City of Belfast

City of Belfast Sedimentation Study for Breakwater Improvements (Fiscal Year 2024, project awarded 2023)

"In this time of climate change and unpredictable weather, assistance with protecting Maine's very valuable shoreside infrastructure and water access has become even more important and without a doubt necessary."– Kathy Given, Belfast Harbor Master

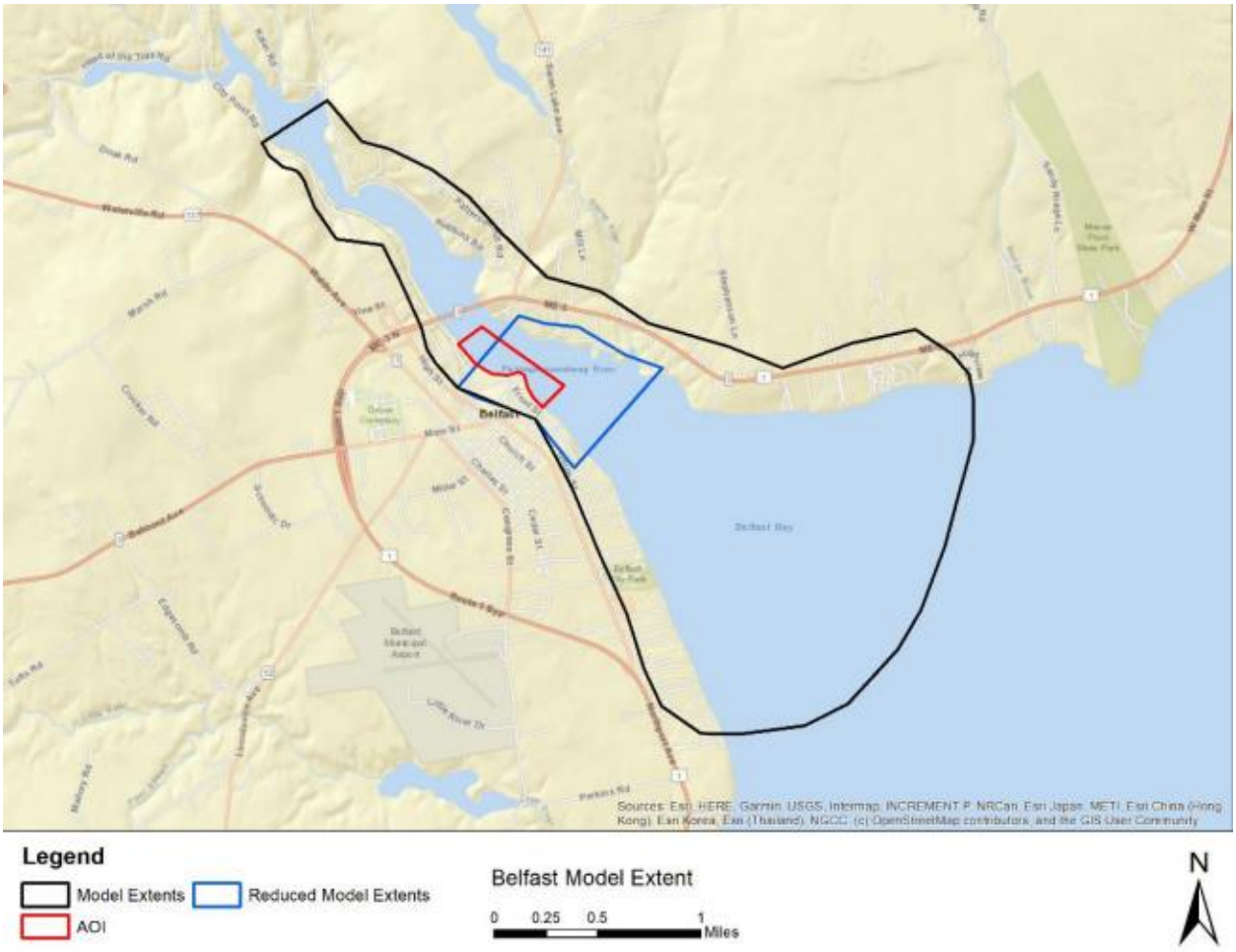
Photo from Sediment Study for Breakwater Improvements Report 2024

Project Description

The city of Belfast aims to rebuild a breakwater that protects the city's marine infrastructure. Previous studies performed by the United States Army Corps of Engineers and the State of Maine have determined that the Belfast Harbor and surrounding facilities are vulnerable to the effects of climate change due to their low elevation. To determine the best way to rebuild the breakwater, the city hired a consultant (WSP Environment & Infrastructure Solutions, Inc.) to perform a study to assess the effects of extending the breakwater on sediment movement in and near the harbor. This project builds on the City's FY22 Shore and Harbor Planning Grant, which provided conceptual designs for four options to raise and/or extend the breakwater. The preferred

option was to both raise and extend the breakwater, but there were concerns that extending it 60 feet into the harbor may impact sediment movement.

To ensure a well-rounded and thorough assessment, the study consisted of four major components: 1) Hydrodynamic assessment of the coastal currents and coastal waves in the vicinity of the proposed redesigned Breakwater; 2) Shear stress analysis of the riverbed in the vicinity of the proposed breakwater; 3) Riverbed/harbor level change assessment based on past surveyed data in the Belfast Channel; and 4) Modeling of potential sediment plumes in the vicinity of the proposed breakwater.



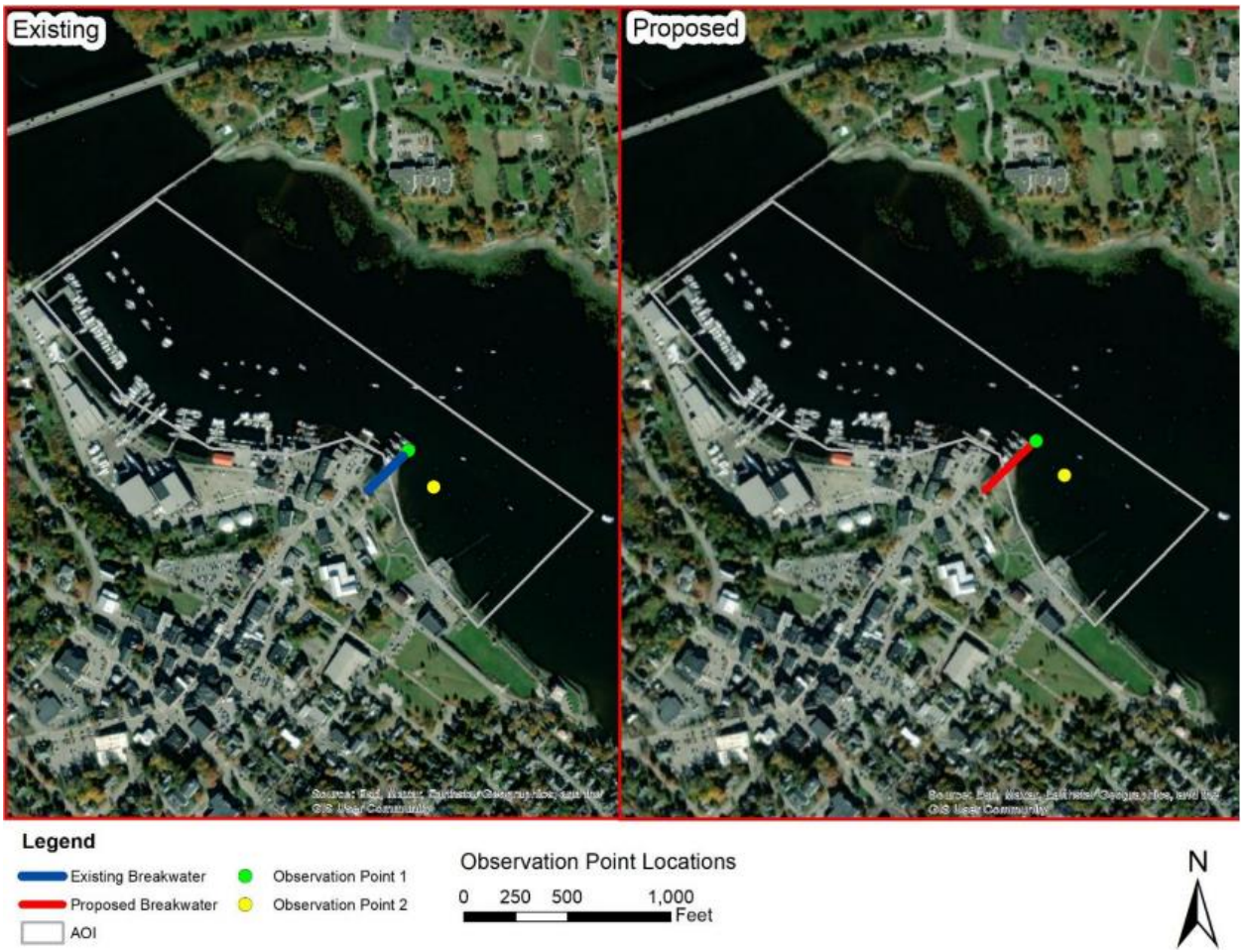
Belfast Model Extent, taken from Sediment Study for Breakwater Improvements Report 2024

Project Results

The sedimentation study examined the potential effects of the proposed redesign, which will extend and raise the breakwater. The full report can be found on the city's website (www.cityofbelfast.org) and was reviewed by the Harbor Committee and presented to the Belfast City Council.

The study concluded that the proposed breakwater does not have a strong effect on wave heights or greatly change the hydraulics in the vicinity. However, the extension of the breakwater is projected to cause an increase in velocity off the tip of the breakwater. The study notes that the proposed breakwater does slightly reduce the shear stress upstream compared to the existing breakwater. The study also determined that the proposed breakwater would not increase the depositional area upstream but does predict increased sedimentation downstream of the

breakwater. Ultimately, the study found that there would be no significant long-term change of sea-bed levels in the surveyed region resulting from the proposed breakwater.



Existing and Proposed Breakwater velocity measurement locations, taken from Sediment Study for Breakwater Improvements Report 2024

Table 4-1 Current Velocity Comparison

SCENARIO	BREAKWATER DESIGN	TIP OF BREAKWATER (FT/S) (OBSERVATION POINT 1)	DOWNSTREAM OF BREAKWATER (FT/S) (OBSERVATION POINT 2)
1	Existing	0.45	0.23
2		0.95	0.51
3		1.1	0.56
4		1.39	0.76
5	Proposed	0.54	0.23
6		1.28	0.41
7		1.37	0.54
8		1.68	0.71

Current Velocity Comparison table, taken from Sediment Study for Breakwater Improvements Report 2024

Future Plans

The city plans to use the results of the sedimentation study to inform the construction of the new breakwater. Raising and extending the breakwater does not appear to have any major impacts on sedimentation in the harbor area; therefore, the city is planning to pursue this design option. The city is currently pursuing additional funding to take the next steps necessary to complete the breakwater redesign, permitting, and construction.

Lessons Learned

Larger projects may take many steps before reaching the end goal. This project has accomplished a significant step towards creating a breakwater that is both effective and long-lasting.

Thanks to Kathy Given for helping to prepare this summary.

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