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

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ERDC
US Army Engineer Research and Development Center

Dredging Operations and Environmental Research
DOER

EENI Project Concept

Identify opportunities to increase environmental enhancements of navigation infrastructure projects

[Focus is on infrastructure (channels, anchorages, jetties, locks, etc.) and not beneficial use of sediment]

Possibilities for Jetties?

Enhance for molluscs, crabs, or lobsters?

Add oyster shell to encourage settlement? Create a sinuous toe?
Add caverns?

EENI Project Concept (2)

Initially based on PIANC* Paper

PIANC Position Paper

'Working with Nature'

October 2008

What do we mean by 'Working with Nature'?

Maximising opportunities; reducing frustrations. **Working with Nature** is an integrated process which involves working to identify and exploit win-win solutions which respect nature and are acceptable to both project proponents and environmental stakeholders. It is an approach which needs to be applied early in a project[1] when flexibility is still possible. By adopting a determined and proactive approach from conception through to project completion, opportunities can be maximised and - importantly - frustrations, delays and associated extra costs can be reduced.

* Environmental Commission of PIANC

EENI Project Concept (3)
Builds on USACE Goals

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

Wetlands at Melvin Price Lock and Dam

Endangered Whooping Crane Aransas National Wildlife Refuge, Texas

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

EOPs especially relevant to the concept

2009
US Army Corps of Engineers' Campaign Plan

Campaign Plan goals especially relevant to the concept

Goal 2: Deliver enduring and essential water resource solutions through collaboration with partners and stakeholders.

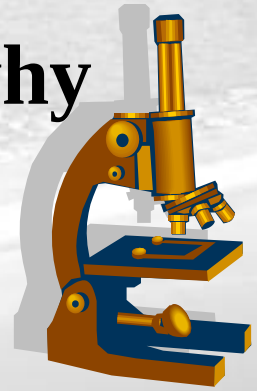
Objective 2a: Deliver integrated, sustainable, water resources solutions.

Objective 2b: Implement collaborative approaches to effectively solve water resource problems.

Objective 2c: Implement Streamlined and Transparent Regulatory Processes to Sustain Aquatic Resources.

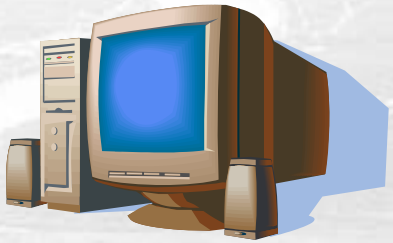
Information Needs

- **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**



Project Approach

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



*Initial Target Group: US Federal Agencies (USACE, USEPA, etc.)

EENI 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)**

EENI Survey Sample

DOER EENI Survey

4. Impediments to Use

A number of potential impediments to incorporating environmental enhancements into USACE navigation features have been identified. These include (1) non-federal cost sharing requirements, (2) institutional resistance within the USACE, and (3) concerns about future maintenance on "enhanced" infrastructure.

*** 1. How high of an impediment do you believe cost sharing is to EENI?**

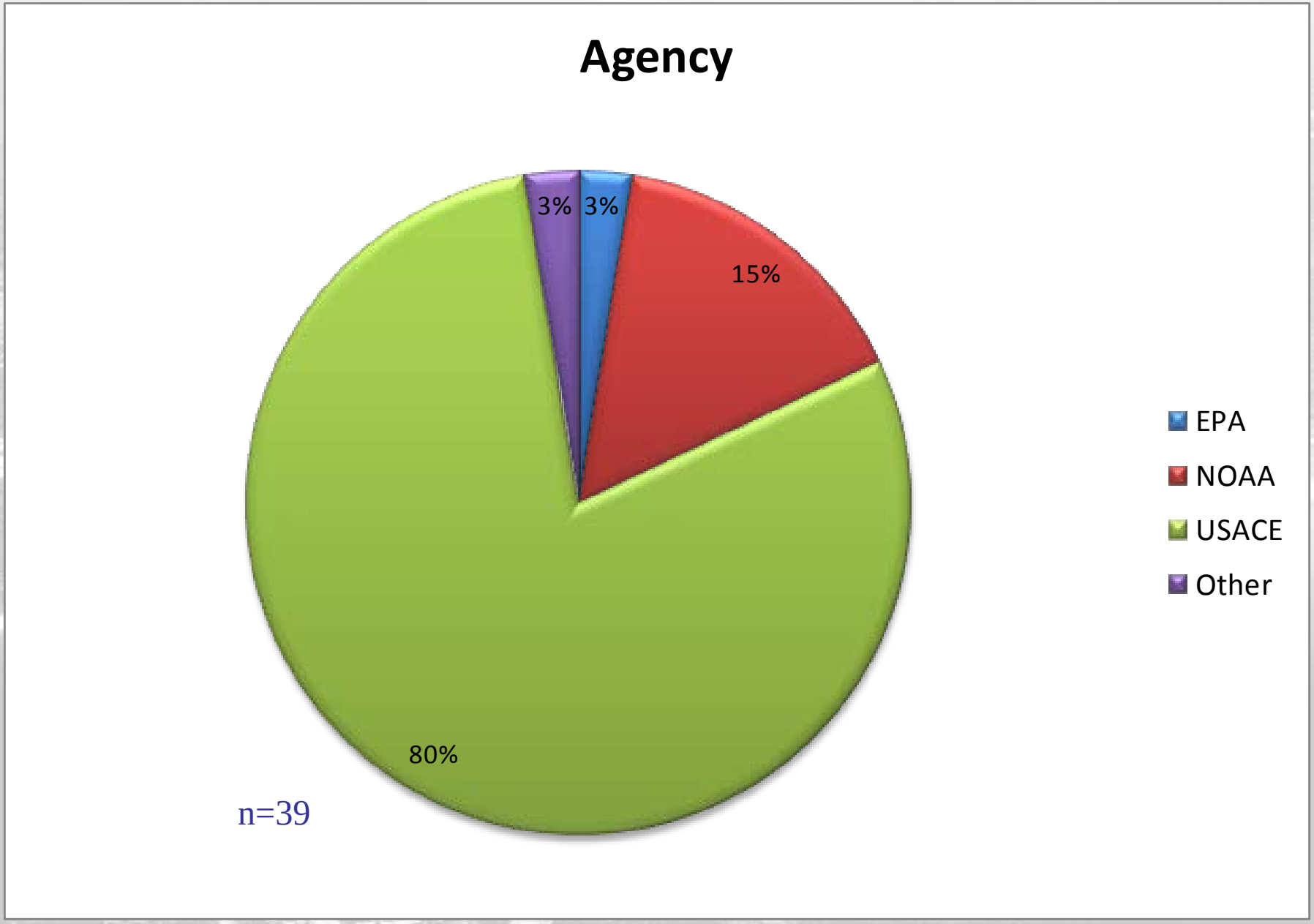
- ☐ Very high
- ☐ High
- ☐ Neither High nor Low
- ☐ Low
- ☐ Very Low
- ☐ No Opinion

2. Can you describe an experience in which cost sharing was the reason an enhancement was not considered?

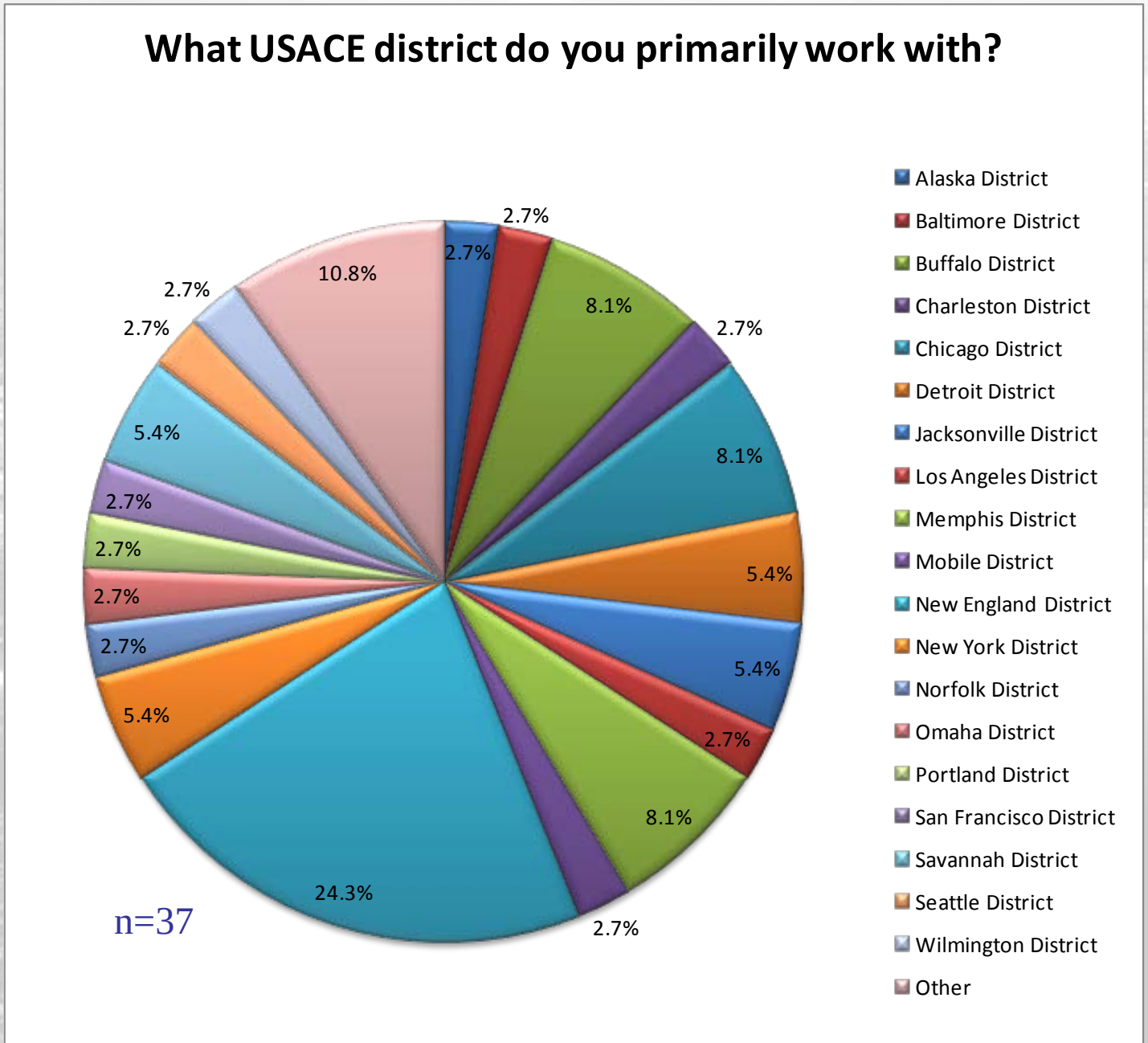
http://www.surveymonkey.com

	Environmental Enhancements: Present and Potential	
1	Do you believe there are opportunities to improve the environmental attributes of existing or future navigation infrastructure projects?	*Yes/No*
2	Are you familiar with any projects in which environmental enhancements have been considered or incorporated?	*Yes/No*
3	Please identify any relevant project(s), the environmental enhancement(s) and provide links to references as appropriate.	*Narrative*
4	How did you find out about designing and implementing these features? What process(es) enabled their consideration?	*Narrative*
5	At what stage of the project(s) were these enhancements considered and why? (e.g. problem formulation, reconnaissance study, generation of alternatives, feasibility study, comparison of alternatives, selection of a plan)	*Narrative*
6	In cases where these features were incorporated, what were the ultimate benefits to the project? Was there any post-construction monitoring and reporting? Please describe and cite, where possible.	*Narrative*
7	In cases where these features were not incorporated, what was the reason?	*Narrative*
8	What agencies and stakeholder groups were involved in the investigation and evaluation of these features? How did you work with them? What expertise did they contribute? Was it a collaborative effort?	*Narrative*
9	What other specific projects would be helpful to investigate for this survey?	*Narrative*
10	Are there (other) environmental enhancements that you believe might be possible to incorporate into existing or future navigation infrastructure projects?	*Yes/No*
11	If Yes, please describe any environmental enhancements that you envision and on what type of project. Be creative.	*Narrative*
12	What information/training would facilitate incorporating these or other environmental enhancements?	*Narrative*
13	What training/information or programs have we tried that didn't work? Why do you think it didn't work?	*Narrative*

Who Took the Survey?



Who Took the Survey?



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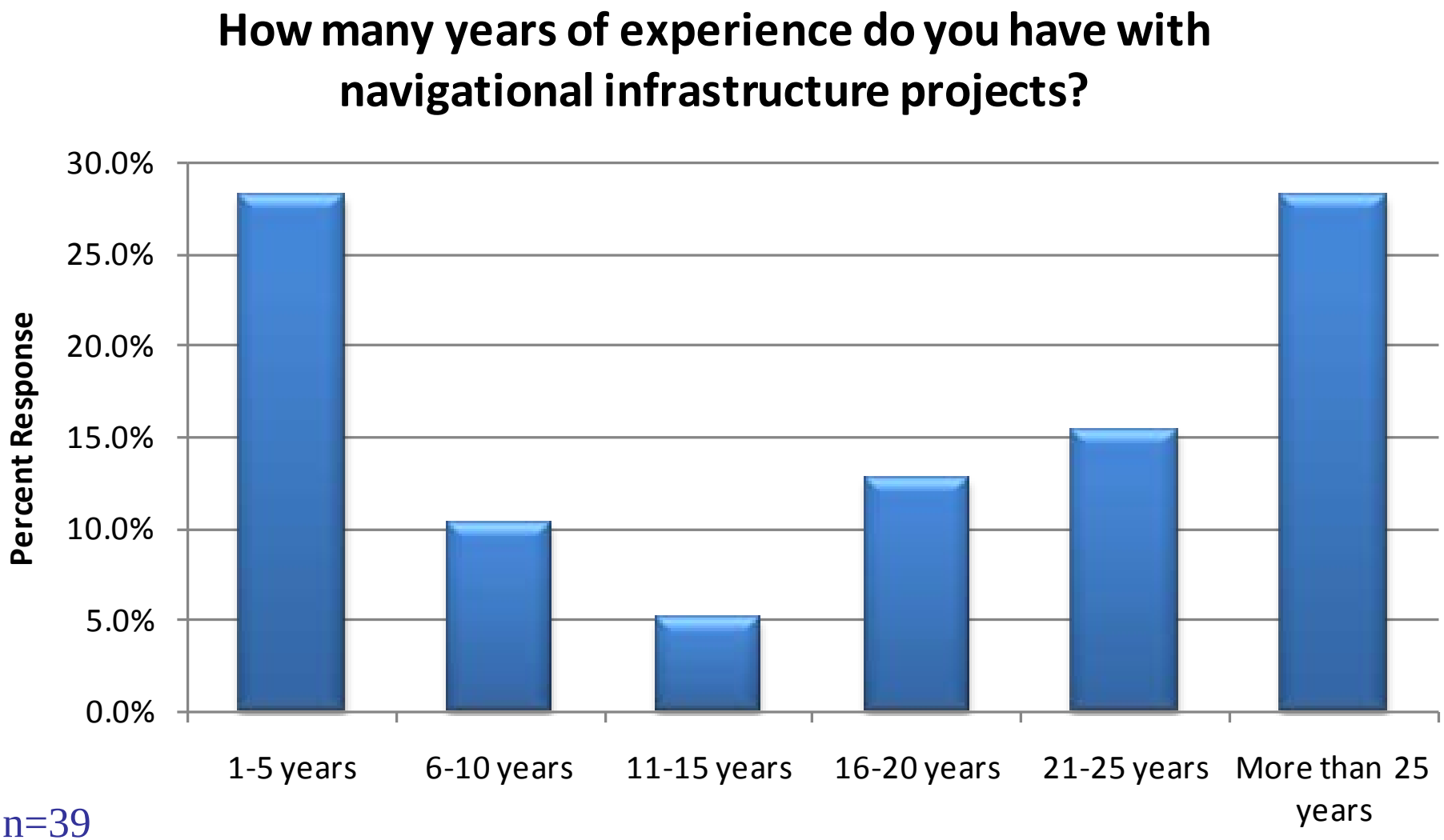

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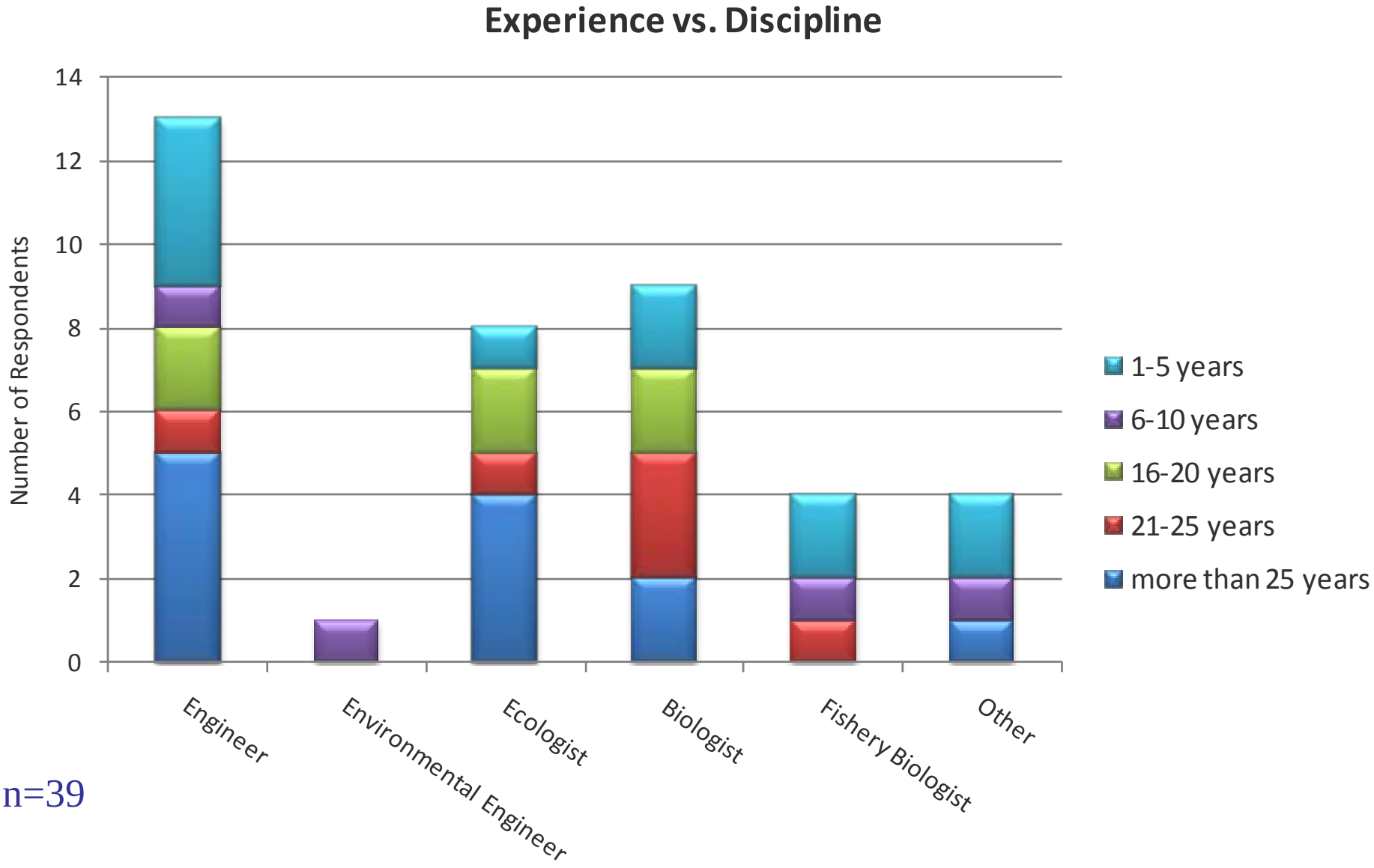

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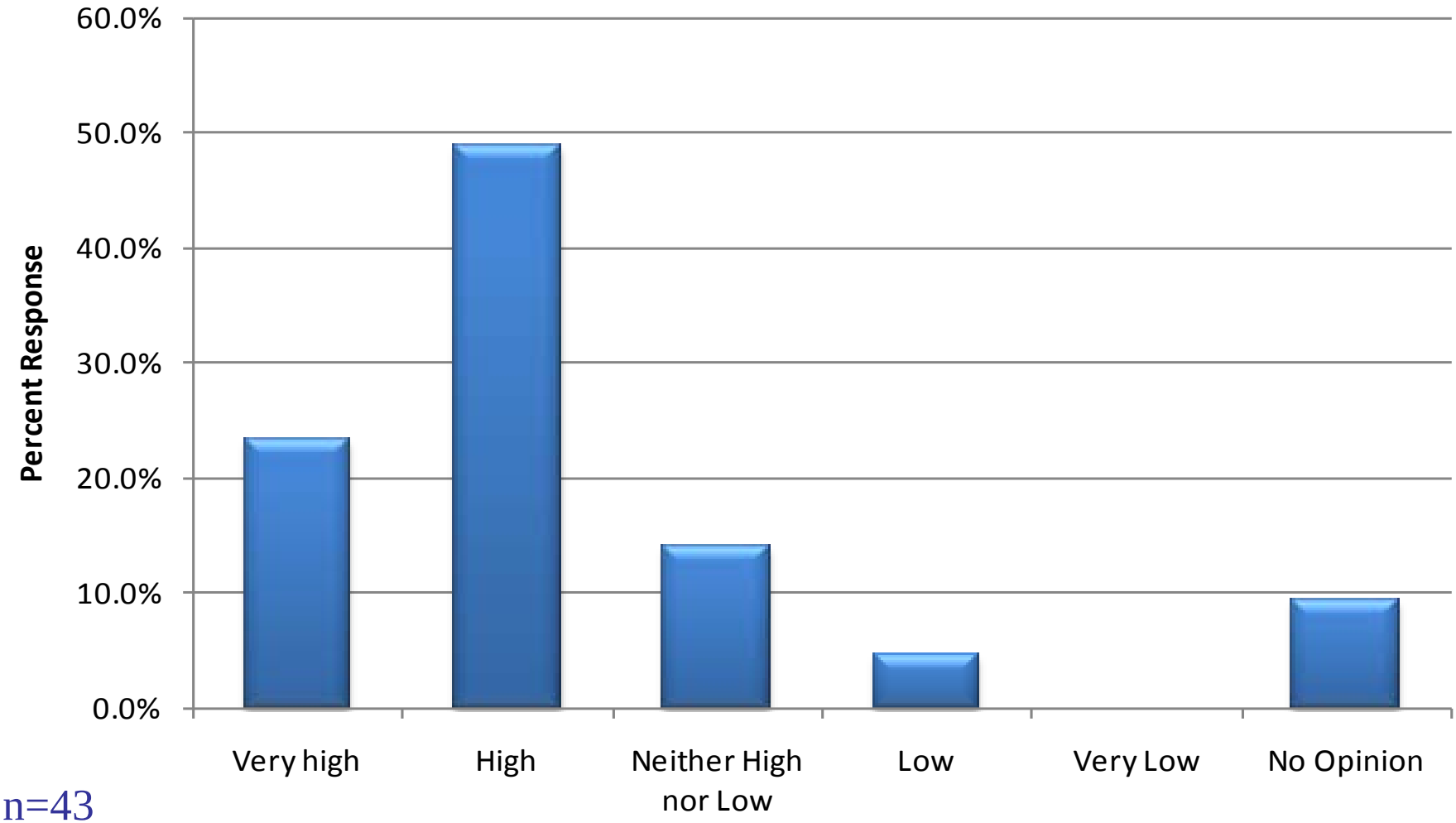
Views on Impediments



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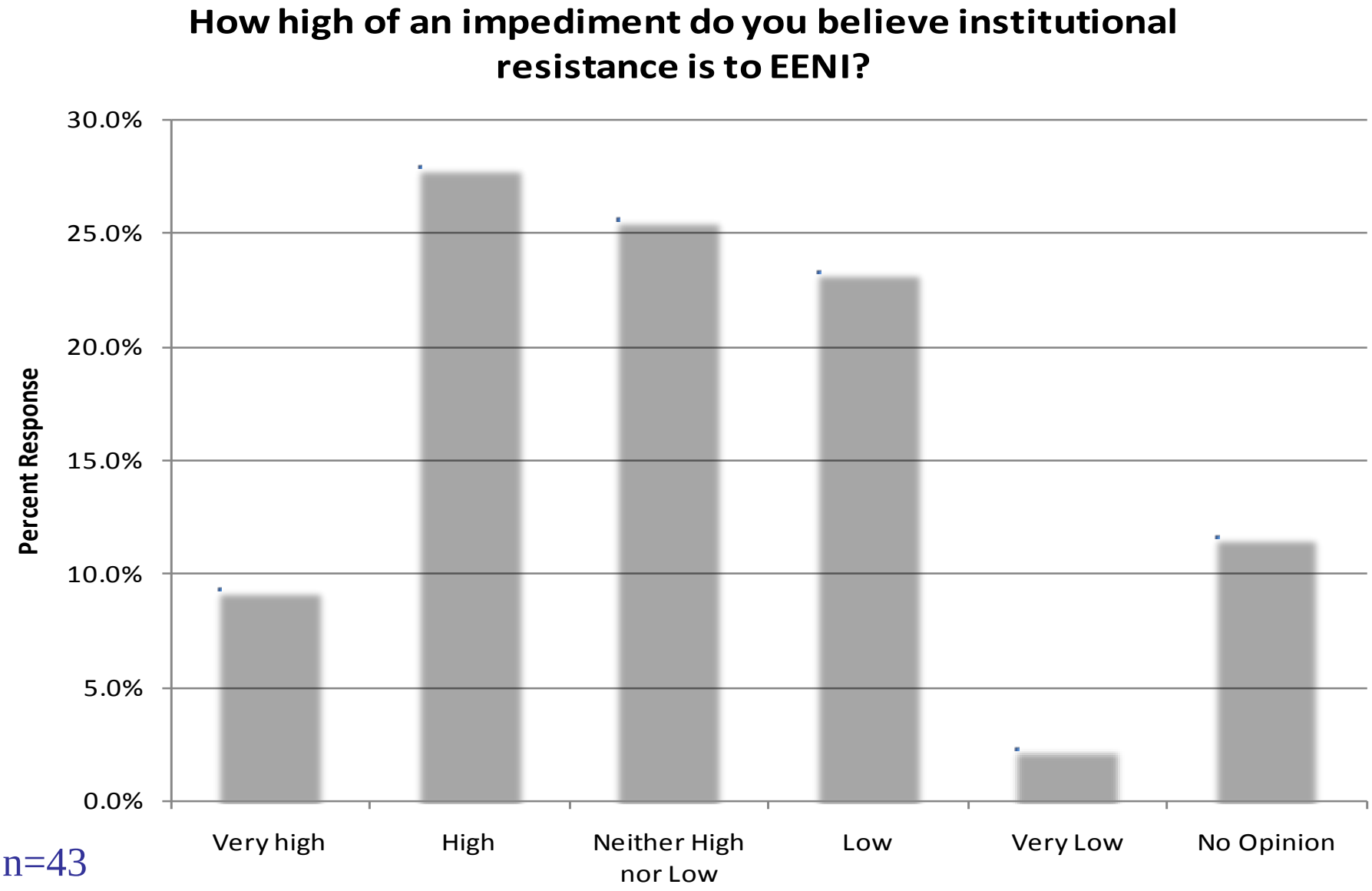
Views on Impediments



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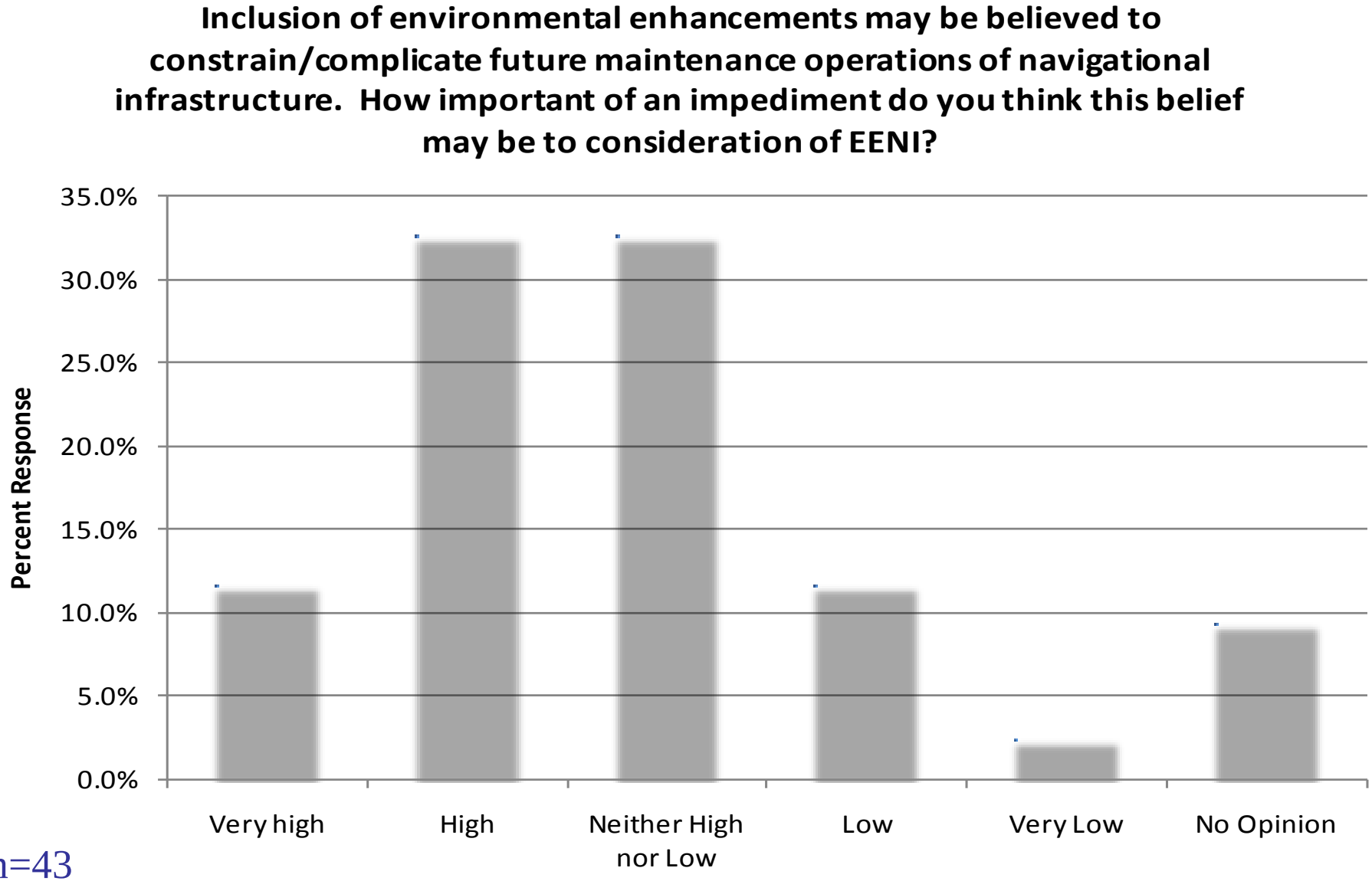
Views on Impediments



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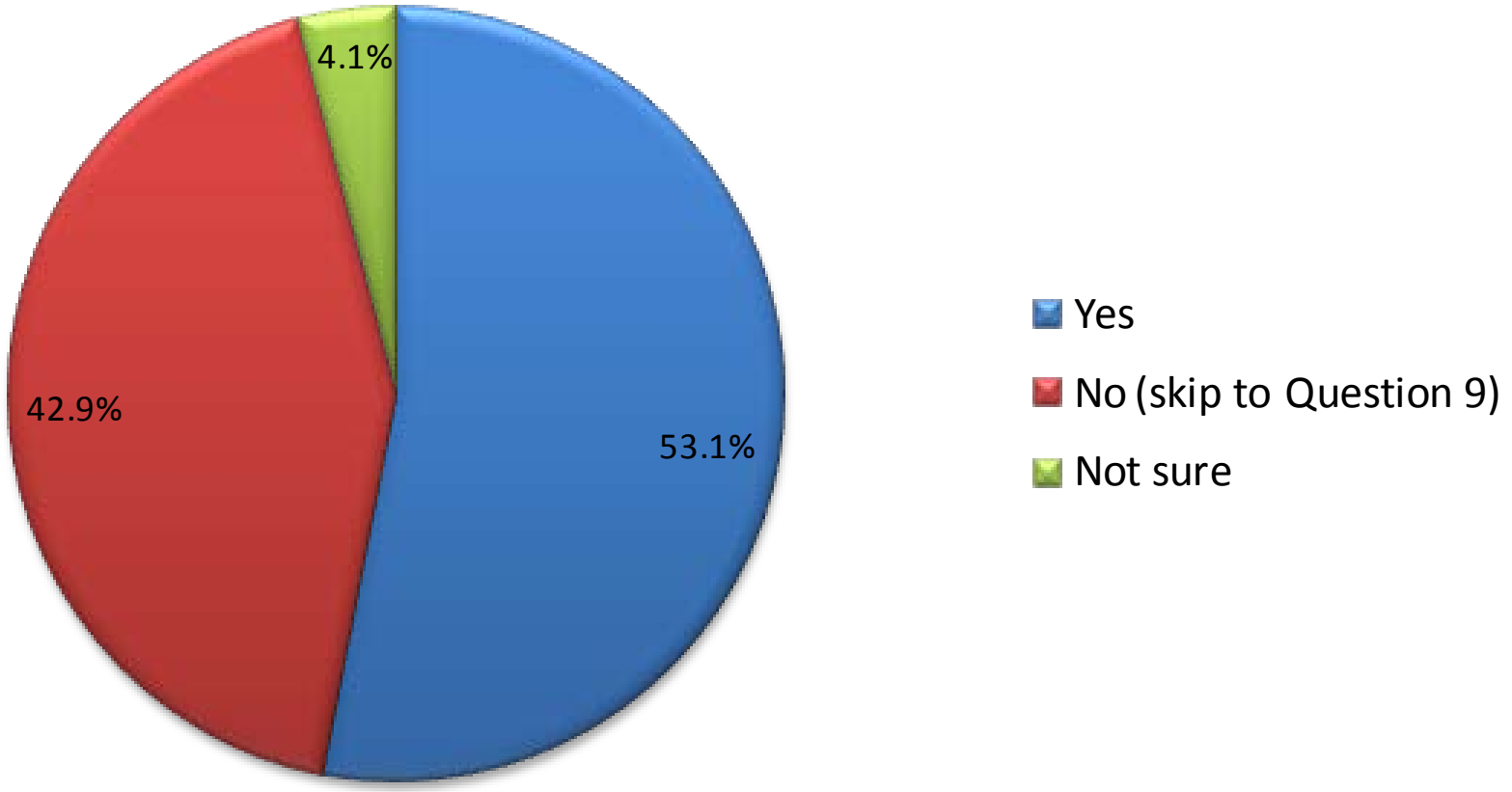
Suggestions to Reduce Impediments

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

Are you familiar with any projects in which environmental enhancements have been considered or incorporated?



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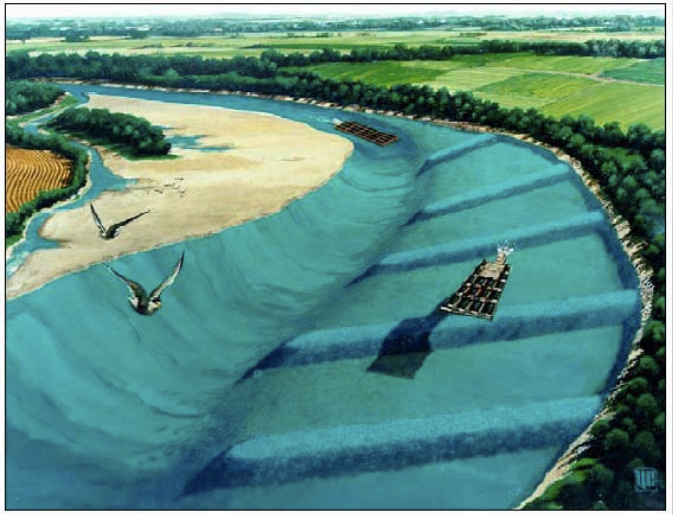
Selected Existing EENI
Inland River Systems

- **Dike notching/chutes**
- **Nature-inspired fish ladders**
- **Groove articulated concrete mats**
- **Chevron notching**

Upper Mississippi River Restoration Environmental Management Program (UMRR-EMP)
http://www.mvr.usace.army.mil/EMP/default.htm



River Training Structures

Off-Bankline Revetment

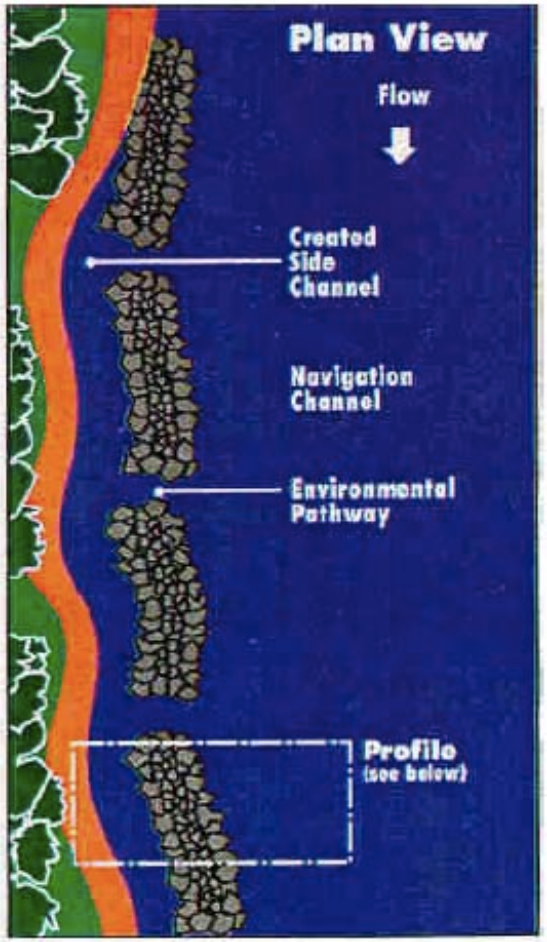
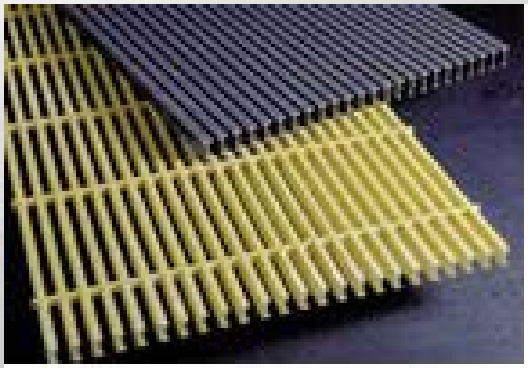


Figure 5.11. Off-Bankline Revetment

Selected Existing EENI
Coastal Systems

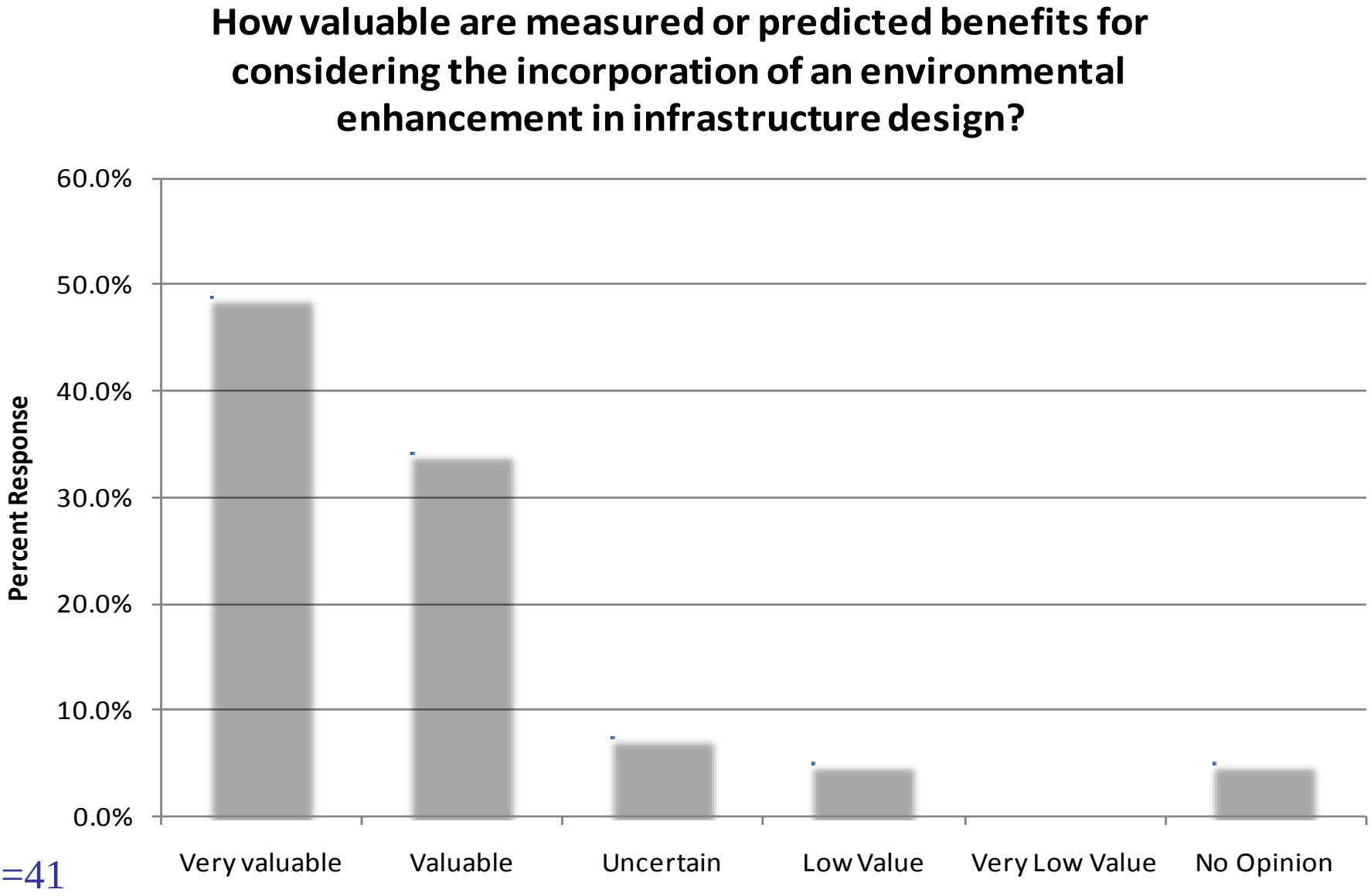
- **Pea gravel around toe of breakwater for fish spawning**
- **Eelgrass planting in anchorage**
- **Shaped breakwater to create habitat variety**
- **Light transmitting dock materials**
- **Dredged material island topped with oyster shell for tern habitat**



Selected EENI Ideas

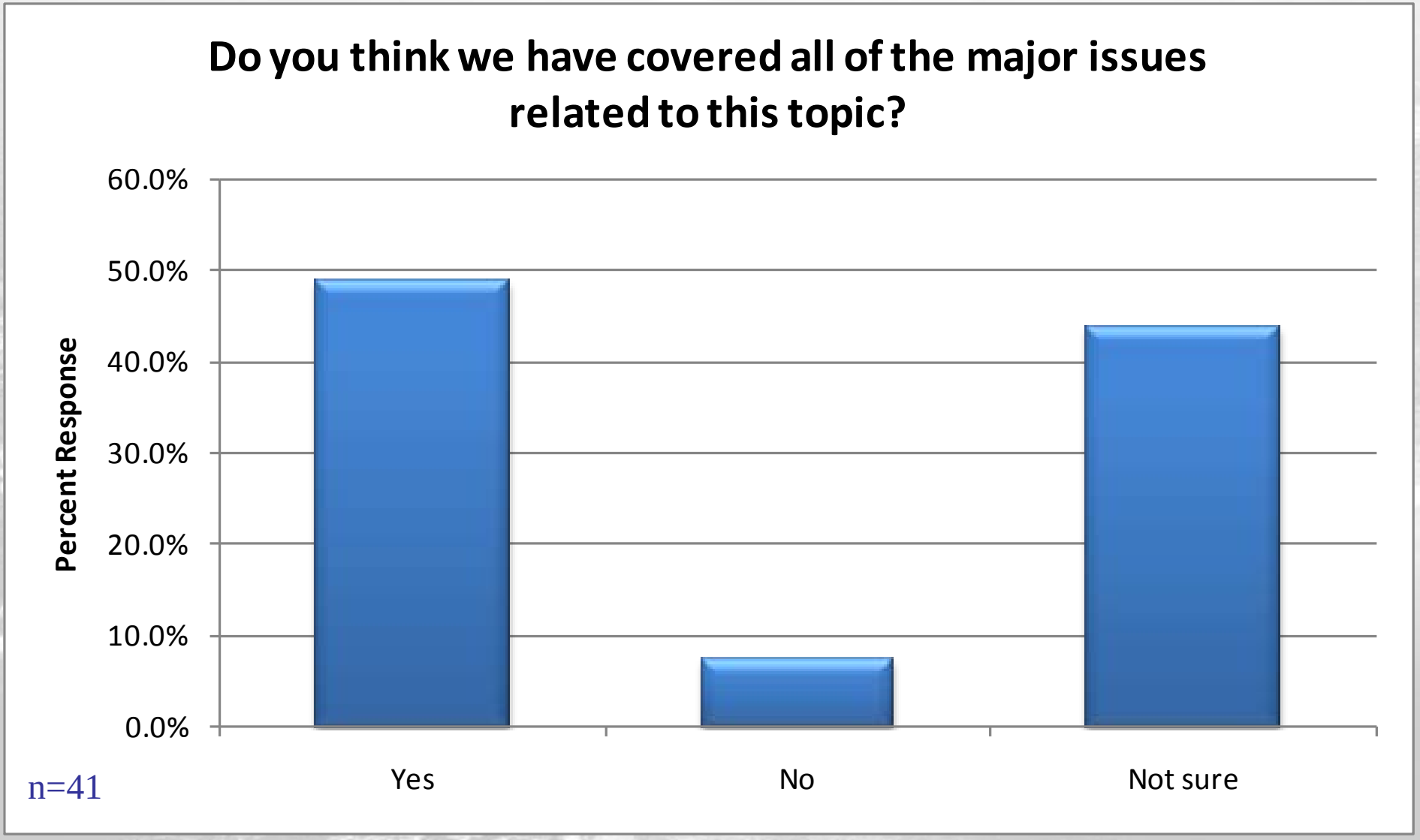
- **Modify breakwater toe, rock sizes, cross section, etc. to create habitat variety**
- **Glue oyster shell to hard structures to encourage colonization**
- **Create terraces in channel side slopes for sea grass**
- **Add marine mammal haul-out shelves to jetties**
- **Add osprey nesting platforms to structures**

Research Needs



Top Research Needs

- **Document case studies and benefits**
- **Conduct demonstration projects**
- **Develop success assessment tools**
- **Prioritization of sites where EENI might work**


Do you think we have covered all of the major issues related to this topic?
Percent Response
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Yes
No
Not sure
n=41

Information Dissemination (1)

ERDC/EL TR-11-X

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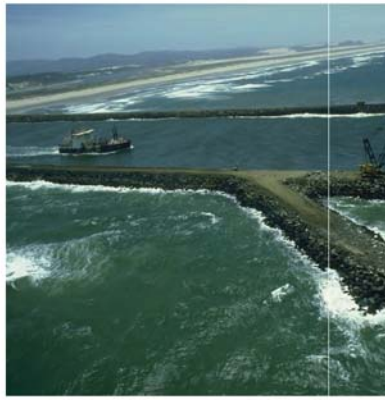

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Environmental Engineering of Navigation Infrastructure: A Survey of Existing Practices, Challenges, and Potential Opportunities

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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 ...perating federal agencies relative to incorporating environmental enhancements into navigation ...tudy sought to (1) investigate institutional attitudes towards the environmental enhancement of ...EN) concept, (2) identify potential impediments to implementation and solutions to such ...isting navigation projects designed with the express intent of enhancing environmental benefit in ...ject purpose, (4) identify innovative ideas for increasing environmental benefits for navigation ...d additional technical information or research, and (6) identify laws, regulations, and policies that ...h design features. The principal investigation tool was an Internet-based survey with 53 questions. ...ange of perspectives on the EENI concept including ideas, concerns, research needs, and relevant ...ommendations included further promotion of the concept of EENI to planners and designers, ...rojects, initiation of pilot studies on some of the innovative ideas provided through the survey, and ...oals and interagency agreements to facilitate implementation. Integr Environ Assess Manag ...AC

...structure Jetties Breakwaters Sustainability Lock and dam

Legal and Policy

...such as channels, anchorages, ...ining structures, and lock and ... objective as part of a safe and ...system. For more than four ...ch infrastructure has involved ...tent practicable, impacts on the ...dard environmental assessment ...ental Policy Act 1969). More ...he concept of environmental ... begun to ask whether such ...ed with some form of environ... 2008) that goes beyond the ...ast environmentally damaging ...[Q1] 40 CFR 230). While the ...new (Goodland 1995), and has ...l use of dredged sediments for ...CE 1987), applying an environ... to infrastructure itself has been ...addressed ...ray

The US Army Corps of Engineers (USACE) has respon... sibility for an extensive coastal, intracoastal, and inland navigation system with over 19,000 km of navigation channel, 195 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 80 km, over 800 hectares[Q2] of anchorage, and over 750 km of channel. In addition to maintenance and replace... ment of existing structures, the USACE is also tasked with building new infrastructure on an ongoing basis. As a consequence, applying an environmental sustainability para... digm during the planning for new infrastructure or main... tenance 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

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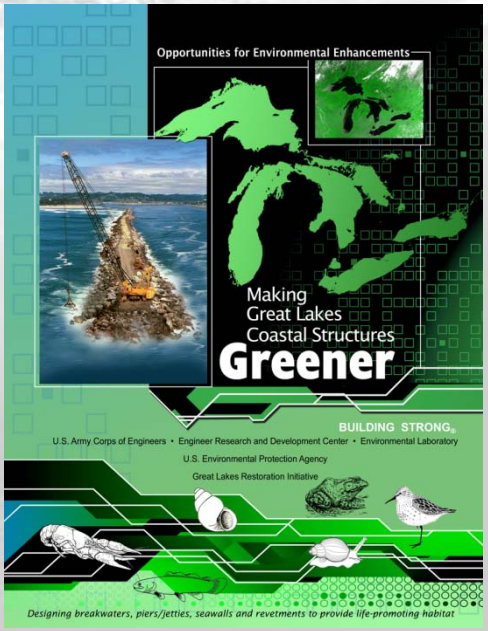
Environmental Enhancements and Navigation Infrastructure: Existing Practices, Innovative Ideas, and Research Needs

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

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.

Information Dissemination (2)

- ***Meetings*** – NDT, NERDT, Env. Planning Chiefs, 2011 DMAM, US/Dutch WwN
- ***Conferences*** – Battelle, SETAC-MS, NCER, CZ11, SETAC, USACE R&D
- ***Webinars*** - EENI (4)
- ***Webinars*** - Green Breakwaters (3)
- ***Brochure/Website*** – Green Breakwaters



Next Steps

- **Continue to promote concept**
- **Consider establishing agency goals**
- **Document case studies and benefits**
- **Pilot projects of innovative ideas**
- **_____ (Work Group Qs)**