – Flooding caused by a rise in relative sea



Societal Exposure

Understanding the populations that live in or near coastal flood-prone areas is an important information need, since residents who are elderly, who live in high-density areas, or who are impoverished may merit special considerations.



Infrastructure Exposure

Community infrastructure, including roads, bridges, and water and sewer systems, can be damaged by coastal flooding. Communities should first assess infrastructure vulnerabilities and associated environmental and economic issues to determine what steps are needed to protect these assets.



Ecosystem Exposure

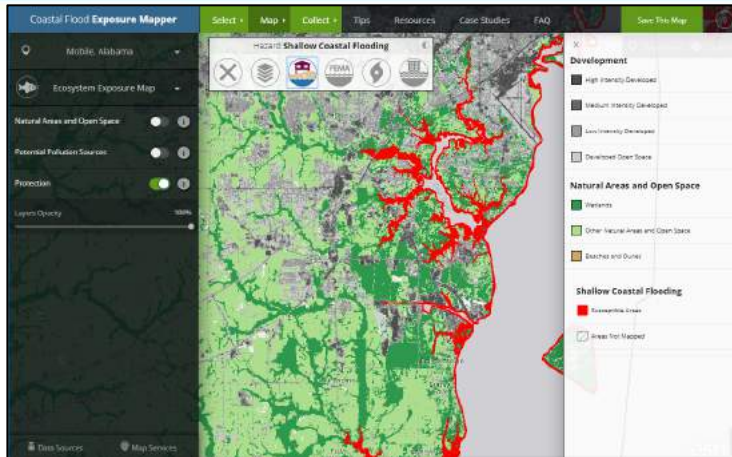
Natural areas provide important benefits to coastal communities, including hazard protection, flood storage, water quality maintenance, fisheries support, and recreational opportunities. Communities can increase resilience by protecting natural areas along the coast that are exposed to flooding and adjacent inland areas.

coast.noaa.gov/digitalcoast/tools/flood-exposure

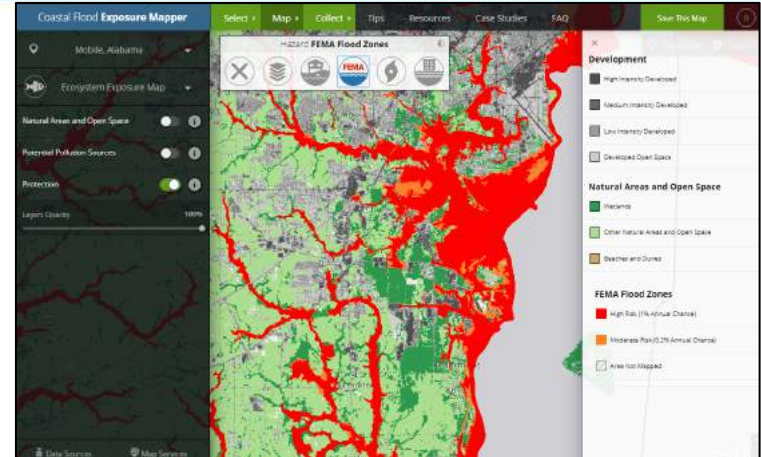


FEMA

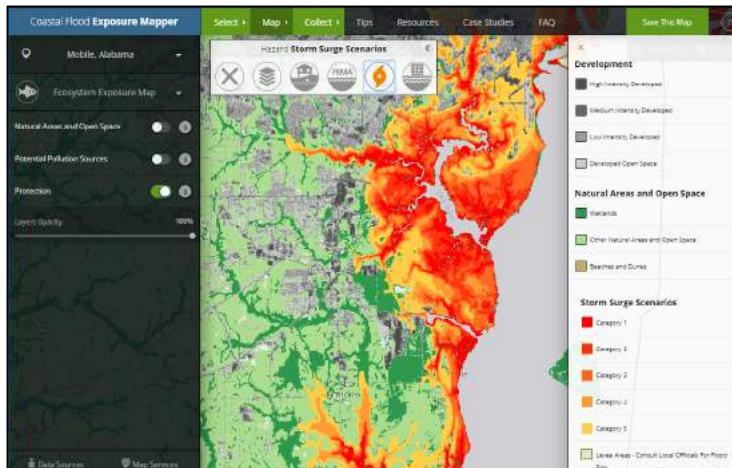
Coastal Flood Exposure Mapper



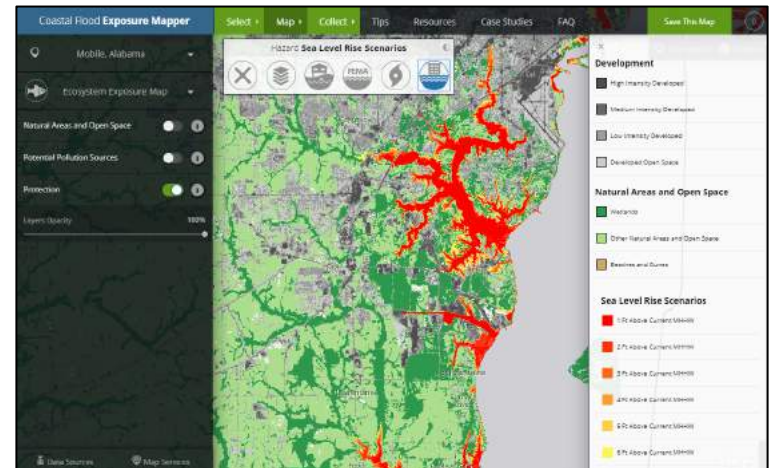
Shallow Coastal Flooding



FEMA Flood Zones



Storm Surge



Sea Level Rise



FEMA

Polling Question #1

Which of the following terms resonate most with you and your stakeholders?

A. Green Infrastructure

B. Natural and Nature-Based Solutions

C. Natural Capital

D. Nature-Based Infrastructure or Natural Infrastructure

E. Other

F. None. Not familiar with the topic.

Landscape Approaches

Better

Worse

Area



Proximity



Connectivity



FEMA

Landscape Approaches

Resource: How To Map Open Space for Community Rating System Credit

Digital Coast How-To

How to Map Open Space for Community Rating System Credit

Steps: 7

- 1 Calculate the community's special flood hazard area
- 2 Identify lands that may qualify for open space preservation credit
- 3 Exclude areas that do not qualify for open space credit
- 4 Calculate the possible



Communities can take steps to lessen flood risk and lower flood insurance rates by participating and earning credit in FEMA's Community Rating System under the National Flood Insurance Program. Preserving open space is one way to get credit. This step-by-step process describes how to calculate open space credits for existing preserved lands and areas that may be considered for future protection.

This "how-to" links to a companion *GIS Workflow and Mapping Guide* that describes the data and information needed to perform each step. Links to other helpful resources are also provided. These resources do not address open space credit for areas protected through open space incentives, low-density zoning, or natural shoreline protection programs, which may also qualify for credit under Activity 420 (open space preservation).

Before you get started

[Checklist of Information Sources](#)

1 Calculate the Community's Special Flood Hazard Area

The area of the community's special flood hazard area is a key piece of information needed to calculate most open space credits. This area is also known as the "100-year floodplain," which FEMA maps on the community's flood insurance rate map, or FIRM. While the focus of this "how-to" is on the special flood hazard area, the community may adopt a floodplain outside this area, where it enforces development regulations similar to those for new development within the special flood hazard area. If seeking credit for open space in coastal erosion areas or special flood-related hazard areas, communities may need additional mapping to calculate credit for those areas.

a. Calculate the acreage of the special flood hazard area (SFHA) shown on the community's flood insurance rate map, as mapped by FEMA.

b. Adjust the total area of the SFHA by subtracting non-qualifying areas and other areas the community does not regulate. This adjusted area will be the denominator for calculations that use the SFHA in Steps 4 and 5. See [Element 403b](#) (page 400-9) in the *CRS Coordinator's Manual*.

How to Map Open Space Preservation for Community Rating System Credit

GIS Workflow

NOAA Office for Coastal Management
coast.noaa.gov

Overview

The Federal Emergency Management Agency's (FEMA) "Communities' efforts to reduce their flood risk with policyholders. The CRS uses credit to determine the way communities can earn CRS credits to preserve and implementation of land use policies that encourage other naturally protective features.

This GIS workflow document is a companion to NOAA's *Community Rating System Credit*. It provides a step-by-step credit for open space under CRS Activity 420: Open protected, and to identify places where additional efforts. The steps draw from guidance in the 2017 Emergency Management Agency (FEMA), and refer

This document is geared towards GIS professionals and local planners with the mapping and calculations in 420. The GIS workflow focuses on the calculations:

- DSP credit for parcels that are kept free of ownership; and
- additional credit for parcels of open space
 - o protected by deed restriction (DR)
 - o have been preserved in or restored

These credits—OSP, DR, NFOS—are based on the floodplain to the area of the impact-adjusted special guidance outlined under Activity 420 of the CRS to possible credit. *All points must be verified and are*

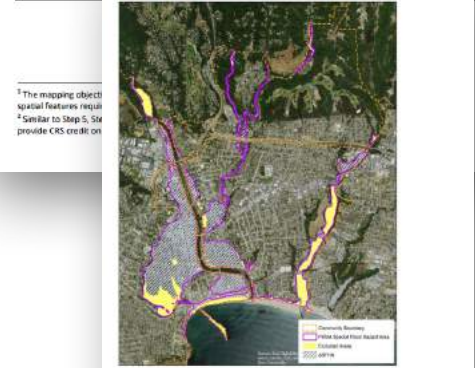
NOTE: This document does not cover mapping or c

GIS Workflow: Open Space Preservation Community Rating System Credit

GIS Goal: Generate a spatial layer that lists parcels with eligible open space preservation (OSP) areas within the community's special flood hazard area (SFHA) or regulatory floodplain, calculate potential OSP credit, and create an impact adjustment map.¹

Mapping Objective	Credit Criteria
Step 1. Calculate the community's impact-adjusted special flood hazard area (SFHA).	<ul style="list-style-type: none"> • Acreage of special flood hazard area (SFHA) with water bodies and federal lands removed to calculate the adjusted SFHA (aSFHA) • aSFHA is the denominator in impact adjustment ratios.
Step 2. Identify lands that may qualify for open space preservation credit.	Parcels that contain potentially qualifying "preserved" open space or development regulations that prohibit buildings and filling.
Step 3. Exclude areas that do not qualify for open space credit.	Impervious areas, parcels that obstruct flood flows or aggravate flooding, and other ineligible lands.
Step 4. Calculate possible credit for the community's preserved open space.	<ul style="list-style-type: none"> • Ratio (rOSP) of preserved open space areas (aOSP) to the adjusted SFHA area (aSFHA), multiplied by the maximum number of points. • rOSP = aOSP/aSFHA (x 1,450 points)
Step 5. Determine whether preserved open space parcels qualify for "extra credit."	Parcels with deed restrictions (DR) or qualify for natural functions open space (NFOS).
Step 6. Gather supporting documentation for each parcel or area to submit to FEMA's ISO/CRS Specialist.	List of eligible parcels showing the area that qualifies for open space credit on an impact adjustment map, documentation of open space status and "extra credit."
Step 7. (Optional) Identify opportunities to earn credit for areas that future protection.	

GIS Workflow: Open Space Preservation Community Rating System Credit



¹ The mapping object spatial features require
² Similar to Step 5, Site
³ provide CRS credit on

Figure 2. Output map from Step 1 that shows the SFHA, excluded areas, and impact-adjusted SFHA (or aSFHA).

coast.noaa.gov/digitalcoast/training/crs



Community and Site Approaches

Low Impact Development Practices



Bioretention (Infiltration and Filtering)

- Rain gardens
- Bioswales
- Stormwater planters



Green Roofs (Storage and Evapotranspiration)

- Blue roofs
- Cisterns



Permeable Pavements (Infiltration)

- Porous asphalt or concrete
- Grass or gravel pavers
- Pavers

Community and Site Approaches

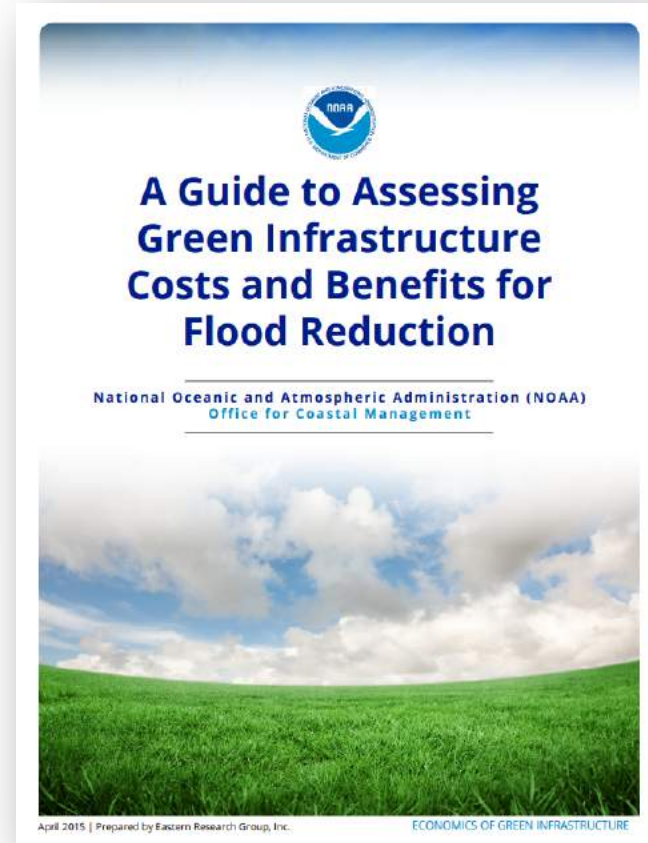
Green Streets

- Key linking component in green infrastructure network
- Design dependent on local conditions but generally includes
 - Alternative street widths
 - Swales
 - Bioretention
 - Permeable pavements
- Provides multiple benefits



Case Study: Toledo, OH

Building Momentum for Green Infrastructure Implementation



Guide - coast.noaa.gov/digitalcoast/training/gi-cost-benefit

Case Study - coast.noaa.gov/digitalcoast/training/toledo-green-infrastructure

Case Study: Toledo, OH

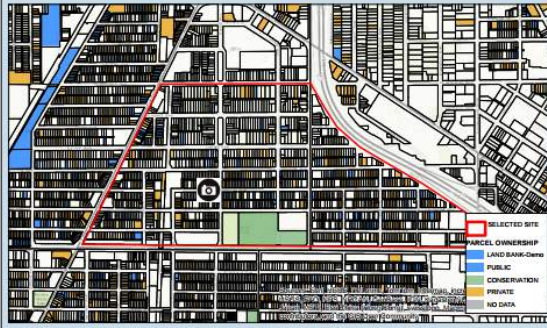
Building Momentum for Green Infrastructure Implementation

Site Selection Exercise: Site C



Site C Characteristics	
Total Vacant Acres	35.2
Future Land Use	Single Family Residential
Proximity to Catch Basin	Within 200 ft
MS4 v CSO	Combined
Land Ownership	Mixed
Site Soils - Hydrologic Soil Group	A3-E Moderate to High Infiltration Rate
Neighborhood Imperviousness	46-51%
Flooding/100 yr Floodplain	Outside 100 yr Floodplain
Unimproved Streets	Curbed

Site C is a neighborhood with over 300 vacant parcels. These parcels are best suited for small scale greening such as rain gardens, tree planting, or downspout redirection. This site offers opportunities to work directly with residents to install these features on vacant side lots.



Maps Produced by TMACOG for the project "Cost-effective Use of Vacant Urban Property for Green Infrastructure Prioritization", which is funded by the Lake Erie Protection Fund. Maps were prepared in collaboration with the University of Toledo College of Engineering, American Rivers, and the Toledo-Lucas County Sustainability Commission. For more information contact: Karl Gierens, TMACOG - gk@tlmacog.org 5/22/2015

Site Selection Exercise: Site E



Site E is best suited for several green infrastructure installations of various sizes such as small rain gardens, larger bioretention areas, and swales. This site also offers opportunities to work with a neighborhood group and includes seven separate lots


Site E Characteristics	
Size (Acres)	1.5
Future Land Use	Single Family Residential
Proximity to Catch Basin	Within 200 ft
MS4 v CSO	Combined
Land Ownership	Mixed
Site Soils - Hydrologic Soil Group	B-Moderate Infiltration
Neighborhood Imperviousness	72%
Flooding/100 yr Floodplain	Outside 100 yr Floodplain
Unimproved Streets	Curbed
Partnerships, Stakeholders, Community Groups etc.	Slope or Elevation of Site
Environmental Justice Issues	Adjacent to Green Spaces



Maps Produced by TMACOG for the project "Cost-effective Use of Vacant Urban Property for Green Infrastructure Prioritization", which is funded by the Lake Erie Protection Fund. Maps were prepared in collaboration with the University of Toledo College of Engineering, American Rivers, and the Toledo-Lucas County Sustainability Commission. For more information contact: Karl Gierens, TMACOG - gk@tlmacog.org 5/22/2015

Community and Site Approaches

Resource: Green Infrastructure Effectiveness Database

 [About](#)

Green Infrastructure Effectiveness Database

This database is a compilation of literature resources documenting the effectiveness of using green infrastructure to reduce impacts from coastal hazards.

[Want to filter on specific items? Show advanced search](#)

RECENTLY ADDED

Assessing urban strategies for reducing the impacts of ...

- Author(s):** Pregniolato, Maria; Ford, Alistair; Robson, Craig; Glenis, Vassilis; ...
- Green Infrastructure:** Green roof/blue roof
- Region(s):** International

[Show](#)



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coast.noaa.gov/digitalcoast/training/gi-database

Community and Site Approaches

Resource: Green Infrastructure Effectiveness Database

Advanced Search

Search Results

Coastal Stormwater Management Through Green Infrastructure: A Handbook for Municipalities.

Link to Resource: <http://www.mass.gov/eea/docs/mbp/publications/massbays-green-infrastructure-handbook.pdf>

Keywords: Watershed assessment; Swale/bioswale; Site assessment; Permeable pavement; LID; Green roof/blue roof; Flooding; Constructed Wetland; Case studies; Bioretention/rain garden; Best Management Practices (BMPs)

Basic Information	
AUTHOR(S)	U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds, National Estuary Program
YEAR PUBLISHED	2014
SOURCE	U.S. Environmental Protection Agency
SOURCE TYPE	Gray literature
CITATION	U.S. Environmental Protection Agency. "Coastal Stormwater Management Through Green Infrastructure: A Handbook for Municipalities." EPA 842-R-14-004 (2014).

Classifications	
GREEN INFRASTRUCTURE TYPES AND/OR TECHNIQUES	Green roof/blue roof, Permeable pavement, Swale/bioswale, Other/Multi LID, Constructed wetlands, Bioretention/rain garden
HAZARDS	Flooding - precipitation (stormwater, riverine inundation), Flooding - coastal (storm surge, high tides, sea level rise, inundation)
METHODOLOGICAL APPROACHES	Perspective



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coast.noaa.gov/digitalcoast/training/gi-database

Shoreline Approaches

Natural



Dunes and Beaches

- Break offshore waves
- Attenuate wave energy
- Slow inland water transfer



Salt Marshes, Wetlands, Vegetation, Submerged Aquatic Vegetation

- Break offshore waves
- Attenuate wave energy
- Slow inland water transfer
- Increase infiltration

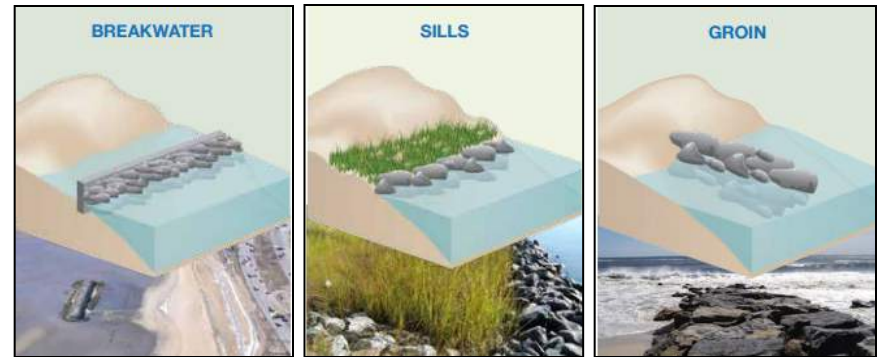


Oysters and Coral Reefs

- Break offshore waves
- Attenuate wave energy
- Slow inland water transfer

Shoreline Approaches


Hybrid



- Blends both nature-based and structural approaches
- Dissipates wave energy from structural practices
- Ecosystem service benefits from nature-based practices

Shoreline Approaches

Resource: Federal Highway Administration Green Infrastructure


 U.S. Department of Transportation
Federal Highway Administration

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Office of Planning, Environment, & Realty (HEP)
[Planning](#) [Environment](#) [Real Estate](#)

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Sustainability



Resilience


- Adaptation Framework
- Case Studies
- Ongoing & Current Research
- Pilots
- Policy & Guidance
- Publications
- Tools
- Webinars
- Workshops & Peer Exchanges
- Related Links

Sustainable Highways Initiative

Energy and Emissions

Newsletter

Contacts

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FHWA → Environment → Sustainability → Resilience → Ongoing And Current Research

Green Infrastructure Techniques for Coastal Highway Resilience

PDF files can be viewed with the [Acrobat® Reader®](#)

FHWA encourages the use of ecosystem-based approaches in adapting to climate change (see [FHWA](#) and [DOT policy orders](#)). Ecosystems provide valuable services that help to build resilience and reduce the vulnerability of people, livelihoods, and infrastructure to climate change impacts.

The FHWA Administrator dedicated a portion of the agency's annual Strategic Initiatives research budget to a project that will provide state and local transportation agencies with research, outreach, and technical assistance on green infrastructure, ecosystem-based approaches for improving coastal highway resilience. While green infrastructure can be used in both coastal and inland environments, this project focuses on coastal areas.

Coastal green infrastructure includes dunes, wetlands, living shorelines, oyster reefs, beaches, and artificial reefs. These features can protect coastal transportation infrastructure from the brunt of storm surges and open water waves. Some can adapt to sea level rise by accreting sediment or migrating inland.

This webpage contains:

- Information on the strategic initiatives [project](#), Green Infrastructure Techniques for Coastal Highway Resilience.
- Current [resources](#) that can assist transportation agencies considering green infrastructure approaches to coastal resilience.
- A compilation of [examples](#) of green infrastructure projects designed to protect coastal highways.




Photo from Center for Coastal Resources Management, Virginia Institute of Marine Science

www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/green_infrastructure/

FEMA

21

RiskMAP
Increasing Resilience Together

Case Study: Coastal Maryland Living Shorelines Projects to Protect Coastal Roadways



FEMA

Case Study: Maryland Department of Natural Resources Living Shorelines Projects to Protect Coastal Roadways

	Creek or Cove	Minor River	Major Tributary	Chesapeake Bay
Water depth (ft)	1	1 to 2	2 to 4	4 to 15
Fetch (miles)	0.5	1 to 1.5	2 or more	2 or more
Erosion (ft/yr)	2 or less	2 to 4	4 to 8	8 to 20
Wave energy	low	medium	medium	High
Type	Non-structural: Beach replenishment Fringe marsh creation Marshy islands Coir logs edging and groins	Hybrid: Marsh fringe with stone groins Marsh fringe with stone sills Marsh fringe with stone breakwaters Marsh edging with stone Stabilization of streambanks with vegetation and stone Stone breakwaters with beach replenishment and appropriate vegetation		Structural: Bulkheads Revetments Stone reinforcing Pre-case concrete units
Cost per linear foot	\$100 - \$200	\$350-\$400	\$450-\$600	\$500-\$1,500



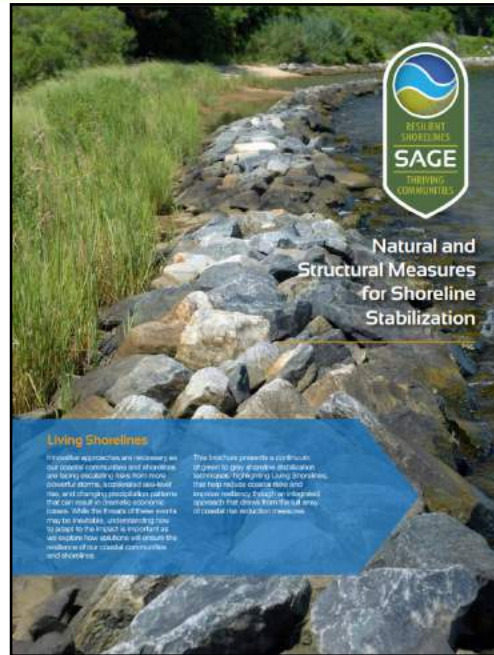
FEMA

Case Study: Maryland Department of Natural Resources Living Shorelines Projects to Protect Coastal Roadways

PROJECT NAME	COUNTY	ROADWAY LOCATION	LIVING SHORELINE PROJECT TYPE	LENGTH (L.F.)	PROJECT COST	DATE COMPLETE
Bay Ridge SECD	Anne Arundel	Bay Drive	Breakwaters	2,250	\$1,039,910	1/1992
Town of Vienna	Dorchester	Water Street	Stone Sill	305	\$157,472	12/2001
Our Lady Star of the Sea	Calvert	Solomon's Is. Road	Stone Groins	430	\$144,987	12/2004
Penttinen, E.W. & E.R.	Anne Arundel	Deep Creek Avenue	Stone Sill	100	\$22,724	6/2011
Columbia Beach SECD	Anne Arundel	Crowner Road	Stone Sill	2,346	\$485,000	10/2011
Arey, P.H.	Anne Arundel	Wiltshire Lane	Stone Sill	172	\$62,188	5/2012
Gibson Road	St. Mary's	Gibson Road	Stone Sill	260	\$94,973	7/2013
Lord R.L. & Zearfoss N.	St. Mary's	Gibson Road	Stone Sill	330	\$108,015	6/2014
Annapolis Cove SECD	Anne Arundel	Comm. Access Road	Stone Sill/Groins	720	\$209,425	10/2013
Town of Charlestown LS project	Cecil	Baltimore-Colonial & Tasker Lane	Revetment/Groins	677	\$319,900.00	12/2006
Dorchester County (tire recycling center) LS project	Dorchester	Hoopers Island Road	Stone Sill	627	\$102,197.00	12/2002
Mid-Hoopers Island Rd	Dorchester	Hoopers Island Road	Breakwaters	1200	\$552,963.00	6/1996
McCready's Point Rd	Dorchester	McCready's Point Rd	Breakwaters	330	\$411,485.00	6/1995
TOTALS:				9,747	\$3,711,239.00	

Shoreline Approaches

Resource: Natural and Structural Measures for Shoreline Stabilization



sagecoast.org/info/information.html



Shoreline Approaches

Resource: Introducing Green Infrastructure for Coastal Resilience Training



Office for Coastal Management
DIGITALCOAST

ABOUT DATA TOOLS TRAINING TOPICS STORIES

[Home](#) | [Training](#) | [Introducing Green Infr...](#)



Introducing Green Infrastructure for Coastal Resilience



TRAINING TYPE
Classroom, Instructor-Led

DURATION
1 day

CONTINUING EDUCATION
YES

Course Description

Natural and nature-based green infrastructure practices can play a critical role in making coastal communities more resilient to natural hazards. In this introductory course, participants review fundamental concepts and examine various practices. Local speakers share their expertise and the ways these techniques have been integrated into local planning processes.

Course participants from land use planning, conservation planning, hazard mitigation, stormwater management, floodplain management, and local government departments will make valuable connections with new and experienced practitioners who are moving green infrastructure projects forward in their communities.

[HOST THIS COURSE](#)

Upcoming Offerings 2

Introducing Green Infrastructure for Coastal Resilience
Virginia Institute of Marine Science at Watermens Hall
Gloucester Point, VA

DATE
Nov. 7, 2017

Introducing Green Infrastructure for Coastal Resilience
Middlesex County Fire Academy
Sayreville, NJ

DATE
Nov. 17, 2017

To register, please email
ocm.training@noaa.gov

[VIEW FULL TRAINING CALENDAR](#)

Related Resources 6

[Quick References](#)

coast.noaa.gov/digitalcoast/training/green



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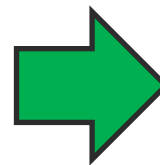
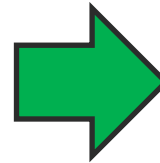
Nature-Based Solutions Redevelopment and Recovery



FEMA

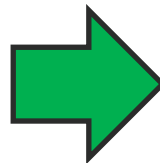
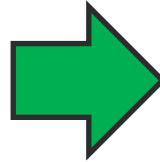
RiskMAP
Increasing Resilience Together

Nature-Based Solutions Considerations for Redevelopment



FEMA

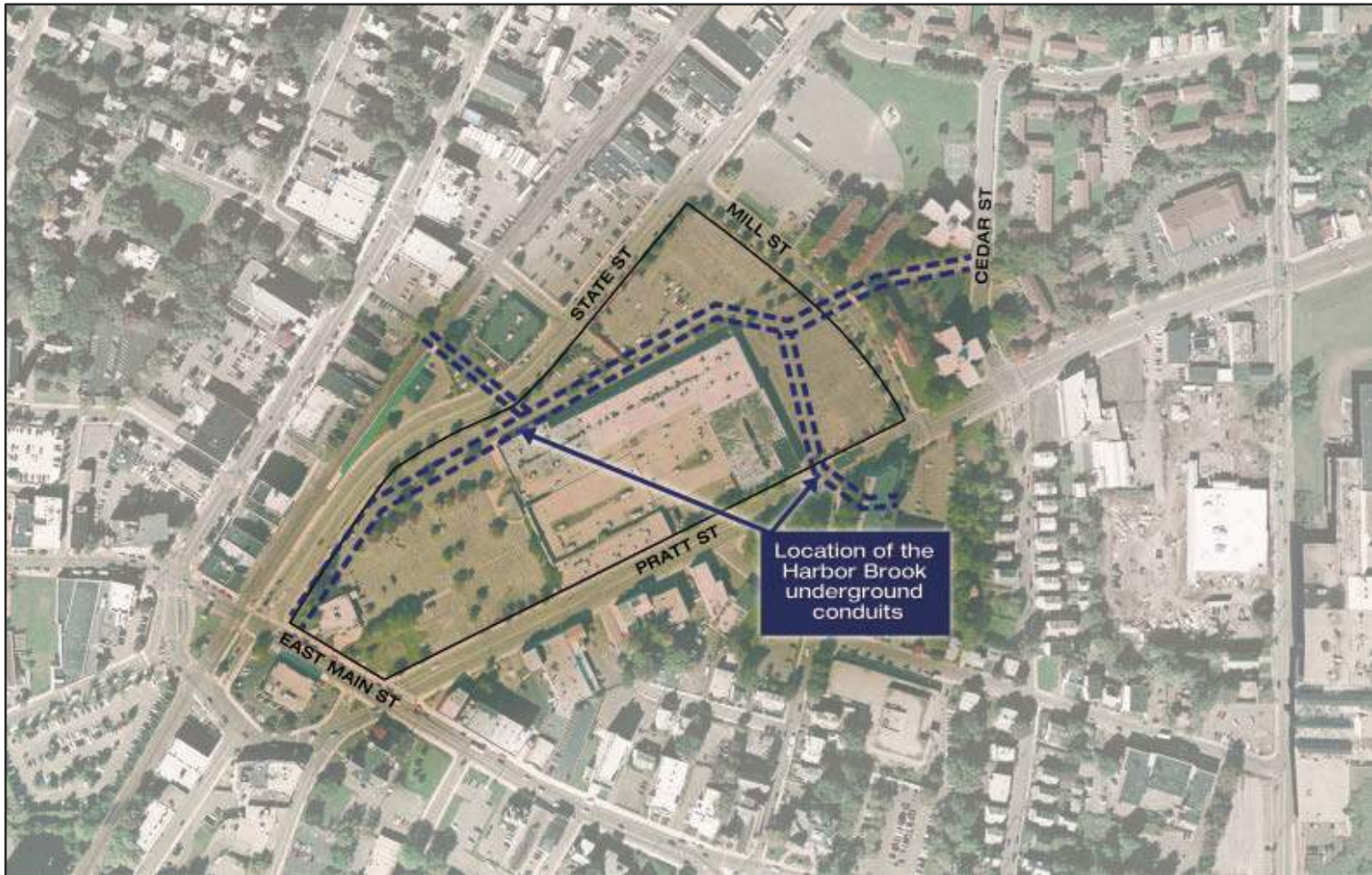
Nature-Based Solutions Considerations for Recovery



FEMA

Case Study: Meriden, CT

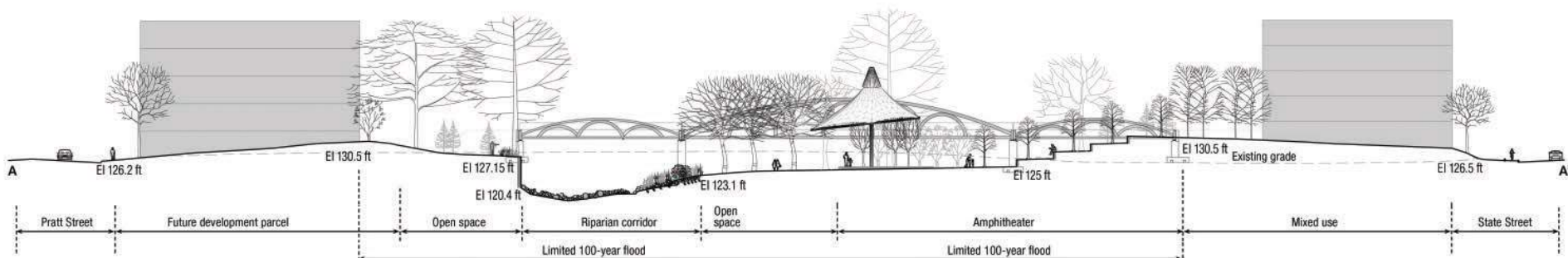
Combining Flood Control and Economic Revitalization



FEMA

Case Study: Meriden, CT

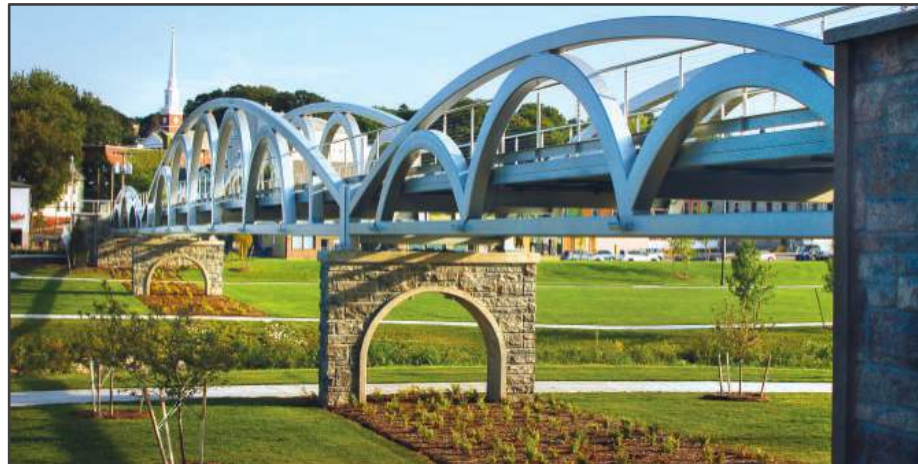
Combining Flood Control and Economic Revitalization



FEMA

Case Study: Meriden, CT

Combining Flood Control and Economic Revitalization



FEMA

Nature-Based Solutions

Resource: Naturally Resilient Communities Website

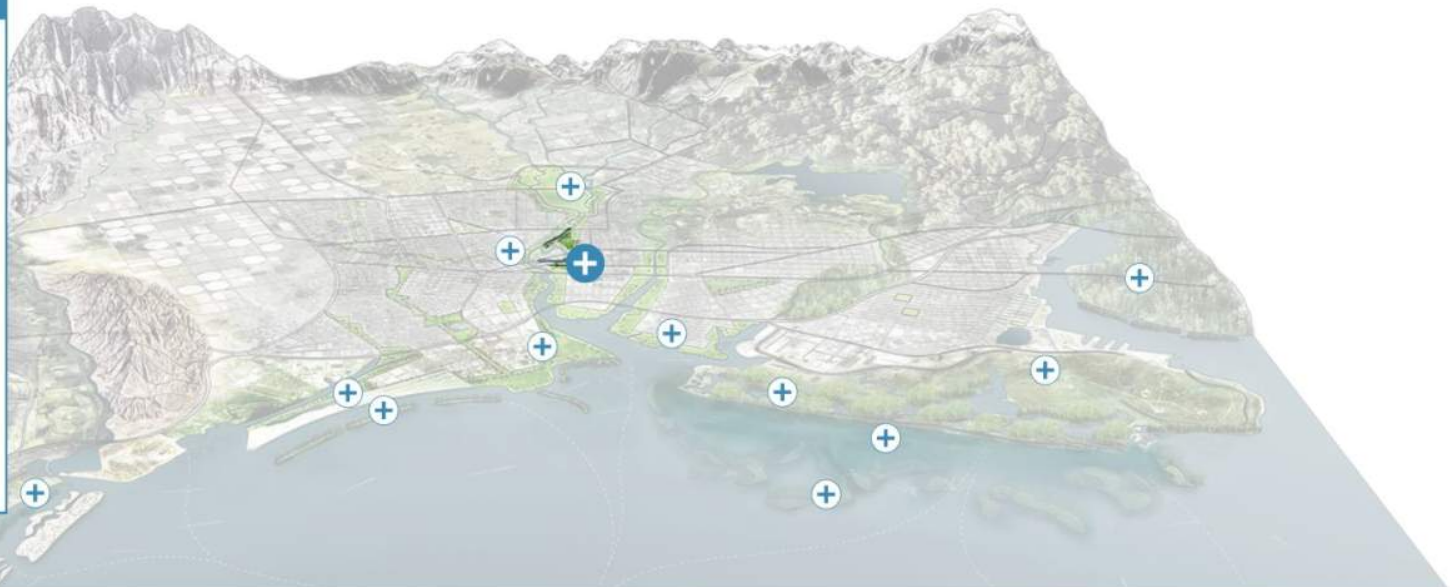
EXPLORE THE DIFFERENT TYPES OF NATURE-BASED SOLUTIONS

WATERFRONT PARKS



Studies show parks increase property values and municipal tax revenues.

[LEARN MORE](#)



COASTAL FLOODING & EROSION

RIVER FLOODING & EROSION

URBAN STORMWATER FLOODING

FIND YOUR SOLUTION



FEMA

Nature-Based Solutions

Resource: Naturally Resilient Communities Website

EXPLORE THE DIFFERENT TYPES OF NATURE-BASED SOLUTIONS

COASTAL HAZARDS



Coastal flooding occurs either as a result of storms, causing wide ranging impacts, or regular tidal cycles, resulting in more frequent, low impact flooding in low lying areas. Coastal erosion is the collapse or loss of land along coastal areas as a result of floods or regular waves.



COASTAL FLOODING & EROSION

RIVER FLOODING & EROSION

URBAN STORMWATER FLOODING



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Nature-Based Solutions Resource: Naturally Resilient Communities Website

SOLUTIONS
30 Results

CASE STUDIES
23 Results

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
- Northeast
- Pacific Northwest
- Rocky Mountain West
- Southeast
- Southwest

Community Type

- Rural
- Suburban
- Urban

Scale


- Community
- Neighborhood
- Site

Cost

- \$
- \$\$
- \$\$\$
- \$\$\$\$

WHAT KIND OF HAZARDS DOES YOUR CITY FACE?


COASTAL EROSION



Erosion along a coast, including erosion along a shore, dunes, or cliff.

Select


TIDAL FLOODING



Flooding to coastal areas caused by high tides (could occur on a sunny day).

Select


COASTAL FLOODING



Flooding to coastal areas caused by waves / storm surge during a storm.

Select


RIVERINE EROSION



Erosion along the edges of a river bank.

Select


RIVERINE FLOODING



Flooding caused by high river levels.

Select

STORMWATER FLOODING



Localized flooding in a community caused by heavy rains.

Select

GO

SOLUTIONS
13 Results

CASE STUDIES
14 Results

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
- Northeast
- Pacific Northwest
- Rocky Mountain West
- Southeast
- Southwest

Community Type

- Rural
- Suburban
- Urban

Scale

- Community
- Neighborhood
- Site


Cost

- \$
- \$\$
- \$\$\$
- \$\$\$\$

CLEAR ALL


DOWNLOAD PDF

Rivers, Streams, and Floodplains




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

Restoring Floodplain Elements




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

Regulatory and Policy Approaches to Address Hazards




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

Planning Approaches to Reduce Natural Hazards




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

Enhanced Floodplain Mapping




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

Open Space Preservation through Land Acquisition




This strategy focuses on the public acquisition of undeveloped and/or season...

Moving People Out of Harm's Way: Property Buyouts




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

Waterfront Parks




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

Setback Levees




Setback levees are earthen embankments that are located at a distance from...

Flood Friendly Culverts




Culverts are essential pieces of infrastructure that allow water to travel from...

Flood Bypasses




A flood bypass is an area along a river or within a...

Floodwater Detention and Retention Basins



A detention basin is an area that has been designed and designed...

Daylighting Rivers and Streams



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




FEMA

How do Nature-Based Solutions Fit into FEMA Programs?

Resource: EPA Fact Sheet

- Fit under the category “Minor Localized Flood Reduction Projects”
- Eligible efforts include measures that reduce flood losses for single structures or facilities, utilities or roads and bridges, groups of structures, or entire neighborhoods.
- Hazard mitigation planning-related activities are also eligible for HMA funding.
- If the project on the property is being proposed for acquisition through FEMA funding, environmental benefits may be included in the benefit-cost analysis.

 United States Environmental Protection Agency

Fund Low Impact Development/ Green Infrastructure Projects with FEMA Grants for Flood Mitigation

EPA promotes the use of Low Impact Development (LID) and Green Infrastructure (GI) as a cost-effective and resilient approach to stormwater management. LID/GI provides many community benefits including cleaner water, wildlife habitat, enhanced aesthetics, and can be designed to supplement localized or watershed flood protection. LID/GI projects that reduce flood losses to properties insured under the National Flood Insurance Program (NFIP) may be eligible for grant funding through the Federal Emergency Management Agency (FEMA).

Where LID/GI Fits in FEMA's Grant Programs

LID/GI projects fit under the category “Minor Localized Flood Reduction Projects,” including rain gardens, roadside swales, and infiltration trenches. The “Soil Stabilization” category includes vegetative buffers or other efforts, such as an LID/GI program, that reduce stream erosion. Minor localized flood reduction projects based on LID/GI may be eligible for funding under FEMA's mitigation grant programs. These projects lessen the frequency or severity of flooding and decrease flood damages. This designation can include a system of LID/GI-based stormwater management devices that reduce runoff volumes by infiltration, evapotranspiration, or storage of rainwater for beneficial uses, as long as the system demonstrably reduces the extent of flooding. These projects must not duplicate flood prevention activities of other Federal agencies and may not constitute a section of a larger flood control system. Eligible minor localized flood reduction efforts include measures that reduce flood losses for single structures or facilities, utilities or roads and bridges, groups of structures, or entire neighborhoods. Therefore, LID/GI may be an effective addition to conventional flood risk management. Hazard mitigation planning-related activities are also eligible for HMA funding, including updating or enhancing sections of the current FEMA-approved mitigation plan to incorporate climate adaptation, green building, or smart growth principles, including LID/GI principles, into the risk assessment and mitigation strategy.

If the LID/GI project is on the property being proposed for acquisition through FEMA funding, environmental benefits may be included in the benefit-cost analysis. Environmental benefits are considered only for acquisition projects at this time. A property is eligible for acquisition if it will be acquired from a voluntary seller, contains a structure that may or may not have been damaged or destroyed as a result of a hazard event, and the underlying land use is deed-restricted to open space in perpetuity. By proposing LID/GI design for the land, it may be possible to increase the environmental benefits and demonstrate cost effectiveness to obtain funding from FEMA or other co-sponsors for acquisition.

A new FEMA policy now encourages the monetary benefits of the ecosystem services of LID/GI to be included in the project benefit cost ratio (BCR), which can help make an acquisition project viable. Green open space and riparian land uses qualify for these environmental benefits, but the project must meet a BCR of at least 0.75 before environmental benefits can be included.



LID/GI in State or Local Hazard Mitigation Plans

Incorporating watershed-based LID/GI into a State Hazard Mitigation Plan may help achieve “Enhanced” plan status for Integrated Planning for Land Use Development and Natural/Cultural Resources. This enhancement might include large-scale projects such as a statewide data registry prioritizing floodplain and wetland restoration, or policies on land development that discourage excess runoff. Local hazard mitigation plans should also consider how LID/GI practices can be incorporated as a means to reduce flood risk.



Photo: Melissa Kravner

Polling Question #2

Have you or your office been involved in a project that has utilized nature-based solutions?

- A. Yes and it was effective**
- B. Yes and it was ineffective**
- C. No, but would appreciate or look forward to more from FEMA on integrating these approaches.**
- D. No**

Polling Question #3 *REQUIRED FOR ASFPM CEC*

What additional information do you need to move nature-based solutions forward in your work?

- A. Training**
- B. Funding Mechanisms**
- C. Communications Products & Visualizations**
- D. Economic/Financial/Cost-Benefit Data**
- E. Other**

Key Takeaways

- Be aware of the specific hazard of concern, the benefits different natural infrastructure techniques can provide, and the surrounding land use that will impact the technique implemented.
- Engage key stakeholders throughout the process so you are implementing natural infrastructure techniques that provide multiple benefits that stakeholders value.
- Redevelopment and recovery are opportunities. Be sure to promote proactive solutions such as modified zoning, strengthening building standards, and the implementation of nature-based solutions as part of the longer term vision of enhanced resilience.

Questions?



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DGILVY PUBLIC RELATIONS &
MICHAEL BAKER INTERNATIONAL



OFFICE FOR COASTAL MANAGEMENT
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

RiskMAP
Increasing Resilience Together



Q&A and Discussion

Please use the chat box and send your questions to Victoria



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OFFICE FOR COASTAL MANAGEMENT
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REQUIRED FOR ASFPM CEC

In the chat box, send the following information to “Taylor Kennedy”:

Name, email address, and state

Ex: Jane Doe, jdoe@gmail.com, Georgia



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