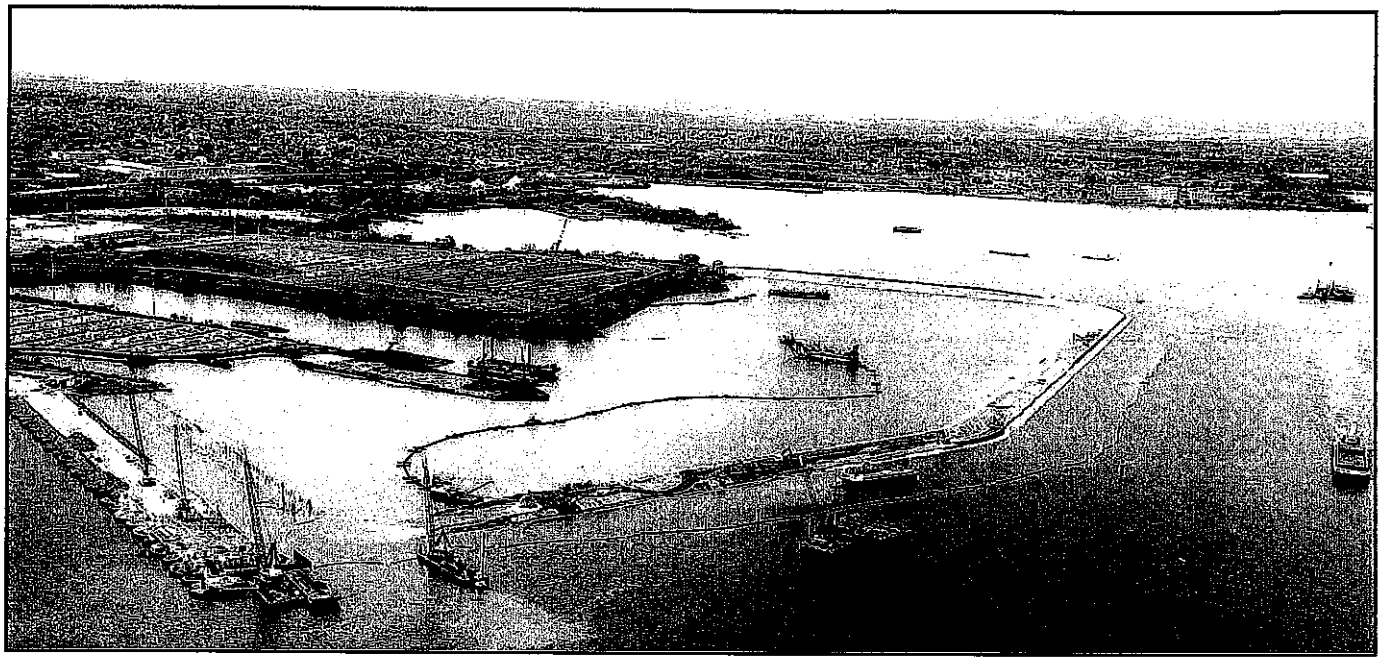
American Association of Port Authorities
2010 Facilities Engineering Awards Application

MASONVILLE
DREDGED MATERIAL CONTAINMENT FACILITY



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INTRODUCTION – PROJECT HIGHLIGHTS

Construction of the Masonville DMCF coordinated several major contract elements:

- Preparatory site dredging for the DMCF combined with concurrent new work dredging at the Seagirt/Dundalk Marine Terminals channels. Contract total $39 M. The combination of these projects saved the Maryland Port Administration (MPA) over $10 M by using material from Seagirt/Dundalk for construction at Masonville; therefore, eliminating the need to purchase 500,000 cy of offsite borrow and the cost of hydraulic unloading of the same 500,000 cy of sand and gravel in the 48-foot high Hart- Miller Island (HMI) DMCF.
- Cellular cofferdam construction, relocation of City of Baltimore 48" watermain, and associated construction. Contract total $44 M.
- Initial dike construction and associated elements. Contract total $23 M.
- Construction of storm drain elements to accommodate new drainage requirements. Contract total $17 M.

These project elements (totaling $123 M) will allow MPA to provide dredged material placement capacity at Masonville starting in 2010.

GOALS AND OBJECTIVES/BUSINESS PROBLEM

Maintenance of Baltimore Harbor's channel system requires dredging between 5.0 to 6.0 million cubic yards (mcy) of sediment annually. The average annual volume of dredged material for which the MPA is responsible is 4.7 mcy, and of this amount, 1.5 mcy is from within Baltimore Harbor. The MPA's main DMCF, HMI, was over 1,100 acres and recently closed due to legislative mandate on December 31, 2009. As part of the solution to the replacement of HMI, the MPA developed the Masonville DMCF, which is the key component to a long-term effort by the MPA to identify, study, design, permit, and construct new confined placement sites to meet the annual 1.5 mcy harbor dredging need. Construction of the Masonville DMCF will be completed in 2010.

PROJECT DESCRIPTION

The Masonville Dredged Material Containment Facility (DMCF) is a 141-acre area within Maryland's Baltimore Harbor constructed to confine an estimated 15.4 million cubic yards of dredged material from navigation new work and maintenance dredging over the period from 2010 to approximately 2030.

In addition to providing a new DMCF for the Port of Baltimore, the overall project provided environmental enhancements, additional acreage for a future marine terminal facility, and the foundation structures for a future berth for roll on-roll-off (RO-RO).

The primary features of the constructed DMCF project include:

1) Approximately 5,000 linear feet of dike, constructed in the existing river bed, consisting of locally borrowed marine sand and gravel sediments. The borrowed materials were dredged from the site's interior creating substantial additional DMCF capacity and dredged and beneficially used from a concurrent harbor new work dredging project at the Seagirt/Dundalk Marine Terminal Channels.
2) Over 1100 linear feet of sheet pile cellular cofferdams forming a foundation for the future construction of a new RO-RO berth as well as the East leg of the DMCF dike
3) Relocation of an active existing 48" watermain entailing a major cofferdam structure and subaquaeous pipeline work in the Patapsco River
4) Placement of an High Density Polyethylene (HDPE) Geomembrane lining on the interior dike slopes
5) Construction of approximately 3000 linear feet of landside dikes completing the containment perimeter
6) Construction of two water level maintenance, riser spillway structures with included discharge piping and diffuser elements for the purpose of controlling water discharge from the DMCF into the Patapsco River.

Additional project elements include: enhancement of a degraded industrial area, clean-up of Masonville Cove, construction of a waterfront environmental education area for community use, and construction of an education center designed as a "Near Zero, Net Energy" Building.

DISCUSSION

Background

The Masonville DMCF was designed to accommodate Baltimore Harbor dredged material which, is statutorily required to be placed in a confined disposal facility. Limited options for placement facilities in Baltimore Harbor led the MPA's project team to develop an in-water facility that required the fill of 141 acres, including 130 acres of tidal open water. The Masonville DMCF has a placement capacity of 15.4 mcy and a projected operational life span of approximately 20 years. Masonville is located in the Baltimore Harbor portion of the Patapsco River, Maryland. Figure 1 shows the project location before and after construction of the DMCF.

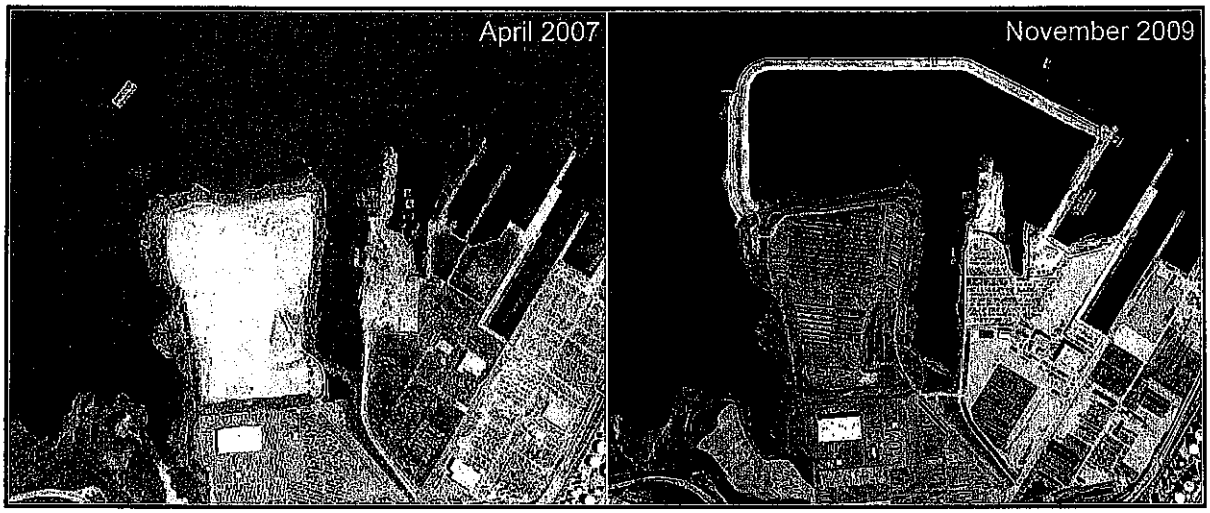

Figure 1 – Before and After Pictures of the Masonville DMCF Project Site

Objectives and Methodology

The facility's in-water footprint was overlain with 15 to 30 feet of unsuitable foundation material underlain by suitable dike construction material. The use of subaqueous borrow from onsite and concurrent Harbor dredging was identified as key to reducing dike fill costs and increasing placement capacity. However, use of this material was seen as difficult due to irregular site geology, existing infrastructure in the site footprint, agency/environmental design constraints, coordination with multiple large-scale projects, and a fast-track schedule. The creative and collaborative engineering and contracting approach developed by MPA to construct the Masonville DMCF by using subaqueous borrow from onsite and concurrent large-scale Harbor dredging has allowed the project to provide cost-effective placement capacity. The MPA's

engineering and contracting approach maximized the volume of material obtained from subaqueous sources and completed initial site construction in time to allow operations in the year following the closure of the HMI DMCF. Overall, the use of subaqueous borrow is estimated to have provided about $58 million in savings to MPA. This includes a reduction in DMCF construction costs by over $11 million, a reduction in Seagirt-Dundalk dredging by over $5 million, and an increase in Masonville dredged material placement site capacity worth over $42 million.

Containment Dike Design - The DMCF containment structure consists of four distinct sections, totaling approximately 10,000 linear feet which, are a fringe wetland dike, a rock armored dike, cellular cofferdams, and a sand dike along existing shoreline. Each of the sections, shown in Figure 2, was designed to serve a specific purpose. Future raisings, from the initial construction to the final elevation, are to be completed with a combination of granular fill and recovered dried dredged material from within the site.

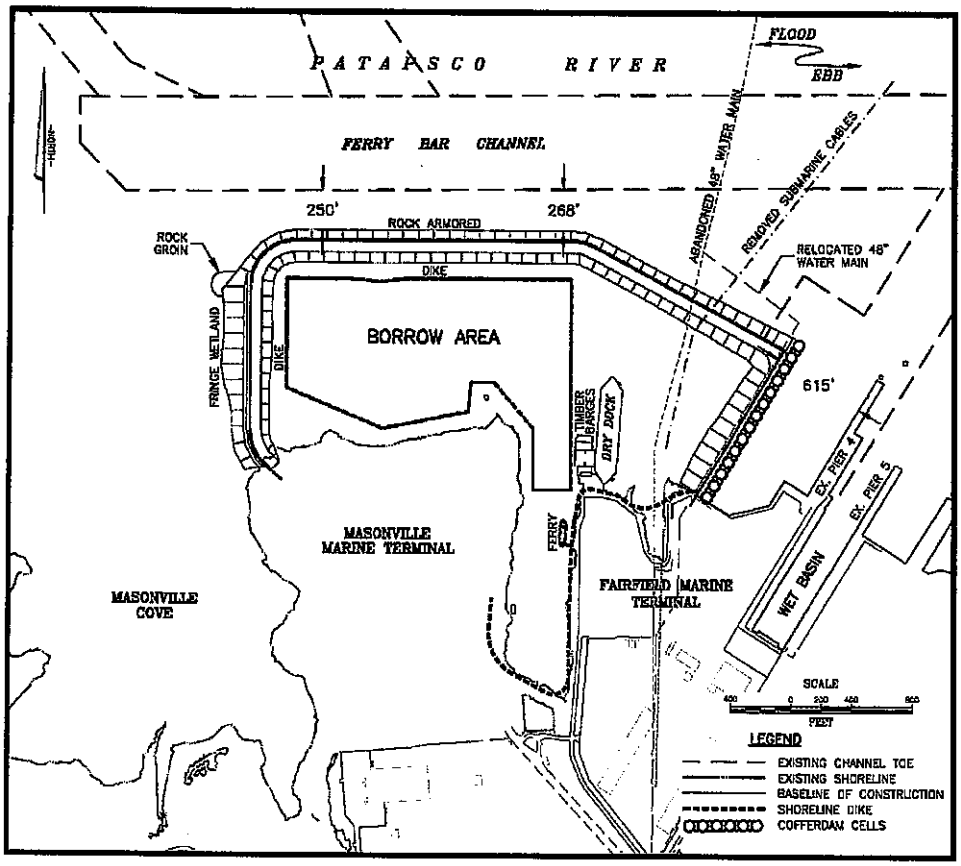

Figure 2 – Site Plan View

Site Design Constraints - The selected dike alignment is a product of numerous design iterations and studies of geographic, geotechnical, navigational, and environmental constraints. The Ferry Bar Channel, a federally maintained navigation channel, is located adjacent to the Masonville DMCF, and provides 42 foot deep access to major MPA terminals. MPA was required to maintain a distance of 250 feet from the toe of the dike to the toe of the Ferry Bar Channel. This constraint and geotechnical considerations dictated the northern dike alignment. Public and regulatory concern over encroaching on Masonville Cove determined the western boundary. The eastern cofferdam alignment was designed to allow construction of a relieving platform to provide a berthing area for handling RO-RO cargo and to maintain a safe operating distance from nearby existing Fairfield Pier 4, which services the adjacent Masonville-Fairfield Marine Terminal Complex.

Geotechnical Considerations - Figure 3 is a soil profile depicting conditions typical of those found at the Masonville site. As shown, the site generally has three stratums: Stratum I, is a layer of soft silts and clays, generally 15 to 30 feet thick; Stratum II, is composed of sand and gravel, generally 10 to 20 feet thick, although 40 foot thick layers were located within the borrow area; Stratum III, is a stiff red clay layer that extends beyond the reach of the borings.

The Stratum II layer was identified as a suitable dike foundation and a potential source of borrow for dike construction early in the Masonville design process. The use of Stratum II material from within the dike alignment for dike construction became the key to allowing the project to provide affordable placement capacity.

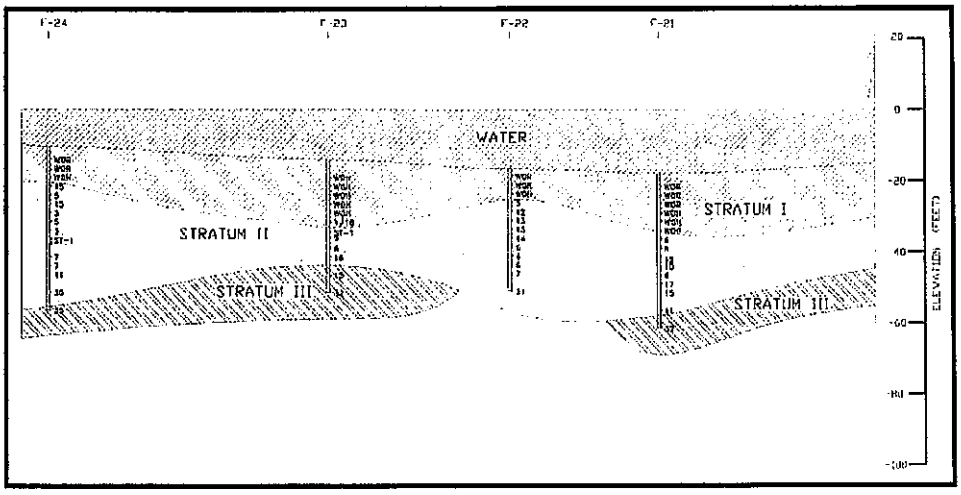

Figure 3 – Typical Soil Profile

Typical Dike Sections - This section provides the three typical design cross-sections for the dike containment structure. Prior to the hydraulic placement of the fringe wetland and rock dikes, the excavation of geotechnically unsuitable material (undercut) was required. Cross sections shown in Figures 4 and 5 depict the unsuitable excavation and the design geometry of the rock armor dike and the fringe wetland dike. Dike construction methodologies included mechanical and hydraulic dredging of borrow material and subsequent placement of material in the dike section

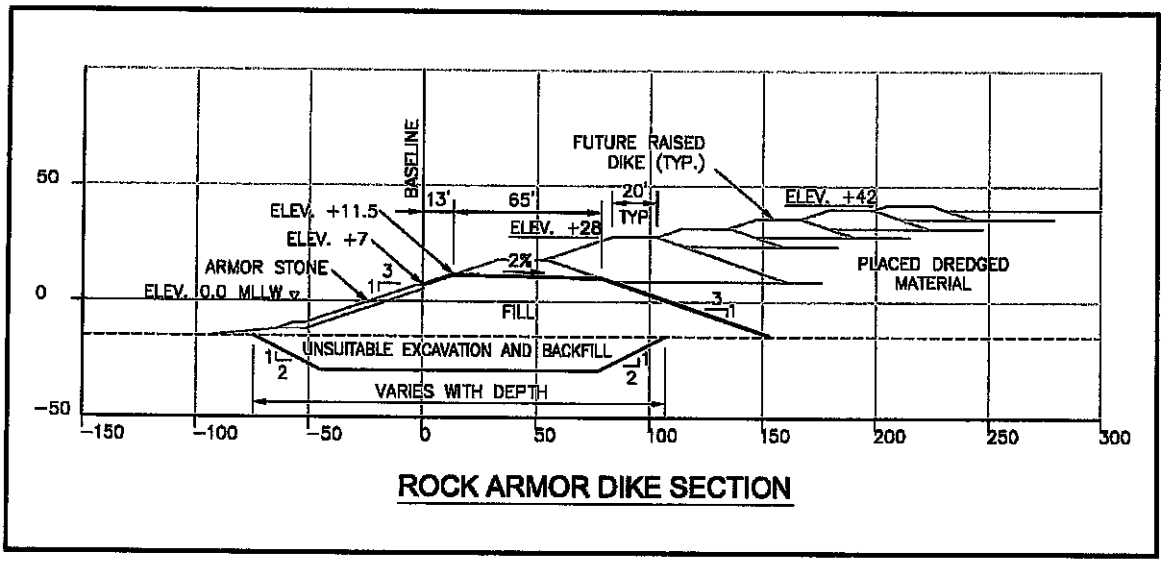

Figure 4 – Armored/North Dike Section

The rock armor dike was designed to consist of a matrix predominantly comprised of sand and gravel hydraulically pumped into place. The designed elevation allows the dike to be armored, the site to become operational, and to be constructed with available on-site borrow.

Similar to the rock armor dike, the fringe wetland dike (Figure 5) was designed to consist of a matrix predominantly comprised of sand and gravel hydraulically pumped into place. Coastal analysis of the fringe wetland dike alignment, determined that an armored slope was not required. Once vegetated with tidal plants, the bench and slope will assist in achieving mitigation requirements and provide a transition zone to the adjacent Masonville Cove restoration.

The fringe wetland dike was designed as it appears in Figure 5. Stockpiled material is currently placed above the future fringe wetland and will provide material for other dike construction activities. One such activity is the mechanical construction of the shoreline dikes (Figure 6), scheduled for mid-2010.

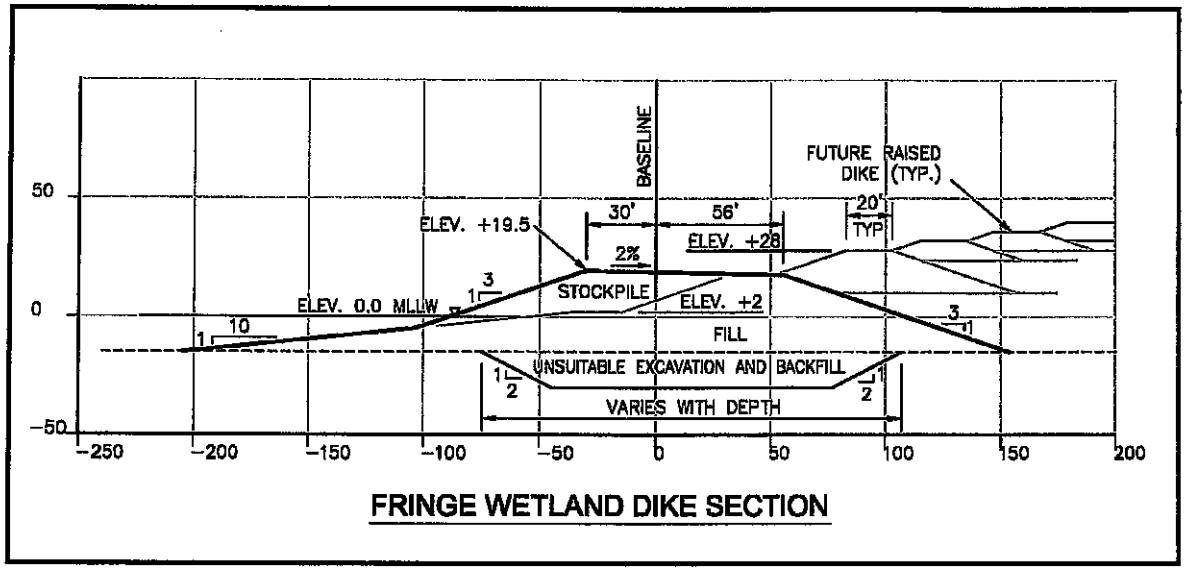

Figure 5 – Fringe Wetland Dike Section

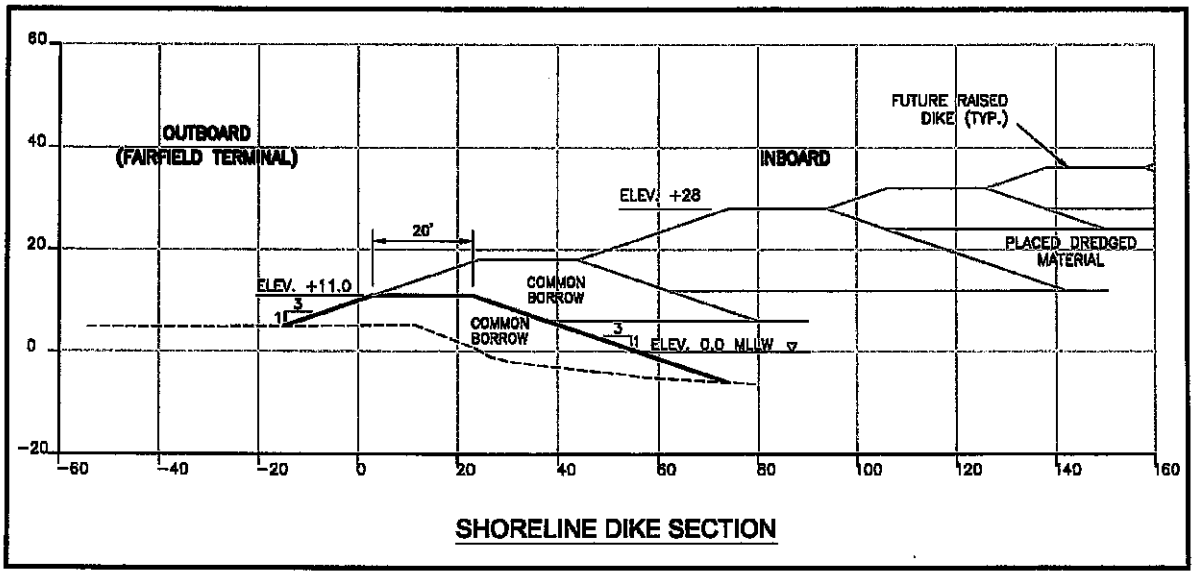

Figure 6 – Shoreline Dike Section

Borrow Area Analysis – Key to Masonville Design - Conceptual level borings identified dike alignments that minimized foundation improvement and undercutting. The borings also indicated that material suitable for dike construction (sand and gravel) existed within the site footprint, but under 15 to 30 feet of unsuitable material (silts and clays). The use of on-site material for the dike construction provided the opportunity for increased site capacity and eliminated the need for off-site dike material, resulting in reduced construction costs.

The geotechnical data collected in the design phase was used to create various digital terrain models (DTMs) for analysis of both cross-sections and contour maps of the dredging site. The engineering team recommended that two contracts be used to construct the dike fill. The first contract would remove the unsuitable material, and the second contract would provide for hydraulic dredging of the borrow area and direct pumping into the dike section.

Following award of the hydraulic dredging contract to McLean Construction, the contractor and MPA structured a jointly funded geotechnical boring investigation, because of the complexity of the borrow area. Figure 7 shows a plan view of the borings and the boring density in the approximately 40-acre borrow area The DTMs, survey results, and geotechnical investigation data were incorporated into north-south and east-west cross sections of the borrow area (Figure 8). The cross-sections enabled MPA to review all pre-work contract submittals and to review the contract progress and activities to ensure that the borrow area was fully exhausted.

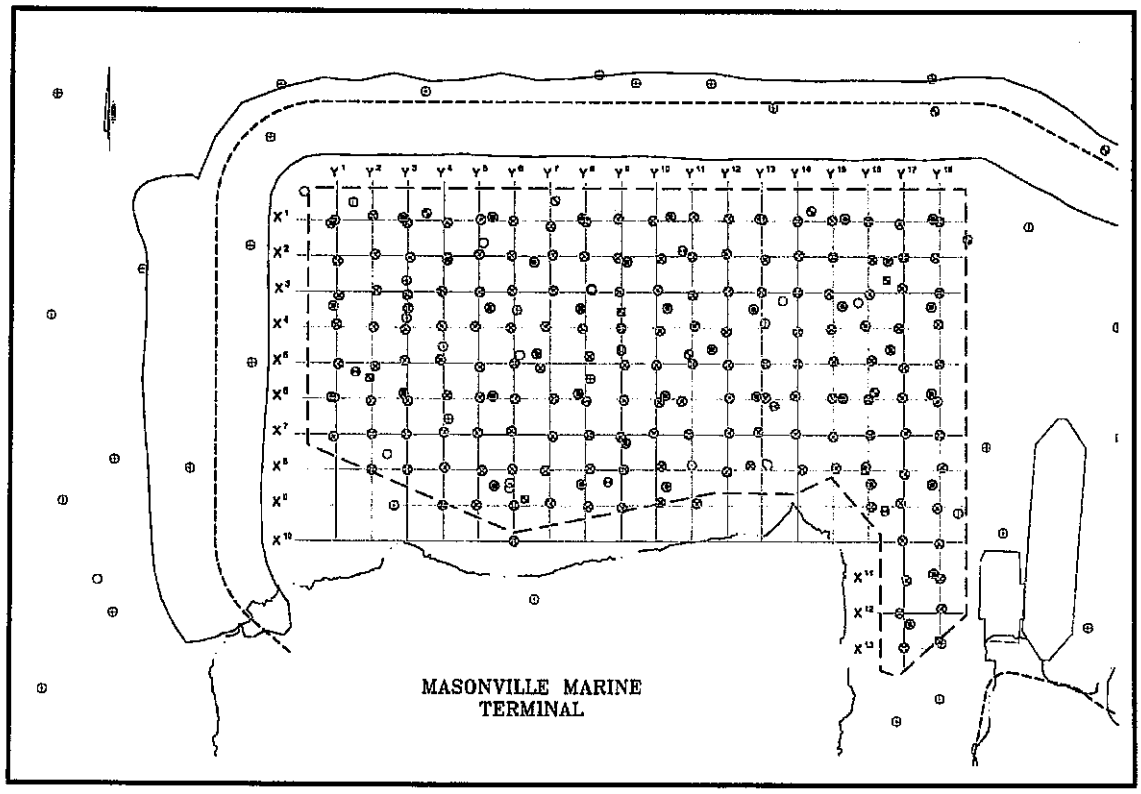

Figure 7 – Plan View of Borings in Borrow Area

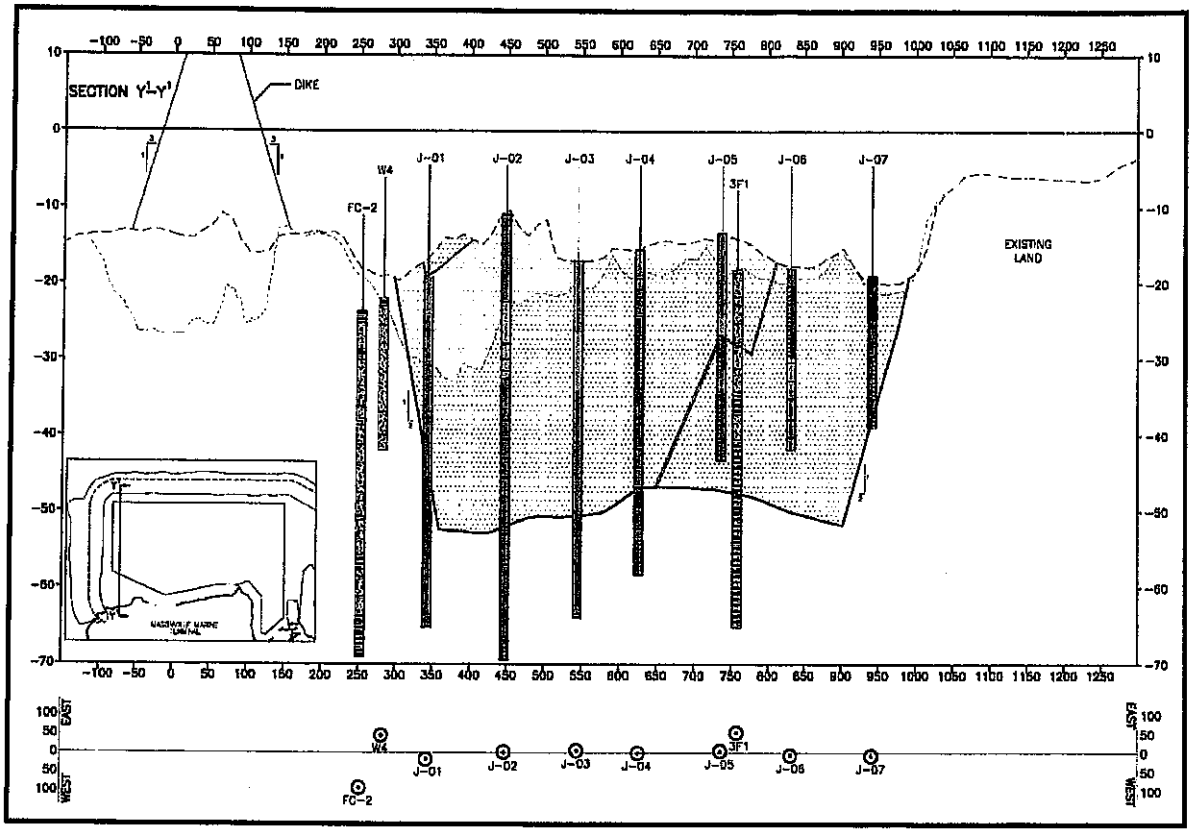

Figure 8 – Example of Cross-Sections Generated from Geotechnical Investigations

Performance Measures

Dredging Contracting and Construction - During the DMCF project development, a concept was developed that would allow the MPA to combine two strategically important, long-term projects into one contract for the mutual benefit of both projects. The first project was the preparatory dredging at Masonville, which required dredging of unsuitable foundation material and stripping of unsuitable material to gain access to the on-site borrow area prior to the construction of the dike. The second project was the deepening and widening of three important harbor channels located approximately three miles from the DMCF site.

Approximately 500,000 cy of the required new work dredging consisted of sand and gravel. This material was placed into the unsuitable excavation area as foundation improvement for the Masonville DMCF. Using this material for construction rather than placing it in a confined disposal facility represented a combined cost savings of $10 million.

Dredging activities at the DMCF site were subject to time-of-year restrictions to protect anadromous fish between February 15 and June 15 of each calendar year. This restriction was a major consideration in the preparation and execution of the initial contract. Additionally, the schedule for the completion of the Masonville DMCF was firmly established by the mandated closure of the HMI DMCF. These factors required that the contract be procured and executed in parallel with the finalization of portions of the permitting documents. The final permit authorizing the Masonville DMCF was received in September 2007.

Under the *Preparatory Dredging at Masonville Dredged Material Containment Facility and New Work Dredging at Seagirt and Dundalk Marine Terminal Channels* contract, the work was structured to successfully deliver two strategic long term goals for the MPA by deepening and widening access channels for two important marine terminals and preparing the Masonville DMCF site for dike construction. Innovative contracting, judicious packaging, bold scheduling and responsible stewardship allowed the MPA's contracting and construction team to furnish a complete project, within time-of-year restrictions at 90.5% of the contract award amount.

In June 2008, competitive bids were solicited for the construction of the Masonville DMCF dike. Two bids were received, $25.2 million and $34.4 million, both significantly higher than the estimated cost of the project. The bids were rejected and the solicitation was cancelled. Cognizant that another unsuccessful solicitation could endanger the legislatively mandated schedule, numerous efforts were made to incorporate industry suggestions. Specific construction elements were modified, and of equal importance, a balancing of risk between the owner and contractor was incorporated into the contract language.

In September 2008, a new solicitation of bids for the Masonville DMCF was issued. The result of this solicitation was two bids, $20.5 million and $20.9 million. The bids were reviewed, and the contract was awarded to McLean Contracting Company and their subcontractors, including Norfolk Dredging Company and Coastal Design and Construction. The Notice to Proceed (NTP) was issued on December 19, 2008 with contract duration of 410 calendar days. Through patient and thorough review of the cancelled solicitation and candid discussions with the dredging industry, the MPA was able to experience a nearly $5 million reduction in bid price without sacrificing any major project elements. The final construction cost

of $23 million included additional work requested through change order that allowed complete enclosure of the site at a 10 foot elevation in lieu of the planned stockpile and mechanical rehandling through additional contracts. The MPA and the Contractor undertook a joint geotechnical investigation to further enhance the information available for dredging planning. The results of the investigation were jointly reviewed and analyzed, and were important in establishing the excavation templates, as contractually required. At the time of design and bid, it was not expected that the dike could be closed in 2009. During execution of the contract, a major change order was negotiated and issued allowing for the expedited/early closure of the dike structure. A careful study of the critical paths of all project components and intense technical coordination with the City of Baltimore resulted in an opportunity to integrate these components, allowing for closure of the dike in 2009.

A major key to success of this contract success was an open, cooperative, trustful relationship developed between the owner and contractor.

Project Coordination - The two major dredging and construction contracts required close coordination with progress and projected progress of multiple major contracts simultaneously being executed within the Masonville DMCF footprint. The project budget was also driven by the site's eventual end-use as a marine terminal. To better facilitate this end-use, the MPA selected 1,000 feet of cellular cofferdams for the eastern containment structure. Fairfield Pier 4, adjacent to the cofferdam, is estimated to be at the end of its useful life and MPA is currently working to obtain funding to construct Masonville Berth 3 on top of the cofferdam structure. Berth 3 would serve the existing Masonville-Fairfield Marine Terminal Complex and any new facilities constructed after closure of the Masonville DMCF.

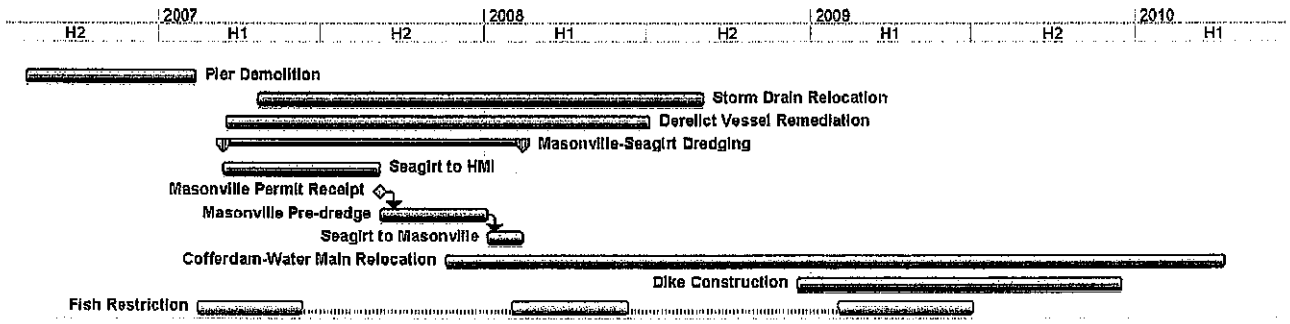

Figure 9 – Project Schedule

How the Project Fulfills the Award Criteria

The Masonville DMCF Construction Project qualifies as a unique and innovative effort that required coordination of multiple infrastructure projects on a rigorous schedule with challenging and sometimes conflicting regulatory, design, contract procurement and construction constraints. The DMCF Project is nationally recognized as a beneficial use of dredged material and is a critical MPA facility for 2010 and will be a foundation for MPA's future infrastructure requirements.

- The structure of work in the *Preparatory Dredging at Masonville Dredged Material Containment Facility and New Work Dredging at Seagirt and Dundalk Marine Terminal Channels* contract successfully provided two strategic long term goals for the MPA:
  - Preparing the foundation of the Masonville DMCF site for dike construction and
  - Deepening and widening access channels for two important marine terminals
- Innovative means of contracting and synergy by combining two large scale contracts to deliver one completed DMCF on schedule and saving over 50 million dollars compared to individual contracting
- Construction of a 15 million cubic yard facility to meet MPA's Dredged Material Management Program and creation of the foundation for future Port terminal infrastructure was completed in record time under a rigorous legally mandated schedule
- Innovative engineering using on site subaqueous borrow, initially deemed unacceptable because of radically irregular geology, proved cost effective when plentiful geotechnical engineering data and combined contracting led to a final product more valuable than the individual parts
- Advanced and innovative planning and design were required to coordinate and account for two major dredging and marine construction contracts to be closely synchronized with other multiple major contracts simultaneously being executed within the Masonville DMCF footprint
- The MPA's engineering and contracting approach maximized the volume of material obtained from within the site footprint and completed initial site construction in time to allow operations in the year following the closure of the HMI DMCF

- Design of the various project construction elements facilitated cost effective construction techniques and ensured the accomplishment of schedule and budget goals

CONCLUSION

The Maryland Port Administration's Masonville Dredged Material Containment Facility project fulfills the requirements for recognition of outstanding results in a completed engineering project at a public port authority and is a worthy candidate for an AAPA Facilities Engineering Award for 2010.

The successful implementation by the MPA of multiple design, public outreach, permitting, procurement and construction activities on a rapid construction schedule in response to a need to sustain the Dredged Material Management Program qualifies as one of the premier accomplishments in the nation for the development of the Country's port infrastructure.

Looking forward to the end use of the Masonville DMCF, Figure 10 shows a rendering of the final Port Facility.

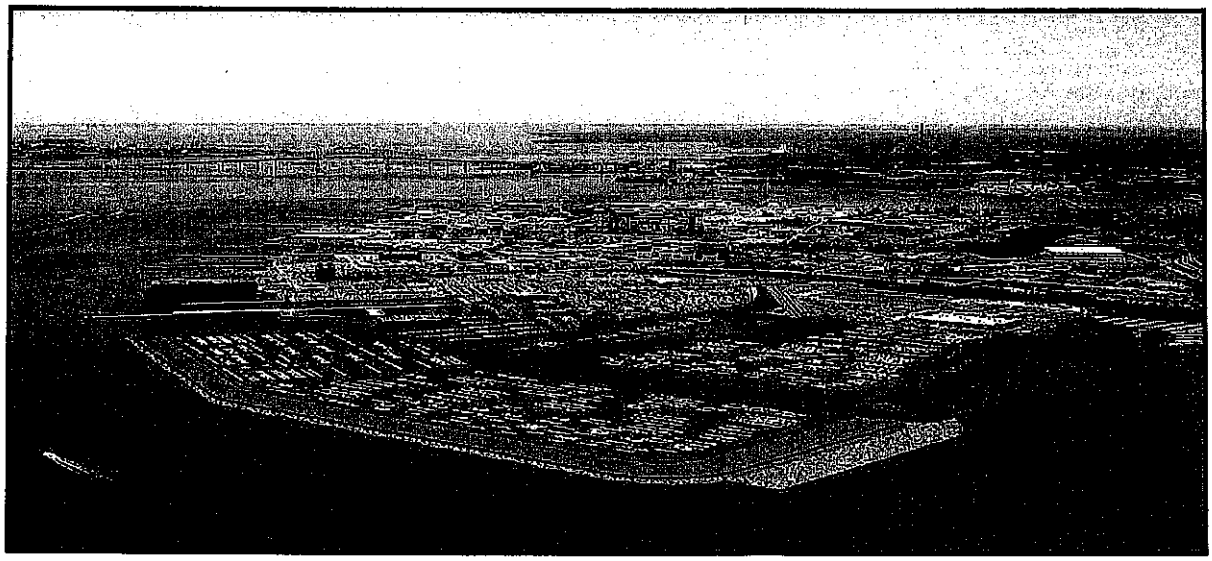

Figure 10 – Final Port Facility Rendering