Remediating Contaminated Sediments in the Ashtabula Harbor as Part of the Ashtabula River Area of Concern: A Collaboration Success Story - 9521

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ABSTRACT

The U.S. Army Corps of Engineers, Buffalo District (USACE), in close collaboration with the USEPA and members of an Ashtabula, Ohio, stakeholder advocacy group, were able to achieve major success in mitigating ecological impacts from contaminated sediments deposited in the lower Ashtabula River and Ashtabula Harbor after years of effort to obtain the federal funding needed to do so. The river and harbor were subject to unregulated discharges of hazardous chemicals, heavy metals, and low-level radiological contaminants from decades of operations by a variety of industrial, manufacturing, processing and production activities located near or adjacent to the river and harbor areas. Conditions in the ecosystem in and around the lower portion of the river deteriorated to the point that it was designated a Great Lakes Area of Concern (AOC) in 1983.

The advocacy group known as the Ashtabula River Partnership (ARP), facilitated through efforts by both USACE and USEPA, developed an innovative plan to remediate the Ashtabula River AOC by conducting a two-phase project, completed with combined funding authorized under the Great Lakes Legacy Act (GLLA) of 2002, and Section 312(a) of the Water Resources Development Act (WRDA) of 1990. Removal of nearly 527,000 m^3 of contaminated sediments from the AOC would significantly reduce the contaminant source term and produce favorable conditions for re-establishing ecosystem balance. This would also be the first project in the nation completed by USACE under its authority to perform environmental dredging covered by WRDA Section 312(a).

INTRODUCTION

The Ashtabula River Industrial Legacy and its Impacts

The Ashtabula River and Harbor lie in extreme northeast Ohio and flow into Lake Erie's central basin at the City of Ashtabula. Ashtabula Harbor, a deep draft commercial harbor, ranked 13th among Great Lakes ports and 69th among leading U.S. ports, averages 910,000 metric tons of material shipped or received per year. The bulk commodities passing through the harbor generate approximately $126 million in direct revenue annually [1] [2] [4].

The convenient access to a water supply and a port outlet to the Great Lakes waterways attracted a variety of industrial concerns to the area. Prevalent industrial activities included manufacturing, chemical processing, and other factory production operations. The port and its shipping activity also supported movement and staging of bulk volumes of various types of materials into the harbor area.

From the 1940s through the late 1970s, unregulated discharges and mismanagement of hazardous wastes caused sediment contamination in the riverbed and adversely affected the river's aquatic life and surrounding ecosystem [3]. According to historical records, maintenance dredging has not been performed on this section of the river since 1979, because of the degree of riverbed sediment contamination. This has limited navigation of recreational and commercial vessels and has hindered the operations of numerous marinas along the shoreline. Chief among unsuitable sediment contaminants are polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbon (PAH), heavy metals; including mercury, lead, chromium, and zinc; and low-level radionuclides; such as uranium, thorium, and radium [4].

Contamination from PCBs, which can cause cancer, was so heavy that, since 1983, the state has issued advisories against eating fish taken anywhere between this part of the river and Lake Erie. Additionally, in 1983, the lower two miles of the Ashtabula River and the harbor were designated a Great Lakes Area of Concern (AOC), as defined by the United States-Canada Great Lakes Water Quality Agreement [3].

Stakeholder Advocacy and Regulatory Framework for Ecosystem Restoration

The coordination and partnerships—on many different levels—that were required to complete this project have taken several years of concentrated effort. In 1994, local government and businesses, state and federal agencies, parties potentially responsible for remediation of the contaminants, recreational groups, and community stakeholders committed to remediation of the Ashtabula River all began working cooperatively under the charter of the **Ashtabula River Partnership** (ARP) [3].

Key ARP participants and facilitators, include the U.S. Environmental Protection Agency (USEPA) Great Lakes National Program Office, USEPA Headquarters and Region V, the Buffalo District of the U.S. Army Corps of Engineers (USACE) Lakes and Rivers Division (LRD), Ohio State regulatory and resource management agencies, the City of Ashtabula, Ashtabula City Port Authority, and the Ashtabula River Coordination Group II (ARCG II) [5]. Additional coordination and communications were also established with other major stakeholders such as the U.S. Coast Guard, Norfolk Southern Ashtabula Coal Dock, Pinney Dock and Transport Company, and Sidley Stone Products [4]. ARP's primary efforts as an advocacy group were to develop, promote, and execute a plan for addressing the contaminated sediments impacting the Ashtabula River AOC.

A Clear Strategy: the Key to Support

A primary challenge before the group was the development of a strategic approach for completing the remediation that would provide justification for the funding needed to implement the project. The end result of the ARP efforts was the completion of the 2001 *Comprehensive Management Plan* (CMP) [5], a study that evaluated a number of options and provided a recommended approach for performing the work. The USACE, Buffalo District, as a member of the partnership, facilitated conduct of this feasibility study and provided subsequent engineering and design for the planned removal and disposal of approximately 527,000 yd^3 of contaminated sediment from the river.

USACE Remedial Authority

Section 101 of the **Water Resources Development Act** (WRDA) of 1986 served as the basis for USACE authority to perform *operation and maintenance* dredging of navigation channels in rivers and harbors of the United States; and Section 312(a) of WRDA 1990 allowed USACE to perform *environmental* dredging as part of its navigable waterways maintenance mission [5]. However, even with these authorities, there were still portions of the AOC boundary that remained outside the limits of the USACE's authority.

USEPA Remedial Authority

Passage of the **Great Lakes Legacy Act** (GLLA) of 2002 gave the USEPA authority, through the Great Lakes National Program Office (GLNPO), to provide planning and oversight for remediation of source contaminants in listed Great Lakes AOCs, and established a shared funding approach for funding the projects completed under this statute [3].

Combined Efforts

The *combined* authority of the USACE and that of the USEPA, granted under these two pieces of legislation, now made it possible for the contaminants in the *entire* Ashtabula River AOC to be addressed under a single project that could be executed with funds from both sources using a phased project approach.

The $60 million cost for the first phase of the cleanup was borne by a combination of federal funding from the Great Lakes Legacy Act of 2002 and additional matching funding from ARCG II and the State of Ohio. Phase II of the plan would be funded (at $14 million) under existing authorities supporting maintenance of the navigation channels by the USACE, and under Section 312(a) of WRDA 1990.

CONTAMINATED SEDIMENTS REMEDIATION PLANNING AND IMPLEMENTATION

Project Goals and Objectives

Beginning in 2004, the ARP used the feasibility study results contained in the 2001 CMP to develop a proposal for the design, construction, and implementation of the Ashtabula River Remediation Project pursuant to the requirements of the GLLA of 2002. This project would address the contaminated sediments in the *upper* reaches of the AOC boundary under jurisdiction of USEPA through the GLNPO. The City of Ashtabula Port Authority was designated the non-federal sponsor for this project [5].

USACE and ARP also developed an *additional* project proposal to complete removal and disposal of the sediments in the Harbor and the *lower* portion of the river, where USACE authority for project implementation would be based on WRDA Sections 101 and 312(a) [6].

An agreement was reached with the GLNPO in December 2005 to execute the two-phase project with USEPA assuming the Lead Agency role for Phase 1 and the USACE assuming the Lead Agency role for Phase 2. **Figure 1** illustrates the delineation of the AOC remediation project boundaries according to agency responsibility. The goals and objectives of the phased project were established to comprehensively address the issues related to rehabilitation of the lower portion of the river and harbor as summarized below:

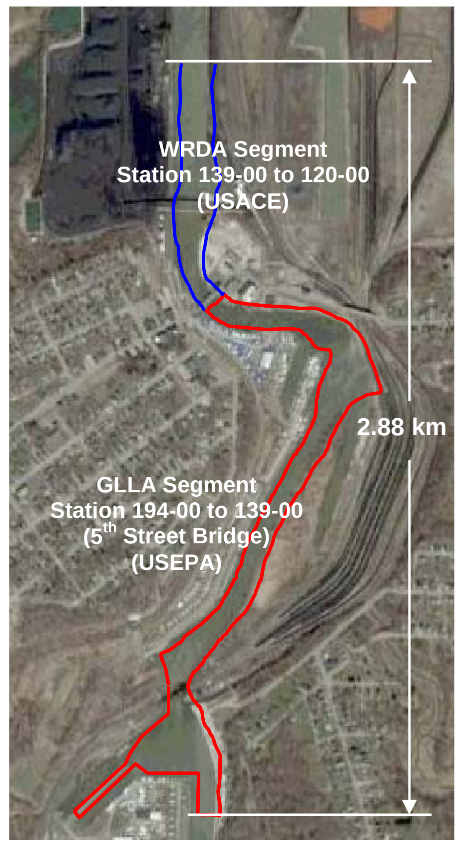

Fig. 1. Project boundaries by agency responsibility.

- Remove and safely dispose of contaminated sediments from the navigable river channel and adjacent areas.
- Initiate restoration of a balanced ecosystem in the Ashtabula River AOC.
- Restore the navigation channel in lower Ashtabula River and harbor for commercial and recreational use.
- De-list the Ashtabula River AOC from the Great Lakes AOC Listing.

Phased Project Planning and Partner Roles

During Phase I, the USEPA, in concert with Ohio EPA, expected to achieve hydraulic removal of about 413,530 m^3 of contaminated sediment from the upper portion of the AOC down to an area just above the Ashtabula Harbor, between September 2006 and November 2007 [5]. Under USACE oversight, Phase II of the project included plans to remove approximately 101,500 m^3 of sediment from the Ashtabula River immediately upstream from, and including the inner harbor during the period between March and July of 2008 [7].

These two federal agencies played key roles as the entities given authority under the applicable statutes to facilitate and integrate the efforts of involved stakeholders, and to direct many of the planning and implementing activities intended to achieve the required end objectives of the total project. Their primary roles and responsibilities are outlined in **Table I** below.

Table I. USEPA/USACE Project Roles and Responsibilities

USEPA/GLLA Roles	**USACE/WRDA Roles**
ARP member	ARP member
River sediment characterization	Feasibility Study remediation options development
Compliance oversight and permitting (TSCA, NPDES) for project activities – in coordination with Ohio EPA	Design and engineering technical support for ARP Comprehensive Management Plan development
Lead agency for contaminated sediments removal under GLLA authority	Lead agency for channel operation and maintenance and environmental dredging under WRDA Section 101 and 312(a) authority
Authority for initiating AOC de-listing activity	

Phase I: GLLA - Contaminated Sediments Removal

The scope of work for project Phase I included a number of activities that would serve to provide infrastructure and support systems potentially useful for efficient completion of Phase II. Accordingly, USACE coordinated closely with and provided technical support to USEPA throughout the Phase I effort to assure an efficient transition of responsibility at the appropriate time. Important work scope elements performed under USEPA oversight during Phase I [5], [8] included

- Baseline sampling of the river
- Landfill (Upland Containment Facility) design
- Landfill geotechnical/chemical characterization
- Landfill construction
- Upper AOC dredging operations
- Transfer pipeline operations
- Landfill operations
- Dredged areas mitigation/restoration

Phase I presented many opportunities to improve operating efficiency through lessons learned and to incorporate practices that would prove to be benefits to the overall project as progress was realized. A complete review of these improvements will not be presented in this discussion for the sake of brevity; however a brief summary of activities accomplished is included here to provide the reader with a sense of the achievements attained in Phase I [8]:

- Dredging begun, September 9, 2006
- Dredging completed, October 14, 2007
- Over 375,940 m^3 of sediment removed, transported, and de-watered

- 3,610,000,000 L (approx.) of water transported, treated, and discharged back to Ashtabula River (NPDES)
- 472 geo-tubes used for sediments dewatering and disposal
- 24-7 operations maintained with 85 operating staff

Phase II: WRDA- Maintenance and 312(a) Environmental Dredging

The USACE responsibility for dredging began at a point in the river just south of the 5th Street Bridge and extended northward into the inner harbor approximately 576 m. The work scope associated with this phase of the project included

- Removal of contaminated sediments from the navigation channel and adjacent areas between river stations 139-00 and 120-00
- Transport, treatment, and disposal of dredged sediments at the Upland Containment Facility or other approved site
- Environmental monitoring/control for dredging activities and other operations in the project area
- Project management, reporting, quality control, and health and safety oversight [7]

The transition of lead agency responsibility from USEPA to USACE presented a number of issues with the potential for creating management and technical challenges that could impact project performance. The transition could also increase the level of risk associated with attainment of key project cost and schedule goals through the introduction of new project participants, and adoption of differing organizational structures, operating protocols, and communication interfaces for project execution. The need for maintaining close coordination with USEPA and other ARP membership was underscored by these considerations. A brief overview of the approach taken by USACE to address circumstances that might arise, and to assure efficient and timely completion of the project is provided in the discussion that follows.

Phase II Project Implementation Concept

A major factor affecting development of the strategy for implementing Phase II was how to retain the flexibility and cost efficiency potentially afforded through utilization of the infrastructure and systems installed and operated by those who completed the Phase I project under USEPA oversight. These facilities, systems and equipment were not owned by the Government, and so could not be transferred as government equipment or resources to entities that would subsequently be contracted to execute the Phase II work scope activities.

Although the Upland Containment Facility (UCF) was designed and constructed during Phase I to accommodate the volume of sediments expected from the total project, it was recognized that other acceptable, cost effective options for disposing of the dredged sediments might exist. However, because retaining the availability of the UCF for potential sediments disposal was seen as an advantage to the project, USEPA agreed with USACE to allow a delay in closure of the UCF and termination of its associated permits for a period of time sufficient for USACE to complete the Phase II sediments removal activity.

Working in concert with USEPA and other key ARP members, USACE developed a plan for acquisition of the contracted construction and operations services required for sediments removal and disposal that would address the issues discussed above. This plan included provisions for the new contractor to lease the installed infrastructure, systems and facilities used in Phase I from their owner/operator, or to propose an acceptable alternative approach for accomplishing the project scope of work.

The USACE Buffalo District decided that acquisition of the required construction services could be expedited by issuing a competitive solicitation to a group of six qualified firms already holding Indefinite Delivery/Indefinite Quantity (ID/IQ) contract vehicles with the District. The project would be awarded to the firm submitting the lowest priced, technically acceptable proposal. The district also required the successful bidder to secure performance and payment bonds in addition to being subject to penalties for exceeding mandated project completion milestones as a means of addressing project cost and schedule risks [7].

Project Implementation Team

TPMC-Energy*Solutions* Environmental Services, LLC (TES), a Small Business Administration-certified 8(a) joint venture formed by TerranearPMC, LLC and Energy*Solutions*, LLC, was selected through the competitive solicitation to be the prime contractor for the project. Project success required well coordinated planning and execution to meet the completion deadline, and to proactively manage potential cost increases related to the uncertain nature of sediment characteristics and other debris or submerged structures that might affect the progress of dredging operations.

TES chose to address some of the project's schedule and cost risks by forming a project team with two other companies: ARCG II and de maximis, Inc.—organizations already involved with the Ashtabula River Partnership—who had participated in the execution of the project's first phase. ARCG II was also able to secure the services of J.F. Brennan Marine as a subcontractor to provide dredging support for the construction effort. The TES Team was thus able to integrate project management skills, and an in-depth knowledge of river and harbor conditions, with a mature infrastructure and support resources already in place, fully capable of addressing the regulatory and operational requirements for sediment removal, transport, and disposal.

The infrastructure elements provided under this arrangement included a 4.2-km long sediment-transfer pipeline and an existing, dedicated Toxic Substances Control Act (TSCA) - permitted, land-based UCF, allowing transport, receipt, and disposal, respectively, of the contaminated sediments. It also provided an operational water treatment facility to receive and treat water from the dewatered sediments, and a second 4.2-km pipeline to return the treated water to the river under an Ohio-issued National Pollutant Discharge Elimination System (NPDES) water discharge permit [8, 9, 10, 11].

Many of the ARP organizations participating in the Phase II project implementation team remained the same as in Phase I, however some played different roles due to the change in lead agency for project execution. A depiction of the Project Implementation Team, along with their major areas of responsibility is provided in **Table II** below.

Table II. Project Implementation Team

Organization	Responsibility
USACE Buffalo • District Office • Ohio Area Office	• Project Management Oversight, contract management, status and progress reporting • Construction management (COR, ACO), site construction and QA oversight • Pre- and Post-dredging confirmation surveys
USEPA • Great Lakes National Program Office • Region V	• Agency project interface and coordination • Agency regulatory compliance monitoring
Ohio EPA	• Regulatory compliance monitoring for NPDES and UCF permits
Ashtabula City Port Authority	• Stakeholder and public communications • Contractor operations coordination support
TES Construction Team • TES	• Project operations, management, H&S, QC, reporting, scheduling, coordination

Organization	Responsibility
• ARCGII / de maximis • Brennan Marine	• Dredging operations • Transfer pipeline operations • UCF operations • Water treatment and discharge operations • Environmental monitoring and control

Work Planning, Coordination and Control

The high visibility and level of interest associated with the project, the number of organizations and stakeholders involved, and the aggressive schedule for completion all meant that work plans would have to remain as flexible as possible to address unforeseen circumstances. In order to make sure that all stakeholders were involved in key decisions, real-time information transfer and efficient communication was essential between all project participants.

The deadline for project completion was 110 days after issue of the Notice to Proceed (NTP). However, this schedule was complicated by inclement weather conditions. Project mobilization could not take place until ice conditions in the river and harbor areas had sufficiently abated to permit placement of the dredging and support equipment into the river. TES and the Buffalo District agreed to expedite contract submittal and planning documents preparation, as well as the review and approval process, in order to protect the schedule. The use of electronic documentation development and submittal protocols also greatly improved response turn-around times.

Work plans and procedures were developed to improve communications and information sharing. This included

- Daily status and work planning meetings involving the field work crews and supervision
- Weekly coordination meetings between the Buffalo District construction oversight representatives and TES field construction managers,
- The use of electronic formats for daily reports,
- Project status summaries, and
- Occurrence reporting.

The Buffalo District chose to require use of the USACE **Resident Management System** (RMS) and its **Quality Control System** (QCS) module in the project Statement of Work to ensure coordination of all contributions and see that all parties involved had access to the information they would need.

The RMS Center is maintained to assist field engineers, inspectors, construction representatives, contractor staff, and office personnel by providing computer programs and automation expertise to plan, accomplish, and control the daily technical and administrative functions of construction projects managed by the USACE. The (RMS) and the (QCS) are quality management and contract administration programs designed by Resident Engineers. The systems provide an efficient method to plan, schedule, and control all aspects of construction.

QCS—a Microsoft Windows® platform on the Firebird® database engine—allows the rapid entry and retrieval of information and documentation of project activities needed to efficiently manage resources and make timely decisions.

USACE and TES jointly established the QCS site for the Phase II project early in the process and used it as the primary platform on which to build a virtually paperless project submittal, management support, contract administration, data transfer and document management system for the project.

Production Scheduling and Operations Planning

Plans were made to upgrade and prepare land-based systems and equipment in early March 2008, for commencement of dredging operations later in the same month. However, the ice conditions in the harbor and the lower portion of the river threatened to interfere with equipment placement and other mobilization activities, thus delaying the scheduled dredging operations start date.

Critical assistance in mitigating this potential impact was provided by an international partner. A Canadian Coast Guard ice-cutter, already located in Lake Erie and close to the Ahstabula area, was dispatched to the harbor entrance to break the ice cover.

The target production rate for Phase-II dredge operations was set at $84m^3$/hr (roughly $2021m^3$/day) in order to meet the schedule milestone. Dredge logs were kept and transferred to QCS to track downtimes and periods of active operation throughout the project.

Dredging crew production operations were scheduled 24 hours a day, 6 days a week, Monday through Saturday. Sundays were used as a maintenance and crew change day. General maintenance—oil changes, dredge cutter-head maintenance, and inspection or repair of machinery or equipment needing attention—was conducted on this day [9].

Dredging production operations commenced on March 28, 2008, on a day-shift basis. Coordination was established with the UCF and WTP during this initial timeframe to ensure that all systems were ready to accept the dredge material efficiently before 24 hour operations were undertaken.

PROJECT FIELD OPERATIONS OVERVIEW

Sediments Removal and Disposal Process

Figure 2 (below) presents a pictorial overview of the sediments removal, transfer, de-watering, disposal and water treatment process. Phase II dredging started at station 139+62 underneath the 5th Street Bridge, and continued north towards Lake Erie to station 119+99 (120+00). The reader is referred to Figure 1 for Phase I and Phase II boundary delineations.

The dredge approach was very similar to that implemented in Phase I. Sediments were removed from the river using a 30.5-cm hydraulic dredge and transported by 30.5-cm high density polyethylene (HDPE) pipeline. A total of four inline booster pumps, one that was water based and three that were land based, were used to pump the dredged sediments through the pipeline. All sediments were transferred to the Upland Containment Facility (UCF) for de-watering and consolidation [8] [9].

Water accumulated from the sediment dewatering process was collected in a basin in the UCF disposal cell and decanted to the water treatment facility where it was treated before discharge back into the Ashtabula River compliant with conditions established under the NPDES permit for plant operation issued by the State of Ohio. The water was returned back to the river through a 4.2-km long, 56-cm diameter pipeline [8] [11].

The sediment transport system was completely sealed with only one access located at each booster pump. Individuals needing to access the pumps wore proper personal protective equipment (PPE) and implemented confined space entry protocols as a requirement for entering these areas. No material handling was required between the cutter-head of the dredge and the header system located in the UCF.

Large debris was encountered during Phase II of the dredge project, however not in the volume and variety experienced during Phase I. Two marine plants, similar to the ones used in Phase I, were used to remove debris weighing up to 1,360 kg. All non-native debris removed from the river was stored in hazardous waste roll-off containers and transported to the UCF for disposal.

Fig. 2. Overview of sediment removal, transfer, de-watering, disposal, and water treatment process.

Removal and Processing Systems Description

Dredging System

The sediment dredging system consisted of a hydraulic dredge with associated equipment, a barge-mounted slurry booster pump and interconnecting piping that were required to transfer the dredged sediments to the land-based transport pipeline system. The same 30.5-cm swinging-ladder cutter-head dredge used during Phase I was operated throughout Phase II. This particular swinging ladder dredge, manufactured by Dredge Supply Company of New Orleans, Louisiana, has a multi-hull configuration that enables it to draft a maximum of 1.2 m when fully fueled[9]. **Figure 3** shows the dredge and the swinging ladder assembly with attached cutter-head (insert).

This dredge was outfitted with a real-time kinematic global positioning system (RTK-GPS) for maximum dredging accuracy well within the established dredge tolerance specifications. The RTK-GPS signals were combined with various sensors onboard the dredge including sensors measuring rotation, ladder inclination, and pitch and roll of the vessel itself. All information from the GPS system and the sensors was processed in real-time and combined through Hypack, Inc., Dredgepack® software to allow accurate operation of the dredge.

A barge-mounted booster pump with a 560-kW capacity was placed on a barge between the dredge and the connection to the land based transport system. This 40.6-cm booster pump, larger than the 30.5-cm on-board dredge pump, was placed in line roughly 485 m behind the dredge.

The dredge discharge pipe was SDR 17 high-density polyethylene (HDPE) pipe manufactured with PE3408 resin and joined by thermal butt-fusion welds to provide a working pressure of 690 Pa, with a 2:1 safety factor. Pipeline between the barge-mounted booster pump and the land-based connection was SDR 11 HDPE, able to withstand the higher discharge pressures from the booster.

Sediment Transfer and Pipeline System

The land-based transport system operated during Phase I was used again for Phase II operations, but with equipment and system upgrades to mitigate the risk of environmental release and to improve operating efficiency.

This system consisted of three in-line booster pumps and 30.5-cm double-walled slurry transport pipe extending 4.2 km from the land-based interface at the river shoreline to the UCF. All three booster pumps were installed on concrete containment pads capable of containing any fluids escaping the pipeline during booster cleanouts.

Fig. 3 Dredge and swinging ladder assembly with attached cutter-head (insert).

Water treated for NPDES-compliant discharge to the river at the UCF water treatment facility was transported back to the river via a 56-cm-diam., 4.2-km-long gravity discharge pipeline that followed the same route as the sediment transfer pipeline. This parallel installation configuration facilitated efficient utilization of operations personnel resources dedicated to monitoring and maintenance of the transfer pipeline system and associated equipment.

Consolidation Facility

The dredge slurry was transferred to the UCF via the transport pipeline and was pumped into geo-tube filter bags placed in the Consolidation Facility in a fashion that allowed the water to decant into a collection basin. Water pressure had to be closely monitored to ensure pressure did not rupture the bags.

The consolidation facility was constructed on an area roughly 4.9 hectares in size, and was permitted to operate under TSCA as a disposal site to receive only those contaminated sediments removed from the Ashtabula River AOC. Although sediments removed from the river during Phase II were placed in the consolidation facility, requirements for clean closure and permit termination were established as part of the scope of work covered by the Phase I project. After USACE completion of the Phase II contaminated sediments removal, Phase I project activity was resumed to accomplish the closure and permit termination under USEPA oversight.

Figure 4 shows a view of the Consolidation Facility and placement of filled geo-tubes.

The Geo tubes were filled by a sediment header system that surrounded the entire perimeter of the Consolidation Facility. The primary sediment header was constructed of 30.5 cm High Density Polyethylene (HDPE), and was tied to a series of 24 cm branch headers used for distribution of the sediments to various areas of the facility. The design of the header system allowed for the filling of multiple tubes simultaneously, and allowed utilization of a technique called “topping off” to maximize Geo tube capacity without impacting dredge production rates. This configuration also permitted isolation or filling of separate or multiple zones within the facility. Flow was directed into each Geo tube through a series of fill ports, evenly distributing the flow of sediment along the length of the tube [10].

An automated polymer-addition system was installed to provide chemical conditioning of the dredge slurry to minimize total suspended solids in the decant water and to optimize fill volume utilization in the Geo tubes. The dilute polymer solution was pumped to the Consolidation Facility through two separate 10-cm diam. HDPE pipelines and injected into the sediment header through distribution and injection spools.

Fig. 4. The Consolidation Facility showing placement of filled geo-tubes.

Water Treatment System

The water treatment plant was designed and constructed to receive, process, and filter the water decanted from the sediments pumped into the geo-tubes and return it to the river once treated. The water treatment systems and equipment design flows were established to provide flexibility to accommodate the production rates expected from the dredging operations at the river and the geo-tube decant water generation rates anticipated from the Consolidation Facility.

The following discussion provides a brief description of the major components of the WTP [11].

A variable speed, self-priming pump transferred water from the decant water collection basin to a set of inclined plate separators at a flow rate of between 3,800 and 19,000 L/m. The flow rate was adjusted manually based on the height of the water within the Consolidation Facility decant water basin and on the efficiency of the settling of suspended solids in the inclined-plate separators downstream.

The inclined-plate separators were designed to enhance the settling of solids from the decant water stream. The effluent from the separators was monitored for turbidity to ensure that operations were optimized for solids removal.

The clarified water from the inclined plate separators was pumped through a set of five (5) single-media (sand) filters, operated in parallel. The filtered water exited the sand filters through a single manifold pipe and continued to the Granular Activated Carbon (GAC) vessels. The pressure drop across the sand filters was monitored closely for indications that backwashing of a vessel was required.

The sand filters were equipped with a rigorous air and water backwash to remove sticky solids that accumulated in the sand during filtration. The air required for scouring was provided by a positive displacement blower.

GAC vessels provided tertiary water treatment prior to discharge to the Ashtabula River. A total of ten GAC vessels were piped as five parallel streams, each with two GAC vessels in series. Each series of two vessels was capable of treating up to 4,180 L/m. Each carbon vessel contains 9,090 kg of GAC.

The sand filter effluent entered the top of the first GAC vessel and flowed down through the carbon bed, where soluble PCBs and other organics were removed. The water then flowed through a second GAC vessel, was discharged through the under drain system, and transferred to the WTP effluent tank before flowing through the 4.2-km pipeline back to the Ashtabula River.

The effluent tank provided a siphon break for the gravity discharge pipe back to the river and supplied a storage volume for equipment backwashing, polymer makeup, and miscellaneous plant use. Water discharged from the effluent tank was monitored for flow rate, temperature, turbidity, and pH.

An ISCO Refrigerated Automatic Effluent Composite sampling unit was used to collect a series of samples over a 24-hour period, providing the composite samples required by the NPDES Permit for monitoring compliance. Solids generated during backwashing of the sand filters and GAC were collected ad pumped back to a designated Geo tube within the Consolidation Facility for disposal.

The WTP included a main PLC to monitor and control the process and a personal computer to provide graphical displays of the treatment trains. In addition, the computer was used to display alarm conditions, including high levels at the decant water basin, backwash waste tank, and filter effluent tank. Alarm software was installed to transmit a minimum of four different alarms to a remote location.

Phase II Project Highlights

The project was executed with a high degree of professionalism and met the requirements set forth in the Statement of Work. Key highlights representing the project’s success include the following:

- 99,250 m^3 of sediment removed, transported, and dewatered.
- Navigation channel depth restored to nominal 4.8–5.5m.

- Project completion under budget and ahead of mandated schedule milestone.
- 1,045,000,000 L of water transported, treated and discharged back to Ashtabula River.
- Majority of contaminant source removed from the Ashtabula River AOC.

BEST PRACTICES AND LESSONS LEARNED

The Phase II project team benefited from the experience gained by those members who participated in the Phase-I effort. This experience facilitated the application of many lessons learned during Phase I in the form of best practices which enhanced operating efficiency and overall performance during Phase II.

The project team did, however, encounter some challenges with the potential to significantly impact the project. Potential impacts were mitigated however, through collaborative efforts of team members to proactively respond with innovative approaches for resolving the issues before they produced adverse results. The lessons learned from resolving these situations will prove beneficial for planning and executing similar actions in the future. A number of the more significant best practices applied and lessons learned during project planning and execution are briefly outlined below.

Best Practices Applications

- Hydraulic dredging of sediments and transfer to upland disposal facility via booster pumps and double walled pipeline using process already proven to reduce risk to project schedule and cost.
- Development and use of pre-determined geo tube placement and filling layout for consolidation of sediments in disposal cell to maximize efficient use of available space.
- Around-the-clock manning and monitoring of pipeline booster pumps and pipeline routes by field operating personnel to minimize impact of equipment upsets or malfunctions on production capacity and to reduce risk of environmental insults in the event of containment system failures.
- Employment of RMS/QCS and electronic formats for operational status and progress reporting to support total electronic submittal and maintenance of project documentation. Result was enhanced availability of real-time project data for distribution to interested parties and associated cost benefits from streamlined management and control of project records.
- Retrofit of transfer pipeline land-based booster pump No.3 to replace the existing 373 kW unit with a 559 kW unit. Reserve capacity was installed to assure required pressures and slurry supply to higher elevations of geo tubes being filled at the consolidation facility and to longer pumping distances involved in the 312(a) project.

Lessons Learned

- Frequent, open communication between the contracting officer/contract specialist and contractor during Pre notice-to-proceed (NTP) submittals and approvals.
- Sufficient schedule allowance to obtain performance/payment bonds for environmental work.
- Delays in proper completion of some pre-NTP submittals as well as loss of schedule time were experienced due to misinterpretations of contract requirements. Lack of timely follow-up and communication to clarify questions extended approval times for certain key contract documents.
- The time for securing performance and payment bonds required of the prime contractor was underestimated and not considered in initial development of the project schedule. The notice to proceed with the project was delayed and the lost time had to be recovered by reducing the time originally allocated for project work plan preparation, review and approval.
- Address/resolve P&S discrepancies or issues regarding environmental dredging projects prior to award.
- Phase I project experience showed that equipment upsets and failures impacted consistency of system operational efficiency and availability when production was based on 7-24 operating

schedule. Adoption of 6-24 operating schedule with designated 7th day reserved for equipment and system inspection and repair improved overall equipment availability and system operating efficiency for the 312(a) project.

- Problems with frequent and significant blinding of filter media in water treatment plant filtration equipment impacted production efficiency during part of the dredging campaign and placed the dredging completion milestone at risk. An earlier decision had been made to improve the operating efficiency of the water treatment plant by undertaking efforts to regenerate and restore the existing filter media during an intervening dormant period between the Phase I project and the 312(a) project start. The problem was finally addressed by implementing a 5-day operations shutdown to change out the filter media. Production capacity was restored to greater than system nominal values and original schedule recovery was accomplished and exceeded. This experience underscores the importance of confirming optimal performance of all key system components and expeditiously completing upgrades.
- Submerged utility cables crossing the channel were encountered by the dredge on two separate occasions despite appropriate use of the location data provided. Required clearances were maintained in the areas where the cable crossings were reported to be in an effort to assure avoidance, however the cables were found to be located further downstream and at a shallower depth than expected according to installation drawings obtained from the utility owner. Contact and coordination with the utility company to have the cables inspected determined no significant damage had been done, but revealed that the cables had apparently migrated from the originally installed location. Despite adherence to protocols for locating submerged structures, always exercise extra caution when operating in areas containing submerged structures. Confirm structure locations in place whenever possible.

CONCLUSION

The USACE Buffalo District and the TES Team successfully completed dredging of the navigational channel and the harbor in June 2008 by pro-actively managing the process, maintaining effective communications with all interested parties, and exercising teamwork and creativity when responding to unexpected events.

The end result was a significant improvement in the environmental quality and commercial viability of the AOC and the River, and a project that received overwhelmingly positive public reaction. The value of this success with respect to the goals and objectives for the project as defined by the ARP and others can be briefly presented through a statement of some key accomplishments and benefits.

Key Accomplishments

- Project completion under budget and nearly a month ahead of schedule
- Significant reduction in Ashtabula River AOC source contamination
- Commercial and recreational navigation restored in the lower reaches of the river and harbor
- Successful completion of first WRDA section 312(a) environmental dredging project in the nation

Key Benefits

- Project completion initiated restoration of ecosystem balance in the AOC.
- The project restored the Federal navigation channel to its authorized depth, and also reduced source contamination to levels sufficient for regulatory review of the Ashtabula River AOC designation.
- The project has already brought new commercial shipping into the harbor.
- First WRDA Section 312a dredging project completed in the Nation.

- Project funding justification, planning and execution provide USACE a viable model for planning and executing future WRDA Section 312(a) environmental dredging projects.

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