

Engineering With Nature



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US Army Corps
of Engineers.

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Engineer Research and
Development Center



Advancing Technical Practice

Outcomes:

USACE Environmental Operating Principles

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.



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Vision: “Contribute to the strength of the Nation through innovative and environmentally sustainable solutions to the Nation’s water resources challenges.”

Sustainable Solutions

To America’s Water Resource Needs
Civil Works Strategic Plan 2014-2018



- Cost-effective engineering and operational practices
- Efficient resolution of environmental conflicts
- Sustainable delivery of project benefits. Triple-win outcomes integrating social, environmental and economic objectives.



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Engineering With Nature...

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

Key Elements:

- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners



EWN Status

- *Engineering With Nature* initiative started within USACE Civil Works program in 2010. Over that period we have:
 - ▶ Engaged across USACE Districts (23), Divisions, HQ; other agencies, NGOs, academia, private sector, international collaborators
 - Workshops (>20), dialogue sessions, project development teams, etc.
 - ▶ Implementing strategic plan
 - ▶ Focused research projects on EWN
 - ▶ Field demonstration projects
 - ▶ Communication plan
 - ▶ District EWN Proving Grounds established
 - ▶ Awards
 - 2013 Chief of Engineers Environmental Award in Natural Resources Conservation
 - 2014 USACE National Award-Green Innovation

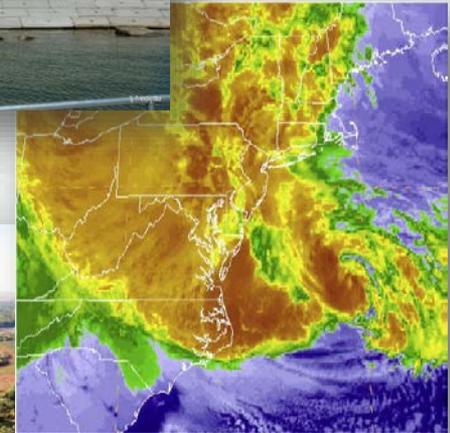


www.engineeringwithnature.org

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EWN Across USACE Mission Space

- Navigation
 - ▶ Strategic placement of dredged material supporting habitat development
 - ▶ Habitat integrated into structures
 - ▶ Enhanced Natural Recovery
- Flood Risk Management
 - ▶ Natural and Nature-Based Features to support coastal resilience
 - ▶ Levee setbacks
- Ecosystem Restoration
 - ▶ Ecosystem services supporting engineering function
 - ▶ “Natural” development of designed features
- Water Operations
 - ▶ Shoreline stabilization using native plants
 - ▶ Environmental flows and connectivity



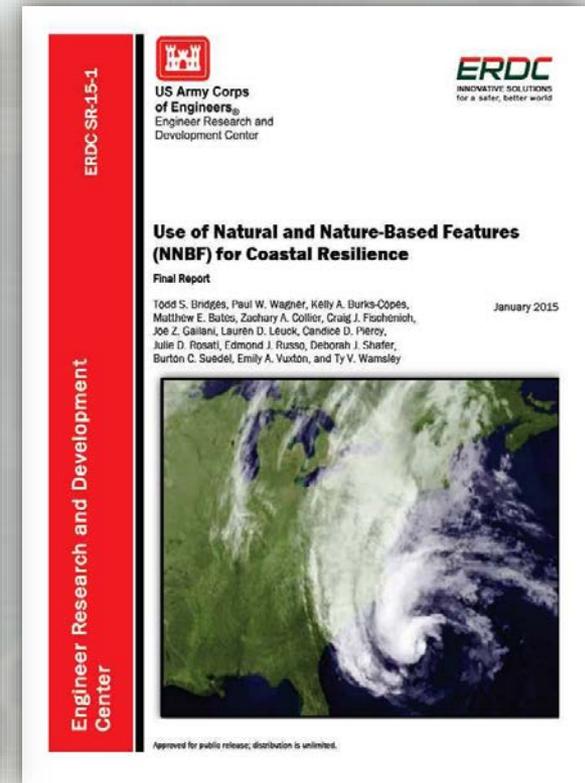
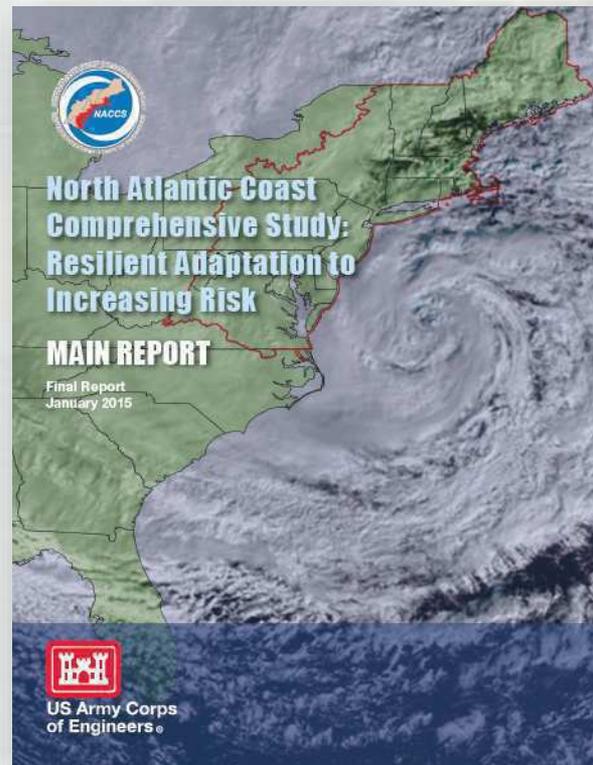
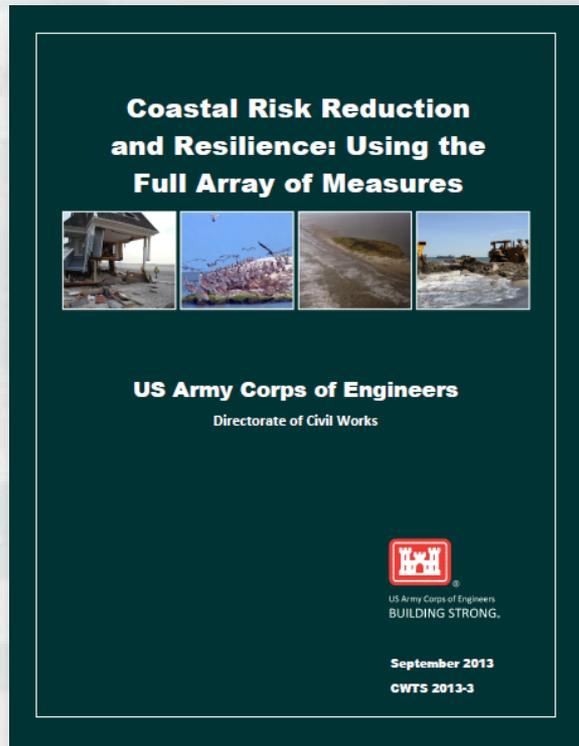
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USACE Galveston, Buffalo, Philadelphia Districts: EWN “Proving Grounds”

- EWN Proving Ground Kick-Off Workshops
 - ▶ October (SWG) and December (LRB) 2014; June 2016 (NAP)
 - ▶ District, Division, EWN Leadership Team
- Identify opportunities to implement EWN across current and future programs and projects
- Emphasis on solution co-development



The North Atlantic Coast Comprehensive Study: Natural and Nature-Based Features



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Engineering Performance: Nature-Based Features Work in Different Ways

Natural and Nature-Based Infrastructure at a Glance

GENERAL COASTAL RISK REDUCTION PERFORMANCE FACTORS:
STORM INTENSITY, TRACK, AND FORWARD SPEED, AND SURROUNDING LOCAL BATHYMETRY AND TOPOGRAPHY



Dunes and Beaches

Benefits/Processes
Break offshore waves
Attenuate wave energy
Slow inland water transfer

Performance Factors
Berm height and width
Beach Slope
Sediment grain size and supply
Dune height, crest, width
Presence of vegetation



Vegetated Features: Salt Marshes, Wetlands, Submerged Aquatic Vegetation (SAV)

Benefits/Processes
Break offshore waves
Attenuate wave energy
Slow inland water transfer
Increase infiltration

Performance Factors
Marsh, wetland, or SAV elevation and continuity
Vegetation type and density



Oyster and Coral Reefs

Benefits/Processes
Break offshore waves
Attenuate wave energy
Slow inland water transfer

Performance Factors
Reef width, elevation and roughness



Barrier Islands

Benefits/Processes
Wave attenuation and/or dissipation
Sediment stabilization

Performance Factors
Island elevation, length, and width
Land cover
Breach susceptibility
Proximity to mainland shore



Maritime Forests/Shrub Communities

Benefits/Processes
Wave attenuation and/or dissipation
Shoreline erosion stabilization
Soil retention

Performance Factors
Vegetation height and density
Forest dimension
Sediment composition
Platform elevation



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Caterpillar Corporation's *Restoring Natural Infrastructure Summit* 4 November 2015, New York City



NY DEC and Sea Grant

Exploring Nature-Based Shoreline Erosion Management Practices Along NY's Great Lakes and Connecting Channels

5 November 2015, Rochester, NY



Department of
Environmental
Conservation



A Workshop for Practitioners: Exploring Nature-Based Shoreline Erosion Management Practices Along NY's Great Lakes and Connecting Channels

November 5, 2015 -- 8:30am to 5:00pm
International Arrivals Hall
Rochester International Airport
1200 Brooks Ave, Rochester, NY 14624

Goal

To gain an understanding of the various types of nature-based shoreline (NBS)* protection techniques and approaches that may be applicable to NY's Great Lakes shorelines, to manage erosion and stabilize shorelines while maintaining coastal processes and preserving or enhancing nearshore habitat. A secondary goal is to establish a dialogue and coordinated strategy among regional experts and practitioners to promote the implementation of nature-based shoreline management practices for erosion management along NY's Great Lakes shorelines.

Workshop Objectives

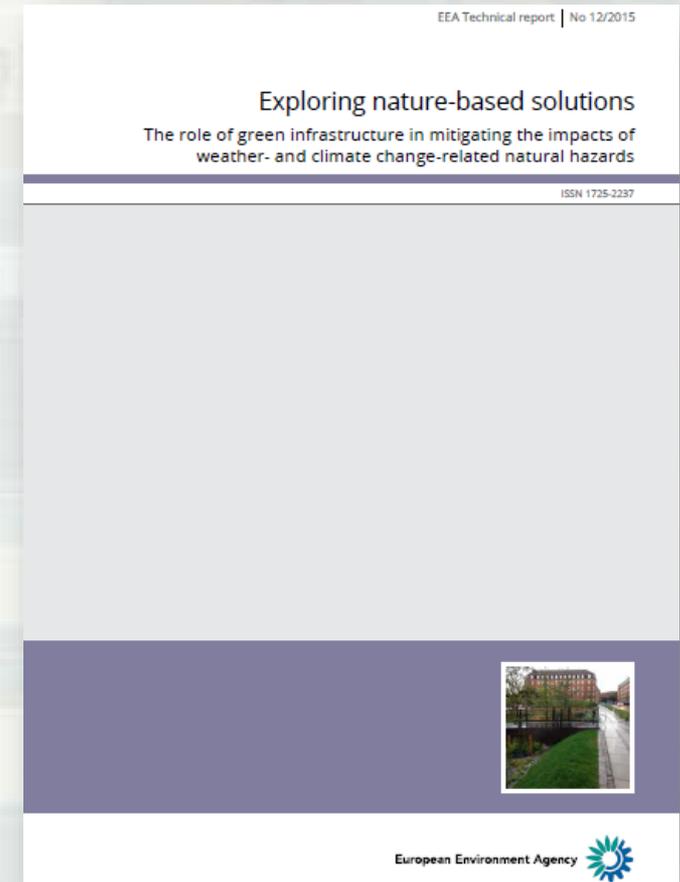
- Learn how nature-based shoreline methods are being used and how they may apply to NY's Great Lakes shorelines;
- Assess opportunities and constraints for implementing nature-based shoreline projects;
- Identify data, research, outreach, and resource needs to advance nature-based shorelines in NYS's Great Lakes;
- Identify demonstration project opportunities by region/reach;
- Identify next steps to work towards a coordinated management approach.



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Exploring nature-based solutions: the role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards

- “...instead of automatically defaulting to grey solutions like dikes and pipes for flooding, we first should look at restoring floodplains or wetlands. Rather than building sea walls, we need to think about conserving sand banks...Planners should compare green to grey and identify new opportunities for investing in nature, including a combination of green and grey approaches when nature-based solutions alone are insufficient. As planners explore how to accommodate infrastructure demands in the future, the lesson is clear: think about green before investing in grey.”



EEA Technical Report No 12/2015

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USACE – NOAA Collaboration Workshop on Natural and Nature-Based Features Charleston, SC; 1-3 March 2016



Fort Pierce City Marina



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Alafia Banks Bird Sanctuary, FL

- 8000 lb reef module breakwaters (930 ft)
- Shore protection for Audubon bird sanctuary islands
- Help restore oyster populations
- Provide habitat



www.reefball.org

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Horseshoe Island EWN Project

Atchafalaya River

- Options for managing DM via shore-based wetland creation were exhausted
- Strategic placement of sediment (0.5-1.8 mcy/1-3 yrs) was used to create a ~35 ha island
- Producing significant environmental and engineering benefits
- Project won WEDA's 2015 Award for Environmental Excellence



Coastal NJ, Philadelphia District



December 2014



Stone Harbor



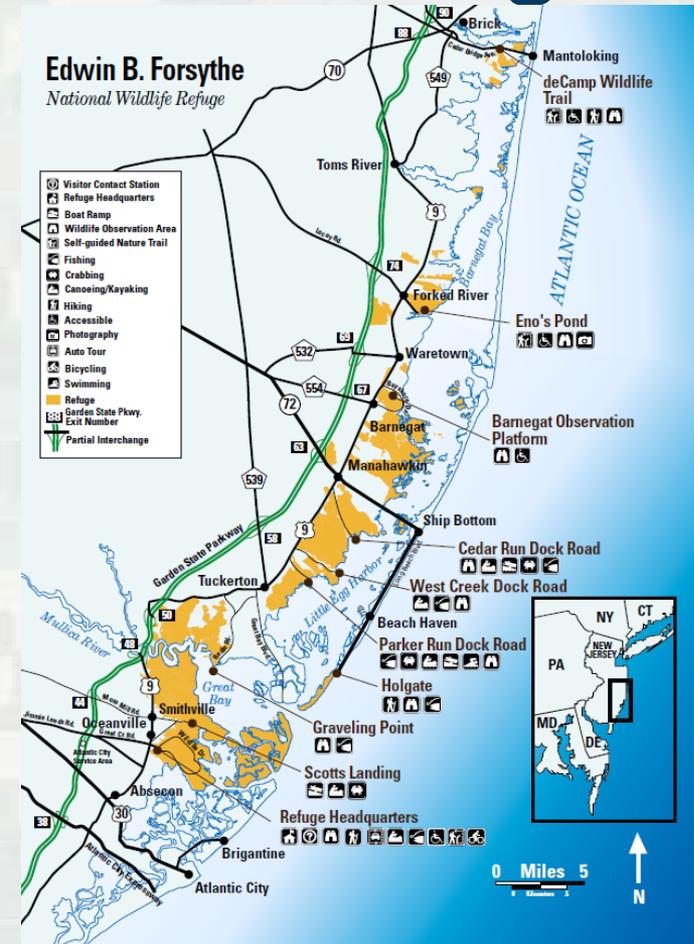
Avalon



US Fish and Wildlife Service

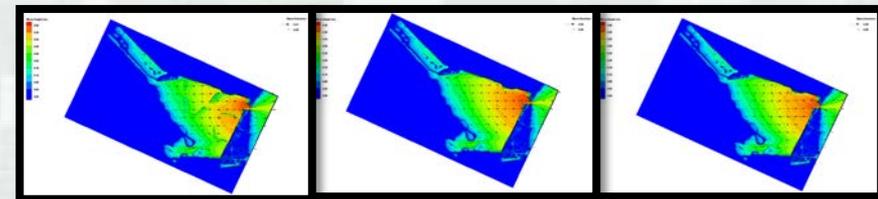
Forsythe National Wildlife Refuge

- Forsythe NWR: >40,000 acres of wetlands and other habitat in coastal NJ
- Collaboration objective: Enhance ecosystem resilience through engineering and restoration
- Means: Smart use of sediment resources and EWN principles and practices



Hamilton and Sears Point Wetland Development, San Pablo Bay

- Accelerate wetland development using berms to support sedimentation during tidal inundation
- Remotely monitoring physical processes: wind, waves, currents suspended sediments, settling velocities, etc.
- Modeling wave generation and dissipation, testing different shapes/configurations of berms



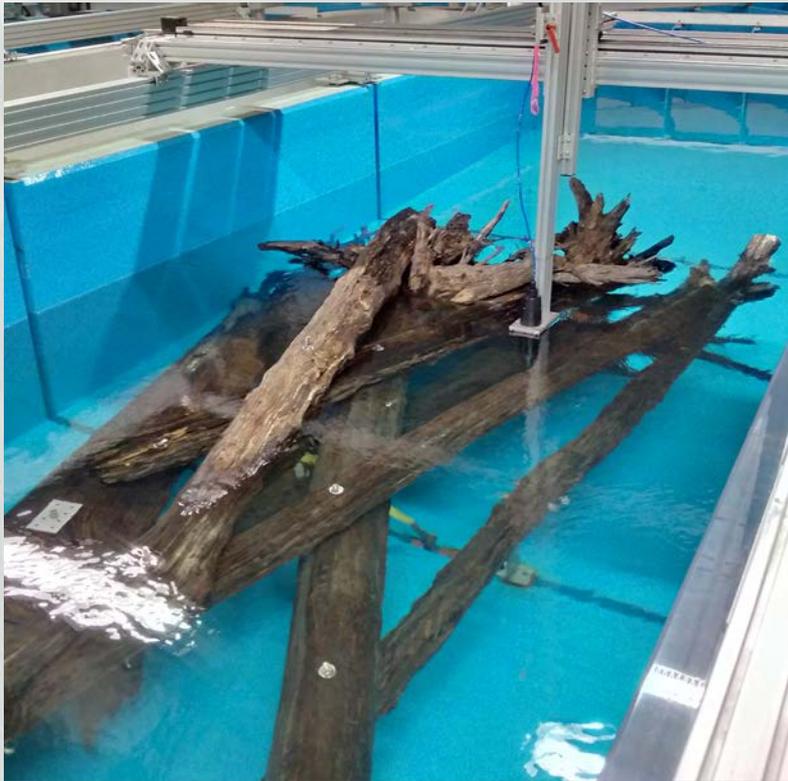
Linear Berms (As-Built)

No Berms (Control)

Mounds (ala Sears Pt.)



Natural Materials



National Large Wood Manual

Assessment, Planning, Design, and Maintenance of Large Wood in Fluvial Ecosystems: Restoring Process, Function, and Structure

January 2016



U.S. Department of the Interior
Bureau of Reclamation



US Army Corps
of Engineers
Engineer Research and
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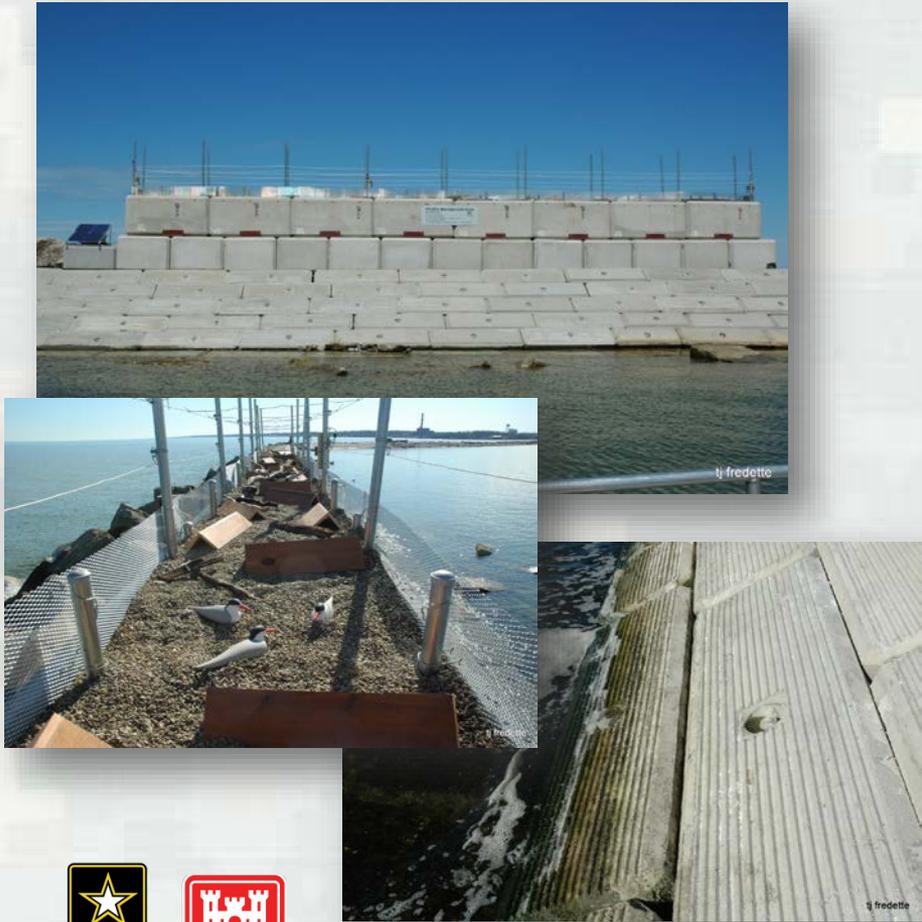


<https://ewn.el.erdc.dren.mil/Tools.html>

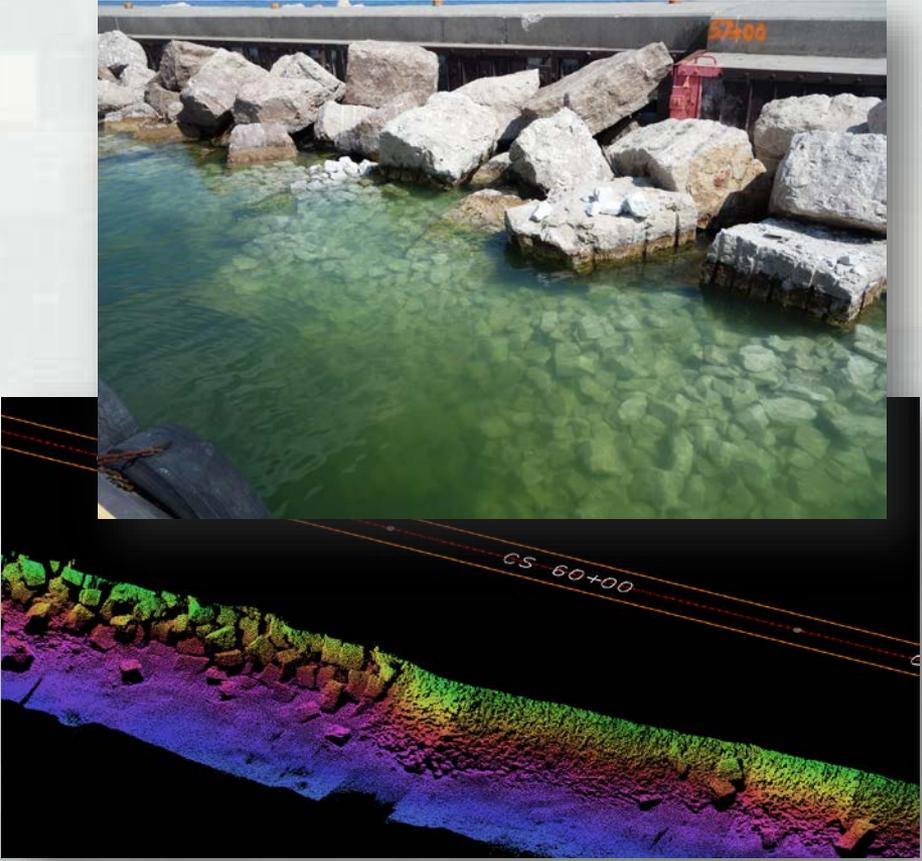
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Example EWN Solutions: Green Breakwaters

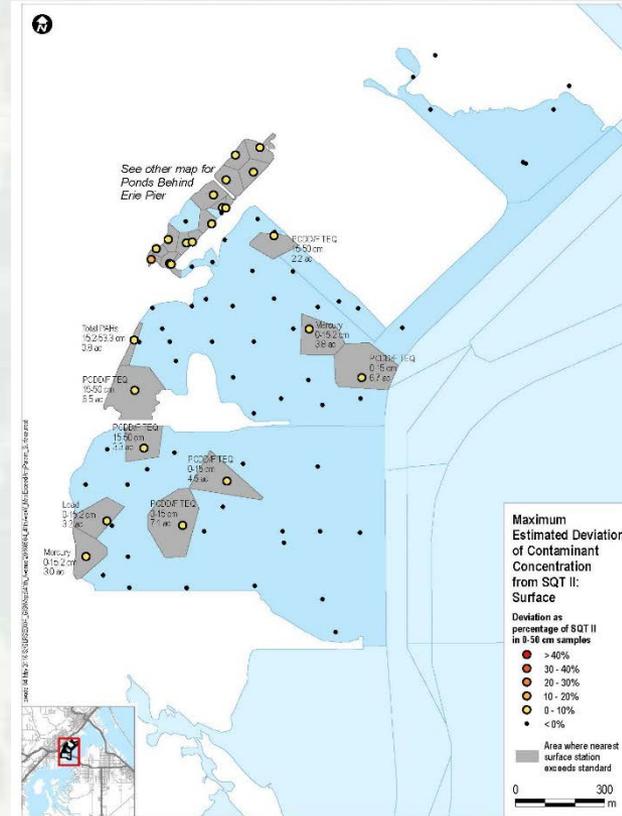
Ashtabula Harbor



Milwaukee Harbor



Duluth Harbor TLP



Ashtabula Activated Carbon Demo



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Thin-Layer Placement Website

www.engineeringwithnature.org (under tools)

<https://tlp.el.erdc.dren.mil/>

The screenshot shows the homepage of the Thin-Layer Placement website. At the top, there is a circular logo with 'TLP THIN LAYER PLACEMENT' and a banner with the title 'THIN-LAYER PLACEMENT OF DREDGED MATERIAL'. Below the banner is a navigation menu with links: 'Welcome', 'What is Thin Layer Placement?', 'Resources', 'Case Studies', 'Points of Contact', and 'Photo Gallery'. The main content area features a large photo of two people in a field, one holding a surveying instrument. Below this is a section titled 'Thin-Layer Placement' with three sub-sections: 'A Living Resource', 'Searchable Resources', and 'What's New'. At the bottom, there is a 'Welcome' section with a brief description of the site's purpose and a link to the 'Sign-up for our List Server'.

The screenshot shows the 'What is Thin Layer Placement?' page. It features a large blue header with the title 'Thin Layer Placement' and a paragraph explaining the process: 'Dredged material is placed in a thin layer on a substrate of dredged material with high permeability to the requirements of the site...'. Below the text are four small thumbnail images showing different stages of the process. At the bottom, there is a large photo of a green field with a fence, and a small text box that says 'Visit the essential resources of this site.'

The screenshot shows the 'Case Studies' page. It features a list of case studies with links to a fact sheet, photo gallery, related reports, and a map-based portal. The case studies listed are: Galveston National Wildlife Refuge Restoration, Galveston C&SW Dredging Water Bay, Orange River and Tar Bay, New Jersey Intracoastal Waterway, Ocean City Harbor Inlet and Sheepshead Bay, Port of Baltimore Channel Expansion, Pine Harbour Marina, Poal River, Gulf Rocks, Jamaica Bay, Mississippi Sound, Pepper Creek, Seal Beach, and West Cove. Below the list is a section for 'Anacostia River Fringe Wetland Creation' with a placeholder for a short project description and a large photo of a wetland area.



EWN High Points



- Conservation / development of natural systems support future sustainability and resilience
 - ▶ Incentivizing and financing
- Focus energy to facilitate innovation in both technical and business processes
- Elevate communication about advancing practice
- Accelerate progress through co-development of solutions
 - ▶ Across government
 - ▶ Between government and industry
 - ▶ Among government, industry, academia, and NGOs

