

Engineering With Nature



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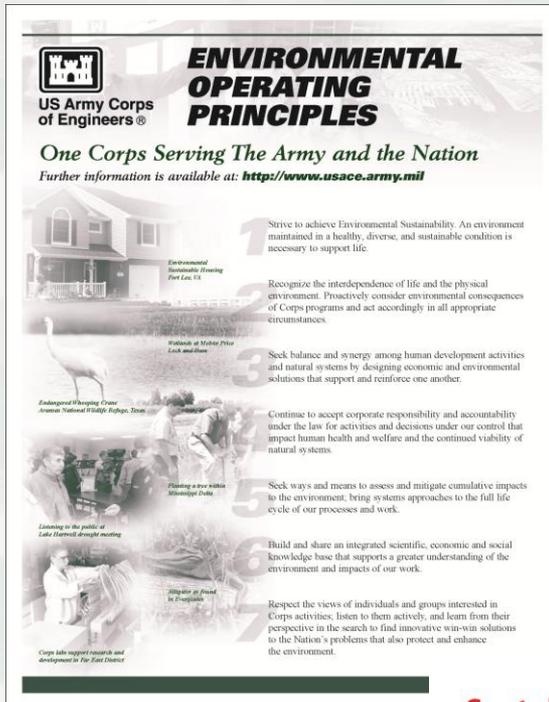


®

**US Army Corps of Engineers
BUILDING STRONG®**



Advancing USACE Practice



Goals:

- More efficient, cost effective engineering and operational practices.
- More collaboration and cooperation, less unproductive conflict.
- Sustainable projects. Triple-win outcomes integrating social, environmental and economic objectives.

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



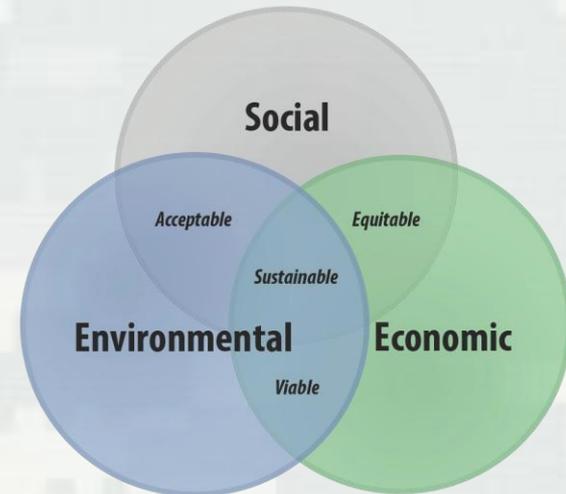
Engineering With Nature...



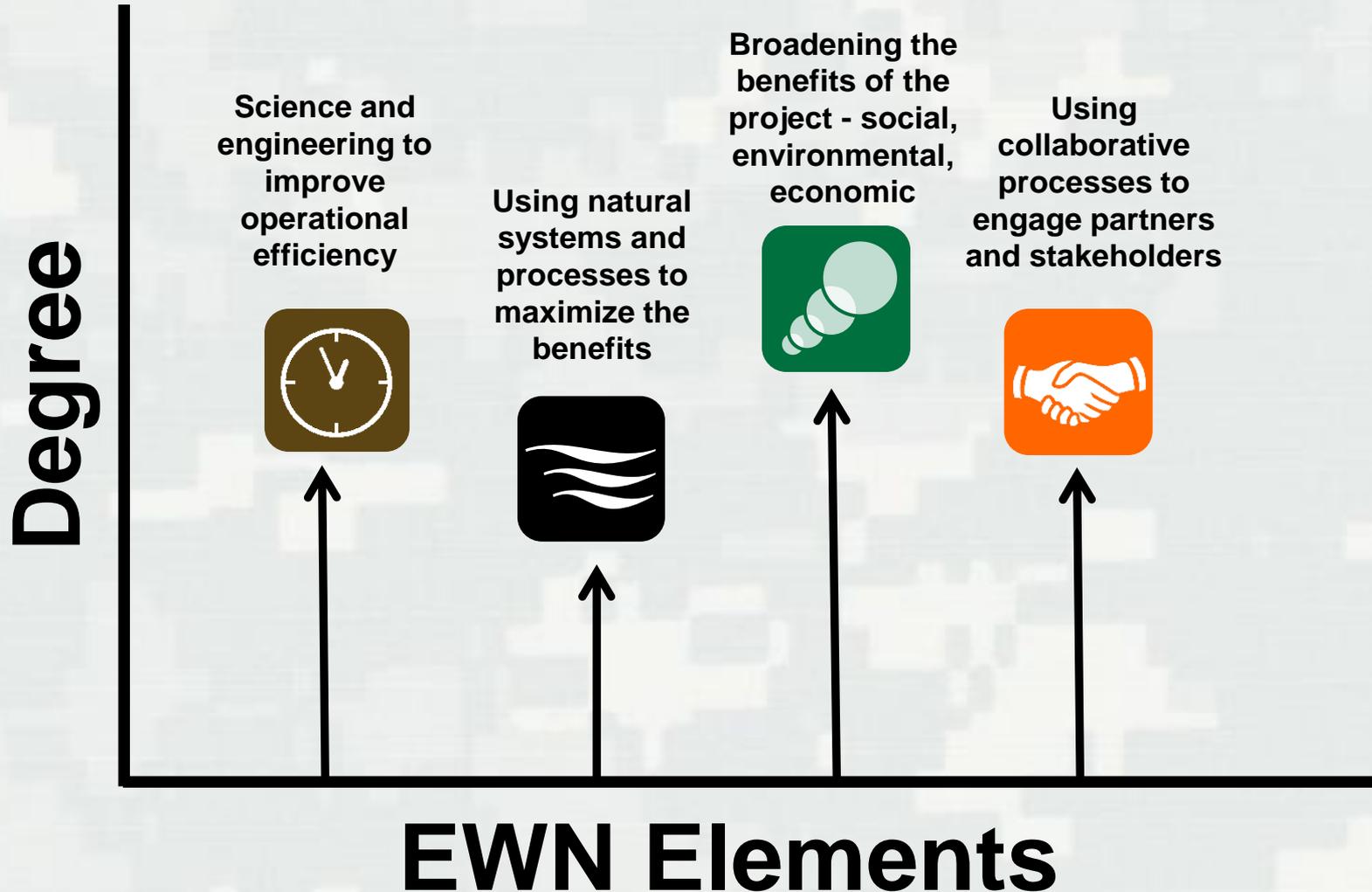
...the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

Key Elements:

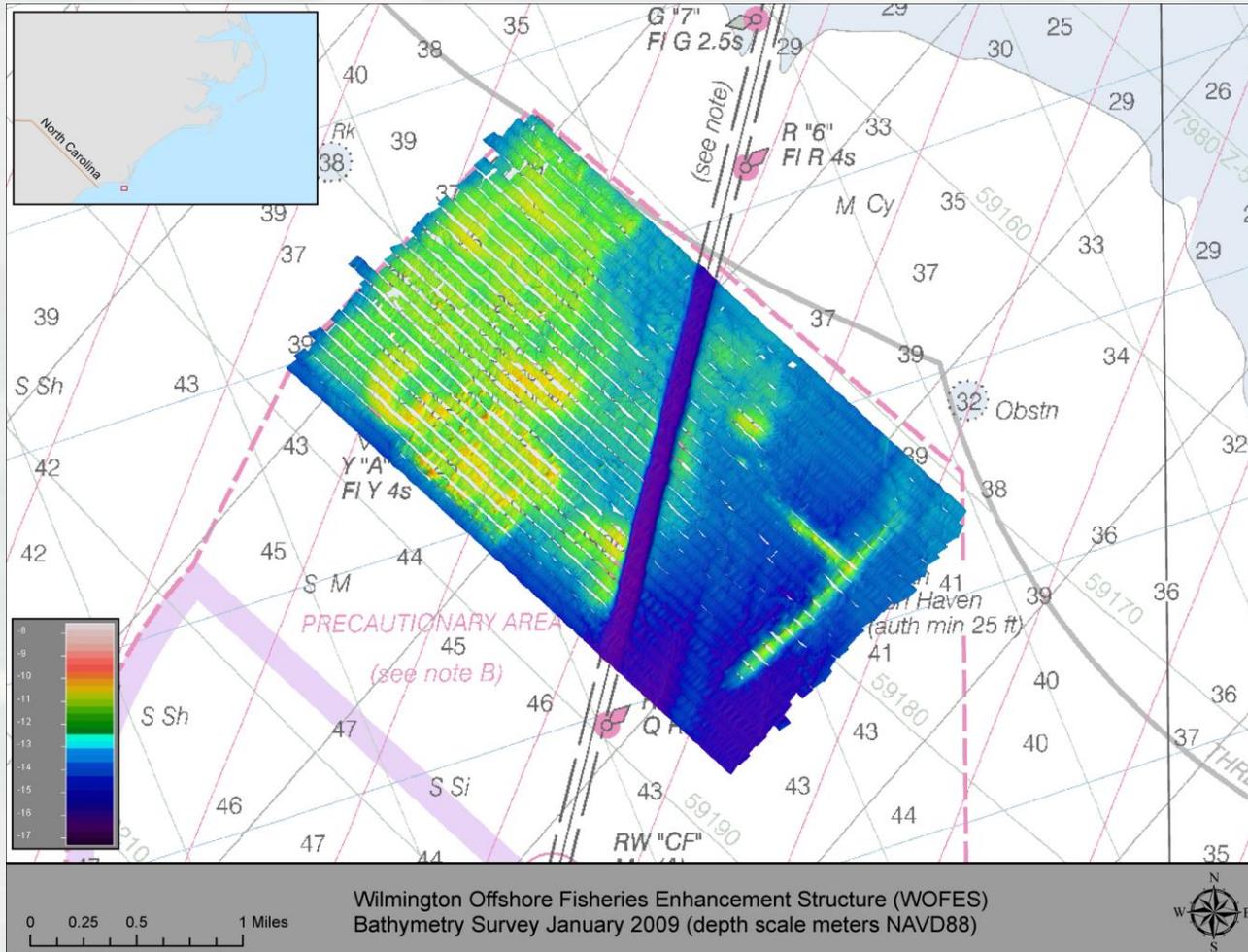
- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners



Engineering With Nature Elements



Example EWN Solutions



Wilmington Offshore Fisheries Enhancement Structure



Example EWN Solutions

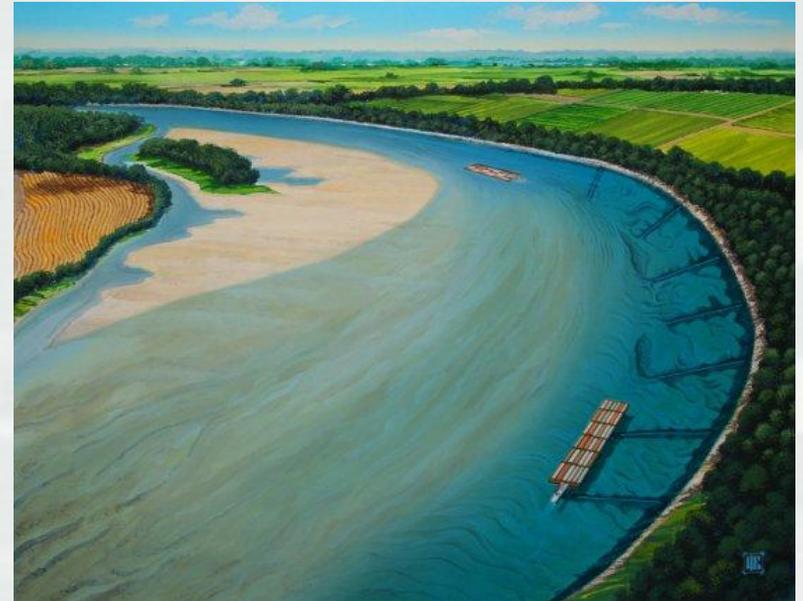
Ashtabula Breakwater Tern Habitat



Example EWN Solutions

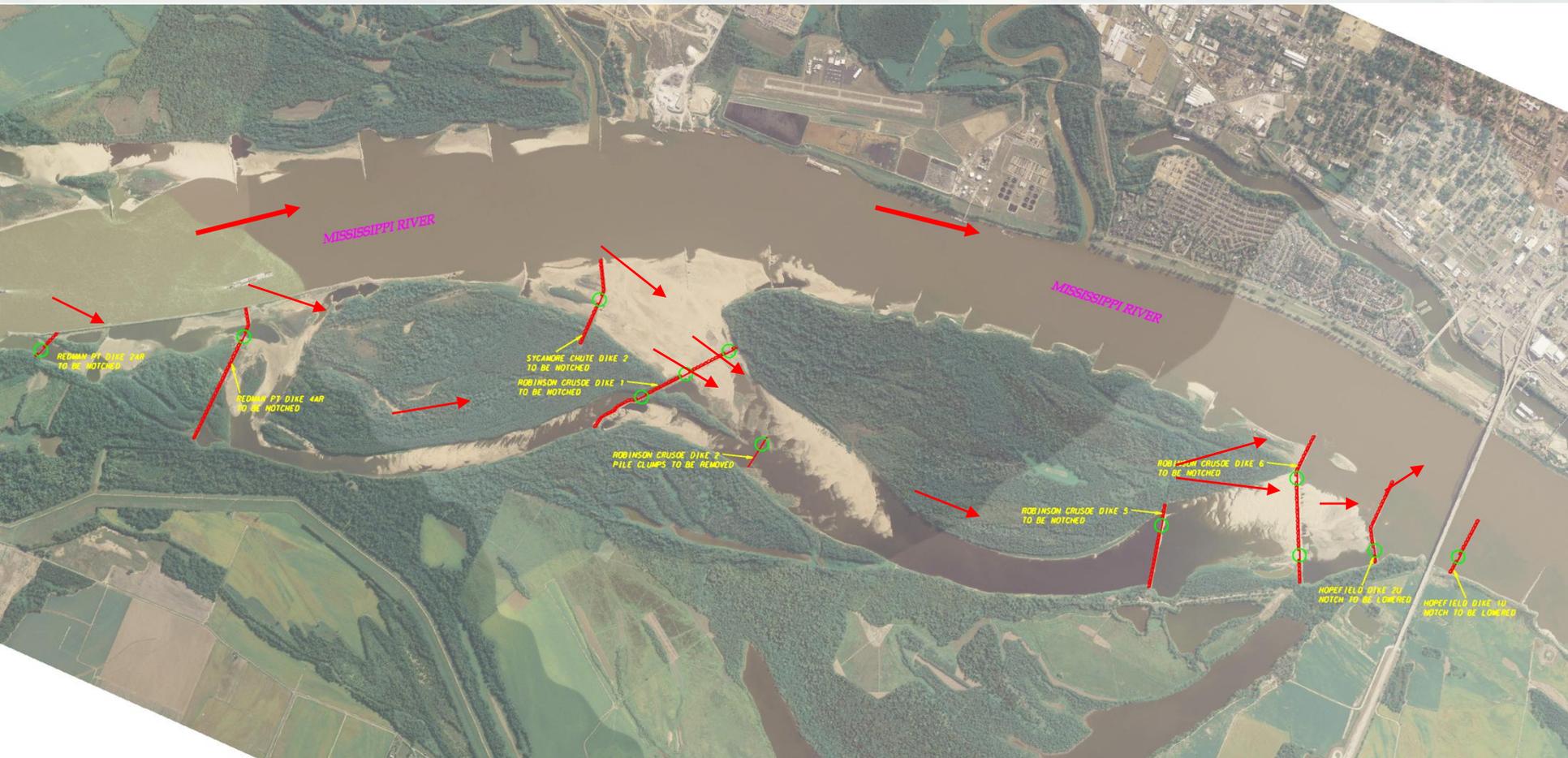


Upper Mississippi River Training Structures: Chevrons



River Bendway Weirs

Example EWN Solutions



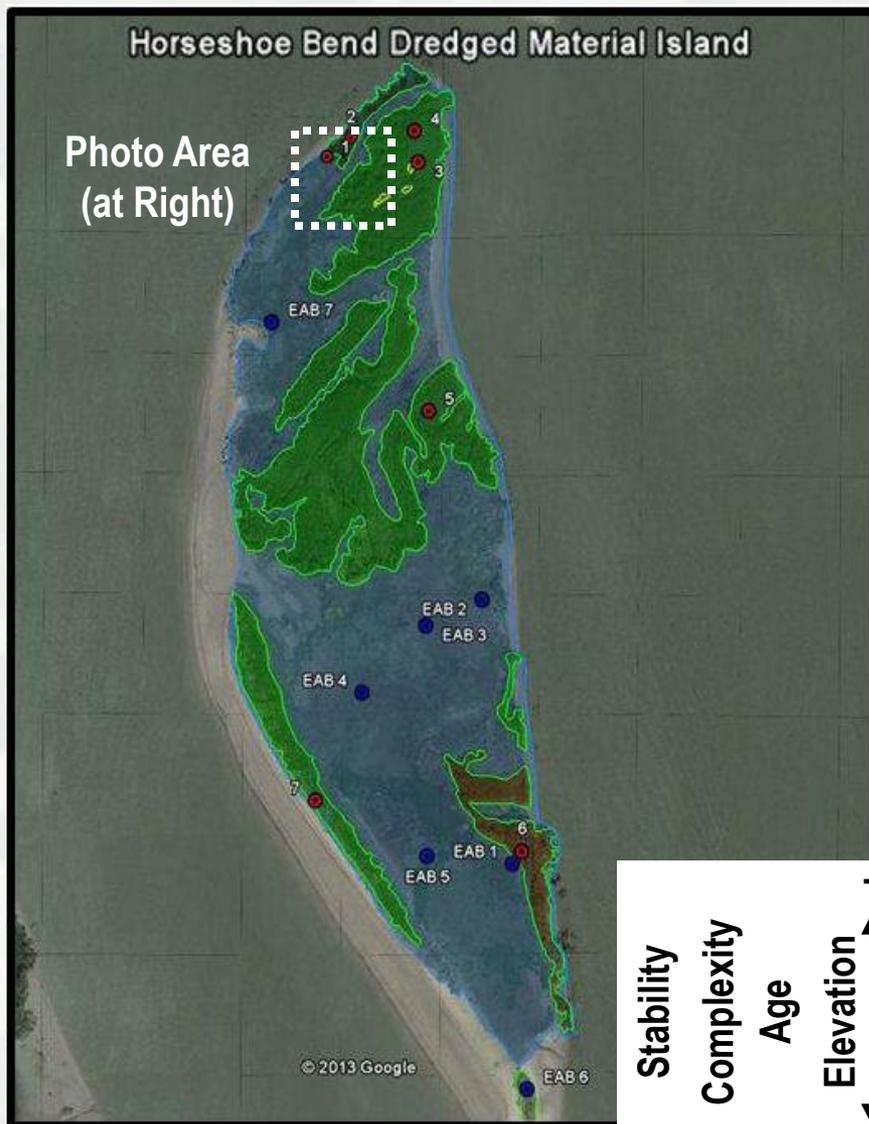
Loosahatchie Bar
Aquatic Habitat Rehabilitation



Atchafalaya River, Horseshoe Bend



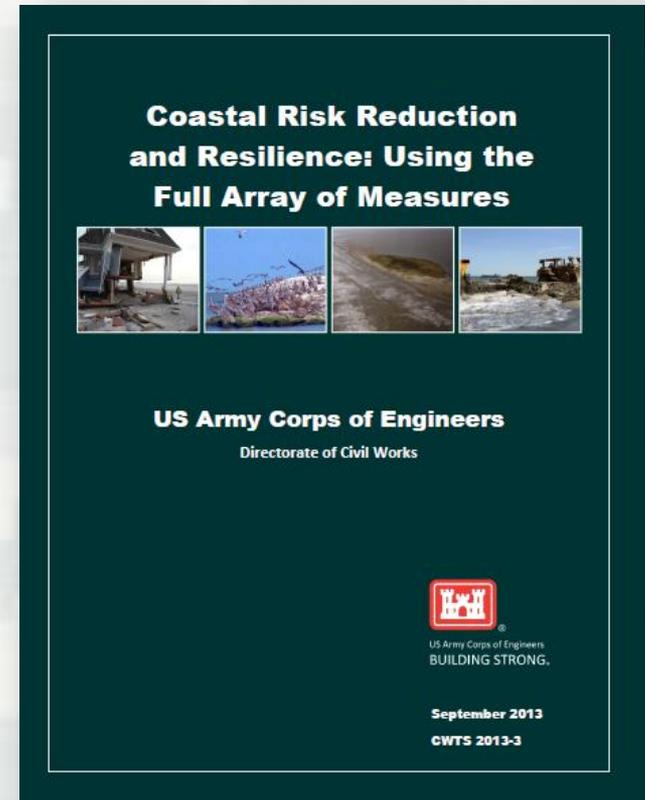
Habitat Classification



- Stability
Complexity
Age
Elevation
- +
-
-  Mature Forested & Scrub-Shrub Wetlands
 -  Young Forested & Scrub-Shrub Wetlands
 -  Emergent Wetland Transition Zone
 -  Aquatic Bed Features

Systems: Coastal Risk Reduction and Resilience

“The USACE planning approach supports an **integrated approach** to reducing coastal risks and increasing human and ecosystem community resilience through a combination of **natural, nature-based, non-structural and structural measures**. This approach considers the engineering attributes of the component features and the dependencies and interactions among these features over both the short- and long-term. It also considers the **full range of environmental and social benefits** produced by the component features.”



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

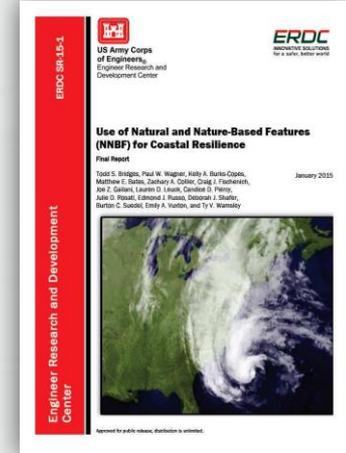
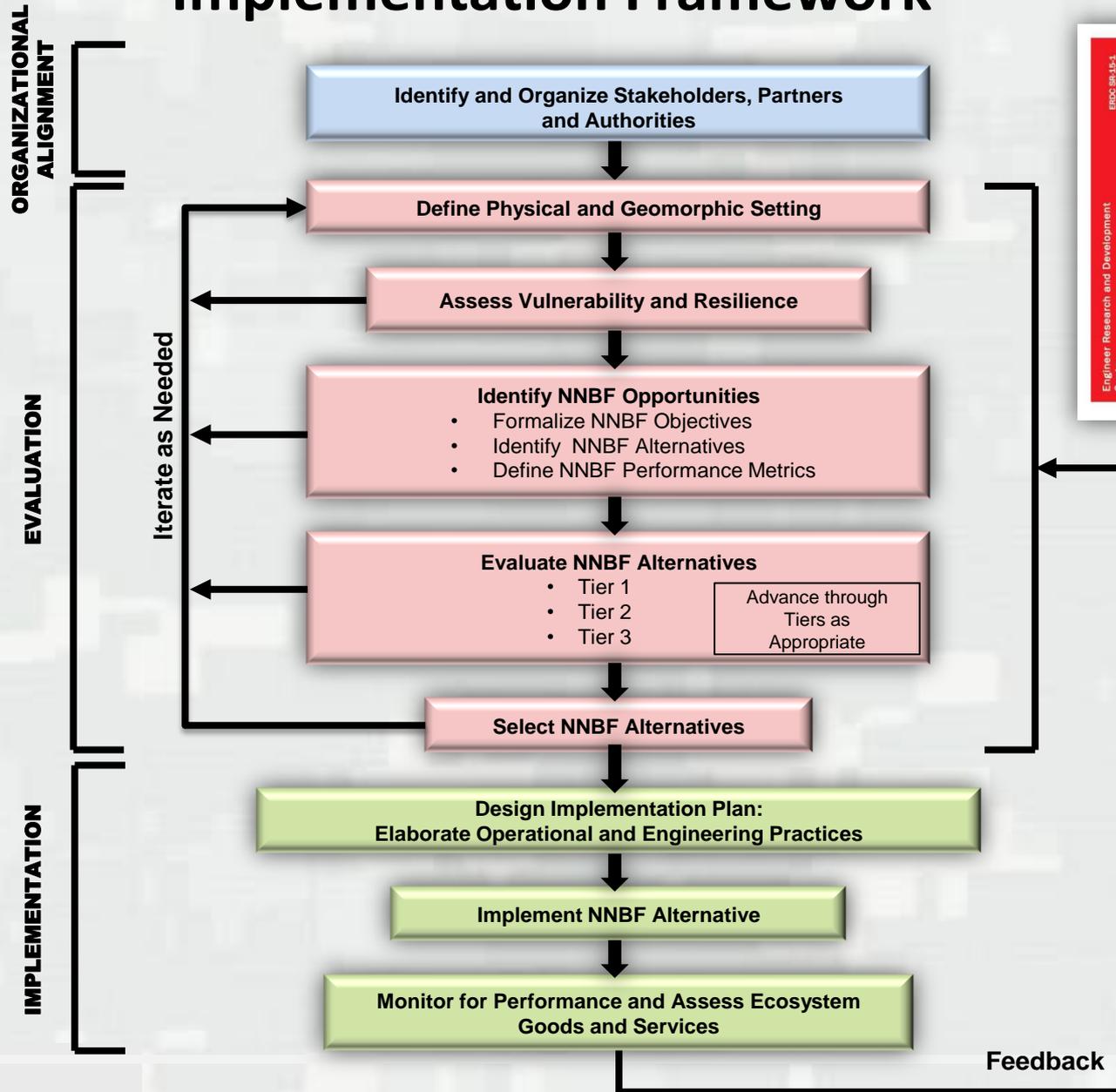
Benefits/Processes

- Wave attenuation and/or dissipation
- Shoreline erosion stabilization
- Soil retention

Performance Factors

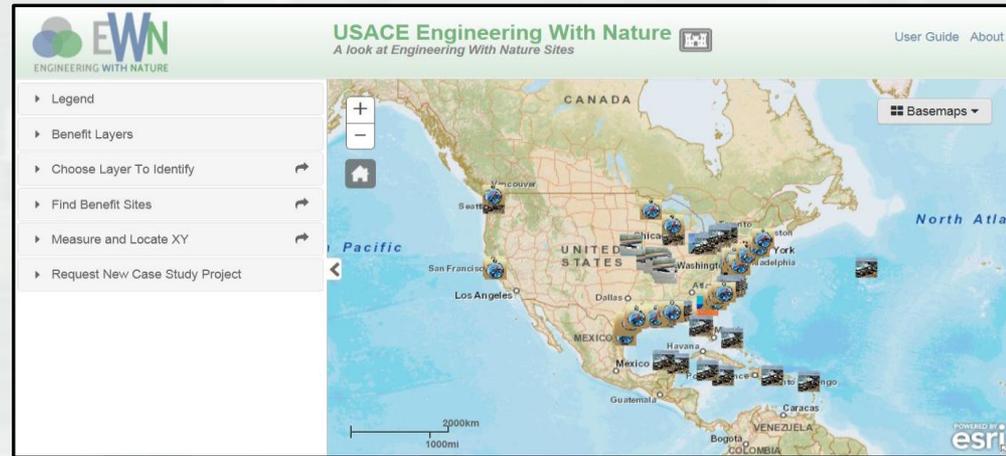
- Vegetation height and density
- Forest dimension
- Sediment composition
- Platform elevation

Natural and Nature-Based Features Evaluation and Implementation Framework



EWN Project Mapping Tool (EWN ProMap)

- Online GIS database of projects illustrating EWN principles and practices
 - ▶ Illustrating the key elements of EWN
- Currently contains ~175 projects
 - ▶ Name
 - ▶ Manager/Owner
 - ▶ Description
 - ▶ Infrastructure association e.g., jetty, breakwater, channel
 - ▶ Benefits e.g., fish habitat, bird habitat, recreation
 - ▶ Links, reports, photos
- Designed to facilitate communication about opportunities, lessons learned, and good practices
- Projects examples can be added through a process of self-nomination and independent evaluation



<http://gis2.sam.usace.army.mil/applications/opj/v013/>

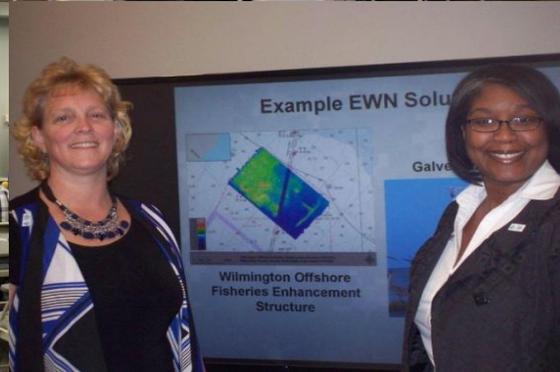
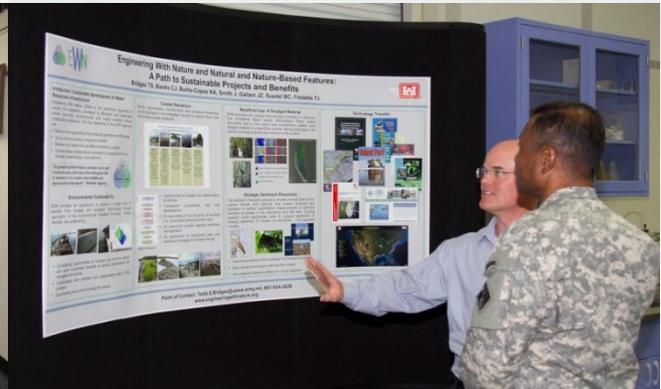


EWN Status

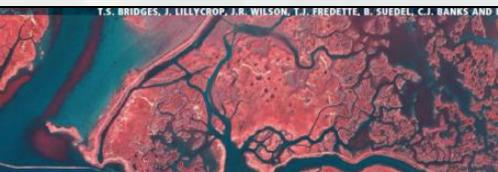
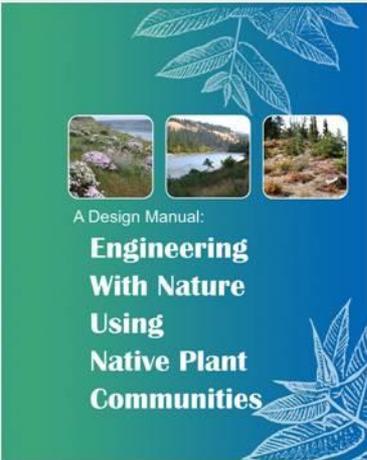
- *Engineering With Nature* initiative started within USACE Civil Works program in 2010. Over that period we have:
 - ▶ Engaged across USACE Districts (23), Divisions, HQ; other agencies, NGOs, academia, private sector, international collaborators
 - Workshops (>20), dialogue sessions, project development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



Engagement



Publications and Recognition



"ENGINEERING WITH NATURE" PROMOTES TRIPLE-WIN OUTCOMES

ABSTRACT

The US Army Corps of Engineers' "Engineering With Nature" (EWN) initiative supports sustainable development of infrastructure by advancing technical and communication practices in order to intentionally align natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaborative processes. The tools and projects that have been developed through EWN support planning, engineering, and operational practices that beneficially integrate engineering and natural systems to produce more socially acceptable, economically viable, and environmentally sustainable projects.

The EWN initiative's focus on developing practical methods provides an achievable path toward an ecosystem approach to navigation infrastructure development. By combining sound science and engineering with advanced communication practices, the EWN initiative is providing a robust foundation for collaborative project development. Engineering With Nature is being pursued through innovative research, field demonstrations, communicating lessons learned, and active engagement with field practitioners across a wide range of organizations. The objectives of EWN are consistent with those communicated in the

"Working with Nature" philosophy of the World Association for Waterborne Transport Infrastructure (PIANC) and the "Building with Nature" initiative of EcoDelta Foundation, a public-private knowledge institute in the Netherlands.

INTRODUCTION

Pursuing the objective of sustainable development of navigation infrastructure must meet both challenges and opportunities for the US Army Corps of Engineers (USACE). Advancing best practices will involve identifying the practical actions that can be taken to better align and integrate engineering and natural systems to produce more socially acceptable, economically viable and environmentally sustainable projects. Engineering With Nature (EWN) is a USACE initiative that supports more sustainable practices, projects, and outcomes by working to intentionally align natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes (see engineering with nature figure 1). The EWN initiative's focus on developing practical methods provides an achievable path toward an ecosystem approach to navigation infrastructure development. By combining sound science and engineering with advanced communication practices, the EWN initiative is providing a robust foundation for collaborative project development. Engineering With Nature is being pursued through innovative research, field demonstrations, communicating lessons learned, and active engagement with field practitioners across a wide range of organizations. The objectives of EWN are consistent with those communicated in the



Dedicated to the USA, Host Country of PIANC's AGA 2014 and the 33rd PIANC World Congress

ERDC environmental research supports USACE

By Dr. Beth Fleming
Director, Environmental Laboratory
U.S. Army Engineer Research and Development Center

ERDC's scientific expertise in environmental research and risk and decision analysis is unique within the Army and Department of Defense. We are committed to sharing the application of these capabilities in a relevant way and demonstrating the environmental impact, risk, benefits and sustainability of our work initiatives. These capabilities are the focus of this column. Environmental Life Cycle Assessment is an early initiative that will provide a comprehensive view of the environmental impacts from the environmental life cycle assessment of Army materials and products. Green Remediation Technologies is an initiative in the prototype phase that focuses on creating new habitat through targeted material placement, allowing more consistent inclusion in the decision process. The benefits of this important effort, the Army Environmental Lifecycle Material Acquisition and Costing, or ALMAnAC, include a scientifically defensible approach for determining the environmental risk increased confidence in anticipating product and technology impact with respect to environmental regulatory requirements, improved lifecycle safety, and enhanced sustainability of current and future fielded technologies.

For more on environmental LCA, contact Amy Borman, associate technical director for Environmental Quality/Innovation (EQI), at Amy.Borman@usace.army.mil. Green remediation technologies for munitions management. EQI researchers are working closely with the range community to test prototype green remediation technologies to reduce the concentration of munitions contaminants (MC) in the environment. These new tools will allow range managers increased flexibility in reconfiguring range impact areas and decrease the risk of exceeding environmental regulatory guidelines related to MC migration off-site in surface and ground water, as well as potential uptake into ecological systems.

Green remediation technologies allow range managers to address future contamination problems from changes in training scope and magnitude, assist remediation techniques on contaminated lands, and explore range management options to extend the life and sustainability of valuable impact areas.

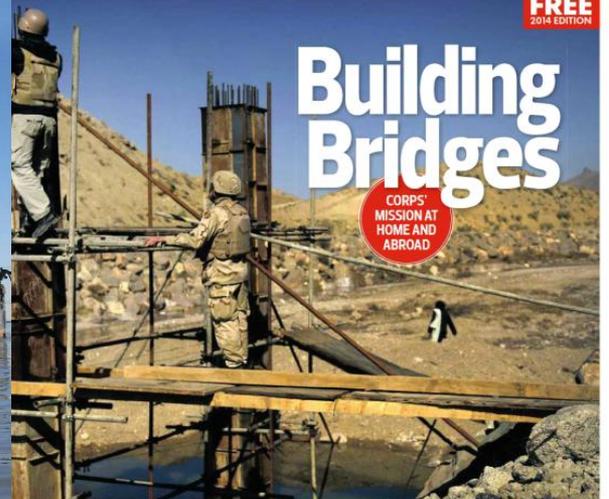
Examples of green remediation technologies include rapid revegetation using nitrogen polymer, responsive riprapable sediment traps - or range traps - to prevent migration of sediment flow, Research Department Explosive (RDX) and lead while better protecting surrounding bodies of water. Lead lead detectors that passively lead MC surface water contamination prior to coming off the impact area without impacting training and RDX in acid with high efficiency.



Supplement to Gannett Government Media Publications

SPECIAL EDITION U.S. ARMY CORPS OF ENGINEERS

FREE 2014 EDITION



USACE *Engineering With Nature* Across USACE

- Collaborating with NAP, LRE, SPN, MVN, on using sediment to enhance coastal resilience
- SWG and LRB serving as “proving grounds” for district-wide integration of EWN principles and practices



Reshape and elevate shoal areas
Lower areas are beach
Higher areas colonized or re-vegetated with vegetation for stability and erosion control



2013 EWN Action Demonstration Projects

- Sediment Retention Engineering to Facilitate Wetland Development (San Francisco Bay, CA)
- Realizing a Triple Win in the Desert: Systems-level Engineering With Nature on the Rio Grande (Albuquerque, NM)
- Atchafalaya River Island and Wetlands Creation Through Strategic Sediment Placement (Morgan City, LA)
- Portfolio Framework to Quantify Beneficial Use of Dredged Material (New Orleans and New England)
- Engineering Tern Habitat into the Ashtabula Breakwater (Ashtabula, OH)
- Living Shoreline Creation Through Beneficial Use of Dredged Material (Duluth, MN)
- A Sustainable Design Manual for Engineering With Nature Using Native Plant Communities



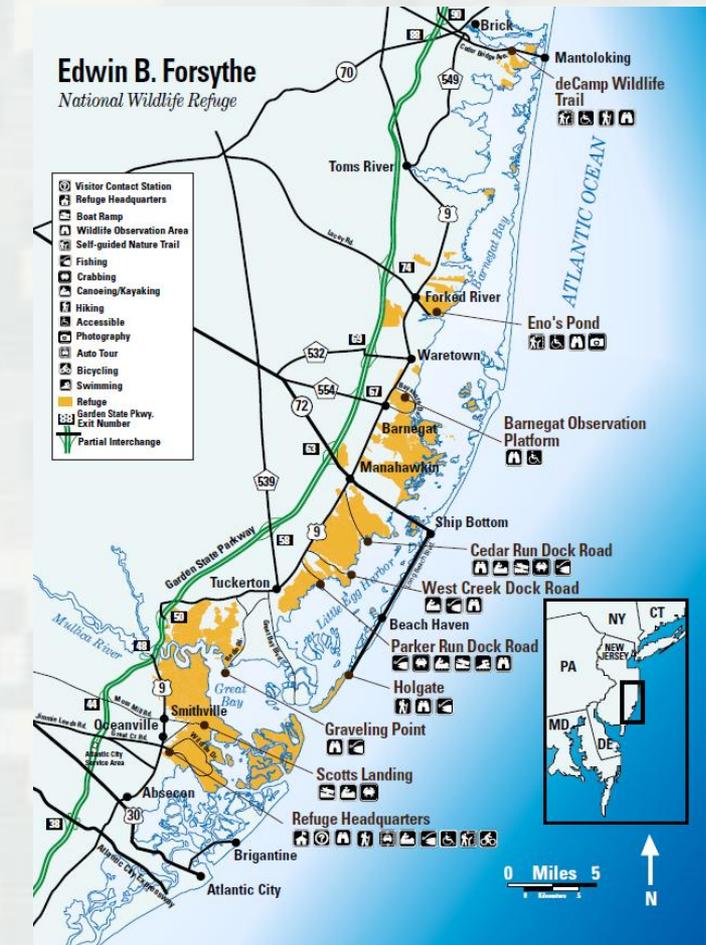
2014 EWN Action Demonstration Projects

- Landscape Evolution of the Oil Spill Mitigation Sand Berm in the Chandeleur Islands, Louisiana
- Guidelines for Planning, Design, Placement and Maintenance of Large Wood in Rivers: Restoring Process and Function (Collaboration with BoR)
- The Use and Value of Levee Setbacks in Support of Flood Risk Management, Navigation and Environmental Services (a strategy document)
- Strategic Placement of Sediment for Engineering and Environmental Benefit (an initial guide to opportunities and practices)



Forsythe National Wildlife Refuge

- Forsythe NWR:
>40,000 acres of wetlands and other habitat
- Objective: Enhance resilience through engineering and restoration
- Means: Apply EWN principles and practices



Collaboration with USFWS on EWN and Endangered Species Act

- USACE spends \$300M per year on ESA compliance
- Combining ESA 7(a)(1) authority with EWN presents opportunity to reduce time and cost, while increasing benefits for species conservation



Engagement with NGOs

- National Wildlife Federation
 - ▶ Use of EWN for conservation and NNBF
- Environmental Defense Fund
 - ▶ Coastal resilience investment
- The Nature Conservancy
 - ▶ Science for Nature and People (SNAP)- Integrating Natural Defenses into Coastal Disaster Risk Reduction
- National Fish and Wildlife Foundation
 - ▶ “Building Ecological Solutions to Coastal Community Hazards”
 - Collaboration with NJDEP, NWF, USACE, Sustainable Jersey, NJ Sea Grant Consortium



www.engineeringwithnature.org



2014/2015 EWN-Sponsored Workshops

- Regional Sediment Management and Engineering With Nature Inland Working Meeting; 29 April – 1 May 2014; Omaha, NE
- Coastal Resilience: The Environment, Infrastructure and Human Systems; 21-23 May 2014; New Orleans, LA (partnered with USEPA and USDOE)
- Working with Nature in Navigating the New Millennium; 1 June 2014, San Francisco, CA (in association with the 33rd PIANC World Congress)
- Flood Risk Management and Engineering With Nature Collaborative Meeting; 10-11 June 2014; Vicksburg, MS
- EWN in Water Operations; 31 March – 1 April 2015; Vicksburg, MS



Creating Value by Engineering With Nature

- Value arguments resonate
 - ▶ Must take assertive control of the dialogue
- Correcting the hyper-focus on risk is achieved by giving more attention to compensating benefits
 - ▶ ...Not by giving more attention to risk
- There are potentially valuable allies in “unlikely” places
- Our projects have the potential to produce multiple benefit streams, but you have to claim them!

