

# Engineering With Nature



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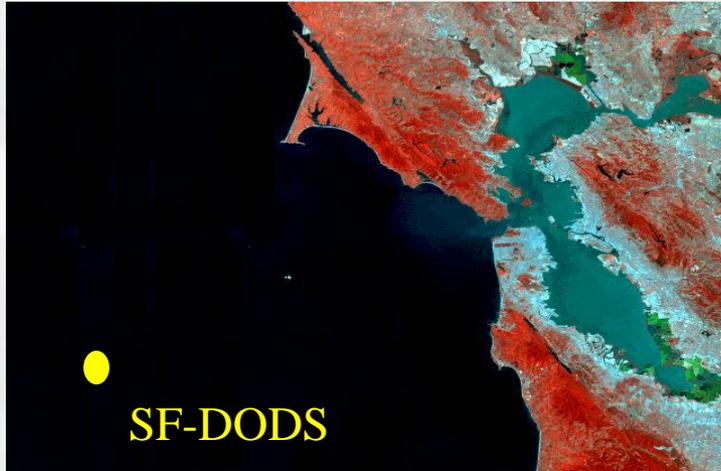


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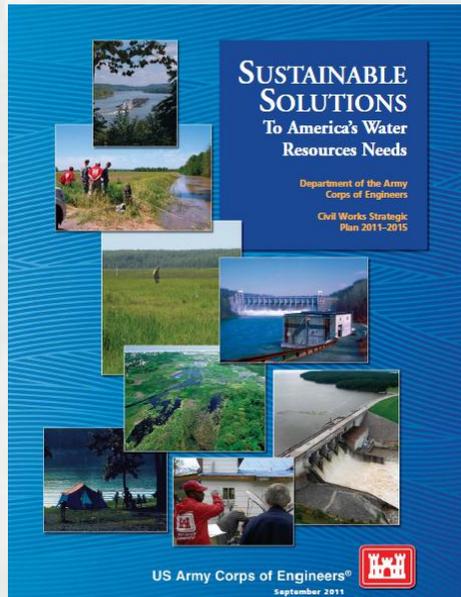


# Moving Beyond the *Status Quo*



## Needs:

- Efficient, cost effective engineering and operational practices
- More collaboration and cooperation, less unproductive conflict.
  - ▶ Ports, commercial interests, regulators, NGOs, and others
- Sustainable projects. Triple-win outcomes integrating social, environmental and economic objectives.



Sustainable Solutions Vision: "Contribute to the strength of the Nation through innovative and environmentally sustainable solutions to the Nation's water resources challenges."

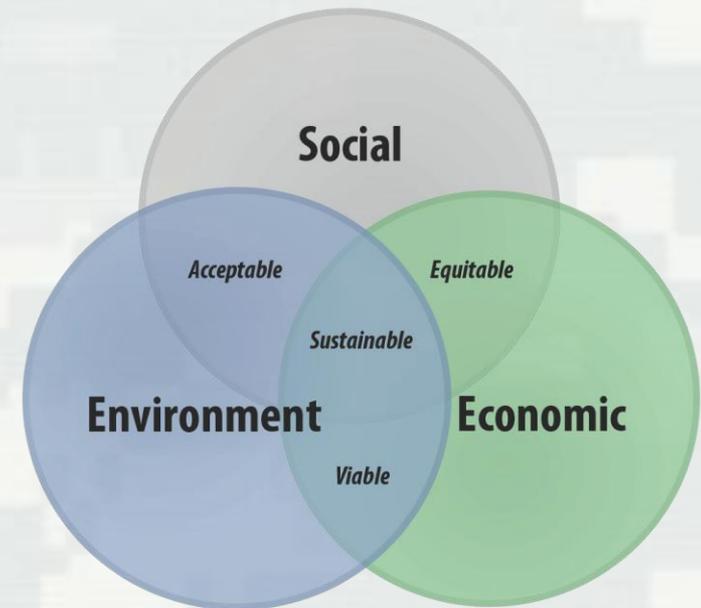


# Engineering With Nature...

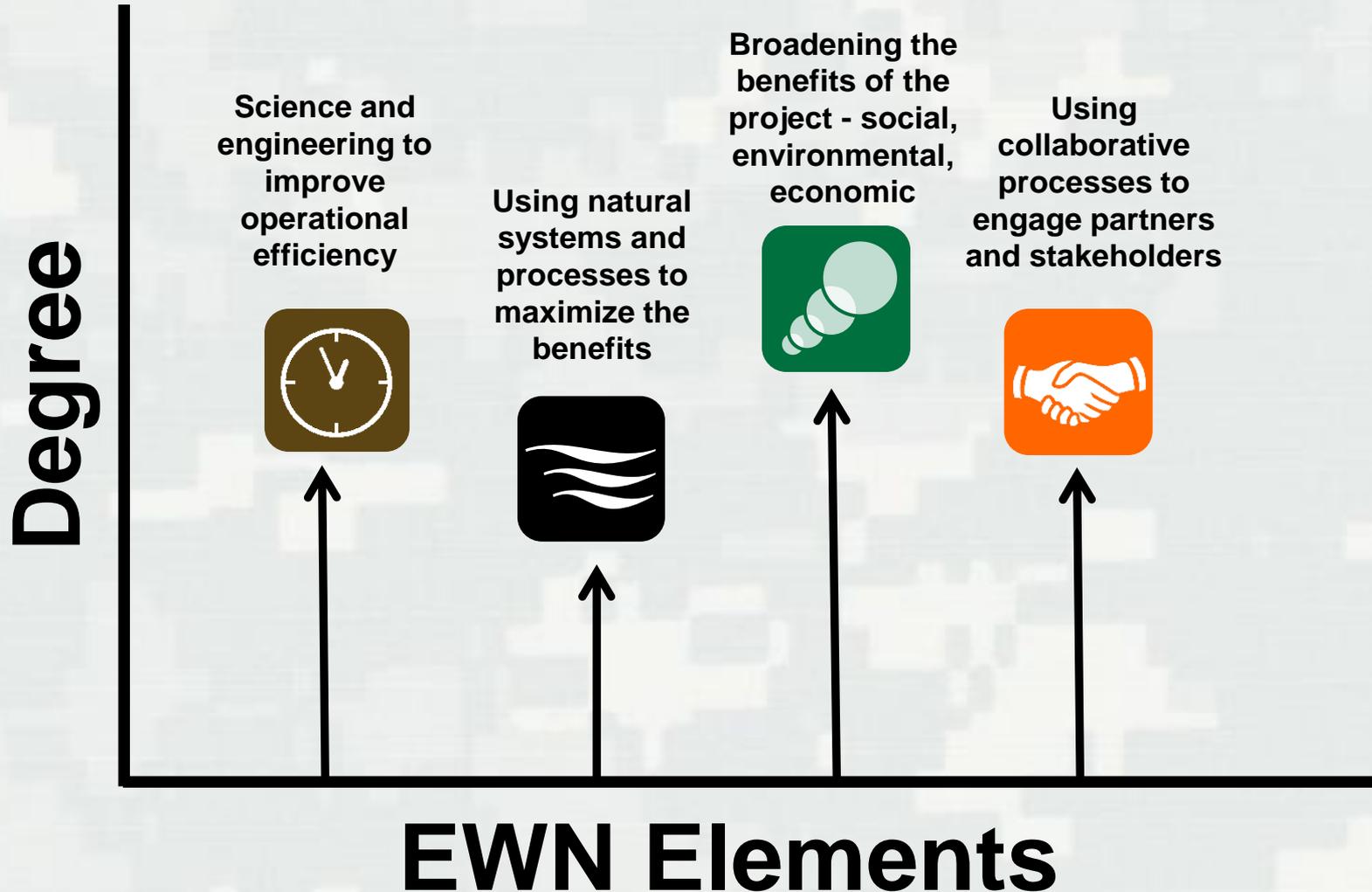
*...the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.*

## 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

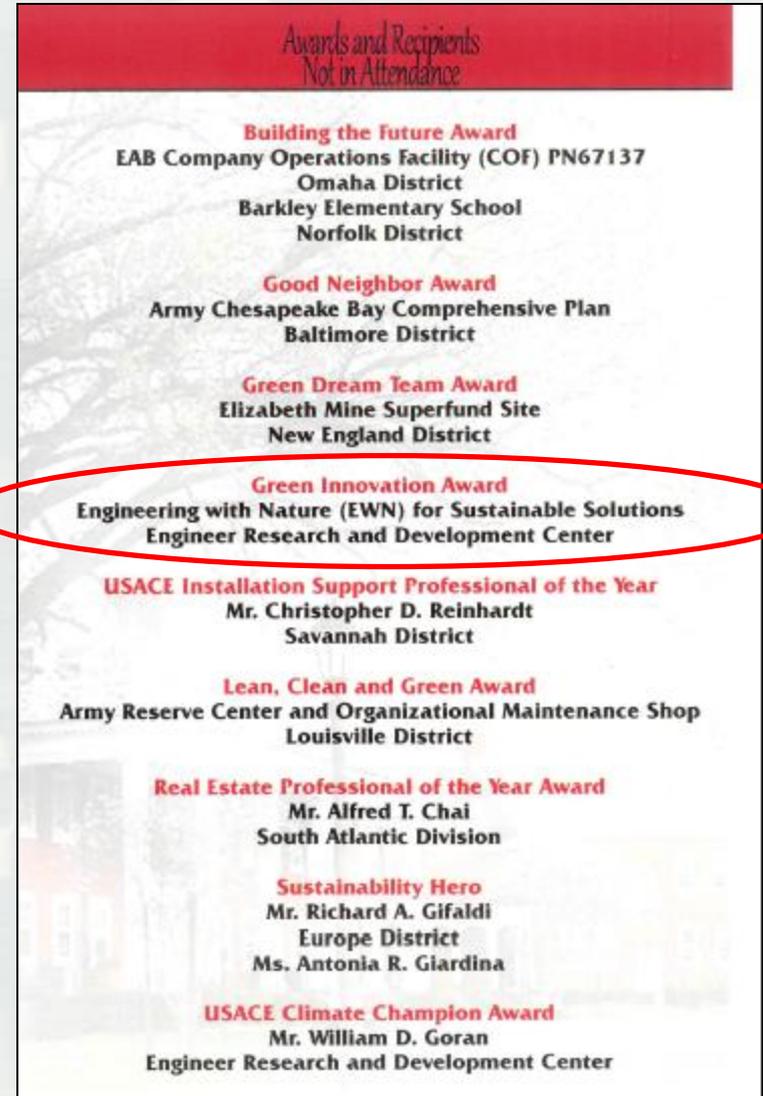
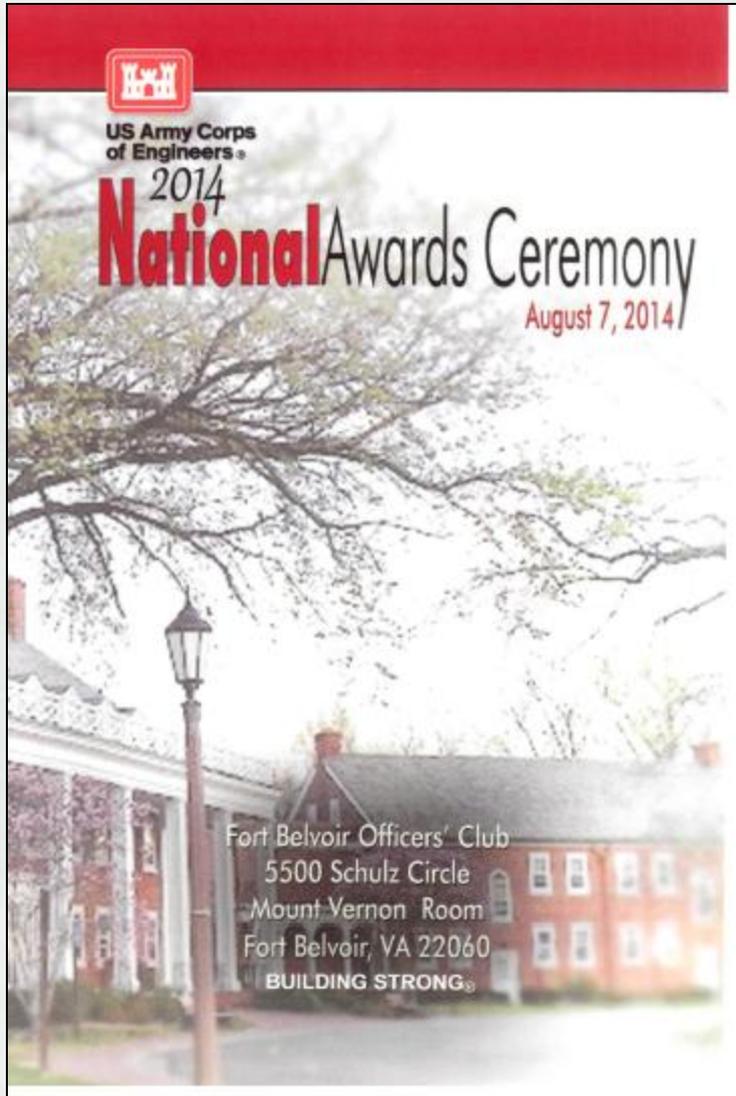


# EWN Status

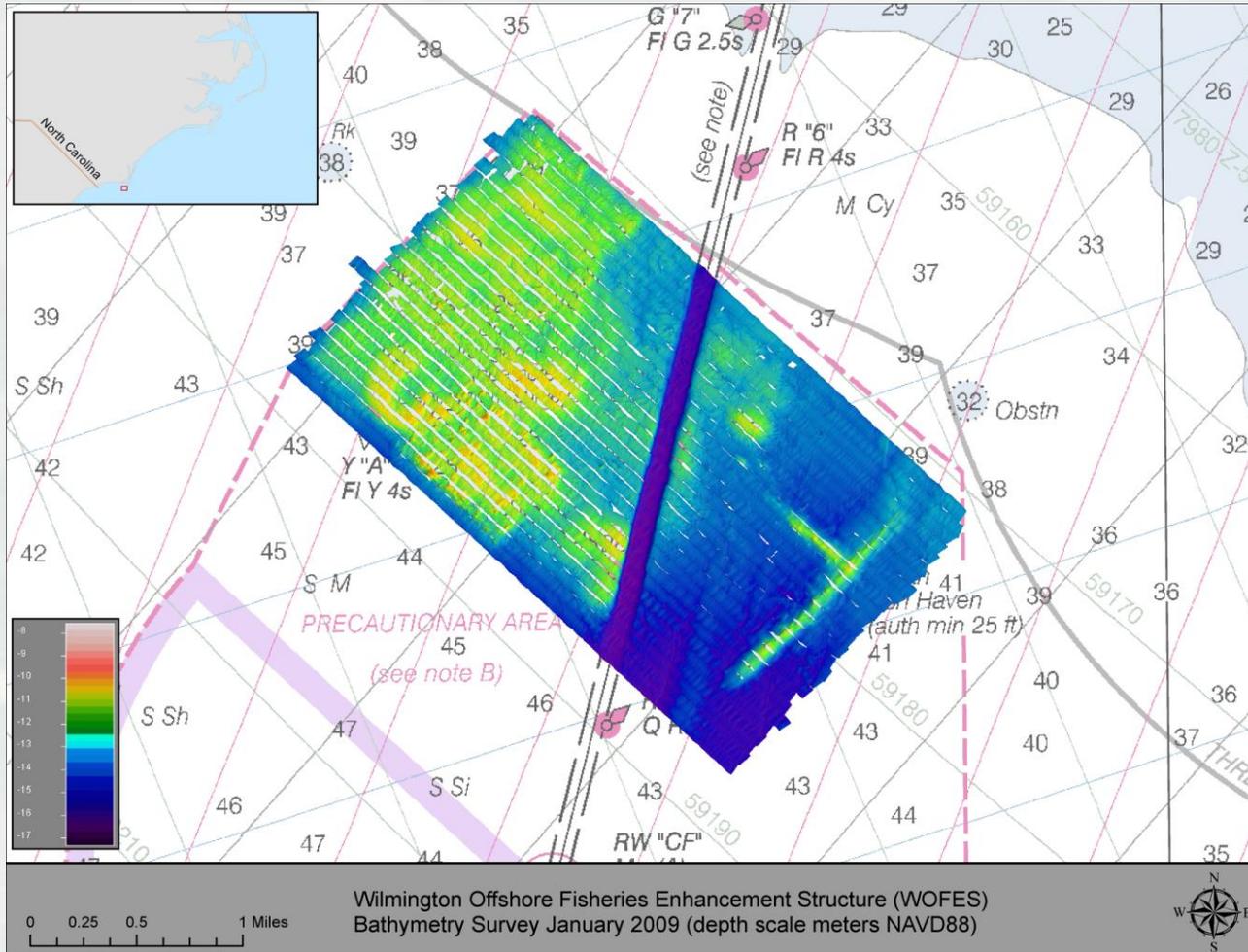
- *Engineering With Nature* initiative started within USACE Civil Works program in 2010. Over that period we have:
  - ▶ Engaged across USACE Districts (23), Divisions, HQ; other agencies, NGOs, academia, private sector, international collaborators
    - Workshops (>20), dialogue sessions, project development 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



# 2014 Green Innovation Award for Engineering With Nature



# Example EWN Solutions



## Wilmington Offshore Fisheries Enhancement Structure

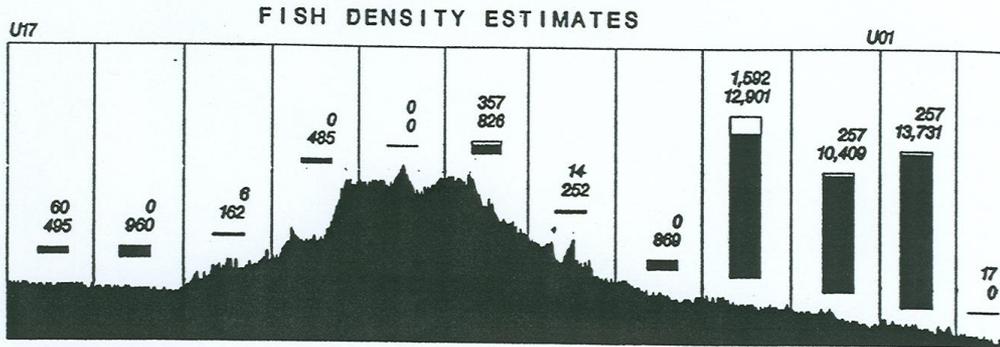
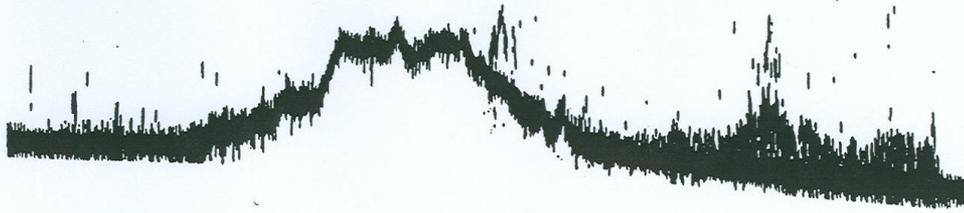


# Example EWN Solutions

## Ashtabula Breakwater Tern Habitat



# Example EWN Solutions

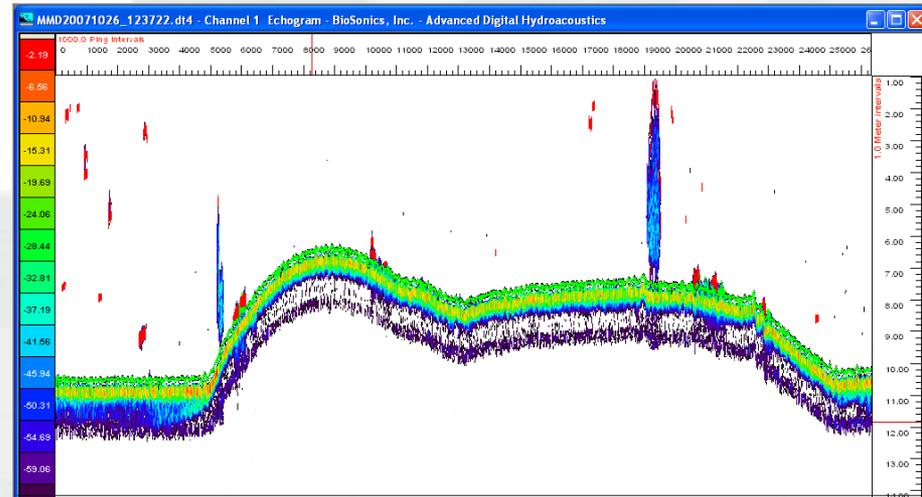


## LEGEND

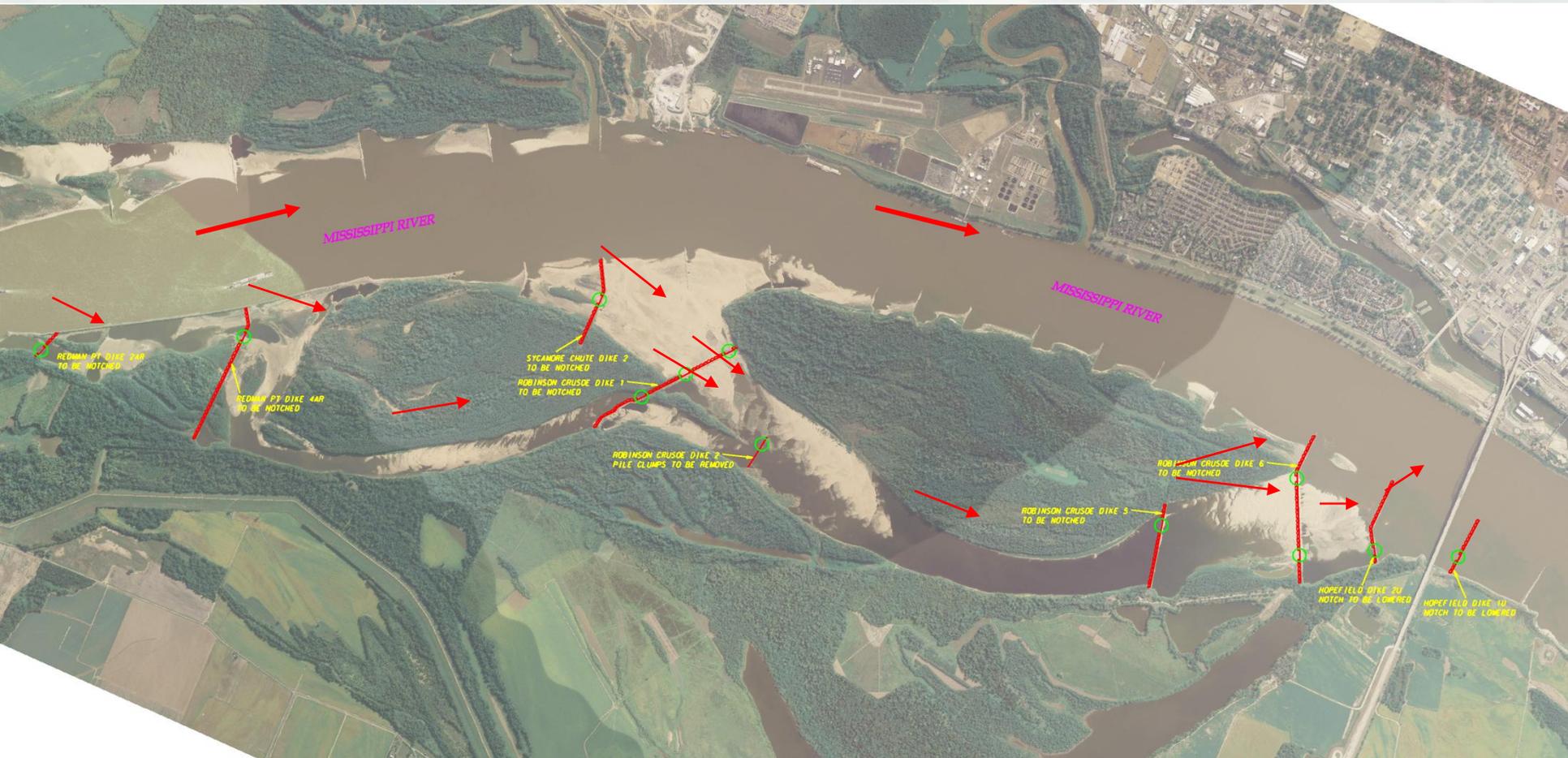
- xxxx Density Of Mid-column Fish
- yyyy Density Of Bottom Fish
-  Histogram Of Fish Density in fish per hectare

Hydroacoustics and trawling data used to document fisheries benefits provided by topographic relief created with dredged material

## Mobile Offshore Dredged Material Mound



# Example EWN Solutions



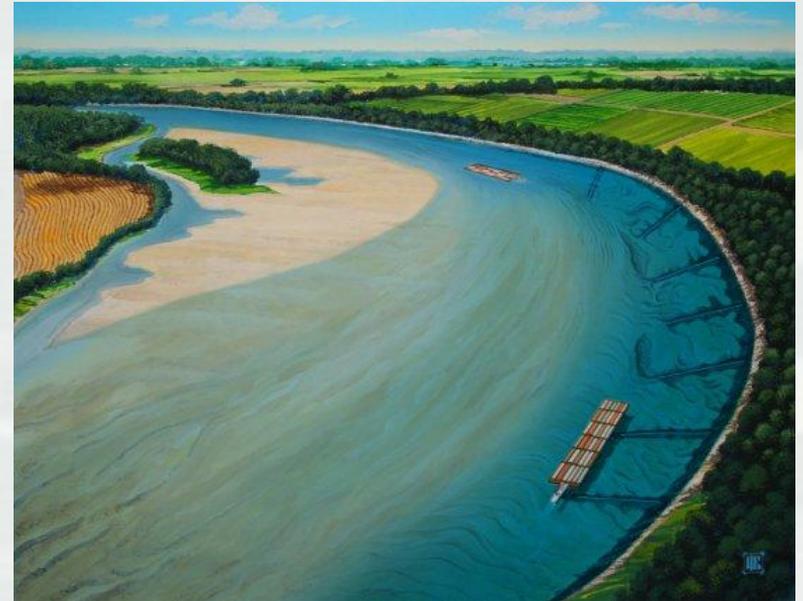
Loosahatchie Bar  
Aquatic Habitat Rehabilitation



# Example EWN Solutions



**Upper Mississippi River Training Structures: Chevrons**

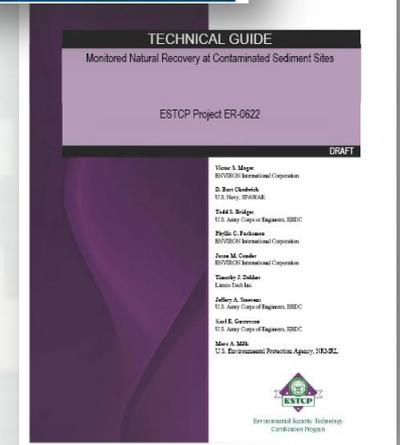


**River Bendway Weirs**



# Monitored Natural Recovery

- Natural processes will operate at all sites, influencing:
  - Chemical transformation
  - Contaminant mobility and bioavailability
  - Physical separation of contaminant and receptor
  - Dispersion
- What additional engineering is needed to bring about acceptable risk reduction?
- Opportunities to combine chemical risk reduction with habitat creation

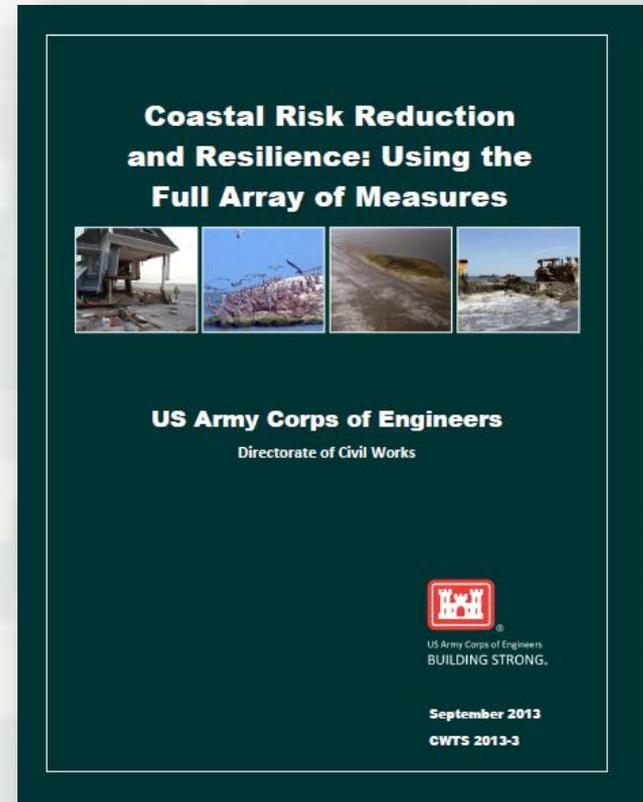


DoD 2009 *Technical guide: Monitored natural recovery at contaminated sediment sites.* ESTCP-ER-0622.

<http://www.epa.gov/superfund/health/conmedia/sediment/documents.htm>

# 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

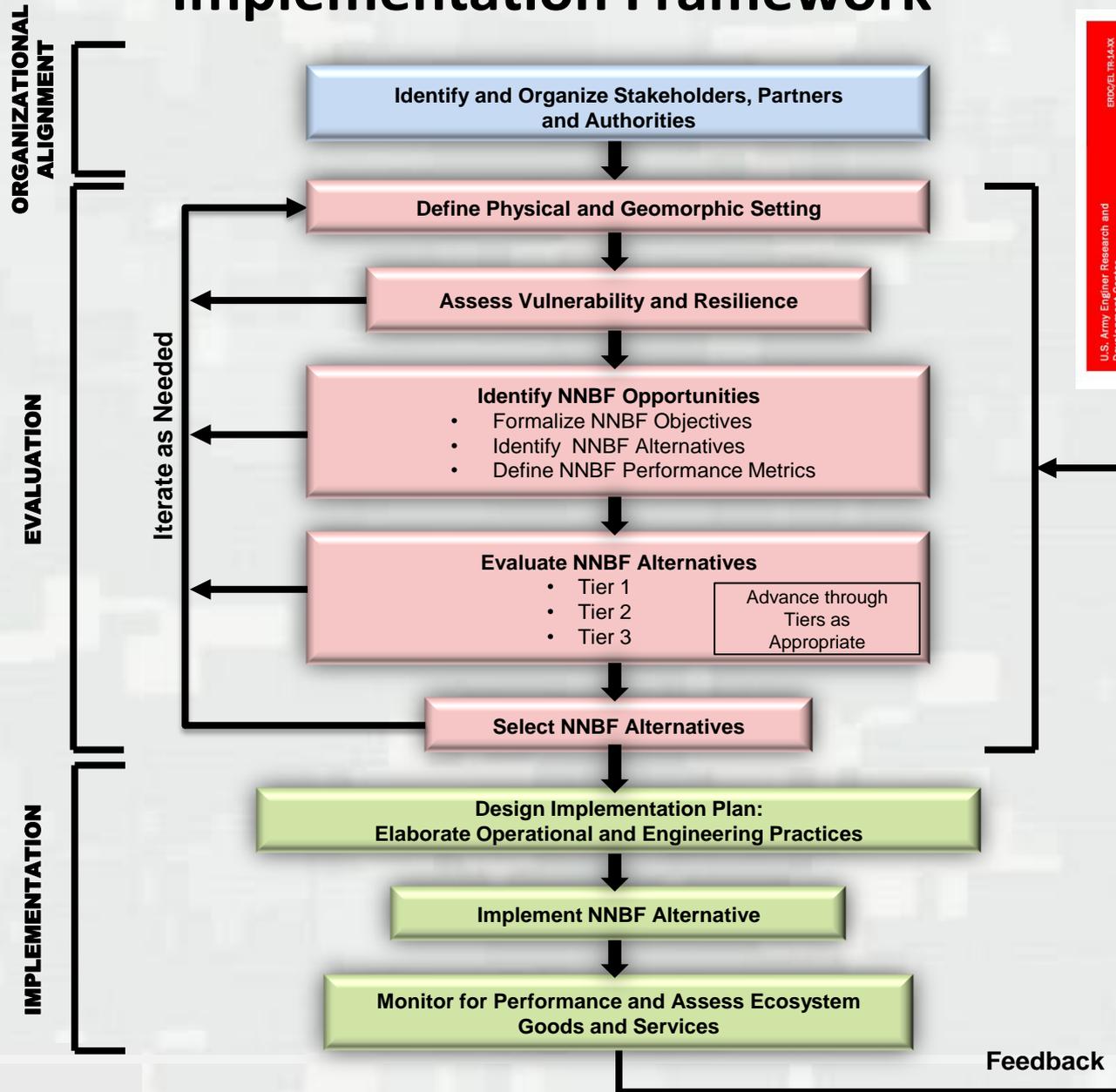
#### Benefits/Processes

- 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



# 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)



# 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

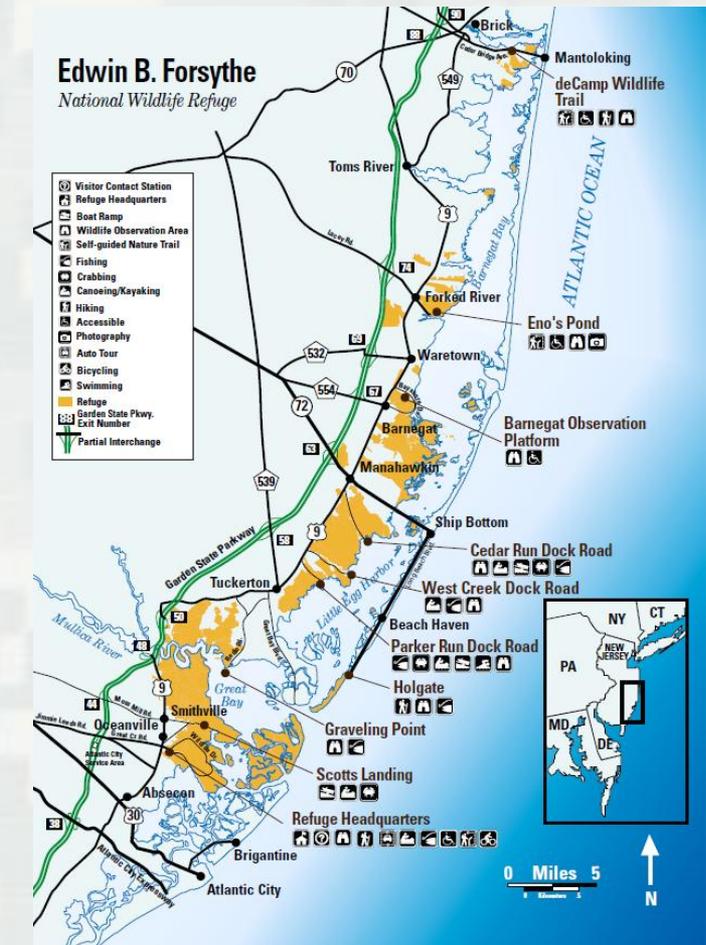


Reshape and elevate shoal areas  
Lower areas are beach  
Higher areas colonized or re-vegetated with vegetation for stability and erosion control



# 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](http://www.engineeringwithnature.org)



# 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
  - ▶ “The enemy of my enemy is my friend”
- Our projects have the potential to produce multiple benefit streams, but we have to claim them!

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