

4 MINUTE READ

# Spicer Creek



from **Engineering With Nature: An Atlas, Volume 3.**

by US Army Engineer Research and Development Center



## Grand Island, New York, United States

### **Creating a multifaceted wave-attenuation system to restore coastal**

**wetlands.** A segmented stone breakwater and large engineered wood structure are reversing the loss of wetlands and the fish and wildlife habitat they provide in the Spice Creek Wildlife Management Area (WMA) along the Upper Niagara River. The new structures combine natural materials and processes in a resilient, minimalist system to mitigate wave action and the erosion and scour it causes and to promote nearshore sediment deposition and wetland creation in this part of the Niagara River Area of Concern (AOC). Biological surveys from the early 1900s describe the Upper Niagara River near the mouth of Spicer Creek as a wetland biodiversity hot spot. But from 1967 to 2021, almost two hectares of wetlands were lost along 1,097 meters of shoreline fringe wetlands, approximately 5% of Grand Island's eastern shore. The wetland restoration project aims to address beneficial use impairments (BUIs), including degraded fish and wildlife populations. Key design considerations for the project included safety, riverbed geotechnical conditions, aligning design features along the Niagara River shoreline, and minimizing downstream impacts to the Niagara

River. An ongoing adaptive management program monitors wetland recovery and will be used in considering additional design features or modifications if needed to continue supporting wetland habitat uplift.

Article Cover: Aerial view of the multifaceted wave attenuation system. The Spicer Creek WMA is in a largely suburban area, approximately 16 kilometers from the northern limit of the City of Buffalo. (Photo by BIDCO Marine Co.)

## Producing Efficiencies

The project works with natural hydrodynamic conditions by subtly modifying physical conditions in its area, minimizing the materials introduced to the river, and using natural sedimentation and other processes to restore wetlands while limiting riverbed and downstream impacts. Exposure ratios in the USACE's *Engineering Design Guidance for Detached Breakwaters as Shoreline Stabilization Structures* helped shape design parameters so the segmented breakwater would attenuate waves but not significantly inhibit sediment flux downstream, which would have exacerbated erosion. Hydrodynamic and sediment flux were modeled to refine the design parameters and evaluate design impacts on river processes.

## Using Natural Processes

By using natural processes such as natural sediment accretion, organic matter deposition, and vegetation establishment to reduce physical stresses to the shoreline, the project design facilitates the natural recovery of wetlands along the Spicer Creek WMA shoreline. Plantings in a portion of the project area near the remnant wetland at the mouth of Spicer Creek helped initiate these processes. The wave-attenuating structures and ballasted woody debris were designed by fisheries biologists to attenuate physical stresses while providing habitat for fish.







Ballasted woody debris placed in the gaps of the segmented breakwater to attenuate waves and provide habitat for fish. Following construction in 2021, monitoring observations indicate that the system is working as intended.

(Photo by BIDCO Marine Co.)

## Broadening Benefits

Lake Erie and the Upper Niagara River are a recognized world-class fishery, so it is not surprising there was interest in improving fish habitat in the river in addition to obtaining the natural wetland benefits this design would provide. The ballasted woody debris placed in the gaps of the segmented breakwater not only help attenuate wave action but also provide habitat for fish. A local charter captain sums up the springtime smallmouth bass (*Micropterus dolomieu*) fishing at the project area in one word: “Prolific!” The site also includes an accessible walkway to the shoreline and two multiuse structures that serve as rest stops for people interested in spending time by the water.



Varying sizes of rocks and large woody debris with intact root wads help create diverse habitat.

(Photo by Ramboll)

## Promoting Collaboration



This project in the Niagara River AOC arose from the collaborative process in the binational Great Lakes Water Quality Agreement, first signed in 1972. This agreement calls for AOCs to be established where significant local BUIs are the legacy of human actions. Such areas require the development of a collaborative Remedial Action Plan that identifies the BUIs and the restorative projects like the one at the Spicer Creek WMA. Multiple stakeholders collaborated to align remedial strategies that could achieve multiple desired outcomes. Among the stakeholders were representatives from federal, state, and local agencies; local businesses; universities; and nonprofit environmental organizations.



The ballasted woody debris provides wave attenuation and fish habitat. Construction of the wave-attenuating structures was completed using an excavator on a floating pontoon.

(Photo by Ramboll)

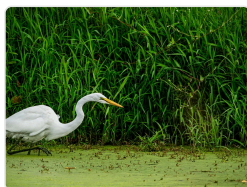


Anchors securing the woody debris to the river bottom.

(Photo by Ramboll)

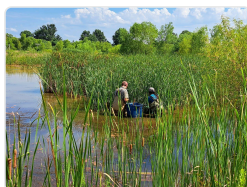


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### Conclusion

4min pages 292-297



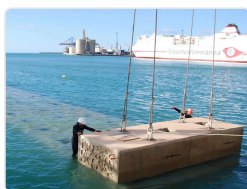
### Mayer Ranch

4min pages 288-291



### Kaskaskia River Basin

4min pages 284-287



### Port of Málaga

4min pages 280-283

**Big River at Calico Creek**

4min pages 276-279

**Shark River**

4min pages 272-275

**Port Lands**

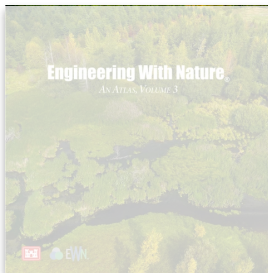
5min pages 268-271

**Cape Cod**

4min pages 264-267

**Newlyn**

4min pages 260-263

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