Incorporating Nature into Breakwaters

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US Army Corps of Engineers
BUILDING STRONG®

Great Lakes (GL) Green Breakwaters Study

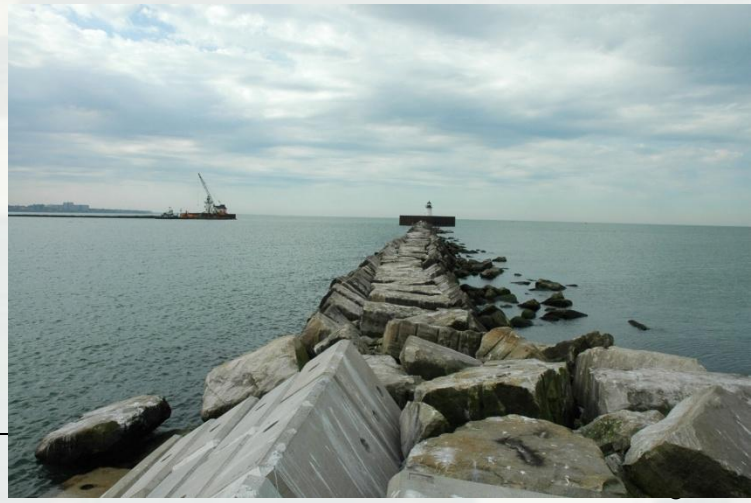
- Evaluate alternatives for enhancing aquatic ecosystem benefits at existing breakwaters and navigation structures
- During routine repairs and maintenance, as part of modifications, or during comprehensive structural repairs and replacements
- Concept extends to shore protection structures, non-USACE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

Demonstration Projects - Approach

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

Cleveland East Arrowhead Breakwater 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



Great Lakes RESTORATION


Study Site
Cleveland East Arrowhead Breakwater – Lake Erie

Cleveland & Ashtabula, OH

Texture Scale

Sample Collection

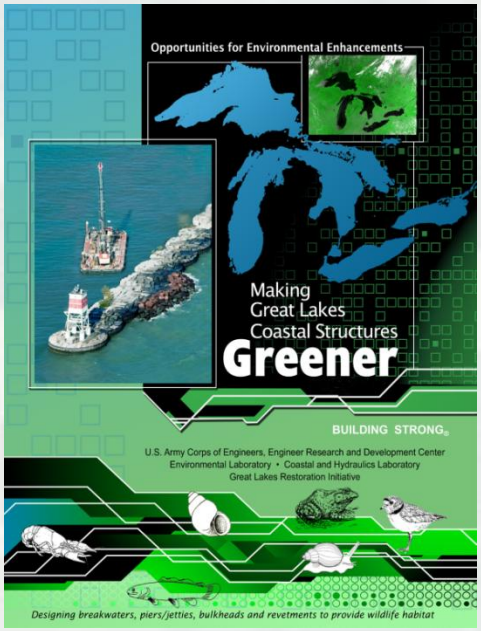
Post-sampled Area

Preliminary Implications

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

Cleveland Harbor Products and Awards

PIANC WwN Certification



Brochures

Trade Publications

Ashtabula Harbor Breakwater Project Approach

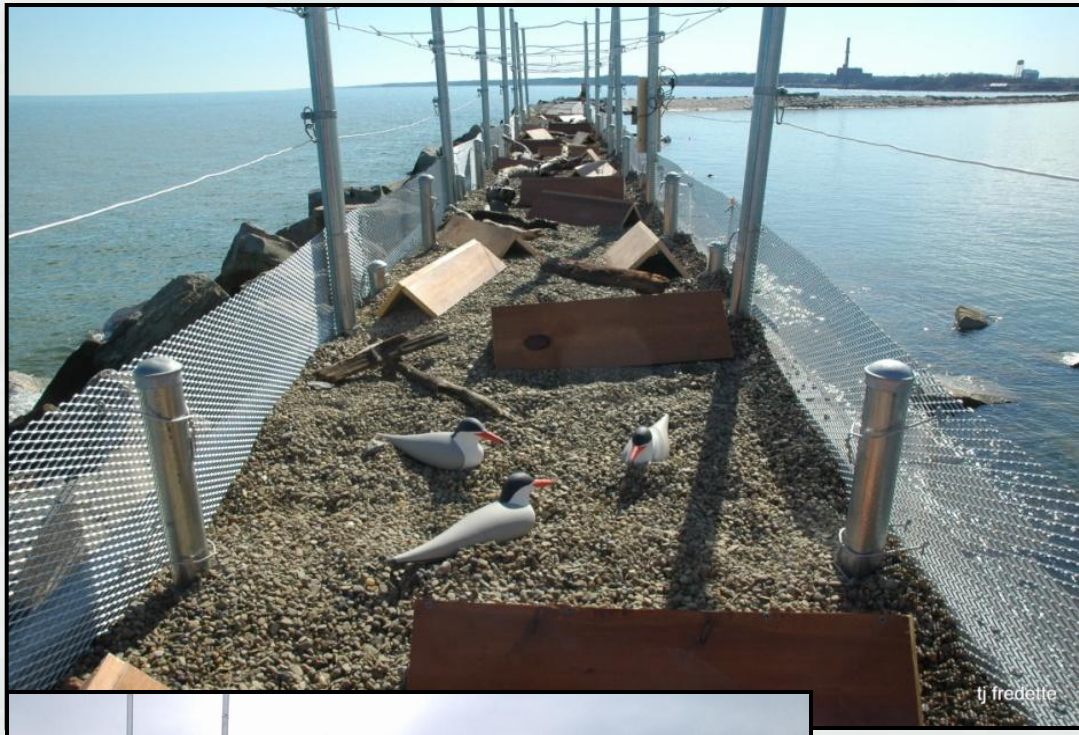
- Beyond indirect and unplanned habitat creation
- Modify design of breakwater to create bird habitat during routine maintenance
- Provide features creating habitat opportunities for the common tern
- Examines creation of tern habitat using modified toe blocks
  - Nesting pea gravel
  - Predator/competitor exclusion grid
  - Side fencing
  - Chick shelters

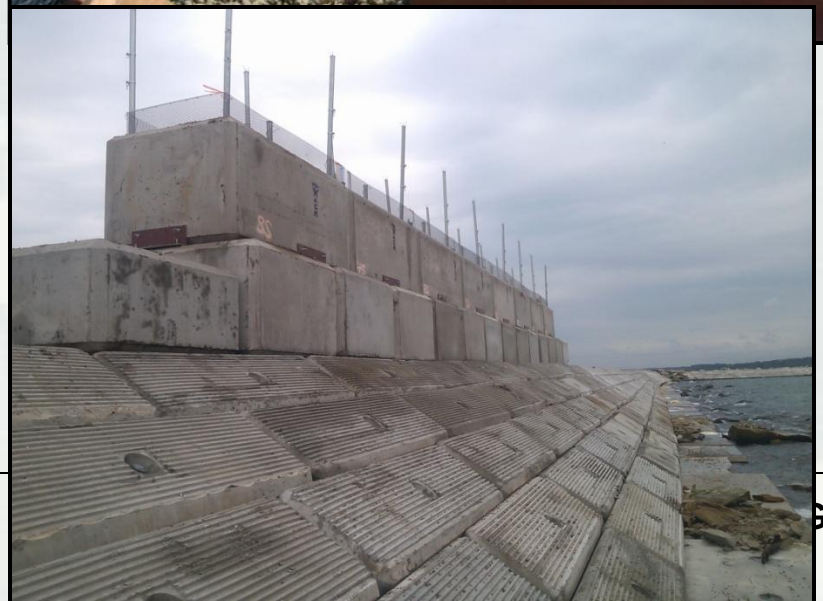

Ashtabula Harbor - Lake Erie
Study Site
© 2013 Google
1999 ft
Image © 2013 TerraMetrics
Imagery Date: 4/5/2012
lat 41.912231° lon -80.792287° elev 0 ft
Eye alt 8642 ft
Google

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
- Doubling habitat size during Phase 2 to sixteen blocks will further increase the chances of success

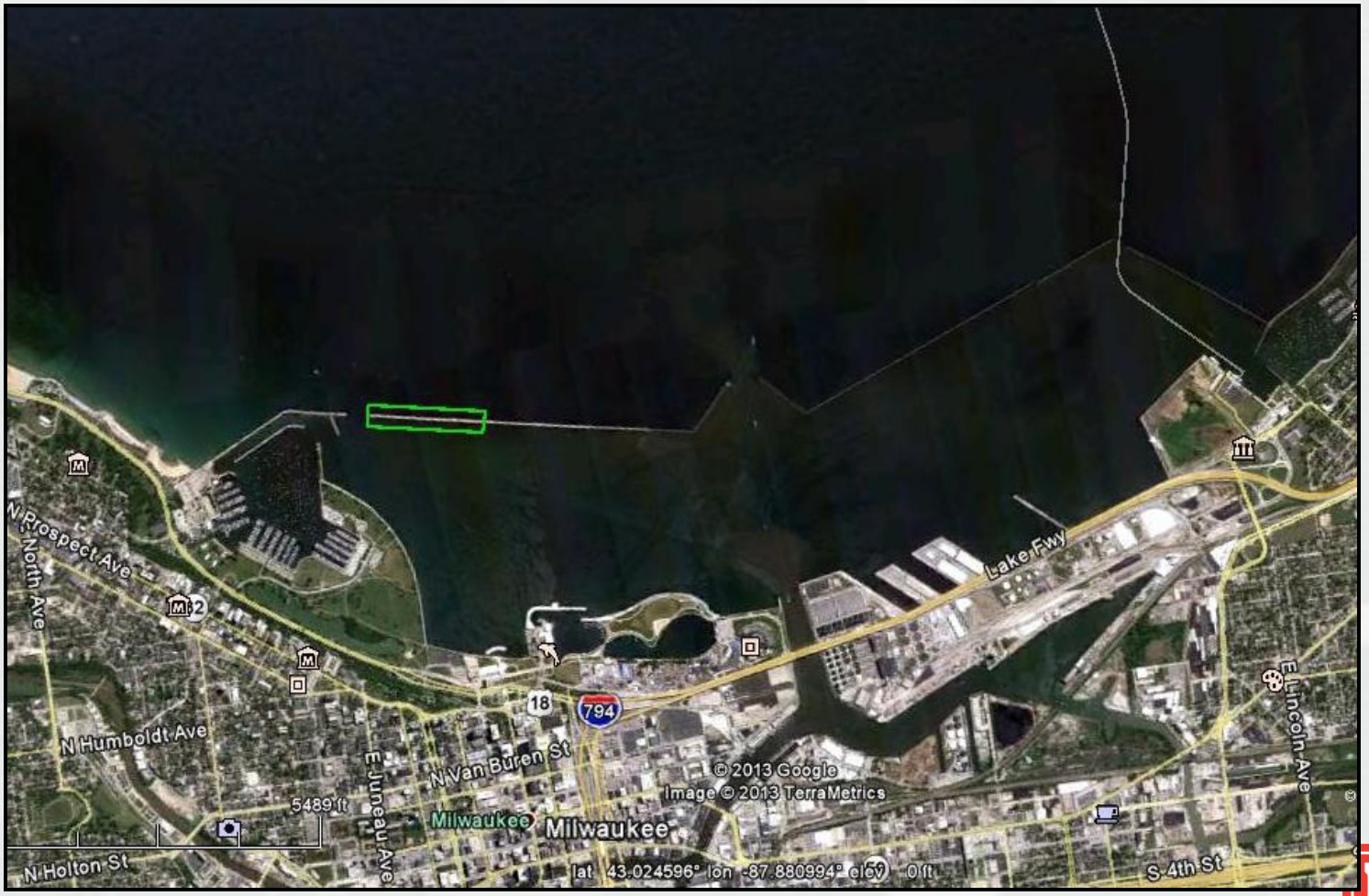




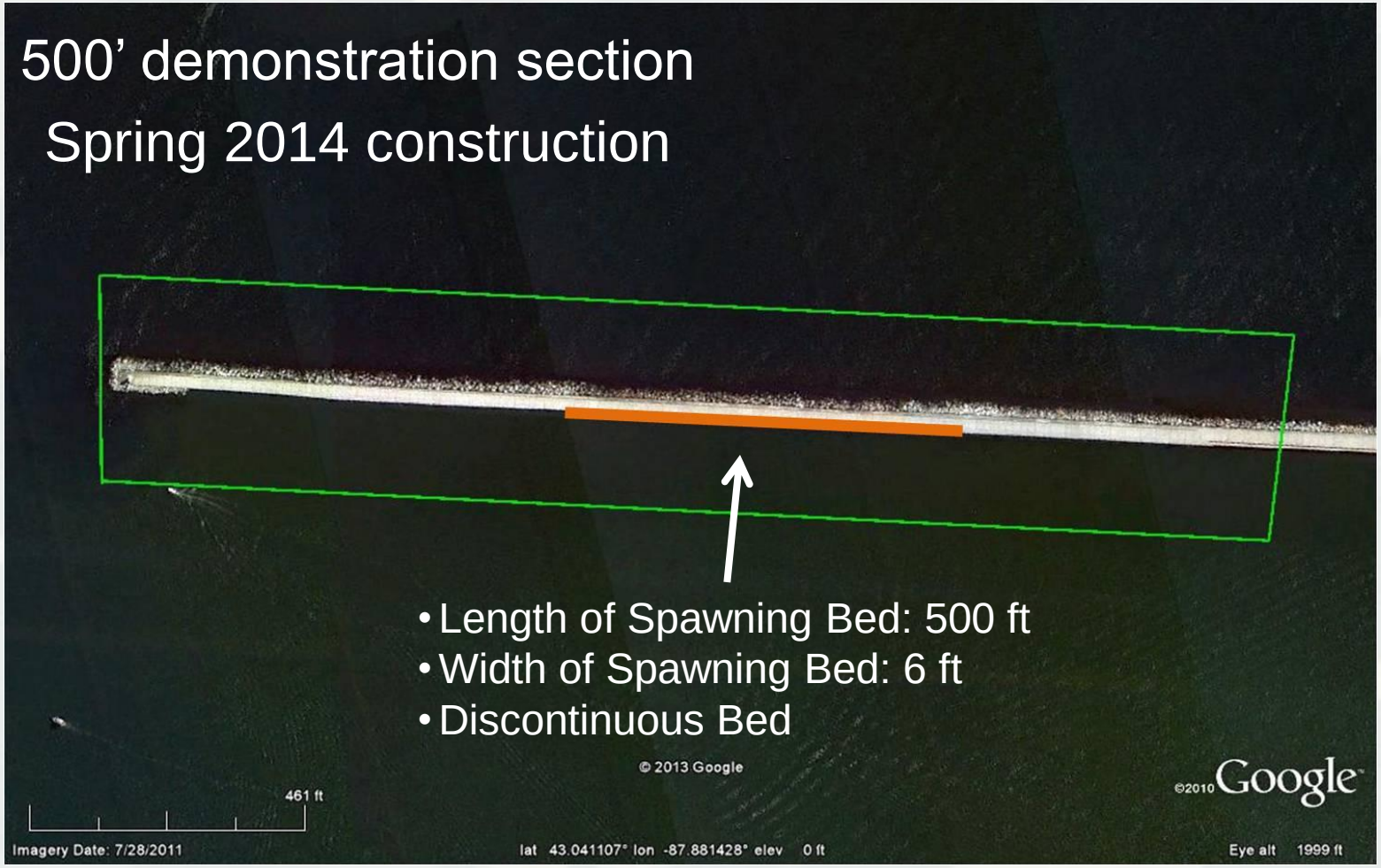
Milwaukee Harbor Project Approach

- Extend beyond indirect and unplanned habitat creation
- Modify design of rubble mound breakwater during maintenance
- Provide features creating habitat opportunities for GL fish and other aquatic life
- Examine creation of habitat surfaces using rubble mound
  - Stone size
  - Gentler sloping shelf
- Create spawning bed for fish such as walleye, northern pike, lake perch, and smallmouth bass

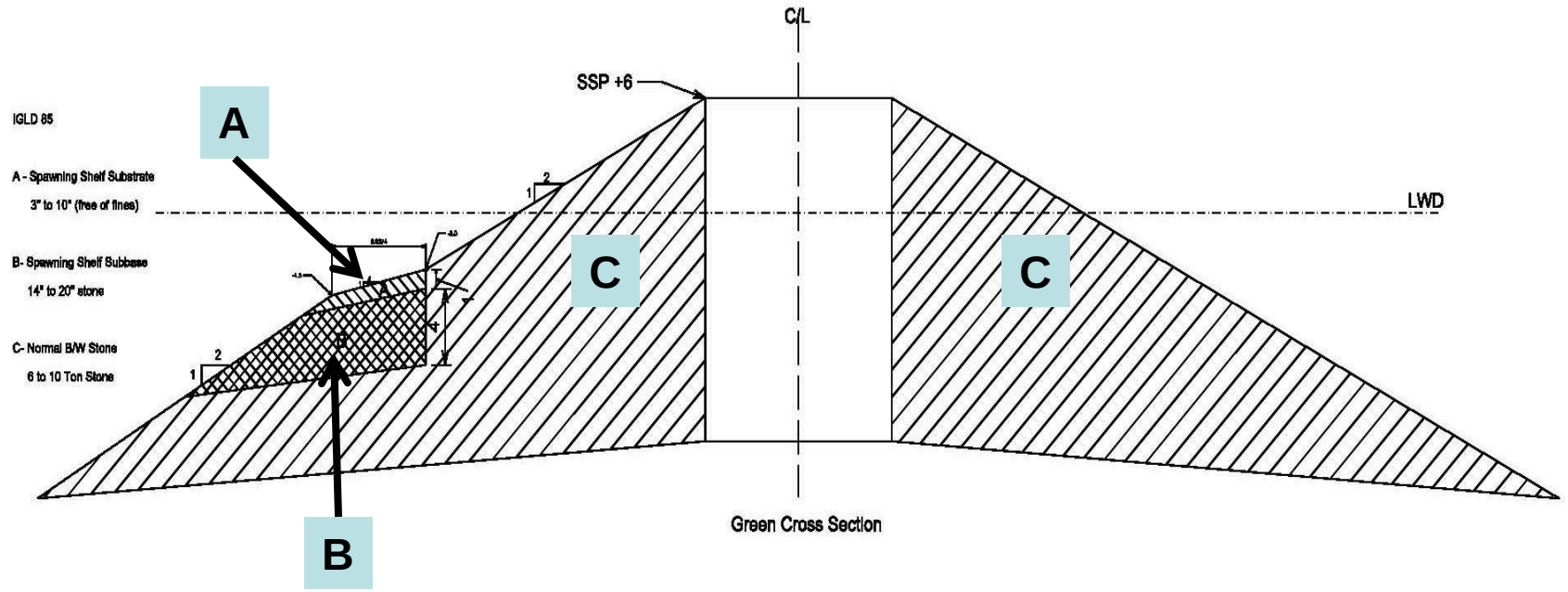
Milwaukee Harbor, WI
Lake Michigan



Fish Spawning Bed Location

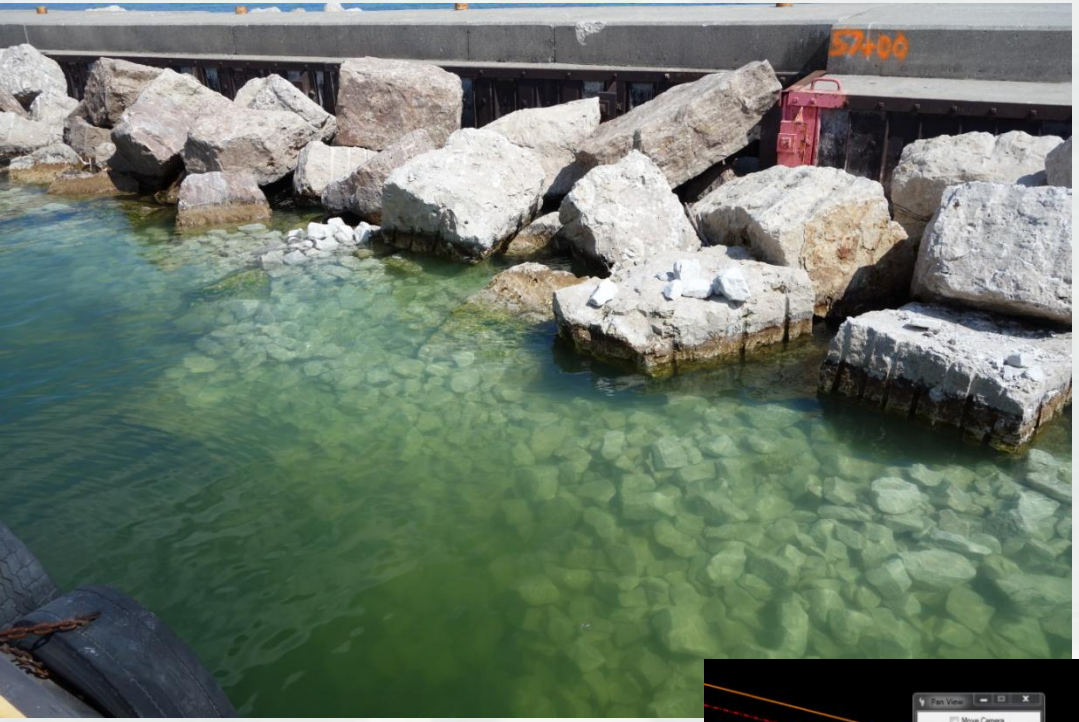


Modified Rubble Mound Breakwater
Fish Spawning Shelf



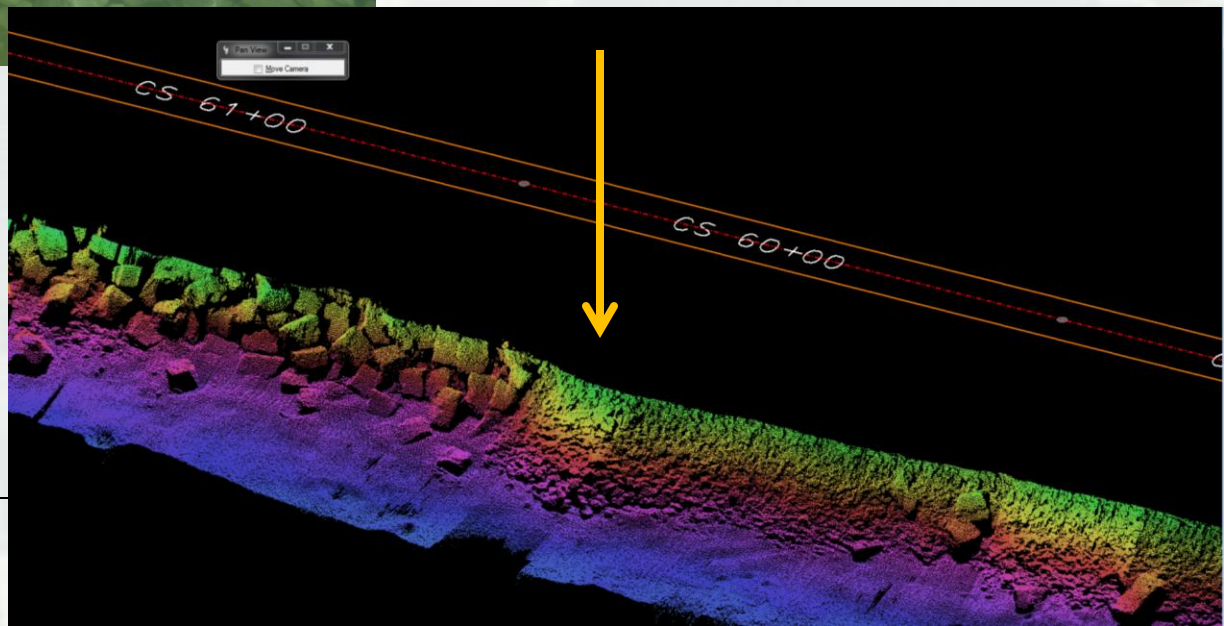
A - Spawning Shelf Substrate: 4-8” stone free of fines
B - Spawning Shelf Sub-base: 8-18” stone
C - Normal B/W Stone: 6-10 ton stone

Post Construction Monitoring



Visual Confirmation

Side-scan Sonar



Green Breakwaters Path Forward

- Assess and report on project findings
- Integrate more fully into organizational culture
- Communicate goals with partners, academia, and public
- Seek opportunities to conduct demonstrations or full scale projects with partners