Project Name: Ashland Phase 2 Wet Dredge Full Scale
Project Location: Ashland, Wisconsin, USA
Award Category: Environmental Dredging
Project Owner: Northern States Power Company (doing business as [DBA] Xcel Energy)
Team Members: Foth/Envirocon Joint Venture, J.F. Brennan Company, Inc.
Date: April 19, 2019

Mechanical dredging operations at the Ashland Phase 2 Wet Dredge—Full Scale project. (Aerial photo courtesy of J.F. Brennan Company, Inc.)

Project Overview Summary

Along the southeastern shore of Chequamegon Bay in Lake Superior sits the picturesque town of Ashland, WI. Approximately 100 years ago, Ashland was a central hub for the shipment of goods, timber, iron ore, and much more throughout the Great Lakes. As mining and timber slowed and drove declining port use, it became apparent that industry and progress left their mark on this area, as with so many other Rust Belt hotspots of the early- to mid-twentieth century. Investigations for contaminants of concern (COCs) began in the 1990s; in 2002, the project site—composed of property owned by Northern States Power (dba Excel Energy) and a portion of what is now Kreher Park—was nominated for the National Priorities List and cleanup under the Comprehensive Environmental Response and Compensation and Liability Act (CERCLA) due to the presence of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), non-aqueous phase liquids (NAPLs), and heavy metals. In 2010, the United States Environmental Protection Agency (US EPA) issued their Record of Decision (ROD) with preferred remedies for successful execution of the project, which chiefly included sheet piling and excavation "in the dry."

The Foth/Envirocon Joint Venture (FEJV) was contracted by Xcel Energy in 2011 to execute a design/build to demolish on-site buildings, install a slurry wall, build a shoreline bulkhead wall and remediate Site soils and other impacted materials in Phase 1, or upland areas, of the Site. As completion of the Phase 1 project was drawing near, the Phase 2, or in-water work, began with a pilot-scale demonstration of the effectiveness of a "wet dredge" approach to removing sediments from Chequamegon Bay. The pilot study was an important component of the ROD, and its success would allow the Phase 2 project to be implemented using traditional, marine-based environmental dredging methods. J.F. Brennan Company, Inc. (Brennan), a subcontractor to the FE JV, began work onsite in 2015 to dredge an area for a rubblemound breakwater, partially isolating the project footprint from the harsh effects of Lake Superior wind and waves. The breakwater was constructed by Roen. The breakwater would allow the pilot study to be implemented to meet the intent of the ROD, provide a method equally protective of the environment, and also increase safety for both the site workers and the surrounding community.

The US EPA deemed the pilot study acceptable and in 2017, work began on what is now known as the Ashland Phase 2 Wet Dredge—Full Scale project. FEJV was contracted to execute a design/build for Phase 2. Although the "wet dredge" remedy saved a great deal of time and energy as compared to the original "dry dredge" remedy in the, it was not without its challenges to create a work environment that could still meet the aggressive Performance Standards as well as intent of the ROD.

Several performance standards were to be met for the Phase 2 Wet Dredge Project:

- Establishing a Phase 2 post-dredge surface weighted average concentration (SWAC)
- Performance Standard of 9.5 ppm total PAH (tPAH); no single value greater than 22 ppm tPAH.
- Source NAPL to be removed
- Requirement to place a sand restorative layer following Phase 2 dredging

To contain generated residuals throughout the dredging effort, the in-water project footprint had to be separated from the remainder of Chequamegon Bay. This involved closing off gaps between the adjacent peninsulas and the ends of the breakwater with geotextile tubes and also installing a robust multilayered sediment curtain system.

After installing this water quality control system, mechanical dredging of target materials began. The target removal prism consisted of three distinct layers: first, multiple vertical feet of discarded slab lumber and logs from historic logging and sawmill operations; then a layer of silt, sand, and woody debris ranging in size from sawed lumber down to sawdust; and finally, an extremely stiff native clay and dense silt pack at the bottom. Each of these layers presented unique concerns.

Sediments were removed using environmental thumb lid buckets that placed sediment and woody debris into material hopper barges. When full, hopper barges were transported to an offloading area where the dredged material was offloaded and conveyed into the material processing tent.

Mechanically removed material was amended with either pebble lime (conventional mixing with excavator), a lime kiln dust/pebble lime mix (mechanized process), or sawdust (small amounts of material at end of project) to remove free liquids before transportation and disposal.

Because of the diligent efforts of the project team, they were able to complete bulk removal of the target material during the 2017 season. The following year, Brennan performed the final hydraulic cleanup pass along the prism bottom with their patented VicVac™ attachment. Finally, to provide a suitable staging area for the repopulation of the benthic community, Brennan installed 6 inches of restorative layer material comprised of a washed concrete sand over the work footprint utilizing their Broadcast Capping System (BSC™). Overall, Brennan removed approximately 138,000 cubic yards of impacted material from Chequamegon Bay and placed approximately 20,000 cubic yards of restorative layer material.

The City of Ashland is currently initiating a waterfront development plan for the newly remediated area and hopes to revitalize their historic town with a new and healthy waterfront.

Award Category: Environmental Dredging

Figure 1. Operations begin along Lake Superior's Chequamegon Bay, restoring a site known for contamination back to quiescence.

The FE JV and J.F. Brennan Company, Inc. (Brennan) nominated the Ashland Phase 2 Wet Dredge—Full Scale project as The Western Dredging Association (WEDA) Environmental Excellence Award for a multitude of reasons. First and foremost, the work exemplifies the heart and soul of successful

environmental remediation through dredging, both mechanical and hydraulic, in the region in which this summit and exposition is taking place. Second, the collaborative methods which all stakeholders undertook to achieve a remedial approach that worked for this site returned substantial dividends to all involved. Third and finally, the benefits of the work conducted onsite will have lasting impact on the community of Ashland and the lessons learned will impel regulators, engineers, and contractors when they advance similar endeavors in the future.

Environmental Benefits

In most remedial dredging projects, the primary and generally overshadowing environmental benefit is the removal of target COCs from a waterway or wetland ecosystem. In the case of the Phase 2 project, the clear winner is the removal of VOCs, SVOCs, PAHs, NAPLs, and heavy metals to levels which are nearly four times better than the established project goal. All stakeholders can be incredibly proud of these exemplary outcomes. But this successful project translates into so much more than just the removal of contaminants from one small portion of a bay on Lake Superior—they mean a fresh start for the area and its environment. By effectively removing the quagmire of wood refuse and waste products, the local ecosystem in the southeast portion of Chequamegon Bay begins anew—and renewed.

Surface water quality sampling and monitoring was extensive during the Phase 2 Wet Dredge project, consisting of real-time turbidity monitoring, hand-held turbidity monitoring and collection of 1,080 water samples for analysis of 27 different water quality analytical parameters from each sample during 108 sampling events. From these 1,080 samples, 29,430 COC water quality parameters were analyzed at four compliance locations. There were eight events in 2017 and two events in 2018 where results were above water quality standards. These events represented only 0.2% of the total number of parameters analyzed, reflecting a compliance rate of 99.8%.

The objective of the Phase 2 Wet Dredge Project for the Ashland/NSP Lakefront Site was to remove tPAH-impacted material while meeting performance standards outlined in the ROD. The results of this Phase 2 Wet Dredge Project demonstrated operational procedures were effective in meeting the performance standards, resulting in the achievement of a SWAC of 2.38 ppm tPAH post-dredge (and just 0.03 ppm tPAH post-restorative layer), well below the overall cleanup goal of 9.5 ppm tPAH SWAC as set forth in the ROD.

Unique Challenges

Anyone with the opportunity of working in the environmental dredging field knows that overall project success is a remarkably difficult summit to reach. Challenges of all natures, both known and unknown, test even the best project teams, and Phase 2 was no different in that regard. One particularly difficult challenge encountered on Phase 2 involved controlling sheen and odors resulting from the agitation of materials during the dredging processes. The concentrations of contaminants and pure product found in the sediments resulted in a tar-like, oil sheen substance that rose to the surface during active dredging. Containing this sheen was necessary to reduce odors both onsite and to the surrounding environment.

In addition, the process of mechanically dredging the clay and silty sediment caused a large amount of turbidity in the dredge area. To maintain water quality standards, this turbidity had to be controlled and contained to the dredging area. To make matters more interesting, the Lake Superior seiche also

threatened to transport turbid water out of the work area. Through teamwork and innovation, the project team successfully mitigated these two issues with practical practices in the field, implementing active sheen capture through use of absorbent materials slowly towed behind vessels and applying Aluminum Sulfate (Alum) to effectively control turbidity in the active work area.

Figure 2. Example of sheen observed during mechanical dredging operation.

Other challenges encountered throughout the course of the project include those related to material management both in and out of water, and safety concerns resulting from the removal of large slab lumber and logs inundated with COCs. Active communication and teamwork by all involved parties mitigated these challenges and many others.

Figure 3. Wood debris present in the top layer of the dredge prism.

Innovation

Innovation was truly fundamental tenant of Phase 2 as the "wet dredge" remedy could not have been realized without the creative and collaborative mindset of the project owners, engineers and contractor to pursue a beneficial alternative to the traditional "dry dredge" remedy preferred by the ROD. Innovation continued as a theme throughout the life of the work, as the project team melded industry tools and practices to forge an all-encompassing approach and provide a complete remedial campaign. These tools and practices included the use of customized dredging buckets for removing the project's unique materials, use of Alum to keep turbidity localized in the work area, final pass dredging utilizing a hydraulic dredge with the patented VicVac™ open-suction attachment to capture remaining residuals, and restorative layer installation using the BCS™. All these tools and practices include sustainable features both in concert or as standalone options under appropriate conditions.

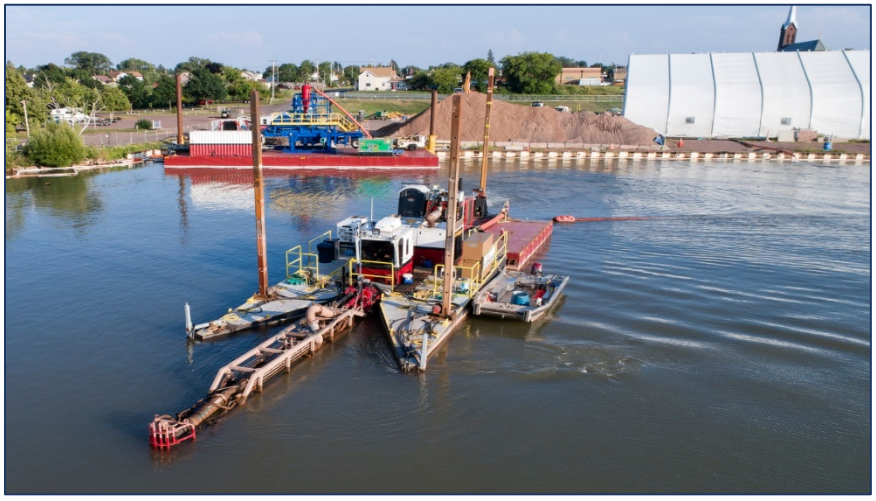

Figure 4. Brennan's hydraulic dredge with our VicVac™ attachment, used for final-pass dredging.

Economic Benefits

Along with accomplishing the objectives of the ROD, this project also proved economically beneficial for all stakeholders involved. First, the rationale to change the removal remedy from "dry dredge" to "wet dredge" significantly reduced the overall the schedule, which in turn reduced overall costs to the client—in the magnitude of millions. Second, reducing the overall schedule also permits the City of Ashland to begin redeveloping their public waterfront space at Kreher Park years earlier than anticipated, and to realize the benefits of marketing a revitalized area for tourism in the near future; the City also took ownership of the $16-million breakwater after completion of the project. Third, a large portion of the labor was performed by a workforce local to the area, sending a portion of the dollars earned back into the cash registers of other local business. Environmentally and economically, this project removed COCs from a commercial fishery that contributes on average $6 million annually[1] and

[1] Great Lakes Indian Fish and Wildlife Commission (GLIFWC)

$1.1 million[2] for Wisconsin alone. Fourth and finally, the benefit of successfully remediated project site will undoubtedly increase the quality of life for area residents and visitors for years to come.

Transferability

The practices and methodologies used at Phase 2 carry themes that are highly transferable to similar sites:

- Collaboration with regulators to develop alternative remediation methods that provide equally or more effective remedies was key to the project and is key to increasing the cost effectiveness of future environmental dredging projects nationwide.
- Innovative remedies that are less intrusive and shorter in duration reduce risk to the public, fast-track redevelopment, and increase the appeal and tax base for local communities.
- Collaboration with regulators leads to increased options for turbidity control.
- Reduction in overall schedule leads to reduced consumption of fossil fuels and other supplies.

Outreach and Education

Stakeholders spent a great deal of time preparing the community for the performance of the project. During project execution, social media sites, local news, and public meetings kept the community informed of progress. As part of the redevelopment effort, the local public has been invited to provide input on the planning for their revitalized waterfront area, furthering the successful practice of community involvement.

Figure 5. Post-remediation aerial view.

[2] State of Wisconsin, Department of Administration, Division of Executive Budget and Finance