Cleveland East Arrowhead Breakwater Demonstration

Burton Suedel, USACE ERDC-EL

ERDC
US Army Engineer Research and Development Center

Great Lakes RESTORATION

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

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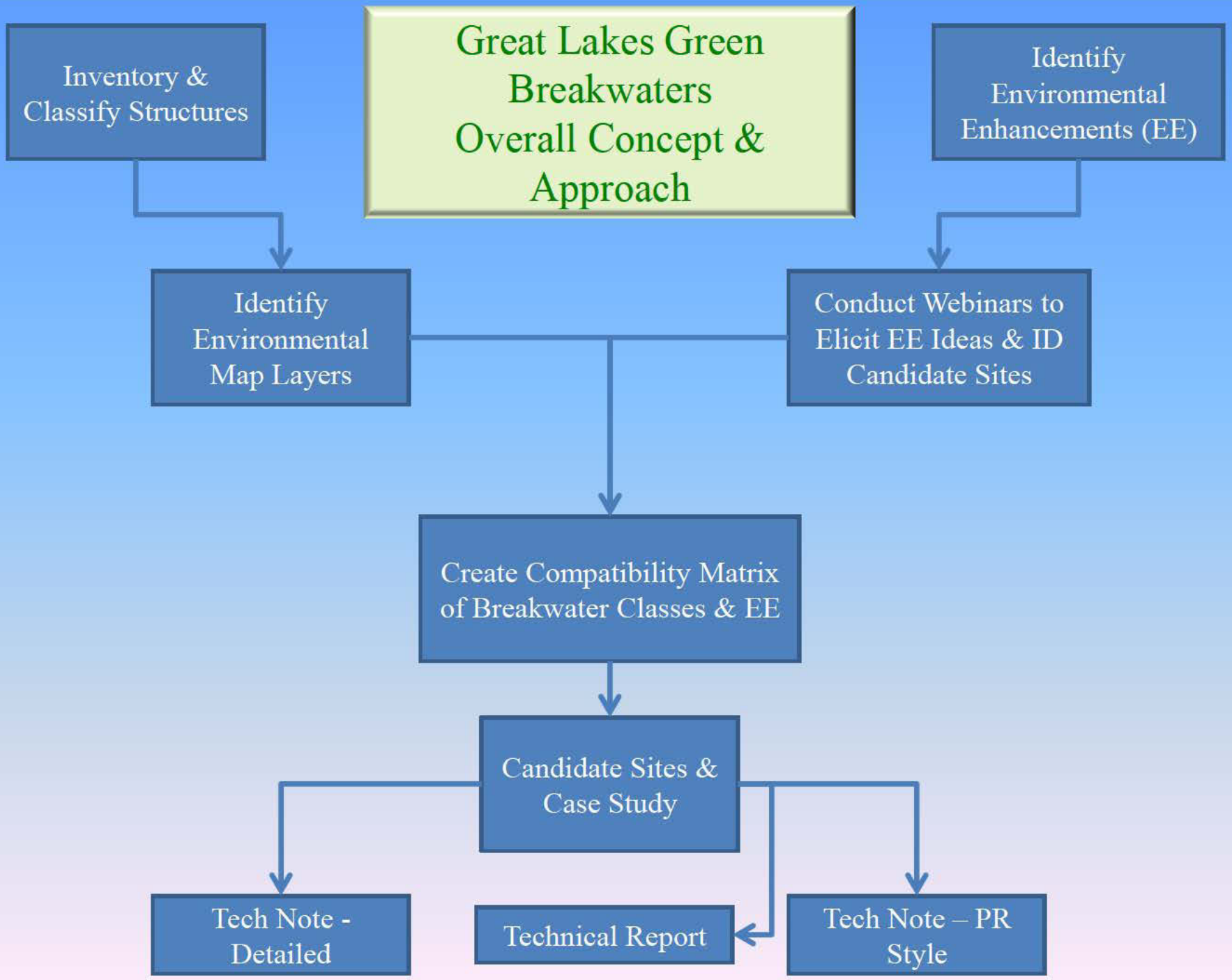
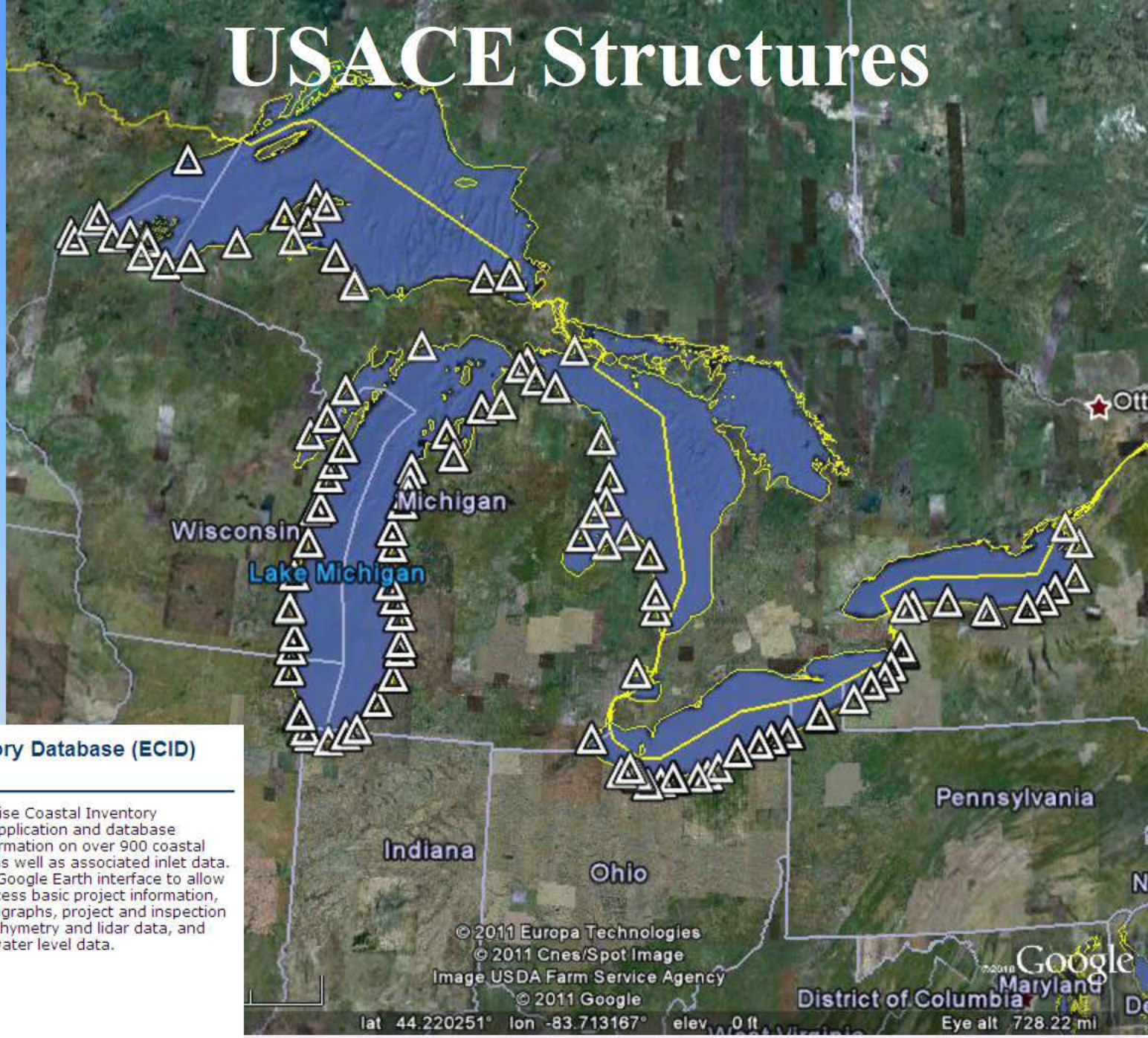
Great Lakes RESTORATION

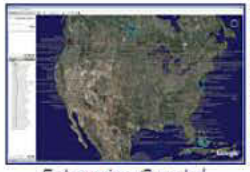

Great Lakes Green Breakwaters Overall Concept & Approach
Inventory & Classify Structures
Identify Environmental Enhancements (EE)
Identify Environmental Map Layers
Conduct Webinars to Elicit EE Ideas & ID Candidate Sites
Create Compatibility Matrix of Breakwater Classes & EE
Candidate Sites & Case Study
Tech Note - Detailed
Technical Report
Tech Note – PR Style

USACE Structures



Enterprise Coastal Inventory Database (ECID)

Active Project



Enterprise Coastal Inventory (ECI)
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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.

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

CANADA
U.S.A.

Lake Superior
Lake Michigan
Lake Huron
Georgian Bay
Lake Erie
Lake Ontario

Nipigon Bay
Jackfish Bay
Thunder Bay
Peninsula Harbour
Torch Lake
Deer Lake-Carp Creek/River
St. Louis Bay/River
St. Marys River
Spanish River Mouth
Manistique River
Menominee River
Fox River/Southern Green Bay
Saginaw River/Saginaw Bay
Sheboygan River
White Lake
Muskegon Lake
Milwaukee Estuary
Waukegan Harbor
Grand Calumet River
Kalamazoo River
Clinton River
St. Clair River
Detroit River
Rouge River
River Raisin
Maumee River
Black River
Wheatley Harbour
Cuyahoga River
Presque Isle Bay
Ashtabula River
Severn Sound
Collingwood Harbour
Bay of Quinte
Port Hope
Metro Toronto
Hamilton Harbour
Niagara River (Ontario)
Eighteen Mile Creek
Niagara River (New York)
Buffalo River
Oswego River
Rochester Embayment
St. Lawrence River (Cornwall)
St. Lawrence River (Massena)

N

Legend

- Canada
- U.S.A.
- Delisted AOC
- Connecting Channels

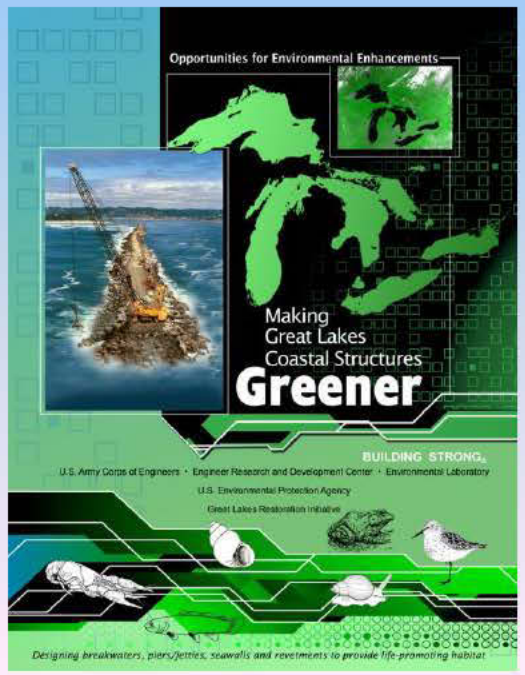
50 0 250 km

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/sinuous 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

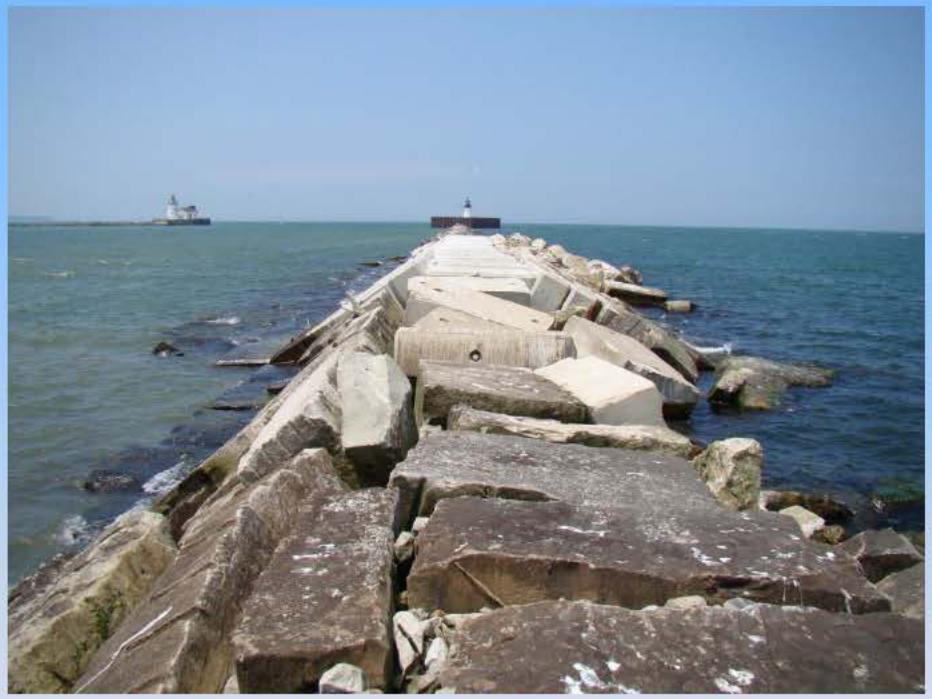
Modified breakwater toe blocks

Toe block with horizontal line surface

Featureless toe block (control)

Cleveland Harbor East Arrowhead Repairs

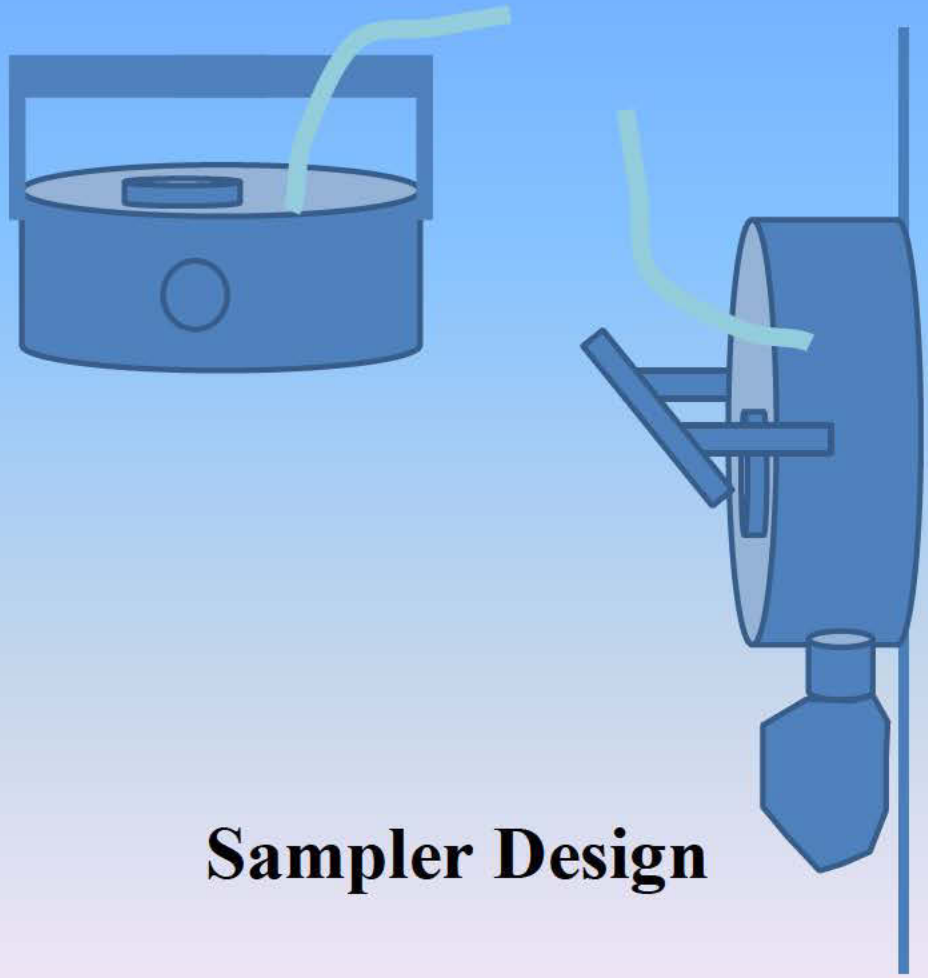
April 2012



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**