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

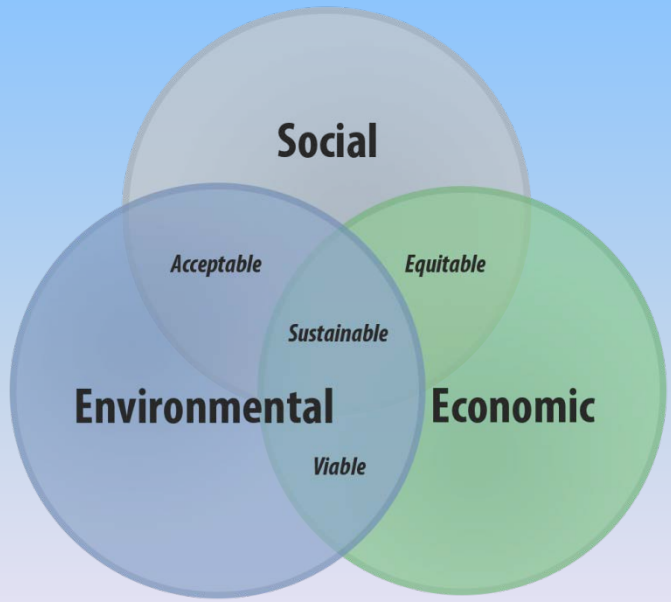
- Engineering With Nature (EWN) background
- Examples
- Project database
- Current demonstration projects
- Path forward

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

EcoShape
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

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.

Wetlands at Melvin Price Lock and Dam

Endangered Whooping Crane Aransas National Wildlife Refuge, Texas

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.

Planting a tree within Mississippi Delta

Listening to the public at Lake Hartwell drought meeting

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.

Alligator as found in Everglades

Corps labs support research and development in Far East District

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)

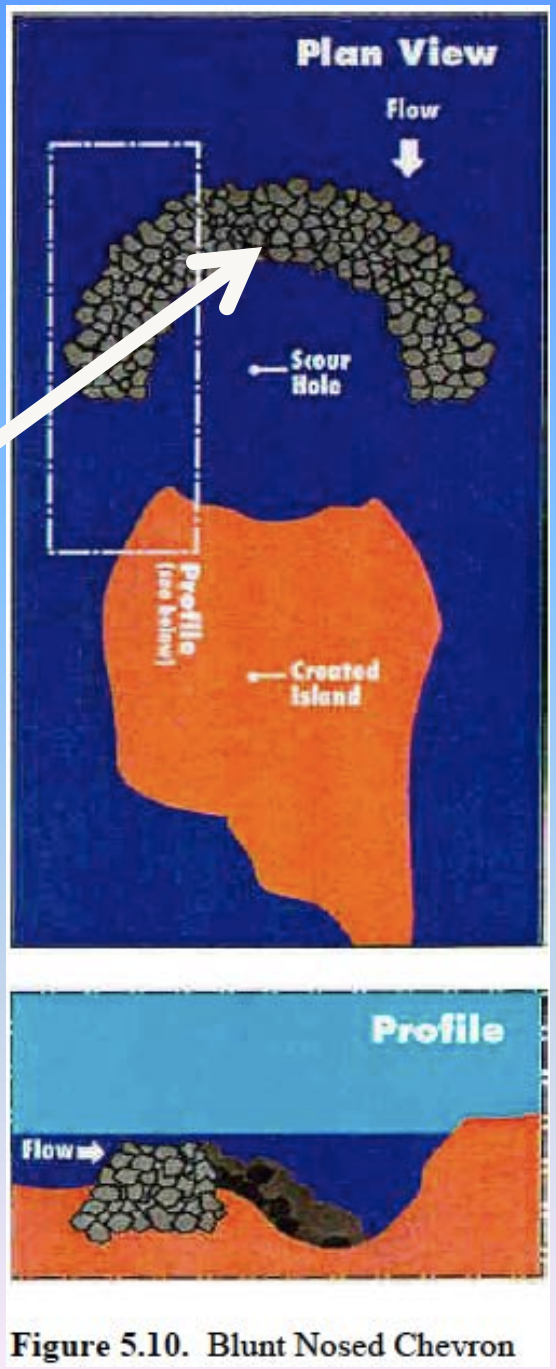


Figure 5.10. Blunt Nosed Chevron

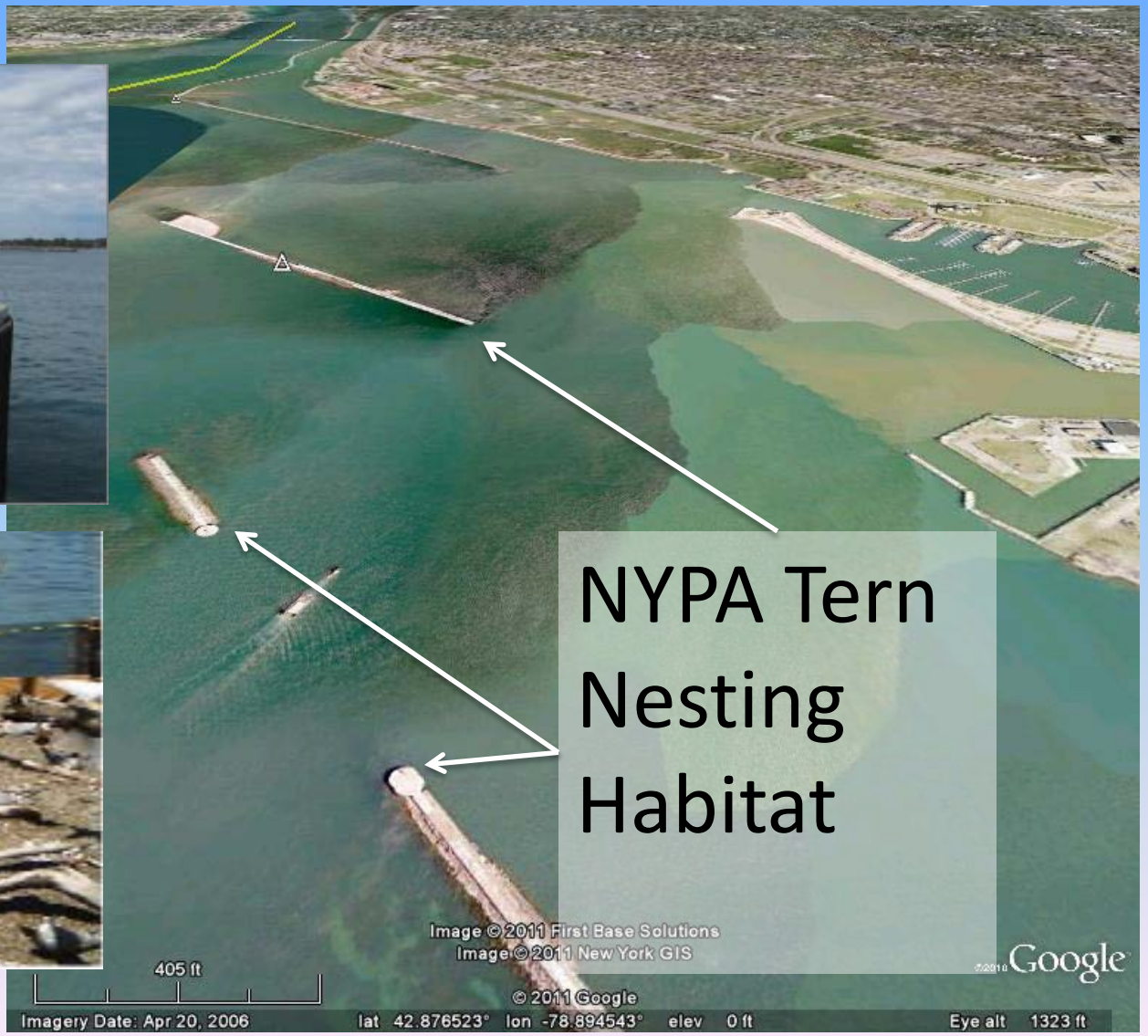
Reef Habitat Breakwaters, Pensacola, FL

South Bay Marina

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

http://www.seagrant.wisc.edu/Home/Topics/HabitatsandEcosystems/Details.aspx?PostID=552

Tern Nesting Habitat
New York Power Authority – Buffalo, NY



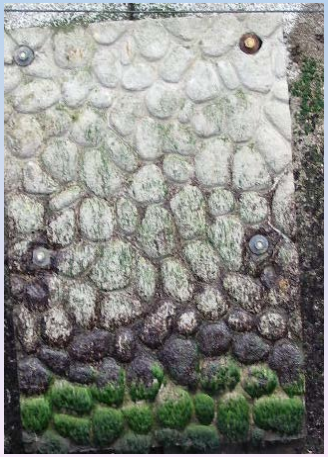
See http://niagara.nypa.gov/EcologicalStandingCommittee/EcoStanddefault.htm

Seattle, WA Seawall Study

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

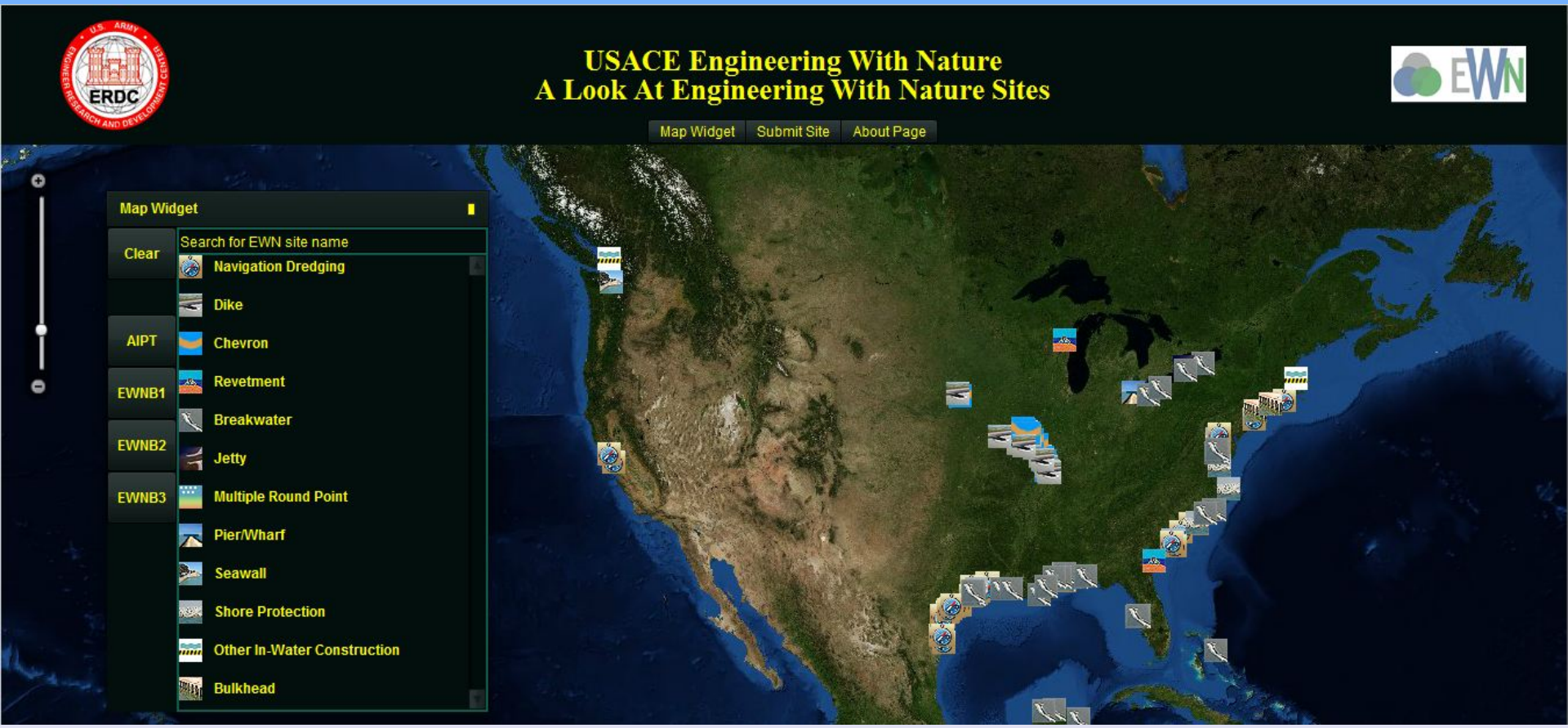
3 Sites

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



EWN ProMap (project mapper)

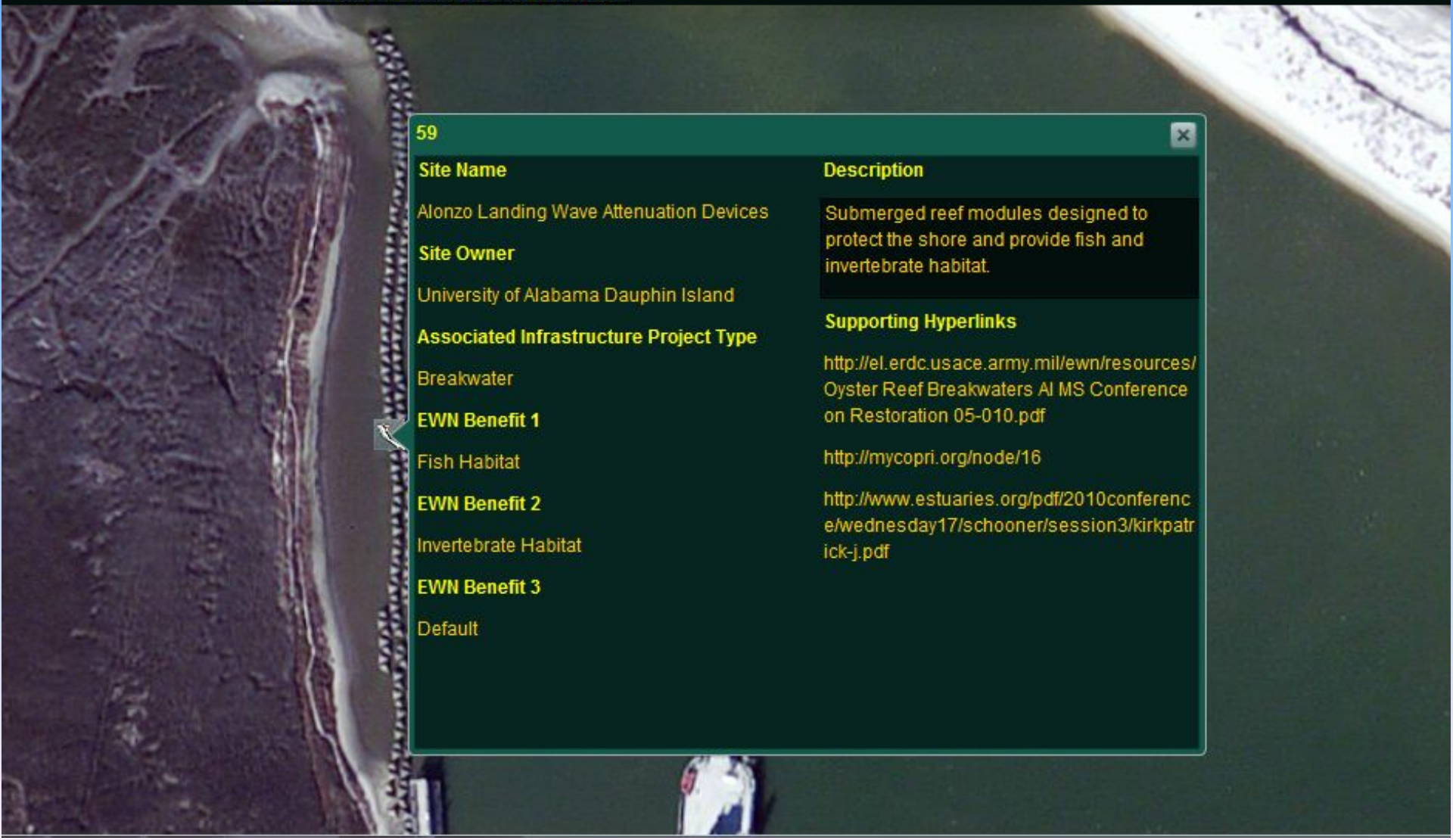
interactive on-line catalog of case studies that apply the EWN concept.



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 Al MS Conference on Restoration 05-010.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

Control

Grooved

Dimpled

Grooved Shelf

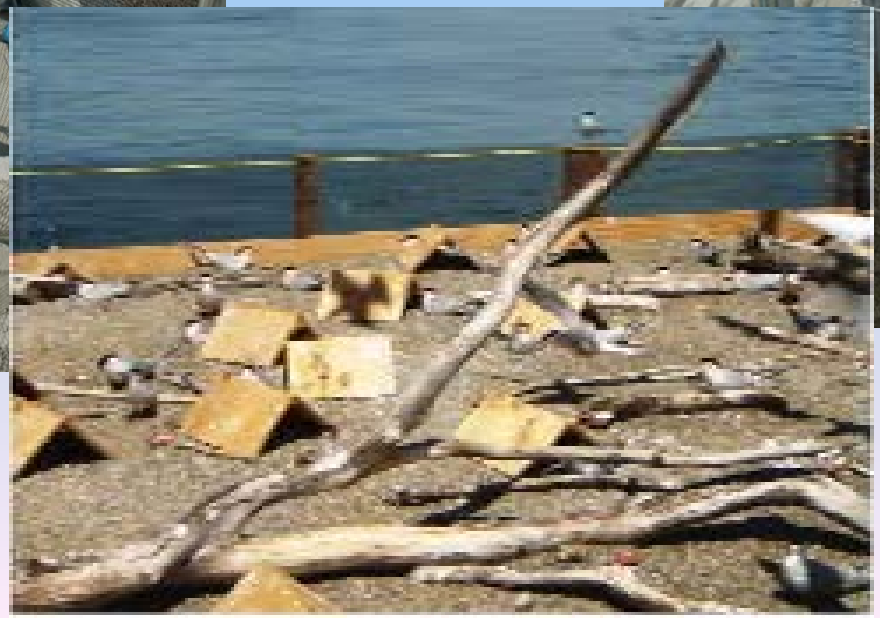
Texture Scale

Ashtabula, OH Tern Nesting

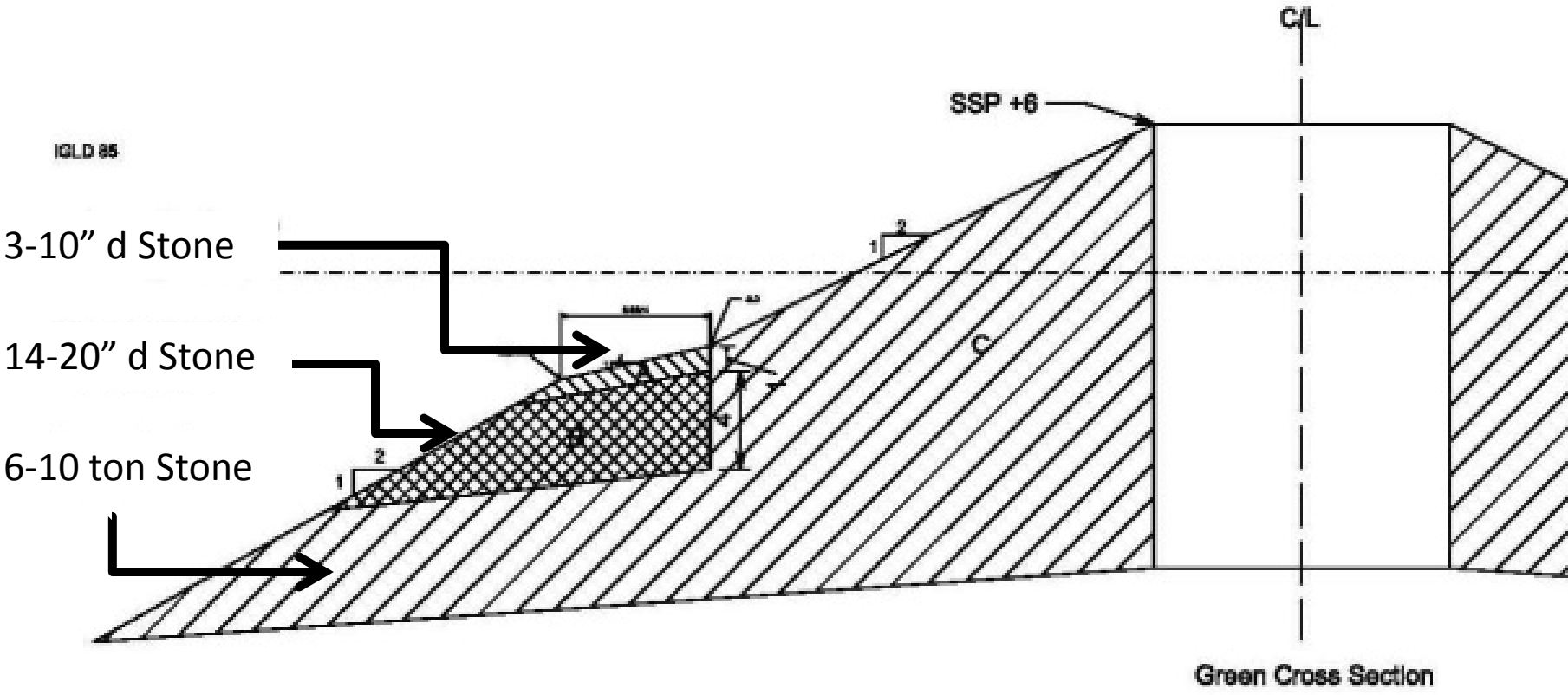
Great Lakes RESTORATION

The Nature Conservancy
Protecting nature. Preserving life.

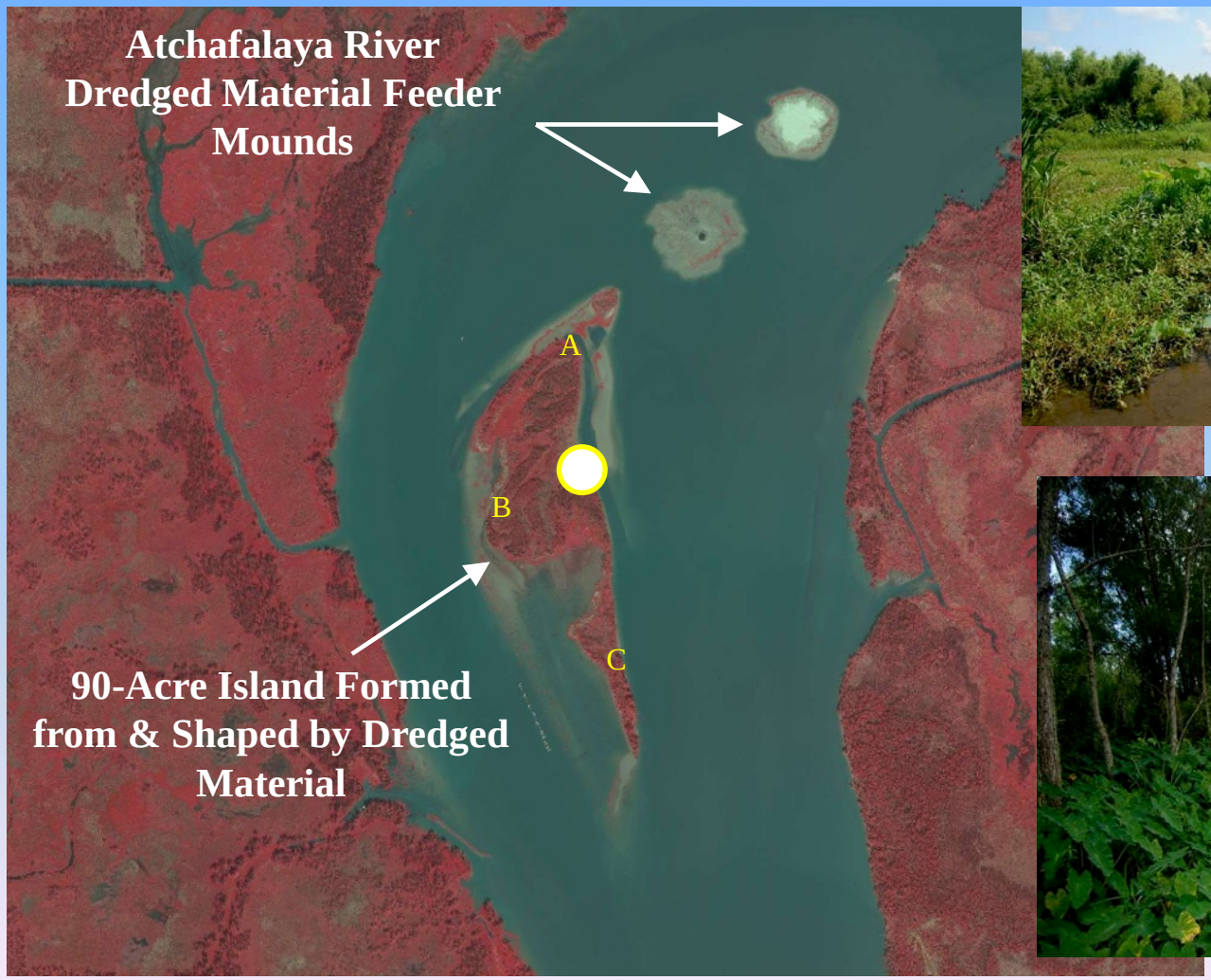
EWN

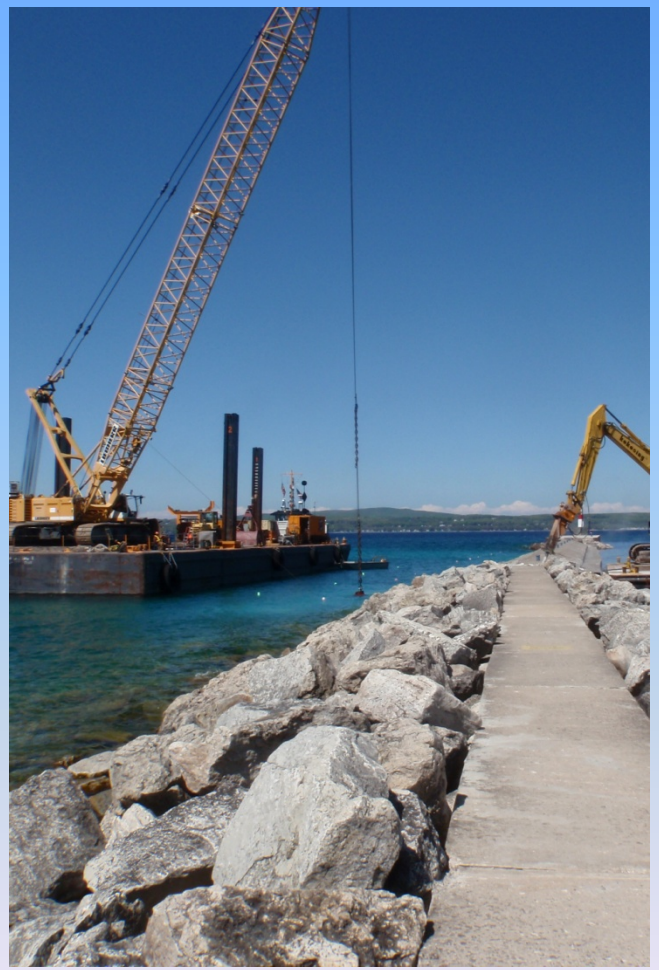


Milwaukee, WI Fish Spawning Shelf



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