

Working with Nature Project database



General information

Name of navigation or waterborne transport infrastructure project	Cleveland Harbor East Arrowhead Breakwaters Demonstration Project
Country	USA
Project location (nearest town or city)	Cleveland, Ohio
Key project objectives	The existing East Arrowhead breakwater had deteriorated over time due to wave damage from the open waters of Lake Erie. Routine maintenance of the breakwater was needed to ensure that the breakwater served its intended purpose of preserving safe navigation in Cleveland Harbor. Objectives also are to provide features that will create habitat opportunities for Great Lakes species that would not otherwise be present and to help reduce beneficial use impairments within the Great Lakes region.
Contact Person	Burton Suedel
Contact E-mail	Burton.suedel@usace.army.mil
Contact Phone	+1-601-634-4578
Position	Research Biologist
Organisation	US Army Corps of Engineers, Engineer Research and Development Center

Project data

Characteristics of environment	
	Lake
	Urban
	Temperate
	No protected areas
Key project dates	
Project is not in the planning phase. Date project planning started	Fall 2011
Project has consents/approvals. Date approval was obtained	Fall 2011
Project construction not yet started. Construction start date	April 2012

Date project was completed May 2012

Type of project

Maintenance program or initiative

Inland

Port

Other

Inland navigation, Commercial and recreational navigation, Harbor, Aquatic habitat enhancement, Demonstration project

Brief description

The demonstration project involves modifying the design of the standard concrete toe blocks used for breakwater maintenance to provide features that will create habitat opportunities for aquatic life. The repair section is 136' long (41 m). Seventeen toe blocks were installed and monitored, each block having a dimension of roughly 8' x 5' x 4' and each weighing about 10 tons (9.1 metric tonnes). The study is examining ways in which substantially more habitat surface can be created on the breakwater by modifying the shape and surface texture of the toe blocks. Three separate block modifications are being investigated to determine how they perform as habitat: (1) a protected indented shelf to serve as fish refuge and potential spawning areas; (2) dimpled block surface texture to provide invertebrate habitat; and (3) grooved block surface texture to provide invertebrate and juvenile fish refuge. Based on monitoring results, textures found to best serve as habitat to native species will be in the future incorporated more broadly across navigation repair and maintenance projects. The Buffalo District of the US Army Corps of Engineers is responsible for maintaining the breakwater and thus serves as the project manager. This project is research and development-oriented for demonstrating that habitat features can be incorporated into the design of blocks not only in Cleveland Harbor, but also in many other Great Lakes Harbors in the future. In fact, the grooved surface texture used in the project has been adopted for use on other toe blocks for repairing breakwaters by the Buffalo District because of its wave energy reducing properties. Monitoring the use of the blocks by aquatic species will be used to guide future block modifications at this and other harbors in the Great Lakes and elsewhere. The stakeholders identified in this win-win project are the Ohio Department of Natural Resources, the US Fish and Wildlife Service, and the US Geological Survey.

Indicative size

Less than 0.5 million US\$

Working with Nature philosophy

Were steps taken to understand the environment before any work was started on the development of the design of the project?

Yes

Yes. Before design work began the project team investigated the species that may be attracted to the toe blocks. It was found that invasive species, especially the round goby and the zebra mussel, inhabit the area, so attempts were made to texture the toe block faces in such a manner that it would attract native, not invasive, species.

Were stakeholders or potential partners involved from the very beginning in the initial process of identifying potential options or solutions and agreeing on a preferred option (i.e. instead of being consulted on already defined options)?

Yes

Yes. While this project was a relatively small demonstration project determining proof of concept, the State of Ohio Department of Natural Resources was contacted to obtain their feedback on toe block face texture designs in attempts to avoid attracting invasive species.

Was a solution identified which provided a clear 'win-win'?

Yes

Yes. The existing deteriorating East Arrowhead breakwater required routine maintenance to ensure that it continues to serve its intended purpose of preserving safe navigation in Cleveland Harbor. As part of the armor stone repair work to maintain navigation safety, a second objective was identified and implemented providing features creating habitat for fish and invertebrates that would not otherwise be present in the harbor, resulting in a win-win for both navigation and the aquatic ecosystem.

Was the project designed to work with and make use of natural processes (e.g. 'letting nature do the work')?

Yes

Did the project include benefits for nature or other environmental enhancements beyond what was legally required?

Yes

Yes. There were no legal requirements to create aquatic habitat on the toe blocks, so the nature benefit goes beyond any legal requirements.

Did the project follow, in order, the steps described in the Working with Nature Position Paper?

Yes

Yes. The four steps of the WWN process were followed for this project. The order in which the steps were followed was not exact, as in some instances steps were implemented concurrently. For example, Step 2 on understanding the environment overlapped with Step 3 on involving stakeholders. No substantive difficulties were encountered during the planning and implementation of the demonstration project.

Reasons/motivation for taking this approach

The repair and maintenance of navigation infrastructure must go beyond the incidental/accidental creation of habitat just by placing structure underwater to serve the navigation mission. Cost-efficient engineering practices are needed for enhancing the habitat value of infrastructure, thus increasing the long-term sustainability of the infrastructure by providing not only economic benefits but environmental benefits as well.

Cost implications

Costs were not lower than the conventional approach to this type of project (i.e. no cost savings were made)

Additional funds were provided from third parties

Extra costs compared to conventional approach

Costs were marginally or significantly higher than a conventional

Additional funding was provided by the Great Lakes Restoration Initiative, launched by the US Environmental Protection Agency in 2010 to address the most pressing environmental concerns in the Great Lakes ecosystem.

The costs were marginally higher than the conventional approach of using featureless toe blocks to anchor the breakwater.

approach to this type of project

Other cost implications

The cost implications for incorporating the approach into the design and implementation of the breakwater repair effort were low. The approach involved purchases and custom design fabrication of liners placed into the block molds as part of the manufacturing process. The liners were used to create the surface textures on the blocks and had minimal impact on manufacturing costs and level of effort.

Percentage of the total cost that was an additional cost associated with adopting these elements of Working with Nature

The cost of the project only increased by less than 1 percent as a result of incorporating the aquatic habitat features to the toe block faces.

Did existing legislation help or hinder your application of the Working with Nature philosophy?

The approach adopted did not help to meet legal obligations

What was done did not exceed legal requirements

No problems were experienced with existing legislation

The approach was not taken despite legal requirements

Legal requirements did not prevent the Working with Nature philosophy being applied

Other implications

Existing legislation did not affect the application of the WWN philosophy for this project. No legal requirements were in place that hindered the application of the concept.

Further information

A link to this project can be found at the USACE Engineering with Nature website at: <http://el.erdc.usace.army.mil/ewn/pdfs/Cleveland%20Harbor%20Green%20Breakwaters.pdf> Caption for pdf file image uploaded below: As part of the repair of the breakwater in Cleveland Harbor, the Buffalo District of the US Army Corps of Engineers positioned toe blocks with ridges and other textures on the outer face designed to serve as aquatic habitat for various species. This toe block redesign was completed with only