## Incorporating EWN into Breakwaters and Other Hard Infrastructure

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**EWN Meeting** 1-3 Dec. 2014 Buffalo, NY



US Army Corps of Engineers BUILDING STRONG<sub>®</sub>





### **Presentation Overview**

- Cleveland & Ashtabula, OH Breakwater Invertebrate/Fish Habitat/Low Vegetation
- Ashtabula, OH Tern Nesting Habitat
- Milwaukee, WI Fish Spawning Habitat
- St. Marys River, MI Multiple options





#### Great Lakes (GL) 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



### **Demonstration Projects - Approach**

- Demonstrate potential improvements
- GL coastal structures during routine maintenance activities
- Simple design
   modifications to structural elements
- Potential to reduce environmental impairments within GL region





### **Cleveland East Arrowhead Breakwater**

- Beyond indirect and unplanned habitat creation
- Modify design of featureless concrete 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



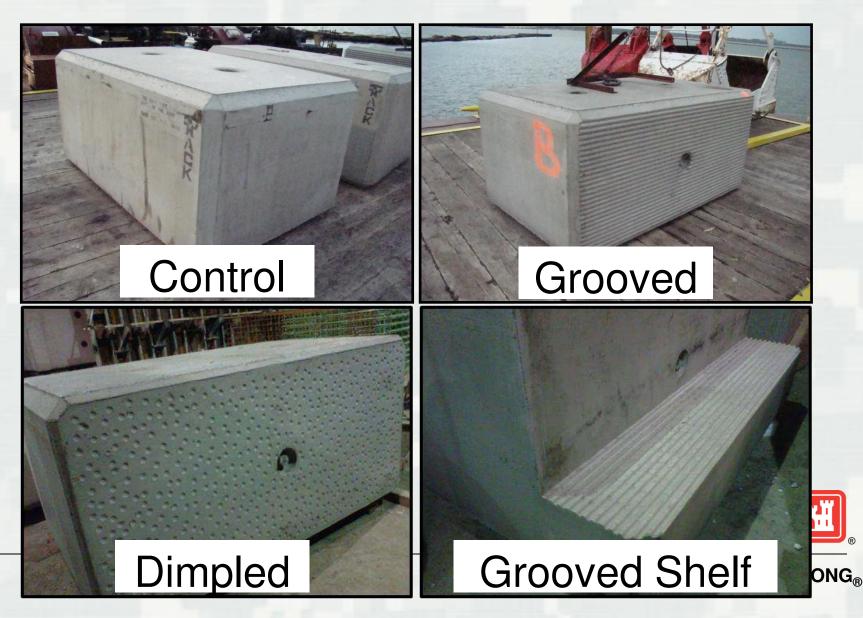


### Study Site

Cleveland East Arrowhead Breakwater – Lake Erie

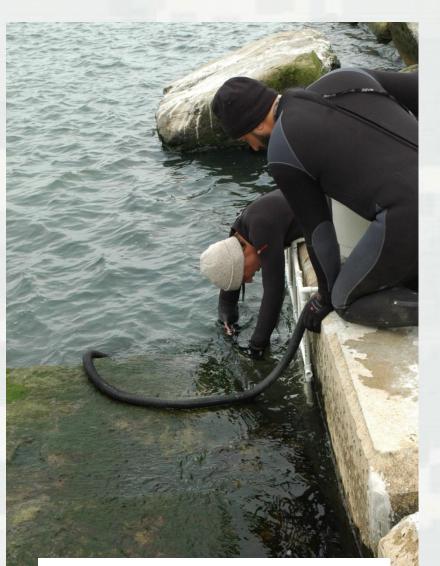


# Cleveland & Ashtabula, OH



#### Sample Collection

#### **Post-sampled Area**

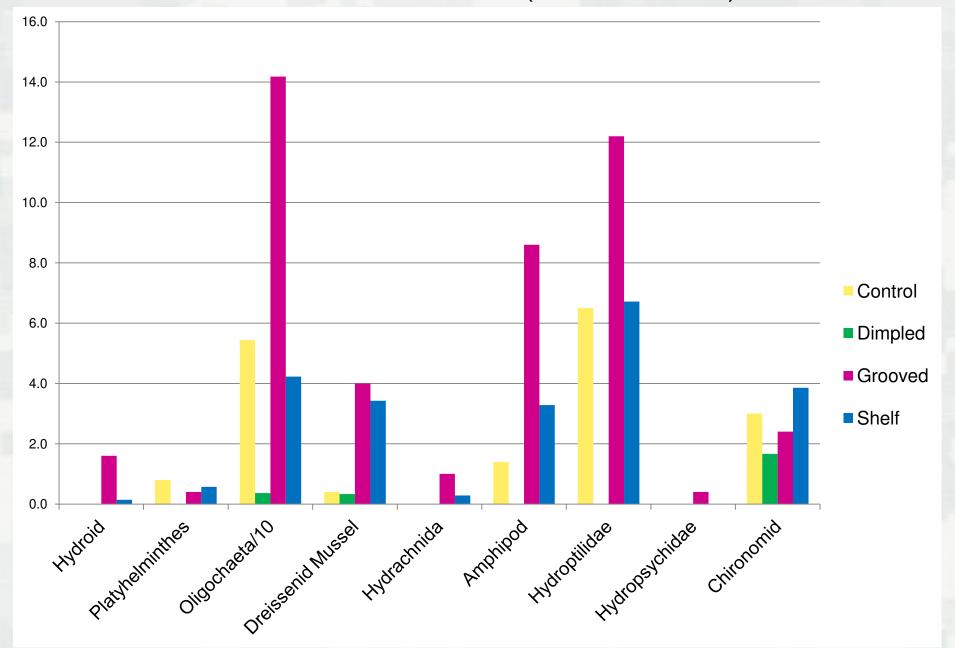


# Schedule

	Cleveland
Construction	April 2012
Monitoring 1	October 2012
Monitoring 2	June 2013
Monitoring 3	October 2013
Monitoring 4	September 2014



#### Results – Abundance (October 2012)



# What Have We Learned to Date?

- Initial colonization (Oct. 2012) greater for most groups on grooved blocks
  - Invertebrate secondary production increase
- Potential to provide juvenile fish refuge
- Awaiting sample processing and analysis from other monitoring events
- Extended monitoring?



## Ashtabula Harbor Breakwater Project Tern Habitat

- Modify design of breakwater to create tern habitat during routine maintenance
- Habitat created using modified toe blocks
  - Nesting pea gravel
  - Predator/competitor exclusion grid
  - Side fencing
  - Chick shelters





## Ashtabula Harbor -Lake Erie

## Study Site

© 2013 Google

Imagery Date: 4/5/2012

Lat 41.912231° lon -80.792287° elev 0 ft

Eye alt 8642 ft

W1

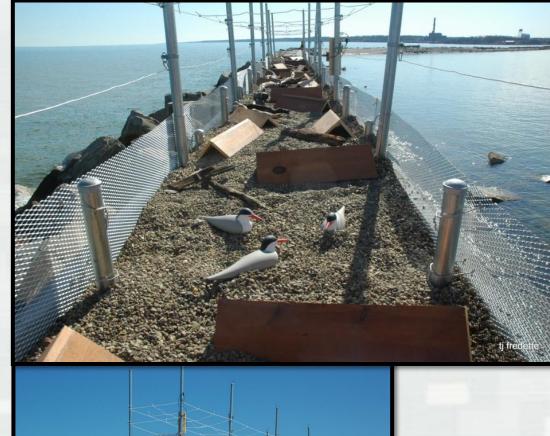
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### Ashtabula Harbor Tern Habitat Construction



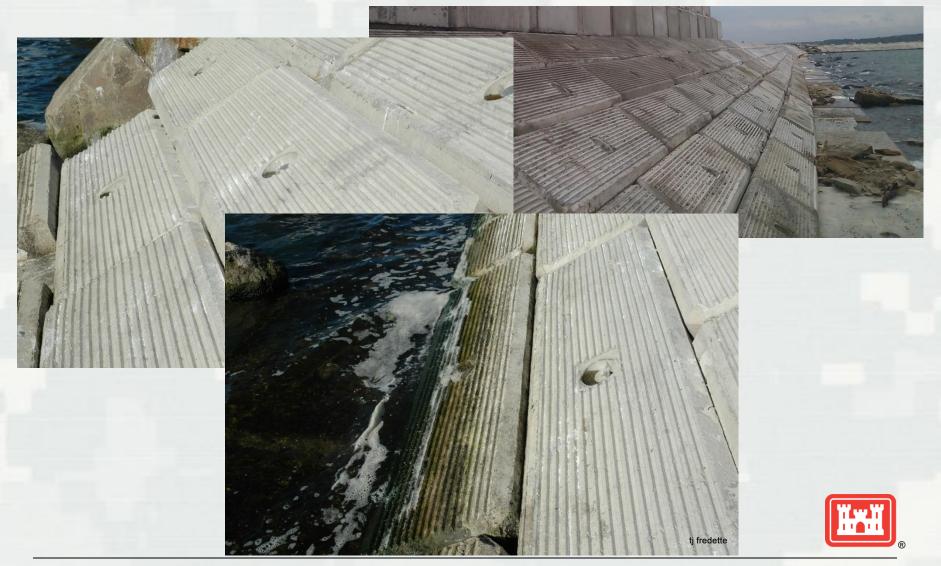
#### **Ashtabula Harbor Breakwater Project Status**

- Winter ice conditions delayed installation of decoys, tern call box, predator cable grid, and shelters until late April
- Site discovery and colony establishment could take 2-3 years
- Tern monitoring ongoing
- Habitat size doubled during Phase 2 (Sept. 2014) to sixteen blocks further increasing the chances of success





#### Ashtabula Harbor Slope Blocks Low-Growing Vegetated Plant Potential

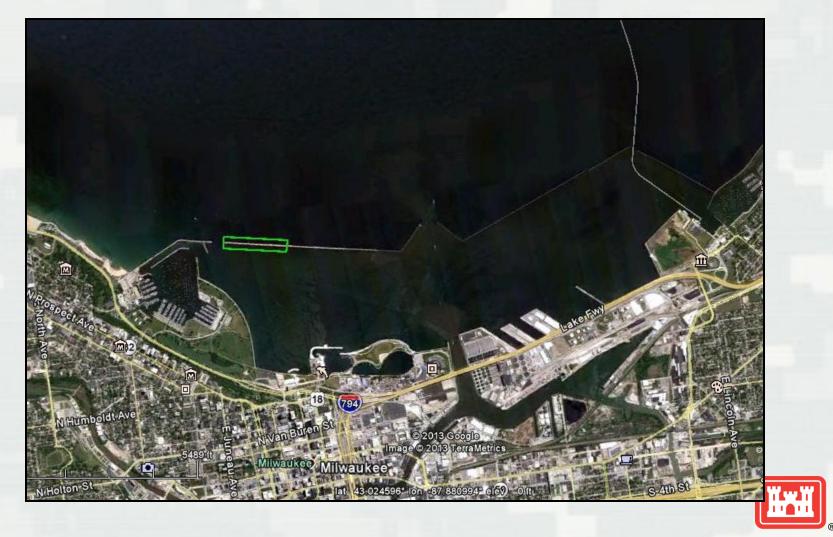


### **Milwaukee Harbor Project Approach**

- Modify design of rubble mound breakwater during maintenance
- Create spawning bed for fish such as walleye and smallmouth bass
- Habitat for forage species
- Modifications
  - Smaller stone size (lee/harbor side)
  - Gentler sloping shelf



### Milwaukee Harbor, WI Lake Michigan



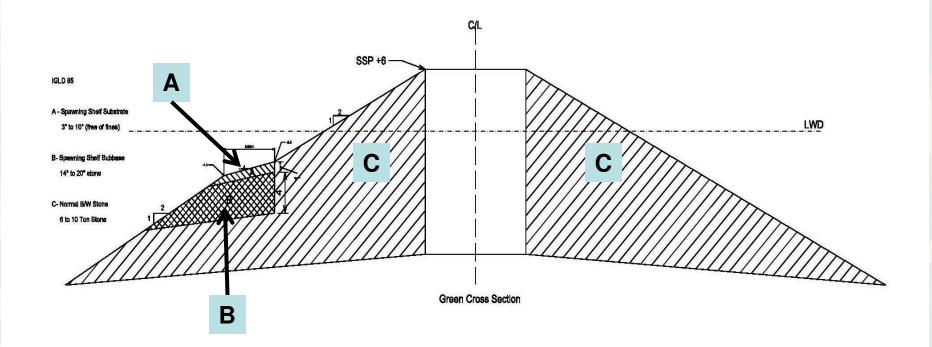
#### **Fish Spawning Bed Location**

500' demonstration section Spring 2014 construction





### Modified Rubble Mound Breakwater Fish Spawning Shelf



- A Spawning Shelf Substrate: 4-8" stone free of fines
- B Spawning Shelf Sub-base: 8-18" stone
- C Normal B/W Stone: 6-10 ton stone



### **Post Construction Monitoring**

CS 61+00



### Visual Confirmation



#### Smallmouth Bass



#### Crawfish



# St Marys River, MI





# Path Forward

- Seek opportunities to conduct demonstrations or full scale projects with partners
- Assess and report

   on benefits and
   realized ecosystem
   goods and services
- Lessons learned adaptively manage
- Fully communicate with partners, academia, and public

