2014 WEDA ENVIRONMENTAL EXCELLENCE AWARD NOMINATION FOR CONSIDERATION

Environmental Dredging of Sheboygan River, Wisconsin

A multi-stakeholder collaboration, simultaneous execution of multiple projects in the same area, innovative technological collaboration, and shoreline restoration

Nomination submitted by WEDA members
Ryba Marine Construction Co. & Terra Contracting Services, LLC
April 18th, 2014

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Summary

Prior to 1969, the US Army Corps of Engineers (USACE) disposed of dredged material from the Sheboygan Harbor in an authorized deep water disposal area in Lake Michigan. Sediment sampling conducted by the USACE in that timeframe found moderate to high levels of PCBs and metals present in the sediment. In 1978, a Do Not Eat fish consumption advisory for resident fish was established by the Wisconsin Department of Natural Resources (WDNR).

The Sheboygan River and Harbor were designated as a Superfund Site in 1986 and, in 1987, were designated as one of 43 Area of Concern (AOC) "toxic hot spots" by the US and Canada International Joint Commission. The USEPA issued a Record of Decision in 2000 for a 14-mile stretch starting in Sheboygan Falls downriver to the Sheboygan Harbor.

The area was designated as an AOC due to water quality and habitat impacts associated with the historic discharge of pollutants. In addition to the conventional pollutants such as suspended solids, fecal coliform bacteria, phosphorus, and nitrogen, toxic pollutants in the sediment included polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and heavy metals. The high level of nutrients, solids, and toxins in the river had caused a series of issues, including nuisance algal blooms, fish consumption advisories, and contaminated sediments.

With the goal of eventually delisting the AOC, the USEPA Great Lakes National Program Office (GLNPO) awarded the Great Lakes Legacy Act (GLLA) Sheboygan River dredging project to Ryba-Terra, a joint venture of Ryba Marine Construction Co. and Terra Contracting Services, LLC.

In a project requiring an unusual level of collaboration due to the other multiple ongoing projects, Ryba-Terra removed 147,500 cubic yards of contaminated sediment and placed a residual sand cover over 9 acres. The successful removal of PCB and PAH contaminated sediment from the 8th Street Bridge to Kiwanis Park sections of the river have greatly contributed to the program objectives to delist the Sheboygan River from the AOC list.

Additionally, this project served as a catalyst to revitalize business and economic development along the riverfront. The navigational channel had not been dredged since 1956 due to the PCB and PAH contamination in the sediment. The lower river and harbor were restored and deepened to authorized channel depths, allowing for additional commercial and recreational boat traffic and minimizing restrictions on future maintenance dredging activities.

The project contained a multitude of challenges including record low water levels, complex coordination with the other on-going remediation and shoreline restoration activities, a dysfunctional lift bridge, an unknown burial depth for the main 13.8 kV feeder line to the City of Sheboygan, and control of re-suspension and turbidity levels. The limited site footprint for dewatering, water treatment, and sediment stabilization in downtown Sheboygan added to the challenges of managing storm water and air releases.

Overcoming these challenges required extensive coordination among regulators, state, city and county governments, contractors and subcontractors, local property owners, marinas, boaters, and local residents. Ryba-Terra worked 24 hours per day, 7 days per week to complete the project with zero major incidents or safety accidents.

Project Team Members

Project Owners: USEPA Great Lakes National Program Office (Marc Tuchman, Heather Williams)

Stakeholders: U.S. Army Corps of Engineers; Wisconsin Department of Natural Resources; Wisconsin Department of Transportation; University of Wisconsin Extension; City of Sheboygan; Sheboygan County; Wisconsin Public Service; Tecumseh; Pollution Risk Services

Design Engineer / Construction Oversight: CH2M Hill - WEDA member (Gina Bayer)

Dredging and Sediment Processing: Ryba Marine Construction Co. - WEDA member (Zac Morrish) and Terra Contracting Services, LLC - WEDA member (Steve Taplin), Joint Venture

Water Treatment: Global Environmental Engineering, Inc. (Bill Korreck and Bill Pierce)

Environmental Monitoring and Quality Control: TechLaw (Rob Young)

Transportation & Disposal Operations: The Environmental Quality Company (Mick Warner)

Nominating Entity: Ryba Marine Construction Co. – Terra Contracting Services, LLC, Joint Venture

Environmental Benefits

The Sheboygan River discharges into Lake Michigan through a federal navigation harbor. The project area was an AOC identified in the 1987 Great Lakes Water Quality Agreement. It was identified as requiring cleanup of toxic pollution to improve water quality in the Great Lakes, which holds 95 percent of the surface fresh water in the U.S. and supports 30 million citizens. The Sheboygan River had been designed to accommodate deep draft navigation in the lower river and harbor. As an urban river, the Sheboygan River was subject to point discharges, combined sewer overflows, accidental spills, and stormwater runoff. Since the navigational channel had not been dredged since 1956 due to the buildup of contaminants in the sediment, the use of the lower river for deeper draft recreational and commercial vessels had been limited. Not only did dredging remove contaminated sediment, but it restored the navigation channel to authorized depths.

While maximum concentrations of 555 mg/kg PCBs and 22,310 mg/kg PAHs, as well as NAPL impacted sediments were detected during the Remedial Investigation (RI), these highly contaminated sediments were surrounded by sediments more lightly contaminated. Using Cable Arm® environmental clamshell buckets in conjunction with GPS positioning equipment, pressure transducers and ClamVision® software, 8,593 cubic yards of TSCA sediments were segregated to a depth tolerance of six inches, treated separately, and transported to a TSCA-approved disposal facility. Tight segregation of the TSCA-regulated sediment with greater than 50 ppm PCBs greatly reduced sediment disposal costs for the project, saving millions of dollars. A total of 147,822 yd3 of PCB and PAH contaminated sediment was removed from the 8th Street Bridge to Kiwanis Park sections of the river.

Post-dredging confirmation sampling was conducted to confirm that remedial action levels were achieved. While sediment sampling results showed that remedial action levels were met in most areas, additional dredging, and/or sand cover placement was performed in some areas to reduce exposure of aquatic life to residual contamination. Sand cover was also added to areas near bulkheads and bridges where structural concerns prevented dredging of contaminated sediments. The post-dredging surface-weighted average concentration for the Sheboygan River was calculated to be 1.09 mg/kg for PCBs and 2.98 mg/kg for PAHs. These SWAC values account for the entire project reach including non-dredged areas (i.e., shoreline offsets and areas below removal criteria). The SWAC values which represent just the dredge footprint are 0.65 mg/kg for PCBs and 1.73 mg/kg for PAHs. The pre-remedial action PCB SWAC was calculated at 4.17 mg/kg PCBs.

Green remediation and sustainability principles were incorporated into the project. Solar powered continuous in-stream monitoring equipment and telemetry systems were used to monitor turbidity. Several company fleet vehicles are flex-fuel powered.

A high capacity environmental bucket (closed clamshell) was used to reduce re-suspension, prevent release of contaminated sediment, and minimize

residual contamination dispersion. The use of specialty dredging equipment and software ensured precise bucket placement and control of dredge cuts. Precise dredge control minimized re-suspension from overfilled buckets and excess water collection in under filled buckets. Baffled penwalls in the scows allowed efficient drainage of sediment and collection of excess water for removal at the shore-based water treatment system. Organic, biodegradable polymers were used for coagulation and flocculation in the water treatment process, reducing the use and discharge of inorganic chemicals such as aluminum and ferric salts.

The project's original design allowed for two sediment processing sites. The project was redesigned for a single processing site, thus eliminating the resources required to construct, operate and remove a second processing area. The project owner, engineer, contractor and subcontractors shared office space which greatly reduced the environmental footprint of the project. New paving, lighting and landscaping were installed for the site's use.

The sediment processing area layout was planned with environmental concerns and post-restoration use in mind. The site layout was planned and visual barriers were used to minimize visual impacts. Careful planning and diversion of off-site runoff allowed all runoff from the site to be collected for treatment by a water treatment system using 10 micron bag filtration and carbon adsorption. During the project, the runoff, erosion control, and water treatment systems collected and treated all runoff from a 10 year, 24 hour storm event while meeting all discharge limits.

The sediment storage area was constructed of double liners inter-layered with sand beneath an asphalt cover. Following testing to meet TSCA requirements, sand layers were recycled during demobilization. After testing to TSCA protocols, recycled, dense-graded aggregate and coarse graded aggregate was used for fill material and was returned to the supplier for re-use after removal.

Recycled sheet pile and H-piling was used to build the offloading platform. Once removed, the sheet pile and H-piling was demobilized via barge, saving on trucking fuel consumption and emissions. The sheet pile and H-pile will be recycled into another project.

Because of poor foundation conditions, light weight geo-foam block was used for fill instead of aggregate with the added advantage of reducing trucking costs, fuel consumption, and emissions. The weight of material trucked over roadways was reduced by approximately 500,000 lbs in both delivery and removal. The majority of the geo-foam fill was recycled, reducing landfill air space by 75 cubic yards.

Baghouses were used to control fugitive emissions from pneumatic offloading of Portland cement to storage silos and pugmill operations. Continual operational improvements and upgrades to dust suppression systems controlled fugitive emissions from stabilization processes and stockpile areas. Real-time air monitoring assessed air emissions at the property line in each direction. The work schedule of 24/7 provided the shortest schedule possible, reduced impacts to the public, and minimized the project's carbon footprint.

Idling time of site vehicles and equipment was limited to reduce fuel consumption and air quality impact. Barge-mounted generators were sized according to the expected auxiliary load to save fuel and energy. Environmentally friendly, biodegradable, hydraulic oil was used in all marine equipment. Used oil from routine maintenance of equipment was recycled. Green cleaning products were used for all decontamination boot wash stations.

Innovation

Several innovations were planned specifically for this project. Record low water levels combined with the unique physical and environmental conditions in the Sheboygan River to require additional innovations as the project progressed.

An air bubble curtain was used in lieu of a traditional silt curtain to control turbidity. The air curtain, located at the downstream limits of the project at the 8th Street Bridge, allowed unimpeded boat traffic under the bridge while providing a barrier to contaminant movement. The cost to install and operate the air curtain was offset by not having to remove and reinstall a turbidity curtain for local boat traffic. Had traditional silt curtains been used, hours would have been lost displacing the curtain for every barge movement and local boaters would have had to wait for passage until the curtain was removed.

In addition, unlike a conventional turbidity curtain, the effectiveness of the air curtain was relatively unaffected by changes in flow direction due to seiche effects from Lake Michigan. The air curtain maintained its effectiveness during high water levels from flood events. If conventional curtains had been used, it is likely that damaged silt curtains would have been replaced several times during the project. Using air curtains for turbidity control had the additional environmental benefits of allowing the free passage of migratory fish to spawning grounds and avoiding the need to decontaminate and/or landfill conventional turbidity curtains. The air bubble curtain allowed the project turbidity control requirements to be achieved during all flow conditions with no adverse environmental impacts or impediments to other river users.

Installation of the air curtain for turbidity control was a required first step in the project; EPA would not allow dredging without turbidity containment in place. However, an additional one-foot drop in Lake Michigan water levels between contract award and mobilization required use of another innovative technology before work could begin.

The drop in water level reduced the draft at the sandbar upstream of the 8th Street Bridge to 3 feet preventing access of the clamshell dredge and scow to the area for installation of the air curtain as originally planned. To make matters more difficult, mechanical issues with the City of Sheboygan's 8th Street lift bridge limited the number of raising and lowering cycles. Impacting the public so early in the project by leaving the bridge in the open position was unacceptable.

To address these issues, the patented Sed-Vac® process was used to excavate sediments under the low-clearance bridge. This type of technology is extremely useful in areas where access is limited or challenging. The Sed-Vac vacuum head was connected to a long-reach excavator and powered by an on-shore vacuum truck to excavate a trench for installation of the air curtain piping with the bridge in the closed position. Sediment was transported by pipeline to the sediment staging area. Guided by GPS technology, the Sed-Vac equipment cut a ten-foot deep trench to precise grades and widths while requiring minimal dewatering prior to stabilization for disposal.

Several major cable crossings were located within the project limits between the 8th Street and Pennsylvania Avenue bridges. Despite working closely with project designers, city engineering and planning staff, and utilities, an abandoned cable was encountered while dredging early in the project. While the existence of the abandoned cable was known and the cable was de-energized, it was particularly disconcerting to encounter the cable on the upstream side of the bridge instead of the downstream side as shown on plans. So the fact that the 13.8 kV main feed line for the City of Sheboygan crossed the river at an unknown depth within the dredge area was of particular concern. Service interruptions could not be tolerated so failing to accurately locate the cable meant large setbacks would be required for safety. The large setbacks would leave several thousand cubic yards of contaminated sediment in place.

Ryba-Terra identified a new electromagnetic location technology to locate the 13.8 kV line. The technology combined modeling of the electromagnetic field around a conductor with field measurements taken in conjunction with GPS tracking equipment. After consulting with the local power distributor, city planning and engineering staff, and EPA, the line was located with the electromagnetic technique. The cable was determined to be well below the planned excavation depth, which allowed the safe removal of all contaminated sediment in the vicinity of the cable and allowed recovery of the full contract value while meeting remedial action objectives.

New dredging equipment was also introduced on the Sheboygan project. While the conventional Cable Arm® level-cut environmental bucket is well-suited for soft sediments, a significant portion of the project area had a harder, more compacted river bottom with significant amounts of boulders and construction debris present. At Ryba Marine's request, a prototype level-cut environmental bucket designed for excavator use was built by Cable Arm. By placing the bucket on an excavator, down-pressure could be applied for greater penetration. The ability to quickly reposition and tilt the bucket with the excavator made it possible to more effectively dredge in harder river bottoms littered with debris while the usual level cut, venting and overlapping side plate features of the Cable Arm design reduced sediment re-suspension and turbidity generation.

As water levels continued to drop into the Fall, the record low water levels forced the Ryba-Terra team to switch approaches to dredging the shallow draft areas upstream to a shore-based sediment removal technique which added a coordination component to the shoreline restoration project. The low water levels also required some change in approaches with the barges and vessels.

Economic Benefits

Much of the millions of dollars spent on the project remained in the community and surrounding area. Materials and supplies were obtained from local vendors when possible. Local subcontractors provided the vast majority of support for electrical, plumbing, and paving work. The project management team stayed in a hotel across the street from the processing site, insuring full occupancy for the business most likely to be adversely impacted and allowing first hand monitoring of any night time impacts.

The sum of the remediation, environmental and navigation dredging and shoreline restoration projects are expected to be much more effective in restoring the watershed as a whole and creating tangible results to local stakeholders. The end result is a restored navigational, reduced risk to human and ecological health and improvements to beneficial use impairments. With future removal of fish advisories, possible resumption of fish stocking, and a deeper harbor, the project will provide a boost to the local boating and tourism economy.

The project had a significant impact on the local economy and waterfront revitalization. With the restored draft, business increased for the shoreline commercial property owners, including boat storage yards, marinas, and restaurants. Site staff was housed locally during the project, supporting local commerce during the lifespan of the project. A project staff varying from 30 to 50 people stayed in local hotels and spent their money in local restaurants. City and county partners commented frequently on the positive impact on tax revenue.

Transferability

Both the innovative techniques and the collaborative teamwork are being transferred to other sites and projects. The use of air curtains to control turbidity in high traffic areas is spreading as a result of Ryba Marine's use of the technology on the Kinnickinnic and Sheboygan Rivers.

The use of electromagnetic sensing and modeling technology to accurately determine the 3-D location of a 250 ft long underwater cable crossing at Sheboygan was presented in a paper at the 2013 WEDA conference in Honolulu. Use of the technology has elicited interest from several major dredging contractors and is being used during a pre-design investigation in the Detroit River. Using feedback from the project, Cable Arm has modified the prototype level-cut bucket for use on a hydraulic excavator at Sheboygan. Improvements will extend the use of the level-cut environmental bucket technology on sloping surfaces and areas of heavy debris.

The collaborative efforts of the project team and stakeholders have set a standard that serves as a model for future GLNPO efforts. The project team, including the Ryba-Terra, funding partners, GLNPO management, oversight contractors, city and county officials, and regulatory agencies were recognized for successful completion of the project by the USEPA Regional Administrator and congressional guests.

The project won the ENR Best Project MidWest in the Water/Environmental Category in 2013 and was featured in ENR Midwest magazine, November 2013 issue, and International Dredging Review, Sept/Oct 2013 issue. A presentation on the project was made at the MidWest Chapter WEDA meeting in 2013. A poster presentation on the technological innovations on the project was made at a 2013 Sediment Management Work Group session. A technical paper on the project will be presented at the 2014 WEDA conference in Toronto, Canada.

Outreach and Education

A several-year effort led by the USEPA coordinated the efforts of many public and private organizations, which culminated in three separate dredging projects and a habitat restoration project occurring simultaneously in the vicinity of each other during the 2011 and 2012 construction seasons.

With the goal of eventually delisting the AOC, the USEPA Great Lakes National Program Office

(GLNPO) began planning meetings and coordination with multiple stakeholder.

Numerous public meetings were held before and during the project. On behalf of USEPA, University of Wisconsin Extension (UWEX) conducted several outreach activities, including newsletter mailings, maintenance of internet web sites and distribution of informational brochures. UWEX worked with local schools on educational activities and tours of the river. Signage explaining major features of the project was placed at strategic points on the riverwalk along the river. Working in conjunction with the City of Sheboygan, several meetings with local marinas and boat owners were held to coordinate project plans to minimize inconveniences to local businesses, boaters, property owners and residents. Strong community support made the project happen.

Newspaper articles and press releases kept the public informed on the project schedule. Representatives of Ryba-Terra and the City of Sheboygan appeared on a local public broadcasting station's weekend news program to answer questions about the project. The program segment won a broadcasting award for the television station. Ryba-Terra worked with the other dredging and shoreline remediation contractors to coordinate activities to minimize impacts to the public. As an example, the record low water levels in 2012 prevented the implementation of the original plan of dredging a navigation channel into a contaminated area near Kiwanis Park, due to the prohibitive disposal cost of dredging additional sediment to obtain navigation draft.

Responding within a few weeks, Ryba-Terra developed a conceptual plan that used a towpath along the shoreline at the park to construct a navigation channel. In concert with federal and state agencies, Ryba-Terra collected samples along the shoreline to characterize PCB concentrations and modified plans to ensure members of the public did not contact contaminated sediments. Then, working closely with multiple departments within the City of Sheboygan, a work schedule for dredging and traffic plans were developed that avoided conflicts with the public's use of the park.

However, while minimizing impacts to public, the new schedule conflicted with the shoreline restoration work at Kiwanis Park. The shoreline restoration contractor and Ryba-Terra then worked together to develop an integrated plan for sequencing activities that allowed both projects to meet their original completion schedule.

The project was conducted in the heart of the downtown area. During late summer evenings, people congregated along the river walk to watch dredging, and the veranda of a local restaurant became a favorite hangout for the public to observe progress. Throughout the project, the stakeholders and dredging contractor worked collaboratively to minimize traffic, light, noise, and odor impacts to the public.

Other Factors

Another important aspect of the project was the attention paid to health and safety. Safety meetings were held at the start of every work day for all shifts and were attended by all site workers, including subcontractors. Through the completion of dredging and sand placement activities, a total of 51,450 hours were worked without a lost time incident.

Lines of communication were kept open among all stakeholders and the unyielding cooperation of all involved was a huge factor in the success of the project. This project had one ultimate goal—to clean up the Sheboygan River with the support and involvement of the public. The collaboration and patient coordination efforts of the project stakeholders, contractors, and subcontractors delivered a successful project, completing work ahead of schedule and under budget.

Local property owners are already reaping benefits with the return of a navigable, usable waterway. Remediation of the urban body of water exceeded local expectations and resulted in a better, deeper river.

The project team would like to extend special recognition to its Program Manager, Bill Priore, for his efforts on this project. Gone too soon, but not forgotten. Rest in peace, Bill.

Figure 1 – Project Signage

Figure 2 - Prototype environmental bucket designed for excavator use

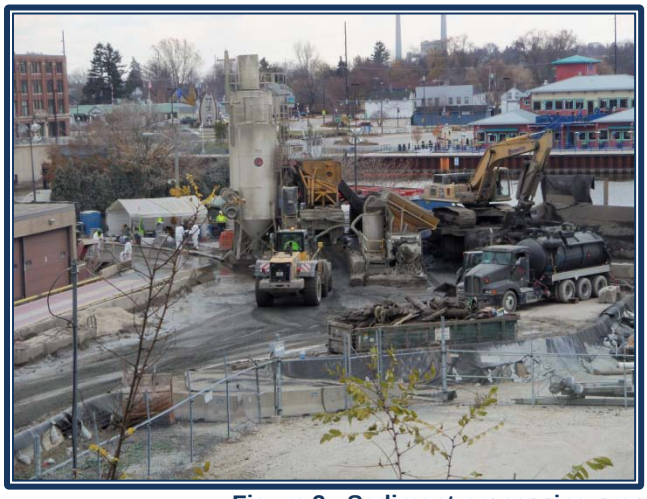

Figure 3 - Sediment processing area

Figure 4 - River dredging with crane barge and material scow

Figure 5 - Material handler offloading dredged sediment

Figure 6 - Truck being loaded with treated sediment

Figure 7 - Aerial view of sediment treatment area

Figure 8 - Dredging Operations

Figure 9 - SedVac Operations