



U.S. ARMY

ENGINEERING WITH NATURE

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National Lead, USACE EWN Initiative

U.S. Army Corps of Engineers
U.S. Army Engineer Research and Development Center

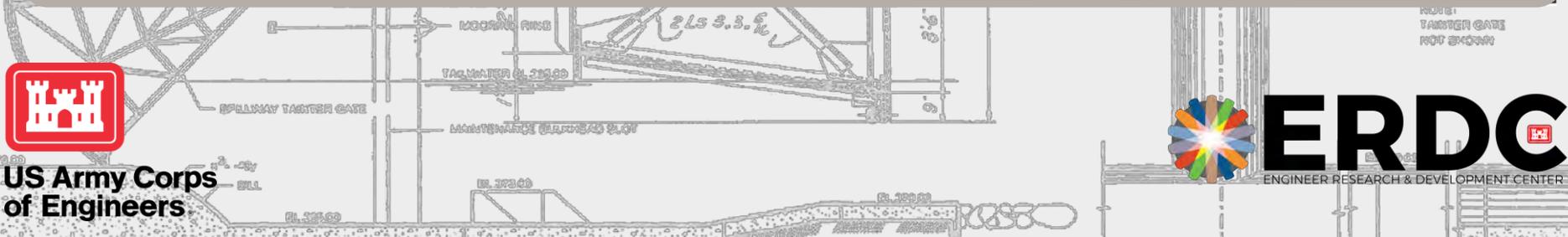
USWFS Webinar
23 July 2019



US Army Corps
of Engineers



ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER



1900-2000: THE CENTURY OF INFRASTRUCTURE (US)

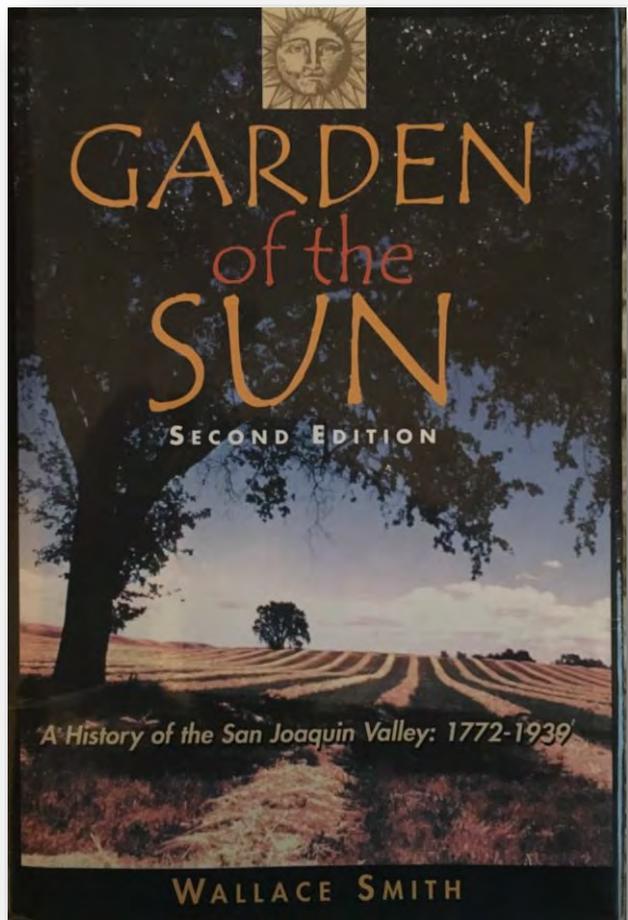
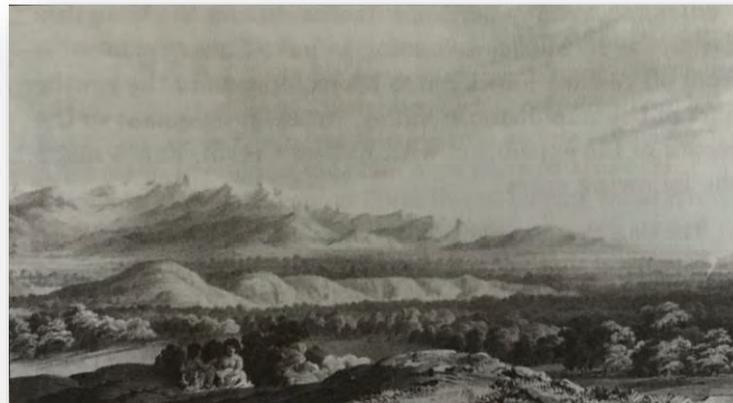
- 4,071,000 miles of roadway
 - 47,182 miles in the Interstate system
- 149,136 miles of mainline rail
- 640,000 miles of high-voltage transmission lines
- 614,387 bridges
- 90,580 dams
- 155,000 public drinking water systems
- 4,500 military installations
- 926 ports



THE SAN JOAQUIN VALLEY, CALIFORNIA



THE SAN JOAQUIN VALLEY, CALIFORNIA



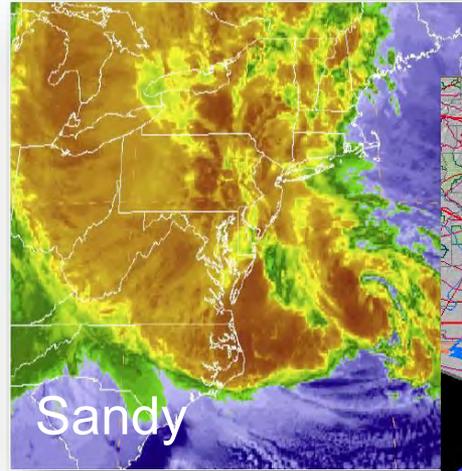
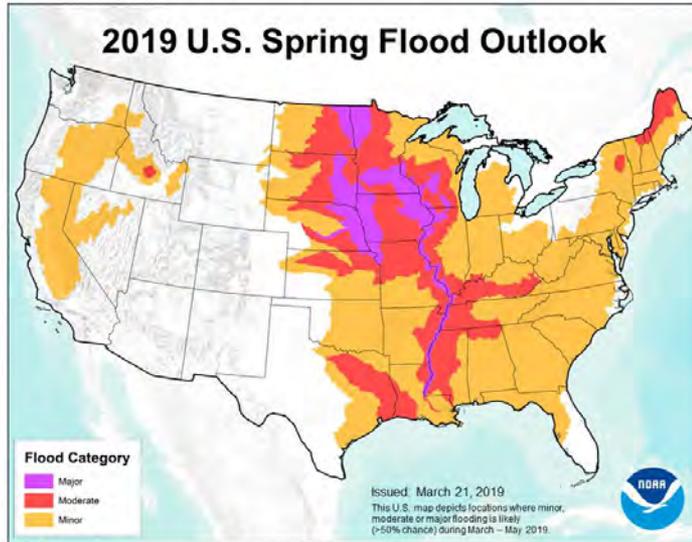
PINE FLAT DAM; KINGS RIVER, CA



THE SAN JOAQUIN VALLEY, CALIFORNIA

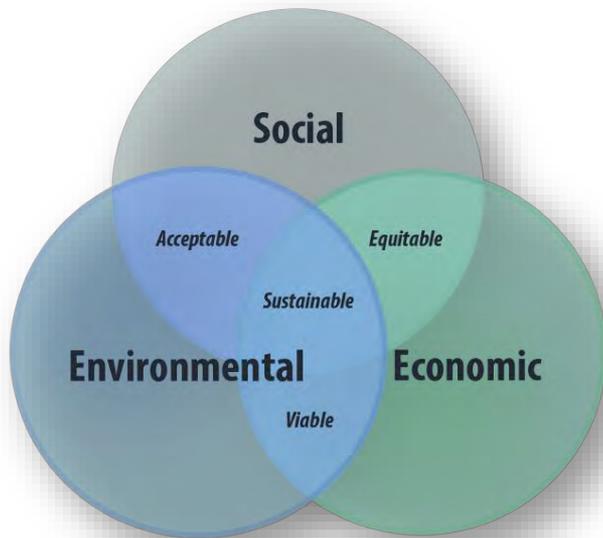


EVIDENCE SUPPORTING THE NEED FOR INNOVATION



SUSTAINABILITY

Sustainability is achieved by efficiently investing resources to create present and future value




SUSTAINABLE DEVELOPMENT GOALS



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



The Nature Conservancy 

And Many More!



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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

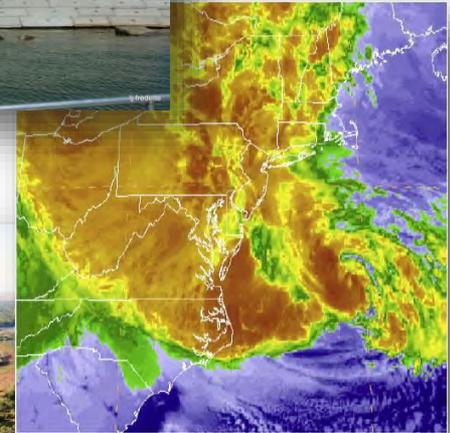
- Natural and Nature-Based Features to support FRM
- Levee setbacks

Ecosystem Restoration

- Ecosystem services supporting engineering function
- “Natural” development of designed features

Water Operations

- Shoreline stabilization using native plants
- Environmental flows and connectivity



EWN[®] OVERVIEW

Engineering With Nature[®] began in 2010

- Engaging across USACE, other agencies, NGOs, academia, private sector, international collaborators
- Guided by a strategic plan
- Established through Proving Grounds
 - Galveston, Buffalo, Philadelphia
- Informed by focused R&D
- Demonstrated with field projects
- Advanced through partnering
- Shared by strategic communications
- Marking progress
 - 2013 Chief of Engineers Environmental Award in Natural Resources Conservation
 - 2014 USACE National Award-Green Innovation
 - 2015, 2017 WEDA Awards; 2017 DPC Award



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EWN[®] STRATEGY

Wave I: Broaden and Deepen Partnerships

- Build the organization and internal capacity to support, grow, and sustain EWN
- Expand by engaging districts and early adopters throughout USACE
- Expand by engaging agency partners and key external stakeholders
- Establish/expand collaboration through agreements with key international partners
- Advance EWN through effective governance

Wave II: Expand Capabilities

- Continue to develop science and technical alliances
- Leverage social science to better engage agency partners and stakeholders, and build capacity
- Expand and focus the EWN research agenda to strengthen capabilities

Wave III: Expand Applications and Communication

- Support and document multi-scale demonstrations of EWN practices
- Support and reinforce EWN progress through ongoing engagement and communication
- Enable EWN application through development of policies and guidance

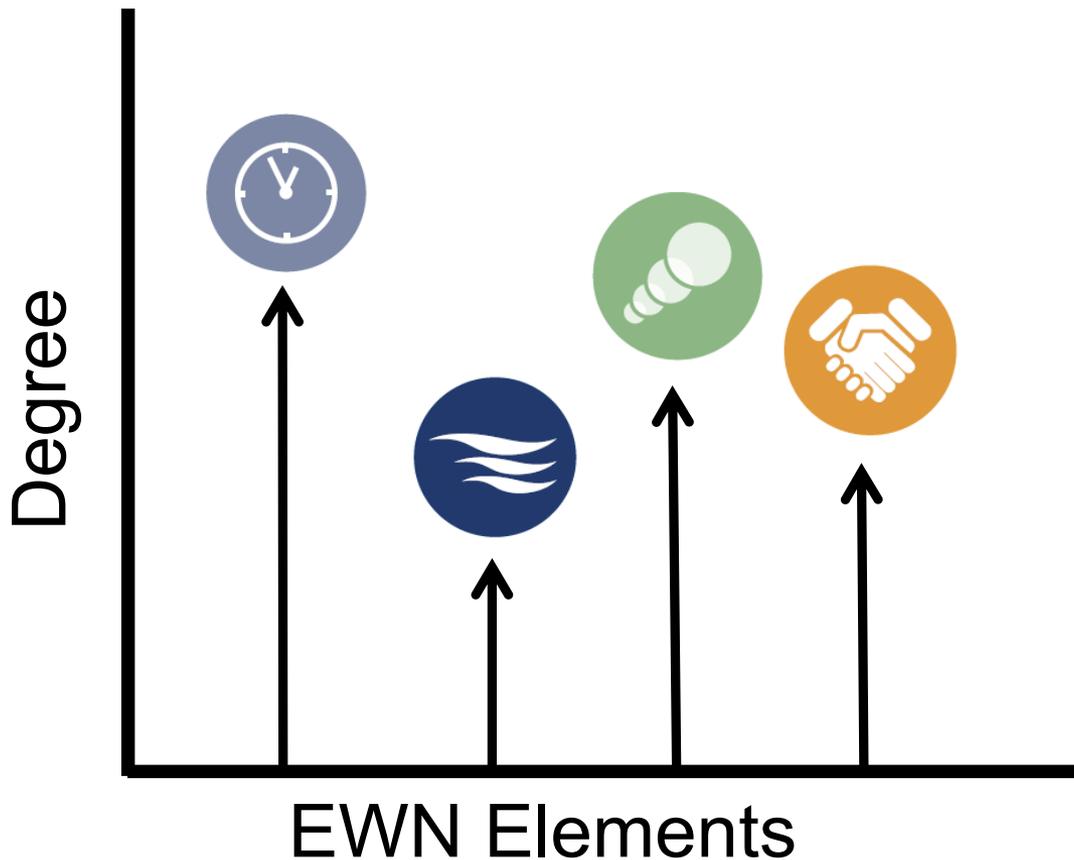
EWN PROVING GROUNDS

- Galveston District (2014)
 - Buffalo District (2014)
 - Philadelphia District (2016)
-
- Method
 - Identify opportunities to implement EWN across current and future programs and projects
 - Pursue opportunities through solution co-development



Engineering With Nature[®]

Elements



EWN Elements

Four major elements are involved in applying EWN to develop infrastructure projects:



Using science and engineering to produce operational efficiencies



Using natural processes to maximize benefit



Increasing the value provided by projects to include social, environmental, and economic benefits



Using collaborative processes to organize, engage, and focus interests, stakeholders, and partners

Enhancing Ecosystem Value



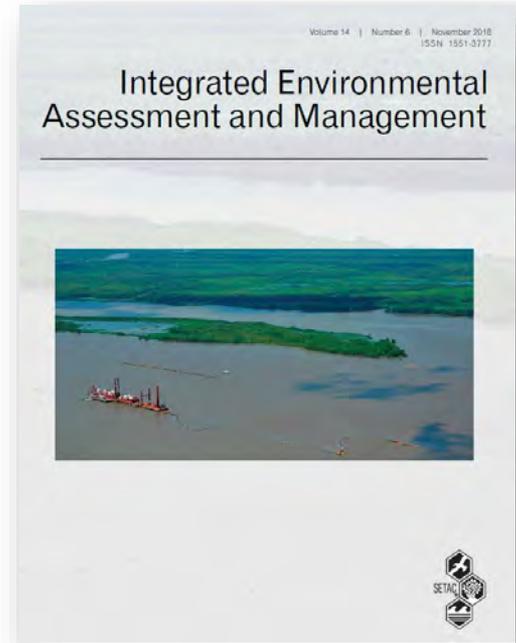
Loosahatchie Bar, Memphis

HORSESHOE BEND ISLAND, ATCHAFALAYA RIVER



Project Awards:

- 2015 WEDA Award for Environmental Excellence
- 2017 WEDA Award for CC Adaption
- 2017 DPC Award for Working, Building, and Engineering with Nature



Quantifying Wildlife and Navigation Benefits of a Dredging Beneficial-Use Project in the Lower Atchafalaya River: A Demonstration of Engineering with Nature[®]

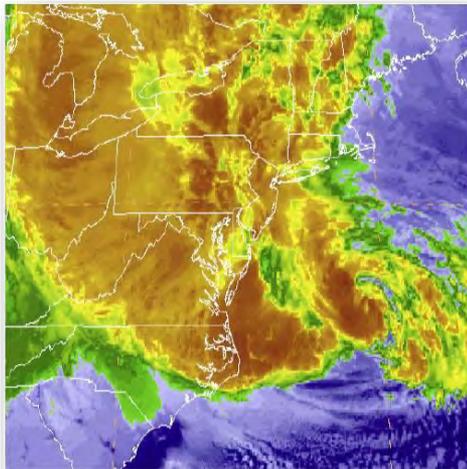
Christy M Foran,[†] Kelly A Burks-Copes,[‡] Jacob Berkowitz,[‡] Jeffrey Corbino,[§] and Burton C Suedel^{**}



LEVERAGING NATURE FOR ENGINEERING VALUE

Following Hurricane Sandy:

- Risk industry-based tools used to quantify the economic benefits of coastal wetlands
 - Temperate coastal wetlands saved more than \$625 million in flood damages.
 - In Ocean County, New Jersey, salt marsh conservation can significantly reduce average annual flood losses by more than 20%.



COASTAL WETLANDS AND FLOOD DAMAGE REDUCTION

Using Risk Industry-based Models
to Assess Natural Defenses in the Northeastern USA

October 2016



The Nature
Conservancy



LLOYDS
TERCENTENARY
RESEARCH
FOUNDATION

FORT PIERCE CITY MARINA, FLORIDA



USACE PHILADELPHIA DISTRICT: EWN IN BACK BAY NEW JERSEY



Mordecai Island

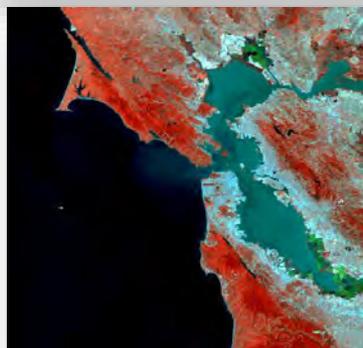
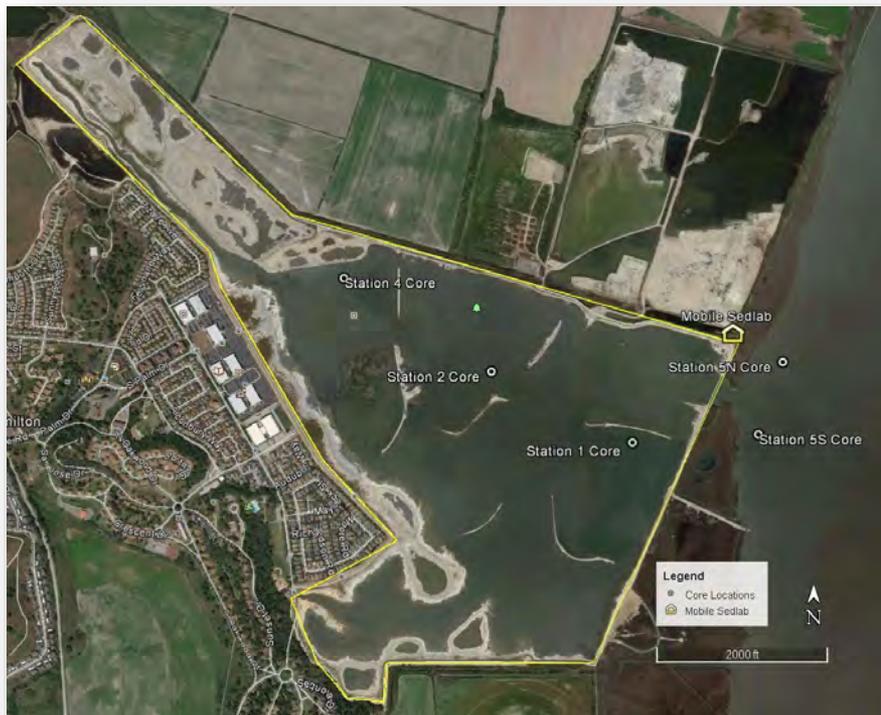


Stone Harbor



Avalon

HAMILTON AND SEARS POINT WETLANDS SAN PABLO BAY, CA

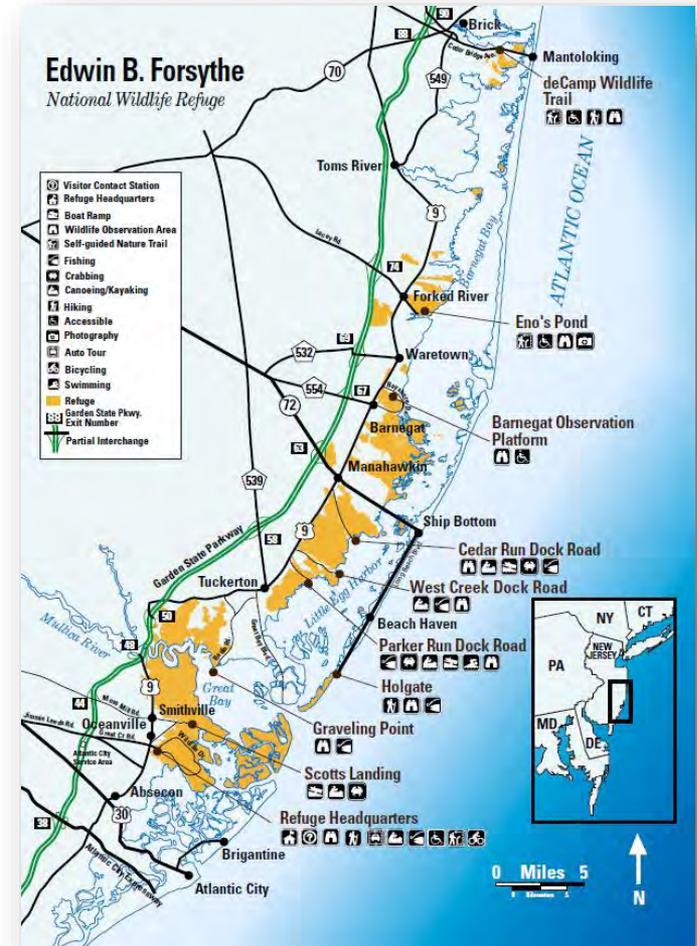


HUMBER ESTUARY; ALKBOROUGH, UK (INCREASED FLOOD STORAGE CAPACITY)



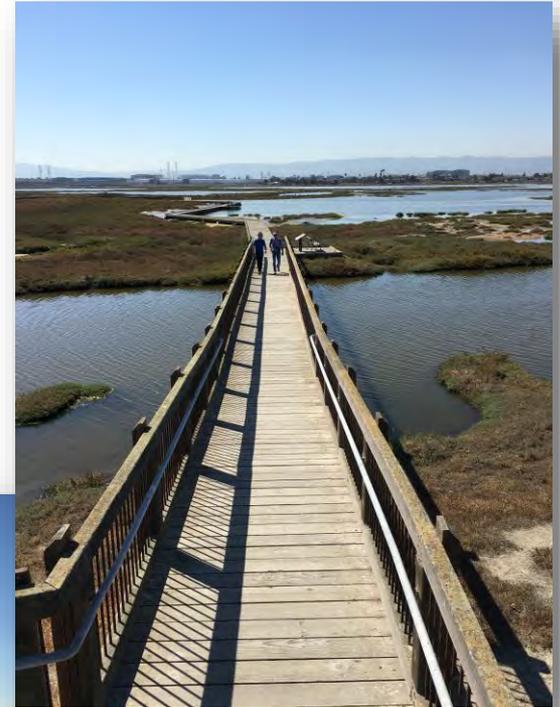
US FISH AND WILDLIFE SERVICE: FORSYTHE NATIONAL WILDLIFE REFUGE

- 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

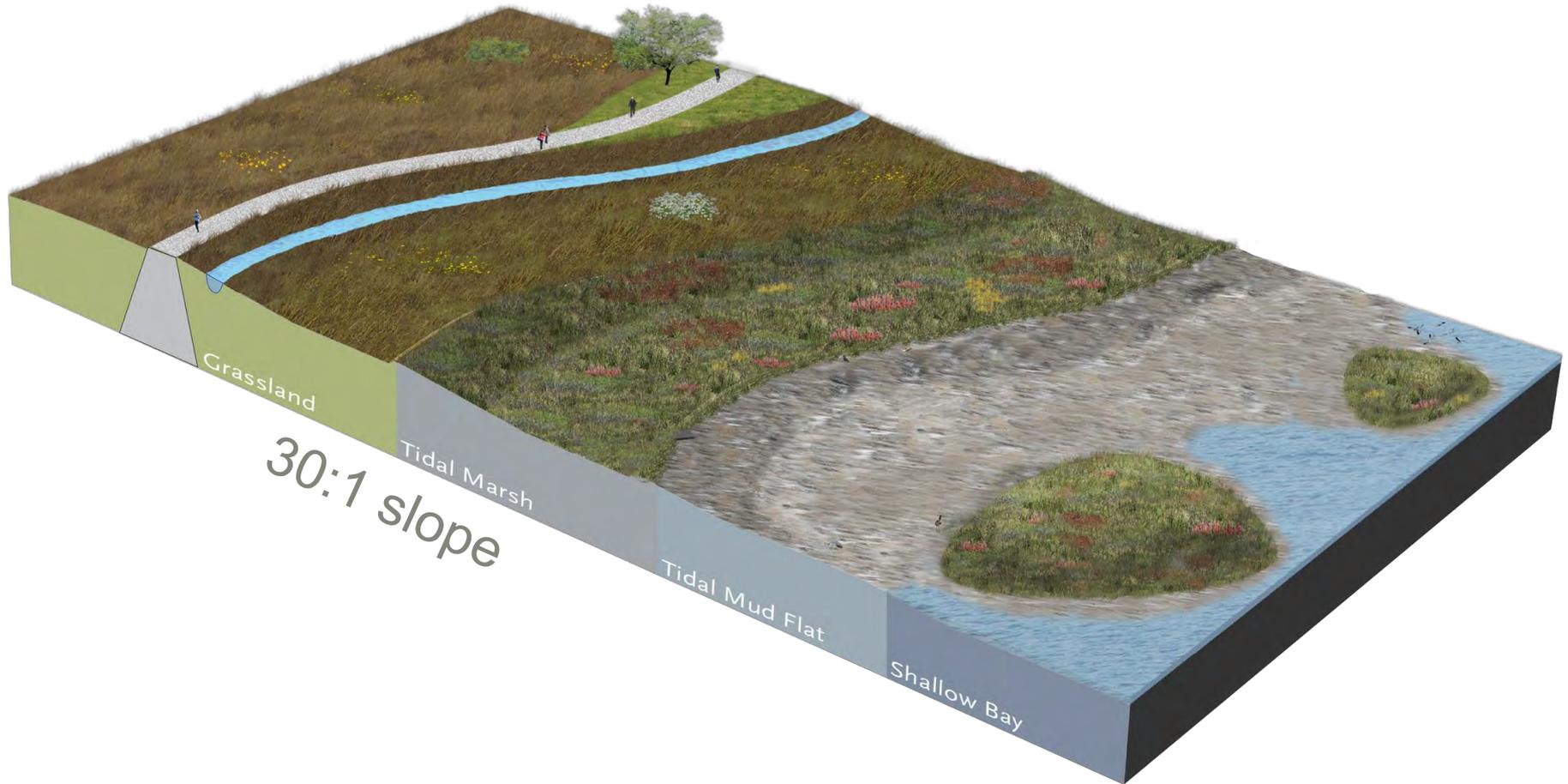


US FISH AND WILDLIFE SERVICE: DON EDWARDS SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE

- Innovative 30:1 “horizontal levee” design to provide SLR adaptation
- Thin-layer Placement of sediment
- Strategic Placement of sediment
- Other opportunities



“HORIZONTAL LEVEE” CONCEPT



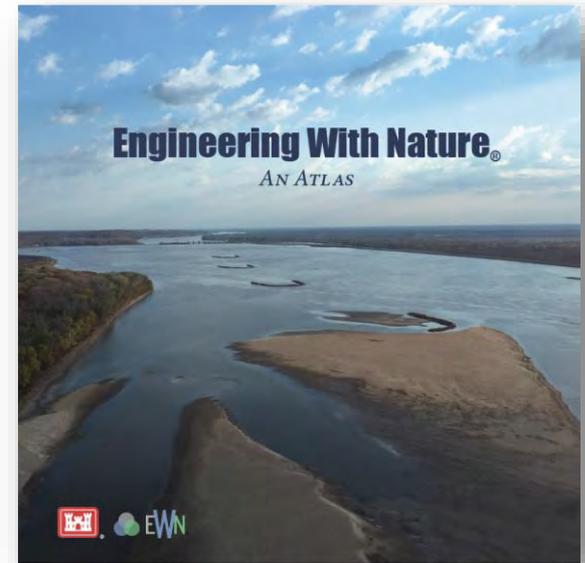
EWN ATLAS LAUNCH EVENT

10:30-12:00

January 16, 2019

National Building Museum
Washington, D.C.

“Engineering With Nature is an important initiative for the U.S. Army Corps of Engineers.” James Dalton, USACE Director Civil Works



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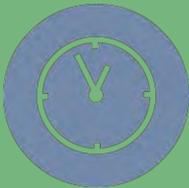
Call for Project Nominations

Engineering With Nature[®]: An Atlas – Volume 2

Publication Launch fall 2020!

Evaluation Criteria

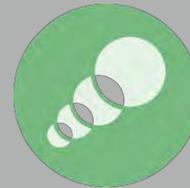
Using science and engineering to produce operational efficiencies.



Using natural processes to maximum benefit.



Increasing the value provided by the project to include social, environmental, and economic benefits.



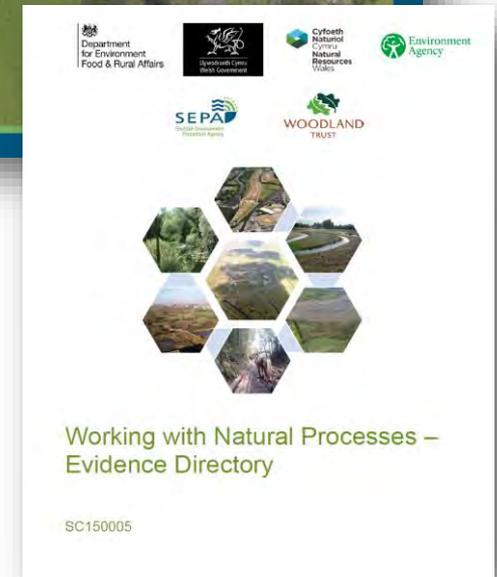
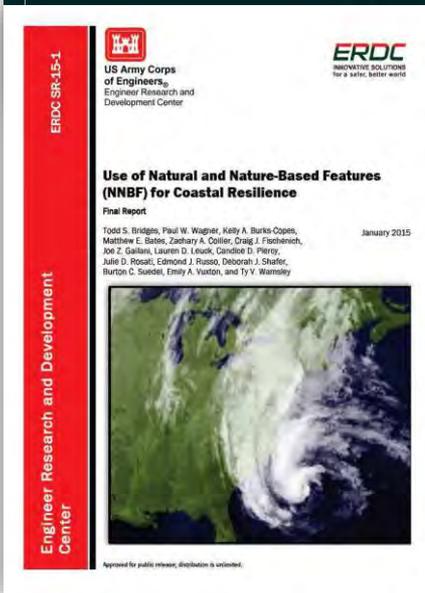
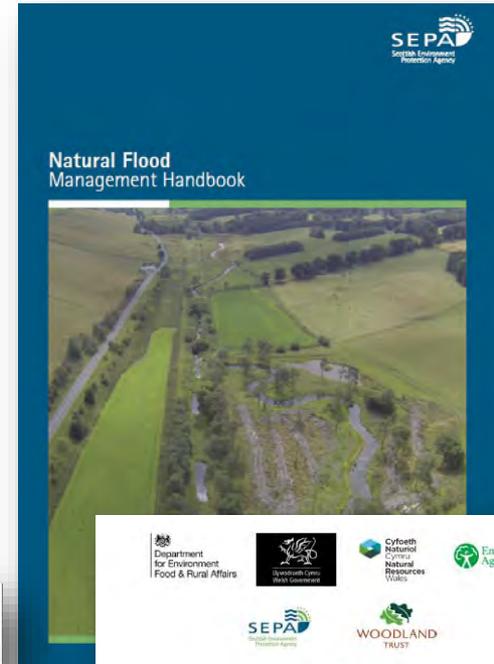
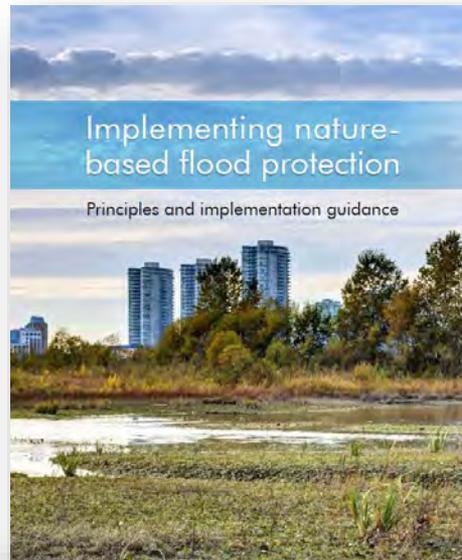
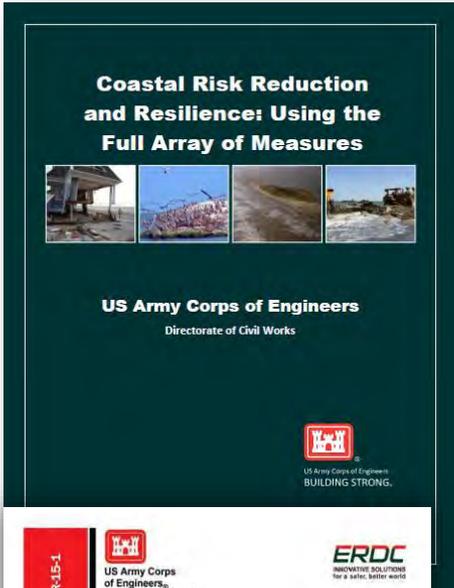
Using collaborative processes to organize and focus interests, stakeholders, and partners.



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<https://ewn.el.erdc.dren.mil/atlasv2.html>

NATURE-BASED GUIDANCE, STANDARDS, EVIDENCE



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INTERNATIONAL GUIDELINES ON THE USE OF NATURAL AND NATURE-BASED FEATURES FOR SUSTAINABLE COASTAL AND FLUVIAL SYSTEMS

Purpose: Develop guidelines for using NNBF to provide engineering functions relevant to flood risk management while producing additional economic, environmental and social benefits.

- Publish NNBF technical guidelines by 2020:
 - ▶ Multi-author: government, academia, NGOs, engineering firms, construction companies, etc.
 - ▶ Addressing the full project life cycle
 - ▶ Guidelines in 4 Parts
 - Overarching
 - Coastal Applications
 - Fluvial Applications
 - Conclusions



 *Institute for Resilient Infrastructure Systems*
UNIVERSITY OF GEORGIA

 THE WORLD BANK

Van Oord
Marine ingenuity

JACOBS
Environment Agency

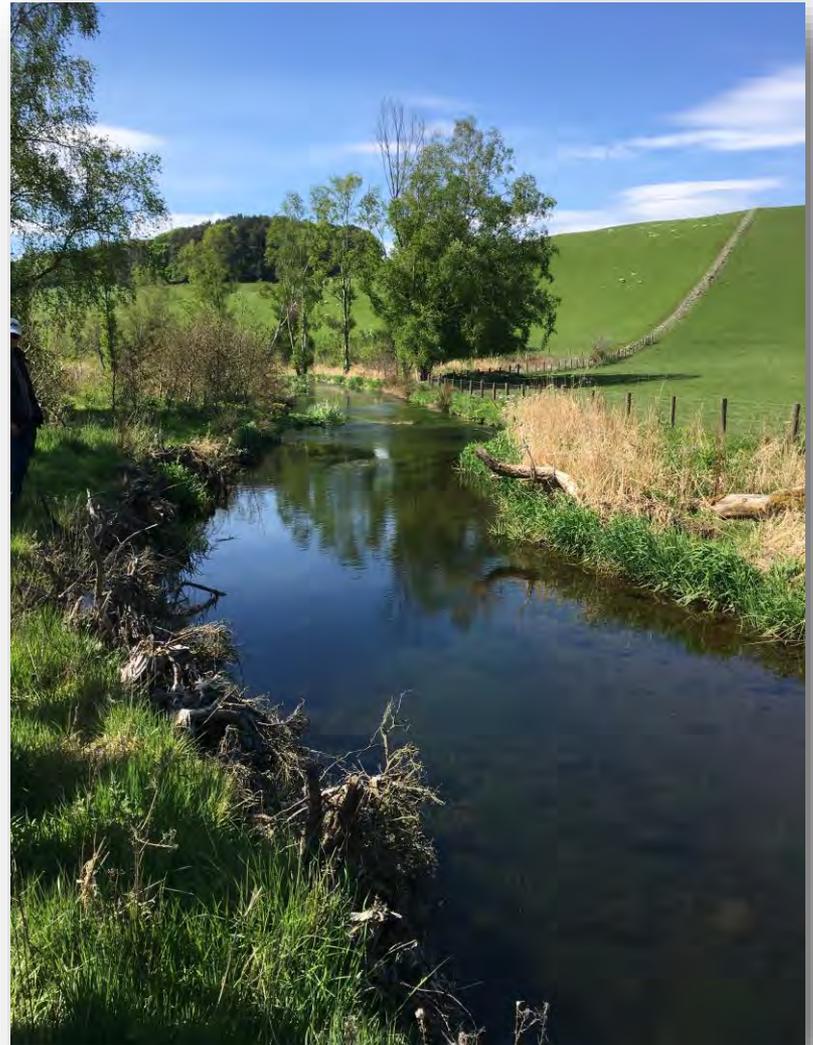
ANCHOR OEA

TFT
Tonkin+Taylor

NIST

NNBF GUIDELINES F2F WORKING MEETINGS

- Vicksburg, MS; Oct '16
- London etc., UK; Jul '17
- Silver Spring, MD, Oct '17
- Delft, NL; Mar '18
- Santa Cruz, CA; Sep '18
- Edinburgh, Scotland; May '19



NNBF GUIDELINES TABLE OF CONTENTS

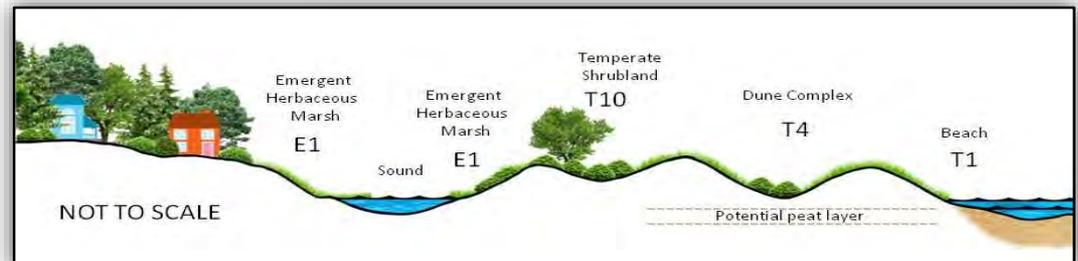
Part 1: Informing the Use of NNBF

- Preface/Definitions
- Introduction
- Principles for Use of NNBF in Coastal and Fluvial Systems
- Community Engagement
- General NNBF Framework
- System Considerations and Combining Elements
- Performance Measures and Metrics
- Analysis of NNBF Benefits
- Monitoring, Maintenance, and Adaptive Management



Part 2: Coastal Systems

- Introduction
- Beaches and Dunes
- Wetlands and Intertidal Areas
- Islands
- Reefs
- Sub-Aquatic Vegetation
- Enhancing Environmental Value of Conventional Infrastructure



Part 3: Fluvial Systems

- Introduction
- Applying NNBF at Watershed Scale
- Applying NNBF at Sub-Watershed Scale
- Naturalizing Techniques



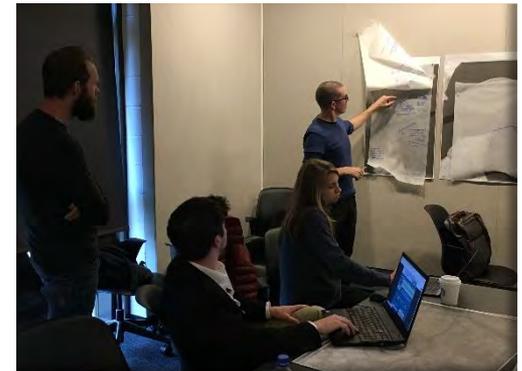
Part 4: Conclusion

- Summation and Future Directions

INCORPORATING EWN/LA TECHNIQUES AND PRACTICES INTO USACE INFRASTRUCTURE

Work on USACE infrastructure pProjects with private/academic LAs

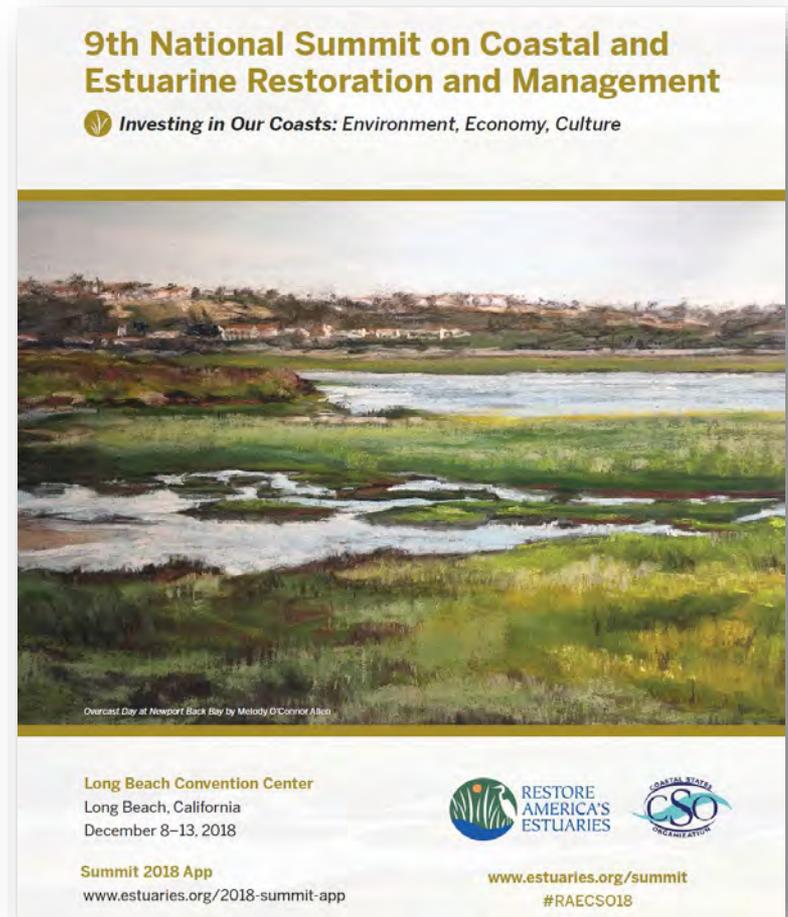
- Projects include:
 - Moses Lake Tide Gate Area (SWG);
 - Comite Canal Project (MVN);
 - Franklin Lock/Dam Recreation Area (SAJ);
 - Morehaven West Campground Site (SAJ);
 - Back Creek and Fishing Creek Jetties (NAB);
 - Proctor Creek (SAM); and
 - NEW: Sabine to Galveston (S2G) Project (SWG)
 - NEW: NJ Bay Bays Study (NAP)
- Team visits project sites and collects data
- EWN/LA Team met JAN 19 at Auburn to work on initial renderings
- Meetings w/ USACE Districts to discuss rendering beginning MAR 19
- Final report/renderings delivered to Districts JUL 19



NNBF AND EWN TRAINING



ICCE, 1-day NNBF training workshop; 29 July, 2018



RAE, 1-day EWN training workshop; 13 Dec, 2018

COLLABORATION ACROSS GOVERNMENT

USACE/NOAA Collaboration Workshop: Natural and Nature-based Features, Charleston, SC; 1-3 March 2016



USACE/NOAA-NMFS Collaboration Workshop Engineering With Nature, Gloucester, MA; October 5-6, 2016

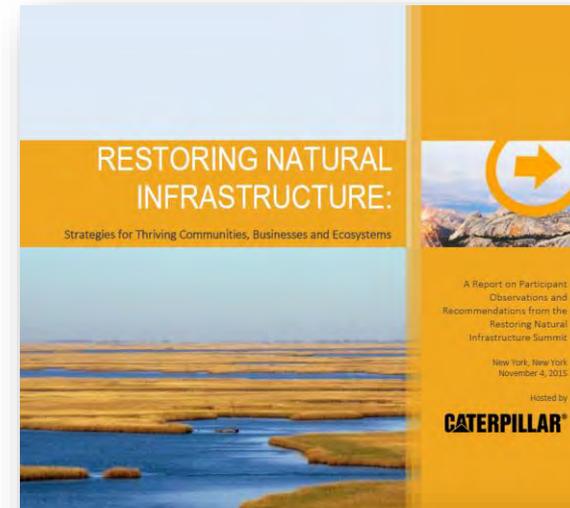


www.engineeringwithnature.org (NNBF)

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COLLABORATION WITH THE PRIVATE SECTOR

- Caterpillar Inc.
 - ▶ Restoring Natural Infrastructure Summit; November 4th, 2015; New York City
 - ▶ Natural Infrastructure Initiative – USACE Collaboration Work Streams
 1. NI Opportunity Evaluation Tool. Capitalizing on enterprise-level capability: CE Dredge DST
 2. Evaluation and Decision Making
 3. Field Application and Demonstration
- Western Dredging Association (WEDA)
 - ▶ Collaborative technical workshop on “Construction Methods Supporting Engineering With Nature”



<http://www.caterpillar.com/en/company/sustainability/natural-infrastructure.html>

COLLABORATION WITH ACADEMIA

- Texas A&M University



- Partnering through the Coastal Science and Engineering Collaborative (CSEC)
- Joint research on NNBF
- EWN Seminar spring 2018
- Developing graduate curriculum to support EWN

- University of Georgia



*Institute for Resilient
Infrastructure Systems*
UNIVERSITY OF GEORGIA

- Institute for Resilient Infrastructure Systems (IRIS)
- Multiple levels of collaboration on EWN and NNBF
- EWN curriculum development

- University of Oklahoma

- Water Security
- Focus on mid-western and western landscapes and water resources
- Streams, rivers, reservoirs and related infrastructure and purposes



ENGINEERING WITH NATURE ON CAPITOL HILL



NATURAL INFRASTRUCTURE: A SMART INVESTMENT

Come hear representatives from Great Lakes Dredge and Dock, Caterpillar, AECOM, The Army Corps of Engineers and The Nature Conservancy discuss why and how their organizations are making investments in natural infrastructure.

Thursday, March 21, 2019
10:30 am – 11:30 am
2253 Rayburn House Office Building

Featured Speakers

Bill Hanson, Great Lakes Dredge and Dock (moderator)
Vice President, Government Relations

Don M. McNeill, Caterpillar
Strategic Growth Manager
Director, Natural Infrastructure Initiative

Michael J. Donahue, PhD, AECOM
Vice President, Water Resources and Environmental Services and
Director, National Coastal and Ecosystem Restoration Practice

Todd Bridges, PhD, U.S. Army Corps of Engineers
Senior Research Scientist (ST), Environmental Science, U.S. Army Engineer
Research and Development Center

Sarah Murdock, The Nature Conservancy
Director, U.S. Climate Resilience and Water Policy

[Click Here to Register](#)

CATERPILLAR AECOM



Photo © Jennifer Embling



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OUTREACH

- USFWS, Savannah Coastal Refuge Complex (29 August, 2019)
- ASA(IE&E)
- USFWS webinar
- Association of State Floodplain Managers
- Society of American Military Engineers
- Silver Jackets
- RESTORE
- Others



BUILDING PROGRESS



- Identify opportunities to expand and diversify value
- Increase collaboration and cross-sector partnerships
- Commit to innovation
- Pursue realistic and affordable demonstrations leading to full-scale projects
- Document the value created
- Coordinate communication across partnering organizations for maximum impact



“Satellite” Image of California, circa 1851 by Mark Clark

