Engineering With Nature

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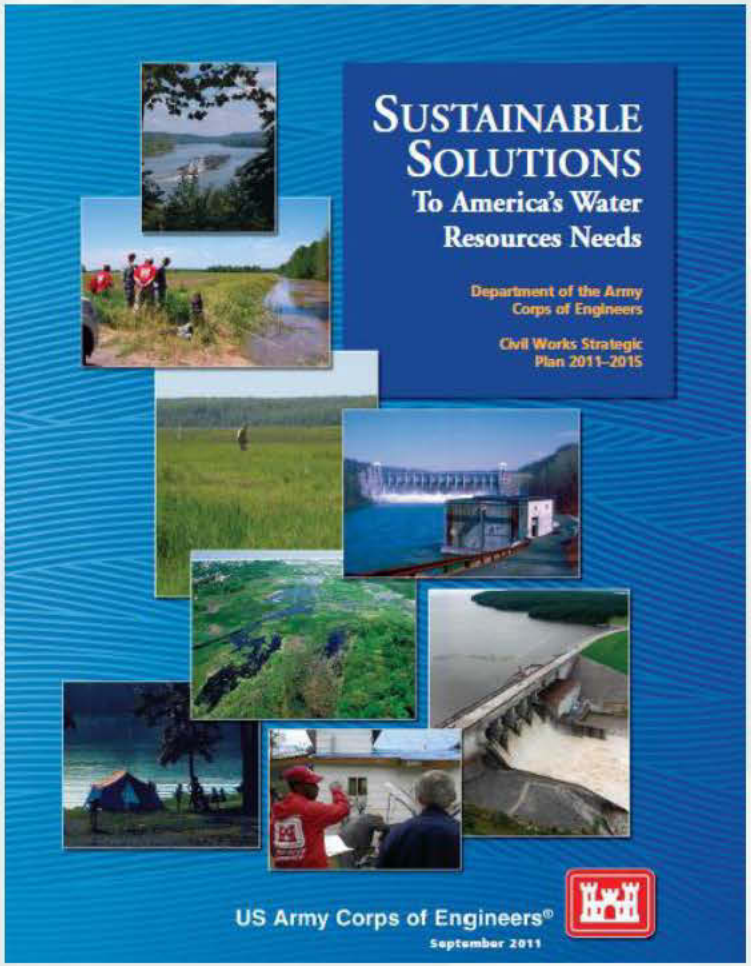
US Army Corps of Engineers
BUILDING STRONG®

The USACE
Civil Works Strategic Plan
Sustainable Solutions to America's Water Resources Needs

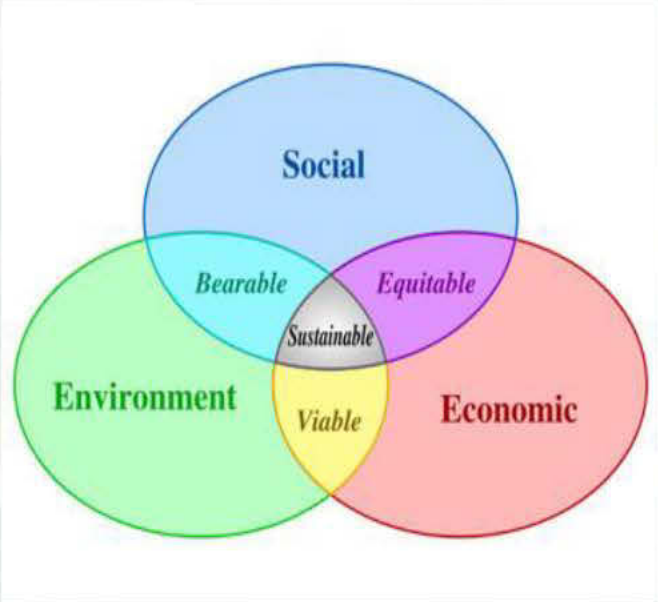
- Vision: "Contribute to the strength of the Nation through innovative and environmentally sustainable solutions to the Nation's water resources challenges."

- The goals established by this strategy are to:
  - Assist in providing for safe and resilient communities and infrastructure.
  - Help facilitate commercial navigation in an environmentally and economically sustainable fashion.
  - Restore degraded aquatic ecosystems and prevent future environmental losses.
  - Implement effective, reliable, and adaptive life-cycle performance management of infrastructure.
  - Build and sustain a high quality, highly dedicated workforce.



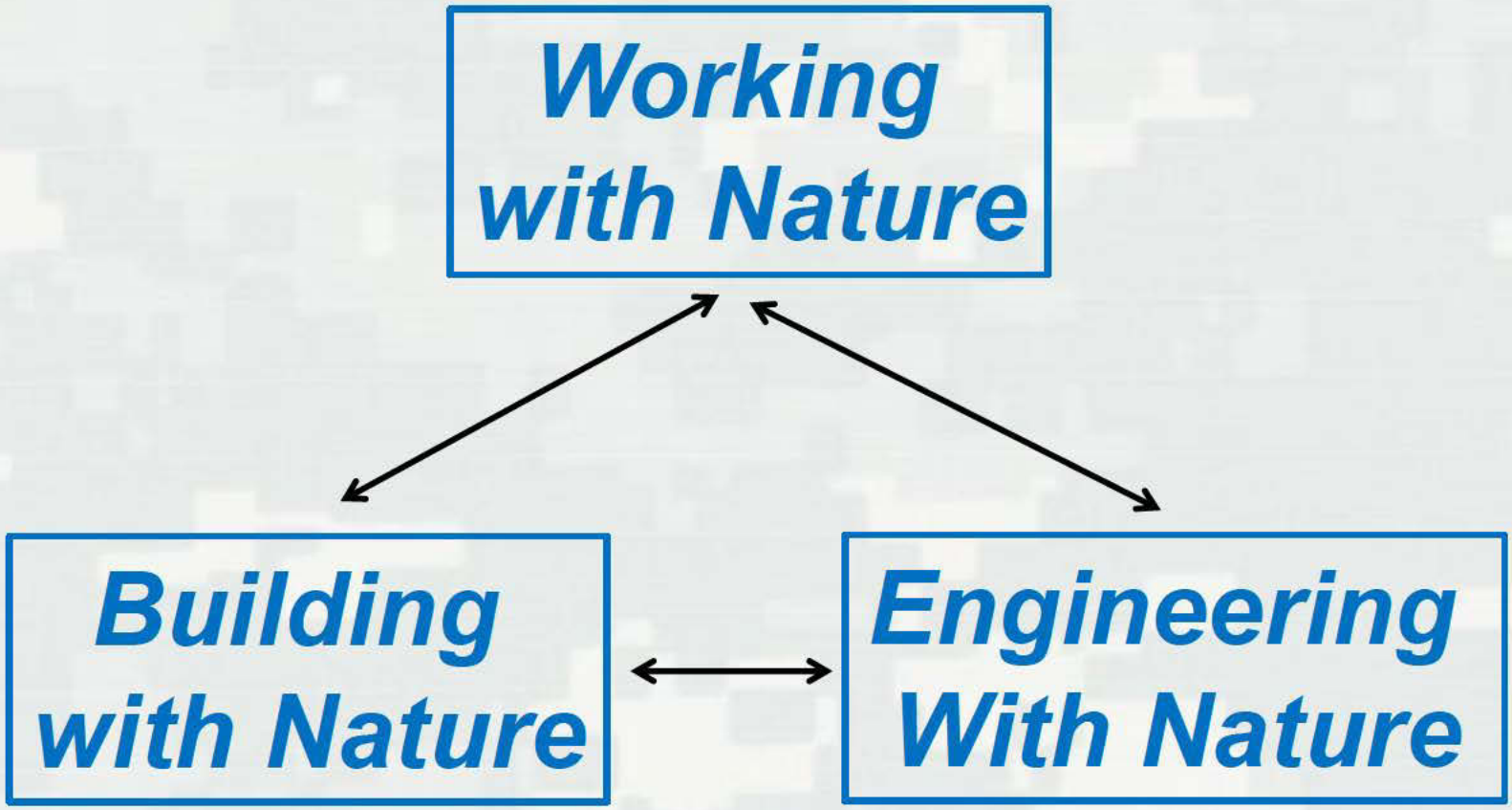
The Challenge
The Status Quo is Not An Option

- USACE needs an efficient, cost effective way to achieve its missions, while simultaneously producing economic, social and environmental benefits.
  - USACE infrastructure and operations are often viewed as being in conflict with environmental and social interests
- We need to do this in a way that fosters collaboration and cooperation with our partners and stakeholders – Ports, commercial interests, EPA, NOAA, FWS, NGOs and others…
- … While building respect and credibility for our program.



Definition

- *Engineering With Nature* is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits.


Working with Nature
Building with Nature
Engineering With Nature

Engineering With Nature
Guiding Principles

- *Engineering With Nature* is:
  - A holistic, ecosystem approach for planning, designing, constructing and operating projects.
  - Focused on the long-term sustainability of the project and it's benefits stream over time within the system.
  - Based on first understanding, then working deliberately with natural forces and processes to accomplish engineering goals.
  - Collaborative. It calls for effective stakeholder engagement from the initial stages of a project, through to completion.
  - Efficient and cost effective, reducing time and rework, while minimizing social friction.
  - Aligned with the values, interests and priorities of USACE, partners, stakeholders and society at large.
  - Provides a comprehensive framework and approach for pursuing effective beneficial use of dredged material
  - The right thing to do – socially, environmentally and economically.

Engineering With Nature:
The Progression

Inputs and Outputs
'Degree of'

System Resilience

Efficiency

Benefits Related to the Project

Outcomes

Inputs

Communications and Technology Transfer

Technical Understanding

Innovation and Creativity

Diversity of Skills and Expertise

Stakeholder Engagement

Business as Usual

Understanding Natural Processes

Aligning Processes

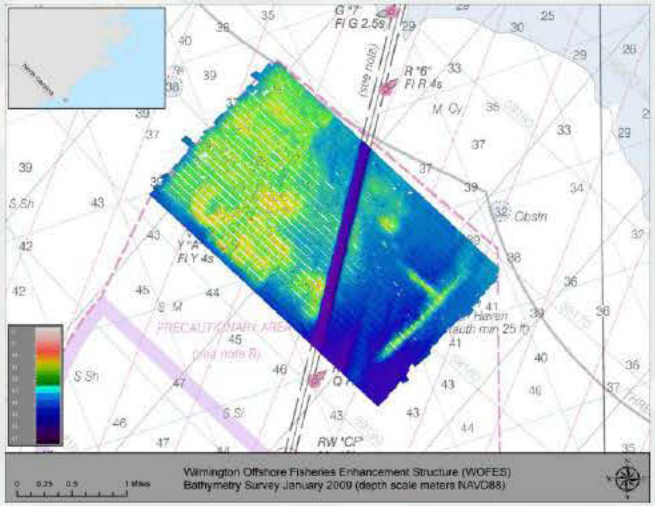
Expanding Benefits

Enabling Self-Sustaining Benefits

STAGES

Other EWN Examples

Poplar Island



Wilmington Offshore Fisheries Enhancement Structure

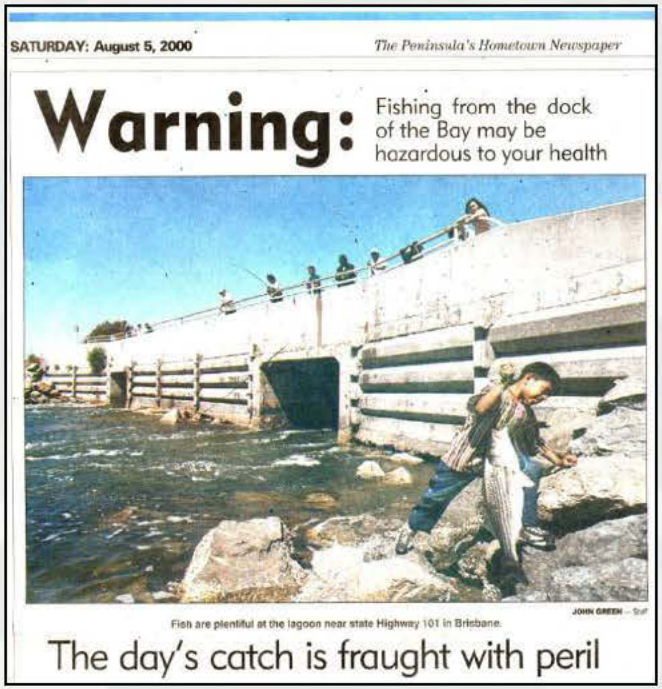
Photograph 2.12. A Series of Chevrons on the Mississippi River

Photograph 2.13. A Series of Chevrons Aligned To Split Flow Between the Main Channel and a Side Channel, While Protecting the Existing Shoreline

Upper Mississippi River Training Structures

Scope of Sediment Problem in US

- EPA 1997 sediment survey report concludes 1.2 billion yd^3 surficial sediment "pose potential risks"
- Cleanup programs
  - ~350 sediment sites in Superfund
    - ~ 30 megasites (> $50M)
- Navigation dredging
  - 250 M m^3 of sediment dredged annually in the US
  - Management costs for sediment range over 3 orders of magnitude



SATURDAY: August 5, 2000 — *The Peninsula's Hometown Newspaper*

Warning: Fishing from the dock of the Bay may be hazardous to your health

Fish are plentiful at the lagoon near state Highway 101 in Brisbane. JOHN GREEN – Staff

The day's catch is fraught with peril

Urban sites, the most challenging of all

- Broad mix of waterway uses
  - Industry
  - Commercial navigation
  - Recreation
- High spatial variability
  - Complex geometries
  - Abrupt transitions
- Multiple sources of contamination
  - Legacy of past industrial activity
  - Permitted industrial discharges
  - CSOs/SSOs

Conclusion: Ongoing sources and "recontamination" pose overarching challenges for remediation and restoration projects in urban settings.

The Technology Options

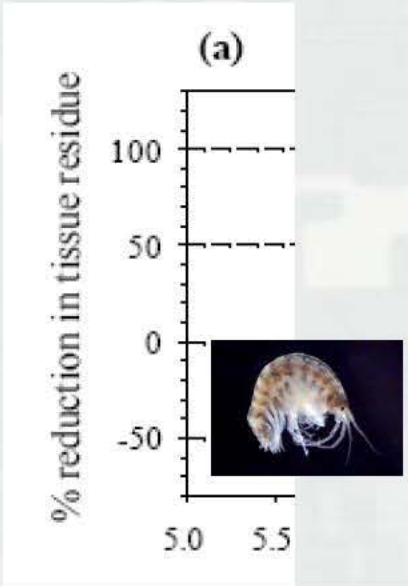
- *Ex situ* alternatives
  - Dredging
    - Containment
    - Treatment
- *In situ* alternatives
  - Monitored Natural Recovery (MNR)
  - Enhanced MNR
    - Which can include treatment
  - Capping

Monitored Natural Recovery

- Natural recovery processes will operate at all sites
  - Chemical transformation
  - Reduced contaminant mobility and bioavailability
  - Physical isolation
  - Dispersion
- What additional engineering is needed to bring about acceptable risk reduction?
- How to develop lines-of-evidence to support decisions

DoD 2009 *Technical guide: Monitored natural recovery at contaminated sediment sites.* ESTCP-ER-0622.
http://www.epa.gov/superfund/health/conmedia/sediment/documents.htm

Use of activated carbon to reduce bioavailability: Measured in terms of bioaccumulation



R. N. Millward, T. S. Bridges, U. Ghosh, R. J. R. Zimmerman ,G. Luthy. 2005. Addition of activated carbon to reduce PCB bioaccumulation by a polychaete (*Neanthes arenaceodentata*) and an amphipod (*Leptocheirus plumulosus*). *Environmental Science and Technology* 39:2880-2887.

Engineering With Nature
Path Forward

We will implement *Engineering With Nature* through a series of actions:

1. Establish the foundation of EWN using examples of “best-practice” projects from across USACE
2. Develop and execute a “Strategic Plan for EWN” to expand application within USACE and with our external partners and stakeholders
3. Demonstrate the EWN progression in future project case studies, communicating lessons learned and successes broadly
4. Focus R&D investments to expand technical and communication science needed to advance EWN
5. Establish leadership and partnerships on EWN through effective engagement and application