# 

International Guidelines on Natural and Nature-Based Features for Flood Risk Management



Fluvial Natural and Nature-Based Features



Puerto Rico I May 2022





## **Fluvial Natural and Nature-Based Features**

Leads: Christopher Haring – U.S. Army Corps of Engineers, USA Ralph Schielen – Rijkswaterstaat, Netherlands Jo Guy – Environment Agency, England Lydia Burgess-Gamble – Environment Agency, England



# **Engineering With Nature**<sub>®</sub>

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

Key Elements:

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







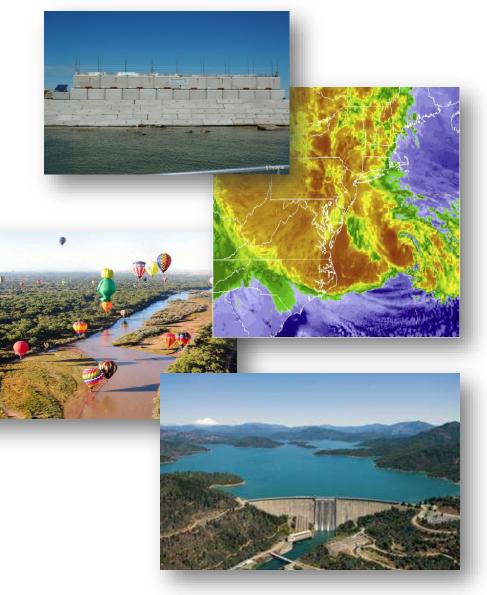


www.engineeringwithnature.org

NAVSYS

# EWN® Across USACE Mission Space

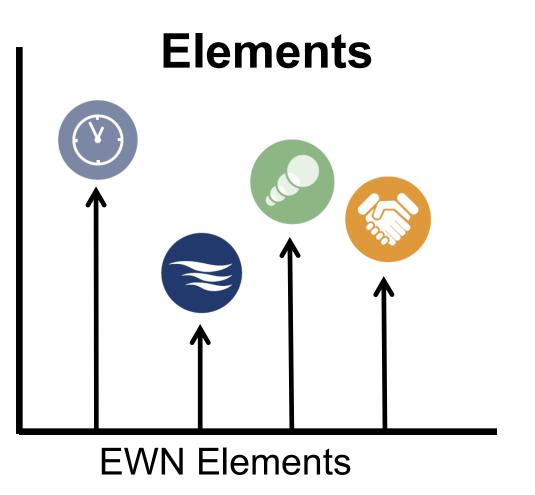
- Navigation
  - Strategic placement of dredged material supporting habitat development
  - Habitat integrated into structures
  - Enhanced Natural Recovery
- Flood Risk Management
  - Natural and Nature-Based Features to support FRM
  - Levee setbacks
- Ecosystem Restoration
  - Ecosystem services supporting engineering function
  - "Natural" development of designed features
- Water Operations
  - Shoreline stabilization using native plants
  - Environmental flows and connectivity

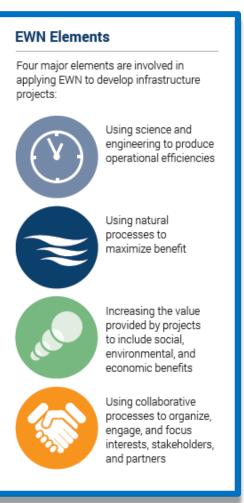


# **B** EWN Engineering With Nature ®

# Degree

Ē



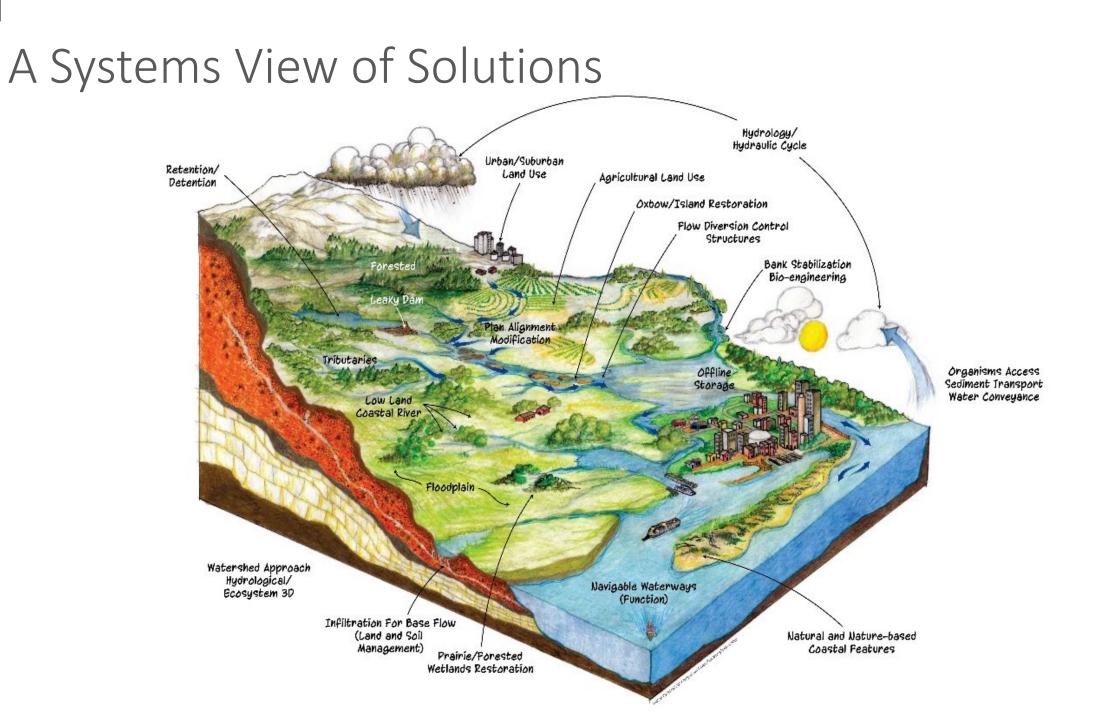




Impacts of Human Activity on the Landscape

- Cleared the Timber
- Plowed the Prairie
- Drained the Wetlands
- Straightened the Streams
- Leveed and Constricted the Floodplains
- Built Cities with Large Areas of Concrete, Asphalt and Rooftops

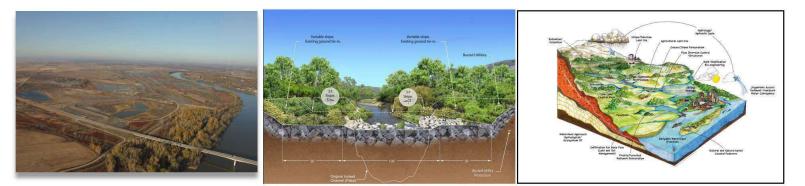




Ę



# NNBF Engineering Performance



#### Levee Setbacks

#### **Benefits/Processes**

-decreased flood levels and velocities -reduced frequency of maintenance and repair on levee -reduced navigational maintenance -reduction in erosion/scour and O&M costs -increased recreational, cultural, and educational opportunities

#### Performance Factors

-amount of new floodplain affects hydrologic loading

-alignment options for improved hazard mitigation

-ecological goals of project with increased floodplain connection

-collaboration with stakeholders and other Federal agencies

#### Naturalization of Channel Design

#### **Benefits/Processes**

-reduced frequency of maintenance on levee and restoration projects
-naturalization of flow regimes and floodplain reconnection
-ecological benefits to floodplain habitat
-reduction in erosion/scour and O&M costs
-increased recreational, cultural, and educational opportunities

#### Performance Factors

-type of practice determines hydrologic loading -practice determines options for improved hazard mitigation, erosion control, and streambed and bank stability -collaboration with stakeholders and other Federal agencies -sediment management options

#### Watershed Treatments

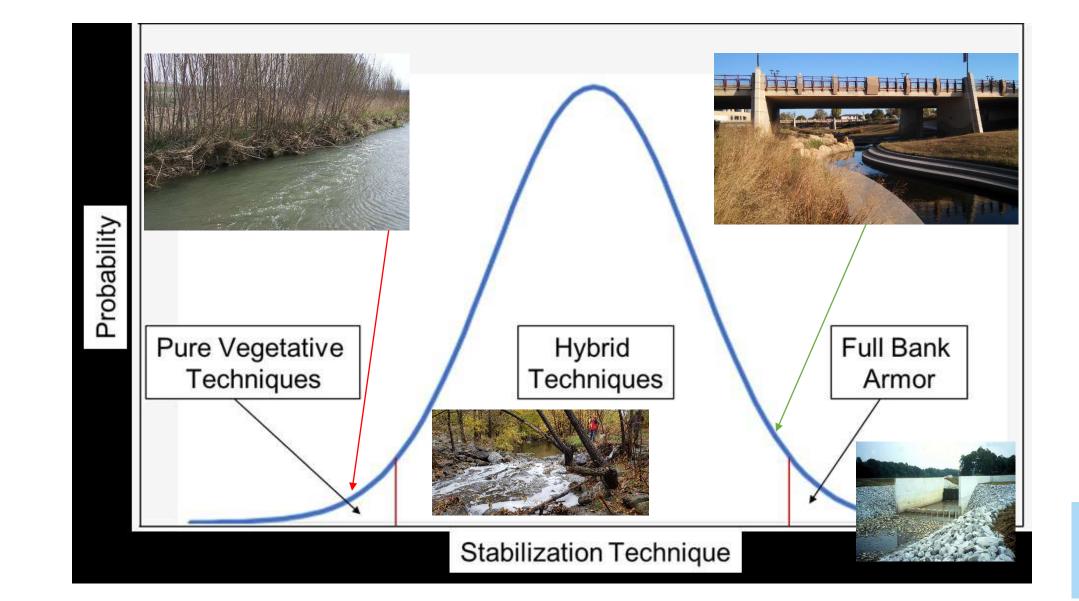
#### **Benefits/Processes**

-naturalization of hydrologic watershed regimes -reduced navigational maintenance -reduction in O&M costs -increased recreational, cultural, and educational opportunities -reduced frequency of maintenance and repair on levee and restoration projects

#### Performance Factors

-watershed management options determine effects on hydrologic loading -practice options for improved hazard mitigation, upland erosion control, and groundwater recharge -sediment management options -collaboration with stakeholders and other Federal agencies



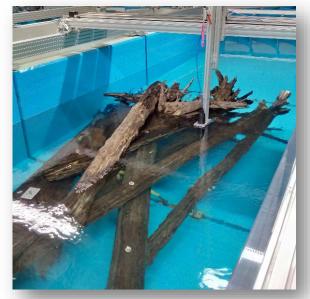


Ę



# EWN and Natural Materials

Ę





#### **National Large Wood Manual**

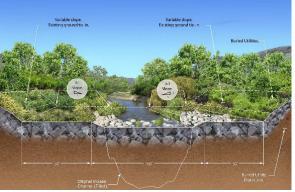
Assessment, Planning, Design, and Maintenance of Large Wood in Fluvial Ecosystems: Restoring Process, Function, and Structure

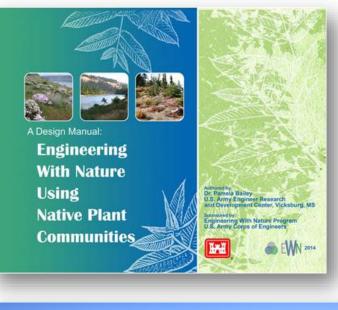
January 2016













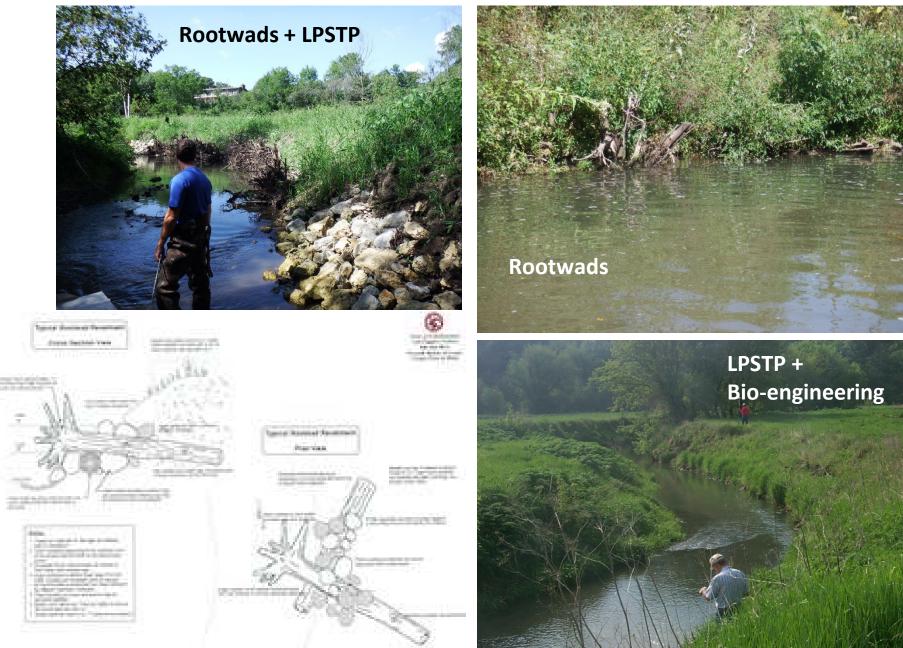


www.engineeringwithnature.org

Ļ





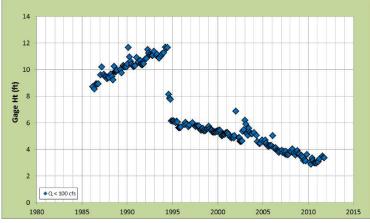




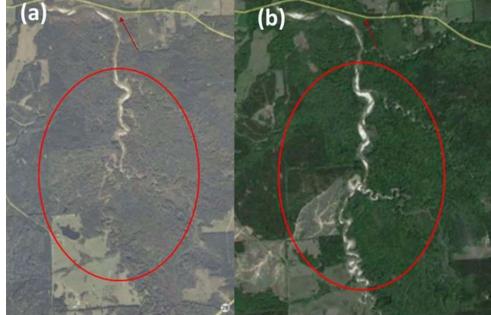
#### 

# EWN to Restore Natural Processes



















#### **Floodplain Restoration Advantages**

- Access of flows (Hydraulically reconnected)
- Areas for sediment deposition
- Dissipates energy
- Reconnection (recharge areas)
- High quality riparian corridor
  - (>70% of all terrestrial species)
- Riparian corridor: to be fully functional need a large buffer width
- Aquatic species (flood flows)











Picture 29: The photo is taken standing on the bridge facing downstream after construction in May 2001.





Natural Features	Ec Pr Fu

Ę

cological roduction unction Servi

Ecosystem Goods and Services

Ecosystem Service Benefits











**Existing Condition** 

Ę



#### EWN FY21 End of Year IPR

Reservoir Sedimentation and Sustainability (ERT 21-12)

2017 NRL Moutardier Point Bank Stabilization Project









Ę

**EWN FY22** Reservoir Sedimentation and Sustainability (ERT 21-12)

New Bank Stabilization Application Projects at Nolin River Lake, KT





**Construction with new materials** 



Vegetation management and new materials

Vegetation from Management areas to stabilize shorelines





• Wetland & Erosion Control

F

• Bottomless Culvert







- Wood structures
- Rock onsite
- Combination



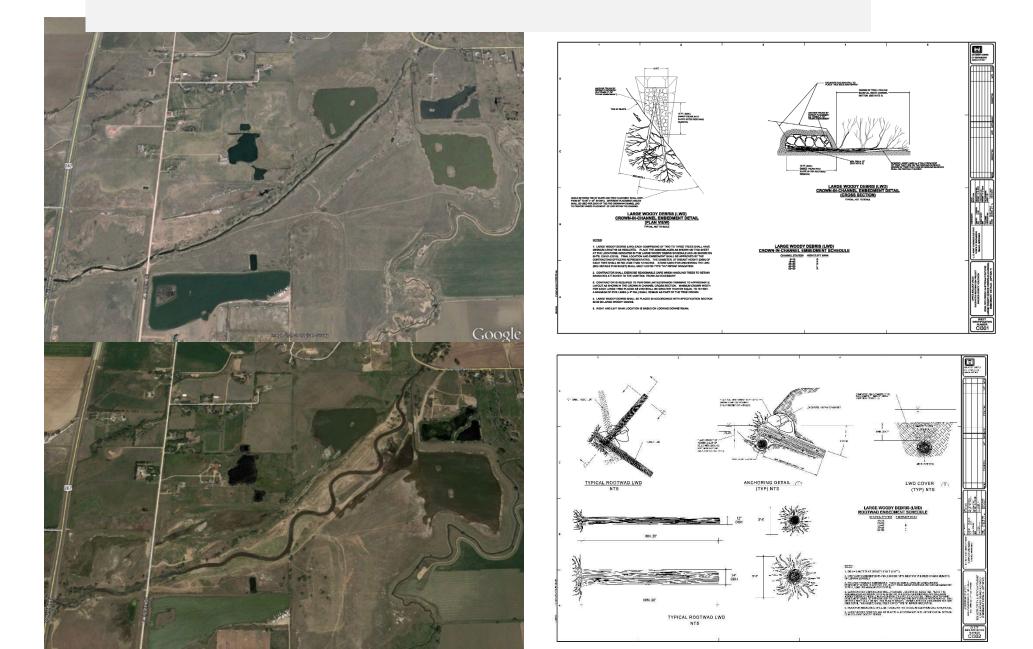








### Floodplain Reconnection - Boulder Creek Project



# Boulder Creek Project











### TNC-USFWS Restoration Project Black Walnut Creek-Trib to Rock River, Ogle County, IL





# Missouri River Levee Setback Omaha District

Producing Efficiencies



Setback reduces frequency of maintenance and repair of levees; reduced navigational maintenance; reduction in associated O&M and RR&R costs.

#### Using Natural Processes



Setback leverages decreased hydrologic loading, decreased flood velocities, and reduced erosion/scour.

#### Broadening Benefits

Improved ecosystem sustainability; improved hazard mitigation; increased recreational, cultural and educational opportunities.

Promoting Collaboration



NWO collaboration with USGS, USFWS, Idaho Dept. of Natural Resources, NGOs, and stakeholders.

**R&D:** Opportunities to quantify ecological, engineering, and societal benefits; increase USACE's capacity to provide effective programs for NSA applications; and data/lessons learned will advance guidance and policy that supports future levee setback projects.









# USACE Albuquerque District:

# Santa Clara Pueblo Watershed EWN

Producing Efficiencies



Working with natural processes using local materials to stabilize the watershed and stream channels; reduced time and cost of importing materials, ecological and

aesthetics benefits. Using Natural Processes



Uses local material in system vs. introducing riprap; placement of materials in situ with native vegetation to re-establish natural channel tendencies.

#### **Broadening Benefits**



New options to place existing materials; habitat created; restoration of channel and reduction of sediment delivered to channels and reservoirs.

Promoting Collaboration



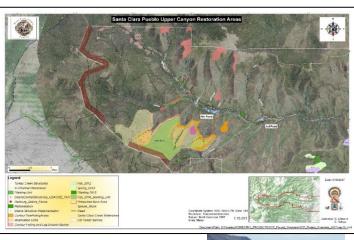
Partnering with Santa Clara Pueblo, USGS, USFS, **BIA, NMDOT, and NRCS** 

Structures

**R&D:** Implement, study and long-term performance of NNBF; Offers opportunities to determine appropriate performance metrics aligned with ecosystem and engineering services.







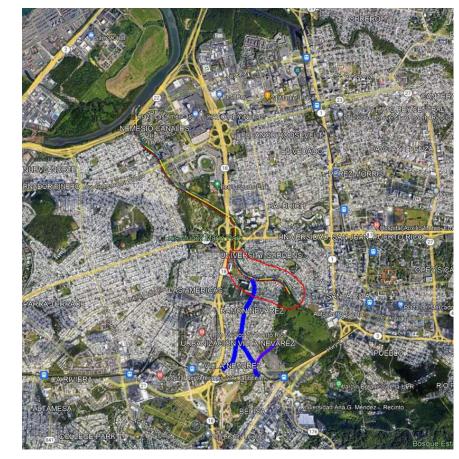


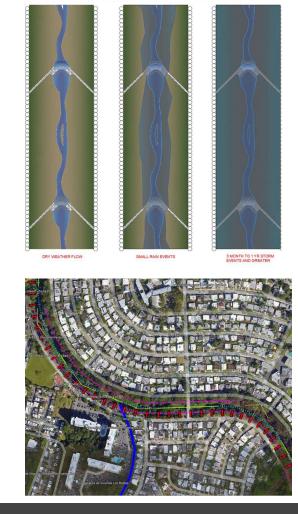


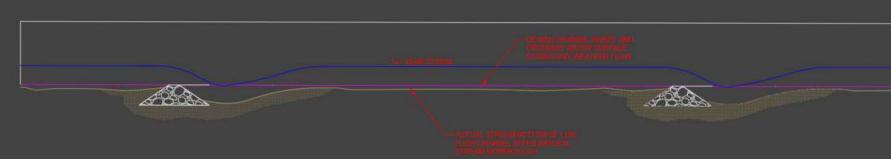




# EWN Projects Puerto Rico









# Building progress

- Expand the "vision" to diversify project benefits
- Increase collaboration and cross-sector partnerships
- Commit to innovation
- Pursue realistic and affordable projects
- Document the value created
- Coordinate communication across partnering organizations for maximum impact











# Questions



EngineeringWithNature.org



# What is FluvialGeomorph?

**FluvialGeomorph (FG):** is a rapid watershed assessment toolkit developed by the Corps of Engineers to assess stream channel stability.

- uses existing high-resolution terrain data-Light Imaging Detection and Ranging (LiDAR) or other available data sets to measure and compare channel morphology.
- channel morphology is then mapped and compared against representative stable channel dimensions (empirical relationships) to identify locations within the watershed where channel instability exists.
- Assessments are completed on a single data set or multiple years depending on the availability of data.
- Geomorphic mapping and the associated metrics provide a basis to identify and assess priority locations within the watershed for further data collection and study or concentrated restoration.





# FluvialGeomorph Workflow:

Ē

