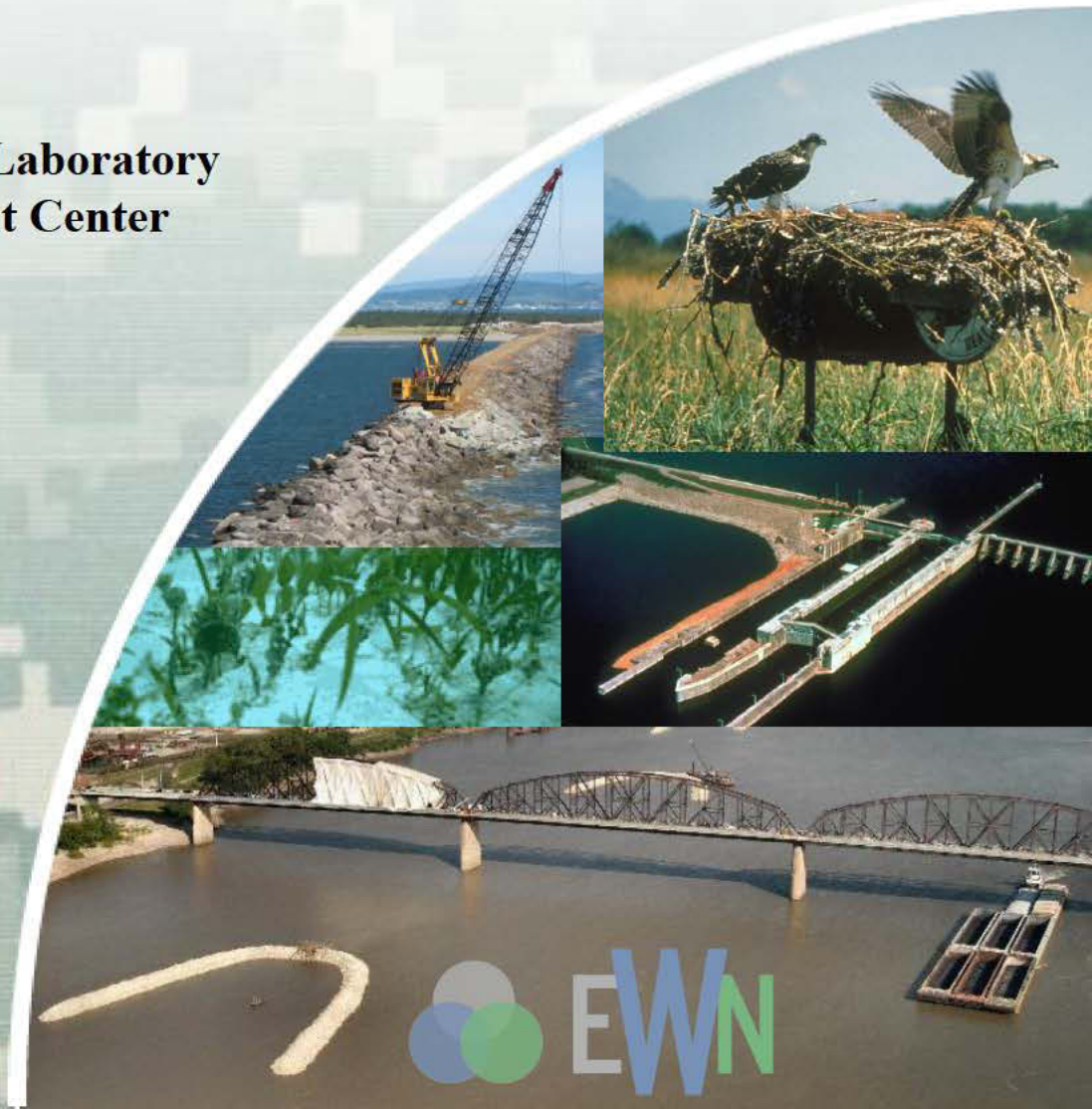
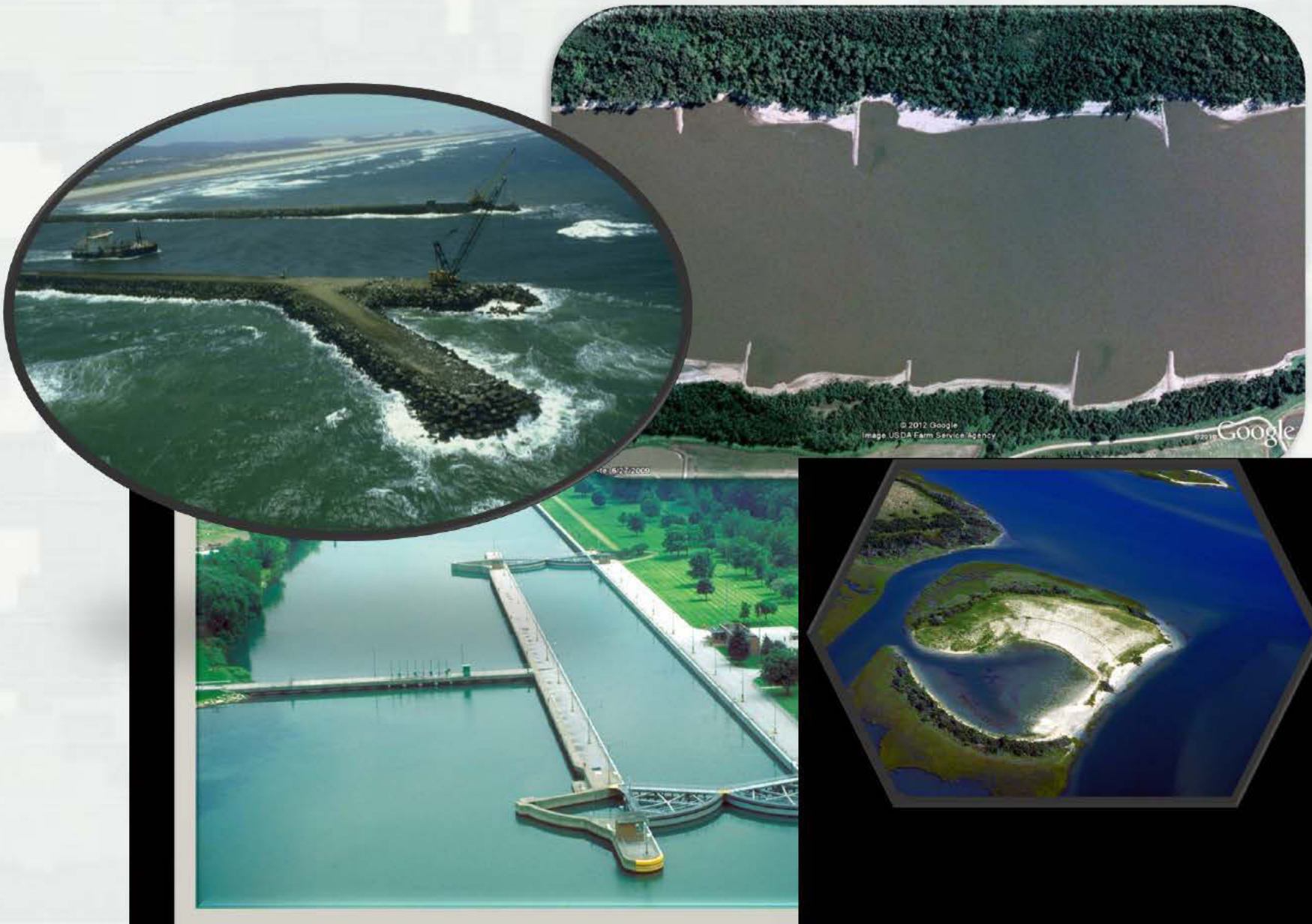
Engineering With Nature
Summary of Prior Work & Results

Dr. Thomas J. Fredette
Research Biologist, Environmental Laboratory
Engineer Research and Development Center



US Army Corps of Engineers
BUILDING STRONG®

Opportunities?



2010 Study

ERDC/EL TR-11-7

Environmental Laboratory

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Engineer Research and Development Center

Environmental Enhancements and Navigation Infrastructure: A Study of Existing Practices, Innovative Ideas, Impediments, and Research Needs

Thomas J. Fredette, Christy M. Foran, Sandra M. Brasfield, and Burton C. Suedel

July 2011

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http://el.erdc.usace.army.mil/elpubs/pdf/trel11-07.pdf

Project Approach

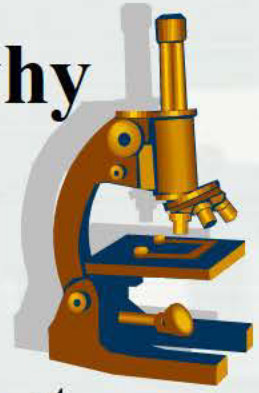
- Webinars
- On-line Survey
- Telephone Follow-up
- Meeting/Conference Presentations
- Data Summary
- Report

Survey Sections

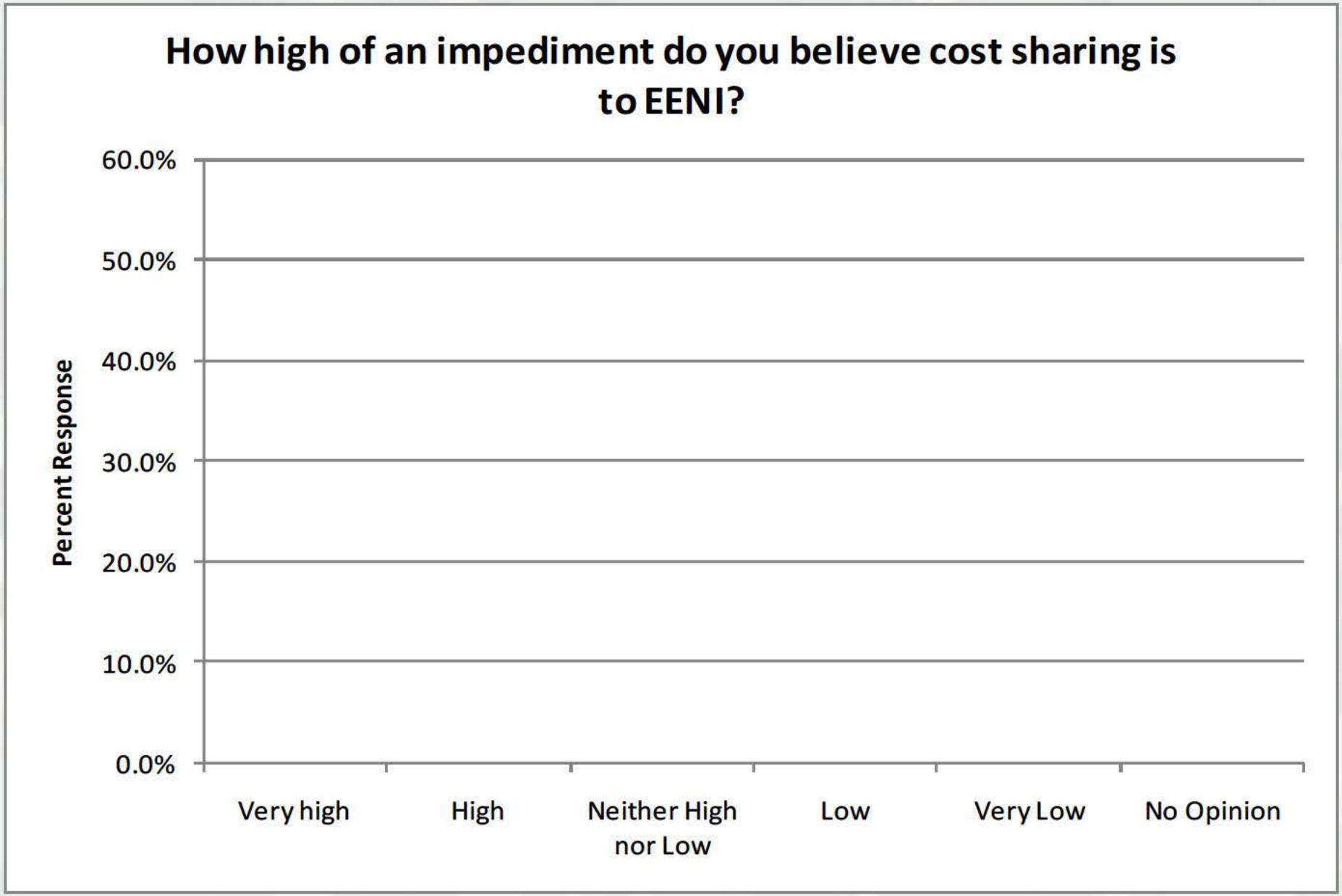
- **Environmental Enhancements: Present and Potential (13 Qs)**
- **Laws, Policies, and Regulations (6 Qs)**
- **Impediments to Use (12 Qs)**
- **Research Needs (8 Qs)**
- **Is There Anything We Missed? (3 Qs)**
- **Invite Others (2 Qs)**
- **Information About You (9 Qs)**

Information Needs

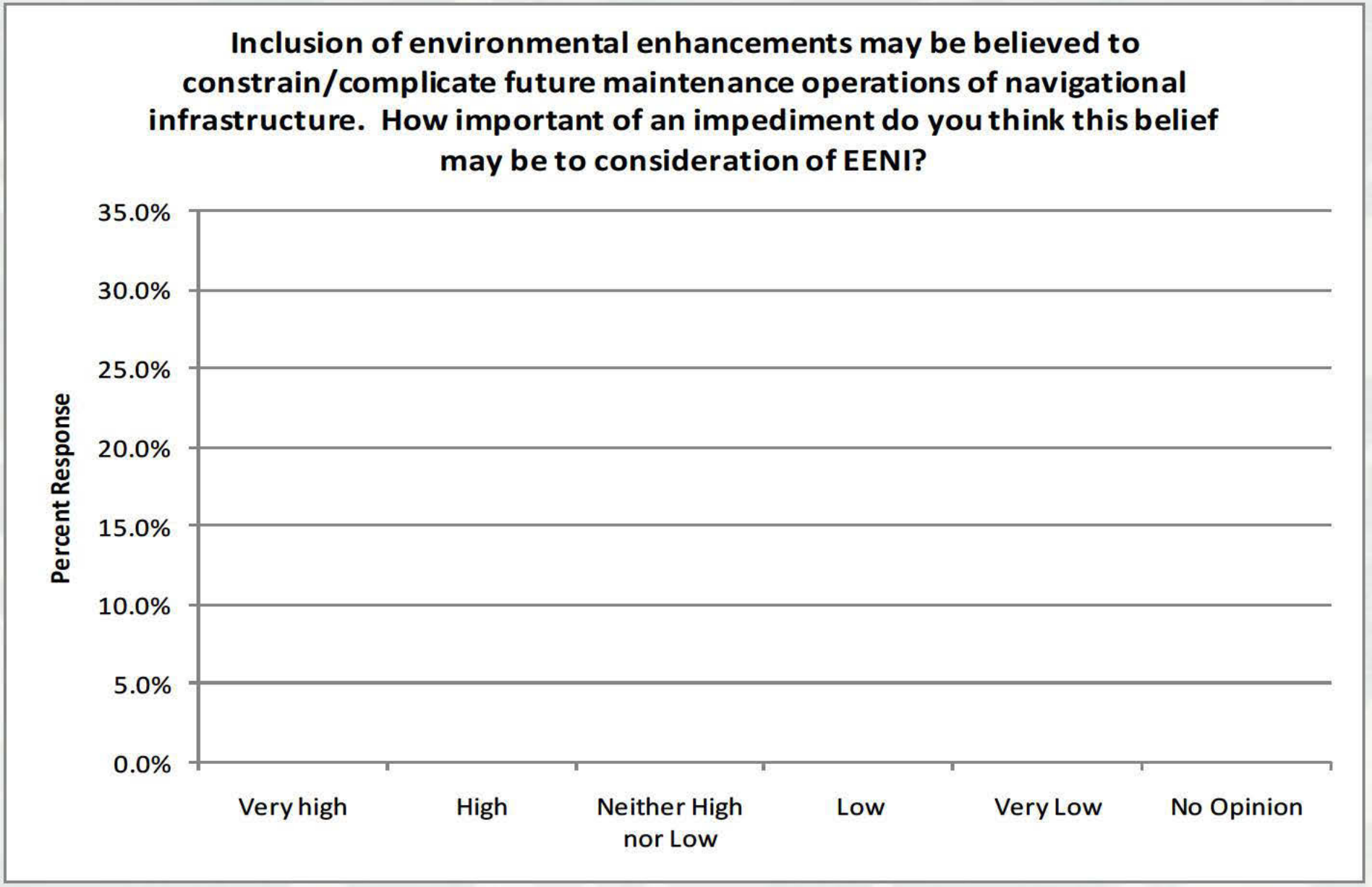
- Key policies, regulations, & laws
- Things we already do
- Ideas for new possibilities
- Things tried that haven't worked and why
- Impediments to improvement
- Potential solutions to impediments
- Items needing further *research* to support use
- Case studies and relevant reports



Views on Impediments



Views on Impediments

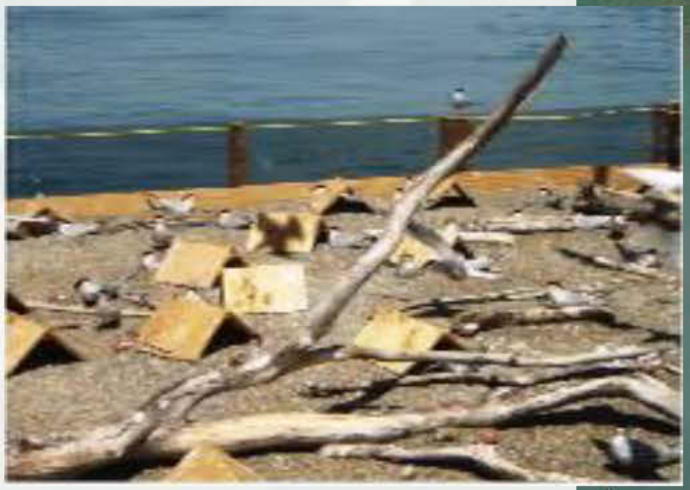


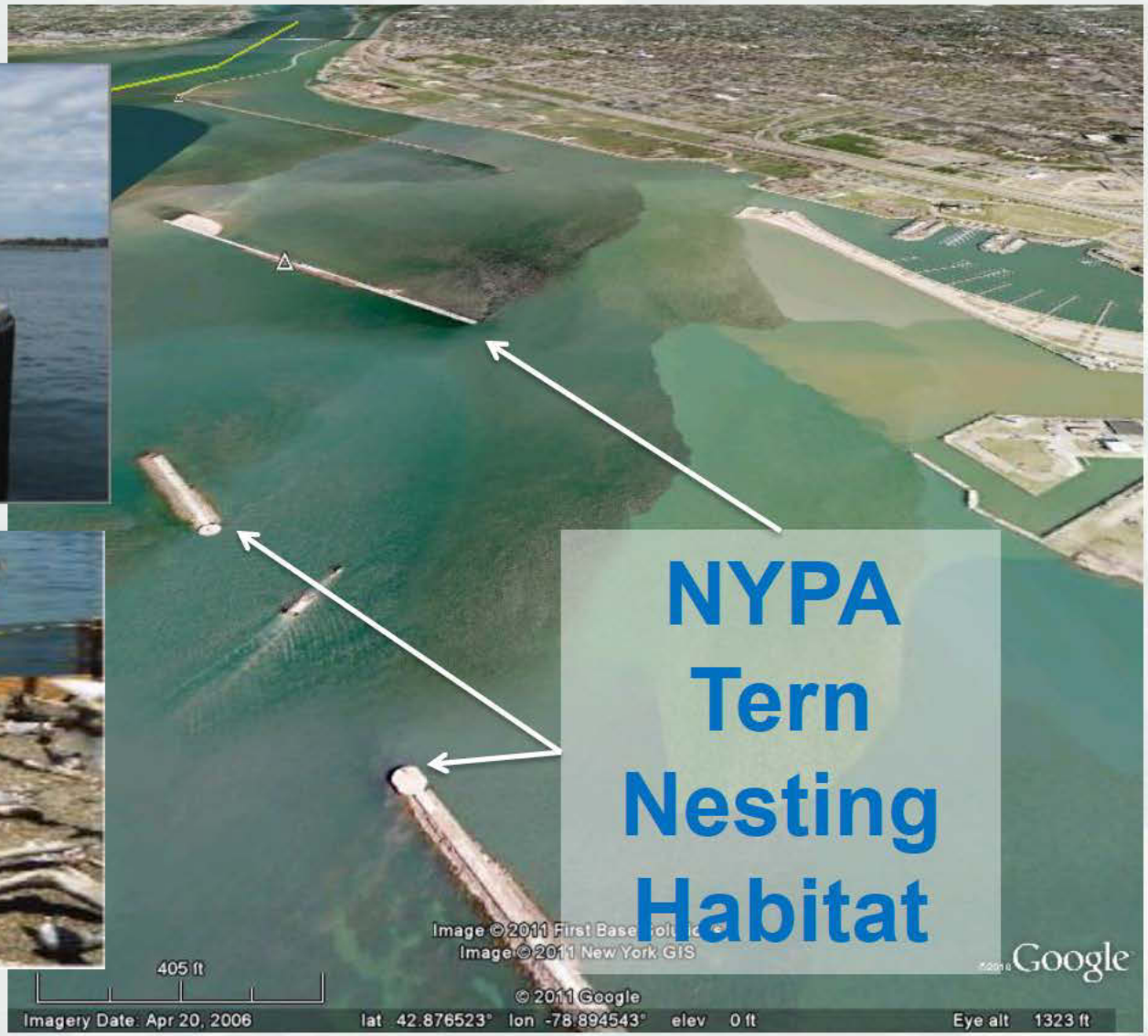
Suggestions to Reduce Impediments

- Greater stakeholder interaction
- Interagency agreements
- Special program funding
- Promote the EENI concept
- Document case studies
- Develop agency goals/metrics

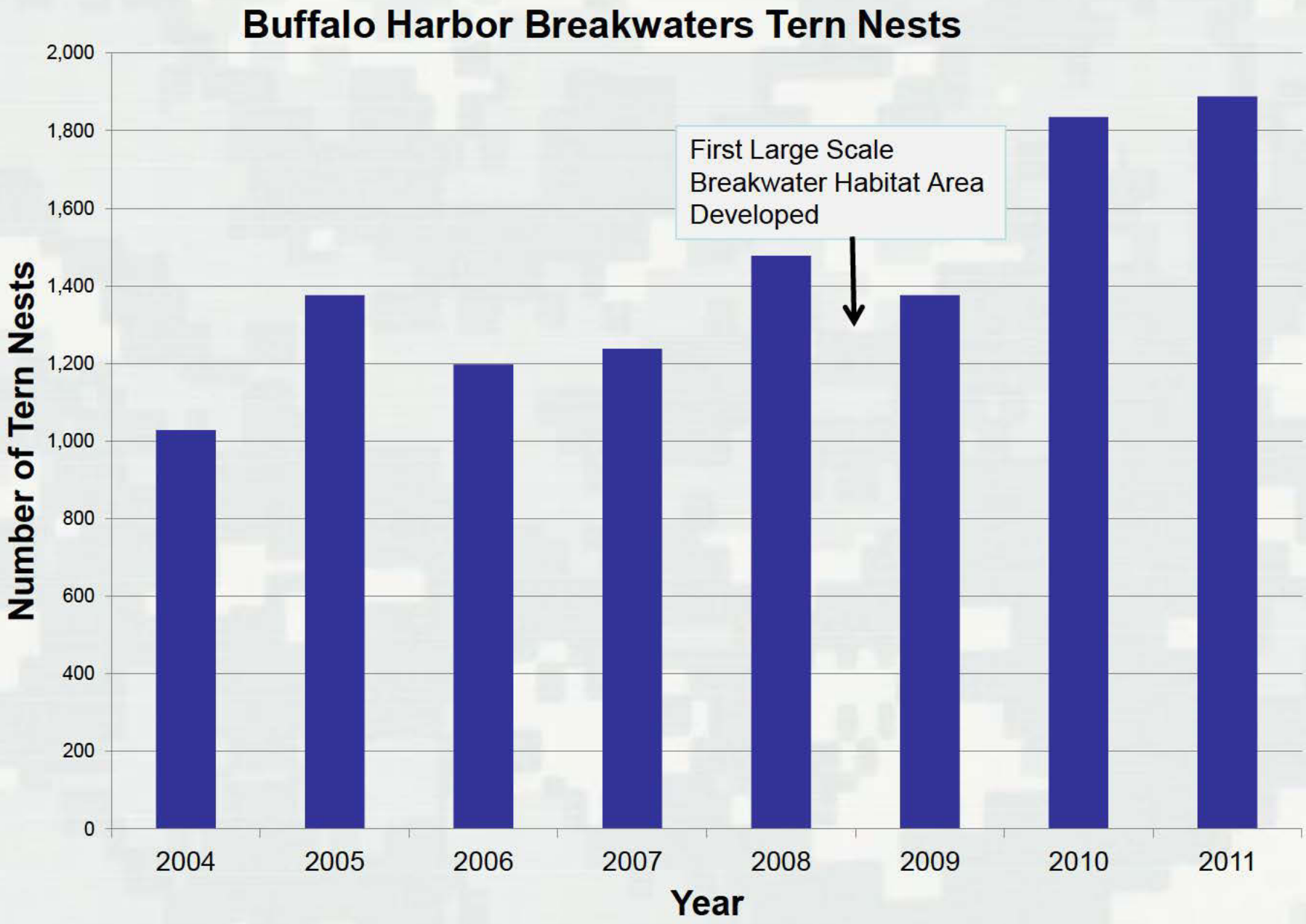
Some Examples

Tern Nesting Habitat
New York Power Authority – Buffalo, NY





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


Buffalo Harbor Breakwaters Tern Nests
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Number of Tern Nests
First Large Scale Breakwater Habitat Area Developed
2004
2005
2006
2007
2008
2009
2010
2011
Year

South Bay Marina

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

ERDC
US Army Engineer Research and Development Center

Great Lakes RESTORATION

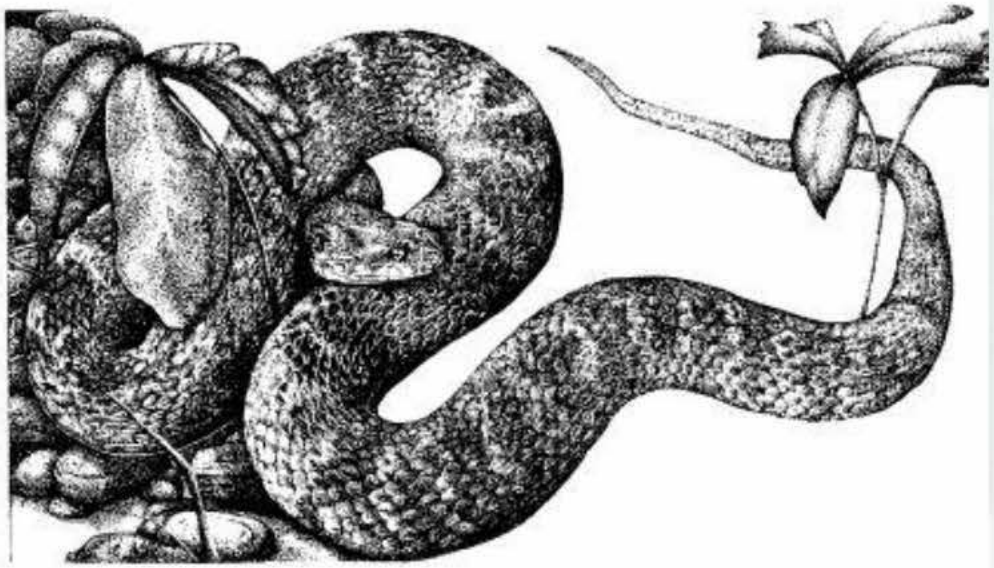
East River Osprey Nest Platform, Buffalo, NY

New York Power Authority

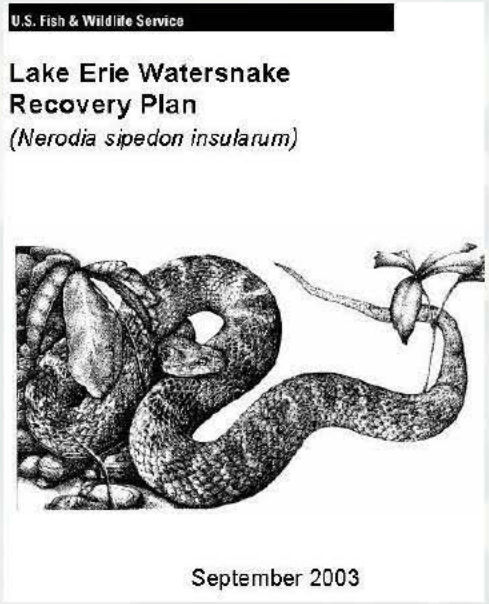
U.S. Fish & Wildlife Service

Lake Erie Watersnake Recovery Plan

(Nerodia sipedon insularum)



September 2003



The ODNR, in consultation with the Ohio Environmental Protection Agency (OEPA) and USFWS, published Coastal Guidance Sheet No.9, entitled, "Shore Structures and the Lake Erie Watersnake" (Appendix C). This document briefly describes the life history and habitat of the snake, and types of shoreline projects that can be designed to benefit the Lake Erie Watersnake. Since the snake was listed under the ESA, the most common type of projects that the USFWS reviews on the islands are private docks. The conservation of Lake Erie Watersnakes can be aided by incorporating rock-oriented designs into shoreline developments and associated erosion control structures. Research indicates that Lake Erie Watersnakes will use rock-filled timber or steel crib docks for summer basking and resting habitat, while sheet steel docks provide no habitat for the snake. In addition, erosion protection such as riprap provides some summer habitat for the snake, while sheet steel or poured concrete erosion protection does not provide habitat for the snake. The guidance sheet provides recommendations to use "snake-friendly" designs to benefit both the landowner and the snake. Such measures have already been adopted by many construction projects on the U.S. islands. By designing these projects in snake-friendly

Public Notice

Applicant: Predevelopment, Ltd.

Date:
Published: December 8, 2005
Expires: January 6, 2006

U.S. Army Corps of Engineers
Buffalo District **CELRB-TD-R** **RE:** 2003-01621(1) **Section:** OH 10 and 404

In Reply Refer To:

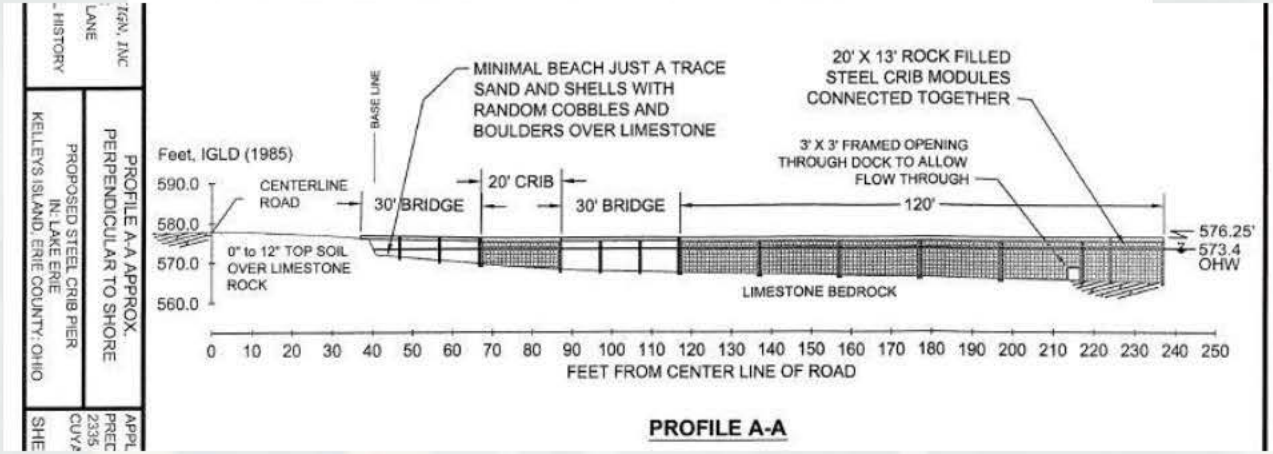
Application for Permit under Authority of Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act (33 U.S.C. 1344).

Predevelopment, Ltd., 2235 Second Street, Suite A, Cuyahoga Falls, Ohio, 44221, has requested a Department of the Army permit to construct a private rock-filled steel crib dock/pier and one stone jetty and install three floating docks in Lake Erie, located on the northwest side of Monagan Road, Kelleys Island, Erie County, Ohio.

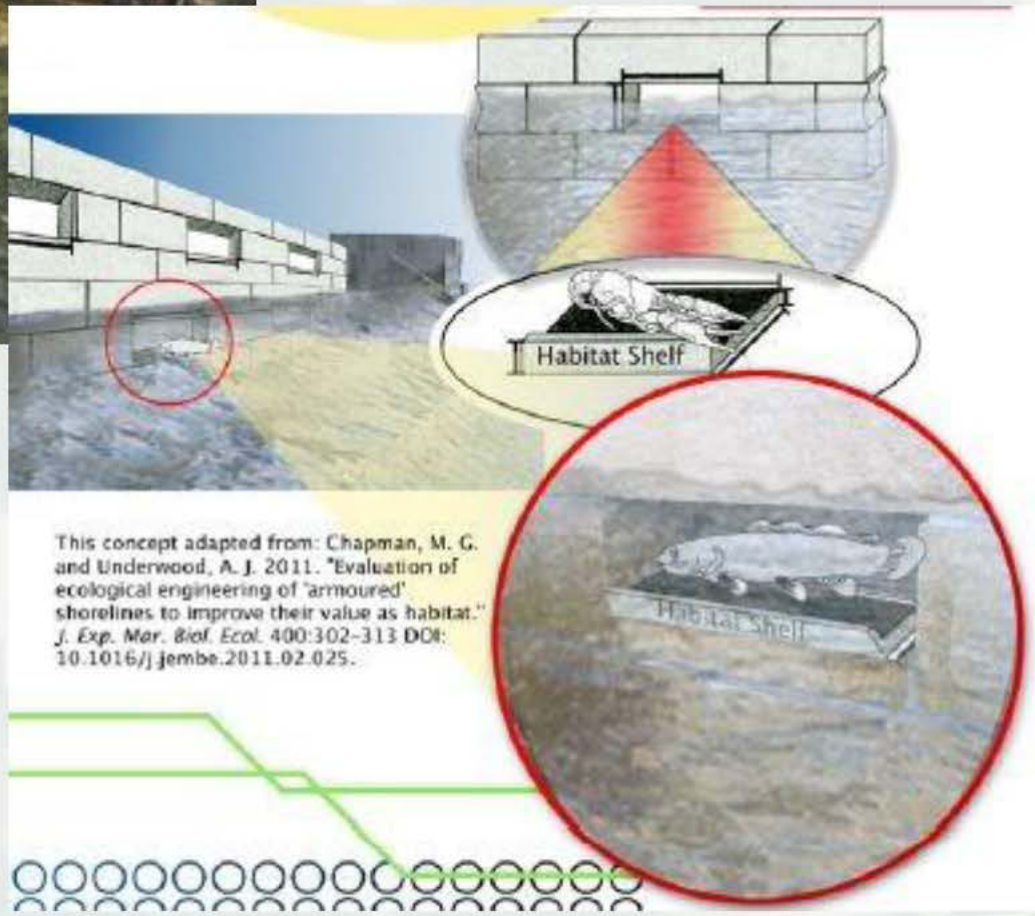
The project consists of the following:

1. The construction of a "J" shaped rock filled steel crib dock/pier, with a 10-foot wide by 200 foot long leg containing two 30-foot long bridges, one at the shore attachment and one waterward of a 20-foot crib dock/pier section. Perpendicular to and west of the north end of this dock will be a 10-foot wide by 186-foot long steel crib dock/pier section. Perpendicular to the west end of this dock and running south will be a 10-foot wide by 40-foot long steel crib dock/pier section. This project was designed to provide habitat for the Lake Erie watersnake (*Nerodia sipedon insularum*) and to maintain water flow along the shoreline.

2. The installation of three 6-foot wide by 24-foot long floating docks on the south side of the 186-foot long dock/pier.



Seawall ½ Flower Pots

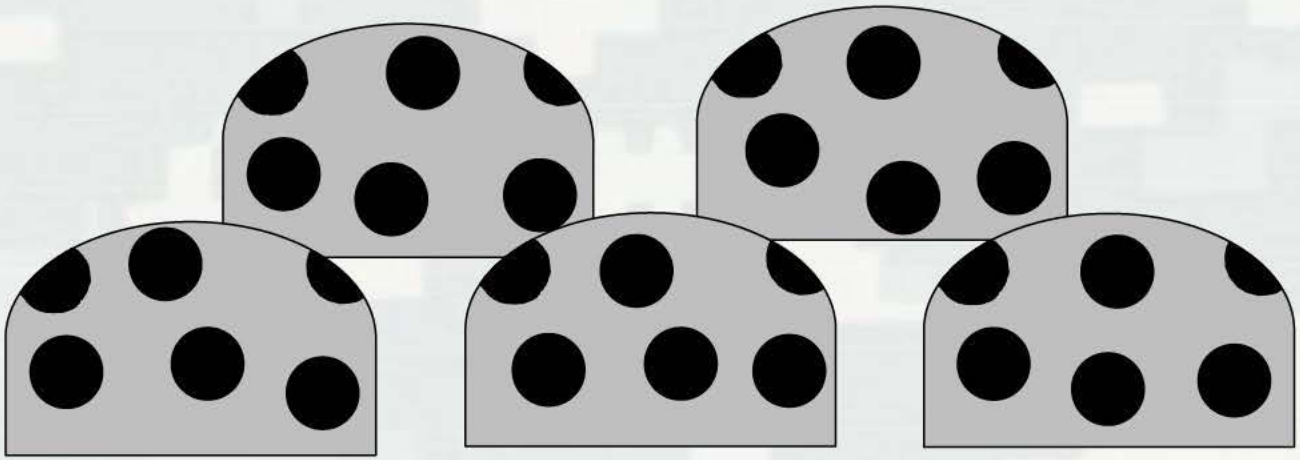


Seawall Habitat Shelves

Dr. Mark Browne

http://youtu.be/iuDmTVHKi40

Reef Habitat Breakwaters, Pensacola, FL



Comparison of Environmental Project Types

Criteria	EWN	Mitigation	Restoration
Extent to which natural processes are used to produce benefits and outcomes	★	★	★
Extent to which the project and its configuration broaden the base of benefits provided (economic, social, and environmental)	★		★
Extent to which the project makes use of collaborative processes to organize and focus interests, stakeholders, and partners	★		★
Extent to which the project produces and makes use of efficiencies to contribute to sustainable delivery of project benefits, including consideration of how the project function is sustainable in the broader systematic context (e.g., regional watershed or sediment systems)	★	★	★
Extent to which the added benefits are incorporated in association with (but not as mitigation for) construction or maintenance of civil works infrastructure	★		

EWN Products

ERDC/EL TR-11-7

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Environmental Engineering of Navigation Infrastructure: A Survey of Existing Practices, Challenges, and Potential Opportunities

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†Environmental Laboratory, US Army Corps of Engineers, Engineer Research and Development Center, 696 Virginia Rd, Concord, Massachusetts 01742, USA

‡Environmental Laboratory, US Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, Mississippi, USA

(Submitted 2 March 2011; Returned for Revision 3 May 2011; Accepted 15 July 2011)

ABSTRACT

Navigation infrastructure such as channels, jetties, river training structures, and lock-and-dam facilities are primary components of a safe and efficient water transportation system. Planning for such infrastructure has until recently involved efforts to minimize impacts on the environment through a standardized environmental assessment process. More recently, consistent with environmental sustainability concepts, planners have begun to consider how such projects can also be constructed with environmental enhancements. This study examined the existing institutional conditions within the US Army Corps of Engineers and cooperating federal agencies relative to incorporating environmental enhancements into navigation infrastructure projects. The study sought to (1) investigate institutional attitudes towards the environmental enhancement of navigation infrastructure (EENI) concept, (2) identify potential impediments to implementation and solutions to such impediments, (3) identify existing navigation projects designed with the express intent of enhancing environmental benefit in addition to the primary project purpose, (4) identify innovative ideas for increasing environmental benefits for navigation projects, (5) identify needs for additional technical information or research, and (6) identify laws, regulations, and policies that both support and hinder such design features. The principal investigation tool was an internet-based survey with 53 questions. The survey captured a wide range of perspectives on the EENI concept including ideas, concerns, research needs, and relevant laws and policies. Study recommendations included further promotion of the concept of EENI to planners and designers, ...tation of pilot studies on some of the innovative ideas provided through the survey, and interagency agreements to facilitate implementation. Integr Environ Assess Manag ...

Jetties Breakwaters Sustainability Lock and dam

...channels, anchorages, ...ctures, and lock-and-...s part of a safe and ...t. For more than 4 ...tructure has involved ...scable, impacts on the ...ronmental assessment ...cy Act 1969). More ...pt of environmental ...to ask whether such ...ome form of environ- ...that goes beyond the ...onmentally damaging ...2010 2010). While the ...odland 1995) and has ...dredged sediments for ...applying an environ- ...ructure itself has been ...

The US Army Corps of Engineers (USACE) has responsibility for an extensive coastal, intracoastal, and inland navigation system with over 19 000 km of navigation channel, 135 navigation locks, and hundreds of jetties, breakwaters, and anchorages. For example, the New England District alone has over 130 breakwaters and jetties with a total length of over 60 km, over 800 hectares of anchorage, and over 750 km of channel. In addition to maintenance and replacement of existing structures, the USACE is also tasked with building new infrastructure on an ongoing basis. As a consequence, applying an environmental sustainability paradigm during the planning for new infrastructure or maintenance of existing infrastructure could result in substantial benefits for ecosystem services where the concept is applied. It is also important to recognize, however, that the USACE is a very large organization and that its activities are governed by a complex set of environmental and fiscal laws, regulations, and policies. Paradigm shifts must contend with such realities. Accordingly, this study was designed to examine the existing institutional conditions within the USACE and cooperating federal agencies relative to incorporating environmental enhancements into navigation infrastructure projects. The study sought to (1) investigate institutional attitudes towards the environmental enhancement of navigation infrastructure (EENI) concept, (2) identify potential impediments to implementation and solutions to such impediments, (3) identify existing navigation projects designed with the express

Environmental Policy & Regulation

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June 2011

DOER

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PURPOSE: The concept that navigation infrastructure can serve as valuable habitat is not novel. However, the concept of designing navigation infrastructure with the specific intent of accomplishing both the engineering goal and specific environmental goals is, in most instances, a new idea for many planners and designers. The inclusion of environmental enhancements in navigation infrastructure represents both opportunities and challenges for project managers. The purpose of this document is to present an overview of the advantages, while addressing some of the implementation challenges, as seen by the current planning and engineering contingents. This study sought to (1) identify existing and potential navigation project features that were designed with the express intent of enhancing environmental benefit; (2) identify laws, regulations, and policies (formulation boundaries) that both support and hinder such design features; (3) identify opportunities for increasing environmental benefits for navigation projects within existing formulation boundaries; (4) propose potential changes to formulation boundaries that would further increase opportunities for environmental benefits; and (5) identify potential areas where research may increase the opportunity to integrate environmental features into future projects.

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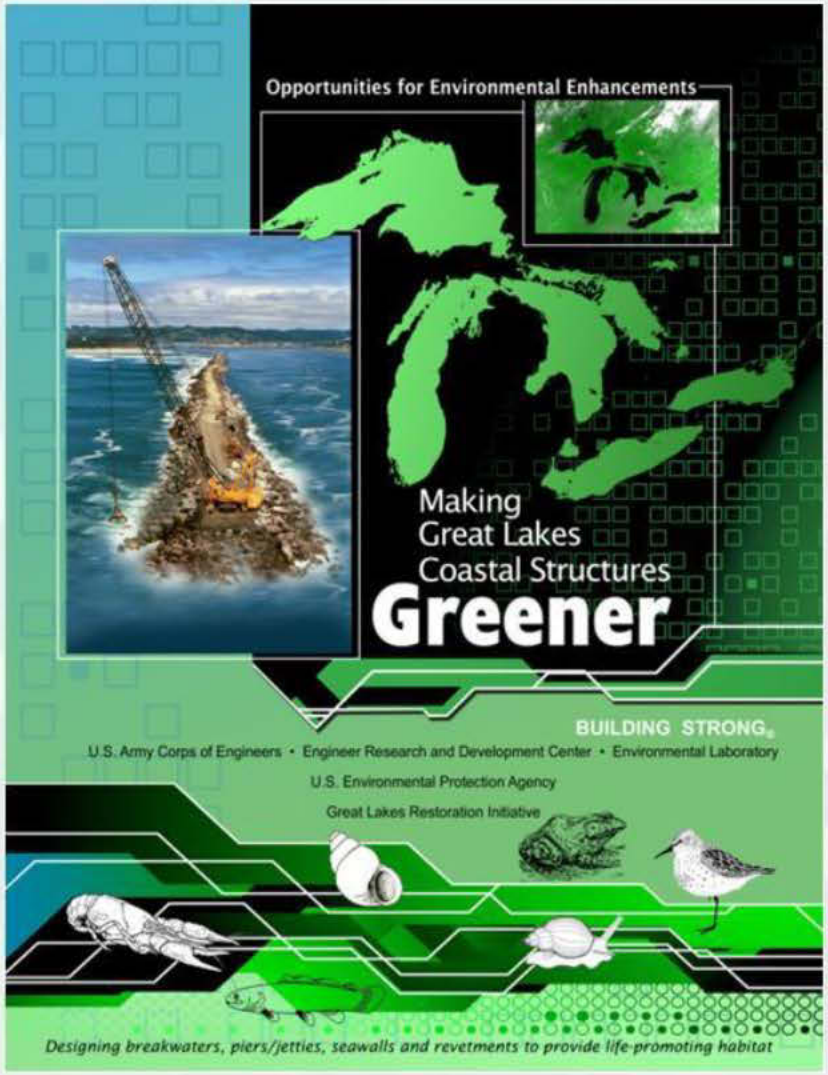
EWN-Related GLRI Products



EWN Mapping Project

Path Forward

EWN Issues	Potential Solutions
Complication of Future Maintenance	Interagency Agreements
Cost Sharing	Section 1135, 206, 107
Compromising Primary Function	Pilot Studies, Modeling
Agency Priority	Agency Goals & Visible Support from Top
Technical Support Basis	***Pilot Studies*** ***Success Documentation***