



Engineering With Nature: Striving for Sustainable, Multi-objective Coastal Infrastructure

ERDC

Engineer Research and Development Center

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US Army Corps of Engineers
BUILDING STRONG®



Outline

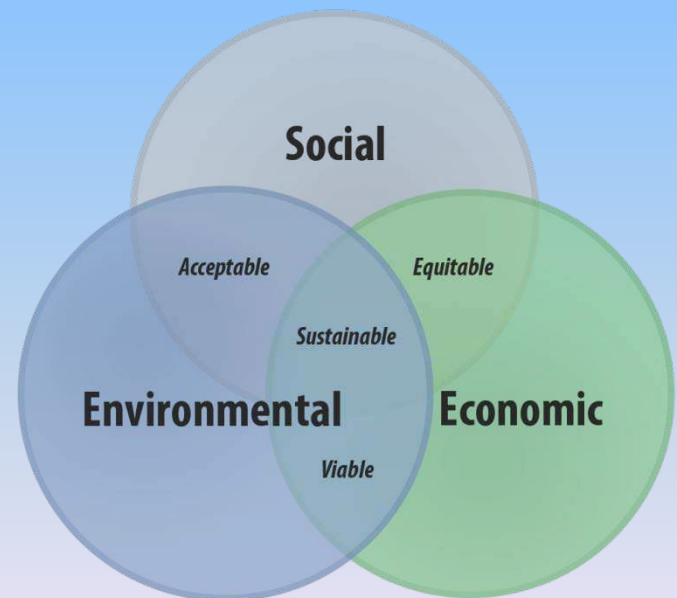
- Engineering With Nature (EWN) background
- Examples
- Project database
- Current demonstration projects
- Path forward

Engineering With Nature is...

...the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits associated with water resources infrastructure through collaborative processes.

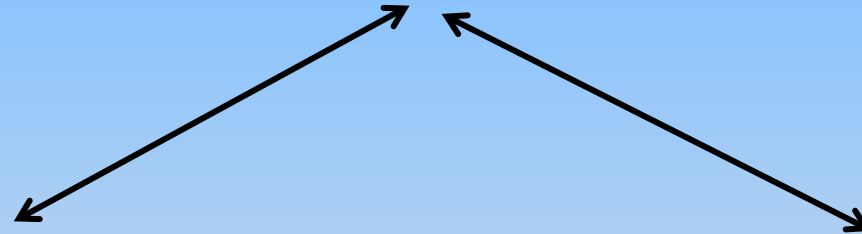
Key Ingredients:

- 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





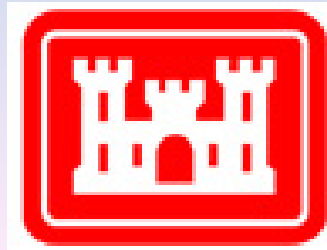
Working with Nature



**Building
with Nature**



**Engineering
With Nature**



The USACE Navigation Mission

To provide safe, reliable, efficient, effective and **environmentally sustainable** waterborne transportation systems for movement of commerce, national security needs, and recreation



The USACE Environmental Operating Principles



US Army Corps
of Engineers®

ENVIRONMENTAL OPERATING PRINCIPLES

One Corps Serving The Army and the Nation

Further information is available at: <http://www.usace.army.mil>



*Environmental
Sustainable Housing
Fort Lee, VA*



*Endangered Whooping Crane
Aransas National Wildlife Refuge, Texas*



*Planting a tree within
Mississippi Delta*



*Listening to the public at
Lake Hartwell drought meeting*



*Alligator as found
in Everglades*

*Corps labs support research and
development in Far East District*

1 Strive to achieve Environmental Sustainability. An environment maintained in a healthy, diverse, and sustainable condition is necessary to support life.

2 Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances.

3 Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

4 Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.

5 Seek ways and means to assess and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.

6 Build and share an integrated scientific, economic and social knowledge base that supports a greater understanding of the environment and impacts of our work.

7 Respect the views of individuals and groups interested in Corps activities; listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the Nation's problems that also protect and enhance the environment.



Current Status

- *Engineering With Nature* initiative was started by USACE Navigation program in 2010. Over that period we have:
 - Engaged USACE Districts (23), Divisions, HQ; other agencies, NGOs, academia, private sector, international collaborators
 - Workshops (9), dialogue sessions, project development teams, etc.
 - Developed a strategic plan for the initiative
 - Initiated research to support the intent of EWN
 - Implementing our communication plan





Opportunities/Existing Examples



River Chevrons



Historical River Training Methodology





Chevrons as Alternative to Dike Extensions



Notched Chevron River Flow and Sediment Bed Behavior

Center section of chevron
at lower elevation (e.g.,
notched)

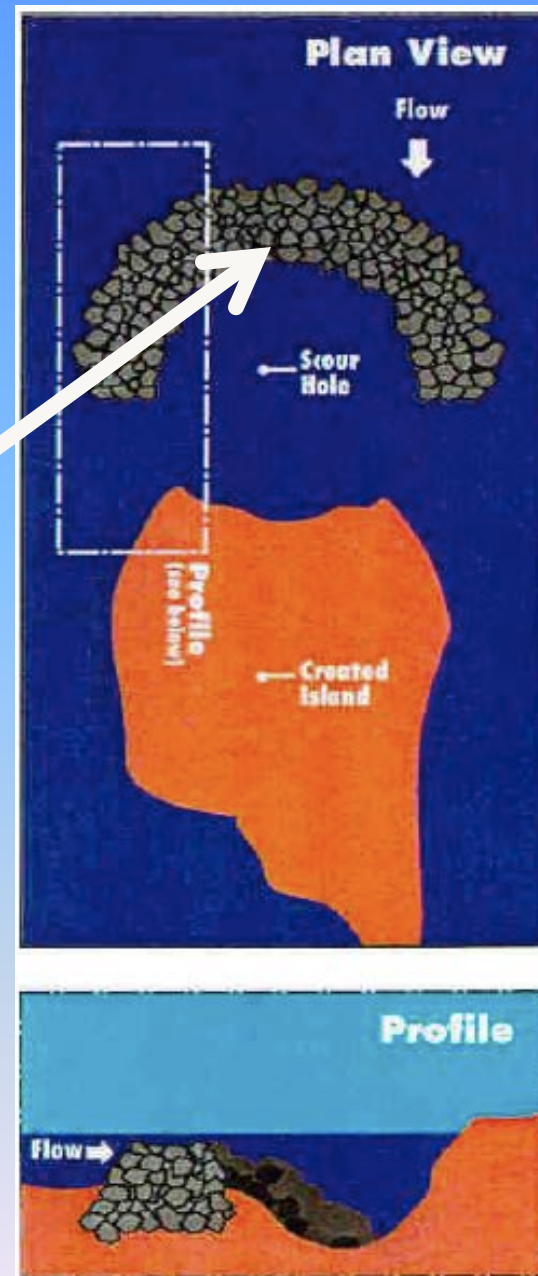
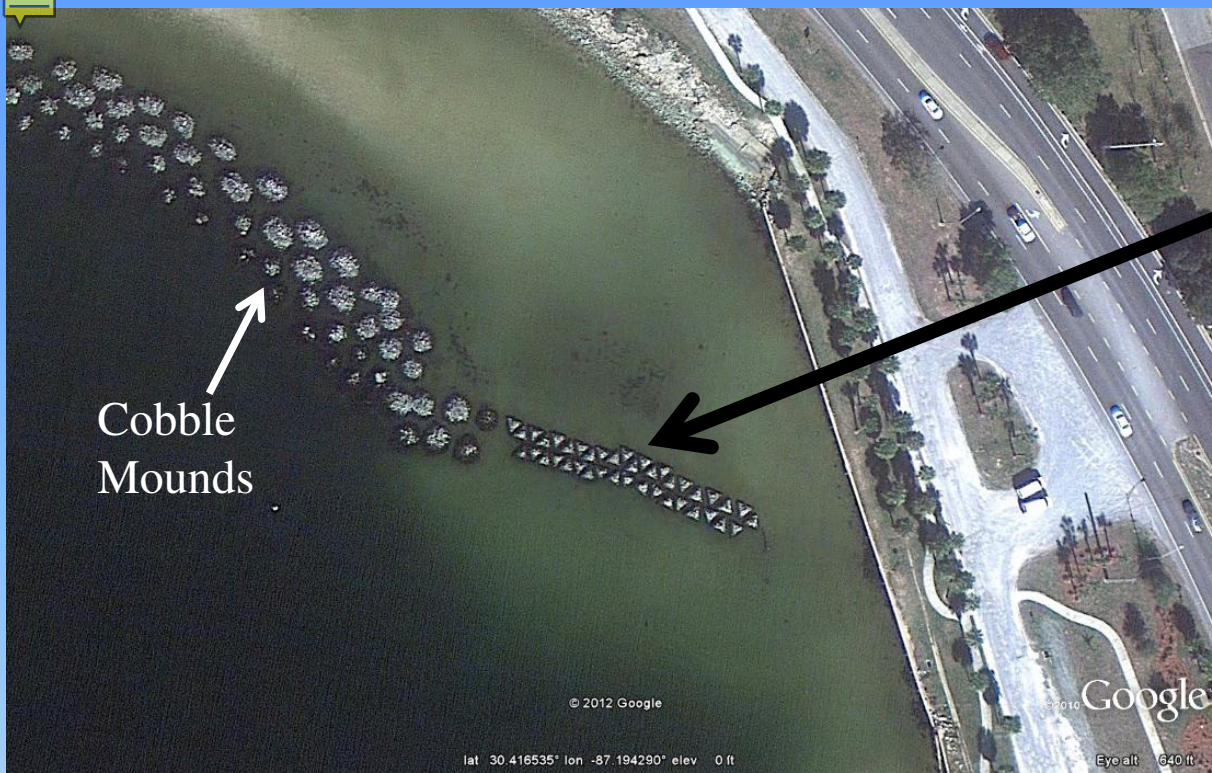


Figure 5.10. Blunt Nosed Chevron



Reef Habitat Breakwaters, Pensacola, FL



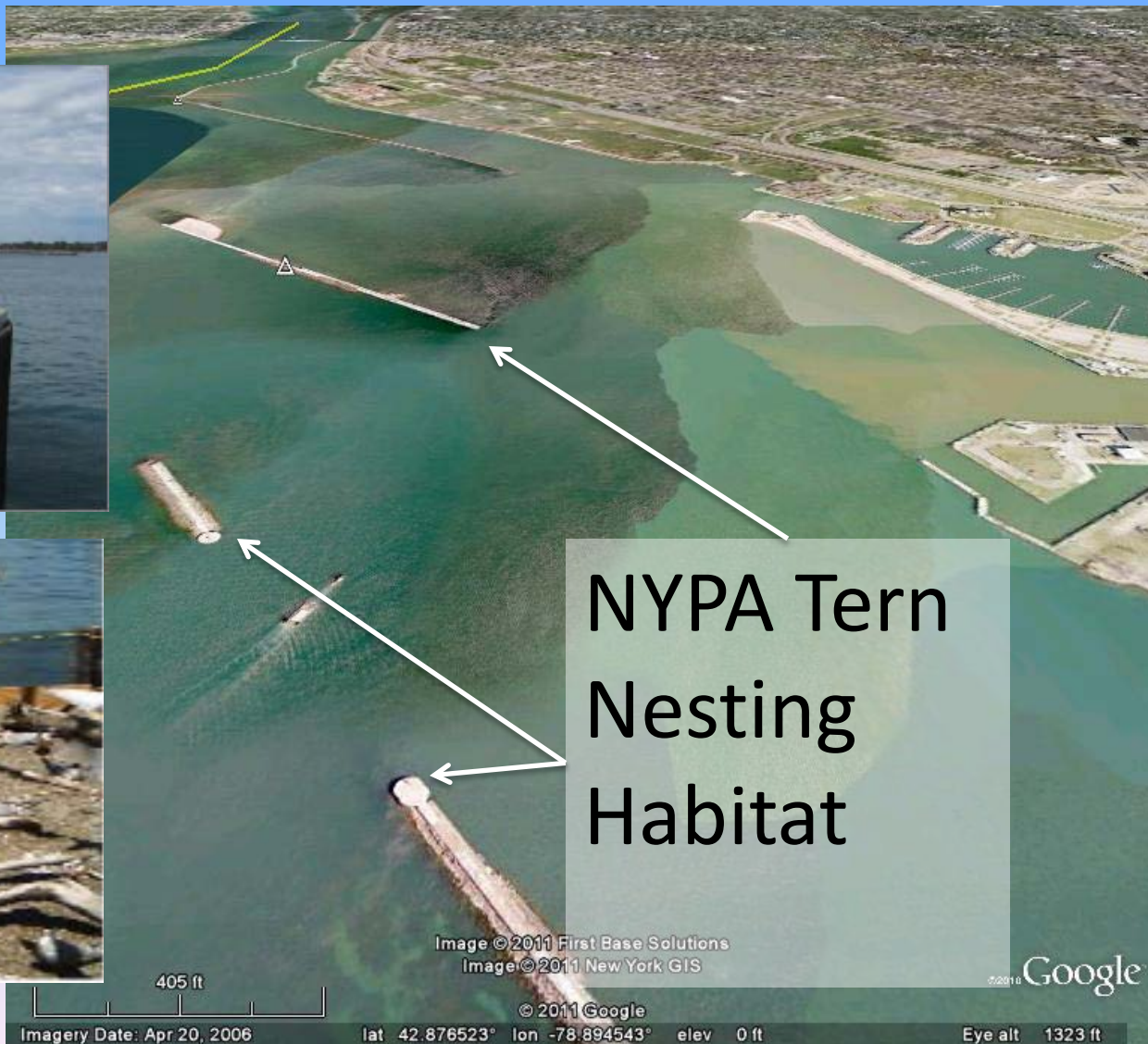
South Bay Marina



- Spur jetties to create marsh and protected shallows.
- Fish spawning stones incorporated into design.

Tern Nesting Habitat

New York Power Authority – Buffalo, NY



NYPA Tern
Nesting
Habitat

Image © 2011 First Base Solutions
Image © 2011 New York GIS

© 2011 Google

405 ft
Imagery Date: Apr 20, 2006

lat 42.876523° lon -78.894543° elev 0 ft

Eye alt 1323 ft

See <http://niagara.nypa.gov/EcologicalStandingCommittee/EcoStanddefault.htm>

Seattle, WA Seawall Study

<https://sites.google.com/a/uw.edu/seattle-seawall-project/home>

3 Sites

3 panel designs, each with 2 surface treatments;
plus Reference and Control

Clay St.

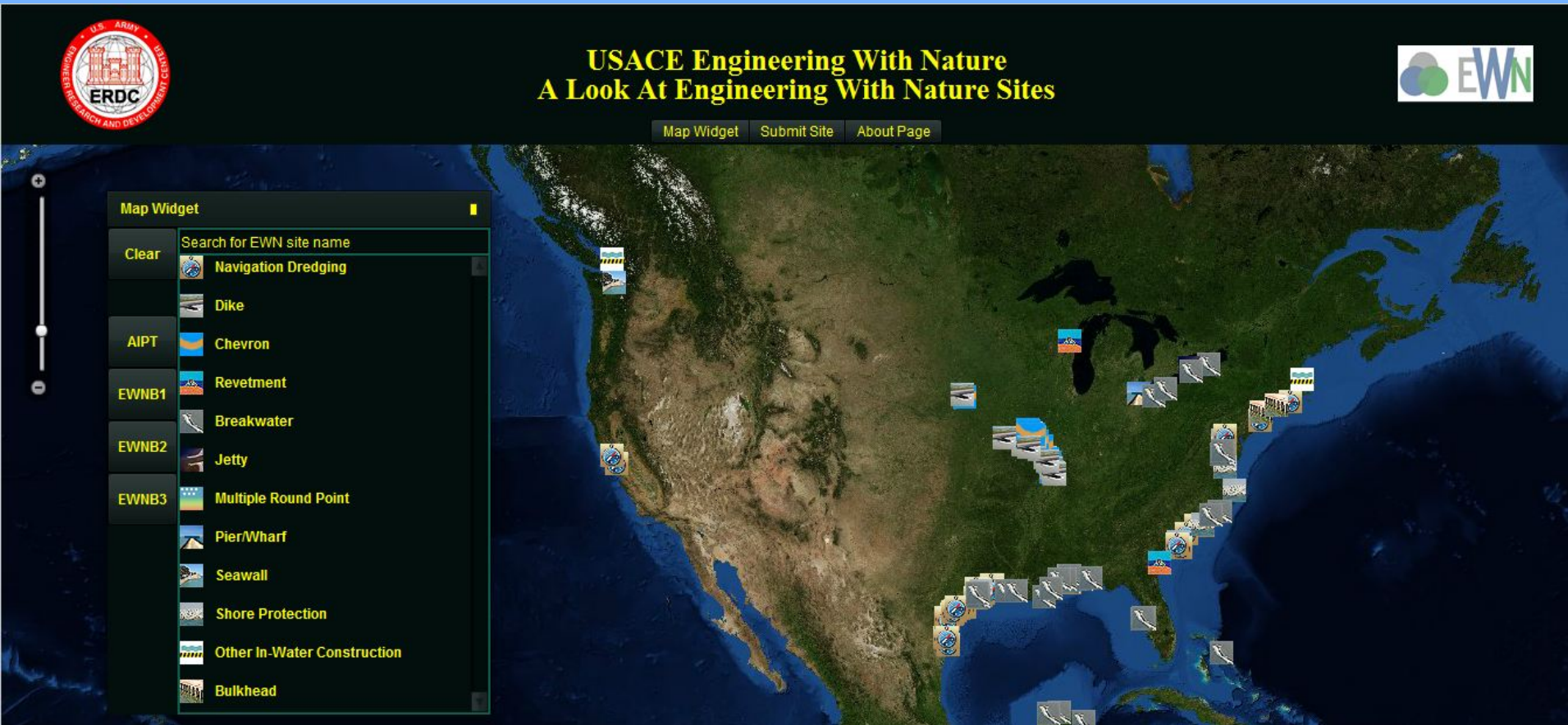
Vine St.

Aquarium



EWN ProMap (project mapper)

interactive on-line catalog of case studies that apply the EWN concept.



<http://155.82.160.6/applications/opj/V013/public/viewer.swf>
or from <http://el.erdc.usace.army.mil/ewn/index.html>

USACE Engineering With Nature

A Look At Engineering With Nature Sites

[Map Widget](#)[Submit Site](#)[About Page](#)

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Site Name

Alonzo Landing Wave Attenuation Devices

Site Owner

University of Alabama Dauphin Island

Associated Infrastructure Project Type

Breakwater

EWN Benefit 1

Fish Habitat

EWN Benefit 2

Invertebrate Habitat

EWN Benefit 3

Default

Description

Submerged reef modules designed to protect the shore and provide fish and invertebrate habitat.

Supporting Hyperlinks

[http://el.erdc.usace.army.mil/ewn/resources/Oyster Reef Breakwaters AI MS Conference on Restoration 05-010.pdf](http://el.erdc.usace.army.mil/ewn/resources/Oyster%20Reef%20Breakwaters%20AI%20MS%20Conference%20on%20Restoration%2005-010.pdf)

<http://mycopri.org/node/16>

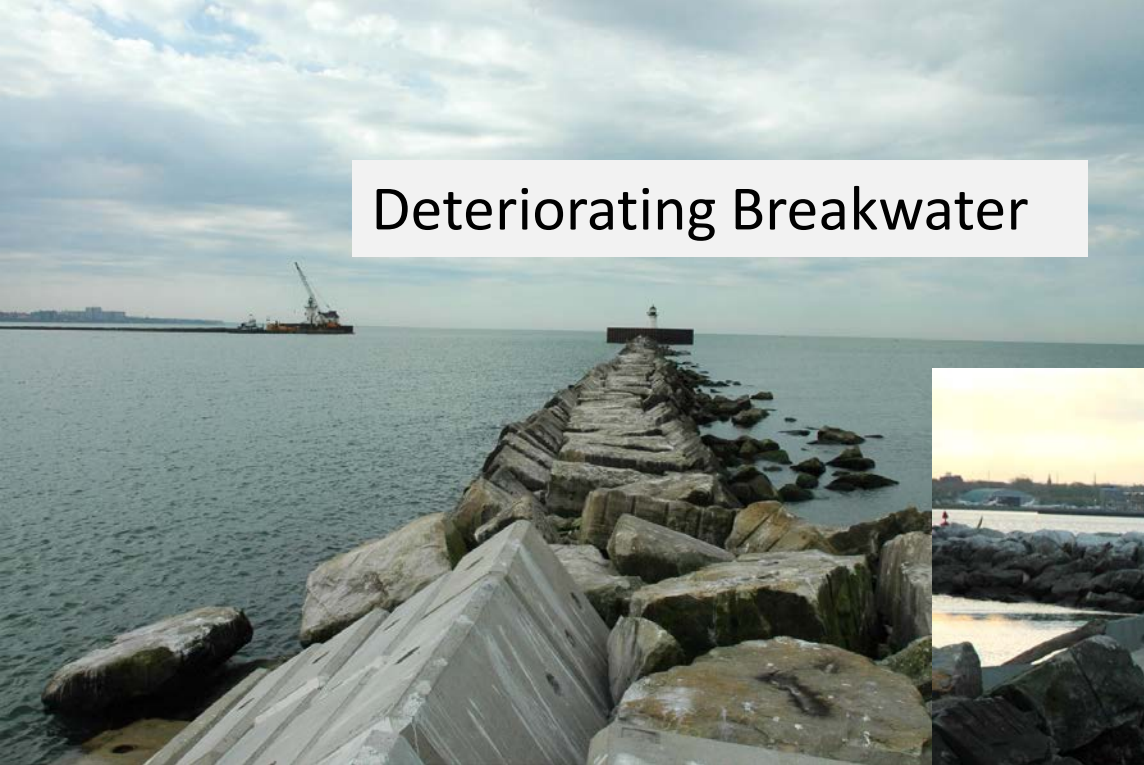
<http://www.estuaries.org/pdf/2010conference/wednesday17/schooner/session3/kirkpatrick-j.pdf>



Current Demonstration Projects



Deteriorating Breakwater



Short Repair Section w/ Block



8' x 4' x 4' Repair Toe Block

Are there ways to improve biological value of blocks?



Cleveland & Ashtabula, OH



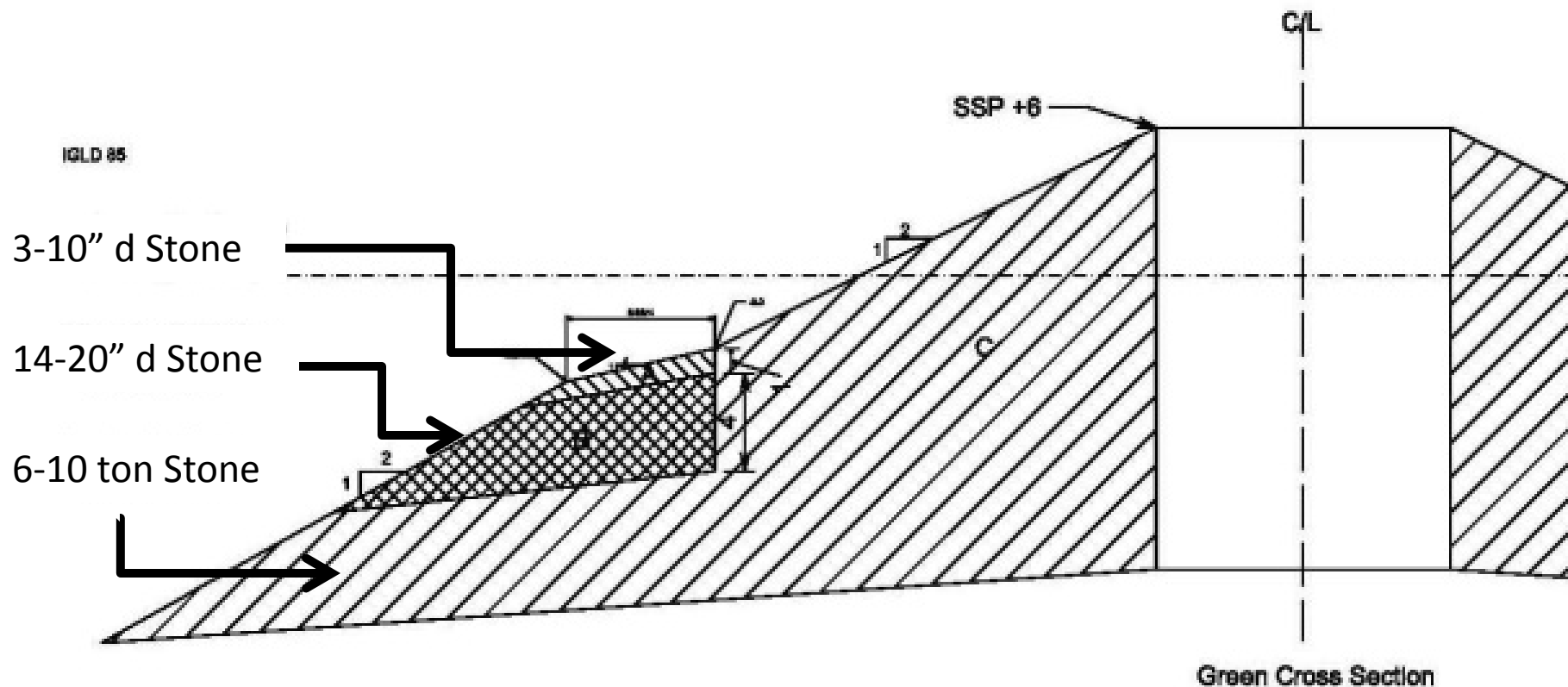
Texture Scale



Ashtabula, OH Tern Nesting



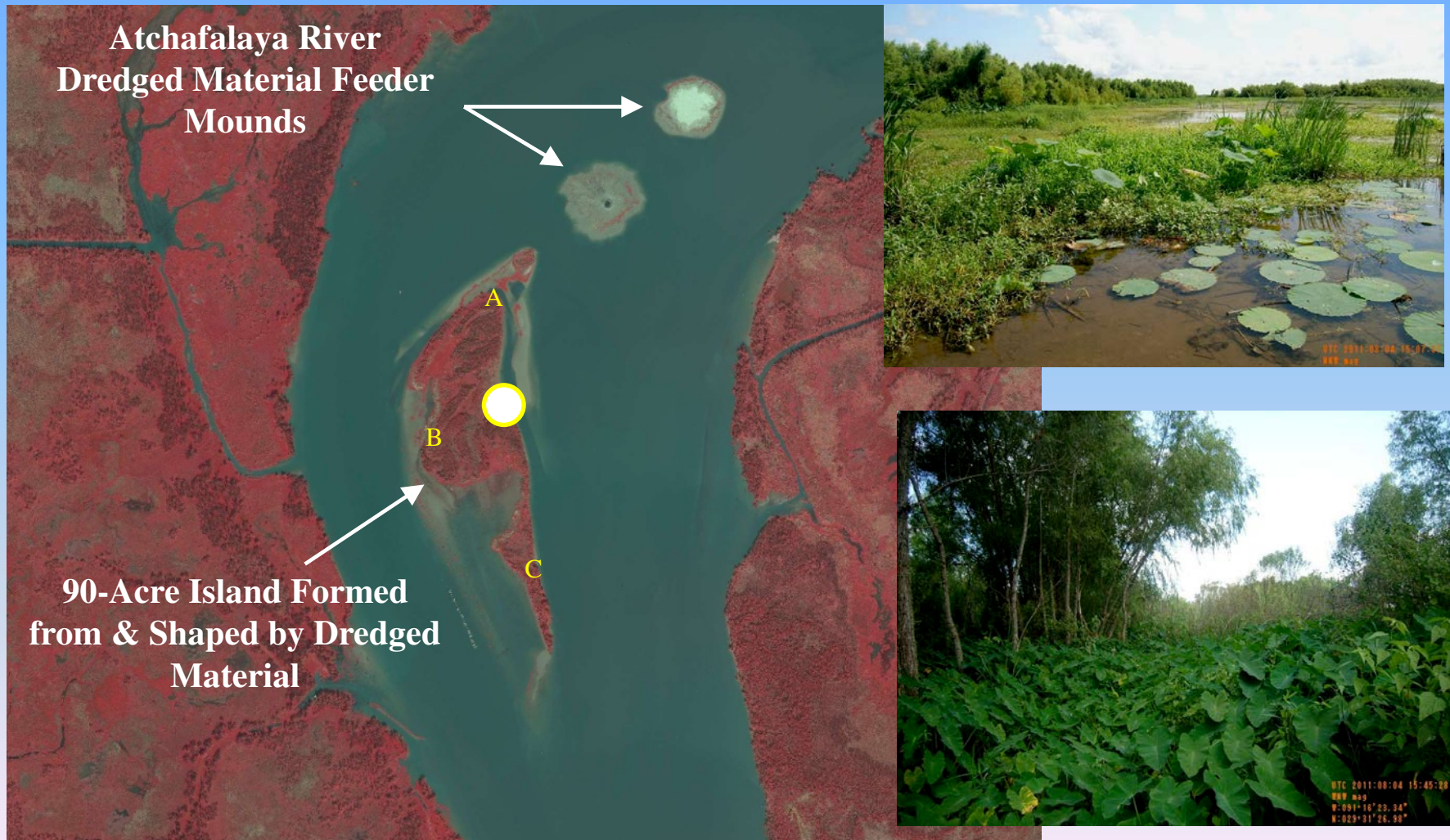
Milwaukee, WI Fish Spawning Shelf





Horseshoe Bend Island

Atchafalaya River, LA



Engineering With Nature Path Forward

- Integrate more fully into organizational culture
- Communicate goals with partners, academia, & public
- Seek opportunities to conduct demonstrations or full scale projects with partners
- Assess and report on project findings

