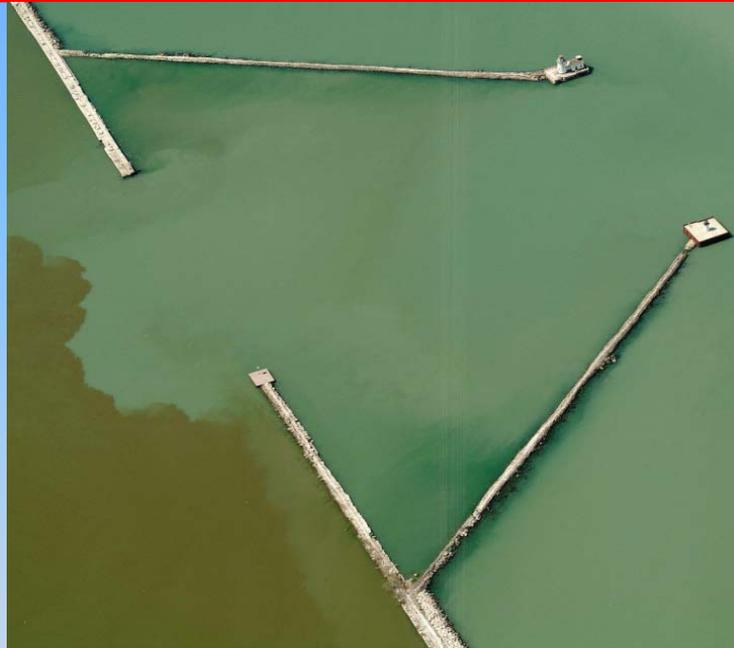


# Cleveland East Arrowhead Breakwater Demonstration

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Burton Suedel, USACE ERDC-EL

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# The Team

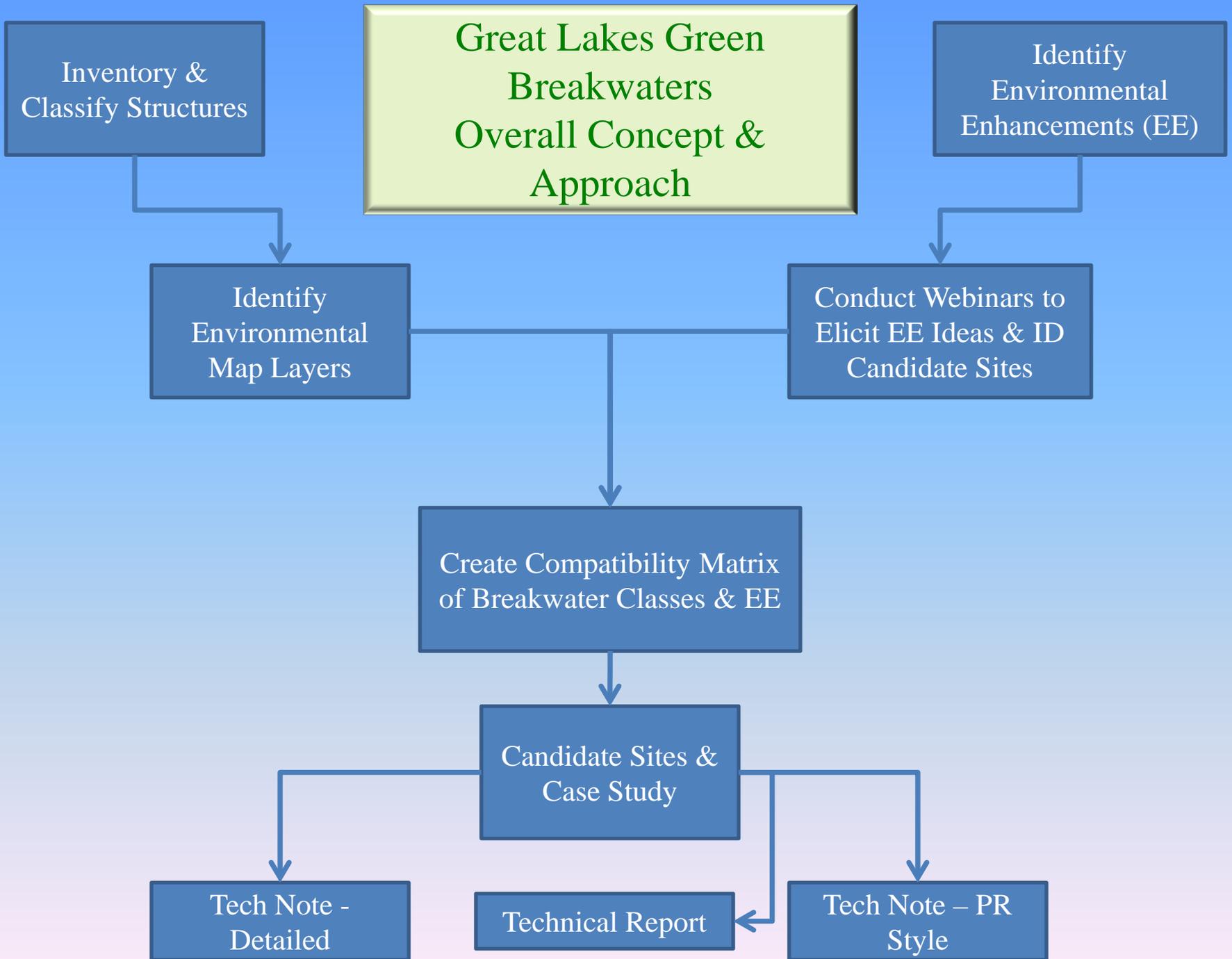
- Cynthia Banks (ERDC-EL)
- Paul Bijhouwer (LRB)
- Tony Friona (ERDC-EL)
- Tom Fredette (ERDC-EL)
- Rich Ruby (LRB)
- Chuck Shea (LRC)
- Burton Suedel (ERDC-EL)



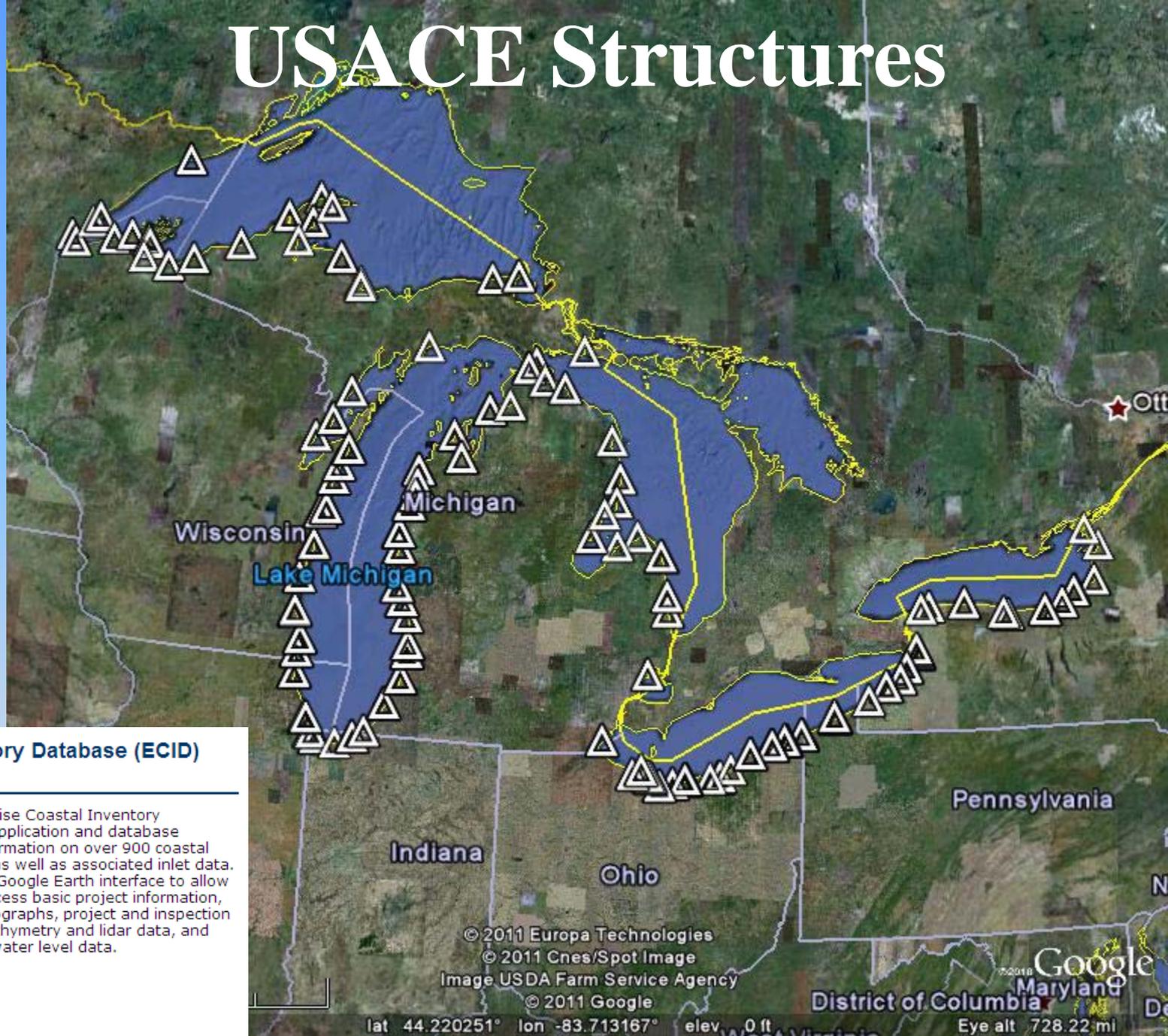
# Great Lakes Green Breakwaters Study

- Evaluate alternatives for enhancing aquatic ecosystem benefits at existing breakwaters and navigation structures
- During routine repairs and maintenance, as part of modifications, or during comprehensive structural repairs and replacements
- Concept extends to shore protection structures, non-USACE structures





# USACE Structures



## Enterprise Coastal Inventory Database (ECID)

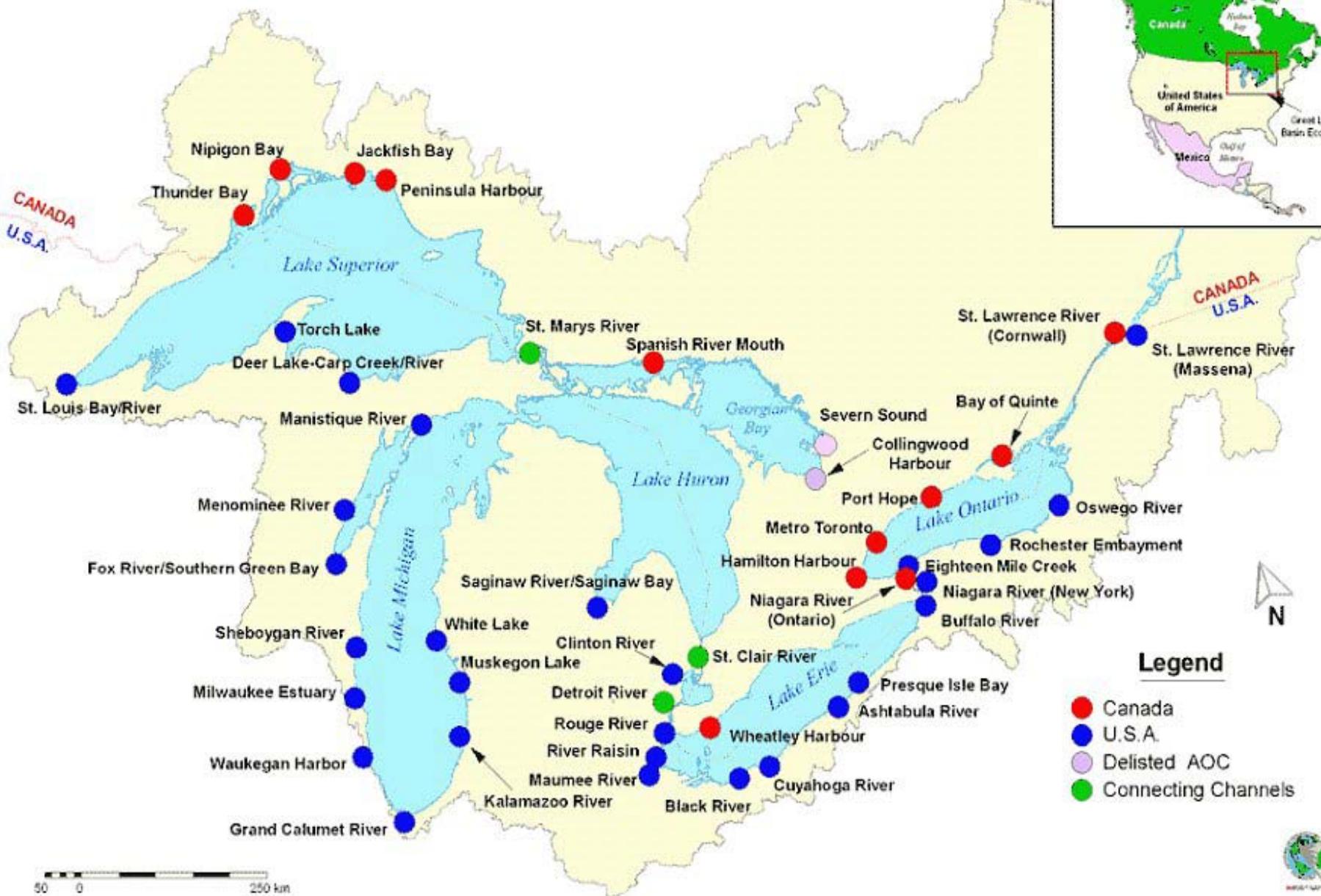
Active Project



The Enterprise Coastal Inventory Database application and database houses information on over 900 coastal structures as well as associated inlet data. ECI uses a Google Earth interface to allow users to access basic project information, aerial photographs, project and inspection reports, bathymetry and lidar data, and wave and water level data.

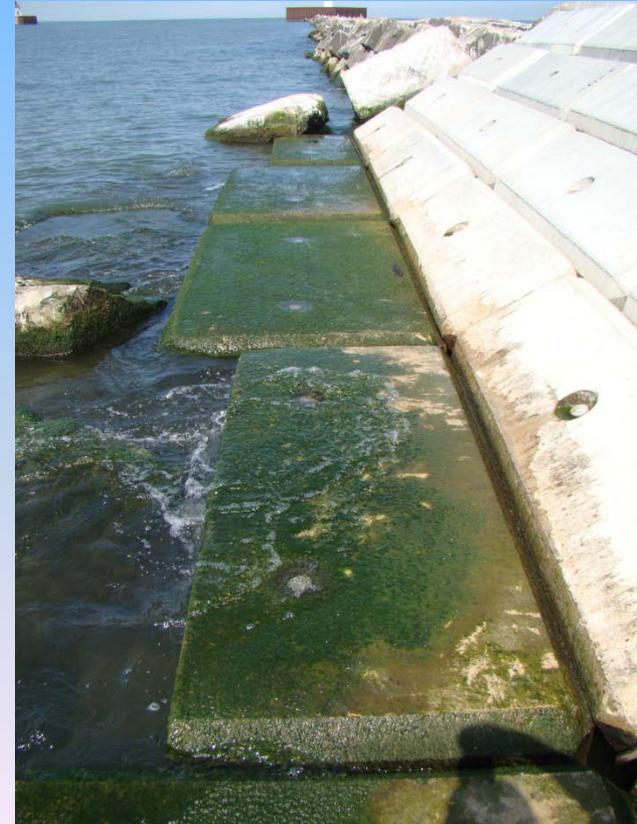
Enterprise Coastal Inventory (ECI)  
Enlarge: 1000x663  
(278kb)

# Areas of Concern in the Great Lakes - St. Lawrence River Basin



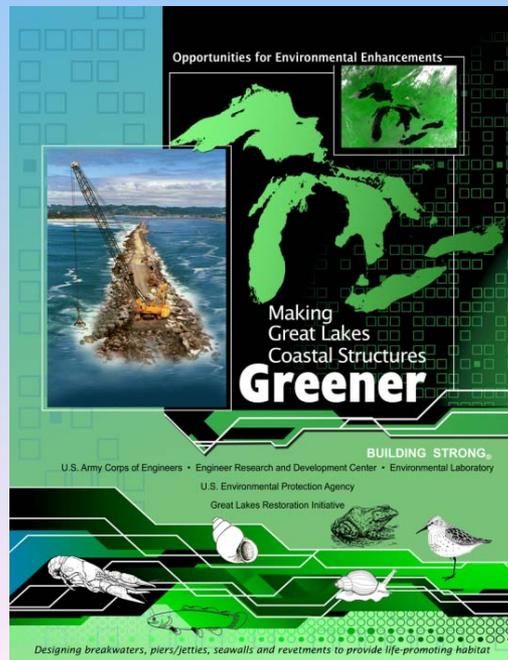
# Green Ideas

- **Pea gravel apron – fish spawning habitat**
- **Mixed rock gradation, shelves, and caverns**
- **Add substrate at bottom of sheet pile structures**
- **Fish spawning stones**
- **Create submerged spurs/sinuuous toe**
- **Rock headlands**
- **Develop wetlands on sediment trapped by structures**
- **Tern nesting habitat**
- **Osprey nesting platforms**
- **Create littoral sediment bypass**
- **Create flow channels**



# Top Research Needs

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



# **Cleveland East Arrowhead Breakwater Demo Project Description**

- **Demonstrate potential aquatic habitat improvements**
- **GL coastal structures during routine maintenance activities**
- **Simple design modifications to structural elements**
- **Potential to reduce beneficial use impairments within GL region**

# Project Approach

- **Beyond indirect and unplanned habitat creation**
- **Modify design of featureless toe blocks used for breakwater maintenance**
- **Provide features creating habitat opportunities for GL fish and other aquatic life**
- **Examines creation of habitat surfaces on toe blocks**
  - **Protected indented shelf**
  - **Dimpled block surface**
  - **Grooved block surface**

# Toe Block Fabrication

## Modified breakwater toe blocks



**Dimpled block surface**



**Habitat shelf with  
horizontal line texture**

# Toe Block Fabrication

## Modified breakwater toe blocks



**Toe block with horizontal  
line surface**



**Featureless toe block  
(control)**

# Cleveland Harbor East Arrowhead Repairs



**April 2012**

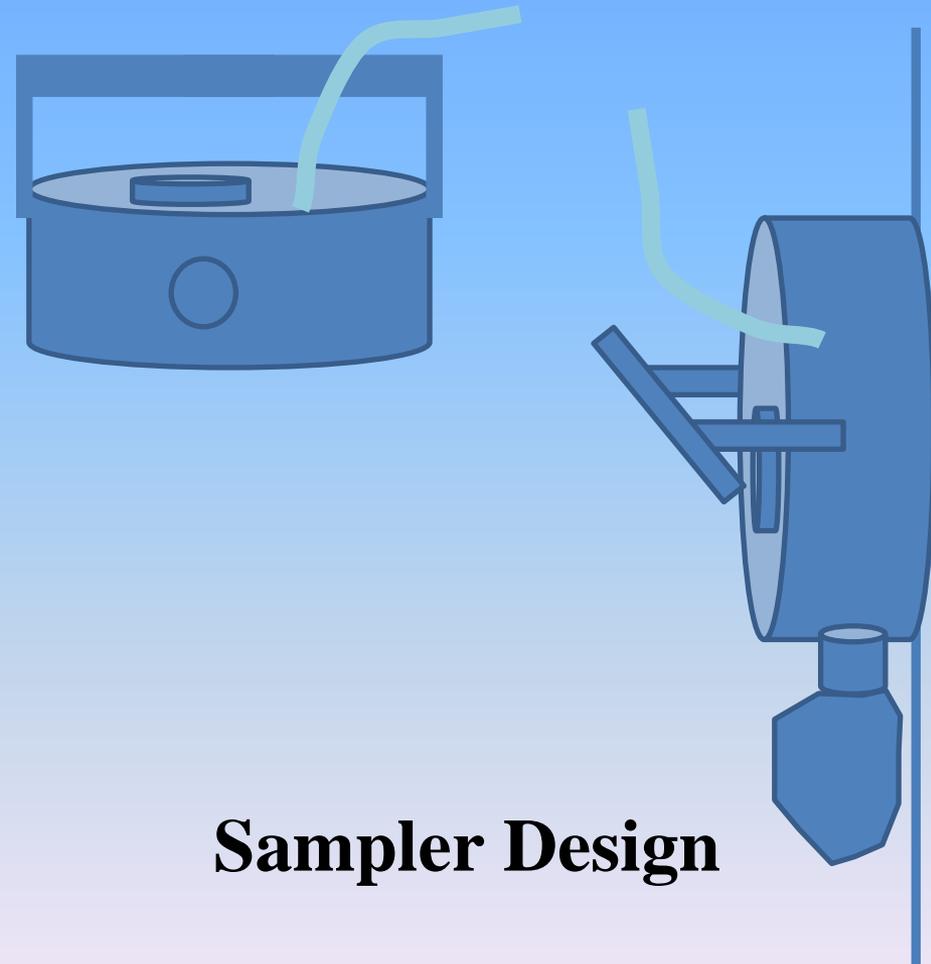


**June 2012**

# Toe Block Monitoring and Sampling



**Toe block with horizontal  
lines Aug 2012**



**Sampler Design**

# Next Steps

- **Monitoring surveys:**
  - **Fall 2012, Spring 2013, Fall 2013**
- **Reporting**
- **Second demonstration in GL**

