Engineering With Nature

Dr. Todd S. Bridges, ST

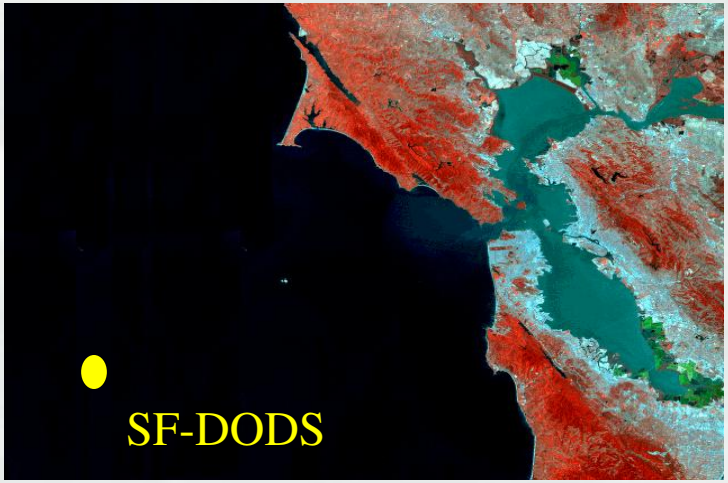
Senior Research Scientist, Environmental Science
Engineer Research and Development Center

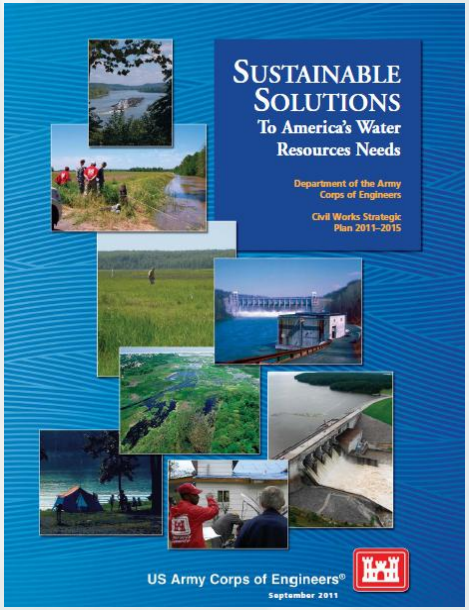
LRB Proving Ground Workshop
1-3 December 2014

todd.s.bridges@usace.army.mil

US Army Corps of Engineers
BUILDING STRONG®

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.

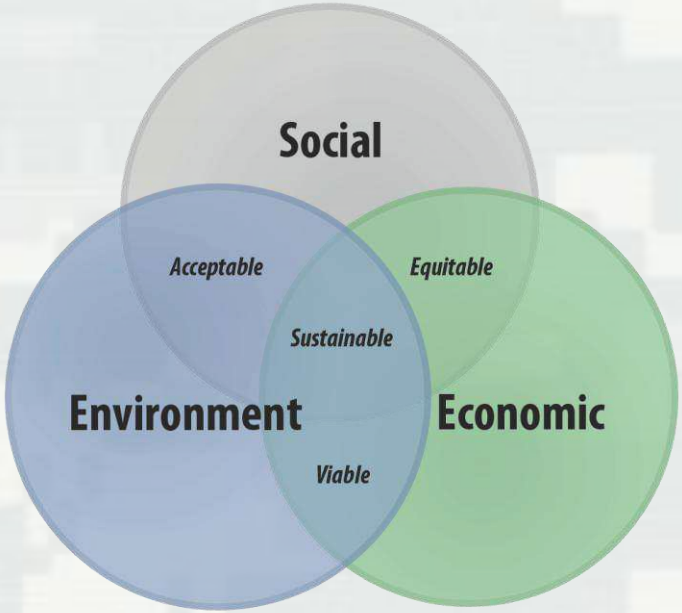
Sustainable Solutions Vision: "Contribute to the strength of the Nation through innovative and environmentally sustainable solutions to the Nation's water resources challenges."

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

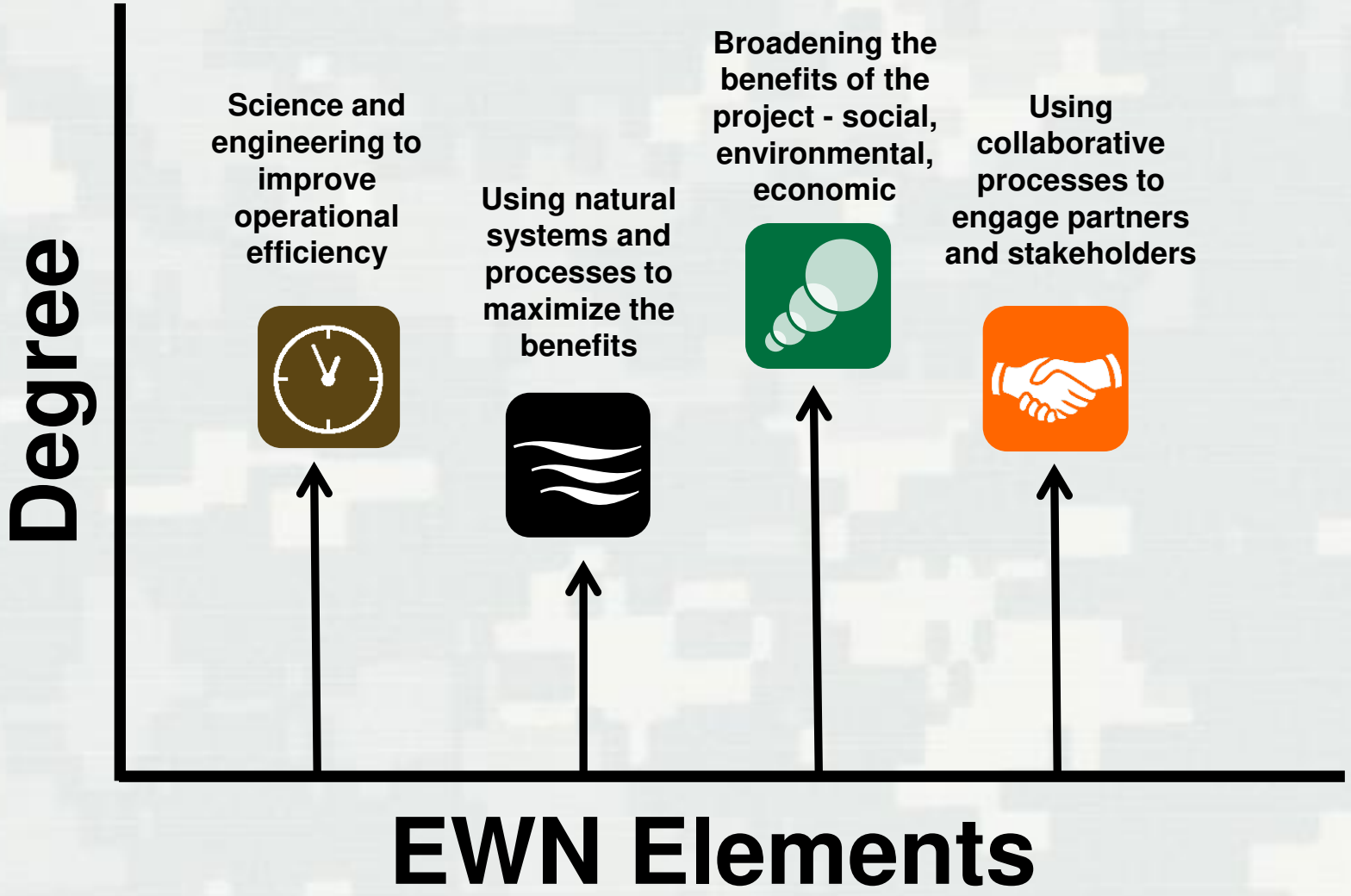
- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners



www.engineeringwithnature.org

Engineering With Nature

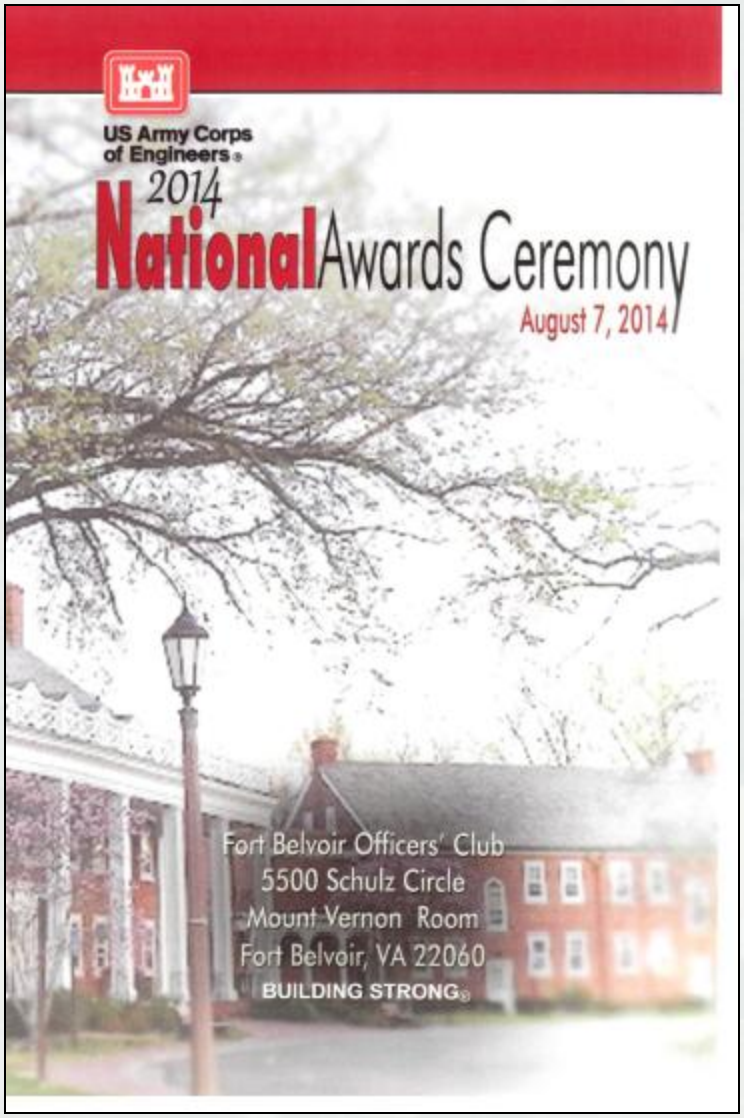
Elements



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



Awards and Recipients Not in Attendance

Building the Future Award
EAB Company Operations Facility (COF) PN67137
Omaha District
Barkley Elementary School
Norfolk District

Good Neighbor Award
Army Chesapeake Bay Comprehensive Plan
Baltimore District

Green Dream Team Award
Elizabeth Mine Superfund Site
New England District

Green Innovation Award
Engineering with Nature (EWN) for Sustainable Solutions
Engineer Research and Development Center

USACE Installation Support Professional of the Year
Mr. Christopher D. Reinhardt
Savannah District

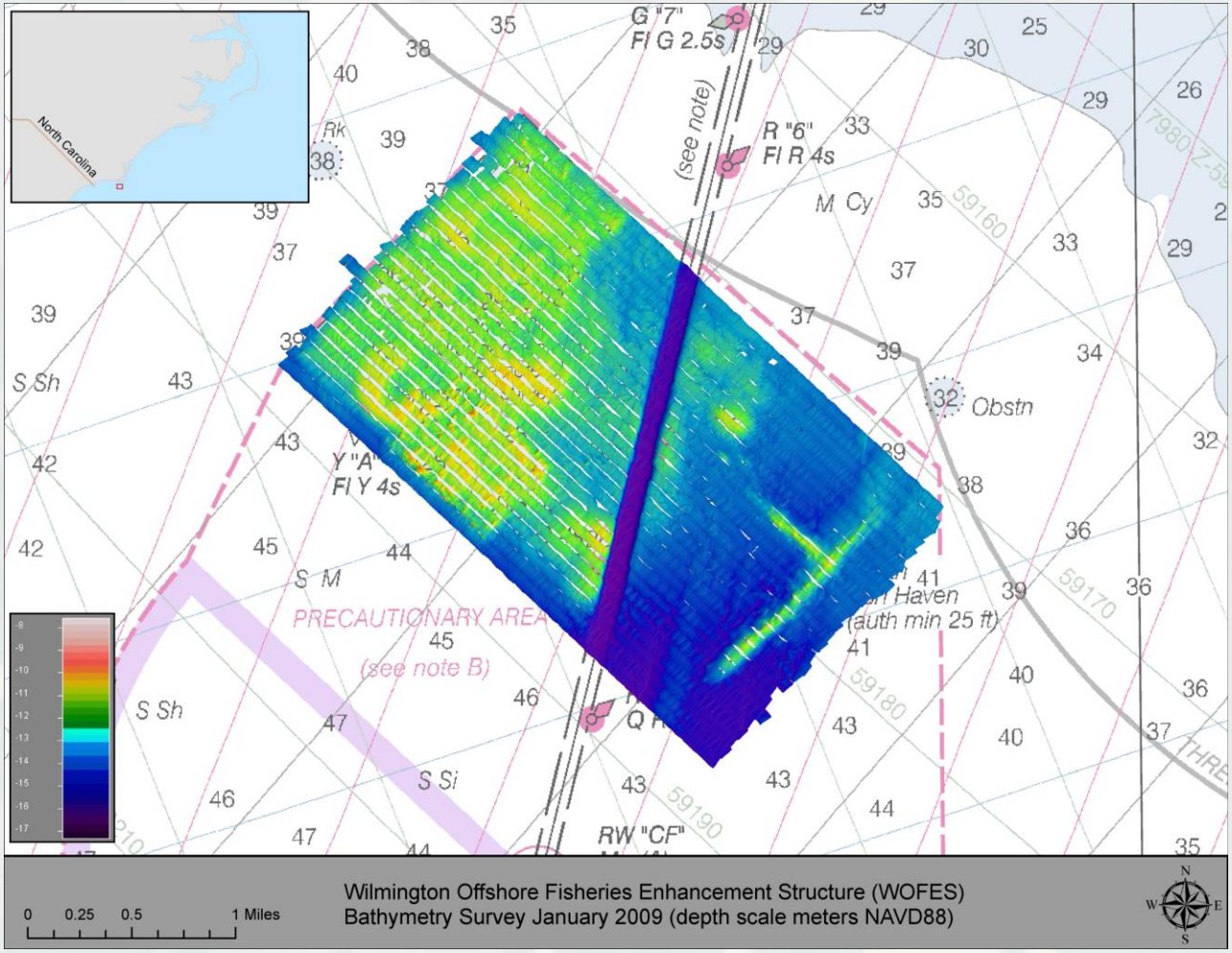
Lean, Clean and Green Award
Army Reserve Center and Organizational Maintenance Shop
Louisville District

Real Estate Professional of the Year Award
Mr. Alfred T. Chai
South Atlantic Division

Sustainability Hero
Mr. Richard A. Gifaldi
Europe District
Ms. Antonia R. Giardina

USACE Climate Champion Award
Mr. William D. Goran
Engineer Research and Development Center

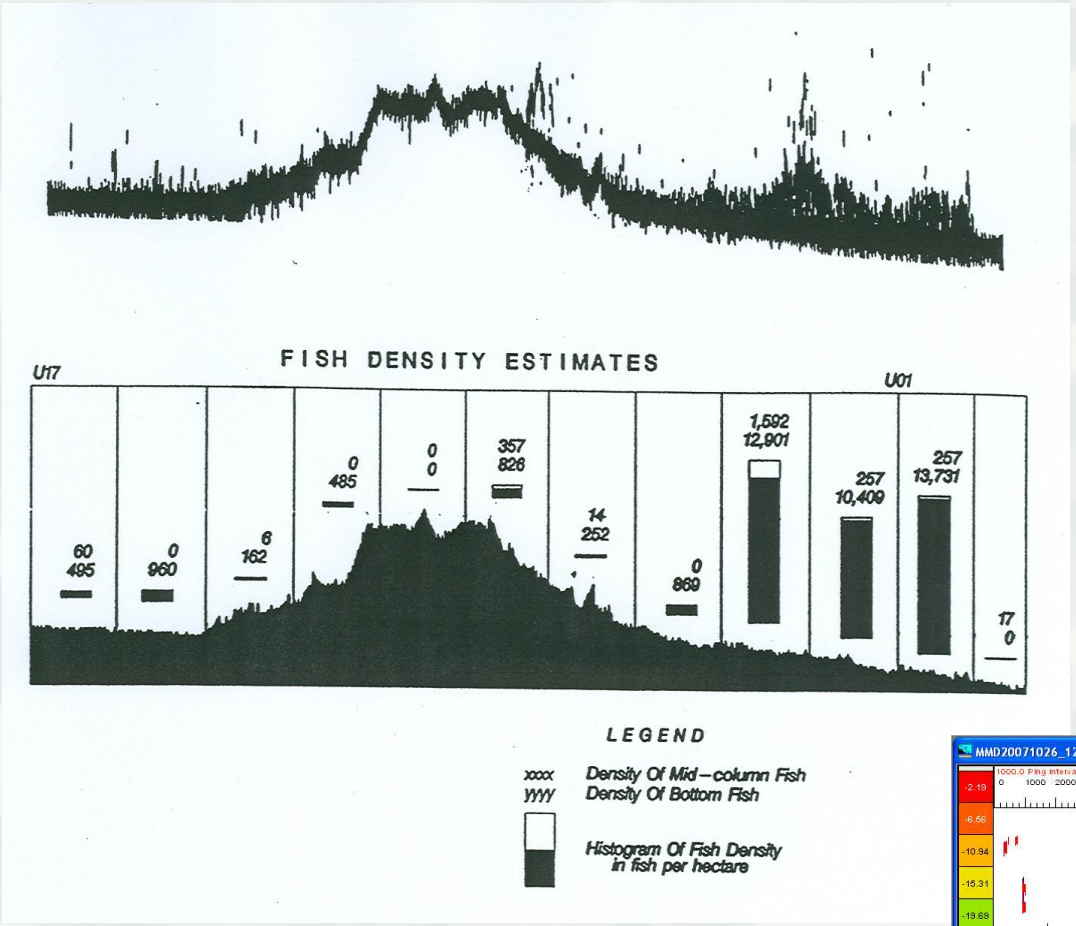
Example EWN Solutions



Wilmington Offshore Fisheries Enhancement Structure

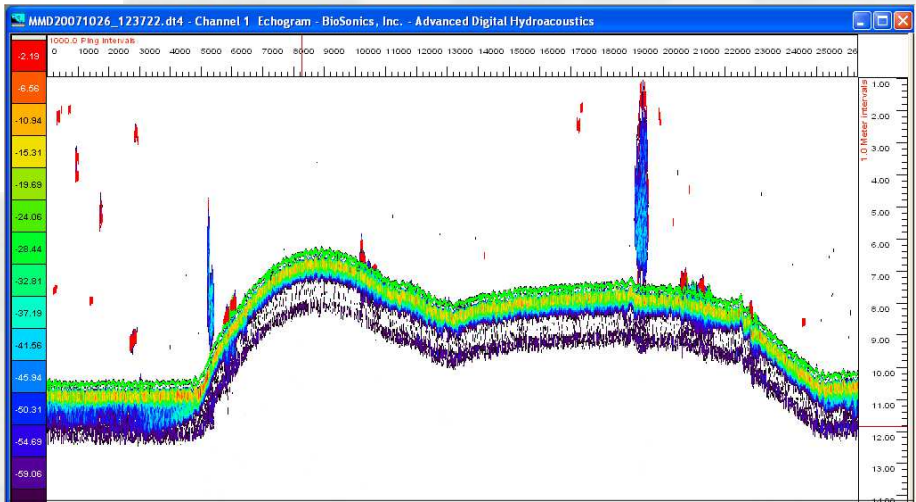
Example EWN Solutions
Ashtabula Breakwater Tern Habitat

Example EWN Solutions

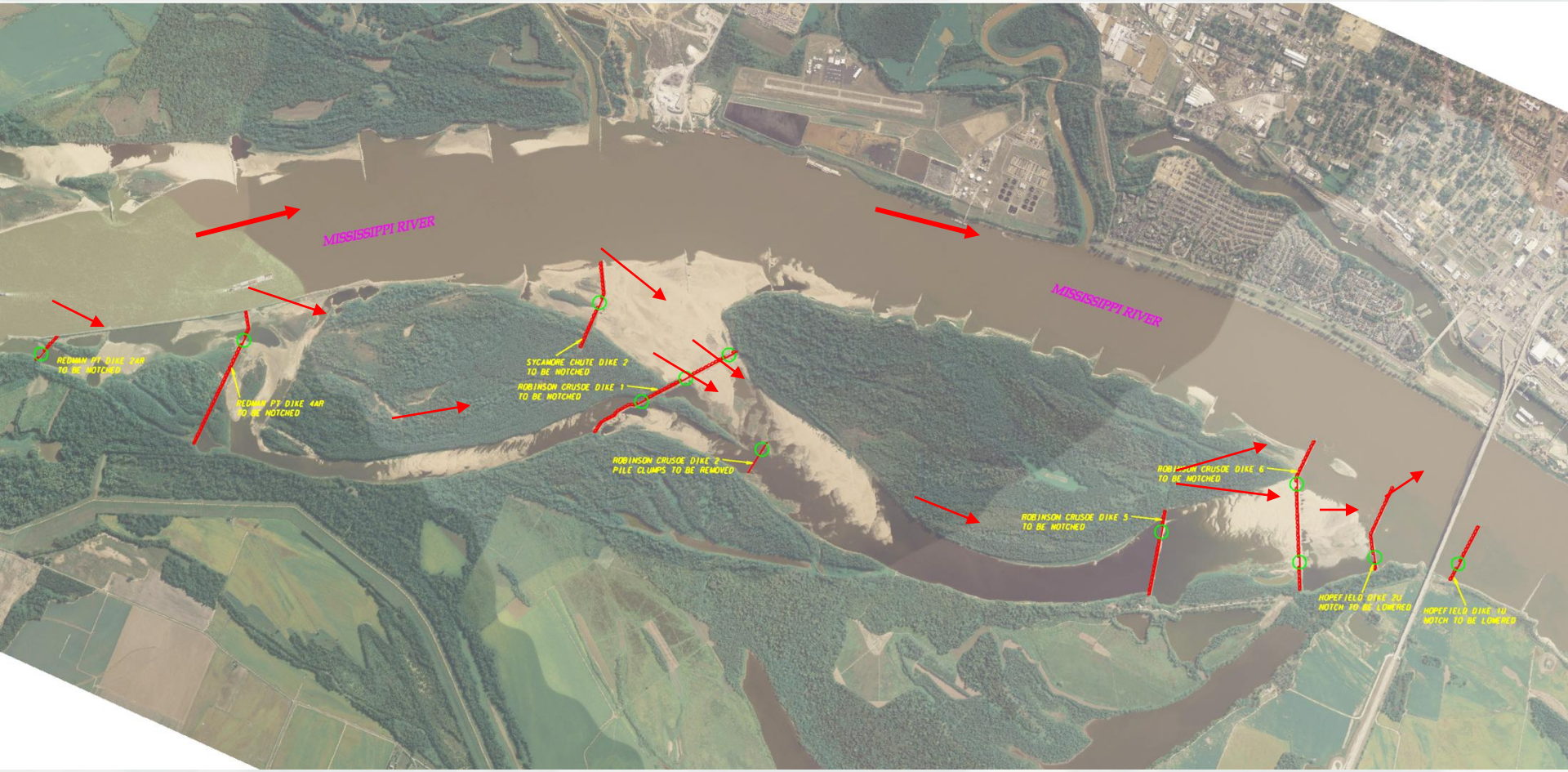


Hydroacoustics and trawling data used to document fisheries benefits provided by topographic relief created with dredged material

Mobile Offshore Dredged Material Mound



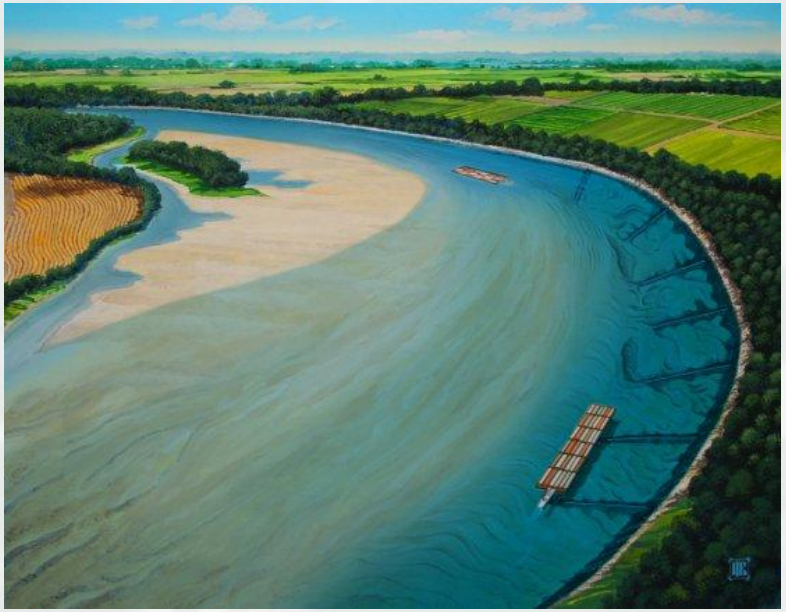
Example EWN Solutions



Loosahatchie Bar
Aquatic Habitat Rehabilitation

Example EWN Solutions

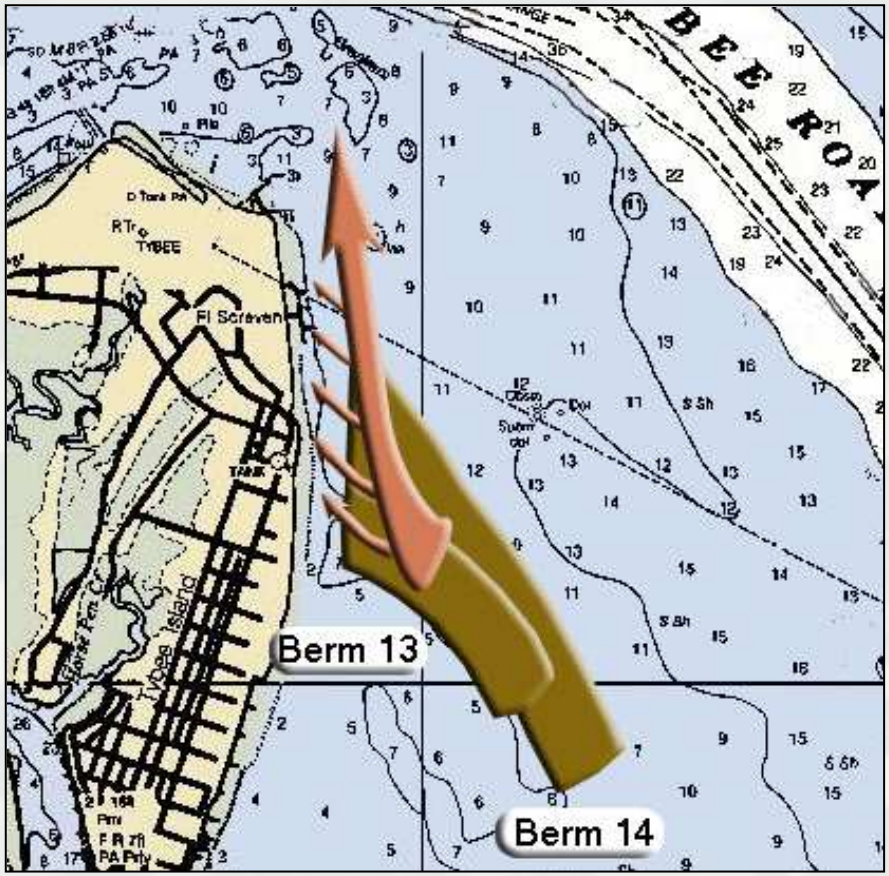
Upper Mississippi River Training Structures: Chevrons



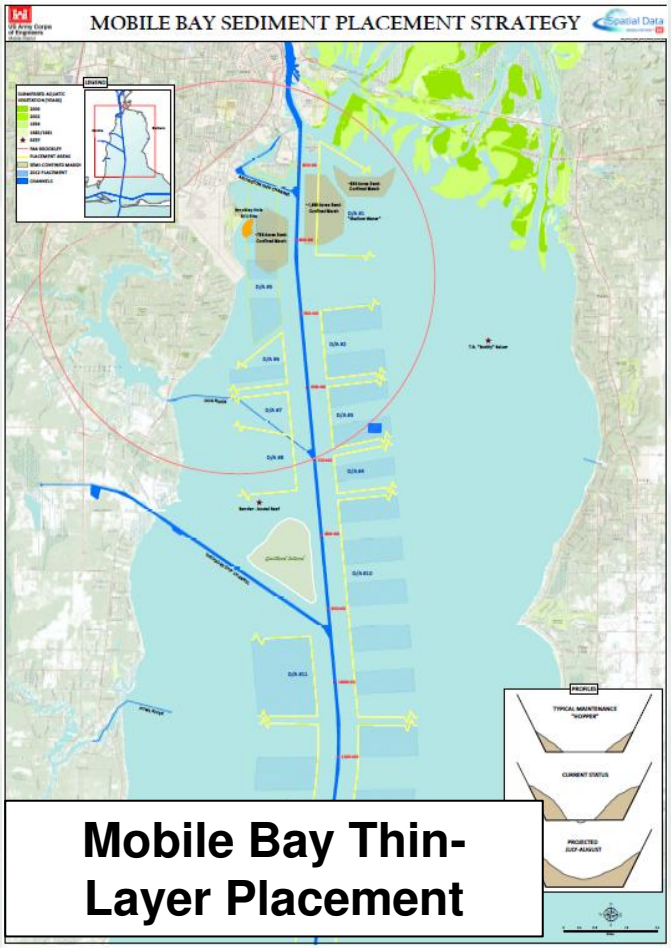
River Bendway Weirs

Example EWN Solutions

Strategic Sediment Placement



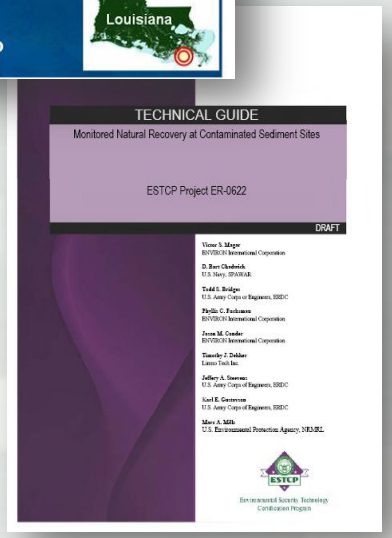
North Tybee Island
Savannah, Georgia



Mobile Bay Thin-Layer Placement

Monitored Natural Recovery

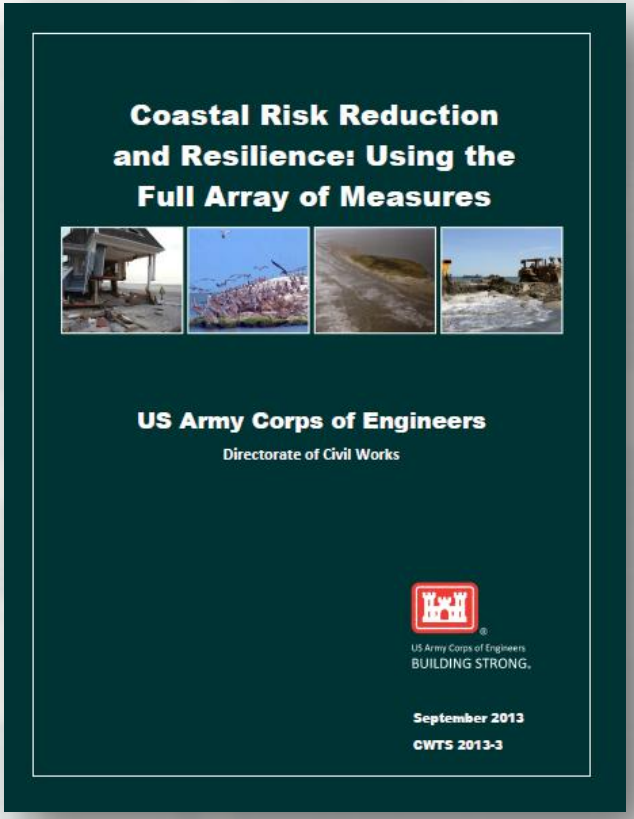
- Natural processes will operate at all sites, influencing:
  - Chemical transformation
  - Contaminant mobility and bioavailability
  - Physical separation of contaminant and receptor
  - Dispersion
- What additional engineering is needed to bring about acceptable risk reduction?
- Opportunities to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

ORGANIZATIONAL ALIGNMENT

EVALUATION

IMPLEMENTATION

Iterate as Needed

Identify and Organize Stakeholders, Partners and Authorities

Define Physical and Geomorphic Setting

Assess Vulnerability and Resilience

Identify NNBF Opportunities
- Formalize NNBF Objectives
- Identify NNBF Alternatives
- Define NNBF Performance Metrics

Evaluate NNBF Alternatives
- Tier 1
- Tier 2
- Tier 3

Advance through Tiers as Appropriate

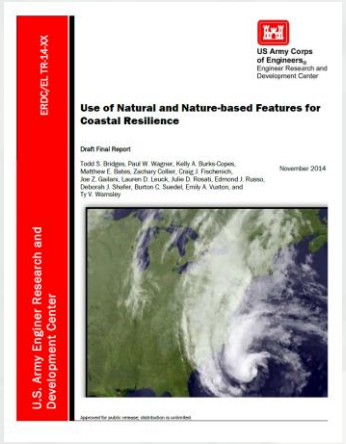
Select NNBF Alternatives

Design Implementation Plan: Elaborate Operational and Engineering Practices

Implement NNBF Alternative

Monitor for Performance and Assess Ecosystem Goods and Services

Feedback



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

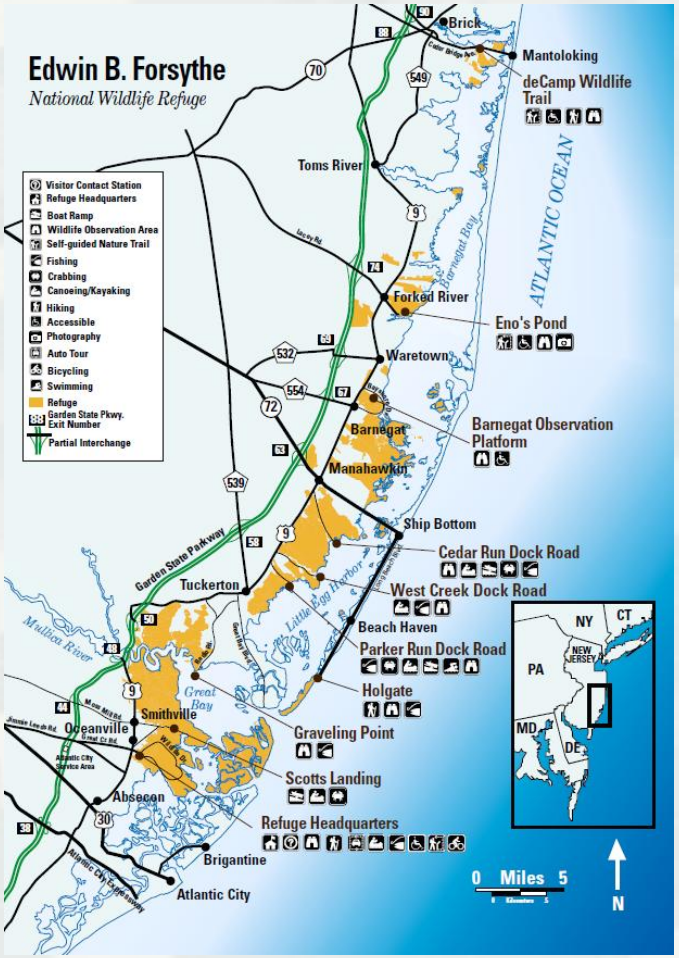
- Landscape Evolution of the Oil Spill Mitigation Sand Berm in the Chandeleur Islands, Louisiana
- Guidelines for Planning, Design, Placement and Maintenance of Large Wood in Rivers: Restoring Process and Function (Collaboration with BoR)
- The Use and Value of Levee Setbacks in Support of Flood Risk 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

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

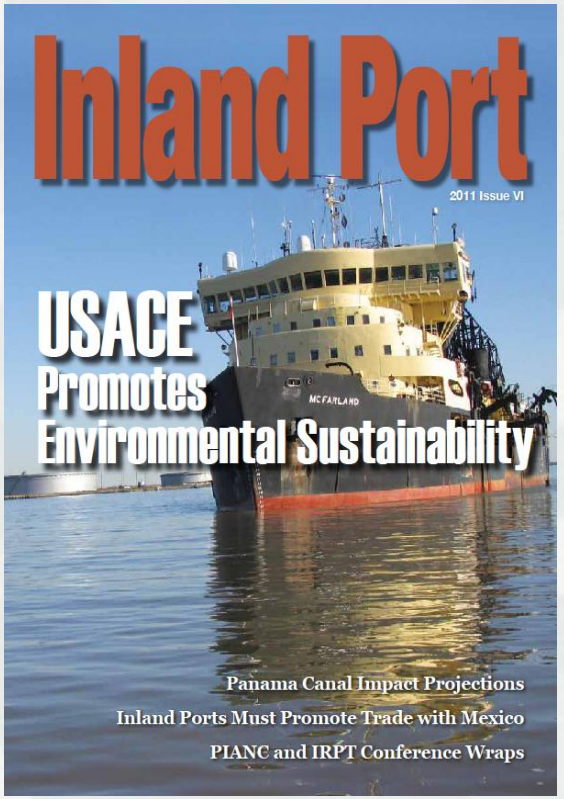
Engagement with NGOs

- 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

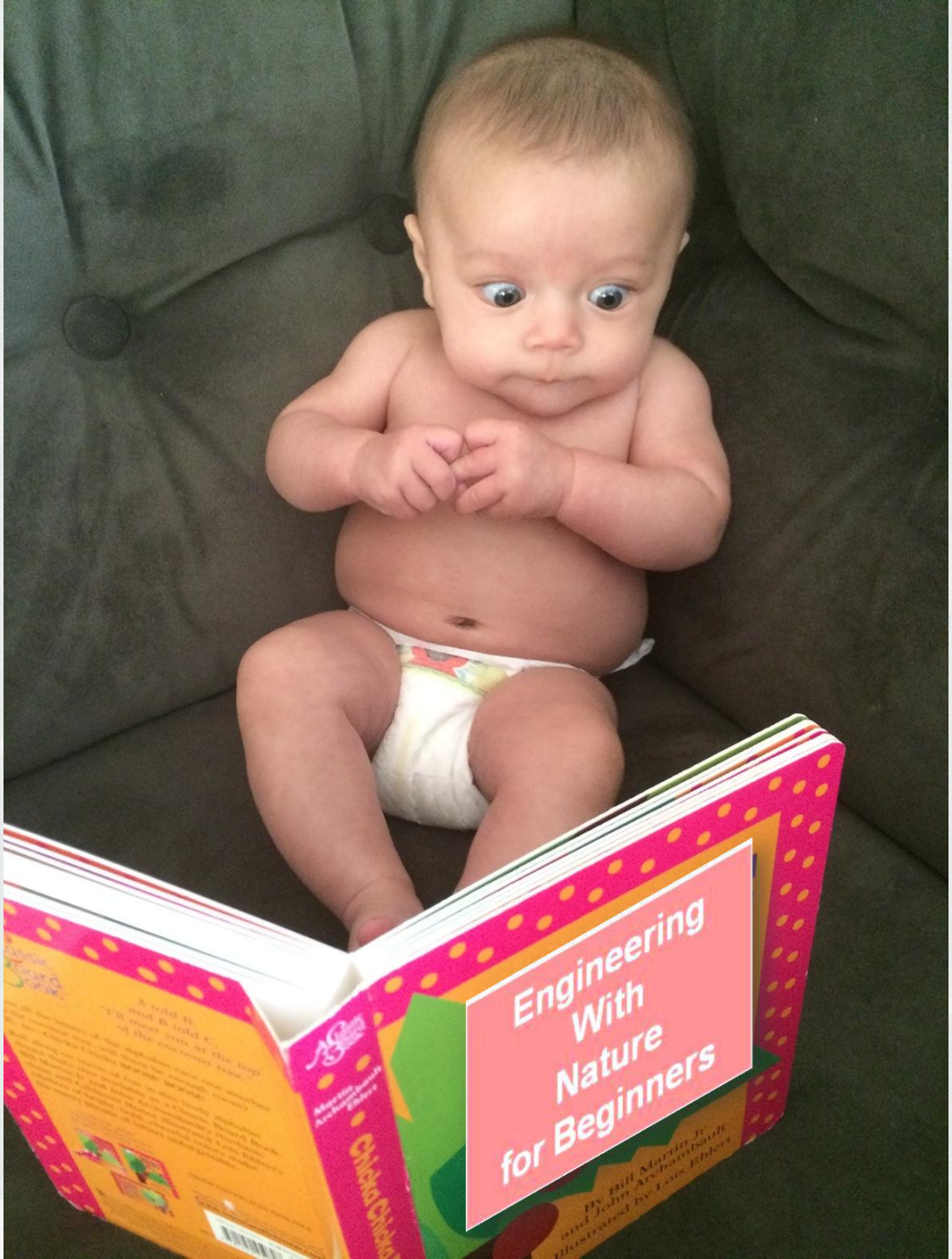
Creating Value by Engineering With Nature

- 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!

www.engineeringwithnature.org


Engineering
With
Nature
for Beginners