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New York District

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2008 Main Report
2005 Internal Update Report
2005 Internal Update Appendix

Update **Volume I**

Dredged Material Management Plan for the Port of New York and New Jersey

In partnership with

The Port Authority of NY & NJ

New Jersey Department of Environmental Protection

New York State Department of Environmental Conservation

United States Environmental Protection Agency

New Jersey Department of Transportation
Office of Maritime Resources

THE PORT AUTHORITY OF NY & NJ

R.M. Larrabee
Director, Port Commerce Department

June 24, 2008

Colonel Aniello Tortora
Commander
U.S. Army Corps of Engineers
New York District
26 Federal Plaza
New York, NY 10278-0090

RE: Dredged Material Management Plan Update

Dear Colonel Tortora:

As a partner in the management of dredged material for the New York/New Jersey Harbor, the Port Authority is pleased to learn that the Dredged Material Management Plan (DMMP) has been updated and is ready to be published. This document will continue to serve as a critical guide for the proper treatment and/or placement of the material removed during the Harbor Deepening Project and the long-term maintenance of the completed channels and berths.

The Port Authority continues to recognize the professionalism and persistence of the multi-agency staffs that participate on the DMMP subgroup of the Regional Dredging Team and the leadership of the Corps in bringing this document to completion. The Port Authority continues to support the recommendations of the DMMP.

Within our budget and authority provisions, the Port Authority will continue to serve as a partner with all stakeholders as we move forward with implementation of the DMMP. In addition, the Port Authority will continue to provide the necessary support for future updates of the DMMP.

Sincerely,

R.M. Larrabee
Director
Port Commerce Department

225 Park Avenue South - 11th Floor
New York, NY 10003
T: 212-435-4218 F: 212-435-4201
rlarrabee@panynj.gov

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

JUL 18 2008

Colonel Aniello L. Totora
District Engineer
U.S. Army Corp of Engineers
New York District
Jacob J. Javitz Federal Building
New York, New York 100278-0090

Dear Colonel Tortora:

I am writing to express the U.S. Environmental Protection Agency's (EPA), Region 2, support of the U.S. Army Corps of Engineers (USACE) 2008 update of the Dredged Material Management Plan (DMMP) for the Port of New York and New Jersey. The update is a result of a consensus by the Port community that a DMMP should be a living document revised periodically to reflect the most current information relevant to dredged material management. Periodic updates ensure that dredged material is being managed in the most environmentally and economically feasible manner.

As a partner in this endeavor, EPA is pleased that dredged material will continue to be utilized beneficially. Since the dredged material disposal crisis of the early 1990s, there have been great strides in the management of dredged material. EPA looks forward to future implementation of additional beneficial use options and supports those alternatives which have a demonstrated benefit to the environment. We also look forward to working with USACE on the Programmatic Environmental Impact Statement (PEIS) that will be revised in the near future to be consistent with the current update.

By maintaining our strong partnerships with USACE, members of the Regional Dredging Team and Port stakeholders, we continue to move forward in the protection of our harbor and the management of dredged material.

Sincerely,

Alan J. Steinberg

Alan J. Steinberg
Regional Administrator

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1. INTRODUCTION

The Dredged Material Management Plan Implementation Report (DMMP IR) for the Port of New York and New Jersey was prepared in 1999 by the US Army Corps of Engineers, New York District (NYD) (USACE 1999). Since 1999, the NYD prepared several updates for internal review. In 2005 the NYD initiated a significant update to the DMMP IR by preparing a preliminary Status Report (SR) of progress toward the DMMP goals, for review by the implementing and regulatory agencies. In 2007 the NYD determined that sufficient changes had occurred to warrant a formal, published update to the 1999 DMMP IR. This Update spans the period from 2005 to the third quarter of 2007 and includes the 2005 SR (Appendix A). Together these documents summarize the progress and highlight areas of particular interest as part of an ongoing process to keep stakeholders and interested members of the public informed the latest developments in the management of dredged material within the New York/New Jersey Harbor.

In 1999 a draft Programmatic Environmental Impact Statement (PEIS) for the DMMP IR was prepared and released to the public for review and comment. Information gathered during the formal review period and public information meeting were incorporated into a Final PEIS. Finalization and the release of the Final PEIS is projected for the same time frame as the release of this document. The Final PEIS includes the data collected as part of the 2005 SR and this update.

This 2008 DMMP Update builds on the information presented in the 2005 SR. The reader is therefore encouraged to review Appendix A as it serves as an integral part of the update, providing greater detail and technical insights that are only summarized in this document. The changes reflected here include updated placement locations, dredging volumes and beneficial use options.

1.1 MANAGEMENT OF THE DMMP

Since the formulation and publication of the 1999 Implementation Report, the NYD and other stakeholders have continued to work together to ensure successful implementation of the DMMP goals. Most recently cooperating agencies organized a New York/New Jersey Harbor Regional Dredging Team (NY/NJ RDT). The NY/NJ RDT, which began meeting in 2006, is comprised of federal, state and local agency representatives, who have multiple roles in the management of dredging and the placement of dredged material from navigation channels, piers and harbor facilities in the NY/NJ Harbor area. The NY/NJ RDT consists of representatives from:

- US Army Corps of Engineers - New York District (USACE)
- US Environmental Protection Agency - Region 2 (USEPA)
- National Oceanographic and Atmosphere Administration (NOAA)
- The Port Authority of New York and New Jersey (PANYNJ)
- New Jersey Department of Environmental Protection (NJDEP)
- New Jersey Department of Transportation - Office of Maritime Resources (NJDOT)
- New York State Department of Environmental Conservation (NYSDEC)
- New York State Department of State (NYS DOS)
- City of New York - Economic Development Corporation (NYCEDC)
- City of New York - Department of Planning (NYC DOP)
- City of New York - Mayor's Office of Environmental Coordination

The NY/NJ RDT meets monthly to discuss dredging and disposal issues, with particular emphasis on facilitating the beneficial use of dredged material. Typical meetings include a review of current and upcoming dredging project schedules, volumes and placement locations, as well as the regulatory and operational status of all current and new beneficial use opportunities, including habitat creation, enhancement and restoration and use of potential upland placement sites. The NY/NJ RDT is part of the larger National Dredging Team (NDT) network co-chaired by the USEPA and USACE.

1.2 DREDGED MATERIAL VOLUMES

The DMMP updates were developed to facilitate management of all projected material dredged as part of the NYD's Operations and Maintenance (O&M) program, and material from the New York and New Jersey Harbor Deepening Project (HDP). Although USACE regulations require that a DMMP only demonstrate sufficient capacity for Federal Navigation Channel(s) for a minimum of 20 years (USACE 2000), to keep this DMMP consistent with the HDP, a 60-year planning horizon, from 2005-2065, was selected. Based on current conditions, the DMMP IR estimates the overall volume of material derived from both the O&M program and the HDP during the next 60 years at approximately 195 million cubic yards (MCY). The HDP is projected to yield approximately 43 MCY by the time of its completion of the overall 195 million cubic yards of material. The total volume includes approximately 89 MCY of dredged material that is suitable for placement at the Historic Area Remediation Site (HARS), 101 MCY of unsuitable or non-HARS material, and 5 MCY of rock (Table 1-1).

Type of Material	Approximate Volume
HARS suitable material	89 MCY
Non-HARS suitable material	101 MCY
Rock	5 MCY
Total of all Material	195 MCY

Table 1-1: Projected material volumes 2005 through 2065

While the HARS is not expected to reach capacity in the foreseeable future, the Corps will continue to look for alternatives to HARS placement and implement these alternatives, where feasible. Possible alternatives may include placement of material in a variety of upland and aquatic sites for additional beneficial uses and/or remediation purposes.

1.3 CURRENT MATERIAL PLACEMENT

Since the 2005 SR, approximately 14.5 MCY of HARS and non-HARS suitable material has been excavated as part of the NYD's O&M program, the HDP, or non-Federal projects. Table 1-2 provides a breakdown of placement.

Type of Material	Approximate Volume
Total of all Material	14.5 MCY
Material Placed at the HARS	9.4 MCY
HARS Suitable Material Placed at NY/NJ Reef Sites (various)	1.2 MCY
Non-HARS Suitable material placed	4.3 MCY

Table 1-2: Total of all material dredged material between 2005 and October 2007

Of the 10.6 MCY of HARS suitable materials listed, approximately 1.8 MCY have come from Non-Federal projects.

2. SIGNIFICANT CHANGES IN OPTIONS SINCE THE 2005 REPORT

The USACE and other government and private entities have investigated a number of options for managing dredged material since the DMMP SR was developed. Only those options that have changed since the 2005 SR are presented below. For the full slate of options please refer to the 2005 SR (see Appendix A).

2.1 CONTAMINANT REDUCTION

Since the completion of the 2005 SR, little has changed in the implementation of contaminant reduction alternatives. However three projects, the Contaminant Assessment and Reduction Project (CARP), the Hudson-Raritan Estuary Ecosystem Restoration Study (HRE) and the Harbor Estuary Program (HEP), have advanced long term habitat restoration and remediation efforts. The objective of these projects is a reduction in the overall exposure of organisms to contaminated sediments through treatment, remediation, removal, containment, and/or capping of contaminated sediments. These programs have progressed understanding of which sources of contamination are most critical to control. Methods to achieve that control have also been developed and implementation is being sought through use of several authorities and funding sources.

2.2 BENEFICIAL USES

Dredged material is recognized today as potential resource material that can be recycled or re-used to implement a variety of projects such as restoration, remediation and upland construction. Beneficial use opportunities for dredged material are numerous, and include potential use for:

- remediation of upland landfills
- upland construction or fill projects
- remediation of in-water disposal areas, such as the HARS
- restoration of bottom surface habitat, including borrow pit restoration opportunities, to improve water quality
- restoration of wetland habitat
- restoration of mudflat or shallow water habitats,
- creation of artificial oyster or fisheries reef habitat,
- enhancement or restoration of bird nesting or foraging habitat
- restoration of shellfish habitat and
- replacement of sand from eroding beaches for storm damage protection.

Further information on beneficial use opportunities is presented in the following reports:

- *Beneficial Uses of Dredged Material for Habitat Creation, Enhancement, and Restoration in New York-New Jersey Harbor* (USACE 2001)
- *Inter-Disciplinary Evaluation Framework for Beneficial Use of Dredged Material* (USACE 2002).

Dredged material is beneficially used in accordance with different government authorities and via different funding mechanisms. Beneficial use of dredged material can be achieved as a project base plan, a least cost placement alternative of a navigation dredging project, or through an independently funded or cost-shared incremental difference above a project base plan. Placement of suitable material at the HARS is an example of successful implementation of beneficial use as a base plan. Placement of rock to create artificial reefs off of the southern Long Island and the New Jersey coastlines are also examples of base plans implemented to date.

Beneficial use of dredged material may also be implemented as betterment to existing projects at full cost to the beneficiary. Section 2037 of the Water Resources Development Act of (WRDA) 2007, Regional Sediment Management, allows the selection of a disposal method that is not a least cost option if the incremental costs are reasonable in relation to the environmental benefits. An example of this use has been the placement of dredged sand material on recreational beaches. Table 2-1 lists the projects that have beneficially used HARS and non-HARS suitable materials since the preparation of the 2005 SR through the last quarter of Fiscal Year 2007.

Placement Site	Approximate Volume
HARS Remediation Site	9.4 MCY
New York and New Jersey Reef Sites (various)	1.2 MCY
New York	
Penn-Fountain Landfill (Brooklyn/Queens)	209,000 CY
Jamaica Bay – Elders Point East	248,000 CY
East Rockaway Beach	260,000 CY
New Jersey	
EnCap Site	1.2 MCY
Prologis Port Reading Business Park	131,000 CY
Prologis Elizabeth Seaport Park	350,000 CY
FDP Enterprises	420,000 CY
Linden Landfill	360,000 CY
Landfill 1E	1.0MCY
Keegan Landfill	60,000 CY
Overpeck Landfill	250,000 CY
Jersey City Turnpike Property	40,000 CY

Table 2-1: Beneficial uses of HARS and Non-HARS suitable material - 2005 through October, 2007

Additionally, dredged material can be beneficially used by public or private interests that contract directly with the dredging contractor to purchase or receive dredged material for the intended beneficial use. Dredged material from the various O&M projects and HDP has been transported directly for reuse or in some cases, is stockpiled and resold at a later time by private companies for various beneficial uses.

2.2.1 HABITAT CREATION, ENHANCEMENT, AND RESTORATION

The NYD and the NY/NJ RDT continues to seek opportunities for the use of HARS suitable material to meet additional various restoration opportunities for O&M and HDP HARS material, based on the type of material required (i.e. sand, silt and/or clay) for a specific site. Table 2-2 lists some of the potential placement sites under consideration.

Potential Future Placement Site	Approximate Volume
Military Ocean Terminal Bayonne (MOTBY) – southern portion only	935,000 CY
Fresh Kills	500,000 CY
Jamaica Bay (including, but not limited to, Elder's West and Yellow Bar)	500,000 CY
Flushing Bay/Creek	520,000 CY

Table 2-2: Potential beneficial uses of dredged material from various projects

The 2005 SR discusses the NYD's strategies for restoration, habitat creation and enhancement (see Appendix A). Since the identification of the twelve options included in the 2005 SR, there has been progress made in advancing several restoration sites, with particular attention being paid to addressing the loss of marsh islands within Jamaica Bay.

Within Jamaica Bay, there are several proposed actions that could potentially benefit from the use of material from several projects. HARS suitable material may provide much of the substrate needed to reverse the continuing marsh losses within Jamaica Bay by adding to existing marsh islands and fringe marshes and the restoration of the sub-surface bottom of the Bay.

An Integrated Ecosystem Restoration Report/Environmental Assessment and Finding of No Significant Impact (ERR/EA), completed in December 2005, evaluated the restoration of Elders Point East, Elders Point West and Yellow Bar Hassock Marsh Islands using dredged material. Elders Point East was constructed in 2006-2007 as mitigation for impacts associated with the HDP. Elders Point East benefited from HARS suitable dredged material from an existing O&M project at Rockaway Inlet and the HDP.

Elders Point West and Yellow Bar are currently considered for implementation through existing Corps of Engineers authorization for beneficial use of dredged material via partnerships between the NYD and the Port Authority, City of New York – Department of Environmental Protection, NYSDEC or the National Park Service. Other potential HARS suitable restoration sites within the City of New York include Flushing Bay/Creek (Queens) and Fresh Kills (Staten Island).

NYSDEC has proposed the restoration of the existing subaqueous pits within Norton Basin and Little Bay, Jamaica Bay utilizing clean dredged material. These areas were excavated several decades ago for material to be used in other areas. The filling of these former borrow areas with suitable dredged material will help increase oxygen in the water, create new benthic habitat and help restore the flow of the waters within the Bay. The concept is to place HARS suitable material to raise the bottom elevation of the pits sufficiently to prevent stratification and to eliminate the hypoxic/anoxic conditions that currently exist.

Finally within Jamaica Bay, a future potential program under consideration is outlined in the Jamaica Bay Watershed Protection Plan (NYCDEP, 2007). The potential plan calls for the placement of HARS suitable material for restoration of several islands, including, but not limited to, Black Wall, Ruler's Bar, Black Bank, Goose Pond and East High. Feasibility studies for these sites have not been initiated to date.

Within New Jersey, three sites are currently under consideration. The southern portion of the MOTBY has been evaluated by the NYD as part of an Environmental Assessment Report (USACE 2004). Restoration activities will be situated within and adjacent to the MOTBY derelict channel. These activities will enhance and develop more productive benthic habitat by restoring the shallow areas for any Essential Fish Habitat species that inhabit the area, including providing more suitable spawning and feeding grounds for winter flounder. Material excavated to deepen the Port Jersey channel has been determined to be a suitable match for placement within this area. This represents an ideal opportunity for providing economic and environmental benefits within the same project area at minimal added cost. The Port Jersey project was awarded for construction in October 2007. At Liberty State Park, there is an authorized project that includes the beneficial use of HARS suitable material to restore benthic habitat within North Cove. Finally, the ongoing Remedial Investigation and Feasibility Study of the Lower Passaic River indicates this area could similarly benefit from the placement of HARS suitable material as part of future remedial actions. The Draft Source Control Early Action Focused Feasibility Study for the Lower Passaic River identifies several potential options including, but not limited to, various backfill, capping, and the placement of rock for armor and for restoration, depending on the selected alternative for the proposed remedial plan (USEPA 2007).

Timing the availability of dredged material with the availability of a placement site is one of the greatest challenges that exist for beneficial use. Although material may be available, the placement site may not have obtained all of the required permits or the necessary funding to place dredged material at the site. The ability to stock-pile material in large quantities within the Harbor until a placement site is ready to receive it is limited, greatly reducing opportunities for its beneficial use. Project funding and Non-Federal cost sharing arrangements, as described in WRDA 2007 (US Congress 2007) and the USACE Implementation Guidance for Regional Sediment Management (USACE 2007c), are also a significant consideration in the selection of the placement location for dredged material. If funding issues exist, the material may not be transferred to the restoration site once they are dredged, again limiting the potential beneficial uses of the material. Competition between available sites for the use of material also can affect placement. Finally, regulatory requirements that delay or increase the cost of implementing a potential beneficial use can also be an issue. The issue of temporary storage and/or processing is further discussed in Section 3.3.

2.2.2 LAND REMEDIATION

Land remediation options combine the beneficial use of dredged material, primarily processed non HARS-suitable material, with the environmental and economic restoration of degraded lands. Sites include active and inactive landfills, brownfields (former industrial sites), quarry sites, and abandoned mines.

Prior to use as grading/closure material at these types of sites, dredged material is typically processed with binding agents to improve its structural properties so that it may be readily applied upland. Binding agents that have been shown to be effective include cement, fly ash, coal ash, lime, and kiln dust. This process also immobilizes contaminants within the material so they do not leach out or otherwise become bioavailable. For this reason, this process also is considered to be a low-end decontamination technology called solidification/stabilization (see Section 2.3, Other Activities). The end product is typically a granular, soil-like material. The stabilized dredged material can be manufactured to meet the material and engineering specifications for a specified use such as structural fill, grading material, final landfill cover, or some other application by modifying the proportion and types of admixtures. Other ways to process dredged material to make it suitable for land remediation include dewatering and manufactured-soil production (blending in cellulose waste and biosolids to make fertile topsoil).

Non-HARS suitable material from the HDP and O&M projects has contributed to several landfill/restoration projects within the City of New York and the State of New Jersey, including, but not limited to the sites presented in Table 2.1. Additional potential sites include the Hunterdon Quarry Site in Hunterdon County, New Jersey, and the Hazelton Mines in Pennsylvania. Each of these sites could potentially accommodate significant amounts of processed dredged materials to restore habitat. Further studies will be undertaken before the economic and technical feasibility of the proposals can be determined. A test project at the Bark Camp site in Pennsylvania sponsored by the NJ Department of Transportation and the Port Authority of NY and NJ has already successfully demonstrated the beneficial use of dredged materials in abandoned mine reclamations (New York/New Jersey Clean Ocean and Shore Trust and the Pennsylvania Department of Environmental Protection 2007).

Potential sites for land remediation with processed or unprocessed material that exist in New Jersey and New York are listed in Table 2.3. Some of these sites still require additional studies to determine the specific type of material (i.e. sand, clay or silt) that could be placed and all sites require permits before they can be opened to accept dredged material. These sites, in conjunction with existing proposals for other sites such as the Flushing Airport Wetlands Restoration and Upland areas or the Brooklyn Bridge Park, may have a potential to accept at least an additional 2.2 MCY of HARS suitable material and 1.5 MCY of treated non-HARS suitable material that passes State criteria for restricted residential use.

Potential Future Placement Sites	**Approximate Volume (if known)**
Pennsylvania	
Hazelton Mines	30.0 MCY
New Jersey	
NJM Landfills	To Be Determined (TBD)
ILR Landfill	300,000 CY
Edison	TBD
Koppers Seaboard	400,000 CY
Burlington Neck Development, LLC Site	250,000 CY
Erie Landfill (New Jersey Meadowlands)	TBD
Hunterdon Quarry	TBD
NL Industries (Sayerville)	TBD
New York	
Bush Terminal, Ridgewood Reservoir and Willets Point	500,000 CY
Arverne East	150,000 CY
Yankee Stadium Heritage Field	200,000 CY
Brookfield Landfill	1.7 MCY

Table 2.3 Potential Future Placement Sites

Two active landfill/cap projects are underway, within the City of New York at the Fresh Kills Landfill in Staten Island, New York, and the EnCap project located in the New Jersey Meadowlands District.

The City of New York Economic Development Corporation (NYC EDC) has received a Beneficial Use Determination (BUD) from the NYSDEC for Anchorage Channel dredged material to be used at unspecified redevelopment sites within the City. As the material from Anchorage Channel meets NYS Residential fill criteria, this general BUD will allow for dredged material from this specific area within the Harbor to be used at a variety of remediation and/or restoration sites, including, but not limited to, Brooklyn Bridge Park, Flushing Airport wetlands and upland restoration sites among others. Future BUDs are planned for the use of suitable material from other channels in the Harbor, including Newark Bay 1 (BUD underway), Anchorage 2 and Ambrose 2. This procedure provides for greater flexibility in the use of dredged material rather than linking it to a specific site and reflects a potential step forward in increasing beneficial uses other than placement at the HARS. These New York City sites, combined, have a potential to accept approximately 9.1 MCY of HARS suitable sand material.

The NYC EDC is working with the International Speedway Corporation (ISC) to obtain authorization from the NYSDEC to commence placement of the fill required to cap the areas designated under the second phase of the NYC EDC's Remedial Action Plan, which also requires wetlands restoration/remediation. The fill material required to meet the Remedial Action Plan specifications is estimated to be approximately 750.000CY to 1.0 MCY of material meeting 6 NYCRR Part 375.6 residential criteria.

Continued development of the Fresh Kills site will require an additional volume of capping material for the purpose of raising the site elevation above Federal Emergency Management Administration (FEMA) floodplain levels. The total additional material required pursuant to the Remedial Action Plan, is estimated to be about 2.0 MCY of fill meeting the 6NYCRR Part 375.6 residential, restricted residential or commercial criteria and is dependent upon the proposed development plan.

Processed dredged material could be used to meet the total 2.75 MCY – 3.0 MCY fill requirement as long as it meets the appropriate 6NYCRR Part 375.6 criteria. The placement of the initial Remedial Action Plan fill is anticipated to start during the summer of 2008; while the placement of the additional grading fill is anticipated to commence in the spring/summer of 2009.

Additional sites for land remediation are continuously being considered by both States with coordination through the RDT. The State of New Jersey has been actively working with its Brownfields Development Areas and Portfields sites to promote the beneficial use of dredged material to facilitate the closure of abandoned landfills and the remediation of brownfield sites in the metropolitan region.

2.2.3 BEACH NOURISHMENT

Beach nourishment projects have been accepting HARS-suitable material (sand) from NYD O&M projects conducted in three main geographic areas: Rockaway Inlet/Jamaica Bay, Sandy Hook Channel, and East Rockaway Inlet. Additionally, sand dredged during the deepening of the Ambrose Federal navigation channel may potentially serve as a source for beach nourishment as needed and if suitable. Material has been placed at various sites within the region based on the availability of and need for sandy material. Beach nourishment projects have the capacity for specific amounts of material on varying (i.e., 2–20-year) cycles.

The potential also exists for placement of material at Plumb Beach in Brooklyn and Great Kills Park in Staten Island to address shore erosion at both locations within the boundaries of Gateway National Recreation Area. However, each of these sites would require additional planning including feasibility studies, regulatory approval and/or funding, to advance such a use.

2.3 OTHER ACTIVITIES

The New Jersey Department of Transportation's Office of Maritime Resources (NJDOT/OMR) and the US EPA have worked together to evaluate innovative sediment decontamination technologies with beneficial use applications for their potential to provide new management opportunities for navigational dredged material. Since 1993, the NYD, the US EPA and the Brookhaven National Laboratory (BNL) have been supporting and demonstrating bench pilot and full-scale applications of sediment treatment technologies. In 1998, NJDOT/OMR initiated the Sediment Decontamination Technology Demonstration Program to evaluate technologies and foster the startup of commercial scale dredged material decontamination facilities that produce value added products from harbor sediments. NJDOT/OMR, EPA and BNL are all working collaboratively on this effort.

The NJDOT/OMR has commissioned four processing demonstration technologies/projects for evaluation including:

- thermal destruction to manufacture lightweight aggregate;
- thermo-chemical destruction to manufacture construction grade cement;
- sediment washing and chemical destruction; and
- enhanced mineralization/chemical destruction.

Within these different techniques several individual goals were set including:

- The transformation of dredged materials into a material suitable for beneficial use, fill, cover or landfill capping projects.
- Liquid-solid separation of contaminants from the water fraction of the sediment and destruction of organic contaminants using a strong oxidizing agent. The resulting clean sediment is to be used as a base for topsoil manufacture for landscape purpose.
- High temperature (2600 degree F) processing of dredged material in a rotary kiln to create a glass aggregate (EcoMelt) that is pulverized and blended with Portland cement. The high temperatures destroy the organic contaminants and the metals are immobilized in the glass EcoMelt.
- The destruction of volatile contaminants (including particulates, mercury and dioxins) by burning in state-of-the-art pollution control equipment. Metals would then be incorporated into the mineral matrix and rendered non-leachable.
- Reduction of organic contamination through the direct addition of a strong oxidizing agent (Potassium Permanganate).
- The use of mechanical means to penetrate unconsolidated sediments, the agitation of the material, and the addition of add a grout mixture that would then allow for easier removal.

Not all projects have yet reached final report status. Those that have been completed may be found on http://www.state.nj.us/transportation/airwater/maritime and www.bnl.gov/wrdadcon. A programmatic report will also be generated by NJDOT and USEPA that will be made available once the projects are complete.

2.4 CONFINED AQUATIC DISPOSAL FACILITIES

Confined Aquatic Disposal (CAD) facilities, or cells, consist of a pit excavated into the floor of a water body where dredged material is placed. In 1997, three CAD cells were permitted for construction as the Newark Bay Confined Disposal Facility (NBCDF) within Newark Bay. It was envisioned that these water-based disposal facilities would hold non-HARS suitable material that could not be used elsewhere. Although the construction of the three disposal pits were authorized in 1997, only Pit 1S of the NBCDF was constructed and is currently in use. The permits for the non-constructed pits have since expired and currently the Non-Federal Sponsor does not plan to apply for new permits. Within Pit 1S, approximately 1.3 MCY has been deposited to date and approximately 469,000 CY capacity remains. Pit 1S will be closed and capped when filled.

III CURRENT IMPLEMENTATION AND CONCLUSIONS

In the 2005 Update specific placement options were developed and presented in two parts; a short term plan (2005 to 2014) and a long term plan (2015-2065) (see Appendix A, Section 4). In general, both plans outlined potential placement options including, but not limited to, habitat creation, enhancement and restoration, landfill, brownfield, Quarry and Mine remediation, aquatic disposal, fish reefs, other marketable processes (decontamination processes) and beneficial uses. Although the amount of material to be placed has increased from 2005, the overall objectives of placement of dredged material, as identified in the aforementioned options, have not (see Appendix A, Section 4, Tables 3.1).

3.1 SHORT-TERM NEEDS (PRESENT TO 2014)

Although work continues on the HDP, there is growing concern with regard to dredged material management in the Harbor. For various reasons, the ability to store, process and place, particularly non-HARS suitable material is still an issue.

HARS suitable material will continue to be used to remediate the HARS and to meet Federal commitments to cover the historic ocean remediation site with a suitable cap of clean material. Some of this material can also be used to meet specific needs of environmental restoration or enhancement projects, as outlined in this and the previous reports (DMMP IR 1999 and 2005 SR). However, often there are problems with coordinating the timing of a dredging project that provides the material with the beneficial use project which receives the material. It can be difficult to time the construction of beneficial use projects to coincide with a dredging schedule/cycle of dredging projects. This is especially true if the potential placement sites require additional studies, cooperative agreements, funding or permits. The availability for temporary storage of dredged material suitable for specific beneficial use projects would greatly assist in this overall effort as it would reduce the challenge of scheduling and allow for access to the material when required. A temporary storage facility, however, may increase the total funds needed for a project, by adding the cost of second handling of the material.

To manage the projected volume of non-HARS suitable material during the course of the short term phase, several land remediation sites in NJ, NY, and PA are now under development by private enterprises (as outlined in sections 2.2, 2.2.1 and 2.2.2 of this report). However, if these private projects do not come to fruition, difficulty may develop in finding placement sites for these materials. New alternatives of where to place non-HARS suitable material will have to be identified and/or moved from the concept phase to implementation quickly.

Currently the NY/NJ RDT has been successful in matching up placement needs with dredging projects. This effort continues to reflect a crisis mode in that site approval and/or use is all too often on a last minute basis. So far, none of the HDP dredging projects have been delayed, although this risk still remains high in absence of long-term site(s) approval.

3.2 LONG-TERM NEEDS (2015 TO 2065)

At this time, the long term phase of the DMMP remains largely the same. For a complete discussion, please refer to Section 4.2 of the 2005 SR (see Appendix A). The most important option recommended is to reduce the volume of non-HARS suitable sediments from entering the harbor. By far the most costly, this effort, along with having adequate placement locations and/or processing/storage facilities, is paramount to achieving the goals outlined in the DMMP.

Placement at locations such as brownfields and other land remediation sites will continue to present challenges for the NYD and its partners. Challenges will become especially evident as these sites become developed and no longer require dredged material while the annual O&M volume continues or even increases over time. The identification of potential new sites, permitting issues, transportation, and environmental issues all contribute to the process of placement and have contributed to what the Corps and the RDT, among others, consider to be a matter of critical concern. The ability to process (as needed), store, transport, and place non-HARS suitable material in a timely fashion is vital to the overall environmental and economic health of the Port and the region. Within the next decade, the NYD and its partners will have to assess the various potential alternatives to ensure the continued safe and viable placement of the non-HARS suitable material.

By dividing future years into manageable increments, a fairly extensive period of additional evaluation, testing, and demonstration projects can be completed. Thus, decision-making and planning can occur with enough leeway so as not to jeopardize the Port's viability and the estuary's environmental recovery. The need to accommodate forecasted Port growth is achievable as long as dredged material management options can be brought on line fairly rapidly. This growth necessitates continued active planning and investigation throughout the life of the DMMP. The long-term health of the Port can also be ensured by applying innovative technologies, and by continuing to develop more traditional approaches, such as a public processing/storage facility or large volume placement sites, such as the Hazleton mine in eastern Pennsylvania. A public processing/storage facility could provide interim capacity while other options are brought online.

3.3 PUBLIC PROCESSING/STORAGE FACILITY

Over the last decade, regional dredged material managers have been considering the feasibility of developing additional facilities to handle non HARS suitable material. This facility would primarily be for public agency use, as an additional option to utilizing existing privately developed facilities. The interest in investigating the feasibility of developing such a facility arose out of concerns that the privately developed processing facilities may not be economically viable or sustainable in the long-term once the individual deepening contracts are complete, or when various large real estate development projects (*e.g.*, landfills and/or brownfields) exhaust their capacity for dredged material. In addition, as each facility is generally matched to a specific dredging contract, they often compete against one another. To reduce their economic risk, processors maintain relatively low through-puts, which can restrict dredging, especially if the same facility is used by multiple contractors.

The primary objective of a public/private facility would be to ensure an ample, reliable capacity, reasonable through-put and stable cost for managing non-HARS material. In doing so, the facility is also expected to foster greater upland placement of dredged material for beneficial uses and to assist small quantity generators that cannot currently afford to conduct necessary dredging because of the high cost of processing non-HARS suitable materials. In addition, there is a relative scarcity of reasonably priced fill material for grading in the Port area. This scarcity could be alleviated if the millions of cubic yards of dredged material removed from the Harbor could be economically converted to a safe and more readily usable material and stored until a specific need arose.

During economic investigations on the feasibility of a public processing facility, it became clear that a consistent, steady supply of dredged material was a key factor in keeping processing costs low (USACE 2006, 2007a and 2007b). As a result, the Port Authority, NYD and members of the NY/NJ RDT investigated the potential of lowering processing costs by creating storage capacity for pre-processed dredged material. A storage facility would provide a stockpile for feeding processing facilities when dredging operations could not provide enough material. Based on criteria developed in the preliminary economic studies and initial siting study (Lawler, Matusky and Skelly Engineers 2003), the NYD identified numerous potential sites (USACE 2007b). The NYD also evaluated different ownership options for a public processing and/or storage facility. Many opportunities exist via public-private partnerships for the public sector to become involved in the siting, construction, operation, management, and operation and maintenance of a processing or storage facility for non-HARS suitable material.

The NY/NJ RDT is currently reviewing the results of these studies so that a recommendation can be made. With increased understanding of the economics of processing and storage, the public sector will continue to work for cost-effective dredged material processing and placement.

3.4 DMMP IMPLEMENTATION UPDATES

To ensure that there is always sufficient capacity for the placement of dredged material from the Harbor, it is imperative to review past, current, and anticipated dredging needs and performance. This analysis forms the basis of successful implementation of the DMMP.

To facilitate this process, the NYD and its partners in managing dredged material meet regularly as part of the NY/NJ RDT to discuss project status and to communicate new opportunities and emerging technologies. The NY/NJ RDT reviews current and potential placement sites for both HARS and non-HARS suitable materials and provides recommendations regarding issues that may have a potential effect on the overall placement process.

The NY/NJ RDT also identifies volume requirements/projects for the current and future years and confirms available capacity/uses for all anticipated dredged materials. To incorporate the dredging needs of private venture projects in future updates, these updates will be provided through the use of an active website. The use of the internet will allow the public and dredged material managers access to useful updated information in order to better track the goals of the DMMP.

Detailed publications, such as this document, will be released to update and obtain input from the public on progress and new developments or to reflect substantial changes in sediment testing, policy or other factors that would alter current recommendations or their implementation.

In the event of a future shortfall of placement locations, the NYD, in cooperation with its partners, will identify necessary actions required to meet the shortfall consistent with the DMMP. The NYD will initiate those actions within its existing budget and authority to prepare additional sites and/or uses, or identify the appropriate agencies and/or entities to assume that responsibility. In order to undertake certain actions, it is likely that commitments in the form of cooperative agreements and/or other contractual arrangements will need to be formalized between NYD and the States, or as appropriate, among agencies, commercial developers, and other groups.

3.5 SUMMARY AND RECENT ACCOMPLISHMENTS

Great strides have been made in reaching the goals initially laid out in the 1999 DMMP IR, yet more work remains. Recently, the initial phase of the Elder's Point East Project, using HARS suitable material, was completed. This partial Jamaica Bay Island restoration not only helped to ensure that Elder's Point marsh remains, but will also serve as a test as to how the various construction methods worked and provide valuable information on best management practices for using dredged material for future marsh restorations. Plans are in process for moving to the next stage of Elder's Point, using HARS suitable material, as well as using dredged material to restore other marsh islands in Jamaica Bay. In addition, plans to beneficially use HARS suitable material for habitat restoration projects to restore degraded benthic habitat adjacent to Liberty State Park and shallow water habitat off of MOTBY in New Jersey have advanced beyond the conceptual phase to the design and construction phase.

Much work has been accomplished in furthering the beneficial use of HARS suitable materials, including the placement of almost 32 MCY of materials at the HARS (approximately 21 MCY between 1999 and 2004 and approximately 11 MCY between 2005-2007). At the same time, the NY/NJ RDT continues to work towards identifying non-HARS suitable material placement sites. Placement options are considered and discussed at the RDT meetings, and lines of communications between regulatory (i.e. permitting agencies) and potential users remain open.

Innovative technologies continue to be explored that have the potential to increase placement capacity and thus increase the amount of material suitable for HARS placement. For example, as part of the overall Sediment Decontamination Technology Demonstration Program (conducted by USEPA and NJDOT), pilot studies were conducted in support of the Lower Passaic River Restoration Project. Passaic River sediment was treated using thermal destruction and sediment washing technologies producing blended cement (Endesco Clean Harbors, 2007) and manufactured soil (BioGenesis Enterprises, 2007).

3.6 CONCLUSION

A great economic need exists to maintain and deepen navigation channels in the Port. Of equal importance is the environmental protection and restoration of the Harbor estuary. Based on an evaluation of many different factors (including non-Federal sponsor preference, environmental issues, cost, and reliability), several options for the management of dredged material have been combined to form a Recommended Plan to meet these needs.

Overall, the goal of the management process and constantly evolving Recommended Plan is to project dredged material placement needs far enough in the future so that the following is accomplished: 1) short term placement needs are not compromised; and 2) decisions for new sites and/or options are judiciously made and properly reviewed by both interested stakeholders and the public with sufficient lead time to move them to operational status when needed without delaying scheduled projects.

3.7 RECOMMENDATIONS

This DMMP – Update Report has been prepared to address existing Operations and Maintenance and the Harbor Deepening Project of the USACE for the Federal navigation projects in the Port with a consideration of Non-Federal needs. The NYD has considered numerous significant issues during the development of the DMMP and the finalization of the PEIS. These issues include environmental and economic concerns, engineering feasibility, and compatibility of the recommended options with the goals of the States, PANY/NJ, and other interested parties.

Since the completion of the 2005 SR, little has changed in the recommended plan, aside from escalating implementation costs. The assumptions and projections that were compiled for the 2005 SR have demonstrated, for the most part, to be accurate. The same holds true for the major assumptions of the 1999 DMMP IR.

The NYD recommends implementation of the preferred options identified in the Recommended Plan and development of contingency options if the preferred options cannot meet the projected dredging needs as outlined in the 2005 Status Report (see Appendix A, Table 3.1). Upon concurrence, this updated DMMP document will provide the context for the progression of individual projects. The plan of action that an approved DMMP sets forth leads to site-specific studies, and eventually, Project Cooperation Agreement(s) that are developed that lead a project into the construction phase.

The plan contained herein reflects the information available at this time and current USACE policies governing formulation of DMMPs. However, it does not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program or the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified at higher levels. Coordination with the States, as well as other agencies and interested parties, will continue during all aspects of the plan's execution and during the development of future implementation/update reports.

ANIELLO TORTORA
Colonel, U.S. Army
District Engineer

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U.S. Army Corps of Engineers
New York District

Appendix A:

2005 Update to the Dredged Material Management Plan
for the
Port of New York and New Jersey

August 2008

U.S. Army Corps of Engineers
New York District

Dredged Material Management Plan for the Port of New York and New Jersey

IMPLEMENTATION REPORT

2005 UPDATE

October 2005

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EXECUTIVE SUMMARY

The Port of New York and New Jersey (Port) must be dredged to maintain navigation and commerce estimated to generate about $25 billion annually in direct and indirect benefits to the region. Due to past and present pollution, managing dredged material from many areas of the Port became increasingly difficult since the early 1990s. This was due both to lack of management options and to the higher cost of the limited number of options available.

In September 1999, the United States Army Corps of Engineers (USACE) – New York District (NYD), prepared a Dredged Material Management Plan (DMMP) for the Port of New York and New Jersey (Port) and an accompanying draft Programmatic Environmental Impact Statement (PEIS). The DMMP identified the primary and contingency options needed to meet the dredging requirements of the Port through the year 2040 giving special emphasis to beneficial uses. This document updates data from the September 1999 DMMP, and forecasts future dredged material management volumes and management options through the year 2065. The USACE has been working with the lead agencies in the region, including the Port Authority of New York and New Jersey (PANY/NJ), United States Environmental Protection Agency (USEPA), New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Transportation, Office of Maritime Resources (NJDOT/OMR), New York Department of State (NYDOS), New York State Department of Environmental Conservation (NYSDEC), New York City Economic Development Commission (NYCEDC), and Empire State Development Corporation (ESDC) to update the DMMP and finalize the PEIS.

The New York/New Jersey Harbor (Harbor) encompasses approximately two-dozen separately authorized and maintained Federal navigation channels. These projects, which range in authorized depth from 8–50 feet, combined with privately operated berthing areas have historically generated 2–4 million cubic yards of dredged material annually from maintenance of required depths. Further, several of these channels are either under construction or in the planning phase for deepening in the upcoming years to accommodate larger vessels that will need to use the Port. The construction of these deeper channels will generate substantial amounts of dredged material. The DMMP Update seeks to identify options to manage the material generated from both the Federal and non-Federal maintenance and deepening of the Port through the year 2065.

The intent of the DMMP is to maximize the use of dredged material as a beneficial resource. As with the 1999 version of the DMMP, management options identified in this DMMP include alternatives to the historical practice of disposing of material solely as a waste product. The examination and inclusion of options that stress beneficial use and environmental protection/restoration is consistent with the Comprehensive Conservation and Management Plan (CCMP) of the New York/New Jersey Harbor Estuary Program (HEP). Dredged material can be used beneficially through a wide variety of preferred and contingency management options . Potential management options utilized in the DMMP include:

- **Sediment Reduction** – Four types of sediment management strategies are under investigation in the Harbor: watershed sediment management controls, channel design optimization, advanced maintenance dredging, and structural modification.

- **Contaminant Reduction** – With the leadership of the states of New York and New Jersey (States), a multi-million dollar, multi-year data collection and analysis program is now underway to identify and track down the sources of pollution that are contaminating dredged material.
- **Historic Area Remediation Site (HARS)** – Dredged material that meets HARS placement criteria is being used beneficially to remediate the HARS (previously impacted ocean disposal area) and will likely require decades to fully complete.
- **Habitat Creation, Enhancement, and Restoration** – Several different habitat applications are included in the DMMP, including creating artificial reefs, creating wetland or shallow water habitat, and creating shellfish and bird habitats.
- **Land Remediation** – Using amended (or treated) dredged material, several landfills and brownfields in the region are being remediated by private companies. Demonstrations of the ability to use this material to remediate abandoned mines also have been performed.
- **Processing Facilities** – The economic feasibility of constructing and operating a public processing facility to process HARS unsuitable material is currently being investigated.
- **Other Beneficial Uses** –Other beneficial use management options being examined are beach nourishment, construction material, and shoreline protection.
- **Decontamination Technologies** – The USEPA and New Jersey have been and are continuing to demonstrate several innovative dredged material treatment methods. The products of the treatment have a wide array of potential uses (*e.g.*, construction material, clean fill).
- **Containment Options –** While not currently needed, aquatic disposal sites remain under consideration as a contingency option should the region's management needs exceed available placement sites. The aquatic sites would be located in existing impacted areas and near to the dredged material sources to minimize adverse environmental impacts.

The main goal of this DMMP is to develop a regionally supported, comprehensive plan to meet all the dredged material management needs for the Port through the year 2065. To achieve this goal, the USACE has established two primary objectives for the DMMP:

1. **Environmental Objective – Maintain and improve the environmental health of the estuary in which the Port is located; and,**
2. **Economic Objective – Maximize and expand the use of the Port.**

The DMMP therefore encompasses two objectives that affect the evaluation and selection of dredged material management options for inclusion in the Recommended Plan in this report.

The NYD has considered numerous significant factors in developing the DMMP Recommended Plan. These factors include environmental and economic concerns, engineering feasibility and compatibility of the recommended options with the goals of the States, PANY/NJ, and other interested parties.

The accompanying National Environmental Policy Act (NEPA) document, the final PEIS, addresses the full range of plans, including the Base Plan, the Environmentally Preferred Plan, and the Recommended Plan. This range of alternatives is retained in the final PEIS. However, the Implementation Report focuses on the Recommended Plan because after extensive meetings with Port Partners, the combined elements of this plan emerged as the most appropriate way to proceed to accomplish the economic and environmental goals of the Port.

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State of New Jersey

Richard J. Codey
Acting Governor

Department of Environmental Protection
PO Box 402
Trenton, NJ 08625-0402

Bradley M. Campbell
Commissioner
Tel. # (609) 292-2885
Fax # (609) 292-7695

August 26, 2005

Colonel Richard Polo, District Engineer
Department of the Army
New York District, Corps of Engineers
Jacob K. Javits Federal Building
New York, NY 10278-0090

Dear Colonel Polo:

I am writing in response to Mr. Frank Santomauro's July 22, 2005 letter notifying the Department of the New York District's intention to publish the Final 2005 Dredged Material Management Plan (DMMP) for the NY/NJ Harbor. USACE has requested our support of the 2005 DMMP update, and to advocate the implementation of the dredged material management options recommended in the document.

Members of my staff have participated in the development of the DMMP since 1999. As such, we are pleased to see that the document is to be finalized, and that it reflects each agency's commitment to the beneficial use of dredged material emanating from the harbor. We look forward to seeing future projects in the harbor utilizing the beneficial use strategies identified. We will continue to work with the USACE to implement the recommendations in the plan, and be an active member in any updates of the DMMP.

Should you have any questions, please feel free to contact me or contact Suzanne Dietrick, of the Office of Dredging and Sediment Technology at (609) 292-8838.

Sincerely,

Joanna Dean Samson for

Bradley M. Campbell
Commissioner

State of New Jersey

DEPARTMENT OF TRANSPORTATION
1035 Parkway Avenue
PO Box 600
Trenton, New Jersey 08625-0600

Richard J. Codey
Acting Governor

John F. Lettiere
Commissioner

Please Reply To:
NJDOT
Office of Maritime Resources
PO Box 837
Trenton, NJ 08625-0837
Phone: 609-530-4770
Fax: 609-530-4860

August 12, 2005

Mr. Frank Santomauro
Chief, Planning Branch
U.S. Army Corps of Engineers
26 Federal Plaza, Room 1937
New York, NY 10278-0090

SUBJECT: DREDGED MATERIAL MANAGEMENT PLAN

Dear Mr. Santomauro:

We are pleased to see that the Dredged Material Management Plan for the Port of New York and New Jersey has been finalized. The New York District is to be commended on their leadership and in the creativity of the approach and the innovative partnerships that have made this groundbreaking document possible.

The State of New Jersey, through its Office of Maritime Resources, has been intimately involved in the development of innovative solutions for the environmentally sensitive and economically sustainable management of dredged material since the early 1990s. As partners in the Regional Dredging Team, we fully support this Dredged Material Management Plan and the process that has been outlined to ensure its success in both near and long term. We are confident that following this plan will ensure the continued maintenance and development of our maritime transportation infrastructure that is critical to our economic well being in New Jersey.

You can be assured that the Department of Transportation will continue to actively pursue the beneficial use of dredged material in the Port of NY and NJ and throughout the State. Our partnership with the USEPA and USACE in the decontamination of sediment has resulted in the recent construction of an environmental manufacturing facility on the Raritan River. We are currently building on the lessons learned in the Port to develop the processes and information management infrastructure necessary to bring dredging relief to our shore and Delaware River communities.

Together we hope to further the efforts started with the DMMP to change the public perception of sediments from "spoil" to resource.

Sincerely,

Richard J. Gimello
Executive Director
Intermodal Services

New York State Department of Environmental Conservation
Region 2: Office of the Regional Director
47-40 21ST Street, Long Island City, NY 11101-5407
Phone: (718) 482-4949 • **FAX:** (718) 482-4954
Website: www.dec.state.ny.us

Denise M. Sheehan
Acting Commissioner

August 18, 2005

Re: Dredged Material Management Plan Update

Frank Santomauro, Chief
Planning Division CENAN-PL
Corps of Engineers, New York District
Jacob K. Javits Federal Building
New York, NY 10278-0090

Dear Mr. Santomauro:

The New York State Department of Environmental Conservation (NYSDEC) recently learned that the US Army Corps of Engineers' New York District will be releasing the 2005 Dredged Material Management Plan (DMMP) for the New York New Jersey Harbor later this summer.

As a key partner in the management of dredged material for the NY/NJ Harbor, NYSDEC staff made significant contributions to the development of the plan and provided critical input on the current and anticipated dredged material management needs of the Harbor. As a participant of the Regional Dredge Team DMMP subgroup, NYSDEC has reviewed and provided comment on the DMMP reports leading to the final plan.

The 2005 Dredged Material Management Plan (DMMP) for the New York New Jersey Harbor is a comprehensive guide for managing dredged material in the coming years and the New York State Department of Environmental Conservation supports its recommendations. Resources allowing, the New York State Department of Environmental Conservation will continue to work as a partner with the USACE New York District to implement and provide support for future updates.

Sincerely,

Thomas C. Kunkel
Regional Director

file/Chron/P-CHRON

9560

THE PORT AUTHORITY OF NY & NJ

R.M. Larrabee
Director
Port Commerce Department

August 22, 2005

Colonel Richard Polo
Commander and District Engineer
US Army Corps of Engineers
Jacob Javits Federal Building
26 Federal Plaza
New York, NY 10278-0090

Dear Colonel Polo:

As a key partner in the management of dredged material for the New York/New Jersey Harbor, the Port Authority is pleased to learn that the final 2005 Dredged Material Management Plan (DMMP) is ready to be published. This document will serve as a critical guide for the proper treatment and/or placement of the material removed during the Harbor Deepening Project, the ongoing Arthur Kill 41/40 Project and the long-term maintenance of the completed channels and berths.

The Port Authority recognizes the professionalism and persistence of the multi-agency staffs that participated on the DMMP subgroup of the Regional Dredging Team and the leadership of the Corps in bringing this document to completion. The Port Authority supports the recommendations of the DMMP, in particular the development of a watershed based sustainable sediment management program.

Within our budget and authority provisions, the Port Authority will continue to serve as a partner with all the stakeholders as we move forward with the successful implementation of this plan. Additionally, the Port Authority will continue to provide the necessary support for future updates of the DMMP.

Sincerely,

R.M. Larrabee
Director
Port Commerce Department

225 Park Avenue South, 11th Floor
New York, NY 10003
T: 212 435 4218 F: 212 435 4201
rlarrabee@panynj.gov

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

AUG 2 2 2005

Mr. Frank Santomauro
Chief, Planning Division
U.S. Army Corps of Engineers
Jacob J. Javits Federal Building
New York, New York 10278-0090

Dear Mr. Santomauro,

I am writing to express the U.S. Environmental Protection Agency, Region 2's, (EPA) support of the U.S. Army Corps of Engineers (USACE) "Final 2005 Dredged Material Management Plan (DMMP) for the Port of New York and New Jersey." The Final 2005 DMMP is the result of a consensus by the Port community that a DMMP should be a "living" document which is updated periodically to reflect the most current information on dredged material volumes, alternatives, best management practices and technologies. Only through periodic updates can we, the Port community, be assured that dredged material is being managed in the most environmentally and economically feasible manner.

As a partner in this endeavor, EPA is pleased that dredged material will continue to be utilized beneficially. Since the dredged material disposal crisis of the early 1990's there have been great strides in the management of dredged material. EPA looks forward to future implementation of additional beneficial use options and supports those alternatives which have a demonstrated benefit to the environment.

I look forward, and am committed, to maintaining a strong partnership with USACE, the States of New York and New Jersey, the Port Authority of New York and New Jersey, the New York City Economic Development Corporation, and other Port stakeholders involved in dredged material management. Thank you for the continued opportunity to participate in the direction and development of the Dredged Material Management Plan for the Port. Should you have any questions, please feel free to contact me at 212-637-3736 or have your staff contact Patricia Pechko at 212-637-3796.

Sincerely,

Kevin Bricke
Deputy Director
Division of Environmental Planning and Protection

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ABBREVIATIONS AND COMMONLY USED TERMS

BMPs	Best Management Practices
BUD	Beneficial Use Determination
CAD	Confined Aquatic Disposal (Subaqueous Aquatic Site)
CARP	Contaminant Assessment and Reduction Project
CCMP	Comprehensive Conservation Management Plan
CDF	Confined Disposal Facility
CFR	Code of Federal Regulations
CPIP	Comprehensive Port Improvement Plan
CY	Cubic Yard
DDT	Dichloro-diphenyl-trichloroethane
Dioxin	2,3,7,8 Tetrachloro-dibenzo-dioxin
DMMIWG	Dredged Material Management Integration Work Group
DMMP	Dredged Material Management Plan for the Port of New York and New Jersey
DO	Dissolved Oxygen
EA	Environmental Assessment
e.g.	*Exempli Gratia* – For Example
EIS	Environmental Impact Statement
ER	Engineer Regulation
ESDC	Empire State Development Corporation
FHWA	Federal Highway Administration
Harbor	New York and New Jersey Harbor
HARS	Historic Area Remediation Site
HEP	New York/New Jersey Harbor Estuary Program
HDP	New York/New Jersey Harbor Deepening Project
HRE	Hudson-Raritan Estuary Ecosystem Restoration Study
HRF	Hudson River Foundation for Science and Environmental Research, Inc.
i.e.	*Id Est* – That Is
KVK	Kill Van Kull
MCY	Million Cubic Yards
MOA	Memorandum of Agreement
MOTBY	Military Ocean Terminal, Bayonne, New Jersey
MPRSA	Marine Protection, Research and Sanctuaries Act
N/A	Not Applicable or Available
NBCDF	Newark Bay Confined Disposal Facility
NEPA	National Environmental Policy Act
NJ	New Jersey
NJDEP	New Jersey Department of Environmental Protection
NJDOT/OMR	New Jersey Department of Transportation / Office of Maritime Resources
NJMC	New Jersey Meadowlands Commission
NPS	National Park Service
NOAA	National Oceanic and Atmospheric Administration
Non-HARS	Historic Area Remediation Site unsuitable
NOI	Notice of Intent

ABBREVIATIONS AND COMMONLY USED TERMS
(CONTINUED)

NY	New York
NYC	New York City
NYCEDC	New York City Economic Development Corporation
NYD	United States Army Corps of Engineers, New York District
NYSDEC	New York State Department of Environmental Conservation
PA	Pennsylvania
PADEP	Pennsylvania Department of Environmental Protection
PANY/NJ	Port Authority of New York and New Jersey
PCB	Polychlorinated biphenyl
PEIS	Programmatic Environmental Impact Statement
Port	Port of New York and New Jersey
ppb	Parts per billion
PPF	Public Processing Facility
RCRA	Resource Conservation and Recovery Act
REMAP	Regional Environmental Monitoring and Assessment Program
REMOTS	Remote Ecological Monitoring of the Sea Floor
ROD	Record of Decision
SAV	Submerged Aquatic Vegetation
States	States of New York and New Jersey
TEF	Testing Evaluation Framework
TEU	20-foot Equivalent Unit
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WRDA	Water Resources Development Act
YR	Year

ABBREVIATIONS AND COMMONLY USED TERMS
(CONTINUED)

Anchorage – An area designated by the USCG for the anchoring of ships in the Harbor.
Ambient Air – The surrounding local air.
Anadromous – An organism that spends most of its life in the ocean, then returns to spawn in freshwater.
Best Management Practices – Practices designed to prevent or reduce pollution.
Bioaccumulation – The process whereby chemicals are accumulated in living biological tissues.
Bioavailability – The degree to which a contaminant is available for uptake or absorption by an organism.
Biodiversity – The variety of living creatures in a given area.
Biota – The plant and animal life of a particular region.
Bulkhead – A rigid vertical retaining wall built along a waterfront used to retain fill material or for erosion control.
Community – A distinctive collection of species occurring together in a particular habitat.
Cumulative Impacts – Collective impacts on the environment that result from separate, individual actions that collectively are significant.
Dioxin – 2,3,7,8-tetrachloro-dibenzo-dioxin (2,3,7,8-TCDD). Dioxin is a by-product in the manufacture of chlorinated phenols and phenoxyherbicides, chlorine bleaching of paper pulp, and combustion of chlorine-containing waste. It is extremely toxic, producing a variety of symptoms including reproductive effects, chloracne, immunotoxicity, liver toxicity, and cancer. The term "dioxin" also may refer to a class of compounds with structures similar to 2,3,7,8-TCDD, but with varying degrees of chlorination.
Dissolved Oxygen – A measure of the amount of oxygen available for biochemical activity in a given amount of water. Adequate levels of dissolved oxygen (DO) are needed to support aquatic life.
Dredging – The removal of bottom sediments in order to deepen or widen a waterway.
Endangered Species – A plant or animal that is in danger of extinction throughout all or a significant portion of its range.
Enhancement – Activities conducted in existing marine, aquatic, estuarine, or riparian areas, which improve one or more of the ecological functions and/or the biodiversity of existing, but degraded or impoverished, habitats.
Environmental Impact Statement – A statement of the environmental effects of a proposed major Federal action and its alternatives.
Essential Fish Habitat – Defined by Law as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity."
Estuary – A semi enclosed coastal embayment where fresh and saltwater mix.
Fines – The category of sediment particles that includes silts and clays.
Furans – A class of chemicals structurally similar to dioxin, except that they lack one oxygen.
GIS (geographic information system) – A database designed to handle geographic data as well as a set of computer operations that can be used to analyze the data.
Habitat – The area where a plant or animal lives and grows under natural conditions.
Hydrodynamics – The motion and action of water.
Inshore – Coastal marine and estuarine environments.

ABBREVIATIONS AND COMMONLY USED TERMS (CONTINUED)

Littoral Zone – The region between the high and low tides along the shore, alternately covered by water and exposed to the air.
Mean High Water – The average elevation of the water at high tide.
Mean Low Water – The average elevation of the water at low tide.
Mean Sea Level – The average elevation of the sea surface level.
Megainvertebrate – For the purpose of this report, invertebrate species greater than ½ inch.
Mitigation – A means of sequentially avoiding impacts, minimizing impacts, and compensating for remaining unavoidable impacts.
National Environmental Policy Act (NEPA) – A law passed in 1969 to encourage productive and enjoyable harmony between people and their environment.
New York Bight – An area of the Atlantic Ocean between New York Harbor, the New Jersey shoreline to Cape May, the Long Island shoreline to Montauk Point, and extending out to the edge of the continental shelf.
No-Action Alternative – The most likely condition expected to persist or develop in the future if existing practices continue unchanged.
Notice of Intent (NOI) – A notice in the Federal Register of intent to prepare an environmental impact statement on the proposed action.
Nutrient – A substance that promotes growth or provides energy for biological processes; common nutrients are phosphate, nitrate, calcium, and potassium.
Ocean Disposal – Disposal of dredged materials into territorial seas and/or ocean waters, as regulated by the Marine Protection, Research and Sanctuaries Act (MPRSA).
Ocean Waters – Those waters of the open seas lying seaward of the baseline from which the territorial sea is measured, as provided for in the Convention on the Territorial Sea and the Contiguous Zone.
Practicable – Capable of being effected, done, or put into practice; feasible.
Record of Decision (ROD) – A document in which a deciding official states the alternative that will be implemented from a prepared EIS.
Remediation Material – Dredged material that meets current Category I standards and will not cause significant undesirable effects including through bioaccumulation.
Restoration – Re-establishment of marine, aquatic, estuarine, or riparian resource characteristics and function(s) at a site where they have ceased to exist, or exist in a substantially degraded state.
Salt Marsh – Coastal grassland periodically drained and flooded by tidal waters and characterized by a muddy substrate.
Scoping – The ongoing process used to determine public opinion, receive comments and suggestions, and determine issues during the environmental analysis process.
Sediment – fine particles of rock debris or organic materials deposited by wind, water, or ice.
Submerged Aquatic Vegetation (SAV) – Rooted, vascular, flowering plants that, except for some flowering structures, live and grow below the water surface.
Substrate – Material making up the base on which an organism lives or to which it is attached.
Suspended Particle – Sediment or organic matter within the water column.
Terrestrial – Pertaining to the upland environment.

ABBREVIATIONS AND COMMONLY USED TERMS (CONTINUED)

Territorial Seas – The belt of seas measured from the baseline (the line of mean sea level and the imaginary line between Rockaway Point and Sandy Hook) along that portion of the coast which is in direct contact with the open sea, in the line marking the seaward limit of inland waters, and extending seaward a distance of 3 miles.

Threatened Species – Those plants and animal species that may become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

Trophic Level – The feeding position occupied by a given organism in a food chain, including producers, herbivores or primary consumers, and secondary and tertiary consumers (carnivores).

Turbidity – Reduced visibility in water due to the presence of suspended particles.

Watershed – The entire region drained by a waterway.

Wetlands – Any non-tidal or tidally influenced areas between upland and open water meeting state or Federal criteria (typically the presence of hydric soils, hydrologic indicators, and hydrophytic wetland vegetation) but including littoral zones, tidal flats and mudflats.

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1 INTRODUCTION

1.1 WHAT IS A DREDGED MATERIAL MANAGEMENT PLAN?

United States Army Corps of Engineers (USACE) regulations (Engineer Regulation [ER] 1105-2-100 Appendix E, section 15) (USACE 2000) requires for each of its navigation projects a Dredged Material Management Plan (DMMP) that demonstrates sufficient dredged material disposal capacity for a minimum of 20 years. A DMMP must identify how much new material will be dredged during deepening work, how much material will be dredged to maintain the Federal channel(s), and how that dredged material will be managed in an economically and environmentally sound manner. The plan is intended to ensure that Federal navigation projects can be maintained in an environmentally acceptable, cost-effective manner, thereby justifying continued investment of Federal funds.

Figure 1-1. Port of New York & New Jersey

This DMMP for the Port of New York/New Jersey (the Port) is an update from the previously released DMMP – Implementation Report, dated September 1999. As in the previous DMMP, this DMMP goes beyond the basic goal of maintaining Federal navigation channels in the Port by including private and local/state dredging needs as well. In this manner, the NYD strives to develop a regionally supported, comprehensive plan to meet the dredged material management needs for the Port.

The Port does not exist as a discrete feature, but within the confines of the estuary. Because the estuary is a diverse and vital natural resource that is invaluable to the region, the NYD and it's partners in managing dredged material are committed to maintaining and enhancing the Port while improving the environmental health of the estuary. The economic objective of the DMMP is to maximize and expand the use of the Port and the environmental objective is to maintain and enhance the estuary in which the Port is located (Figure 1-1). Therefore the goal of the DMMP has two objectives that affect the evaluation and selection of dredged material management options for inclusion in the Recommended Plan.

1.2 WHY IS DREDGING NECESSARY?

The New York/New Jersey Harbor (Harbor) is naturally shallow (approximately 19 feet) in many locations, which restricts waterborne transportation to and from the ocean. Periodic dredging to maintain or increase channel depth is essential to maintain safe navigation channels in the Port for oil tankers, bulk vessels, and container ships, some of which require depths up to 50 feet. Past economic analyses performed by the USACE New York District (NYD) have demonstrated a need not only to maintain many of the Federal channels in the Port, but also to deepen certain channels in the Port to better accommodate the present and projected future shipping fleets.

The Harbor is a vital economic and environmental resource both regionally and nationally. According to the Port Authority of New York and New Jersey (PANY/NJ), the Port directly or indirectly supports a total of 229,000 jobs resulting in $25 billion in economic activity for the region. The Port serves the largest regional market in the country, and mobilizes nearly $100 billion in exports and imports. During 2002, total loaded and empty container volumes handled at the Port's container terminals, totaled 3,749,014 20-foot equivalent units (TEUs), a 13% increase over the number of containers in 2001. The NYD projected in 1999 that the volume of containers would increase to over 4 million TEUs by 2010, and double again by 2030 (USACE 1999a). If the Port is able to maintain and improve its system of channels to meet current and anticipated shipping needs, the projected growth will provide significant additional jobs.

Though the economic benefits justify dredging, there are other less tangible, but still meaningful benefits to be derived from maintaining the Port that are not included when calculating the economic benefits. For example, if the Port could not accommodate modern shipping vessels, transportation of goods to the region in trucks from other Ports would increase. Maintaining the Port precludes the increased air pollution and wear and tear on the infrastructure that would result from increased regional truck transportation. In areas where contaminated sediments are deposited, dredging navigation channels lessens the Harbor's contaminant burden. In addition, the use of suitable dredged material to remediate and restore degraded upland and aquatic areas has the potential to provide substantial environmental benefits.

1.3 WHAT IS DREDGED MATERIAL?

"Dredged material" is naturally accumulated sediment, or existing rock, that is excavated, or *dredged*, from the bottom of channels, berthing areas, and other navigation facilities to create or maintain sufficient depth for safe and efficient vessel operation. In the Port, material dredged from the maintenance of an existing channel can vary between sandy to silt/clay material depending on where in the Port the dredging occurs. Material dredged from the construction or deepening of a channel can also contain materials such as glacial till, clay, or bedrock, again depending on where in the Port the dredging occurs.

Much of the dredged material addressed in this DMMP contains contaminants, as does sediment and soil throughout the Harbor[1]. These contaminants enter the waterways from a number of

[1] Although contaminants may be present, dredged material generally has not been found to classify as hazardous or toxic waste as stipulated in the Federal Resource Conservation and Recovery Act (RCRA) Subtitle C. Dredged

different sources, many of which originate outside the Harbor (including upland sources). While the concentrations of contaminants in some of the dredged material are low or non-detectable, a substantial portion of the material does not pass current ocean placement protocols, for ocean placement at the Historic Area Remediation Site (HARS). (The HARS is an area in the New York Bight Apex designated by the United States Environmental Protection Agency, Region 2 (USEPA), for the purpose of remediating adverse impacts from past ocean disposal practices. (See Section 2.3.1 HARS for more information.) Failing this evaluation indicates that dredged material may result in unacceptable biological effects in marine test organisms and may have an unacceptable ecological/environmental effect. Materials failing evaluation have been and continue to be excluded from placement at the HARS.

Fortunately, a broad range of sediments has been found to be suitable for use as remediation material at the HARS. These materials include sand, silt, glacial till, and clay. Because the HARS is a remediation site, the placement of suitable cap material at the HARS is considered a beneficial use of dredged material. However, as stipulated in 40 Code of Federal Regulations [CFR] Section 227.16, all potential users of the HARS must first demonstrate that there is no other alternative available for utilizing the material beneficially at a reasonable cost.

In the event that dredged material is tested and found unsuitable for placement at the HARS, additional testing may be required to determine its suitability for placement elsewhere, particularly if the alternative site(s) are upland since the contaminant pathway risks of upland sites are considerably different. Material unsuitable for placement at the HARS and/or intended to be managed elsewhere would be tested under protocols and criteria specifically designed for the other management option(s) chosen or under consideration. It is important to note that dredged material can only be placed in the ocean when no practicable alternative exists. Only material proposed for ocean disposal is required to be tested under ocean disposal protocols.

Dredged material is thus determined to be HARS suitable or HARS unsuitable (i.e., Non-HARS). These broad categories are used to distinguish between the two main types of dredged material that are included in the DMMP.

1.4 HOW MUCH DREDGED MATERIAL DOES THE PLAN NEED TO MANAGE?

The DMMP is intended to manage all planned maintenance material, Federal and non-Federal, as well as material that may be generated from Federal and non-Federal deepening projects. Although Federal regulations require that a DMMP only demonstrate sufficient capacity for a minimum of 20 years (USACE 2000), to keep this DMMP in line with the New York/New Jersey Harbor Deepening Project (HDP), a 60-year planning horizon was selected: 2005–2065. The overall volume of material (maintenance + deepening) that the DMMP must manage between 2005 and 2065 is currently estimated at about 195 million cubic yards (MCY), including 101 MCY of HARS unsuitable material, 89 MCY of HARS suitable material, and 5 MCY of rock (Table 1-1). Of this overall total, 76% is estimated as maintenance material and 24% is projected to be deepening material. The average annual maintenance volume is calculated to be 2.44 MCY from 2005 through 2065, which equates to 0.89 MCY of HARS

material found to be hazardous as defined in RCRA would not be managed under the DMMP, but regulated by the responsible agencies pursuant to the appropriate statutes.

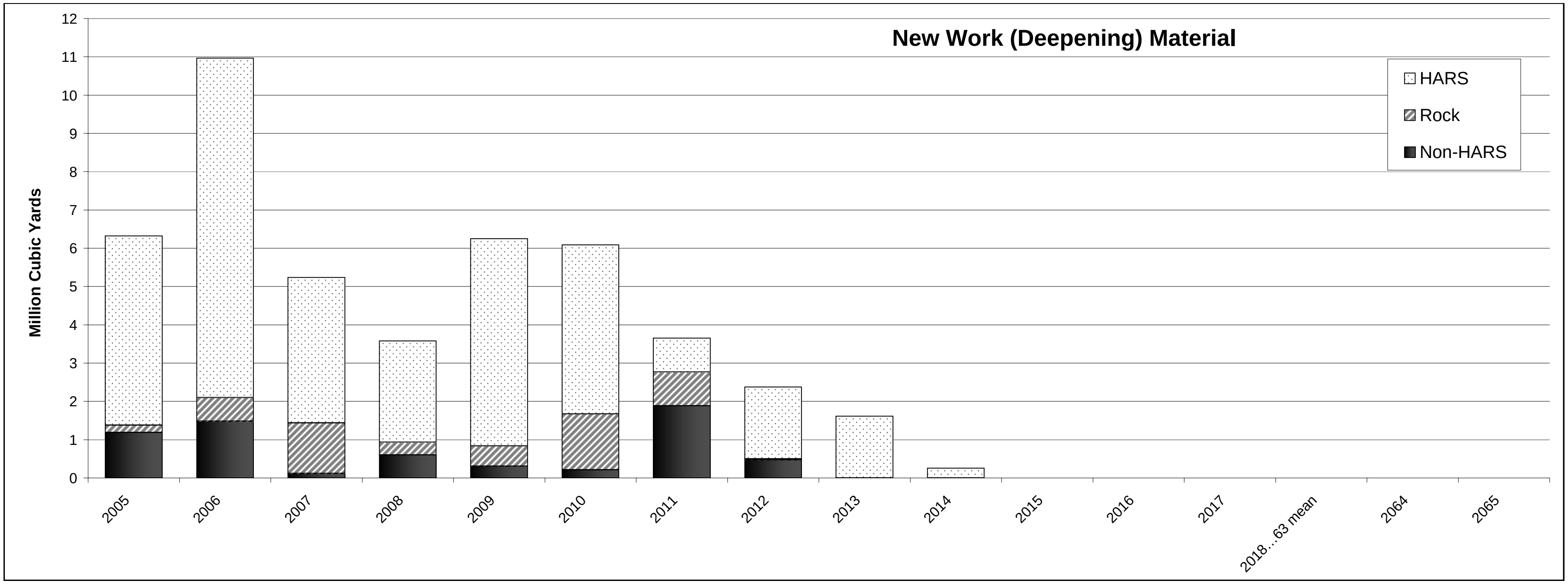
suitable and 1.55 MCY of HARS unsuitable maintenance material. These values assume no changes in the out-years due to contaminant reduction or changes in HARS testing protocols. The average annual deepening volume is calculated to be 4.63 MCY from 2005 through 2014 for HARS suitable, rock, and HARS unsuitable material. Table 1-2 provides a summary of the volume projections for the DMMP.

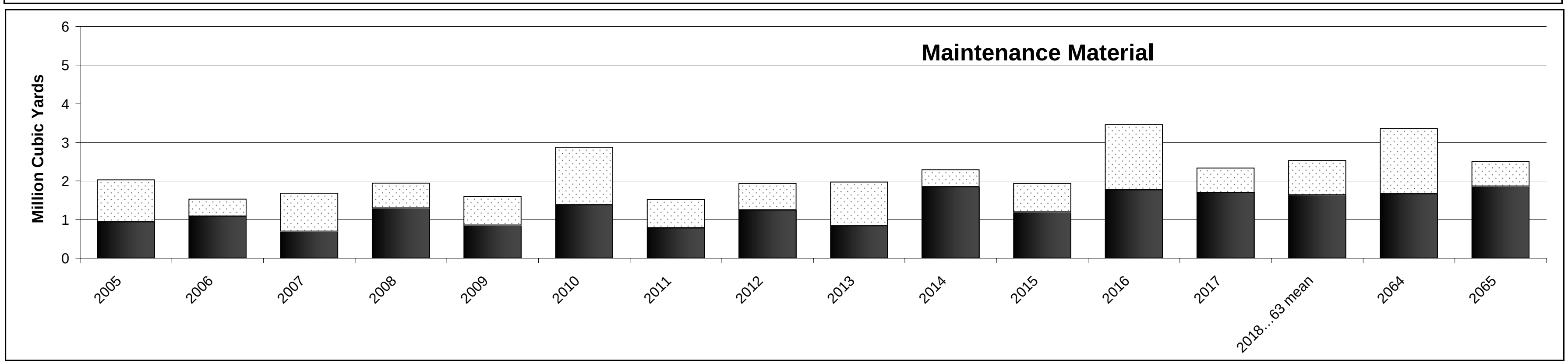
Annual Federal and non-Federal maintenance volumes used in the DMMP have been averaged based on past dredging activities and a survey of needs and plans of past and current users. This needs survey is considered a fairly reliable estimate of annual maintenance volumes through the next few years, although it does not account for possible constraints such as funding limitations, and placement site availability. Projections become less reliable beyond a few years, because they require projecting future sedimentation rates, which are difficult to predict. Maintenance needs have been adjusted to include projected increased maintenance dredging due to increased sedimentation, which will result from the present and planned deepening of selected channels in the Port. Several measures to reduce sedimentation in the channels are currently being investigated and are addressed in Section 2.1, Sediment Reduction. With respect to the sediments entering the Harbor from the watershed, land use decisions can affect the amount of suspended sediment in the Harbor water. Although both states have implemented watershed management controls, the effects of their implementation are difficult to assess and remain largely unknown at this time.

To accommodate larger and deeper draft vessels, construction is underway to deepen the Kill Van Kull (KVK) and Newark Bay Federal channel to 50 feet, the Port Jersey Channel to between 44.5 and 53.5 feet, and the Arthur Kill (AK) Channel to between 41 and 50 feet. The NYD also is preparing to further deepen the Anchorage and Bay Ridge channels in the Harbor to 50 feet and the Ambrose Channel to 53 feet, as recommended by the HDP (USACE 1999a). Further deepening will achieve the transportation efficiency needed to meet the forecast demand for imported and exported containerized goods in the region.

Tables 1-1 and 1-2 present volume projections for deepening and maintenance dredging material. Current estimates project that for the period between 2005 and 2065, approximately 64% of the dredged material from Federal and non-Federal maintenance activities will be unsuitable for placement at the HARS (Table 1-2), assuming no reduction in future sediment contaminant levels. However, a decline in the future level of sediment contamination is expected from ongoing and proposed contaminant reduction efforts in both New York (NY) and New Jersey (NJ). If successful, a contaminant reduction program could substantially reduce the future volumes of HARS unsuitable material, thereby allowing less costly beneficial use options to be utilized. This program, and its consequences for managing dredged material, is discussed in more detail in Section 2.2, Contaminant Reduction.

Table 1-1. Dredged Material Management Plan Volume Projections





Volume Projections (Million Cubic Yards [MCY])

Material Type		Calendar Year																Short-Term 2005 - 2014 Total	Long-Term 2015 - 2065 Total	Project 2005 - 2065 Total
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018…63 mean	2064	2065			
New Work (Deepening)																				
	HARS	4.94	8.87	3.80	2.65	5.41	4.41	0.89	1.88	1.61	0.26	0.00	0.00	0.00	0.00	0.00	0.00	34.72	0.00	34.72
	Rock	0.19	0.62	1.32	0.33	0.53	1.46	0.88	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.35	0.00	5.35
	Non-HARS	1.19	1.48	0.12	0.60	0.31	0.22	1.88	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.27	0.00	6.27
Maintenance																				
	HARS	1.09	0.44	0.99	0.64	0.74	1.49	0.74	0.69	1.13	0.44	0.74	1.69	0.64	0.88	1.69	0.64	8.39	45.94	54.33
	Non-HARS	0.94	1.09	0.69	1.30	0.85	1.38	0.79	1.25	0.84	1.85	1.20	1.77	1.69	1.64	1.67	1.86	10.99	83.71	94.69
TOTAL		**8.36**	**12.50**	**6.92**	**5.52**	**7.84**	**8.96**	**5.18**	**4.31**	**3.58**	**2.55**	**1.94**	**3.46**	**2.33**	**2.52**	**3.36**	**2.50**	**65.72**	**129.65**	**195.37**

Table 1-2. Summary of Dredged Material Management Plan Volume Projections

Material Type	Total Volumes (Cubic Yards [MCY])	Percent of Total by Type of Work	Percent of Total by Total Volume	Average Annual Volume (MCY)
Deepening (New Work) [1]	**46.34**	**100%**	**24%**	**4.63**
HARS	34.72	75%	18%	3.47
Rock	5.35	12%	3%	0.54
Non-HARS	6.27	14%	3%	0.63
Maintenance	**149.02**	**100%**	**76%**	**2.44**
HARS*	54.33	36%	28%	0.89
Non-HARS*	94.69	64%	48%	1.55
TOTAL	**195.37**			

* Assumes no changes in out-years due to contaminant reduction or changes in HARS testing protocols.

1. Deepening (New Work) in the Port is anticipated to be completed by 2014, therefore the average annual volume listed represents this 10-year period only.

Dredging associated with remediation and restoration also will be included in the DMMP. The specific amount of dredging associated with planned remediation and restoration activities are largely unknown at present. However, future updates of the DMMP will account for this material as these activities proceed.

There is a strong need to develop and include suitable alternative management options to the use and remediation of the HARS in the DMMP, especially if future HARS suitable volumes are increased by a successful contaminant reduction program. The current large amount of rock (5 MCY) and HARS suitable material (89 MCY) estimated in the DMMP (Tables 1-1 and 1-2) is the direct result of the deepening projects, which generally remove deeper sediments that have not been exposed to contaminants.

Testing for HARS suitability requires substantial funds and time to complete, and the results are valid for a limited period of time. Most of the estimates generated in the DMMP are based upon the latest available sediment geotechnical information and past test results from in and around the identified dredged areas. Consequently, while the DMMP makes projections and plans for future sediment suitability, the formal determinations made on any specific project, contract or permit action will rely solely upon the tests and evaluations performed prior to the proposed dredging and placement action.

Conversely, the laws, regulations, and testing protocols that determine what material is suitable for placement at the HARS may also become more (or less) restrictive/protective in the future to reflect the most recent scientific advancements (see Section 2.3.1 HARS). Changes such as these also could effect the long-term projections for the suitability of material for placement at the HARS.

1.5 HOW WILL DREDGED MATERIAL BE MANAGED?

The dual goals of dredging the naturally shallow Port while restoring and preserving the estuary were identified in the 1999 draft of the DMMP – Implementation Report (USACE 1999b). The management options identified in that Implementation Report represented alternatives to the historical practice of placing most dredged material in the ocean. This movement away from ocean disposal of dredged material (as opposed to remediating the ocean site with suitable material) is consistent with the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA). MPRSA permits the use of a designated ocean disposal site only if there is a demonstrated need to dredge and no practicable alternative exists (40 CFR Section 227). The examination and inclusion of non-ocean options (including other aquatic options) that stress beneficial use and environmental protection/restoration is also consistent with the Comprehensive Conservation and Management Plan (CCMP) of the New York/New Jersey Harbor Estuary Program (HEP), which recommends that dredged material be used in a beneficial manner and disposed of only when it cannot practicably be used beneficially.

In identifying options evaluated in the DMMP, the preference is for options that best manage dredged material as a resource, such as the following:

1. Reduce the volume of material needing to be dredged through sediment reduction, watershed management, etc.
2. Reduce the level and/or bioavailability of contaminants in dredged material (decontamination, hot spot dredging, and remediation) through new source reduction and the clean up of existing contaminated sediments (non-navigational dredging).
3. Use dredged material in a beneficial manner (environmental restoration/ remediation and construction/transportation projects).
4. Dispose only material that cannot feasibly be used beneficially.

Many factors must be considered in evaluating the management options in the DMMP. Factors include environmental impacts (positive and negative), economic benefits and costs, availability, capacity, and support by the non-Federal sponsors/partners. Several technical reports detail investigations of various options and provide data on many of these factors. Results are summarized and referenced in the DMMP – Technical Appendix (attached). A final Programmatic Environmental Impact Statement (PEIS), which evaluates environmental concerns and benefits of each of the potential options that are or have been under consideration, has also been prepared and is bound within this document. In accordance with the National Environmental Policy Act of 1969 (NEPA), the final PEIS accompanies this plan as a means of providing widespread public review of the potential impacts of the recommended plan. Chapter 2 of this report summarizes the management options under consideration in the final PEIS, and highlights their current status as potential components of the comprehensive DMMP for the Port.

Several management options to handle HARS unsuitable material are presently in use or planned as part of state or local ventures, private initiatives, or as public-private partnerships. Many of these options are in accordance with the previous DMMP – Implementation Report (USACE

1999b), the previous PANY/NJ plan (PANY/NJ 1996), and the "Joint Dredging Plan for the Port of New York and New Jersey" (NY/NJ 1996), developed under the auspices of the two state governors. These existing and future options, described in Chapter 2 of this report, , would be expected when implemented to provide sufficient capacity to meet dredging needs through the DMMP planning horizon (2065), at processing and placement costs ranging between $29-$42/CY of non-HARS material dredged. Variations of those options that prove most successful will be pursued in accordance with a long-term strategy, outlined in Section 4.3 DMMP Updates, to manage dredged material from the Port through the coming decades.

1.6 HOW WAS THE DMMP DEVELOPED?

The 1999 version of the DMMP – Implementation Report (USACE 1999b) described and recommended management options and sites for either continued investigation or implementation. It was the culmination of an iterative process that built upon previous plans developed by the PANY/NJ and the states of New York and New Jersey (States). Further, it was developed in close coordination with the states, the PANY/NJ, and other involved stakeholders in the region (e.g., the Dredged Material Management Integration Work Group (DMMIWG) of HEP). The PEIS was also reviewed by those agencies that agreed to serve as cooperating agencies under NEPA.

Based on this coordination, a team was formed from members of the various involved agencies to evaluate the management options and reach consensus on those that should be part of the Recommended Plan. This was accomplished by assigning a preference to each option based on its potential to beneficially use dredged material (especially for environmental restoration/ remediation), or to safely contain it. The following rankings were used to indicate the Option Preference:

1. <u>Preferred option</u> – Options that beneficially use dredged material, often with a positive impact on the estuary.
2. <u>Fall-back option</u> – Options that can safely manage HARS unsuitable material and not pose an unacceptable risk to the estuary when properly sited and utilized.
3. <u>Uncertain option</u> – Options that require more analysis regarding technical or economic feasibility but warrant continued consideration because of their potential to beneficially use dredged material.
4. <u>Least preferred option</u> – Options that have either a low potential for beneficial use and/or a potential for undesirable risk to the estuary.
5. <u>Non-preferred option</u> – Options that have potentially unacceptable impacts or are technically/economically infeasible.

A "status" ranking was also developed that describes an option's current availability for use with respect to permits, overall sponsor approval, engineering and design development, funding, and technical/environmental evaluation. The status is an indication of the readiness of an option to be implemented, as opposed to its preference for use. It is a measure of the reliability of an option to meet a specific dredging need. The Option Status rankings are:

1. Fully permitted – Option is ready for implementation, as all necessary permits have been issued following review of technical design and environmental assessment.
2. Permit application pending _ Option design and environmental assessment currently under (regulatory) review. Implementation dependent upon permit approvals.
3. Evaluation and design completed – Option design and environmental assessment have been completed but not yet submitted for (regulatory) review. Implementation dependent upon permit approvals.
4. Pending evaluation and design – Completion of option design and environmental assessment pending availability of additional technical/environmental information. Implementation dependent upon permit approvals.
5. No longer under consideration – Option design and environmental assessment not under development.

The actual selection and formulation of options into a Recommended Plan is described in Chapter 3. The goal of the selection process is to identify more Preference 1 options than are necessary to meet the minimum requirements to manage all dredged material through the DMMP planning horizon. This allows for some options to be deferred and still provide a comprehensive plan to meet all the Port's dredging needs in a beneficial manner. It also promotes other considerations, including increased reliability resulting from planned surplus processing and placement capacity to accommodate any unexpected changes in planned future dredging volumes or in testing methods, and decreased costs provided by private sector competition and from public sector sponsored options. The Preference 2 options provide the back-up to meet specific needs for HARS unsuitable material in a given year if the more preferable beneficial use options are not available in a timely fashion or are not economically sustainable. As such, they serve as fallback options intended to keep the Port operating through all contingencies.

Some Preference 3 options are included in the Recommended Plan, and others may be added in the future, as more information is developed to confirm their beneficial use potential, environmental impact, and/or economic viability. Preference 3 options have to undergo the same public review and permitting process that preference 1 and 2 options must complete, and new preference 3 options may be added to the Recommended Plan through future periodic updates of the DMMP (as described later in this section).

Cost also is a factor in the selection process. Over the past few years the cost per cubic yard (CY) to manage dredged material has varied considerably, from year to year and contract to contract. Estimates of dredging needs over the next 60 years (Section 1.4 How Much Dredged Material Does the Plan Need to Manage?) predict that approximately 64% of the maintenance material projected to be dredged over that timeframe (a total of 95 MCY) (Tables 1-1 and 1-2) may be unsuitable for placement at the HARS (Section 1.3 What is Dredged Material?) under the existing HARS Testing Evaluation Framework (TEF) (see Section 2.3.1 HARS, for more information on the TEF).

The large volume of HARS unsuitable material has raised the cost of maintaining or deepening the Port's channels. An increased level of funding may be necessary to maintain the Port's navigation channels. The level of increased cost that can be justified or sustainable is difficult to predict. This is due, in part, to the inability to calculate the value of the environmental benefits provided by those management options that treat and use dredged material to remediate or restore upland and aquatic habitats. Multiple management options and sites continue to be assessed and/or included in the DMMP to provide competition to keep costs down and to provide enough choices to ensure the Port's viability even if some recommended management options are not implemented. There exists a commitment in the region to support and fund efforts to reduce contaminant inputs into the Harbor and to treat the sediment that is already highly contaminated. This local commitment to the pursuit of promising management options, and bringing them on-line at affordable costs will ultimately keep the Port viable.

In the short-term this DMMP also emphasizes utilization of the most beneficial and appropriate options. It also provides the flexibility essential to allow the region to take advantage of newer or more promising management options, as they become available. This approach provides for opportunities to update and modify the long-term plan, as the needs of the region (both environmentally and economically) and the feasibility of the management options are better defined.

The DMMP also focuses attention on new or innovative techniques, partnerships, or policies to meet the goals of increased beneficial use of dredged material, while also assuring needed capacity for placement is available through the next several years and beyond. A full menu of viable options is an integral part of the plan to provide the certainty needed to maintain confidence in the Port and its future. A flexible plan encourages and gives priority to innovative, non-traditional management options that maximize the beneficial use of dredged sediments. At the same time, other more traditional management options can be developed, if needed, as a contingency to ensure that the Port always remains viable and able to grow to meet shipping needs, without risk of significant adverse impact to the estuary.

To fully evaluate some of the new management options and to fully define long-term dredging needs will take time. As the DMMP has the ability to meet foreseeable dredged material management needs in the short-term future, prudence dictates that further decisions on implementation of the longer-term management options be postponed until it is closer to the time they will actually be needed. As new management options prove successful (i.e.,., become more cost effective or environmentally acceptable), they can be incorporated into the out-years of the plan. A process to periodically evaluate and report on progress in implementing the DMMP provides a structured vehicle for assessing these emerging management options and reassigning priorities and funding based on actual need and field results. This would also serve to keep the public informed of proposed changes to the Recommended Plan and management options under new or renewed consideration.

As with its development, the implementation of the management options recommended in this report will be made through a combination of Federal, state, local and private interests. Ultimately the responsibility of maintaining the channels and the Port rests with the NYD, along with the PANY/NJ and the States. They will make the final decisions as to which management options are included. However, these decisions will not be made in a vacuum. To be successful, the plan must have regional support from all the stakeholders and incorporate the findings of various other Port planning studies that may affect the volumes and time frames for implementing selected management options.

Planning studies include the following: the PANY/NJ report "Building a 21st Century Port" (2000); the New York City Economic Development Corporation (NYCEDC) Cross-Harbor Transport Study; the ongoing Comprehensive Port Improvement Plan (CPIP) of the States, PANY/NJ, NYCEDC, USEPA, Federal Highway Administration (FHWA), and the NYD; the NYD's HDP (USACE 1999a); the Port Dredging Plan of the PANY/NJ (1996); and the "Joint Dredging Plan for the Port of New York and New Jersey" (NY/NJ 1996). A recent addition to this list of studies is the report "Health of the Harbor: The First Comprehensive Look at the State of the NY/NJ Harbor Estuary" (Steinberg, et al. 2004) prepared by Hudson River Foundation for Science and Environmental Research, Inc., (HRF) for the HEP. With its existing framework of interested parties and regional commitments, the HEP plays an important role in providing a forum in which many parties can discuss how the DMMP can meet its dual goals for the Port and estuary in a manner consistent with HEP's CCMP. In this manner HEP can serve as a vehicle for regional support of the DMMP. Close coordination will be the key to ensure that all pieces fit together into a unified, comprehensive plan for a thriving Port and a healthy estuary.

Periodic updates, detailed plans and designs, engineering studies, permit reviews and more site-specific environmental data and NEPA documentation will be required to implement many of the management options in the Recommended Plan. In addition, the private sector and the States will continue to develop initiatives for other alternatives for consideration as possible additions to the DMMP. Dredging requirements are established so that decision-makers can implement and fund the DMMP's management options within the appropriate time frames. Obviously, continued close coordination among all the stakeholders will be necessary to see that this flexible plan continues to be molded to meet the needs of the region in an environmentally acceptable and economically affordable manner.

1.7 HOW TO USE THIS DMMP

The DMMP consists of three main documents: an Implementation Report, a Technical Appendix, and a PEIS. The Implementation Report provides a comprehensive overview of the Recommended Plan, and addresses the development process as well as the needs for its successful implementation. The Technical Appendix addresses the technical issues surrounding the development of the plan. These issues include economic factors and costs, potential capacity, reliability, application techniques, potential impacts, and further study requirements. The Technical Appendix is intended as a support document to this Implementation Report and provides a more in-depth view of the technical aspects involved in evaluating placement options. Lastly, the PEIS evaluates and compares four alternative plans in accordance with NEPA. These plans are the No Action Plan, the Base Plan, the Environmentally Preferred Plan, and the Recommended Plan. Although the 2005 Implementation Report and accompanying Technical Appendix present only the Recommended Plan, discussion of the No Action, Base and Environmentally Preferred Plans is retained in the final PEIS.

The main purpose of this Implementation Report is to describe the process by which the NYD, in collaboration with its Federal, state, and local partners, developed the Recommended Plan for managing the future dredging needs of the Port. In developing the Recommended Plan, various options for placement of dredged material from the Harbor were considered in conjunction with projected dredging needs. The Recommended Plan was designed to maximize the beneficial use of dredged material by utilizing the options that are currently feasible to implement and those that have potential for implementation in the future. The remainder of this Implementation Report is presented in three chapters. Chapter 2, **Management Options**, is a discussion of the various placement options that were considered in developing the Plan. Chapter 3, **Formulating the Recommended Plan**, describes the process used for identifying which options to include in the current Plan. Chapter 4, **Implementing the Recommended Plan**, discusses the short- and long-term needs for successfully implementing the Plan.

All three of the DMMP documents have been updated from their 1999 draft version, and, as of this writing, reflect changes in dredging needs and placement opportunities that have occurred since then. Every effort has been made to provide a best estimate of the future dredging needs and potential placement options. As a living document the DMMP – Implementation Report will be periodically updated (see Section 4.3 DMMP Implementation Updates) to reflect changes in dredging needs and placement alternatives as they arise. Additionally, the updates will serve to correct any inaccurate information that may be presented in previous versions of the DMMP.

2 MANAGEMENT OPTIONS

Management of dredged material from the Harbor offers formidable challenges due to the material's intractable physical properties (high proportion of fine-grained particles, high water content, and salinity), and/or a wide range of organic and inorganic contaminants at highly variable concentrations. Much of the following discussion focuses on material unsuitable for placement at the HARS as it poses issues of greater concern and usually requires more expensive management. While this material may be unsuitable for placement at the HARS, it can be used beneficially for many other purposes, especially if processed to stabilize or otherwise render the contaminants unavailable to humans or the non-human biota. Millions of cubic yards of such material have already been beneficially used in a variety of applications in and around the Harbor region and throughout the nation. The intent of the DMMP is to maximize the use of all dredged material as an important resource, whenever feasible.

The USACE and other government and private entities have investigated a number of options for managing dredged material. These options are summarized in this chapter as a means of comparing capacity, cost, reliability, availability, and potential impacts and benefits to the estuary. The data on the various options are presented in Tables 2-1(a-c). Table 2-1a presents the placement options that are currently under consideration. Table 2-1b presents the processing facilities, both currently available and planned, for processing HARS unsuitable material for use in landfill, brownfield, quarry, and mine remediation sites. Table 2-1c presents the least preferred or non-preferred placement options that were evaluated, and are no longer considered in this DMMP. The locations of many of these management options are shown in Figure 2-1. For a more detailed description of these options, the reader is referred to Appendix A Management Option Analysis and Detail, in the DMMP – Technical Appendix, which includes the current status regarding ongoing investigations, operational techniques, impacts, and action required for implementation.

2.1 SEDIMENT REDUCTION

Sediment is an essential, integral, and dynamic part of river basins, estuaries, and coastal zones. Most sediment is naturally derived from the weathering and erosion of minerals and soils in upstream areas, and is transported downstream by surface waters. Channel gradients decrease in estuarine areas, thus flow rates decline and transported sediment is deposited within the estuary and on the seabed of the coastal zone.

Sediment is one of the key components of the aquatic ecosystem, forming a variety of habitats and environments utilized by a diversity of marine organisms. Sediment is also an important source of nutrients for these organisms and thus, indirectly, for species higher in the food chain that feed on them. Erosion and sedimentation dynamics as well as gradients in grain size and water content can form favorable conditions for the development of a variety of environments, from the origin of a river to the coastal estuary. Conversely, sedimentation can also result in negative impacts, including: destroying fish habitat through blanketing of fish spawning and feeding areas and elimination of certain food organisms; directly impacting fish through gill abrasion and fin rot; and reducing sunlight penetration, thereby impairing photosynthesis of aquatic plants. Furthermore, high concentrations of suspended sediment in the water column

Table 2-1. DMMP Dredged Material Placement Options Evaluated in the Programmatic Environmental Impact Statement

Table 2-1a. Placement Options Under Consideration

Option Type	Option Identification Code	Option Site	Included in Recommended Plan (Y/N)?	Option Preference (see footnote)	Options Status (see footnote)	Material Type(s) Accepted (see footnote)	Estimated Capacity of Placement Option as of January 2005 (MCY- specify if per year)	Processing Required	Projected Date of Availability	Sponsor / Implementing Organization	Typical Transportation and Placement Cost to User $/CY	Funding from Other Sources (Y/N)?
SEDIMENT CONTAMINANT REDUCTION												
	CR1	Implement Pollution Reduction Programs	Y	1	1	F & G	NA	None	2011+	NY - NJ	$ -	Y
SEDIMENT/DREDGING REDUCTION												
	SR1	Pneu. Sed. Susp. Demo at IMTT NJ	Y	1	1	F	NA	None	Currently Available	NJ / Private	$ -	N
	SR2	"Turbo Scour" Demo at CITGO, Linden, NJ	Y	1	1	F	NA	None	2003-demo	NJ / Private	$ -	N
	SR3	Continued "Turbo Scour" at CITGO, Linden, NJ	Y	1	2	F	NA	None	ongoing	NJ / Private	$ -	N
BENEFICIAL USES - Ocean Remediation												
	OR1	Historic Area Remediation Site, US	Y	1	1	A - D	TBD*	None	Currently Available	Corps / EPA	$ -	N
	OR2	Additional Ocean Remdiation, as needed	Y	3	4	A - D	NA	None	TBD	Corps / EPA	$ -	N
BENEFICIAL USES - Habitat Creation, Enhancement & Restoration												
	HC1	Create Fish Reefs, NJ	Y	1	1	E	available rock	None	Currently Available	NJ / Corps	$ -	N
	HC2	Create Fish Reefs, NY	Y	1	1	E	available rock	None	Currently Available	NY / Corps	$ -	N
	HC3	Create Oyster Habitat	Y	1	4	A - D	0.10	None	2007	NY - NJ / Corps	$ 10	N
	HC4	Create Shellfish Habitat	Y	1	4	A & B	0.10	None	2007	NY - NJ / Corps	$ 7.5	N
	HC5	Create Bird Habitat	Y	1	4	A - D	1.00	None	2007	NY - NJ / Corps	$ 13.5	N
	HC6C	Marsh Creation at Bowery Bay, NY (cap/cover material)	N	3	4	A & B	0.90	None	TBD	NY	$ 5	N
	HC6S	Marsh Creation at Bowery Bay, NY (subfill material)	N	3	4	A - D	2.50	None	TBD	NY	$ 30	N
	HR1	MOTBY Channel Enhancement	Y	1	2	A - D	0.90	None	2005	NJ / Corps	$ -	N
	HR2	Norton Basin, Jamaica Bay, NY	N	3	4	A - D	1.00	None	TBD	NY / Corps	$ 3	Y
	HR3C	Little Bay, Jamaica Bay, NY (cap material)	N	3	4	A & B	0.25	None	TBD	NY / Corps	$ -	Y
	HR3S	Little Bay, Jamaica Bay, NY (subfill material)	N	1	4	A - D	0.5	None	TBD	NY / Corps	$ 3	Y
	HR4C	Grassy Bay, Jamaica Bay, NY (cap material)	N	3	4	A & B	4.10	None	TBD	NY	$ -	N
	HR4S	Grassy Bay, Jamaica Bay, NY (subfill material)	N	3	4	A - D	25.00	None	TBD	NY	$ 2	N
	HR5C	Jo-Co Marsh Pit, Jamaica Bay, NY (cap material)	N	3	4	A & B	0.90	None	TBD	NY	$ -	N
	HR5S	Jo-Co Marsh Pit, Jamaica Bay, NY (subfill material)	N	3	4	A - D	6.50	None	TBD	NY	$ 2	N
	HR6	Hoffman/Swinburne North Pit, NY	N	3	4	A & B	TBD	None	TBD	NY	TBD	TBD
	HR7C	Hoffman/Swinburne South Pit, NY (cap material)	N	3	4	A & B	TBD	None	TBD	NY	TBD	TBD
	HR7S	Hoffman/Swinburne South Pit, NY (subfill material)	N	3	4	A - D	TBD	None	TBD	NY	TBD	TBD
	HR8C	West Bank Pit, Lower Bay, NY (cap material)	N	3	4	A & B	TBD	None	TBD	NY	TBD	TBD
	HR8S	West Bank Pit, Lower Bay, NY (fill material)	N	3	4	A - D	TBD	None	TBD	NY	TBD	TBD
BENEFICIAL USES - Landfill, Brownfield, Quarry, & Mine Remediation												
	LR1A	Kearny A	Y	1	4	A - D & F	0.40	None or Stabilized	TBD	NJ	$29 - $42	N
	LR1B	Kearny B	Y	1	4	A - D & F	0.30	None or Stabilized	TBD	NJ	$29 - $42	N
	LR2A	Secaucus A	Y	1	4	A - D & F	0.20	None or Stabilized	TBD	NJ	$29 - $42	N
	LR2B	Secaucus B	Y	1	4	A - D & F	0.20	None or Stabilized	TBD	NJ	$29 - $42	N
	LR3	Overpeck Landfill	Y	1	4	A - D & F	0.80	None or Stabilized	TBD	NJ	$29 - $42	N
	LR4	ENCAP	Y	1	1	A - D & F	5.00	None or Stabilized	Currently Available	NJ / Private	$29 - $42	N
	LR5	Carteret Landfill	Y	1	3	F	1.00	None or Stabilized	2005 / 2006	NJ / Private	$29 - $42	N
	LR6BPL	Brookfield, Staten Island, NY (Barrier Protection Layer)	Y	1	4	A - C	0.21	None or Stabilized	2005 / 2006	NY	$29 - $42	N
	LR6S	Brookfield, Staten Island, NY (Below Liner)	Y	1	4	A - D & F	0.21	None or Stabilized	2005 / 2006	NY	$29 - $42	N
	LR7BPL	Fountain Landfill, Brooklyn, NY (Barrier Protection Layer)	Y	1	1	A & B	0.60	None or Washed	Currently Available	NY	$29 - $42	Y
	LR8	Fresh Kills Landfill	Y	1	1	A - D & F	4.00	Stabilized	Currently Available	NY	$29 - $42	N
	LR9	Other New York Landfills	Y	1	4	A - D & F	0.00	Stabilized	TBD	NY	$29 - $42	N
	BR1	Motor Sports Entertainment Complex (MSEC), Staten Island	Y	1	4	A - D & F	5.00	None or Stabilized	2005	NY / Private	$29 - $42	N
	BR2	Koppers Coke, NJ	Y	1	1	F	0.40	Stabilized	2004	NJ / Private	$29 - $42	N
	BR3	NL Industries, Sayreville, NJ	Y	1	4	F	5.80	Stabilized	2005	NJ / Private	$29 - $42	N
	BR4	Allied Signal, Elizabeth, NJ	N	1	4	F	0.00	Stabilized	TBD	NJ / Private	$29 - $42	N
	BR5	MOTBY Bayonne, NJ, Construction Fill	Y	1	4	A	1.30	None	2006	NJ / BLRA	TBD	N
	BR6	FDP, Jersey City, NJ	N	3	1	A - D & F	1.50	None or Stabilized	Currently Available	NJ/Private	$29 - $42	N
	BR7	Other New York Brownfields	N	1	4	A - D	0.00	None or Stabilized	TBD	NY / Private	$29 - $42	N
	QR1	Hunterdon Quarry, NJ	N	3	4	A - D	30.00	Washed	TBD	NJ / Private	$29 - $42	Y
	MR1	Eastern Pennsylvania Mine Reclamation Projects	Y	1	4	F	20.00	Stabilized	TBD	PA / Private	$29 - $42	N

Option Type	Option Identification Code	Option Site	Included in Recommended Plan (Y/N)?	Option Preference (see footnote)	Options Status (see footnote)	Material Type(s) Accepted (see footnote)	Estimated Capacity of Placement Option as of January 2005 (MCY- specify if per year)	Processing Required	Projected Date of Availability	Sponsor / Implementing Organization	Typical Transportation and Placement Cost to User $/CY	Funding from Other Sources (Y/N)?
BENEFICIAL USES - Other Uses												
	BU1	Beach Nourishment from USACE Maintenance Work	Y	1	1	A	TBD	None	Currently Available	NY - NJ	$ 2	N
	BU2	Construction Material from Main Ship Channel USACE Maintenance Dredging	Y	1	4	A, C, D	TBD	None	Currently Available	NY - NJ	$ -	N
DECONTAMINATION TECHNOLOGIES AND OTHER MARKETABLE PROCESSES												
	DT1	Decon Scale-Up, Various Sites	Y	1	2	F- G	0.03	Decon	Currently Available	NJ / Private	$29 - $42	Y
	DT2	Decon Scale-Up, Various Sites	Y	1	2	F - G	0.15	Decon	2005	NJ-NY / Private	$29 - $42	Y
	DT3	Decon Scale-Up, Various Sites: (2006-2065 summary)	Y	1	4	F - G	0.50/year	Decon	2006-2065	NJ-NY / Private	$29 - $42	N
CONFINED AQUATIC DISPOSAL FACILITIES												
	AC1C	Newark Bay CDF (1S), NJ (cap material)	Y	1	1	A	0.13	None	TBD	PANY/NJ	$ -	N
	AC1S	Newark Bay CDF (1S), NJ (subfill material)	Y	1	2	F	0.50	None	Currently Available	PANY/NJ	$ 36	N
UPLAND/NEARSHORE CONFINED DISPOSAL FACILITIES												
	UC1	Belford CDF(N61), NJ	N	3	3	A,B & F	0.00	None	TBD	Mon. County	$ TBD	N
	UC2	Permitted Disposal Facilities Outside Region	N	2	1	TBD	0.00	None or Stabilized	TBD	N/A	$ TBD	N
	UC3	Disposal Adjacent to Permit Applicant's Dredging	Y	NA	NA	TBD	NA	None or Stabilized	TBD	N/A	$ TBD	N
	NC1	South Brooklyn Piers, NY	N	5	4	A - D & F	0.40	Stabilized	TBD	NYCEDC	$ 37	N

*** See text for a discussion of the HARS area and its potential capacity.**

Note:

Option Preference:	Option Status:	Material Type:
1 - Preferred Option	1 - Fully Permitted	A - Sandy HARS Suitable Material
2 - Fallback Option	2 - Permit Application Pending	B - Fine-Grained HARS Suitable Material
3 - Uncertain Option	3 - Evaluation & Design Completed	C - Glacial Till/Mixed HARS Suitable Material
4 - Least Preferred Option	4 - Pending Evaluation & Design	D - Stiff Clay HARS Suitable Material
5 - Non-Preferred Option	5 - No Longer Under Consideration	E - Rock Material
NA - Not Applicable and/or Available	NA - Not Applicable and/or Available	F - Non-Ocean Placement Material
TBD - To Be Determined		G - Non-Ocean, Unsuitable for Upland Placement Material

Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Table 2-1b. Processing Facilities for Landfill, Brownfield, Quarry, and Mine Remediation Sites (costs included in the estimates in Table 2- 2a)

Option Type	Option ID Code	Option Site	Processing Capacity (MCY/day)	Processing Capacity (MCY/year)	Projected Date of Availability
PROCESSING FACILITIES					
	PF1	Harbor-wide processing facility	TBD	TBD	TBD
	PF2	Clean Earth Tech., Jersey City, NJ	0.004	1.20	Currently Available
	PF3	Donjon (in barge processing)	0.008	2.40	Currently Available
	PF4	EIC Associates (pugmill)	0.004	1.20	TBD
	PF5	MSEC, Staten Island - Processing	0.010	3.00	2006
	PF6	Metals Management (offloading facility only)	0.005	1.50	2003
	PF7	Interstate Materials Corp (in barge processing/pugmill)	0.010	3.00	2005
	PF8	VanBro Corporation (in barge processing/pugmill)	0.004	1.20	2006
	PF9	Great Lakes, Koppers Seaboard Site, Kearny (pugmill)	0.004	1.20	2004

Table 2-1c. Least Preferred or Non-Preferred Placement Options

Option Type	Option Identification Code	Option Site	Option Preference (see footnote)	Options Status (see footnote)	Material Type(s) Accepted (see footnote)
CONFINED AQUATIC DISPOSAL FACILITIES					
	AC2C	Newark Bay CDF (2S), NJ (cap material)	4	4	A
	AC2F	Newark Bay CDF (2S), NJ (subfill material)	4	4	F
	AC3C	Newark Bay CDF (2N), NJ (cap material)	4	4	A
	AC3F	Newark Bay CDF (2N), NJ (subfill material)	4	4	F
	AC4C	Newark Bay CAD Pits East of Channel, NJ (cap material)	5	5	A & B
	AC4F	Newark Bay CAD Pits East of Channel, NJ (subfill material)	5	5	F
	AC5C	Constable Hook Flat CAD Pits, NJ (cap material)	5	5	A & B
	AC5F	Constable Hook Flat CAD Pits, NJ (subfill material)	5	5	F
	AC6	Port Jersey Sub-Channel Pit (Turning Basin), NJ	4	4	A - D
	AC7	Bay Ridge/Red Hook Sub-Channel Pit, NY	4	3	B & F
	AC8	Bay Ridge/Red Hook Sub-Channel Pits, NY	4	4	F
	AC9C	New Lower Bay CAD Pits (Zone 1), NY & NJ (cap material)	5	5	A & B
	AC9F	New Lower Bay CAD Pits (Zone 1), NY & NJ (subfill material)	5	5	F
	AC10C	New Lower Bay CAD Pits (Zone 2), NY & NJ (cap material)	4	4	A & B
	AC10F	New Lower Bay CAD Pits (Zone 2), NY & NJ (subfill material)	4	4	F
	AC11	Lower Bay Island CDF (Zone 2), NY & NJ	5	5	F
	AC12	Ocean Island CDF (Zone 3), US	5	5	F
BENEFICIAL USES - Habitat Creation, Enhancement & Restoration					
	HC6F	Marsh Creation at Bowery Bay, NY (subfill material)	4	4	F
	HR2F	Norton Basin, Jamaica Bay, NY	4	4	F
	HR4F	Grassy Bay, Jamaica Bay, NY (subfill material)	4	4	F
	HR5F	Jo-Co Marsh Pit, Jamaica Bay, NY (subfill material)	4	4	F
	HR7S	Hoffman/Swinburne South Pit, NY (subfill material)	4	4	F
	HR8S	West Bank Pit, Lower Bay, NY (fill material)	4	4	F
	HR9C	CAC Pit Lower Bay, NY (cap material)	5	5	A & B
	HR9F	CAC Pit Lower Bay, NY (fill material)	5	5	A - D & F
	HR10C	Large East Bank Pit, Lower Bay, NY (cap material)	5	5	A & B
	HR10F	Large East Bank Pit, Lower Bay, NY (fill material)	5	5	A - D & F
	HR11C	Small East Bank Pit, Lower Bay, NY (cap material)	5	5	A & B
	HR11F	Small East Bank Pit, Lower Bay, NY (fill material)	5	5	A - D & F
BENEFICIAL USES - Landfill, Brownfield, Quarry, & Mine Remediation					
	QR2	Hudson Valley Quarry Sites, NY	5	5	F
UPLAND/NEARSHORE CONFINED DISPOSAL FACILITIES					
	UC4	Preliminary Screening of Regional Sites, NY & NJ	5	5	F
	NC2	OENJ Bayonne, Phase 2 (Constable Hook Flats), NJ	4	4	A - D
	NC3	Atlantic Basin, NY	5	4	F
OCEAN DISPOSAL					
	OD1	New Ocean Disposal Site, U.S.	5	5	A - D

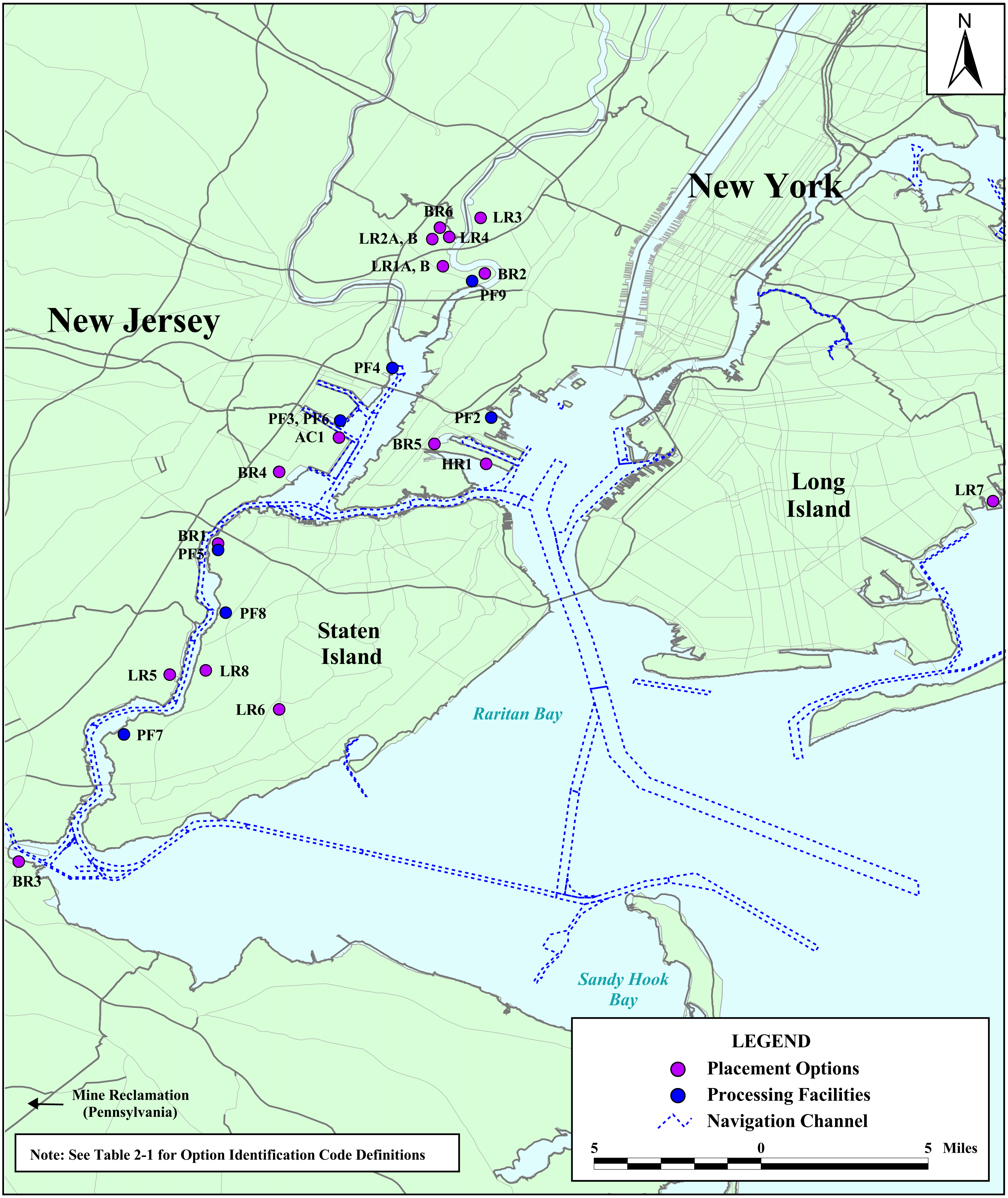
Note:
These alternatives have been **considered and rejected** as placement options for dredged material under current conditions. These alternatives are **included in this document to comply with NEPA guidelines** requiring review and consideration of all potential placement alternatives, even those that are not practicable.

Note:

Option Preference:	**Option Status:**	**Material Type**
1 - Preferred Option	1 - Fully Permitted	A - Sandy HARS Suitable Material
2 - Fallback Option	2 - Permit Application Pending	B - Fine-Grained HARS Suitable Material
3 - Uncertain Option	3 - Evaluation & Design Completed	C - Glacial Till/Mixed HARS Suitable Material
4 - Least Preferred Option	4 - Pending Evaluation & Design	D - Stiff Clay HARS Suitable Material
5 - Non-Preferred Option	5 - No Longer Under Consideration	E - Rock Material
NA - Not Applicable and/or Available	NA - Not Applicable and/or Available	F - Non-Ocean Placement Material
TBD - To Be Determined		G - Non-Ocean, Unsuitable for Upland Placement Material

Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Figure 2-1. Dredged Material Placement Options and Processing Facilities



(i.e., high levels of turbidity) decreases recreational values and uses, reduces fishery habitat, adds to the mechanical wear of water supply pumps and distribution systems, and adds to treatment costs for water supplies. Nutrients and toxic substances attached to sediment particles are transported to waterbodies and may enter aquatic food chains, cause fish toxicity problems, or degrade the water as a drinking water source.

While less than 30% of the sediment deposited in the Harbor is actually generated *within* the Harbor, high sedimentation rates within some of the channel areas necessitate frequent and costly dredging to keep the channels open for safe and efficient navigation. Sediment management focuses on controlling the amount of sediment settling within the navigation channels. The sediment management strategies can be classified into four main types: watershed sediment management controls, channel design optimization, advanced maintenance dredging, and structural modification. These strategies are described as follows:

Watershed Sediment Management Controls are strategies to prevent and reduce the amount of sediment reaching a waterbody by controlling it at points of origin and throughout a watershed.. Both States have developed watershed based sediment reduction controls. Techniques include the implementation of Best Management Practices (BMPs) and Total Maximum Daily Loads (TMDLs), which are designed to reduce the volume of sediment in storm water runoff, redirecting runoff to collection basins or other pervious surfaces where infiltration to the ground water can occur, and protecting and reinforcing steep slopes and stream banks.

Channel Design Optimization involves decreasing the sedimentation rate within the channel by re-engineering the channel from a straight channel to one with curves. Straightening channels tends to increase the water velocity within the channel. The higher water velocity entrains a larger percent of material suspended in the water column and decreases the amount of material settling out and accumulating in the channel. Conversely, increasing the sinuosity of a channel slows water velocity and increases potential for material to settle out. Channel design optimization strategies are examined during initial project design and as part of the routine maintenance procedures. Many of the Design Optimization strategies have already been incorporated into the existing channel designs. Consequently, little additional benefit might be gained from further analyses at this time.

Advanced Maintenance Dredging is dredging below the required channel depth, and it has been used as a short-term means of reducing overall dredging cost and frequency. Sediment settling in the channel will eventually fill the channel to the authorized depth, and the time between maintenance dredging operations will increase. This lowers cost by avoiding several expensive mobilization and demobilization cycles of dredging equipment and reduces the frequency of dredging, which may reduce short term, localized environmental impacts associated with more frequent dredging.

Structural Modifications are physical features designed to keep sediment moving through (instead of settling in) a channel or berth area or to prevent sediment from entering the channel or berth area. Typical structures include flow training dikes and sills, scour jets, gates and curtains, pneumatic barriers, and sedimentation basins. Several technologies have been proposed for reduction of sedimentation in berthing areas. Before recommending or permitting the widespread use of these technologies, the NJDEP has requested that demonstration projects be conducted with concurrent modeling of sediment loading and ecological effects. New Jersey Department of Transportation / Office of Maritime Resources (NJDOT/OMR) evaluated the efficacy of a pneumatic sediment suspension system at a location in New Jersey. The results of this study indicate that although the pneumatic barriers do appear to decrease sedimentation, the costs associated with design, installation, and operation may be prohibitive (Chapman and Douglas 2002). CITGO Petroleum of Pennsauken, NJ, is currently performing a demonstration of a turbo scour system at its facility on the Arthur Kill. Note that these systems are not designed to resuspend already deposited sediment, but rather to prevent settling of sediment particles.

These management strategies are presented in more detail in Section A–2 Sustainable Sediment Management, in the DMMP – Technical Appendix.

2.2 CONTAMINANT REDUCTION

Following the 1992 implementation of USEPA's revised ocean placement protocols, a significant amount of dredged material became no longer suitable for placement at the HARS. With few economically and environmentally viable placement alternatives, annual dredging budgets increased by as much as four to five times previous budgets due to the added cost of transporting and processing this material for reuse. This dramatic increase in dredged material management cost is one of the driving forces behind a regional, multi-agency effort to develop a contaminant reduction strategy.

Currently, the NYD estimates that approximately 64% of the dredged material from maintenance projects, and 14% of the dredged material from deepening work, will not be suitable for placement at the HARS. The average annual volume of Federal and non-Federal maintenance material dredged during the planning period (2005–2065) that is unsuitable for placement at the HARS is currently projected to be approximately 1.55 MCY (Table 1-2). The proposed DMMP reduction target is to decrease the annual amount of dredged material unsuitable for HARS placement to approximately 0.5 MCY by the year 2040, and to 0.25 MCY by 2060. Attaining this goal would require a total volume reduction of HARS unsuitable material of approximately 52 MCY between 2005 and 2065. Presently the typical placement cost for HARS unsuitable material ranges from $29–$42/CY. By increasing the volume of HARS suitable dredged material, a successful contaminant reduction program increases both the in-water and upland use possibilities, resulting in a cumulative potential cost savings of $1.5–$2.2 billion over the next 60 years. This goal for contaminant reduction could be attained using a two-phased contaminant reduction target, beginning in 2012 and 2017, using the following reductions in HARS unsuitable material: a logarithmic 1.5% and 2.8% decline in volume from Newark Bay and the Kills; a 1.75% and 2.8% decline in volume from Upper Bay, Hudson and East Rivers, and Western Long Island Sound; and, a 2% and 2.8% decline in volume from the Lower Bay, Jamaica Bay and Bight Apex. Figure 2-2 depicts the projected trend of dredged material unsuitable for HARS placement over the next 60 years with and without these contaminant reduction measures[2]. These contaminant reduction targets are used to re-evaluate dredging

[2] The solid line in Figure 2–2, representing the volume of material unsuitable for HARS placement (assuming no contaminant reduction measures) does not generally decrease with time. There are a number of factors that could support either a decreasing trend or an increasing trend in the amount of HARS unsuitable material. These factors include natural attenuation of

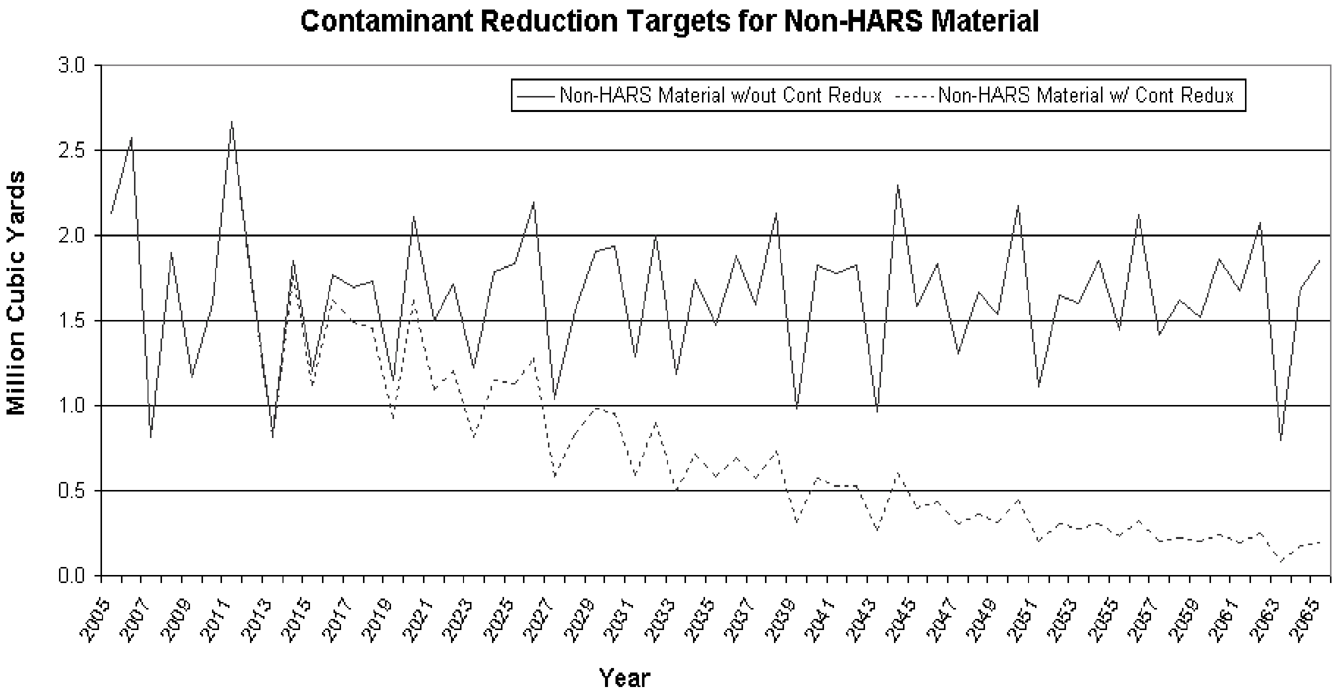


Figure 2-2. Contaminant Reduction Targets for Non-HARS Material

volume projections, which then are compared with placement and processing management options in the formulation processes of the Recommended Plan (Section 3, Formulating the Recommended Plan).

For planning and management purposes it is desirable to quantify contamination trends in the sediments for the entire Harbor area. The most recent analysis of the trends of contaminant levels in sediments, water and biota was conducted by the HRF and published in its Health of the Harbor report (Steinberg, et al. 2004). The report indicates that mercury, PCBs, dioxin, and DDT in Harbor sediments have declined dramatically over the last 30 years in many regions of the Harbor (one notable exception is a slight increase of dioxin in Jamaica Bay). In its analysis of sediment data, which includes a review of radionuclide and sediment contaminant data reported by Bopp et al. (2000), HRF suggests that the observed long-term rates of decline in sediment contamination are likely the result of the Clean Water Act control measures implemented in the 1970s. The rate of decline, however, seems to have tapered off as evidenced in their comparison of 1993 and 1998 Regional Environmental Monitoring and Assessment Program (REMAP) data, which suggests that contamination level of dioxin and a number of metals have not significantly improved in the last 5 years with respect to meeting sediment quality guidelines. Evidence of improvements in sediment toxicity was largely inconclusive. Based on these observations it is reasonable to assume that sediment contamination levels will

contaminants (supports a decreasing trend) and the implementation of more stringent ocean placement protocols (supports an increasing trend). However, because of the uncertainty in the degree to which opposing effects like these will influence the trend in the annual volume of material unsuitable for HARS placement over the next 60 years, no long-term trend in the annual volume was assumed for this analysis, as indicated by the solid line of Figure 2–2.

not improve significantly in the next 5 to 10 years without further contaminant reduction measures. Further, it is reasonable to assume that as a consequence, the volume of dredged material that is suitable for HARS placement also is not likely to increase significantly in this same period.

Clearly these observations further support and reemphasize the need for an aggressive contaminant reduction strategy. One of the major initiatives to aid in the development of an effective strategy is the Contaminant Assessment and Reduction Project (CARP). Over the last several years the HRF has been coordinating this program designed to address the ecological and economic problems associated with contaminated sediments of the Harbor. Principally funded by the States, this $30 million dollar multi-agency commitment was tailored in part to assist dredged material managers in the following:

1. Identifying and evaluating sources of contaminants that need to be reduced or eliminated to ensure that, in the future, newly deposited sediments in navigational waterways will be suitable for ocean placement activities, as well as additional upland placement opportunities.
2. Defining which actions will be the most effective in abating the sources.
3. Determining how long it will take for sediments to become suitable for placement at the HARS and other beneficial use sites.

CARP is essentially an extensive Harbor-wide data collection and mathematical modeling effort. The data collection phase of the program involves both compiling historic sediment chemistry data and implementing a sampling plan to characterize current contaminant levels in sediments, water and biota. The primary purpose of these data is to provide input and model calibration for the detailed sediment and contaminant fate and transport modeling effort, as well as to guide efforts to track down major sources of contamination. Initiated in 1999, most of the data collection effort was completed by the summer of 2001 and analyzed and validated by 2003. Following validation, the NYSDEC in collaboration with Rensselaer Polytechnic Institute scientists presented their analysis of the sediment data in their report "Contaminant Assessment and Reduction Project: NY/NJ

Summary of Findings in

CARP: NY/NJ Sediment Report 1998–2001

(NYSDEC 2003)

1. "The sediments in the western harbor are generally more contaminated than the rest of the harbor."
2. "Historical sediments (1940-1980) are more contaminated than recent depositions. (i.e., the concentration of PCBs in the harbor sediments seems to have decreased by about 90% since the mid-1970s.)"
3. "Historically, about two-thirds of the PCBs in the harbor sediments appear to have originated from the Upper Hudson River. Currently, the percentage is estimated to be around 25."
4. "The Passaic River has been and is a likely source of mercury, PCBs and chlordane to the western harbor."
5. "The Newtown Creek has been and is a potential source of contamination to the Upper Bay and East River."
6. "Mercury, silver, lead and copper are likely the most environmentally important inorganic contaminants in the harbor complex. Cadmium and chromium appear to be of minimal concern."

Sediment Report 1998–2001" (NYSDEC 2003), which includes a summary of findings and recommendations for next steps. The 1999–2001 CARP dataset, along with the compiled historic sediment chemistry data, is now available online through a database on the CARP website:

http://www.carpweb.org/main.html.

The CARP mathematical models will be used to evaluate the movement of sediments and contaminants, as well as biotic uptake of contaminants. The modeling effort was initiated in December 2001 and progress since then has resulted in calibrated hydrodynamic and sediment transport models. Data collected for the CARP will provide input and model calibration for the contaminant fate and transport modeling effort. The HRF anticipates that the contaminants model will be calibrated and validated for PCBs and dioxin (all 17 congeners) by the end of 2005. Also by this time, regional loadings analyses and contaminant reduction scenario development will have begun.

Modeling results will be used to focus dredged material managers (and ecosystem restoration programs) on the major problem areas of the Harbor. This will provide support in re-evaluating and ascertaining the potential for achieving the reduction targets outlined above. Ultimately, the successful implementation of CARP will be marked as an unprecedented achievement and will serve as a valuable tool for developing an aggressive contaminant reduction strategy.

The NYD, the States, the Port business community and, ultimately, the public, all are beneficiaries of the lower costs of managing dredged material, as well as the reduction of environmental exposure to the contaminants, associated with a successful contaminant reduction program. Other programs, such as the $19 million Hudson-Raritan Estuary Ecosystem Restoration Study (HRE) and other habitat restoration efforts, may provide the additional benefit of reducing the overall exposure of contaminated sediments to all organisms through treatment, remediation, removal, containment, and/or capping. Port interests have committed significant resources toward improvements in water and air quality, priority habitat preservation and restoration. As a member of the NY/NJ Harbor community, the NYD will continue to participate in partnerships designed to reduce both the volume of HARS unsuitable dredged material and the uncertainty associated with dredged material management.

2.3 BENEFICIAL USES

2.3.1 HISTORIC AREA REMEDIATION SITE (HARS)

On August 27, 1997, the USEPA promulgated a final rule that de-designated and closed the NY Bight Dredged Material Disposal site (also known as the Mud Dump Site). Simultaneously USEPA designated an area, known as the HARS, that included the Mud Dump Site, as well as other areas impacted by historic disposal activities (see Figure 2-3). This designation included a plan that the site be managed to reduce the historic impacts to acceptable levels (in accordance with 40 CFR Section 228.11(c)). To accomplish this, the HARS is being remediated with HARS suitable dredged material, which consists of dredged material that meets current Category I standards and will not cause significant undesirable effects including through bioaccumulation.

Use of the site is restricted to dredged material suitable for use as “Material for Remediation.” At least 1-meter of remediation material will be used to cap the entire Priority Remediation Area (PRA) of the HARS. The designation of HARS is unique because its primary purpose is remediation of previously impacted ocean bottom. HARS was designated based upon a variety of information, including amphipod toxicity, dioxin bioaccumulation in worm tissue, and the presence of elevated levels of PCBs and dioxin in area lobster stocks.

As of March 2005, approximately 22.5 MCY of remediation material had been placed at the HARS since its designation. Recent monitoring of the HARS (e.g., side scan, bathymetry, benthic recolonization, Remote Ecological Monitoring of the Sea Floor [REMOTS], etc.) indicates that dredged sediment has been accurately placed over areas requiring remediation and that the material placed is stable. Given technical considerations (e.g., compaction) that have affected, and will continue to affect, the amount of material that needs to be placed to fully remediate the HARS, a precise remediation volume for the HARS cannot be determined. However, it is anticipated that full remediation will require millions of cubic yards more than the 22.5 MCY already placed there. Consequently, for purposes of this report, future HARS suitable dredged material is projected to be placed at the HARS (and/or possibly at some other comparable and practicable alternative to the HARS) thru the DMMP planning horizon.

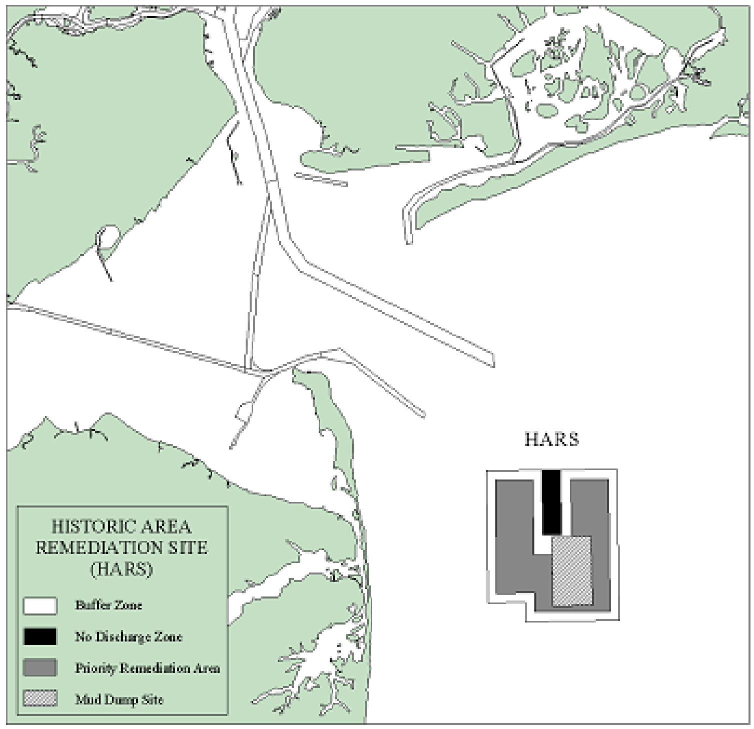


Figure 2-3: Historic Area Remediation Site Map

To ensure that the goal of remediation is achieved, the USEPA and the USACE executed a Memorandum of Agreement (MOA) in 2000 that committed the two agencies to a process to update the Technical Evaluation Framework (TEF) that is used to make determinations regarding material proposed for remediating the HARS. The process outlined in the MOA included an extensive stakeholder and public involvement process along with conducting a scientific peer review on the USEPA-developed draft TEF. The purpose of this review is to ensure that the approach taken by USEPA and USACE to evaluate dredged material for use at the HARS reflects the most recent scientific developments and to ensure that the approach remains consistent with the remedial objectives of the HARS designation.

In response to a court decision related to the process by which the HARS-specific PCB bioaccumulation value was implemented as part of the MOA, USEPA established formal rulemaking to change the HARS criterion for the PCB concentration in worm tissue from 400 parts per billion (ppb) to 113 ppb. The rule was announced in the Federal Register on March 17, 2003 and went into effect on April 16, 2003. The rule also noted that this HARS-specific worm tissue PCB criterion would remain in effect until the USEPA implements new HARS-specific evaluation processes as a result of this current TEF review. To complete the actions described in the MOA, the USEPA and the NYD are now jointly performing the following tasks:

1. Revising the draft ecological aspect of the TEF and then performing a scientific peer review upon it;
2. Performing necessary studies in response to the critical technical issues raised on the TEF by the peer reviewers on both the human health and ecological aspects of the TEF;
3. Responding to the scientific peer review comments on both the human health portion of the TEF (which was performed in 2002) and the ecological portion of the TEF; and,
4. Coordinating the actions above with the Remediation Material Workgroup, a regional stakeholder group formed to advise and assist the USEPA and the USACE in this process.

When these steps are completed, the resultant final proposed TEF would then be the subject of further rulemaking, if necessary. The USEPA and the NYD estimate that it may take up to 4–5 years to fully complete this process.

2.3.2 HABITAT CREATION, ENHANCEMENT, AND RESTORATION

In support of the NYD's effort to investigate opportunities to use dredged material beneficially, a technical document was prepared to assess the various potential beneficial use applications of dredged material for habitat creation, enhancement and restoration in the Harbor (USACE 2001). In this Beneficial Use report, various applications to create, enhance, or restore habitats with dredged material were investigated in terms of their potential benefits, impacts, relative costs, and potential capacity. Specifically, the following applications were considered in the assessment:

1. Upland habitat
2. Degraded aquatic site restoration (e.g., borrow pit restoration)
3. Treatment wetlands
4. Wetland habitat
5. Recontouring for shallow water habitat
6. Filling dead-end basins
7. Artificial reefs
8. Bird habitat
9. Shellfish habitat
10. Mud flats

11. Oyster reefs
12. Submerged Aquatic Vegetation (SAV) habitat

Each of these options is discussed in Section A.3.2 Habitat Creation, Enhancement, and Restoration, in the DMMP – Technical Appendix. The reader is referred to the Beneficial Use report for a thorough examination of each option.

To broaden the opportunities to use dredged material beneficially, the NYD is committed to making use of dredged material for habitat creation, enhancement, and restoration an integral part of the solution for managing dredged material in the future. The initiation of this commitment is the inclusion of several future placement options in this DMMP for the purpose of creating, enhancing, or restoring habitat (see Table 2-1).

Many of the above options have been implemented in other regions around the world, with varying degrees of success. Currently, the only implemented application of dredged material intended to improve habitats in the Harbor has been the construction of offshore artificial reefs using dredged rock. Artificial reefs constructed of dredged rock have been implemented in both NY and NJ waters, and are now host to an abundance of marine life such as fish, shellfish, and lobsters. Much of the rock used to create these reefs was produced from the deepening of the Kill van Kull Federal navigation channel as part the NYD's HDP. Over the last 5 years, over 2 MCY of blasted rock has been utilized for this purpose. As the HDP continues, it is anticipated that more rock will be generated and available for use in on-going and proposed reef construction projects. However, to ensure that rock placement availability does not interfere with dredging project schedules, a long-term rock placement plan that specifies reef locations and quantities may need to be developed.

Another potential placement option (preference 1 option) is the proposed habitat enhancement of the in-active Military Ocean Terminal Bayonne (MOTBY) channel using HARS suitable material removed during the deepening and realignment of the Port Jersey Federal navigation channel. Habitat enhancement of MOTBY channel was pursued because the realignment of the Port Jersey channel will involve the removal of about 12 acres of sub-littoral sediments, which has been determined to be potentially viable spawning and nursery habitat for winter flounder (USACE 1999c). To offset this loss of potential habitat, an Environmental Assessment (EA) was conducted to investigate the opportunity to use the HARS-suitable Jersey Flat material to fill relatively deep areas of the MOTBY channel to enhance habitat conditions for winter flounder and other species (USACE 2004). Sampling conducted in support of the EA revealed that the deeper sections of the MOTBY channel (35+ feet) are characterized as very fine-grained sediments dominated by stress-tolerant polychaete species. The sampling effort also revealed very low abundance of mature winter flounder and no evidence of winter flounder eggs. The EA concluded that filling the deeper sections of the channel to a depth of 9 to 15 feet could result in 63 acres of enhanced habitat more favorable for winter flounder foraging and spawning activities. This represents the potential to realize a net gain of 51 acres of enhanced habitat conditions and the beneficial use of 0.9 MCY of dredged material. NJDOT/OMR has submitted an action permit (currently pending), and implementation is anticipated to begin in 2005.

As identified in the Beneficial Use report, habitat improvement options that may be feasibly implemented in the near-term include those for oyster, shellfish, and bird habitats. Some organizations such as NY/NJ BayKeeper have already begun efforts to restore oyster reef beds in response to the improving water quality of the Harbor. The pilot programs they have conducted over the last several years indicate that constructed reefs can support planted oysters (NY/NJ Baykeeper 2005). () The amount of dredged material required or available?? for this use is relatively small compared to other beneficial use options but could yield significant benefits in terms of added ecological value to the Harbor. Although the creation of oyster reefs is included as a Preference 1 option, further evaluation studies, demonstration projects, and/or attractive nuisance assessments are needed first to ensure that constructed oyster reefs using dredged material would be self-sustaining and would pose no risk to public health.

Historically, shellfish have been abundant throughout the Harbor estuary and in many areas shellfish beds continue to flourish. In terms of biodiversity, they are an integral part of a healthy estuarine ecosystem in their contribution to improving water quality and as an essential food source for other marine organisms. According to the Beneficial Use report, populations of softshell clams (*Mya arenaria*) in the Raritan Bay/Sandy Hook region have declined in recent years for reasons that are not well understood. The report warns that attempts to create large-scale clam beds in the area using dredged material would be better served if the cause of their decline was determined first, or until small-scale projects demonstrate likely success. As with the construction of artificial oyster beds, this option is a preferred option (Preference 1 option), but future implementation is pending further study of sustainability and attractive nuisance potential.

Several opportunities for bird habitat enhancement with dredged material have been identified in the NY/NJ area. These are the creation of upland habitat at Floyd Bennett Field in Brooklyn, mudflat/marsh restoration at South Brother Island (East River) for colonial waterbird and migratory shorebird feeding habitat, and habitat development at Prall's Island (Arthur Kill) and Shooters Island (Kill van Kull) to support colonial waterbird nesting/feeding. The District also is considering the placement of dredged material on Hoffman-Swinburne Islands to create upland bird habitat for species such as least terns. While these opportunities are included as a preferred option (Preference 1 option), permission from the National Park Service (NPS) is required for some of these projects (e.g., Hoffman-Swinburne Islands and Floyd Bennett Field) before planning and implementation can begin.

There are a number of relatively deep pits located within sheltered areas of Jamaica Bay along its southeast shore that are leftover from sand dredging activities during the early-mid 20th century, and may provide opportunities for habitat enhancement. Given the potential volume of material that could be beneficially reused through the restoration of habitat in selected degraded aquatic sites and the cost-effectiveness of the operation (potentially equivalent to the HARS), this option is valid to pursue in further detail. The NYD and the NYSDEC are currently engaged in a three-phased demonstration project at the Norton Basin and Little Bay degraded aquatic sites. The purpose of Phase 1 of this demonstration project is to collect data to determine if the aquatic sites in question are indeed degraded. The decision making process will involve a public participation component, including the review of all documents generated by the interagency team of experts, and extensive public input. At the completion of the public participation process, a final decision will be made by the NYD and the NYSDEC as to whether it is in the public interest to proceed to Phase 2 of the demonstration project. In October 2004, the NYSDEC issued a findings statement on a recently completed evaluation of the habitat function of Norton Basin and Little Bay as part of Phase I. In this statement the Interagency Technical Committee (made up of the USACE, NYSDEC, NOAA, USFWS, NPS and USEPA) concluded that both sites suffered significant impairments and could be characterized as degraded. A summary of the NYSDEC's findings statement is presented in Section A.3.2 Habitat Creation, Enhancement, and Restoration, in the DMMP – Technical Appendix. NYSDEC's findings statement is posted in its entirety at:

http://www.dec.state.ny.us/website/reg2/jbborrow/findings.html.

As a result of these findings, the Interagency Technical Committee has recommended that the NYSDEC and the NYD proceed with hydrodynamic and water quality modeling to evaluate the potential net environmental benefits from recontouring the pits to various depths using HARS suitable dredged material. Phase 2 would involve using HARS suitable material to fill or partially fill the Little Bay pit, followed by an extensive monitoring program to determine the success of the restoration project, based upon the establishment of a well oxygenated, high-quality benthic habitat and associated benthic community. Only after the monitoring results are fully evaluated, and can substantiate that such an operation can be accomplished in an environmentally safe and beneficial manner, would proposals be considered for application to other Jamaica Bay pits (e.g., Grassy Bay or Jo-Co Marsh, both of which are listed as preference 3 options in Table 2-1).

Regarding those options listed in the Beneficial Use report that have not been specifically addressed above, several policy and technical issues need to be resolved before some of the more innovative applications can be implemented. Resolution of these issues would require field data collection and demonstration. As was mentioned previously, many of the applications have been undertaken at other locations, either locally or elsewhere in the world, but may need their applicability demonstrated in this region. These applications will require additional research and monitoring before they can be fully implemented on a Harbor-wide basis. Examples of issues that need to be addressed include the potential to improve existing value or use, the potential plume generated during placement operations, and the potential to attract edible fauna that, if harvested, may pose a human health risk (attractive nuisance).

An opportunity exists for pursuing habitat creation or restoration in light of the substantial amount of material expected to be dredged during the on-going HDP. The availability of HARS-suitable material from the HDP provides the unique opportunity to use dredged material for a number of beneficial uses at reduced or no cost for the material. The current projection of the volume of clean sand to be dredged from Ambrose channel alone is approximately 11 MCY over the next 6 years. Currently, the NYD is working to coordinate HDP efforts with the HRE via this DMMP to identify environmentally beneficial placement options for clean dredged material as it is being produced. As a result of this coordination, the NYD has already identified two opportunities to use material from channel deepening beneficially that could restore lost habitat. One opportunity is to use sand dredged from Ambrose channel in Jamaica Bay as a source of material for stabilizing some of the rapidly disappearing salt marsh islands. Currently, planned pilot stabilization projects at Yellow Bar and Elders Point islands require 350,000 CY of material, which is more than is available from the nearest maintenance dredging project at Rockaway Inlet). Accordingly, the concurrent deepening of Ambrose channel affords the opportunity to use dredged material beneficially at reduced or no cost by supplementing these pilot studies and restoring a significant portion of habitat lost from Jamaica Bay. A similar opportunity exists at Liberty State Park, as 750,000 CY of clean material are needed to cap and re-contour the site prior to planting new vegetation. Construction for both projects is expected to occur within the 2006 to 2007 timeframe, and Ambrose channel deepening could again be the source of material at a fraction of the price it would take to either dredge or truck material to the site from other sources. The target result would be a rejuvenated wetland habitat for a variety of birds, fish, shellfish, and benthic organisms, at far less cost and consistent with using deepening material beneficially.

Although these opportunities offer the potential to beneficially use over 1 MCY of material, there is a great deal more material that will be available for similar uses in the coming years. The NYD looks to identify more opportunities for using dredged material in ways beneficial to the environment as part of its plan to manage future dredged material. The DMMP will be periodically updated to identify opportunities deemed acceptable to the Port's dredged material managers, regulators and the public. It should be noted, however, that the window of opportunity to use material from channel deepening for habitat creation and enhancement, among other uses, is finite. At no other time in the foreseeable future will there be a peak in volume of HARS-suitable material available for this purpose after the HDP is complete (~2014). Accordingly, the NYD is developing an outreach strategy to inform all stakeholders and interested parties of the opportunities to use dredged material that have the potential to contribute to the restoration of the Harbor.

2.3.3 LAND REMEDIATION

This option combines the beneficial use of dredged material, primarily processed HARS-unsuitable material, with the environmental and economic restoration of degraded lands. Degraded lands include active and inactive landfills, brownfield sites (former industrial sites), quarry sites, and abandoned mines.

Prior to use as grading/closure material at these types of sites, dredged material is typically processed with binding agents to improve its structural properties. Binding agents that have been shown to be effective include cement, fly ash, coal ash, lime, and kiln dust. This process also immobilizes contaminants within the material so they do not leach out or otherwise become bioavailable. For this reason, this process also is considered to be a low-end decontamination technology called solidification/stabilization (see Section 2.4, Decontamination). The end product is typically a granular, soil-like material. The stabilized dredged material can be manufactured to meet the material and engineering specifications for a specified use such as structural fill, grading material, final landfill cover, or some other application by modifying the proportion and types of admixtures. Other ways to process dredged material to make it suitable for land remediation include dewatering and manufactured-soil production (blending in cellulose waste and biosolids to make fertile topsoil).

Landfills and brownfields offer unique opportunities for the beneficial use of dredged material. These sites often have environmental safeguards incorporated into the site's design, such as liners and leachate collection systems in the case of landfills, and groundwater containment and monitoring at brownfields sites. In addition, the use of dredged material on these sites often saves capital investment needed to otherwise purchase the required fill and grading material for the remediation and management of the site.

Land remediation using processed dredged material has already been implemented successfully in this region. In 1997, the Jersey Gardens Mall Site in Elizabeth, NJ, utilized 850,000 CY of processed dredged material for the base of a parking lot at a cost of $56/CY (including dredging). In 2003, the Bayonne landfill remediation utilized approximately 3 MCY of processed dredged material as structural fill material in the remediation of a landfill site prior to the creation of a golf course, at a cost ranging from $29–$42/CY, depending on the volume being dredged, the specific nature and location of the material being dredged, and the market conditions (given that the site had been privately developed and selected through an open bid competition process). Approximately 200,000 CY of processed dredged material was used in the remediation of the Port Liberte brownfield site, preparing the site for anticipated construction of a golf course.

Recently, the Brooklyn Navy Yard project demonstrated a beneficial use of dredge material from the Harbor. Approximately 10,000 CY of dredged material was removed from the Brooklyn Navy Yard and beneficially reused instead of using other fill from an upland source. After the material was processed and stabilized with addition of gradation stone, approximately 5,000 CY of material was used on-site as structural fill material in road construction. The remaining 5,000 CY of material was processed as a fill material and beneficially reused for a mine reclamation project at Bark Camp, Pennsylvania (PA).

The land remediation sites in the region to date have been developed through private enterprises that are largely spurred by real estate development, therefore the price for processing and placing HARS-unsuitable dredged material fluctuates from contract to contract. Based on several of the past USACE contracts (from both deepening and maintenance projects), the cost to the user for these options ranges from $29–$42/CY dredged. Also, some demonstration and/or pilot options that show promise for future, larger scale applications (e.g., coal mine remediation), have been partially subsidized by sponsoring agencies such that their cost to the user falls within this same range. For purposes of calculating the general costs of the landfill, brownfield, quarry, and mine remediation management options within this plan, the midrange value of $36/CY has been used, although one should note that any specific contract cost might differ substantially from this figure given the specific circumstances and details of the contract.

While the use of HARS-suitable sediments at some land remediation options (e.g., as potentially final cap material) is now under consideration by various agencies in the region, the costs for using HARS-suitable material would likely need to be comparable to that of the HARS for the option to be practicable to the user. Alternatively, the land remediation would have to provide some substantial unique or valuable environmental benefits to warrant the added costs. For this reason, and as this application develops, subsidies from other sources likely will be needed for these options to be implemented using HARS suitable sediments.

Landfills

The use of dredged material (processed as necessary) as a low permeability cap and as structural fill on both active and inactive landfill sites offers several environmental benefits. Uncapped landfills in the region are estimated to generate approximately 400,000 gallons of leachate per acre per year. The low permeability of processed dredged material, particularly cap material, will reduce the amount of precipitation infiltrating contaminated historic fill. This results in a substantial reduction of contaminants leaching out of the soil that would otherwise contaminate groundwater and surface water in the Harbor region.

EnCap Golf, Inc., is remediating four landfills in the NJ Meadowlands. This Brownfield Redevelopment Project encompasses three orphaned landfills and an adjacent fourth landfill for a total of approximately 700 acres. It is estimated that these landfills will need a minimum of 2.5 MCY, and up to a maximum of 5.0 MCY, of dredged material and/or processed dredged material as the shaping and grading layer beneath and as part of the cap(s) for these landfills. Upon completion of the remedial and closure activities, the site will be converted into three golf courses and a commercial, resort development. The site is currently accepting material. Placement costs at the site have been negotiated to remain static at $5.23/CY of processed dredged material, which does not include the possible processing and upland transportation costs.

The NJDEP has identified hundreds of landfills across New Jersey that may require remediation and final, proper closure. Of these, the NJMC has identified approximately eight major landfills within their jurisdiction. The NJDEP is working in conjunction with the NJMC and NJDOT/OMR to develop Closure Plans for these landfills using a minimum of 5 MCY of processed dredged material and Pleistocene red-brown clay from the deepening of the Federal navigation channels in the Kill Van Kull, Newark Bay, and Port Jersey Channel.

In a dredged material pilot study, New York City (NYC) evaluated the potential for using dredged material for the contour layer, barrier protection layer (above the geomembrane liner) and as a final planting medium for the restoration of a coastal plant community at the Pennsylvania Avenue and Fountain Avenue landfills. The study confirmed that dredged material can be effectively used as a rough grading material and has been used in several cases for this purpose. The final report for this portion of the study was released in November 2004. The establishment of coastal grassland and a mixture of indigenous deciduous and evergreen plants at these sites will greatly improve the environment surrounding Jamaica Bay. Processed dredged material from the following projects was placed at the landfills: Pier 79 (36,000 CY), the Kill van Kull (60,000 CY), and Flushing Creek (80,000 CY) have been placed at the landfills as grading material.

The State of NY and NYC have closed most of the municipals landfills in the State over the last two decades. Presently, there remain only two former NYC municipal landfills in the harbor area undergoing closure (Fresh Kills Landfill and Brookfield Landfill), offering the potential for using approximately 3–4 MCY of dredged material.

Consistent with the view that dredged material is a beneficial resource, all the landfill remediation projects discussed are preference 1 options (Table 2-1).

Brownfields

As defined by USEPA, brownfields are abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by actual or perceived environmental contamination.

The State of NJ has identified several thousand brownfield sites, some of which are located within the Harbor Complex.

- The Koppers Coke site in Kearny, NJ, is a brownfield identified for remediation and reuse as a manufacturing or warehousing facility. The site has already accepted 1.1 MCY of processed dredged material. The site is owned by the Hudson County Improvement Authority. Additional dredged material (approximately 400,000 CY) may be placed at the site pending resolution of a remediation strategy. Cost of processing and placement ranges between $29–$42/CY.

- Several other brownfields in this region, including, but not limited to, NL Industries (Sayreville, NJ), Allied Signal (Elizabeth, NJ), and Military Ocean Terminal (MOTBY) (Bayonne, NJ) are anticipated to have a combined dredged material capacity of 7 MCY at a cost ranging between $29–$42/CY (see Table 2-1). FDP Enterprises (Jersey City, NJ) is another brownfield site originally permitted in 1998 to accept about 700,000 CY of material. Since that time, the site has undergone further permit modifications and has utilized processed dredged material as part of the remediation plan for the site. As the site's future capability to accept more material is presently under regulatory review, to be conservative, no future dredged material is planned for the site as part of this DMMP update. However, in recognition of its pending status, the FDP site remains listed in Table 2-1 as an uncertain future placement option (Preference 3 option).

NY has several brownfield sites within the area of the Harbor falling under one of several brownfield programs (RCRA, State Superfund, and Voluntary Clean-Up Program). Efforts are presently underway to determine the suitability of several sites to receive dredged material as remediation material. Factors under consideration include, but are not limited to, proximity to the Harbor, existence of waterfront bulkhead, and proposed end use of the site. NYSDEC is supportive of using dredged material as fill at brownfield sites, and where deemed appropriate, issues Beneficial Use Determinations for that purpose. The NYSDEC is presently evaluating the potential of using dredged material in the remediation of these sites.

- The Motor Sports Entertainment Complex (MSEC) site on Staten Island is presently undergoing remediation, and representatives from MSEC have approached the NYSDEC about the possibility of using dredged material in the remediation process. MSEC is presently preparing the required plans to obtain the necessary permits from the State. Capacity at the site is approximately 5 MCY at a cost ranging between $29–$42/CY (Table 2-1).

All brownfield sites, except FDP, are currently Preference 1 options (Table 2-1).

Quarry Reclamation

Quarries are open excavations for extracting aggregate, limestone, slate, or similar materials. Dredged material can be used beneficially to fill excavations and restore contours at quarry sites, thereby eliminating the safety hazards associated with the cut face of the quarry. In addition, restored contours often result in the creation of areas suitable for further habitat restoration or economic development.

- In NJ, Pattenburg Quarry (also called the Hunterdon Quarry) has been identified as a possible placement site for dredged material/processed dredged material with a capacity of approximately 30 MCY. This site is equipped with rail access to and from the Harbor/Newark Bay area so the upland transport and placement cost is expected to be in the neighborhood of $7/CY (not including any necessary processing costs).

- The Upland Confined Disposal Siting Study (USACE 1996) identified six potential quarry sites in the region, all located along the Hudson River waterfront in upstate New York. Preliminary estimates indicate that the total potential capacity exceeds 17 MCY. Currently, there is a lack of local sponsorship or support for the use of processed dredged material at these sites.

The Hudson Basin Quarry sites lack local support and are therefore non-preferred options (Preference 5 option), while the Hunterdon Quarry is a Preference 3 option (Table 2-1).

Abandoned Coal Mine Reclamation

Abandoned coal mine sites can cause a variety of serious environmental problems, including land subsidence, underground mine fires, dangerously high vertical rock faces, and most significantly, acid mine drainage. Acid mine drainage is the major cause of water pollution in every Appalachian coal-mining state, and impacts over 3,000 miles of PA's rivers and streams. Using dredged material as fill for abandoned coal mines, both strip and deep mines, offers the potential of vast disposal volume and environmental benefits. Thousands of abandoned mines dot the eastern U.S. in relative proximity to the Port of NY/NJ, many with capacities in excess of 100 MCY.

- The PA Department of Environmental Protection (PADEP) permitted a demonstration project in June 1997 for using processed dredged material for abandoned coal mine reclamation. The mine site chosen for the demonstration project was the Bark Camp Mine Reclamation Laboratory located in Huston Township in Clearfield County, PA. The site was permitted to accept 0.735 MCY of processed dredged material. At project completion, almost 500,000 CY of dredged material from NY/NJ Harbor was placed at the site. While the costs of this demonstration project range from $42–$86/CY, depending on volume, to date the costs have been heavily subsidized by the State of NJ (NJDOT/OMR) and the PANY/NJ. Water run-off and well samples from the Bark Camp test site, after placement of the initial volume of material, showed no difference in contaminant levels from background levels tested prior to placement. Using established leachate procedures, all contaminants levels were below the state standards, with most contaminant levels below the detection limit (PADEP 2004).

This use of dredged material for acid mine reclamation has been highly successful, prompting the PADEP to issue a General Permit for the use of amended dredged material for the closure of the Lehigh Coal and Navigation Mine in Lehighton, PA (the Springdale Pit). This mine has a capacity in excess of 25 MCY. The cost of this option is projected to be about $29/CY. However, economies of scale through reduced railroad transport and the contribution of mine reclamation funding, along with a contribution from funds for use of cement, fly ash, lime, and kiln dust (which also constitute waste streams that require management) to offset costs, may result in a net cost of $20–$26/CY for this application.]

All of the mine reclamation projects are preference 1 options (Table 2-1).

Red Clay as Cap Material for Upland Sites

The NJDOT/OMR sponsored a pilot study to investigate the feasibility of beneficially using dredged red clay at upland sites for low-hydraulic-conductivity caps and other engineering applications (CAIT 2005b). Important findings of the study include the following: 1) dredged red clay can achieve the same low-hydraulic-conductivity requirement as mined clay with additional moisture conditioning and compaction; 2) material transport and application processes associated with the application of dredged red clay were found to be feasible; and, 3) based on a comparison of the relative application costs, using dredged red clay in lieu of mined clay has the potential to be more cost effective. In general, the study suggests that using dredged red clay as capping material for upland sites may be a more appropriate use of this valuable material than the current practice of using it as cap material for HARS. Further, this approach is consistent with the objective to utilize, when feasible, beneficial use opportunities other than the HARS for the placement of HARS-suitable material. Ongoing status of NJDOT/OMR research can be viewed at the NJDOT/OMR website:

www.state.nj.us/transportation/maritime.

2.3.4 PUBLIC PROCESSING FACILITY

Dredged material disposal is one of the biggest challenges facing most ports in the United States today. As our coastal and harbor areas continue to grow in population, competition for use of waterfront property and adjacent harbor and ocean waters challenges our ability to dispose of dredged material in an environmentally appropriate and economically feasible manner. Increased sensitivity and knowledge of the impact of chemical contamination in some dredged material adds additional challenges to finding environmentally appropriate dredged material disposal alternatives in older urban ports like New York (USACE 2003).

Over the last decade, regional dredged material managers have been considering the economic benefits of constructing a public possessing facility to handle material unsuitable for HARS placement as an alternative to utilizing existing privately developed facilities. The interest in investigating the feasibility of constructing such a facility arose out of concern that the privately developed processing facilities may not be economically viable or sustainable in the long-term once the deepening projects are complete, or when various large real estate development projects (e.g., landfills and/or brownfields) exhaust their capacity for dredged material.

Generally, it is believed that the development of a Harbor-wide dredged material processing facility might resolve some of the unpredictability in the supply of dredged material, which could result in substantial cost savings. These costs savings could be realized by designing a facility with adequate storage or stockpiling capacity to facilitate continuous and unimpeded operations. In addition, a Harbor-wide processing facility could help to reduce current costs for stabilization and transportation by maximizing the volumes of dredged material to be processed. After the 50 foot deepening project is complete, reducing the cost of maintenance dredging operations will be critical in response to the expected increase in shoaling rates in some of the deeper channels, which may increase the frequency of maintenance dredging (USACE 1999a).

The primary objective of the facility is to ensure an ample reliable supply of usable dredged material to the point where upland placement of dredged material for beneficial uses becomes an economically preferred alternative and dredging become economically feasible for small quantity generators that cannot currently afford to conduct necessary dredging. In addition, there is a relative scarcity of reasonably priced fill material in the Port area that could be accommodated if the millions of CYs of dredged material removed from the Harbor could be economically converted to usable construction fill.

The facility is proposed to be privately owned but accessible to all in the Port District, accepting dredged material from both Federal channels and private berthing facilities. It is intended that the facility would complement, not compete with, existing and planned future privately operated dredged material processing endeavors. The NYD, in conjunction with Port stakeholders, is currently evaluating the feasibility and economic costs/benefits of a Harbor-Wide Public Processing Facility (PPF) to support all types of proposed dredging in the Port.

Beneficial Use and Storage

Dredged material could be processed for a variety of beneficial uses ranging from source material for manufactured products to placement at various upland remediation sites, including brownfields and sanitary landfills. In addition to processing, interim (on-site) storage would be available for pre and post processing in order to accommodate the different rates of dredging, processing, and transport to the ultimate end-use application.

Facility Siting and Design

The facility would be located within a reasonable distance from Port facilities/channels (ideally within the Port itself), and provide for adequate road, rail and deep water (15 ft or greater) access to facilitate the movement of dredged material on to and off of the site. Other considerations for the facility include a mobile processing component that could be used at alternate locations to create dredged material product.

Regional Processing Capacity

The intent of the facility would be to provide the region with a regular flow of material and consistent pricing of processing capacity. Processing and storage capacities would be determined based on projected needs over the short and long terms.

2.3.5 OTHER BENEFICIAL USES

Other beneficial uses include a variety of options that utilize the different types of dredged material such as sand, clay, glacial till, and rock. These options include beach nourishment and construction material (Table 2-1).

Beach Nourishment

Beach nourishment projects have been accepting sandy HARS-suitable material from USACE maintenance dredging work conducted in three main geographic areas: Jamaica Bay, Sandy Hook Channel, and East Rockaway Inlet. Additionally, sand dredged during the deepening of the Ambrose Federal navigation channel may also serve as a source of sand for beach nourishment as needed. Material is placed at various sites based on availability of and need for sandy material. Beach nourishment projects have the capacity for specific amounts of material on varying (i.e., 2–20 year) cycles.

Construction Material and Other Marketable Products

Because de-watered dredged material is essentially soil, it has the potential for wide application in construction projects that require fill material. In most applications, fill material requires certain specific geotechnical properties, which de-watered dredged material by itself may not exhibit. To enhance the geotechnical properties of dredged material, it is common to amend it with additives such as Portland cement, coal fly ash, or incinerator ash, which absorb excess water and produce a more stable and compactable soil-like product. The amount and type of additives mixed with dredged material is dependent on the application, which may require specific geotechnical properties per construction regulations. In other construction applications, dredged material has been used as the raw material for blocks, tiles, and bricks. In such a case the dredged material is mixed with various additives and processed to meet American Society for Testing and Materials (ASTM) geotechnical standards for building materials.

As an example of the utilization of dredged material as a construction aggregate, Amboy Aggregates, Inc., mines up to 2.5 MCY of sand per year from a portion of Ambrose channel. This private mining operation serves as part of the maintenance of Ambrose Federal navigation channel to maintain a depth of 90 feet over the life of their permit. The sand is barged to a facility in South Amboy, NJ, where it is processed for use as construction aggregate. The clear advantage of this arrangement is that the material is used beneficially and reduces the cost to the Federal government for maintaining the channel.

Dredged sand from the Ambrose Federal navigation channel will also be used in the redevelopment of the Peninsula of Bayonne. Part of the redevelopment of the Peninsula is an increase in grade above the local flood plain elevation. Specifications indicate that about 1.3 MCY of sand will be needed as construction fill to reach the desired grade elevation. The sand will be supplied from the coincidentally scheduled Ambrose Channel Deepening Project, a convenient source that will reduce costs to the project by eliminating the need to purchase and ship sand.

A number of studies in NJ have been conducted for investigating other potential uses of dredged material in construction applications. During the development of the Jersey Gardens Mall Site at the former Elizabeth Landfill site in Elizabeth, NJ, (see Section 2.3.3, Land Remediation), the NJDOT/OMR sponsored a study to evaluate the feasibility of using stabilized dredged material as a fill material for roadway embankments (SAI 2001). This study established that stabilized dredged material satisfied most of the geotechnical criteria for embankment construction, except those for durability, requiring proper coverage and protection similar to that provided for fills constructed on cohesive soils (Maher et al. 2004, Maher et al. in review). Evaluation of potential for environmental impacts of the use of stabilized dredged material in construction applications showed that current policy regarding application sites and engineering controls were effective at controlling the potential for risk to human health or the environment (Douglas et al. 2005).

In another study, the Center for Advanced Infrastructure and Transportation (CAIT) at Rutgers University evaluated the geotechnical properties of the dried dredged material in the Palmyra Cove CDF, in Palmyra, NJ, to determine its usefulness as construction fill (CAIT 2005a). Based on various geotechnical tests, CAIT concluded that the dried material in the Palmyra Cove CDF was suitable for uses such as roadway sub-base, embankment earth fill, retaining wall backfill, pipe trench bedding, and general earth fill. These findings support the idea that the CDF's capacity may be extended by removing the dried material from the CDF for use as construction fill, and refilling the vacancy with newly dredged material.

In the interest of expanding the beneficial use of dredged material from the Harbor, it is anticipated that the feasibility for using dredged material for construction applications like these will continue to be investigated and applied.

2.4 DECONTAMINATION

Decontamination technologies reduce or eliminate the harmful effects of contaminated dredged material by physical, chemical, thermal, and/or biological treatment. In decontamination processes contaminants are destroyed, removed, or immobilized (cement or vitrified matrix). Fortunately, very little HARS-unsuitable navigational dredged material needs to be extensively decontaminated prior to beneficial use in land remediation projects (as discussed in Section 2.3.3, Land Remediation). However, through treatment, this material could be used in wider and less restricted applications and at more types of placement sites. Depending on the decontamination process used, the end product may have significant market value, such as clean soil, lightweight aggregate, construction-grade cement, structural fill, and architectural glass tiles.

Low-end processes are relatively simple and inexpensive and include solidification/stabilization and manufactured-topsoil production (both addressed in Section 2.3.3, Land Remediation). High-end processes are typically more expensive, complex, and energy-intensive. These include solvent extraction, sediment washing, and thermal processes.

Section 405 of the Water Resources Development Act (WRDA) of 1992, as amended, authorized USEPA Region 2 and the NYD to develop and implement the NY/NJ Harbor Sediment Decontamination Technologies Demonstration Program that demonstrates the feasibility of decontaminating dredged material from the Harbor to produce high value, environmentally acceptable beneficial use products. Working with Brookhaven National Laboratory, the WRDA Section 405 program has progressed through demonstrations of various technologies at bench and pilot scales and is now moving forward towards full and commercial scale demonstrations and implementation. The step-up procedure has resulted in the reduction in the number of participants based on technical performance, demonstration costs, cost sharing, and the availability of beneficial uses for the processed material. To date, under the USEPA program, seven bench-scale, five pilot-scale, and up to three full/commercial-scale demonstrations are in construction and implementation for 2005 and 2006. The NJDOT/OMR is working in partnership with the USEPA program in developing commercial scale applications of these technologies with beneficial use applications. NJDOT/OMR has conducted four pilot-scale tests and will be overlapping with the USEPA in demonstrating over 2005–2006 up to three full/commercial scale technologies with high-value beneficial use applications. Approximately $42 million has been appropriated over the past decade between Federal and state resources for evaluation and development of commercial scale sediment decontamination. More information on the Federal and state NY/NJ Harbor Sediment Decontamination Technologies Demonstration Program, including technical reports and ongoing efforts, is available at the following websites:

www.bnl.gov/wrdadcon/
www.state.nj.us/transportation/maritime

Section A-4 Decontamination, in the DMMP – Technical Appendix describes in detail technologies that have undergone bench/pilot demonstrations through both the USEPA and NJDOT/OMR Decontamination Programs. The USEPA, NJDOT/OMR, NJDEP, NYSDEC, Empire State Development Corporation (ESDC), PANY/NJ and the NYD will continue to coordinate closely on these projects. It is expected that decontamination could be utilized for up to 1 MCY/YR of dredged material by 2007 and the cost will have been reduced from the current cost of approximately $90–$150/CY to a competitive cost of $35–$55/CY. The economics of these systems for scale-up potential are based on 250,000–500,000 CY/YR processing systems. If economies of scale and technological advances do not enable the costs to be competitive with the other options, sediment decontamination may be limited to remedial restoration activities unless the benefits to the environment and public health are shown to justify the incremental expense.

All decontamination technologies are Preference 1 options (Table 2-1).

2.5 CONFINED AQUATIC DISPOSAL (CAD) FACILITIES (SUBAQUEOUS AQUATIC SITES)

A confined aquatic disposal (CAD) facility is a depression excavated into the bottom of a body of water for the purposes of disposing and confining dredged material. Depending upon the character and nature of the material excavated from the channel bottom, the material excavated to create the CAD facility would either be used beneficially (including remediation of the HARS) or disposed of in an appropriate manner if other beneficial use options were not suitable or feasible. The dredged material selected would be placed into the CAD facility and then covered or capped with an appropriate layer of sediment to isolate the contaminants from both the surrounding water column and the marine/estuarine organisms that inhabit the area. A variation on this option is to use existing degraded aquatic sites that were previously created by sand mining. This variation would fill and cap the degraded aquatic sites in the same manner as that for a constructed CAD facility. The use of existing degraded aquatic sites solely as a containment/disposal option is no longer under consideration (Preference 5 options). However, for those degraded aquatic sites with a demonstrable degraded habitat, filling or partially filling may serve to remediate that condition. Therefore, this case is considered a beneficial use of dredged material and is discussed further in Section 2.3.2, Habitat Creation, Enhancement, and Restoration.

On May 19, 1997, the PANY/NJ received an approval valid for 5 years to construct the three Newark Bay Confined Disposal Facilities (NBCDFs), to be used for the disposal of dredged material that is not suitable for ocean disposal. NBCDF was named a Confined Disposal Facility (CDF), but it is actually a CAD facility. An extension of the approved permit was granted to the PANY/NJ in 2002 for an additional 5 years to continue operating NBCDF. Disposal is restricted to dredged material excavated within the NBCDF draw area, which includes Newark Bay, KVK, Arthur Kill, and the NJ side of the Upper Bay to Liberty State Park. The approved project consists of the construction of three subaqueous sites designated as 1S, 2S and 2N. All of these sites were proposed to be excavated to a depth of –70 feet below mean low water. In addition, access channels were to be excavated to a depth of –20 feet below mean low water. The project was phased such that site 1S was constructed first. Site 1S and its access channel encompass 26 acres, and are located on a subtidal flat bordered by Port Elizabeth Channel to the south, the Newark Bay Middle Reach Channel to the east, the Port Newark Channel to the North, and the Port Newark Pierhead Channel to the west. Sites 2S and 2N were to be constructed in the second phase of the project. Sites 2S and 2N encompass 21 acres and 10 acres respectively. Both sites are located to the west of Newark Bay North Reach Channel, north of Port Newark Channel and south of the NJ Turnpike Extension Bridge.

NBCDF site 1S was constructed between May and November 1997. Initial capacity was 1.8 MCY of dredged material. This facility is managed and operated by the PANY/NJ. To date 32 separate dredging projects with a combined total of 1,386,059 CY have utilized the NBCDF-1S for disposal leaving approximately 576,888 CY of available capacity. Dredged material disposal in NBCDF has originated from Federal, state, private and PANY/NJ facilities located within the permitted draw area. The current user fee is $36.75/CY for placing dredged material at the NBCDF site 1S.

Results of environmental monitoring and bathymetric surveys indicate that the facility is effective in containing the material disposed into it with no measurable impact outside the boundaries of the facility. More information on this is contained in Section A-5 Confined Aquatic Disposal Facilities, in the DMMP – Technical Appendix. The two permitted (but not constructed) CAD cells would have a combined additional capacity of 2.4 MCY of dredged material. The original permit to construct the remaining cells expired in May 2002. An extension of the approved permit was granted to continue operating NBCDF for an additional 5 years, but construction of sites 2S and 2N would require new permit action.

In the Port region, several potential areas for constructing new CAD facilities have been tentatively identified based on existing and newly collected biological and physical data. These potential sites include Upper Bay, Newark Bay, Lower Bay (Zone 2) and Raritan Bay (Zone 1). Placement costs in Upper Bay were estimated in 1997 to be $35–40/CY. These estimates were high compared to Newark Bay ($25/CY) because of potential for excavating sediments that are HARS unsuitable, or that would require decontamination. Preliminary volume estimates for Lower Bay and Raritan Bay indicate that these two zones have sufficient capacity to meet all maintenance and new work needs through the middle of the century, at a placement cost of $15/CY. However, because of potential impacts to sensitive biological resources, at this time these zones are considered the least desirable of those that are potentially feasible. However, future conditions may necessitate reevaluation of this option, and they may then be reconsidered as viable. A more detailed discussion of these potential CAD facility sites is found in Section A-5 Confined Aquatic Disposal Facilities, in the DMMP – Technical Appendix. The above cost estimates were in 1997 and are provided here for comparison purposes only.

Sequencing the use of CAD facilities over many years provides the flexibility to respond to changes in sediment quality that may come about as a result of implementing contaminant reduction and/or decontamination measures. If these initiatives function well enough to markedly reduce the future volumes of HARS unsuitable dredged material, the construction of additional degraded aquatic sites could be phased out with no loss of capital investment, as the degraded aquatic sites would only be constructed on an as needed basis.

2.6 CONFINED DISPOSAL FACILITIES (CDF)

A CDF involves the construction of dikes or other retention structures lined with impermeable material to contain dredged material isolating it from exposure to the environment. Dredged material can be placed within the dikes of the CDF through a variety of methods. Monitoring is typically conducted periodically in areas adjacent to the CDF to ensure safe containment of the dredged material and any associated contaminants. Excess surface water is clarified by ponding, treated as necessary to meet applicable effluent standards, and released. Active or passive consolidation techniques may be employed to maximize the usable capacity of the CDF. Once filled, the CDF is capped with appropriate material, permanently isolating the dredged material. The CDF dikes can be built on land, in water adjacent to land and in open waters to create an upland, nearshore or island CDF, respectively. Upland, nearshore and island CDFs have been used in the U.S. and other countries for the disposal of contaminated dredged material.

Upland CDFs

Upland disposal involves the construction of dikes or other retention structures with impermeable material or liners on land to contain dredged material. The upland CDF is capped when it has been filled to its design capacity. The effluent is tested prior to discharge from the facility, and the adjacent surface and ground water is monitored to ensure that the material is properly contained (USACE 1997).

After a preliminary site screening study to identify potential upland CDF sites, all but one site (located in Belford, Monmouth County, NJ) were dropped from further consideration due to concerns raised by the public and the potential project sponsors (Preference 5). The site in Belford, NJ, (N61) was historically used for disposal of material dredged from the area and/or dewatering with subsequent transfer to other adjacent locations such as a nearby landfill (See Section 2.3.3, Land Remediation). At the request of state and county officials, the site may potentially be utilized in the future for disposal of material generated only from navigation projects located in the waters of Monmouth County. However, at this time the likelihood of future use of the site for temporary or permanent placement of dredged material from Monmouth County water is unknown.

The Belford site covers a relatively small area with an estimated volume capacity of 275,000 CY. However, because the volume of dredged material from the projects located in this area is also small, a CDF designed and constructed on this site may provide many years of maintenance capacity for those local projects. Given the uncertain nature of the future use of the site, it is classified as a Preference 3 option (Table 2-1).

Nearshore CDFs

Nearshore CDFs involve the construction in coastal waters of an enclosing dike, attached to land, isolating the interior ponded water from exchange to the ecosystem. Once the dike is constructed, the inner area is filled with dredged material and then capped to isolate the material from the environment.

This disposal method has been used extensively over the past two centuries for creating land throughout the Port using a broad variety of materials. However, this type of disposal was considerably reduced in the region with the implementation of the Clean Water Act.

Several sites have been identified for potential nearshore CDF construction in the Port. These sites are OENJ Bayonne, Phase 2 (Constable Hook flats), NJ; Atlantic Basin, NY, and South Brooklyn Piers, NY. If all these sites were implemented, their total capacity would be approximately 12.75 MCY. The placement cost per cubic yard for these nearshore CDF sites is dependent on the size and end use, however costs have been estimated to range from approximately $29–$42/CY. However, given the limited available nearshore habitat in the inner Harbor, the three identified nearshore CDF sites are non-preferred options and are not part of the current DMMP.

Island CDFs

An island CDF (also known as a containment island) involves the construction in open bay or ocean waters of an enclosing dike isolating the interior from exchange to the ecosystem. Once the dike is constructed and interior containment achieved, the inner area is filled with dredged material (typically over many years or decades) and ultimately capped to isolate the material from the environment.

To be cost-effective, island CDFs are generally constructed and used for dredged material disposal over many years or decades due to the relatively large initial cost of construction. Due to the potential for significant coastal storms in the region, the dike of an island CDF would need to be designed to withstand extreme conditions and to prevent loss of material placed within the facility.

An initial engineering and environmental siting process identified potential sites in the Lower Bay and New York Bight Apex for an island CDF. Given the volume and potential lifespan under consideration for an island CDF, an approximate capacity of 50–100 MCY, an approximate size of 350–625 acres, and an estimated placement cost of $13–$30/CY (not including potential mitigation costs) are projected. Due to the economies-of-scale involved with island CDFs, the minimum capacity under consideration has been 50 MCY, unless a modular or cellular construction method were employed. Preliminary environmental assessment of this option has determined that, while the project is feasible from an engineering standpoint and would be cost effective, both potential and perceived environmental impacts for an island CDF in these waters are unacceptable. An island CDF is therefore a Preference 5 option and no island CDFs are currently under consideration (option status 5) (Table 2-1).

2.7 OTHER POTENTIAL CONTINGENCY OPTIONS

In the out-years of the DMMP, conditions may preclude the use or availability of alternatives previously discussed and require the development and use of options other than those listed above. Other contingency options that may be considered include the following.

New Ocean Placement Site

As indicated in Chapter 2, at least 1 meter of suitable cap material will be needed to fully remediate the HARS. Due to factors such as consolidation, the amount of material required to actually achieve at least 1-meter cap is uncertain. As of March 2005, approximately 22.5 MCY of remediation material has been placed at the HARS. However, it is anticipated that full remediation will require millions of CYs in addition to the 22.5 MCY already placed there.

While it is expected that full remediation of the HARS will take many years, eventually that point will be reached, and the USEPA, upon making the determination that the HARS is fully remediated, will subsequently de-designate the HARS as a remediation site. When this occurs, an alternate site for HARS-suitable material may have to be designated to fulfill the requirements identified in this DMMP.

Although all reasonable efforts are being taken to maximize the beneficial uses of suitable dredged material to extend the life of the HARS, designation of a new long-term ocean placement site may be necessary at some point in the future. Once a need has been established, designation of a new ocean site would be the responsibility of the USEPA. The process would encompass a complete assessment of the need for such a site balanced against a full consideration of available alternatives. In addition, the process would likely entail a new site screening process and extensive agency and public review, and could take many years before any site could actually be used. Many other areas of the New York Bight Apex have been impacted from past disposal activities (e.g., sewage sludge, cellar dirt, acid waste, etc.). Given the potential need for a new ocean placement site, great emphasis would be placed on identifying other sites with potential remediation benefits rather than just disposal. Consequently, a potential new ocean remediation site is given an option Preference 3 ranking. Because a new ocean disposal site, which would not beneficially use the material, is a non-preferred option in the region, it is given an option Preference 5 ranking and is no longer under consideration.

Contract Disposal

Under this option, instead of designating or planning for the management of the dredged material at a specific placement site or sites, a dredging contract is advertised with no known permitted placement site being available to manage the material from the contract. In this option, the contractor is required to identify (and potentially develop and acquire permit for) the placement methods necessary to manage the material dredged from the contract. Sites developed for utilizing this “unplanned” option typically have limited capacity, therefore costs for this option can vary widely. Without cost-effective option(s) available for use, there are few reliable means to control costs and promote beneficial use, or to establish any level of certainty that would maintain economic viability of the Port. Contract disposal may suffice to quickly meet emergency or other unanticipated short-term needs, but it is inappropriate for consideration as an integral part of a comprehensive, long-term cost-effective DMMP for the Port.

3 FORMULATING THE RECOMMENDED PLAN

The dredged material management options listed in Table 2-1 were ranked with respect to their ability to meet the region's goal to beneficially use dredged material, as well as other technical and practical factors. These rankings were developed and applied by a DMMP team that consisted of the USACE, USEPA, potential project sponsors, the States, and the PANY/NJ. The selection process stressed beneficial uses of dredged material (Preference 1 options), especially those with environmental restoration potential, and recommended environmentally acceptable disposal facilities (Preference 2 options) only as a contingency, to be implemented only when there are no practicable beneficial use options available for a given project. Additional options are considered that have the potential to beneficially use dredged material, but may require additional research and analysis regarding feasibility (Preference 3 options). Limitations include but are not limited to economics, environmental considerations, and/or logistics.

In formulating the Recommended Plan, both States agreed that material from NY waters may not rely on NJ options and material from NJ waters may not rely on NY options. This agreement was first applied in the "Joint Dredging Plan for the Port of New York & New Jersey" (NY/NJ 1996), developed under the auspices of both governors. The Joint Dredging Plan consisted of three parts: a bi-state component representing initiatives common to the two States, and individual components particular to each state's dredging needs. This strategy is intended to ensure that the States share in the responsibility to implement and site the recommended options.

Unlike in the Base Plan (See Section 1.7), cost was not a primary factor in assessing options. In some cases more expensive options were selected because they yield additional desirable (e.g., environmental) benefits. Since this was done to meet the region's environmental goals, the stakeholders accepted the added costs that an approach may incur. The apportionment of these added costs among the stakeholders will be evaluated on a project-by-project basis.

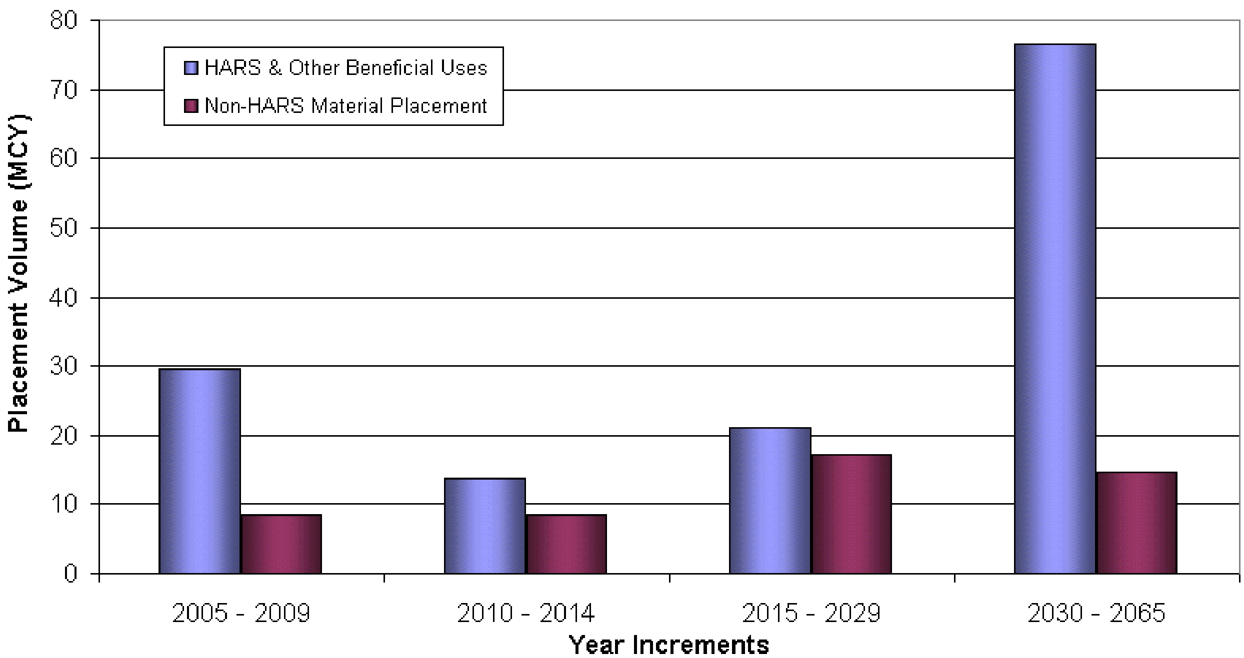
The reader should also note that each of the options under development in the Recommended Plan will also be subject to further, supplemental, site-specific NEPA documentation and the regulatory permit review process, as applicable.

Chapter 2 described various options for managing dredged material from the Port. Many uncertainties exist regarding actual dredging needs, the future quality of sediment from different parts of the Harbor, and the cost effectiveness and efficiency of a number of newer and developing management options. Clearly, no single option or site will be able to meet all the dredged material management needs of the Port. The challenge of developing a DMMP is determining the combination of the various options that will meet the short and long-term needs of the Port in an economical and environmentally acceptable manner. The more traditional USACE approach of a fixed plan based strictly on proven solutions and lowest cost is not sufficient to meet this challenge. For this plan to succeed in its implementation, it must be flexible enough to respond to and incorporate changing needs and opportunities as they occur. Since the timeframe agreed to among the stakeholders for this DMMP is 60 years, some of the decisions in implementing evolving management strategies can be programmed for the future. This will allow the opportunity to test and evaluate a number of promising techniques now under development.

The overall Recommended Plan is presented here in two timeframes. The first timeframe, referred to as the 2014 Plan, covers the time period of 2005–2014. The second timeframe, referred to as the 2065 Plan, covers the time period of 2015–2065. The short and long-term timeframes will be discussed in detail in the following sections. Additionally, Table 3-1 (a-c) summarizes the results of the Recommended Plan, specifically in terms of placement options for HARS suitable, rock, and HARS unsuitable material (Table 3-1a), beneficial use placement options for HARS suitable material (Table 3-1b), and placement options for HARS unsuitable material (Table 3-1c).

Table 3-1. Recommended 2005 – 2065 Dredged Material Management Plan for the Port of New York and New Jersey

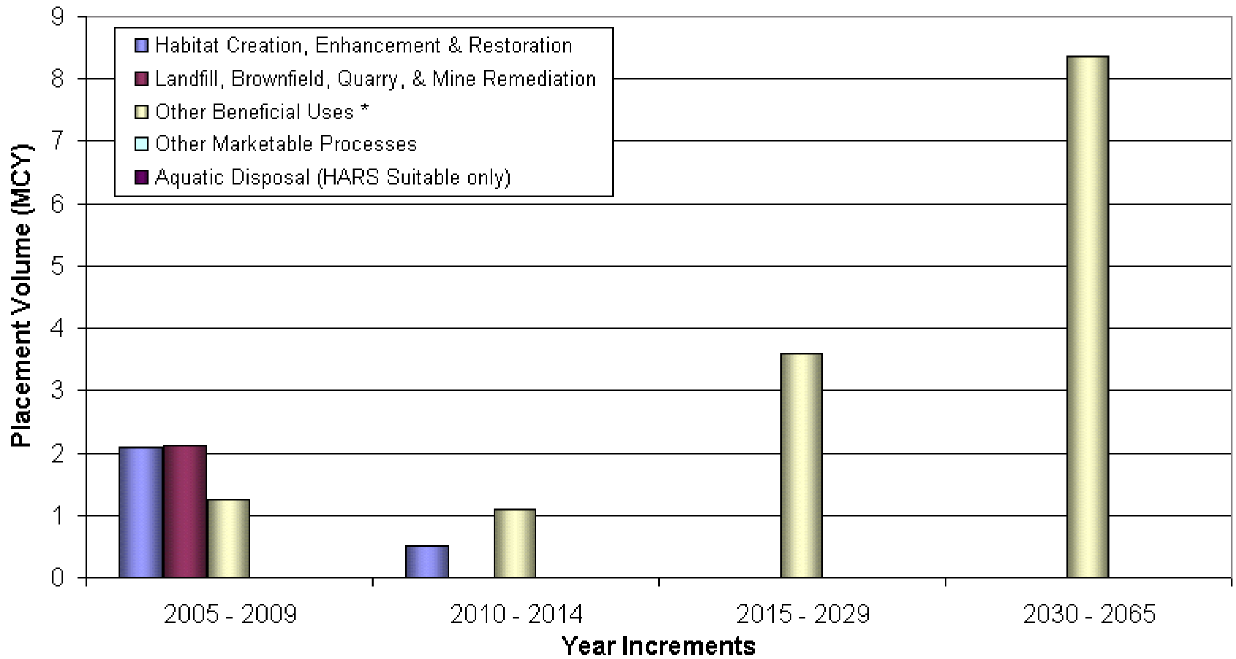
Table 3-1a: Placement Options for HARS Suitable and Non-HARS Suitable Material



Material Placement Options	Placement Volume (MCY) 2005 - 2009	2010 - 2014	2015 - 2029	2030 - 2065	Total Placement (MCY)
HARS & Other Beneficial Uses	29.58	13.68	21.15	76.45	140.86
Non-HARS Material Placement	8.58	8.53	17.30	14.74	49.16

Table 3-1. Recommended 2005 – 2065 Dredged Material Management Plan for the Port of New York and New Jersey (continued)

Table 3-1b: Beneficial Use Placement Options for HARS Suitable Material



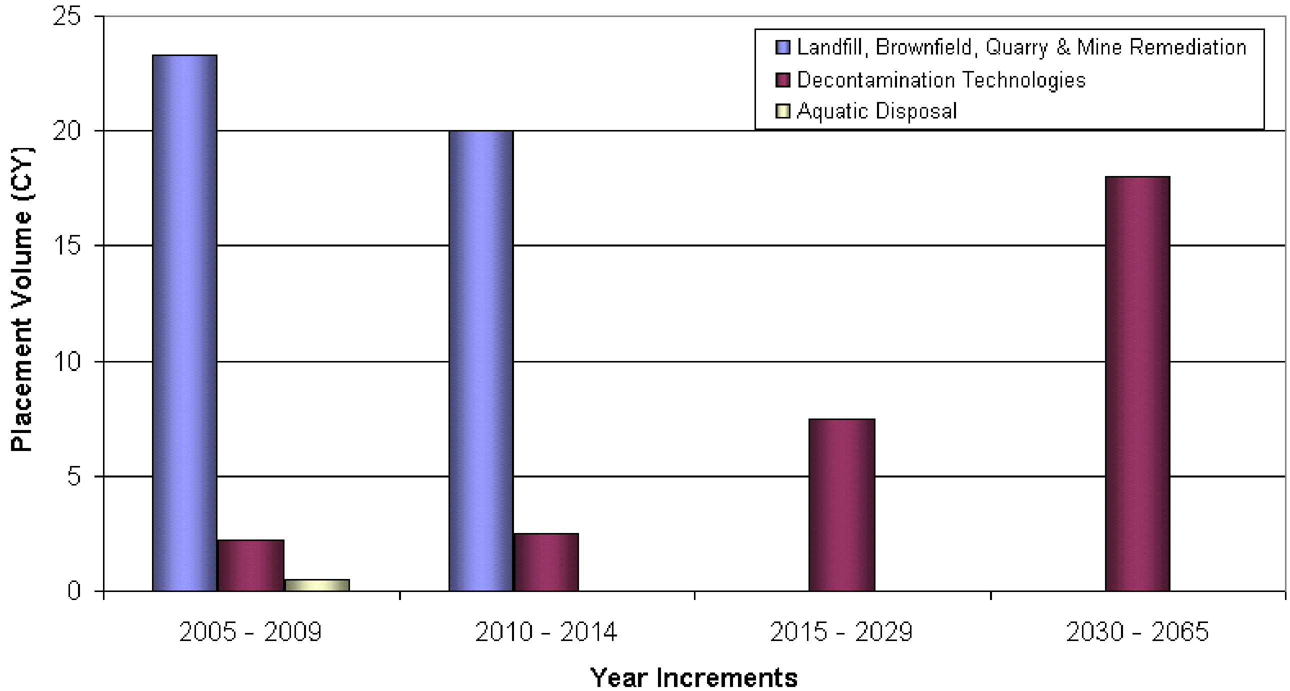
Material Placement Options	Placement Volume (MCY) 2005 - 2009	2010 - 2014	2015 - 2029	2030 - 2065	Total Placement
Habitat Creation, Enhancement & Restoration	2.10	0.50	0	0	2.60
Landfill, Brownfield, Quarry, & Mine Remediation	2.11	0	0	0	2.11
Other Beneficial Uses *	1.25	1.10	3.60	8.35	14.30
Other Marketable Processes	0	0	0	0	0
Aquatic Disposal (HARS Suitable only)	0	<1	0	0	<1
Sum of HARS Suitable to Beneficial Uses					**19**

Material Placement Options	Total Capacity (MCY)	User Placement Cost ($/CY)	Total Option Cost ($Millions)	Material Type Restrictions
Habitat Creation, Enhancement & Restoration	2.60	$6.44	$16.75	various
Landfill, Brownfield, Quarry, & Mine Remediation	2.11	$36	$76.07	no Stiff Clay
Other Beneficial Uses *	14.35	$2	$28.70	Various
Other Marketable Processes	N/A			
Aquatic Disposal (not including HARS)	<1	$0	$0	Sand material only
Sum of Beneficial Use Placement Options *	**19**			

* For all years EXCEPT 2065, the amount of HARS suitable material dredged is greater than the placement capacity of beneficial uses, so that the amount of HARS suitable material going to Beneficial Uses is limited by the amount of placement capacity. In 2065, only 200,000 CY of material (Sand) is available, and 250,000 CY of placement capacity is available. Therefore, in the year 2065, the amount of HARS suitable material to Beneficial Uses is limited by the amount of material dredged, not on the placement capacity.

Table 3-1. Recommended 2005 – 2065 Dredged Material Management Plan for the Port of New York and New Jersey (continued)

Table 3-1c: Placement Options for Non-HARS Suitable Material



Material Placement Options	Placement Volume (MCY) 2005 - 2009	2010 - 2014	2015 - 2029	2030 - 2065	Total Placement
Landfill, Brownfield, Quarry & Mine Remediation	23.31	20.00	0	0	43.31
Decontamination Technologies	2.18	2.50	7.50	18.00	30.18
Aquatic Disposal	0.50	0	0	0	0.50
Sum of Non-HARS Suitable Placement Options					**73.99**

Material Placement Options	Total Capacity (MCY)	User Placement Cost ($/CY)	Total Option Cost (Millions)	Material Type Restrictions
Landfill, Brownfield, Quarry & Mine Remediation	43.31	$36	$1,559.27	includes Non-HARS
Decontamination Technologies	30.18	$36	$1,086.30	includes Non-HARS
Aquatic Disposal	0.50	$36	$18.00	includes Non-HARS
Sum of Non-HARS Suitable Placement Options	**73.99**			

Non-HARS Placement Data	Placement Volume (MCY) 2005 - 2009	2010 - 2014	2015 - 2029	2030 - 2065	Total Placement
Sum of Non-HARS Material Placed at Placement Options	8.58	8.53	17.30	14.74	**49.16**
Remaining Available Capacity	17.41	31.38	21.57	24.83	**24.83**
Sum of Non-HARS Suitable Placement Options					**73.99**

THE 2014 PLAN

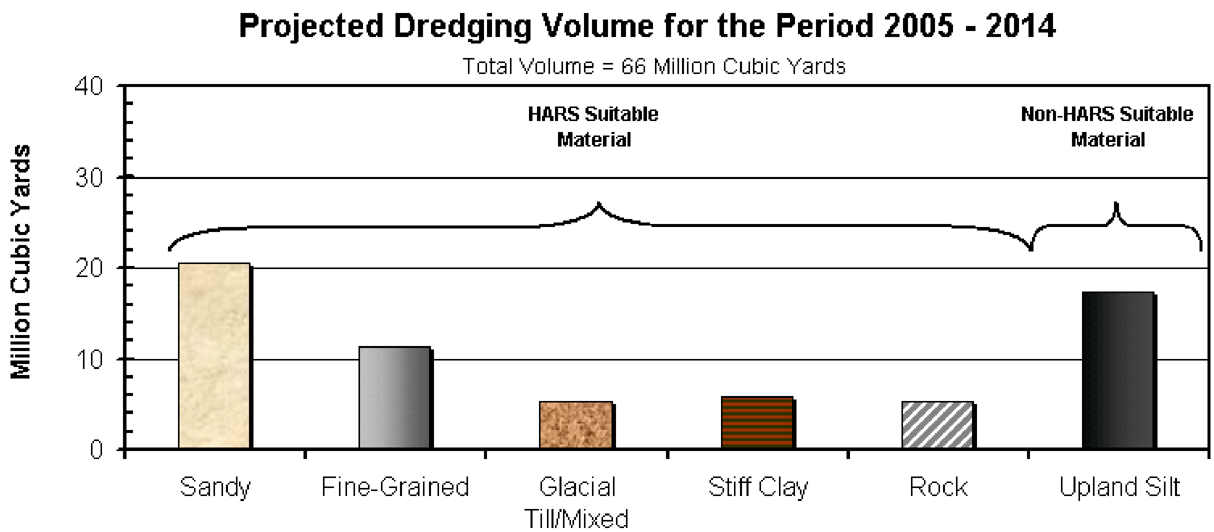
This initial part of the overall plan covers 10 calendar years beginning in 2005, which encompasses the planned and underway deepening projects, as well as the anticipated maintenance volumes to keep the existing and improved channels/berthing areas open. The 2014 Plan relies exclusively on Preference 1 and Preference 3 options from Table 2-1 to create, remediate, and restore a variety of existing degraded or impacted habitats in the region with suitable dredged material. The remaining dredged material is treated and stabilized, as needed, and then applied to remediate degraded and potentially polluting areas such as brownfields, landfills, and mines or converted to marketable products at processing facilities and private decontamination facilities.

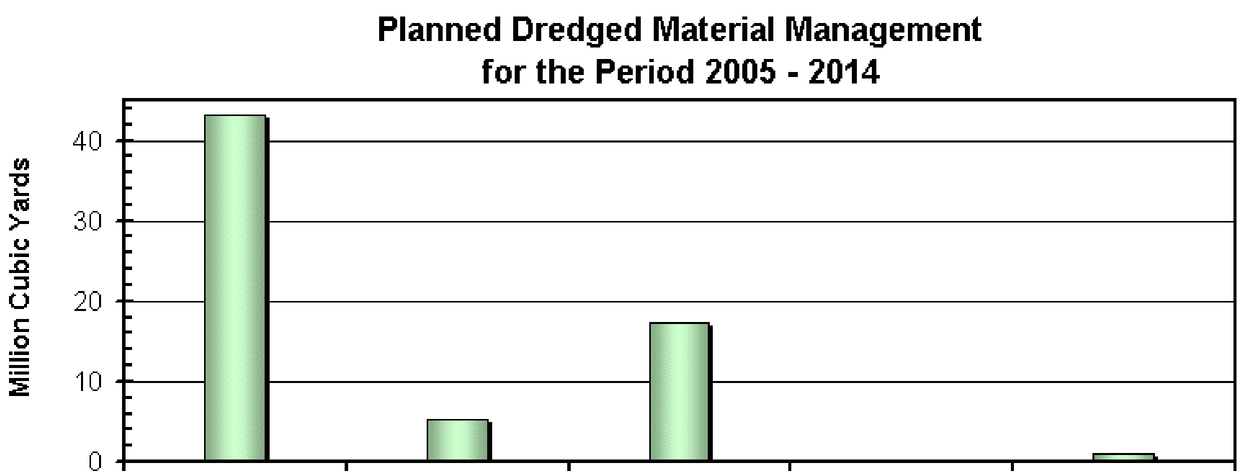
Figure 3-1 summarizes the recommended 2014 Plan and provides more detail than the 1999 draft DMMP. This update of the DMMP includes ongoing (KVK deepening to 50 feet), planned (Arthur Kill and Port Jersey deepening to 40–53.5 feet), and potential deepening (as described in the New York and New Jersey Harbor Navigation Report, [USACE 1999a]). Table C-2-1 in the DMMP – Technical Appendix contains a more detailed breakdown of volumes, options and yearly costs of the Recommended Plan (from 2005 through 2065).

Of the total HARS unsuitable material anticipated to be dredged through 2014 (17 MCY), there is more than enough placement capacity provided by beneficial uses (i.e., landfill, brownfield, quarry, and mine reclamation) (43 MCY), decontamination technologies (5 MCY), and aquatic disposal at the NBCDF (500,000 CY) (Table 3-1c). This allows these placement options to accommodate more material should additional needs develop beyond those currently projected. All of the HARS unsuitable placement options have a placement cost of approximately $29–$42/CY for HARS unsuitable material.

As a result of the plans to deepen the Federal navigation channels to 50 feet, the amount of HARS material to be managed (about 43 MCY) over this period will be more than twice the amount that is typical from maintenance dredging alone (Table 3-1a). The Recommended Plan takes advantage of the suitability of much of this material for beneficial use applications, including habitat creation, enhancement, and restoration (3 MCY), or landfill, brownfield, quarry, and mine reclamation (2 MCY), other beneficial uses such as beach nourishment (2 MCY), and aquatic disposal (<1 MCY) (Table 3-1b).

As mentioned earlier, the placement options for HARS unsuitable material have a user placement cost of $29–$42/CY; an average dollar value of $36/CY was used in cost calculations in Table 3-1 and Table C-2-1 in the DMMP – Technical Appendix. It is assumed that additional sites would be approved for processing and decontamination facilities, and that they, along with the other upland remediation options, would be sponsored/supported as needed by non-Federal entities to maintain the $36/CY price. If the price of remediation cannot be maintained at its current level, or if sites are not approved, other options will be substituted using other preference 1, 2, or 3 placement options listed on Table 2-1. Preference 2 and 3 placement options would be used only if a Preference 1 option was unavailable in the timeframe needed. Their use would be limited in duration until a Preference 1 option was available.





HARS & Other Beneficial Uses		Artificial Fish Reefs		Land Remediation		Decon for Beneficial Uses		Small, Private Users (e.g., marinas)*	
	Planned Capacity		Planned Capacity		Planned Capacity		Planned Capacity		Planned Capacity
Sites	*MCY*	*Sites*	*MCY*	*Sites*	*MCY*	*Sites*	*MCY*	*Sites*	*MCY*
HARS	TBD	Shark River Reef	TBD	Kearny (A&B), NJ	0.7	Endesco/Clean Harbors	TBD	Small Dredging Projects with local/adjacent placement	1
MOTBY Channel Enhancement	0.9	Atlantic City Reef	TBD	Secaucus (A&B), NJ	0.4	Biogenesis	TBD		
Shellfish Habitat	0.1	Carlson River Reef	TBD	Overpeck Landfill, NJ	0.8	Upcycle	TBD		
Oyster Habitat	0.1	Sandy Hook Reef	TBD	ENCAP, NJ	5	Harbor Resources Mgmt.	TBD		
Beach Norishment	2.35	Other	TBD	Carteret Landfill, NJ	1	Other	TBD		
Liberty State Park	0.75			Fresh Kills Landfill, NY	4				
J.B. Marsh Islands	0.35			MSEC, NY	5				
Construction Aggregate	TBD			Koppers Coke, NJ	0.4				
Remedial material for sediment hotspots	TBD			NL Industries, NJ	5.8				
MOTBY Construction Fill	1.3			Brookfield Landfill, NY	0.43				
Other	TBD			Fountain Landfill, NY	0.6				
				Other	TBD				

* Refers to small dredging projects where the material is placed upland, often adjacent to the dredging site. Information regading the amount of material dredged from marinas and small scale shoreline development is not been quantified. The estimate of 1 MCY is purely speculative and highly uncertain.

Figure 3-1. Projected and Planned Dredged Material Management for the Period 2005–2014

THE 2065 PLAN

The 2065 Recommended Plan covers the Port's needs for the years following completion of the majority of the channel/berthing area deepening and other Port improvements (2015–2065). It is primarily aimed at managing maintenance material, including increased volumes needed to keep the deeper channels open. The 2065 Plan is based on an assumption that contaminant reduction programs will be implemented to meet the targets established in Section 2.2 Contaminant Reduction, thereby converting a significant portion of the volume of HARS unsuitable material to HARS suitable material (approximately 52 MCY) between 2015 and 2065, as depicted in Figure 3-2. The Recommended Plan employs only Preference 1 and Preference 3 options from Table 2-1. The Recommended Plan for this period is shown in greater detail in Table C-2-1, in the DMMP – Technical Appendix. Overall, the 2065 Plan is not specific because annual dredging needs, funding, future shoaling, and contaminant reduction rates are uncertain.

There are no projected landfill, brownfield, quarry, and mine remediation sites projected for placement of HARS-unsuitable material in NY, NJ, and PA, in the 2065 Plan. Approximately 26 MCY of HARS unsuitable material is expected to be managed by utilizing decontamination technologies. The remaining HARS-unsuitable material will be placed at land remediation, decontamination technologies, and aquatic disposal sites initiated during the first decade (i.e., 2005–2014) of the planning period (Table 3-1c). These data can be found in more detail in Appendix C Formulation of Plans, Table C-2-1, in the DMMP – Technical Appendix.

For HARS-suitable material, the 2065 Plan attempts to maximize the use of all practicable alternatives to the HARS. Currently the 2065 Plan projects that approximately 12 MCY of material may be beneficially used, all of which is designated for placement at other beneficial uses (Table 3-1b). There are no designated sites for placement of rock material in the 2065 Plan.

The 2065 Plan also includes the continuation of placing of HARS-suitable material at the HARS remediation site until at least a 1-meter thick cap has been achieved (See Section 2.3.1). Presently, 22.5 MCY of HARS-suitable material has been placed at the HARS. However, due to factors such as consolidation, the amount of material required to actually achieve at least a 1-meter cap is uncertain. When the HARS cap reaches a thickness of 1 meter, the USEPA will determine whether applying additional remediation material is prudent and beneficial to the site. Regarding HARS designation, 40 CFR 228.15(d)(6)(vi) states: "Period of Use: Continuing use until USEPA determines that the PRA has been sufficiently capped with at least 1 meter of Material for Remediation. At that time, USEPA will undertake any necessary rulemaking to de-designate the HARS." Reasons for applying additional material may include using a cap layer thicker than the 1-meter layer currently projected, or replacing material that may have been consolidated. At the point that the USEPA considers the HARS to be fully remediated, the NYD will work in coordination with the other regional stakeholders to identify and develop other comparable beneficial use opportunities for the excess HARS material.

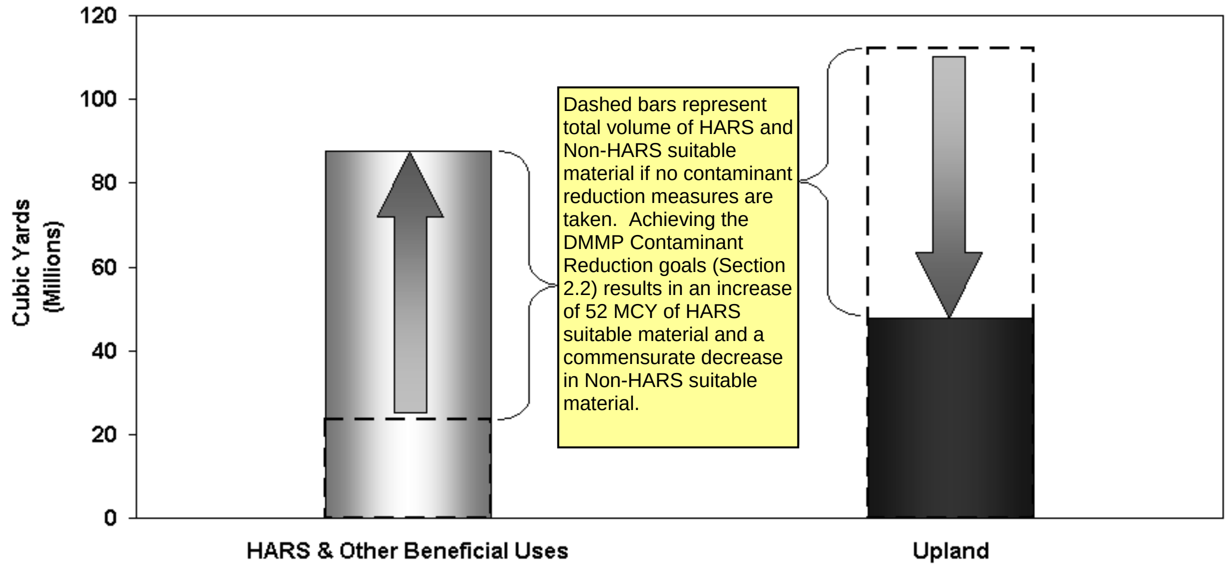
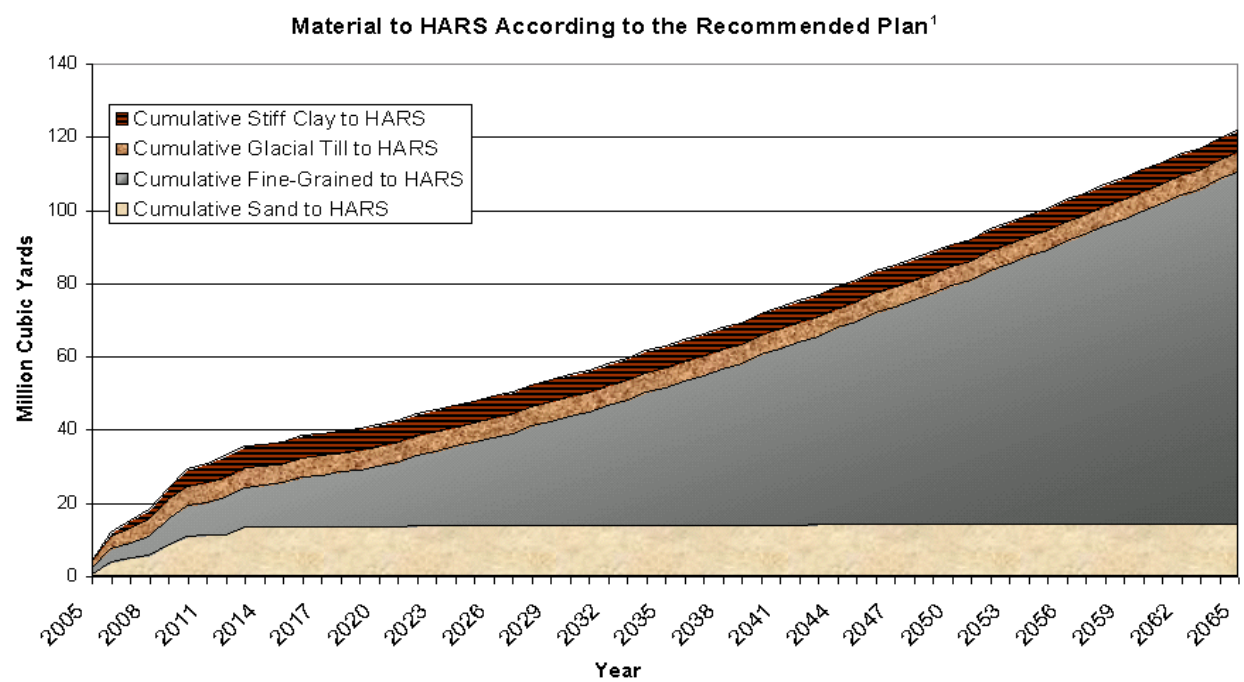


Figure 3-2. Projected Dredging Volume for the Period 2015–2065
Total Volume = 130 Million Cubic Yards



Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis. The data in this table are stacked to present cumulative volume of material placed at the HARS.

[1] Includes the effects of contaminant reduction on future volume projections for the amount of HARS suitable material.

Figure 3-3. Material to HARS According to the Recommended Plan

4 IMPLEMENTING THE RECOMMENDED PLAN

To implement the Recommended Plan depicted in Table 3-1 and Appendix C Formulation of Plans (Table C-2-1, in the DMMP – Technical Appendix), the dredging needs of the Port were separated into two timeframes to identify when the various options and contingency decisions would be needed. Short-term needs include dredging projections from 2005–2014, and long-term needs extend from 2015–2065.

4.1 SHORT-TERM NEEDS (2005–2014)

To manage the projected volume of HARS-unsuitable material during the course of the next 10 years, several land remediation sites in NJ, NY, and PA are now under development by private enterprises. Also, decontamination production-scale and scale-up projects are now under way by the USEPA, USACE, and the States as described in Section 2.4, Decontamination. The USACE and the States have several habitat creation/restoration projects now under consideration or being implemented in areas throughout the Harbor. The State of NY has permitted a processing facility scheduled for construction in the near future, and another facility has submitted an application to NYSDEC for a dredged material processing facility. A third company is in pre-application discussions with NYSDEC regarding a third dredged material processing facility. Combined, the three facilities have the capacity to process/treat greater than 3 MCY per year, for on-site and off-site uses. These land remediation and processing options more than meet the projected need for all the HARS-unsuitable material for the next 10 years.

Further, contingency options are under consideration for development by the PANY/NJ and the NYD, should the need arise. If all recommended facilities operate at the projected processing rates, there will be no need to utilize Newark Bay CAD sites 2S or 2N or the other potential sites discussed in Section 2.5. However, should the recommended options as a whole not keep pace with dredging needs and schedules, contingency options will be developed such that they can be implemented and made available for use to keep projects on schedule.

Other restoration projects such as the Jersey Flats and beneficial use projects such as the Peninsula at Bayonne (formerly known as MOTBY) are expected to use considerable quantities of HARS-suitable material. The total beneficial use of dredged material for these projects is projected to be 2.6 MCY.

During the short-term timeframe, considerable quantities of HARS-suitable remediation material (from maintenance and deepening actions) would continue to be used at the HARS. A smaller volume (up to several MCY) of HARS suitable material might be diverted to a NY State sponsored pilot study for restoring degraded aquatic sites, as well as smaller NYD demonstrations for habitat creation (oyster, shellfish, and bird). Initiation depends on identification and availability of needed authorizations and funding for both construction of the placement options and the dredging projects that would utilize them. Should the planned projects prove successful, further application of habitat restoration at other degraded aquatic sites could address a significant portion of the short and long-term Port needs at an economical cost and with environmental benefits, in keeping with the dual purpose of the DMMP.

As the various pilot and demonstration projects are completed, plans for longer-term use of material for mine reclamation, decontamination, and/or habitat restoration can be evaluated with more accuracy. Concurrently, the bi-state contaminant track-down program (part of CARP) will be completed and a plan developed to target its findings through an active contaminant reduction program, which could utilize HARS suitable material to cap and/or replace hot spots identified for clean-up. Several years will then be available to assess the potential and actual success of this effort and determine its effect on the need for treatment or containment options. If these options are practicable at an affordable price, then a sizeable portion (if not all) of the long-term need will be met for the upcoming decades. If most, or all, prove infeasible or too costly, the planning (including any needed authorizations and funding agreements) for contingency options will be under way to allow sufficient time for implementation.

4.2 LONG-TERM NEEDS (2015–2065)

The single most significant and important option recommended for the long-term is sediment contaminant reduction. Its projected impact (based on the targets established in Section 2.2 Contaminant Reduction) on the long-term dredging needs amounts to a cumulative cleanup of about 52 MCY of HARS-unsuitable material over the years 2015 to 2065. Assuming a placement cost difference between HARS suitable and HARS unsuitable material ranging from $29–$42/CY, this would amount to an average savings of over $30 million per year during the 50-year project life (i.e., 2015–2065). By complete implementation of this option, the region can ensure that the problem of dredged material contamination does not continue in perpetuity.

Land remediation and processing facilities are a part of the Recommended Plan for HARS-unsuitable material, pending the implementation of sediment contaminant reduction measures. If additional brownfield and mine remediation sites become available, there is potential for additional placement of HARS-unsuitable materials. Also, presently only quarry reclamation is not part of the current Recommended Plan. However, if actions for quarry reclamation can be implemented, then there is the potential to beneficially utilize approximately 30 MCY of HARS-suitable material at quarry reclamation sites.

Over the next 10 years, the Port will have sufficient time to assess the capability of additional measures, such as sediment contaminant reduction, land remediation, habitat restoration, and decontamination. If these options are as successful as expected, they will represent the management tools that will keep the Port viable through the long-term. If, however, these measures don’t prove feasible, then contingency options may be needed.

By dividing future years into manageable increments, a fairly extensive period of additional evaluation, testing, and demonstration can be completed so that decision making can occur without jeopardizing the Port’s viability and the estuary’s environmental recovery. The need to accommodate Port growth is achievable as long as options can be brought on line fairly rapidly (i.e., on a yearly or as-needed basis). The long-term health of the Port can also be ensured by applying innovative and proven technologies, and by continuing work on more traditional approaches.

4.3 DMMP IMPLEMENTATION UPDATES

To ensure that there is always sufficient capacity for the placement of dredged material from the Harbor, it is imperative to constantly review past, current, and anticipated needs and performance. This analysis forms the basis of successful implementation of the DMMP.

To facilitate this process, the NYD, in coordination with its partners in managing dredged material, will periodically provide a short implementation/update report that summarizes previous dredging activities and the Recommended Plans for the coming years. The report will provide summary information on all the dredging projects completed, including: project location, volume of material handled and final placement/use of the dredged material. The summary data presented in Table 3-1 and volume projections will be updated, as maintenance and deepening needs, as well as remediation and restoration activities that involve dredging, are better identified. The future updates will also identify volume requirements/projects for the current year, and confirm available capacity/uses for all anticipated dredged materials. Private venture projects also will be included in future updates.

In the event of a future shortfall, the NYD, in cooperation with the involved agencies, will identify necessary actions required to meet the shortfall consistent with the DMMP. The NYD will initiate those actions within its existing budget and authority to prepare additional sites/uses, or identify the appropriate other agencies/entities to assume that responsibility. In order to undertake certain actions, it is likely that commitments in the form of cooperative agreements will need to be formalized between NYD and the States, or as appropriate, among agencies, commercial developers, and other groups.

The future updates will also facilitate the continuous improvement and assessment of progress towards the dual goals of economic development of the Port and environmental restoration of the estuary. The NY/NJ Regional Dredging Team (RDT), composed of representatives from the PANY/NJ, NYD, the States of NY and NJ, NJDOT/OMR, and USEPA, will meet regularly and coordinate with other working groups and agencies during the formulation of the report to ensure that all input is received and a regionally supportable effort can be maintained. This report will be instrumental in making informed choices in pursuing environmentally sound and cost-effective options.

4.4 SUMMARY & RECENT ACCOMPLISHMENTS

There are a number of recent accomplishments in the management of dredged material that are worth highlighting. These projects are previously discussed in Section 2.3.3, Land Remediation and are reiterated here for emphasis.

- The Jersey Gardens Mall Site, in Elizabeth, NJ, is an example of a successful implemented land remediation project using processed dredged material. This site utilized 850,000 CY of processed dredged material, at a cost of $56/CY.

- The Bayonne landfill remediation utilized processed dredged material as structural fill prior to creation of a golf course. This site utilized approximately 3 MCY of processed dredged material, at a cost ranging from $29–$42/CY.

- The Port Liberte brownfield remediation used approximately 200,000 CY of processed dredged material in remediating and preparing the site for eventual construction of a golf course.

- The Brooklyn Navy Yard project beneficially used processed dredge material from the Harbor for on-site and off-site uses. Approximately 10,000 CY of dredge material was removed; 5,000 CY of material was processed and used in on-site road construction, and 5,000 CY of material was processed and used for mine reclamation at Bark Camp, PA.

- The Pennsylvania Avenue and Fountain Avenue landfills beneficially reused 176,000 CY of processed dredged material as below the liner structural fill in the closure of the landfills.

- The PADEP authorized the use of processed dredged material for mine reclamation at the Bark Camp Mine in PA. The Bark Camp site received a permit to accept 735,000 CY of processed dredged material, and costs ranged from $42-$86/CY. Costs to the user were heavily subsidized by the State of NJ, and may have been less than actual costs. Following placement of dredged material, water samples showed no difference from background level and passed the state standards, with most contaminant levels below the detection limit.

- The use of dredged material for acid mine reclamation has been highly successful, prompting the PADEP to issue a General Permit for the use of amended dredged material for the closure of the Lehigh Coal and Navigation Mine in Lehighton, PA (the Springdale Pit).

- The Fresh Kills Landfill has received a beneficial use determination (BUD) from NYSDEC for acceptance of processed dredged material for use as structural fill in the closure of the landfill. Fresh Kills has a capacity of approximately 3 MCY.

Other noteworthy accomplishments and developments related to the dredged material management include the following:

- On April 26, 2004, the HRF and the HEP released a report "Health of the Harbor: The First Comprehensive Look at the State of the NY/NJ Harbor Estuary" (Steinberg et al. 2004). According to the report, contaminants in sediments and fish have dropped significantly and losses of wetlands and near-shore habitats have slowed considerably. Additionally, dissolved oxygen levels in the Harbor have greatly improved and sewage-related pathogenic contamination has been notably reduced. However, even with these improvements, the report also indicates that significant environmental challenges remain. For example combined sewer overflows continue to contribute raw sewage to waterways when it rains. Advisories against eating fish and shellfish from the estuary remain in effect because of elevated contaminant levels in their flesh. Also, some shellfish beds have remained closed.

- CARP status: initiated in 1999, most of the data collection effort sampling effort was completed by the summer of 2001 and data were analyzed and validated by 2003. Following validation, the NYSDEC in collaboration with Rensselaer Polytechnic Institute scientists presented their analysis of the sediment data in their report CARP: NY/NJ Sediment Report (NYSDEC 2003), which includes a summary of findings and recommendations for next steps. The 1999–2001 CARP dataset, along with the compiled historic sediment chemistry data, is now available online through a database on the CARP website: http://www.carpweb.org. The modeling effort was initiated in December 2001 and progress since then has resulted in calibrated hydrodynamic and sediment transport models. Currently, data from the CARP data collection effort are being used in the development of the contaminant fate and transport model inputs and calibration. The contaminants model should be calibrated and validated for PCBs and dioxin (all 17 congeners) by the end of 2005. Also by this time, regional loadings analyses and contaminant reduction scenario development will have begun.

- In October 2004, the NYSDEC issued a findings statement on a recently completed evaluation of the habitat function of Norton Basin and Little Bay pits. In this statement the Interagency Technical Committee (made up of the USACE, NYSDEC, NOAA, USFWS, NPS and USEPA) concluded that both pits suffered significant impairments and could be characterized as degraded. A summary of the NYSDEC's findings statement is presented in Section A.3.2, Habitat Creation, Enhancement, and Restoration, in the DMMP – Technical Appendix. NYSDEC's findings statement is posted in its entirety at the following web site:

  http://www.dec.state.ny.us/website/reg2/jbborrow/findings.html.

- The USEPA and NJDOT/OMR Regional Sediment Decontamination Programs have progressed since 1994 from gallon buckets of test sediments to the implementation of full/commercial-scale demonstrations in 2005–2006. The "environmental manufacturing" and marketing of beneficial use products from decontamination technologies is crucial to the success of the program. Manufactured soil, construction-grade cement, lightweight aggregate, architectural tiles, and bricks are some products that have been manufactured from these processes. Between both programs, 11 bench, and 10 pilot-scale tests have been completed. In 2005–2006, the program will demonstrate up to four full/commercial-scale processes. The program has ventured forward in developing public-private partnerships. One such accomplishment is the Federal-state partnership with Bayshore Recycling Corporation in Keaseby, NJ, which will be hosting up to four full/commercial-scale technology demonstrations in 2005–2006. These demonstrations are significant since it will be the first application of technologies that will utilize both navigational dredging and the lower Passaic River Restoration Study sediments.

- The NYD estimates that approximately 22 MCY of material was dredged from Federal and non-Federal navigation channels and berths of the NY/NJ Harbor between 1999 and

2004. This estimate was based on dredging and placement volumes compiled from the States of NY and NJ, the Port Authority, and the NYD. Figure 4-1 illustrates that 96% of the material dredged during this period was used beneficially in applications that include HARS remediation, beach nourishment, artificial reef construction, land remediation, and decontamination projects (to produce marketable products). The remaining 4% was the portion of the total volume that could not be used beneficially and was placed at the NBCDF.

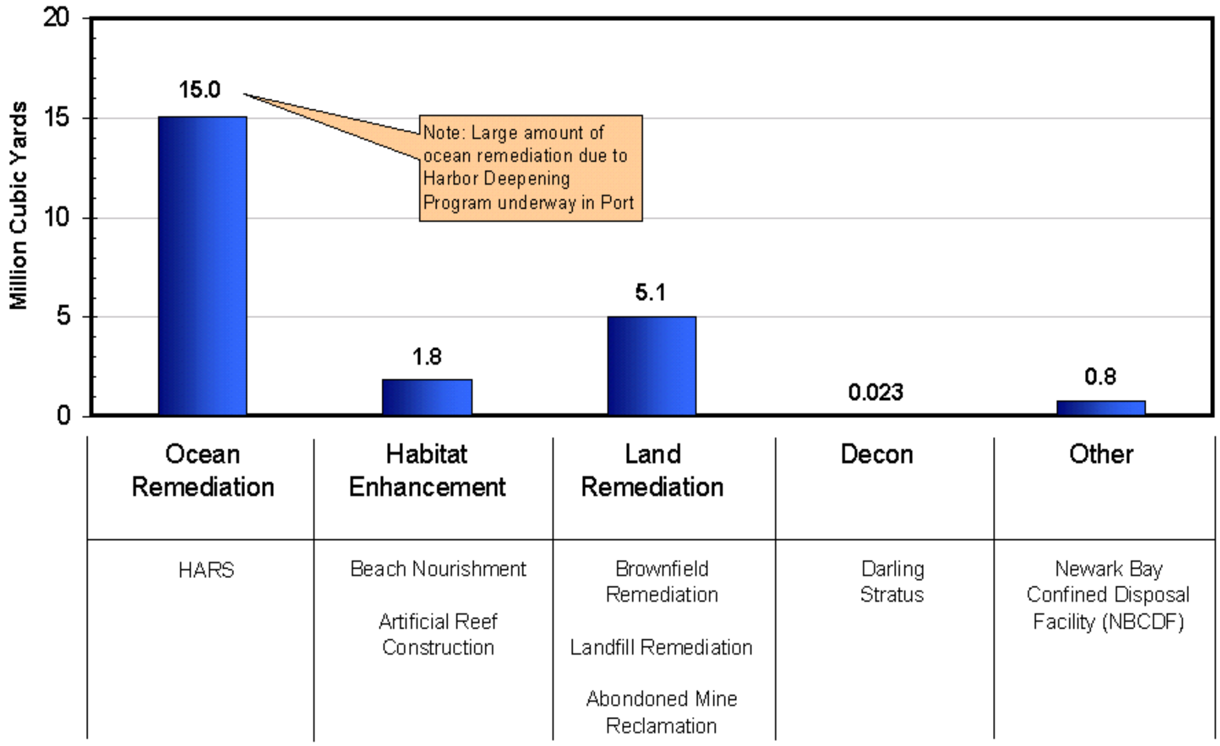


Figure 4-1. Usage of Material Dredged from the Port of NY/NJ Harbor from 1999–2004 Total Volume = 23 Million Cubic Yards

Of the total volume of material dredged during this period, 23% was not suitable for HARS placement. Some of this material went to the NBCDF as indicated above, whereas the remainder was processed for, and applied to, available land remediation projects. The remaining 77% of the total volume was HARS-suitable material primarily from Harbor deepening activities. During this period, available beneficial use applications other than HARS remediation were limited to beach nourishment and artificial reef construction, and utilized approximately 11% of the HARS suitable material. Having exhausted all other available beneficial use options, the remaining 89% was used as remediation material at the HARS, as depicted in Figure 4-1. The placement distribution as shown in Figure 4-1 will be tracked in future updates of the DMMP to establish placement trends such as these and for performing post-audits of the placement projections presented in this DMMP.

4.5 CONCLUSION

A great economic need exists to maintain and deepen navigation channels in the Port. Of equal importance is the environmental protection and restoration of the Harbor estuary. Based on an evaluation of many different factors (including non-Federal sponsor preference, environmental issues, cost, and reliability), several options for the management of dredged material have been combined to form the Recommended Plan to meet these needs. Given the growing convergence of both the economic and environmental needs of the region and the opportunities afforded by the large volumes of material needing to be dredged in the short-term future, the time is ripe for a multiple agency effort into building off of and linking these management options to develop an integrated, watershed-based, sustainable sediment management program for the estuary, particularly the more impacted areas.

The flexible management process inherent in the Recommended Plan makes it the core vehicle for meeting the dredged material management needs of the region, and is fundamental to the success of the DMMP. The PANYNJ and the States have designated points-of-contact for dredged material management issues. These representatives along with the USACE coordinate decision-making within their respective agencies and authorities, and regularly convene with other interested stakeholders at Regional Dredging Team meetings to discuss potential options and their implications. Additional coordination is also undertaken with other agencies and public involvement groups through the HEP policy committee and DMMIWG.

Overall, the goal of the management process and constantly evolving Recommended Plan is to project dredged material placement needs far enough in the future so that the following is accomplished: 1) short term placement needs are not compromised; and 2) decisions for new sites and/or options are judiciously made and properly reviewed by both interested stakeholders and the public.

4.6 RECOMMENDATIONS

This DMMP – Implementation Report has been prepared under the existing Operations and Maintenance authority of the USACE for the Federal navigation projects in the Port. The NYD has considered numerous significant issues during the development of this DMMP and the finalization of the PEIS. These issues include environmental and economic concerns, engineering feasibility, and compatibility of the recommended options with the goals of the States, PANY/NJ, and other interested parties.

The NYD recommends implementation of the preferred options identified in the Recommended Plan (Table 3-1 and Table C-2-1 in the DMMP – Technical Appendix) and development of contingency options if the preferred options cannot meet the projected dredging schedules. With the approval of this DMMP by the Federal government and concurrence by the States, separate Project Cooperation Agreements can be developed and executed, as needed, for those components of this plan that the Federal government will implement. Additionally, decisions by the NYD regarding open ocean disposal are subject to concurrence by the USEPA.

The plan contained herein reflects the information available at this time and current USACE policies governing formulation of DMMPs. However, it does not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program or the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified at higher levels. Coordination with the States, as well as other agencies and interested parties, will continue during all aspects of the plan's execution and during the development of future implementation/update reports.

Richard J. Polo, Jr.
Colonel, Corps of Engineers
District Engineer

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U.S. Army Corps of Engineers
New York District

Implementation Strategy
of the
Dredged Material Management Plan
for the
Port of New York and New Jersey

TECHNICAL APPENDIX

2005 UPDATE

October 2005

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APPENDIX C

ACRONYMS & ABBREVIATIONS

AK	Arthur Kill
AMD	Acid mine drainage
AUD	Acceptable Use Determination
BGW	BioGenesis of NJ, Inc., Montgomery Watson Harza, Inc. and BioGenesis Enterprises, Inc.
BMPs	Best Management Practices
BSAF	Biota-Sediment Accumulation Factor
BUD	Beneficial Use Determination
CAD	Confined Aquatic Disposal (Subaqueous Aquatic Site)
CARP	Contaminant Assessment and Reduction Project
CDF	Confined Disposal Facility
CFR	Code of Federal Regulations
cm/sec	centimeter per second
CSO	Combined Sewer Overflow
CY	Cubic Yard
DDD	an anaerobic breakdown product of DDT
DDT	Dichloro-diphenyl-trichloroethane
Dioxin	2,3,7,8 Tetrachloro-dibenzo-dioxin
DMMIWG	Dredged Material Management Integration Work Group
DMMP	Dredged Material Management Plan for the Port of New York and New Jersey
DO	Dissolved Oxygen
EA	Environmental Assessment
e.g.	*Exempli Gratia* – For Example
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EP	Engineer Pamphlet
EQIP	Environmental Quality Incentives Program
ER	Engineer Regulation
ERLIS	East River and Western Long Island Sound
ERM	Effects Range-Median
ESDC	Empire State Development Corporation
Farm Bill	Farm Security and Rural Investment Act
FEIS/R	Final Environmental Impact Statement and Final Environmental Impact Report
FSEIS	Final Supplemental Environmental Impact Statement
GIS	Geographic Information System
GTI	Gas Technology Institute
Harbor	New York and New Jersey Harbor
HARS	Historic Area Remediation Site
HEP	New York/New Jersey Harbor Estuary Program
HDP	New York/New Jersey Harbor Deepening Project
HR	Hudson River
HRE	Hudson-Raritan Estuary Ecosystem Restoration Project
HRF	Hudson River Foundation for Science and Environmental Research, Inc.
HRM	Harbor Resource Management Environmental Group
i.e.	Id Est – That Is
JB	Jamaica Bay
JCI	Jay Cashman, Inc.
KVK	Kill Van Kull
LBA	Lower Bay, Transect and NY Bight Apex
MCY	Million Cubic Yards
mg/l	milligrams per liter
MOA	Memorandum of Agreement
MOTBY	Military Ocean Terminal, Bayonne, New Jersey

ACRONYMS & ABBREVIATIONS
(CONTINUED)

MSEC	Motor Sports Entertainment Complex
MS4s	Municipal Separate Storm Sewer Systems
NB	Newark Bay & tributaries
NBCDF	Newark Bay Confined Disposal Facility
NEPA	National Environmental Policy Act
NJ	New Jersey
NJDEP	New Jersey Department of Environmental Protection
NJDEP/DFW	New Jersey Department of Environmental Protection, Division of Fish and Wildlife
NJDOT/OMR	New Jersey Department of Transportation / Office of Maritime Resources
NJMC	New Jersey Meadowlands Commission
NJPDES	New Jersey Pollutant Discharge Elimination System
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NOAA	National Oceanic and Atmospheric Administration
Non-HARS	Historic Area Remediation Site unsuitable
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NUI	National Utility Investors Environmental Group
NY	New York
NYC	New York City
NYCDEP	New York City Department of Environmental Protection
NYCEDC	New York City Economic Development Corporation
NYD	United States Army Corps of Engineers, New York District
NYSDEC	New York State Department of Environmental Conservation
PA	Pennsylvania
PADEP	Pennsylvania Department of Environmental Protection
PAH	Polycyclic Aromatic Hydrocarbons
PANY/NJ	Port Authority of New York and New Jersey
PCA	Project Cooperation Agreement
PCB	Polychlorinated biphenyl
PEIS	Programmatic Environmental Impact Statement
PIA	Public Involvement Appendix
PICG	Public Information and Coordination Group
Port	Port of New York and New Jersey
ppb	Parts per billion
PRA	Priority Remediation Area
QA	Quality Assurance/Quality Assessment
RCRA	Resource Conservation and Recovery Act
REMAP	Regional Environmental Monitoring and Assessment Program
REMOTS	Remote Ecological Monitoring of the Sea Floor
RFP	Request for Proposal
S/S	Solidification/Stabilization
SAV	Submerged Aquatic Vegetation
SERG	Senior Executive Review Group
SETAC	Society of Environmental Toxicology and Chemistry
SPDES	State Pollutant Discharge Elimination System
States	States of New York and New Jersey
TBP	Theoretical Bioaccumulation Potential
TEF	Testing Evaluation Framework
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UB	Upper Bay

ACRONYMS & ABBREVIATIONS
(CONTINUED)

USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WES	USACE Waterways Experiment Station
WQC	Water Quality Certification
WRDA	Water Resources Development Act
YR	Year

A MANAGEMENT OPTION ANALYSIS & DETAIL

A-1 SUSTAINABLE SEDIMENT MANAGEMENT

DESCRIPTION

The navigation channels of Harbor are part of a dynamic and complex system. High sedimentation rates within some of the channel areas necessitate frequent dredging to keep the channels open. Sediment management focuses on controlling the amount of sediment settling within the navigation channels. The sedimentation minimization strategies can be classified into four main types: Watershed Sediment Management Controls, Channel Design Optimization, Advanced Maintenance Dredging, and Structural Modification.

TECHNIQUES

Watershed Sediment Management Controls are strategies to prevent and reduce the amount of sediment reaching a waterbody. Both States have developed watershed based sediment reduction controls. Techniques include the implementation of Best Management Practices (BMPs) and Total Maximum Daily Loads (TMDLs), which are designed to the reduce the volume of sediment in storm water runoff, redirecting runoff to collection basins or other pervious surfaces where infiltration to the ground water can occur, and protecting and reinforcing steep slopes and stream banks.

New York (NY) is reducing the amount of sediment in runoff to its waters by implementation of management practices appropriate for the source of non-point pollution being controlled. NY's Non-Point Source Pollution (NPS) Management program includes several source categories that generate sediment. The NY State Department of Environmental Conservation (NYSDEC) has developed management practice catalogues for agriculture, silviculture, construction, urban/stormwater runoff, roadway and right-of-way maintenance, and hydrologic and habitat modification. For agricultural sources of sediment, NYSDEC works with the NY Department of Agriculture and Markets, and the State Soil and Water Conservation Committee, using Federal (e.g. Natural Resources Conservation Service [NRCS] – Environmental Quality Incentives Program [EQIP]) and state (e.g., Environmental Protection Fund and Clean Water / Clean Air Bond Act) cost share funds, and local matching funds ranging from 25% to 75% to control sediment runoff from farms using structural, vegetative, and operational practices. Within NYSDEC, the Division of Water works with the Division of Lands and Forests to assist foresters, loggers, and landowners to minimize sediment runoff during tree harvesting and forest road construction or maintenance.

The Federal Phase 2 Stormwater program in NY addresses sediment runoff using general discharge control permits as part of its delegated National Pollutant Discharge Elimination System (NPDES) and State Pollutant Discharge Elimination System (SPDES). General permits apply to construction sites greater than 1 acre and to Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas. Management practices that control sediment or that address any of the six minimum measures required in the Phase 2 program are found in several of the subcategory catalogues within the "Urban/Stormwater Runoff Management Practices Catalogue for Nonpoint Source Pollution Control Prevention and Water Quality Protection in New York State" (NYSDEC 1996). The four source category catalogues that pertain most to the control of sediment in urban and suburban stormwater runoff are the construction, urban/stormwater runoff, roadway and right-of-way maintenance, and hydrologic and habitat modification catalogues.

Recent Federal emphasis on the restoration of riparian buffers (e.g., Conservation Reserve Program, Conservation Reserve Enhancement Program, and NRCS – EQIP) to reduce sediment transport in all watersheds is also reflected in NY's ranking criteria for agricultural and non-agriculture non-point source grant projects funded by both state and Federal funds (e.g., Clean Water Act Section 319, Farm Security and Rural Investment Act [Farm Bill]).

New Jersey's (NJ) Non-Point Source Pollution Control Program includes several strategies aimed at reducing sedimentation. The NJ Department of Environmental Protection's (NJDEP) is working collaboratively with the NJ Department of Agriculture to take advantage of Federal cost share funds directed at the restoration of riparian buffers (e.g., Conservation Reserve Enhancement Program) and the implementation of BMPs designed to reduce sediment transport off of existing agricultural sites (e.g. NRCS – EQIP). NJ also uses federal funding provided under section 319 of the Clean Water Act to implement "action now" projects designed to eliminate erosion along NJ streams and rivers. The future centerpiece of NJ's Non-Point Source Pollution Control Program will be a new set of Stormwater Management Rules, (proposed on January 6, 2003). The proposed new Stormwater Management rules will require the reduction of 80% of the Total Suspended Solids (TSS) from all new major development in the State. The NJDEP has developed a BMP Manual providing guidance on methods to achieve the 80% TSS requirement. One of the methods includes the use of manufactured stormwater treatment devices. Removal efficiencies of these devices are verified/certified by NJDEP, in conjunction with the NJ Corporation for Advanced Technology as well as other testing organizations. These Rules will also require comprehensive stormwater management planning at the municipal and regional levels. In addition, NJDEP is in the process of developing TMDLs that establish numeric reduction in sediment as well as other pollutants to achieve the remediation of impaired waters.

<u>Channel Design Optimization</u> involves decreasing the sedimentation rate within the channel by re-engineering the channel. Straightening channels, called channel realignment, tends to increase the water velocity within the channel. The higher water velocity entrains a larger percent of material suspended in the water column and decreases the amount of material settling out and accumulating in the channel. In the channel design optimization process, the Corps also examines the economic need to dredge the channel. The channel must have sufficient economic value to warrant the use of Federal funds for the channel's maintenance. Channel design optimization strategies are examined during initial project design and as part of the routine maintenance procedures. Many of the Channel Design Optimization strategies have already been incorporated into the existing channel designs. Consequently, little additional benefit might be gained from further analyses at this time.

<u>Advanced Maintenance Dredging</u> has been used as a short-term means of reducing dredging cost and frequency by dredging below the desired channel depth. Sediment settling in the channel will eventually fill the channel to the authorized channel depth, and the time between maintenance dredging operations will increase. This lowers cost by avoiding several expensive mobilization and demobilization cycles of dredging equipment and reduces the frequency of dredging, which may reduce any short term, localized environmental impacts associated with more frequent dredging.

<u>Structural Modifications</u> are physical constructs designed to keep sediment moving through (instead of settling in) a channel or berth area or to prevent sediment from entering the channel or berth area. Typical structures include flow training dikes and sills, scour and propeller jets, gates and curtains, pneumatic barriers and sedimentation basins. Several technologies have been proposed for reduction of sedimentation in berthing areas. Numerical models of hydrodynamics, salinity and sedimentation are used to assess the feasibility of generic and specific structural modification plans.

<u>POTENTIAL IMPACTS</u>

<u>Watershed Sediment Management Controls</u> are designed to minimize the loss of soil from upland sources and thus reduce the sediment load in storm water runoff. If stream or channel bank reinforcement were proposed, the potential impacts would be evaluated in a separate Environmental Assessment (EA). The major elements for impact assessment include habitat disturbance, ecologically important species, wetlands and mudflats disturbance, and water quality.

<u>Channel Design Optimization</u> strategies are investigated during channel design and before <u>Advanced Maintenance Dredging</u> projects are initiated. The potential impacts are examined under the EA for these projects. If significant channel realignment were proposed, the potential impacts would be evaluated in a separate EA. The major elements for impact assessment include habitat disturbance, ecologically important species, wetlands and mudflats disturbance, and water quality.

Each component of the Harbor navigation system was examined to identify areas that were suitable for sedimentation management measures. Specific <u>Structural Modification</u> plans were developed for the four sites identified in the Interim Report: North of Shooters Island, Port Newark/Port Elizabeth, Military Ocean Terminal at Bayonne, and Claremont Terminal. Physical Sediment Reduction measures have the possibility of impacting the benthic and fish communities. Impact concerns include the habitat loss from the project "foot-print" and alterations of the water velocity and water quality. There may also be positive impacts associated with the pneumatic sediment suspension systems including increased aeration, increased fish habitat and reduced dredging frequency. There is a potential to encounter both prehistoric and historic cultural resources if proposed structural work is not limited to previously disturbed areas.

IMPLEMENTATION

The NJ Division of Watershed Management has established a watershed-based program to develop TMDLs for impaired waterbodies in NJ. The impairments (as listed on the Federal 303d list) are defined by exceedances of NJ Surface Water Quality Standards. The development of TMDLs will provide a basis for the development of Watershed Management Plans by region (20 in NJ) to reduce point and nonpoint sources of pollution so that these water bodies will no longer be impaired. NYSDEC has a similar TMDL based program.

Several technologies have been proposed for reduction of sedimentation in berthing areas. While some of these systems have been used elsewhere in the country with some success, there is no data on their efficacy in the Harbor. Preliminary technical designs and economic evaluations of four proposed structural modification projects were completed in 1997 (USACE 1997). The North of Shooters Island project proposed the construction of a flow-training dike to narrow the channel to a width similar to that which currently exists in the Arthur Kill and KVK. Sedimentation modeling indicates that the proposed flow-training dike would reduce shoaling within the project boundary by 50,000 CY per year (CY/YR). The cost of the dike is $18,000,000 and economic analyses indicate that the plan would be cost effective for dredging costs exceeding $36/CY. Option plans for flow training dikes and pneumatic barriers, were developed for sites within Port Newark/Port Elizabeth. Modeling results indicate the options could reduce sedimentation by between 25,000 CY/YR and 150,000 CY/YR. Economic evaluations indicate that plans are cost effective for dredging costs from $30–$52/CY. The larger reduction in dredged material volumes is associated with the high project cost. The project plans for Military Ocean Terminal, Bayonne, NJ (MOTBY) and Claremont Terminal both proposed narrowing the entrance to the reach through the construction of a pneumatic barrier. Both the MOTBY and the Claremont Terminal project could reduce shoaling by approximately 20,000 CY/YR at an estimated project cost of $23/CY.

Before recommending or permitting the widespread use of these technologies, the NJDEP has requested that demonstration projects be conducted with concurrent modeling of sediment loading and ecological effects. NJ Department of Transportation/Office of Maritime Resources (NJDOT/OMR) evaluated the efficacy of a pneumatic sediment suspension system at a location in NJ. The results of this study indicate that although pneumatic barriers do appear to decrease sedimentation, the costs associated with design, installation, and operation may be prohibitive (Chapman and Douglas 2002).

In addition, CITGO Petroleum of Pennsauken, NJ, is currently performing a demonstration of a turbo scour system at its facility on the Arthur Kill. The SCOUR SYSTEM technology utilizes high volume low velocity water jets to maintain movement of water across the berth bottom during slack tide. Multiple heads are installed across a bulkhead and are designed to operate in sequence to prevent sediment from settling in the design berth area. A final report is in preparation and will be evaluated by NJDEP for sediment management effectiveness as well as Essential Fish Habitat (EFH) impacts. Cumulative impacts of widespread use of this approach will also be determined during the NJDEP review.

The preliminary evaluations and demonstration projects described above indicate that there may be opportunities for feasible sediment management projects in the Harbor watershed area. Note that these systems are not designed to resuspend already deposited sediment, but rather to prevent settling of sediment particles. The NYSDEC and NJDEP watershed management programs, as well as the New York/New Jersey Harbor Estuary Program (HEP), the Contaminant Assessment and Reduction Project (CARP), and the Hudson Raritan Estuary Program, will advance the state of knowledge concerning Sediment Management options in the Harbor.

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A-2 CONTAMINANT REDUCTION

DESCRIPTION

The USACE, NY District (NYD) has estimated that approximately 64% of maintenance dredge material is unsuitable for ocean placement as remediation material at the Historic Area Remediation Site (HARS). The long-term annual average amount of HARS unsuitable material dredged is estimated to be approximately 1.55 million cubic yards per year (MCY/YR) (See Table 2–1 in the DMMP – Implementation Report).

There is some evidence that contaminant levels in Harbor sediments are declining. In general, older (deeper) sediments have higher contaminant levels than the more recently deposited material. Dramatic decreases in sediment contamination from 1960s levels have been documented in certain areas of the Harbor, while studies conducted in other areas have proved inconclusive (Bopp *et al.* 1997; United States Environmental Protection Agency [USEPA] 1993; National Oceanic and Atmospheric Administration [NOAA] 1995). If trends toward cleaner sediments were to continue throughout the Harbor, significant reductions in the volume of HARS unsuitable dredged material would be realized. This in turn would have profound effects on the long-term dredging budgets, Port planning decisions, selection of management options, and the overall restoration efforts in the estuary.

The difficulty in accurately quantifying contamination trends in the sediments for the entire Harbor area has been the lack of sufficient data. Since the 1999 draft of the DMMP, additional studies of harbor sediments, including Regional Environmental Monitoring and Assessment Program (REMAP) 98 and CARP, have contributed to the datasets that could be used toward ascertaining trends in the condition of harbor sediments. However, even with the addition of these data it is still difficult to reasonably predict which sediments are likely to fail ocean placement criteria, or to determine when sediments are likely to meet these criteria, or what actions are needed to achieve these goals. To tackle this problem the Hudson River Foundation for Science and Environmental Research, Inc. (HRF), under the auspices of NY/NJ Harbor Estuary Program (HEP), is coordinating a regional Contaminant Assessment and Reduction Program (CARP) designed in part to assist dredged material managers in quantifying these contamination trends. Stakeholders include not only the Corps, but also the States of NY and NJ (States) and the Port Authority of NY and NJ (PANY/NJ). The CARP will not only help to fill the gaps in the data, but will also synthesize the data to generate a predictive contaminant fate and transport model. The model will be designed to predict trends in both toxicity and bioaccumulation. To date, the non-Federal stakeholders have invested approximately $30 million. A focal point of the Corps role in the program is obtaining greater certainty in these predictions, which are expected to continue to evolve over the next few years. Accordingly, the CARP, as well as other Dredged Material Management Plan (DMMP) related programs, should be flexible enough to incorporate and respond to new information, as it becomes available. Significant dredged material disposal costs savings and habitat restoration benefits are all within the reach of a successful program, therefore the Corps is a direct beneficiary and key component of the program. The Corps' commitment to the CARP initiative must coincide with a similar commitment from the other regional stakeholders.

Pending the completion of the development stage of the CARP contaminant model, the NYD made an attempt in the 1999 draft of the DMMP to use sediment data to make short- and long-term projections regarding the future quality of dredged material. What follows is a discussion of the techniques employed and potential impacts of the findings. The analyses were based on data available at that time, which did not include REMAP 98 or CARP data. However, the general conclusions drawn below are consistent with those of a more recent analysis of contamination trends perform by the HRF and reported in their publication "Health of the Harbor" (Steinberg *et al.* 2004). Therefore, the 1999 projection analysis is still relevant and remains part of this technical appendix to the DMMP for informational purposes.

TECHNIQUES

For the 1999 draft DMMP the NYD developed two methods to generate estimates of the quality of dredged material in the out years (beyond 2000). In making predictions, emphasis was placed on toxicity and the bioaccumulating contaminants (e.g., PCBs and dioxin) that impede HARS use of the Harbor dredged material.[1]

The first method to predict the quality of post-2000 dredged material assumed that contaminant concentrations measured in surficial Harbor sediments during three sediment assessment efforts: REMAP (1993–94); NOAA Status and Trends (1995); and MAXUS (1991–95) would be representative of the level of sediment contamination present in material that would require dredging in years 2000–2010. Post-2000 material was projected to be suitable for beneficial use in those areas of the Harbor with sediments determined to be HARS suitable material and/or in areas where the surficial sediments met current bioaccumulation and toxicity criteria. The analysis is further described in section A, below.

The second method used to predict sediment suitability for beneficial use establishes temporal trends for important contaminants using radionuclide data and contaminant levels reported by Bopp *et al.* (1997). These trends were then extrapolated to estimate contaminant levels and suitability for beneficial use in future dredged material. The analysis is further described in section B, below.

A. Prediction of Dredged Material Quality through 2010: Use of surficial sediment data as a surrogate for post-2000 dredged material.

Dredged material suitable for ocean placement as remediation material at the HARS must meet current HARS remediation standards. These standards are based on biological criteria; specifically, exposure of benthic organisms to the material must not result in adverse effects due to toxicity or to bioaccumulation of contaminants. Projections of post-2000 dredged material quality were based upon 10-day exposures of the marine amphipod *Ampelisca abdita* to surficial Harbor sediments during the REMAP and NOAA studies. It is important to recognize that these calculations are not used in the United States Army Corps of Engineers (USACE) regulatory process for determining HARS suitability. However, these calculations provide an indication of the potential for adverse effects due to bioaccumulation. The theoretical bioaccumulation potential (TBP) of non-polar organic contaminants (DDT, PCBs, and dioxin) in the sediments is calculated using the following relationship:

Ct-28d = (BSAF28d*%L*C_s)/TOC.
Where:

Ct-28d = estimated tissue concentration resulting in an organism exposed to the sediment for 28 days;
BSAF28d = biota-sediment accumulation factor;
%L = lipid concentration of organism (wet weight), expressed as decimal;
C_s = concentration of non-polar organic compounds in sediment; and,
TOC = organic carbon content of sediment, expressed as decimal.

TBPs were calculated assuming the mean lipid concentrations of test animals were as reported in Federal dredged material testing projects since 1992 and using biota-sediment accumulation factors (BSAFs) reported by Rosman *et al*. (1997). The results of the toxicity and the TBP calculations were then compared to current HARS criteria to determine the suitability of the sediment for beneficial use. It should be noted that new BSAFs are currently being generated by the CARP using synoptic sediment and tissue samples from various parts of the Harbor. These new BSAFs will be used in the CARP model.

B. Projections of Future Quality of Dredged Material through 2040: Extrapolation of temporal trends in sediment contaminant concentrations to predict long term trends in dredged material quality.

In a previous study by Bopp *et al.* (1997) sediment samples were taken from different depths of cores collected throughout Harbor and analyzed for PCBs, DDD (an anaerobic breakdown product of DDT), and dioxin levels. Dates of deposition of these samples were estimated using radioisotopes. These data showed that concentrations of these contaminants have decreased dramatically in certain parts of the Harbor since the 1960s; results were inconclusive in other areas. The rates of decline of contaminant concentrations revealed by these cores were extrapolated in the present study to predict future levels of contaminants in dredged material and to forecast Harbor sediments suitable for beneficial use. Since total DDT, not DDD, is used in making beneficial use suitability

[1] It must be recognized that non-bioaccumulating contaminants (*e.g.,* Polycyclic aromatic hydrocarbons (PAHs), metals) can contribute significantly to the toxicity of dredged material; therefore their importance should not be minimized.

determinations under the current evaluative framework, a suitable target sediment concentration had to be developed for this compound. Using the TBP equation, it was determined that the NOAA Effects Range-Median (ERM) value (i.e., the median sediment concentration observed or predicted by different methods to be associated with biological effects) for PCBs approximated the appropriate target sediment concentration for determining the potential for exceedances due to bioaccumulation of this contaminant. Therefore, targets for contaminant concentrations in sediments for beneficial use were set to NOAA ERMs for both DDD and PCBs. Following a review of bioaccumulation data from recent Federal dredging projects, the target sediment concentration for dioxin was set at 10 parts per trillion.

POTENTIAL IMPACTS

A. Prediction of Dredged Material Quality through 2010: Use of surficial sediment data as a surrogate for post-2000 dredged material.

The distribution of surficial sediments samples tested for amphipod toxicity is shown in Figure A-2-1. The amphipod test results show that dredged material throughout the Newark Bay-Kills-Hackensack and Passaic rivers complex is likely to continue to be unsuitable for use as remediation material at the HARS. Significant potential for amphipod toxicity is also shown for Jamaica Bay and areas of the Upper Bay and the lower East River.

TBP results predict that, as anticipated, exceedances of criteria due to bioaccumulation of PAHs are limited to a few select areas in the Passaic River, Hudson River, Bay Ridge and a tributary of Jamaica Bay (Figure A-2-2). PCBs, dioxin, and DDT will continue to be problem contaminants in the Passaic and Hackensack rivers, Newark Bay and the Kills through year 2010 (Figures A-2-3 through A-2-6). Scattered exceedances for PCBs are also predicted in the Upper Bay and the East River through 2010. (TBPs predict similar patterns in bioaccumulation criteria exceedances in both *Macoma nasuta* and *Nereis virens* [compare the results for PCBs in Figures A-2-3 and A-2-4], so only TBP results for one species [*i.e., M. nasuta*] are depicted on the Figures.)

Patterns revealed by analysis of surface sediments in the Harbor indicate that little or no increase in the volume of dredged material that is suitable for HARS use is anticipated by 2010. Areas that presently yield the remaining material are predicted to continue to be problematic.

B. Projections of Future Quality of Dredged Material through 2040: Extrapolation of temporal trends in sediment contaminant concentrations to predict long term trends in dredged material quality.

Extrapolation of the observed trends in sediment contaminant levels predicts that PCBs will continue to exceed HARS use criteria in Newark Bay dredged sediments through 2070 and in the Passaic River beyond 2100. Likewise PCB levels in the Upper Bay are predicted to exceed HARS use criteria until 2025 and in Jamaica Bay until 2010 (Figure A-2-7). Similar extrapolations predict that DDD will continue to be problematic in the Passaic River, Newark Bay, and the Kills until at least 2025, whereas sediments in the Upper Bay may already be below target levels (Figure A-2-8). Dioxin data were only analyzed in Newark Bay and the Passaic River. Dioxin concentrations are predicted to be problematic through 2045 in these areas (Figure A-2-9). Projected dates for HARS suitability in the waterways considered are summarized in Table A-2-1. It is important to note that all of these projections assume a relatively static bottom condition where buried sediments remain buried. However, this assumption has recently been challenged in the literature (Geyer *et al.* 2001).

The projections using surficial sediments and the dated sediment cores generally agree in predicting that dredged material from Lower Passaic River, Newark Bay, Kill van Kull, Arthur Kill, and portions of the Upper Bay will remain unsuitable for HARS use for at least the next 15 years. Portions of the Upper Bay and Jamaica Bay may meet the criteria for HARS use by 2010. The forecasts of dredged material suitability from the sediment core data are based on extrapolations from very few observations at a single location within a given waterway and must be viewed as highly uncertain. The CARP model is being developed with the ability to reduce this uncertainty by incorporating more detailed information and new conceptual understanding of the Hudson/Raritan estuary.

Table A-2-1. Projected Timelines for Dredged Material in Various New York/New Jersey Harbor Waterways to reach potential HARS use quality

Year was extrapolated from chemical and radioisotope data reported for sediment cores by Bopp *et al.* (1997).

Waterway/Contaminant	Dioxin	DDD	PCBs
Lower Passaic River	2040	Post-2100	Post-2100
Newark Bay	2045	2035	2070
Kill van Kull	NA	2025	NA
Arthur Kill	NA	2025	NA
Upper Bay	NA	2000	2025
Jamaica Bay	NA	NA	2010

NA = Not Analyzed

IMPLEMENTATION

What may be concluded from the above analyses is that there is no clear evidence suggesting that the volume of material unsuitable for HARS placement will decline significantly over the next 5 to 10 years for those navigation channels where dredged material tends to be unsuitable for HARS placement. However, this conclusion is far from definitive due to the large uncertainties surrounding the prediction of future contaminant levels.

Given the uncertainties associated with these predictions, the DMMP does not attempt to predict the amount of contaminant reduction expected over the next 60 years but rather sets a goal for the regionally based contaminant reduction program. The proposed DMMP target is to reduce the annual amount of dredged material unsuitable for HARS placement to 0.5 MCY by the year 2040 and to 0.25 MCY by 2065. Attaining this goal would require a total volume reduction of HARS unsuitable material of approximately 52 MCY (Figure A-2-10). Presently the typical placement cost for HARS unsuitable material is $29–$42/CY. By increasing the volume of HARS suitable dredged material, a successful contaminant reduction program increases both the in-water and upland use possibilities, resulting in a cumulative potential cost savings of $1.5-$2.2 billion over the next 60 years. In order to reach this goal, a two-phased contaminant reduction is required, starting in 2012 and 2017: a logarithmic 1.5% and 2.8% decline in volume from Newark Bay and the Kills; a 1.75% and 2.8% decline in the Upper Bay, Hudson and East rivers, and Western Long Island Sound; and, a 2% and 2.8% decline from the Lower Bay, Jamaica Bay, and NY Bight Apex.

These goals may be within the reach of a cooperative and aggressive contaminant reduction program. The HRF is coordinating an approximately $30 million regional CARP, principally funded by the States. The primary objective of the CARP is to assist dredged material managers by:

(1) Identifying and evaluating sources of contaminants that need to be reduced or eliminated to ensure that in the future, newly deposited sediments in navigational waterways will be clean enough for ocean placement activities, as well as additional upland placement opportunities;
(2) Defining what actions will be the most effective in abating the sources; and,
(3) Determining how long it will take for sediments to become clean enough to be suitable for placement at the HARS.

The NY State Department of Environmental Conservation (NYSDEC) work plan “Sources and Loadings of Toxic Substances to New York Harbor” and NJ Department of Environmental Protection (NJDEP) “New Jersey Toxics Reduction Workplan” describe the majority of the monitoring activities associated with the program. Data collection efforts under CARP began in 1999 and completed in 2001. The States funded a Quality Assurance/Quality Assessment (QA) and Data Validation component for the CARP, which was completed in 2003. The QA activities and procedures were implemented to ensure that the all CARP environmental data collection activities were scientifically valid, and that the data collected were complete, representative, comparable, and of a known and documented quality. The CARP QA Officer independently validated compliance through audits and inspections. Booz-Allen Hamilton provided the QA services. Close coordination with stakeholders and the public will ensure the continued commitment to the success of the program. Meeting the currently outlined goals will require the participation of all concerned parties in developing and implementing the program. The program's goals, if deemed appropriate by all stakeholders, must be actively pursued and monitored.

The State of NJ and the PANY/NJ have appropriated approximately $2.9 million for the development of a Harbor-wide contaminant fate and transport model. HydroQual, Inc. was selected through a Request for Proposal (RFP) process by the Hudson River Foundation to develop and apply mathematical modeling tools to integrate the CARP data. Model development was initiated in December 2001 and will be ongoing through 2005. A tiered approach has been taken in developing these models for the CARP. Tier-one will involve selecting, refining, and applying existing large-space-scale, seasonal-time-scale model(s) for contaminant fate and bioaccumulation. Tier-two will be the development of explicit, finer-scale models that couple hydrodynamics, water quality, and cohesive sediment transport. Shortcomings with either data or modeling assumptions can be improved upon in the second phase (Tier 2). These models are expected to provide dredged material and contaminated sediment managers the predictive capability to evaluate the consequences of various remedial actions. This information will better allow managers to outline the best approach to reach the aforementioned contamination reduction goals.

A reliable assessment of the proportion of dredged material that is unsuitable for the HARS is an essential element of this DMMP program. The collection and analysis of additional data on contaminant levels and sources is ongoing, and will provide the basis for generation of more reliable estimates, and could enable more optimistic projections to be made. As new information on contaminant sources and distributions become available, they will be incorporated into the CARP and DMMP programs. These programs are designed with considerable flexibility to accommodate and react to increasingly reliable estimates of future dredging volumes and material types. The NYD is a direct beneficiary of the lower dredged material disposal costs associated with a successful contaminant reduction program. Other programs of the NYD, such as habitat restoration will also benefit from the cleaner sediments, water, and biota. As such, the NYD will continue to participate in partnerships designed to reduce both the volume of HARS unsuitable dredged material and the uncertainty associated with dredged material management.

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Figure A-2-1. Sediment Toxicity Results for *Ampelisca abdita*

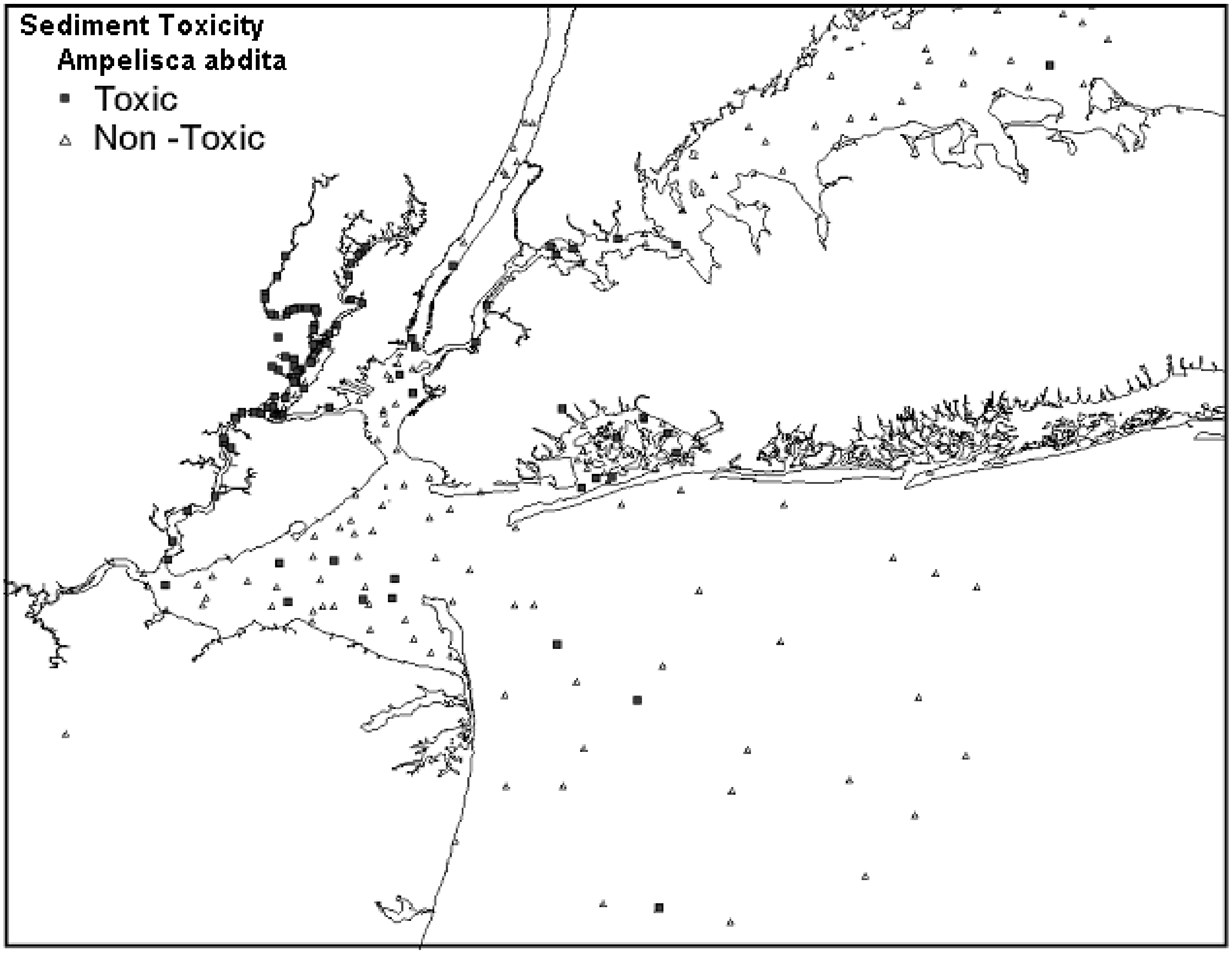


Figure A-2-2. Theoretical Bioaccumulation Potentials for Total PAHs in *Macoma nasuta*

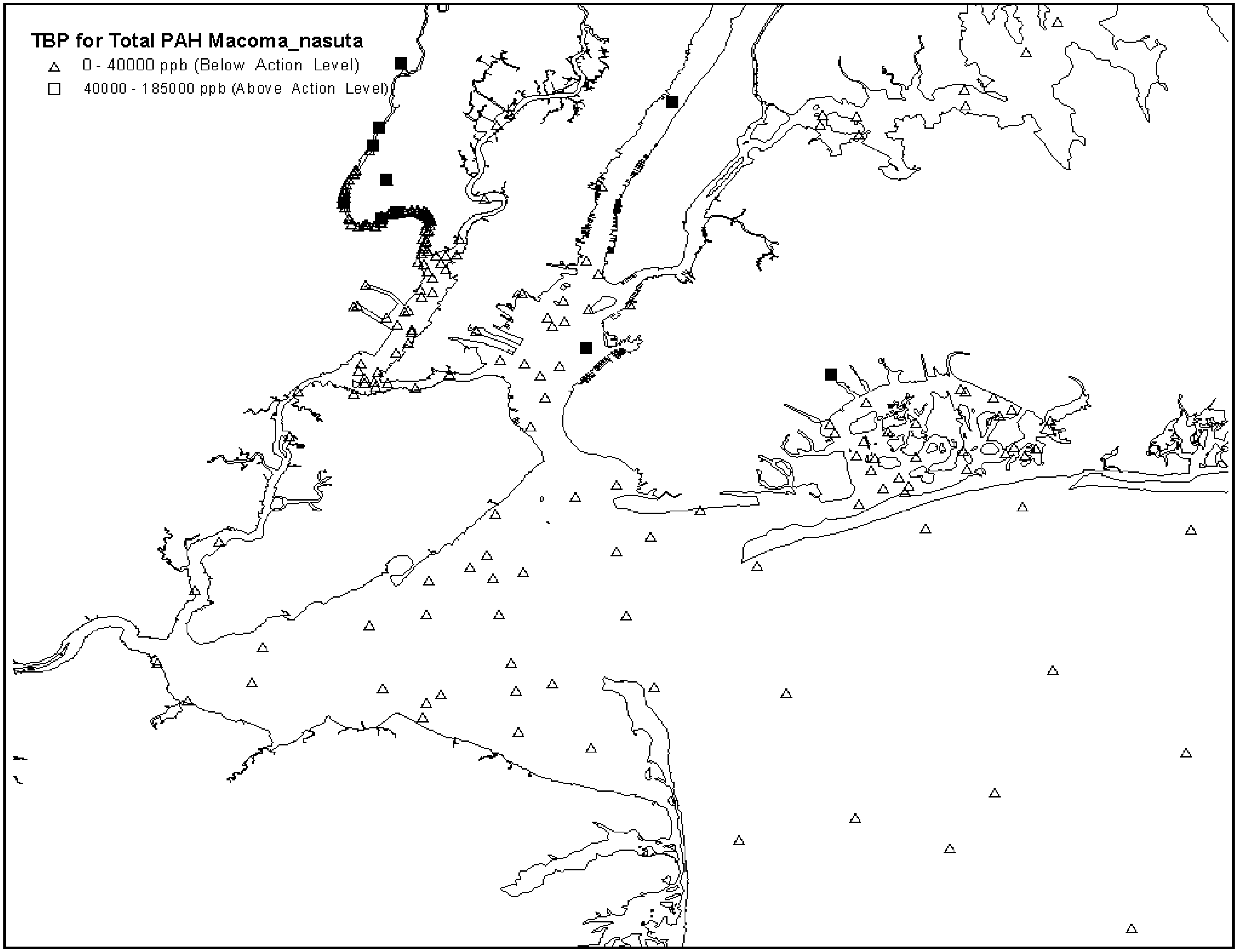


Figure A-2-3. Theoretical Bioaccumulation Potentials for Total PCBs in *Macoma nasuta*

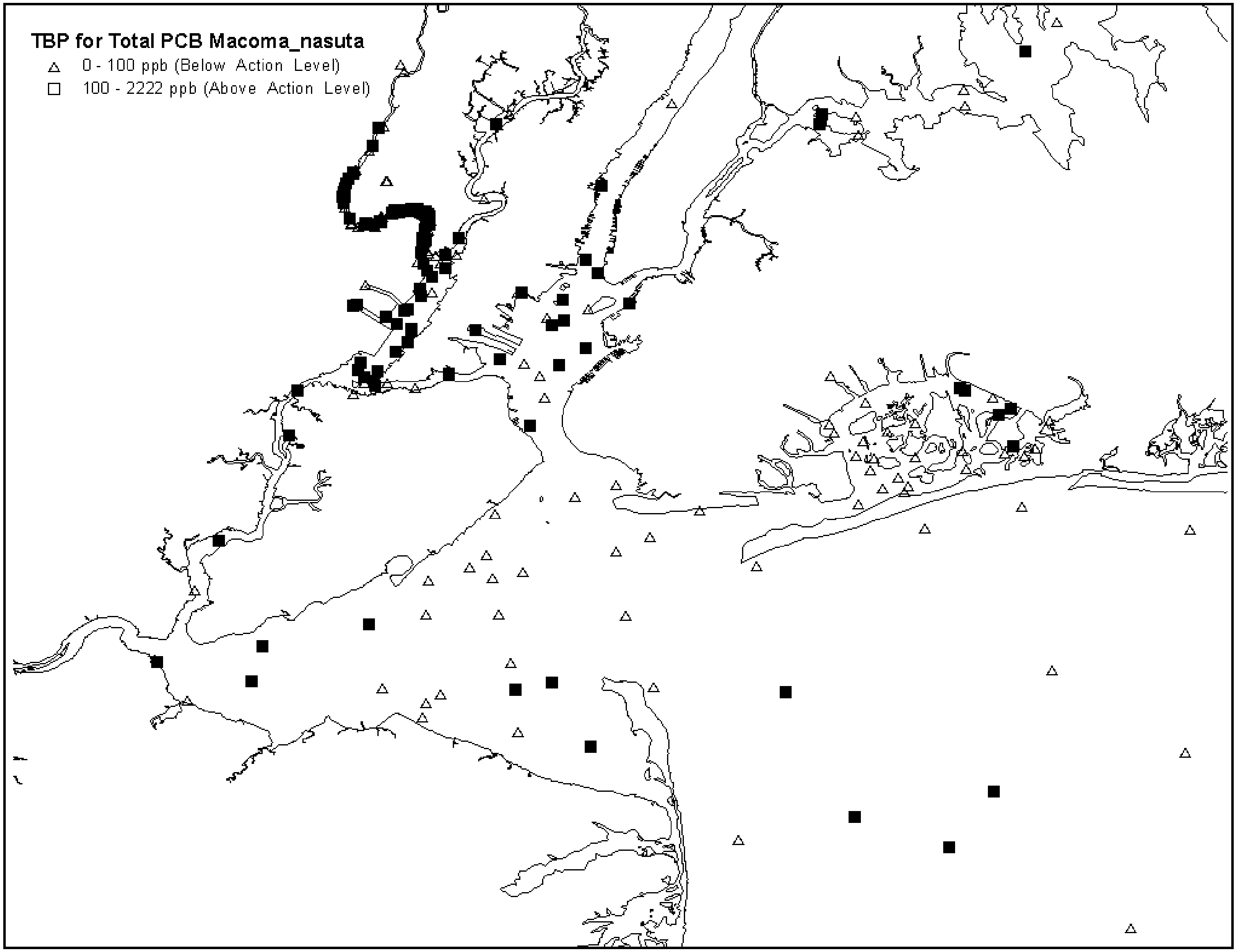


Figure A-2-4. Theoretical Bioaccumulation Potentials for Total PCBs in *Neries virens*

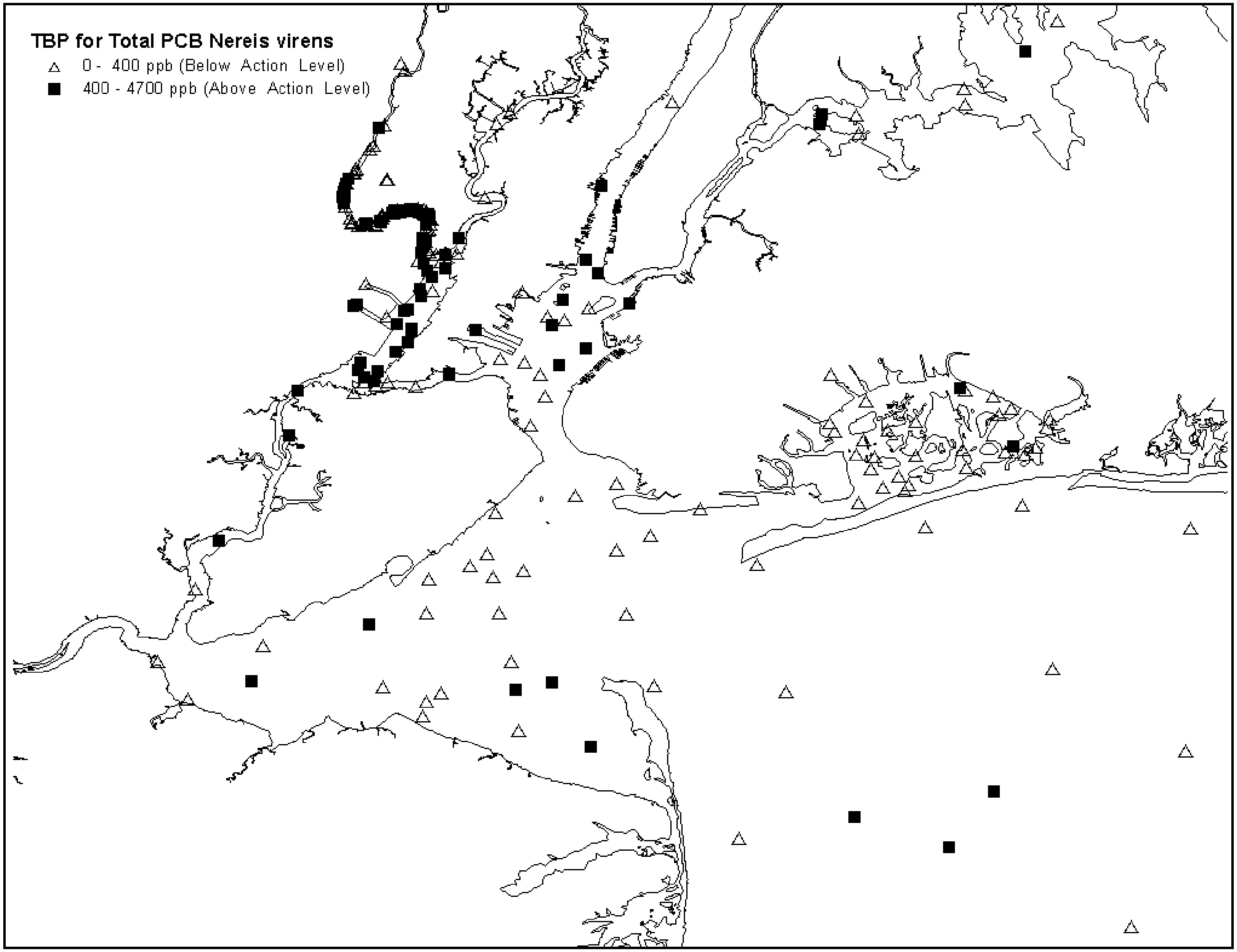


Figure A-2-5. Theoretical Bioaccumulation Potentials for 2,3,7,8 TCDD (Dioxin) in *Macoma nasuta*

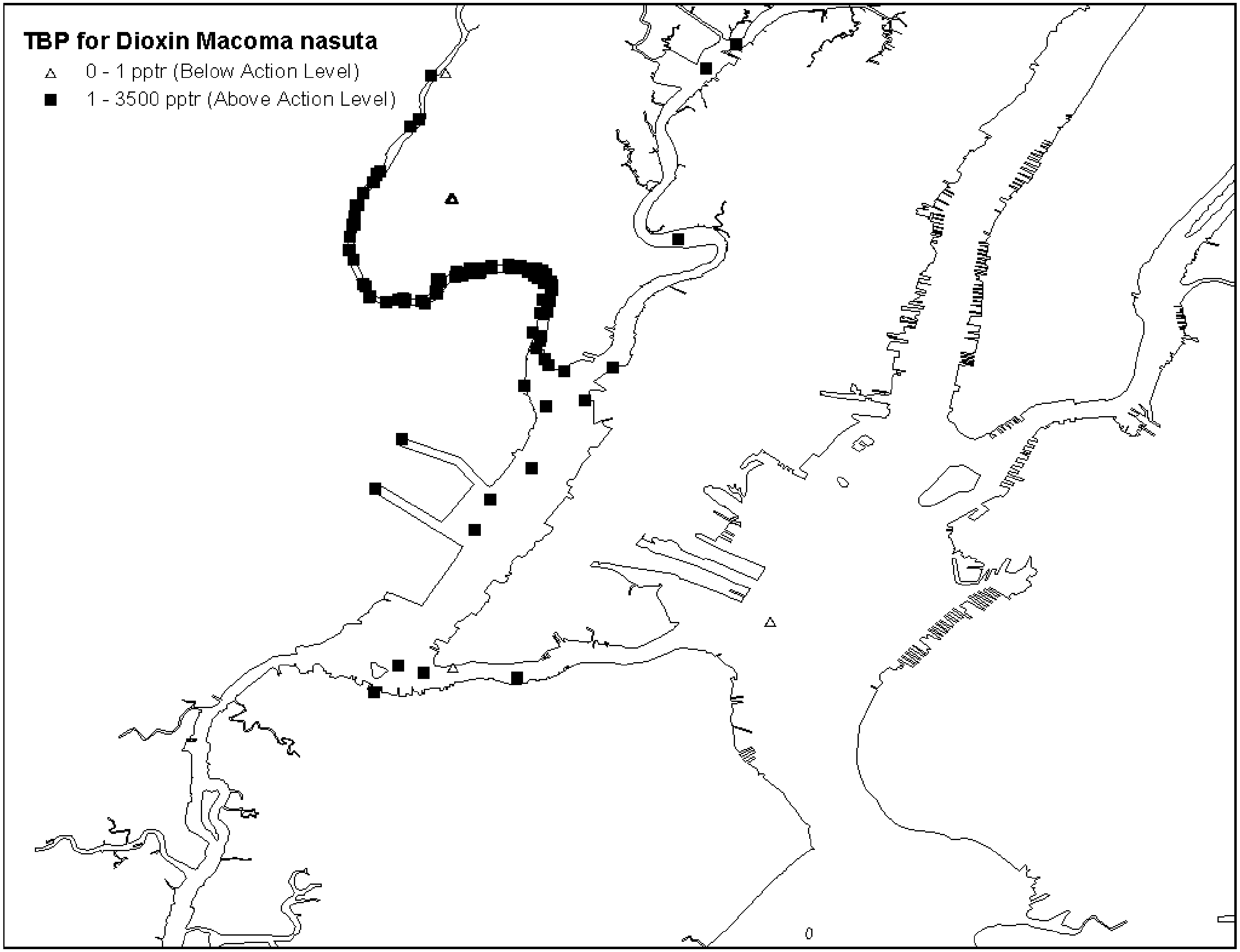


Figure A-2-6. Theoretical Bioaccumulation Potentials for Total DDT in *Macoma nasuta*

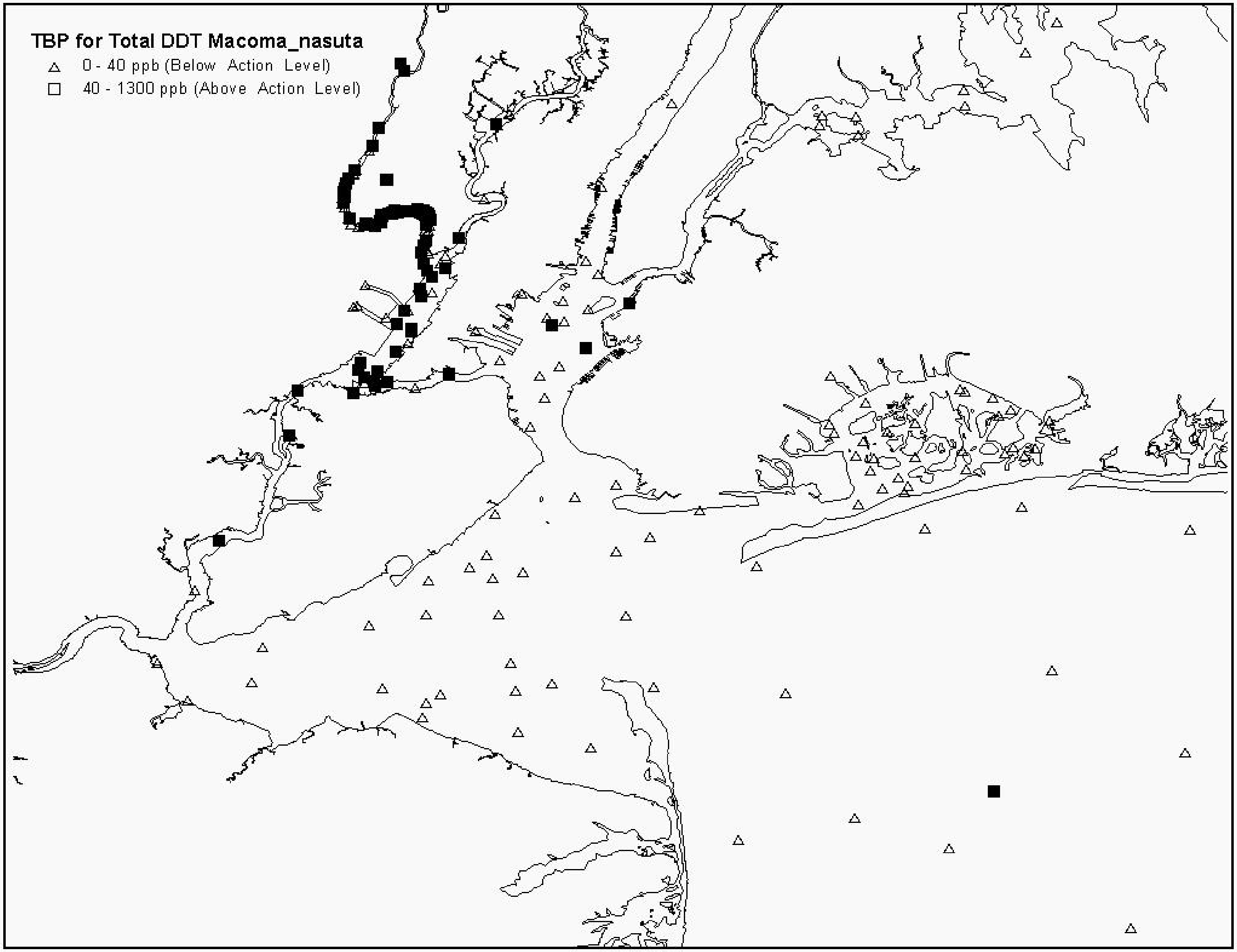


Figure A-2-7. Prediction of Long Term Dredged Material Quality for Total PCBs Based on Historic Trends

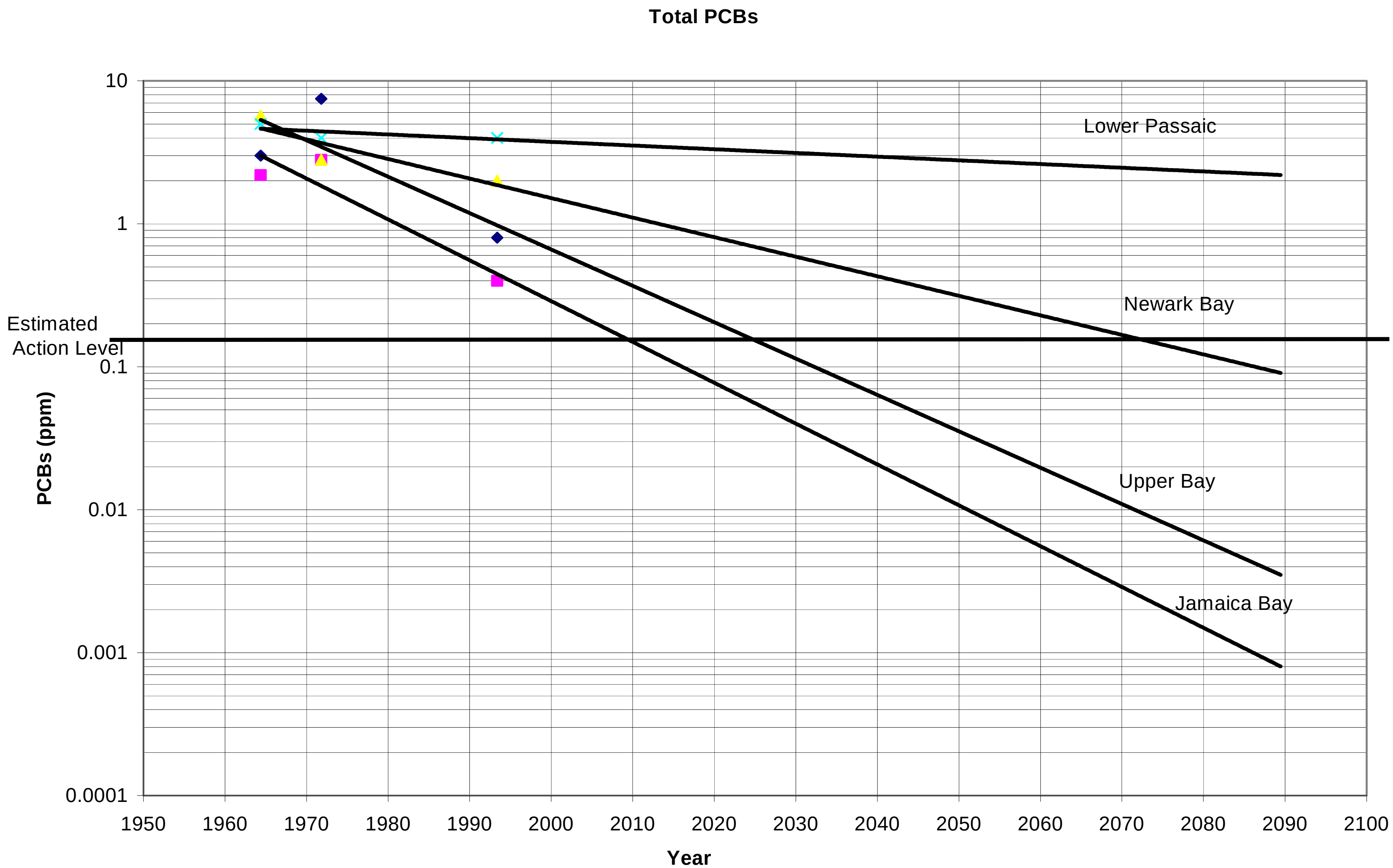


Figure A-2-8. Prediction of Long Term Dredged Material Quality for DDD Based on Historic Trends

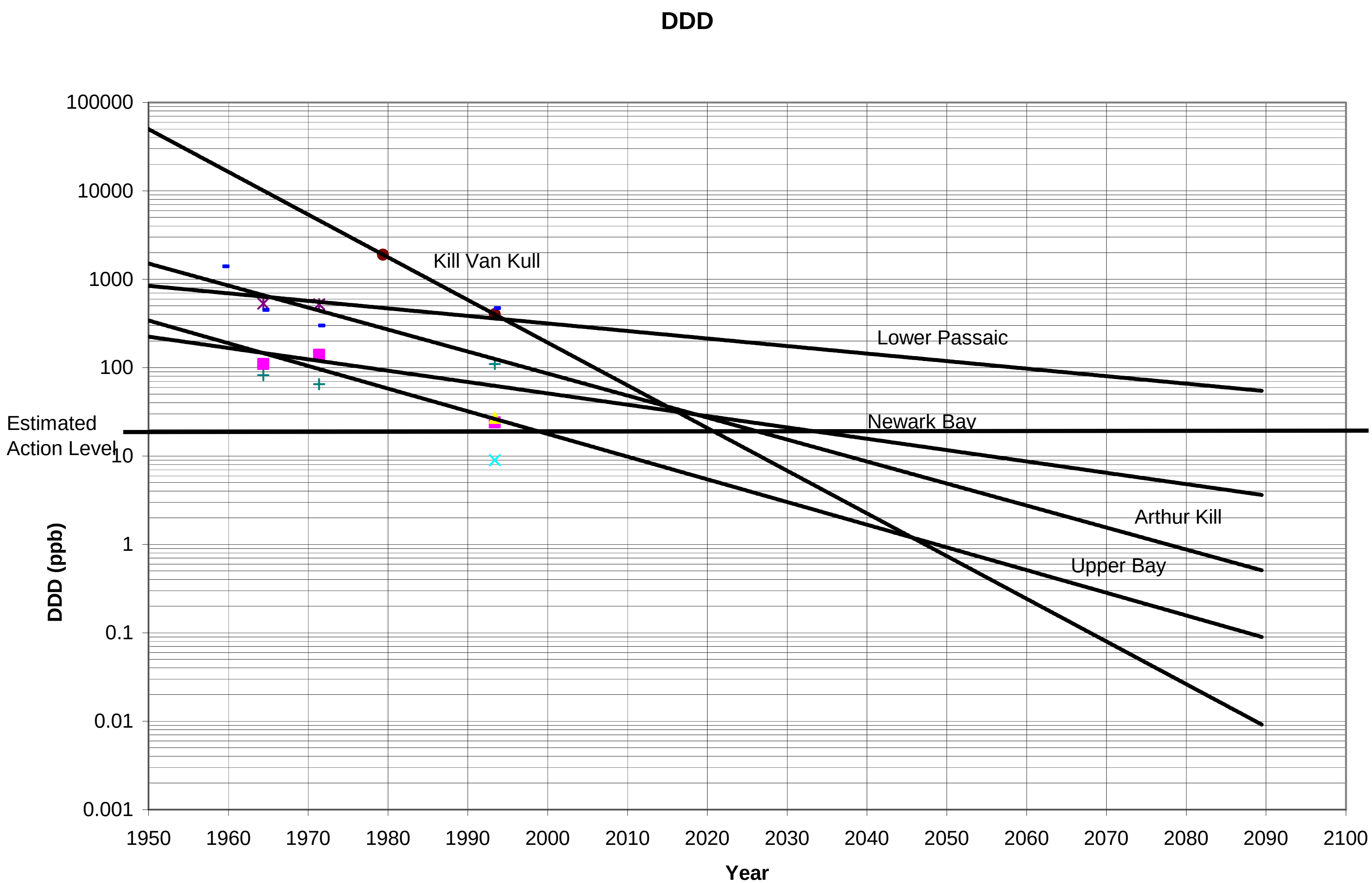


Figure A-2-9. Prediction of Long Term Dredged Material Quality for Dioxin Based on Historic Trends

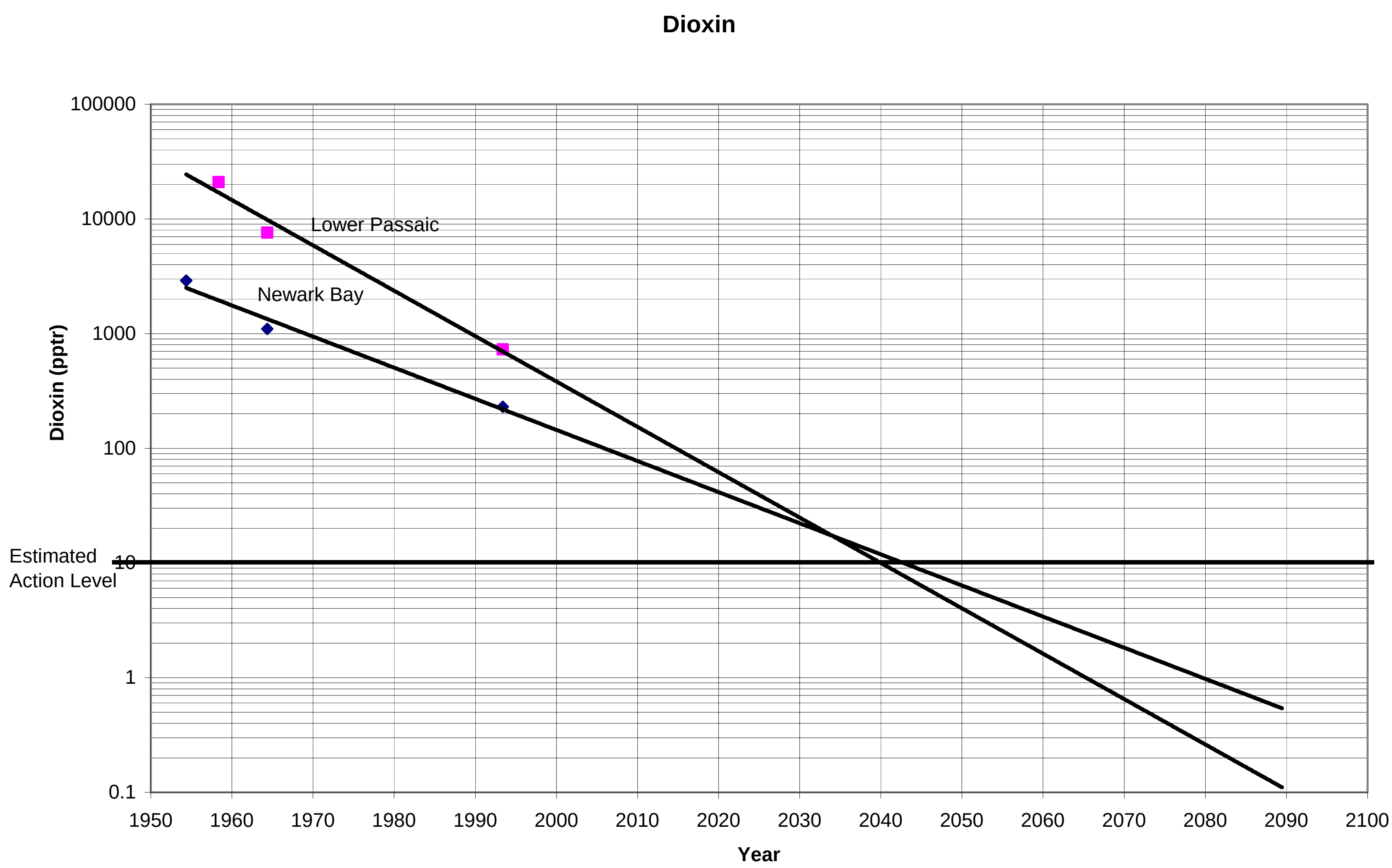
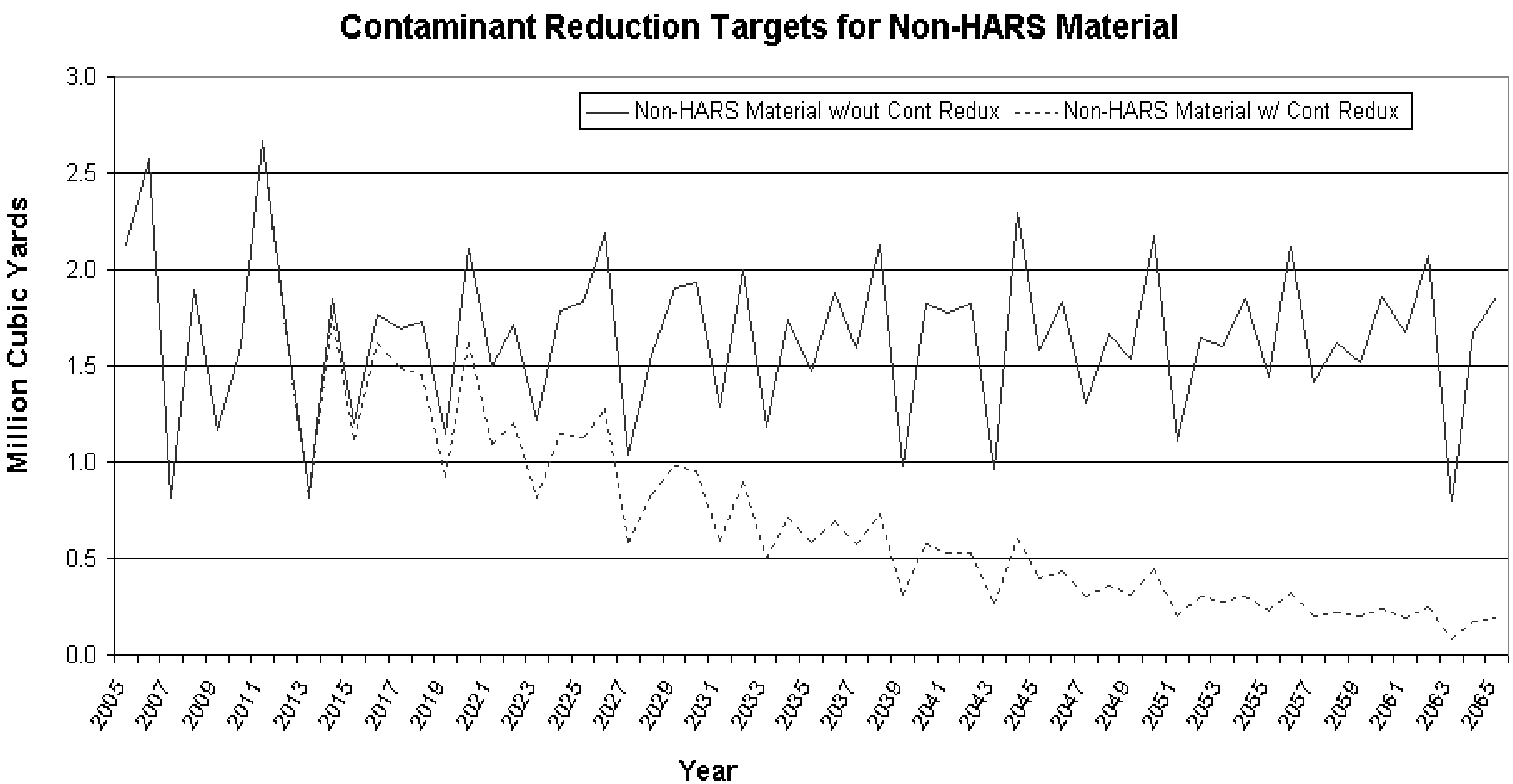


Figure A-2-10. Contaminant Reduction Targets for Non-HARS Material



A-3 BENEFICIAL USES

A.3.1 HISTORIC AREA REMEDIATION SITE (HARS)

On August 27, 1997, the United States Environmental Protection Agency (USEPA) promulgated a final rule that de-designated and closed the NY Bight-Dredged Material Disposal Site (also known as the Mud Dump Site). Simultaneously, USEPA designated an area, known as the Historic Area Remediation Site (HARS) that included the Mud Dump Site, as well as other areas impacted by historic disposal activities (Figure A-3-1). This designation included a plan that the site be managed to reduce the historic impacts to acceptable levels (in accordance with 40 Code of Federal Regulations [CFR] Section 228.11(c)). To accomplish this, the HARS is being remediated with dredged material that meets current Category I standards. Use of the site is restricted to dredged material suitable for use as "Material for Remediation." At least 1-meter of remediation material will be used to cap the entire Priority Remediation Area (PRA) of the HARS. The designation of HARS is unique because its primary purpose is remediation of previously impacted ocean bottom. HARS was designated based upon several different types of data including amphipod toxicity results, dioxin bioaccumulation in worm tissue, and the presence of elevated levels of Polychlorinated biphenyl (PCBs) and 2,3,7,8 Tetrachloro-dibenzo-dioxin (dioxin) in area lobster stocks.

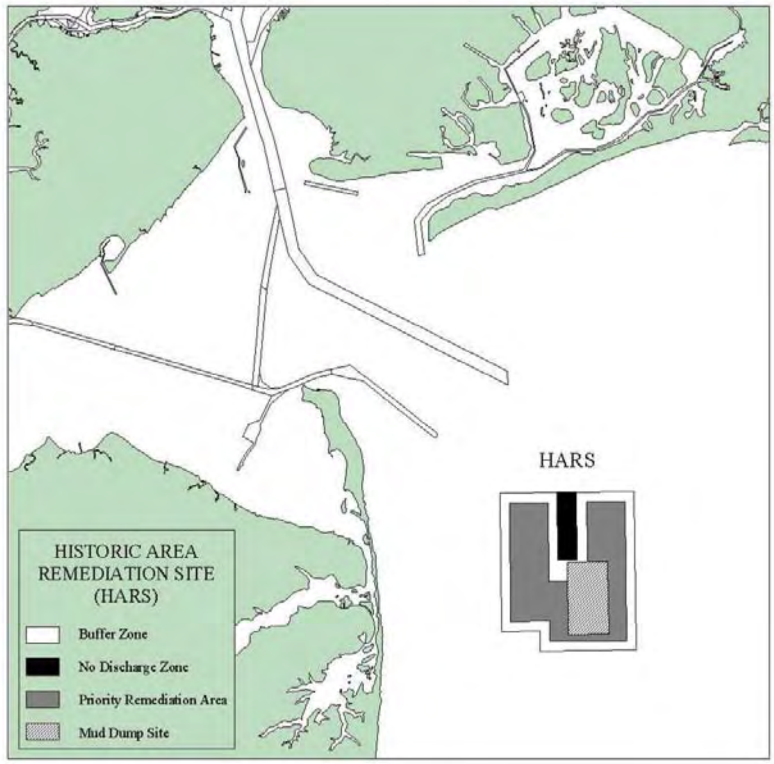


Figure A-3-1. Historic Area Remediation Site

As of March 2005, approximately 22.5 million cubic yards (MCY) of Remediation Material has been placed at the HARS since its designation. Recent monitoring of the HARS (i.e., side scan, bathymetry, benthic recolonization, Remote Ecological Monitoring of the Sea Floor [REMOTS], etc.) indicates that dredged sediment has been accurately placed over areas requiring remediation and that the material placed is stable. Given different technical considerations (e.g., compaction, etc.) that have and will continue to affect the amount of material that needs to be placed to fully remediate the HARS, a precise remediation volume for the HARS cannot be determined. However, it is anticipated that full remediation will require millions of cubic yards in addition to the 22.5 MCY already placed there. Consequently, for purposes of this report, future HARS suitable dredged material is projected to be placed at the HARS (and/or possibly at some other comparable and practicable alternative to the HARS) thru the DMMP planning horizon.

To ensure that the goal of remediation is achieved, the USEPA and the United States Army Corps of Engineers (USACE) executed a Memorandum of Agreement (MOA) in 2000 that committed the two agencies to a process to update the Testing Evaluation Framework (TEF) that is used to make the determination of what material is suitable for remediating the HARS. The process outlined in the MOA included an extensive stakeholder and public involvement process along with conducting a scientific peer review on the USEPA developed draft TEF. The purpose of this review is to ensure that the approach taken by USEPA and USACE to evaluate dredged material for use at the HARS reflects the most recent scientific developments and to ensure that the approach remains consistent with the remedial objectives of the HARS designation.

In response to a court decision related to the process by which the HARS-specific PCB bioaccumulation value was implemented as part of the MOA, USEPA established formal rulemaking to change the HARS criterion for the PCB concentration in worm tissue from 400 parts per billion (ppb) to 113 ppb. The rule was announced in the Federal Register on March 17, 2003, and went into effect on April 16, 2003. The rule also noted that this HARS-specific worm tissue PCB criterion would remain in effect until the USEPA implements a new HARS-specific evaluation process as a result of this current TEF review. Also, since the issuance of the MOA, the scientific peer review of the human health aspects of the TEF has been completed. To complete the actions described in the MOA, the USEPA and the USACE are now jointly performing the following tasks:

(1) Revising the draft ecological aspect of the TEF and then performing a scientific peer review upon it;
(2) Performing necessary studies in response to the critical technical issues raised on the TEF by the peer reviewers on both the human health and ecological aspects of the TEF;
(3) Responding to the scientific peer review comments on both the human health portion of the TEF (which was performed in 2002) and the ecological portion of the TEF; and,
(4) Coordinating the actions above with the Remediation Material Workgroup, a regional stakeholder group formed to advise and assist the USEPA and the USACE in this process.

When these steps are completed, the resultant final proposed TEF would then be the subject of further rulemaking, if necessary. The USEPA and the USACE estimate that it may take up to 5 years to fully complete this process.

A.3.2 HABITAT CREATION, ENHANCEMENT AND RESTORATION

BACKGROUND

The successful use of dredged material for habitat creation, enhancement, and restoration in highly urbanized areas like the Harbor requires the implementation of non-traditional and innovative approaches, as well as commonly used applications such as beach nourishment. Further, as much of the Harbor navigation channel sediment is not suitable for placement at the HARS, it cannot be exposed to the environment over the long term without modification and/or spatial buffering. On the other hand, it is also recognized that leaving contaminated sediments in navigation channels over the long term poses a risk of continued contaminant exposure and uptake by various aquatic organisms.

Both HARS and non-HARS suitable dredged material from the Harbor have many functional restoration applications, such as: habitat restoration (aquatic, wetland, and upland), water quality improvement, shoreline erosion control, water circulation improvement (e.g., filling existing degraded aquatic habitat), and aesthetic improvement. Section 2.3.2 in the DMMP – Implementation Report summarizes these applications, which are discussed in more detail below.

The USACE is the lead agency in the country responsible for the restoration of aquatic, wetland, and upland habitat using dredged sediments. Implementation of the beneficial use of dredged material, carefully considered, can provide opportunities for habitat and water quality restoration in areas where otherwise it might not be possible. Use of both HARS and HARS unsuitable (as appropriate) dredged material offers a unique opportunity to use a resource that has historically been treated as waste, and at the same time restore and improve degraded habitats in estuaries, the ocean, and adjacent uplands. In addition to supporting the DMMP's goals, the beneficial use of dredged material in the Port of NY/NJ (Port) area also supports one of the primary goals of the USEPA's HEP to protect, restore, and enhance habitat in the Harbor (USEPA 1996).

Habitat restoration is best implemented in a collaborative environment. It needs to be pursued within a regional restoration plan framework. Regional restoration plans are classes of site-specific recommendations based on assessments of resource conditions or trends on a large watershed or ecosystem basis. The basic premise of regional restoration planning is that the relative combinations of types of habitats, as well as their individual amounts, should be used as a guide for prioritizing individual restoration efforts. Habitat restoration efforts should target re-establishment of the habitat ratios (to the extent practical in urban areas) present when the area's ecosystem was considered healthy. Any plans to use dredged material for habitat creation, enhancement, or restoration needs to follow an approach that uses good science to evaluate current ecological functional deficiencies and recommends realistic levels and types of estuarine habitat for implementation. Furthermore, a realistic plan needs to consider less obtrusive ways of accomplishing goals (e.g., hydrologic restoration of intertidal wetlands may be preferred over the creation of new wetlands from uplands, which in turn might generally be preferred to conversion of shallow sub-tidal areas to wetlands).

Although current dredging technology can be used to build many types of estuarine habitat, the use of dredged material in estuaries always involves trade-offs in natural resource functional values. For example, creation of nesting islands for birds may eliminate benthic foraging habitat for fish. In some cases this trade off makes good ecological sense for an area, in others it does not. Inclusion of the public and natural resource agencies in the examination of the many habitat trade-offs involved is necessary to ensure support for these projects. The DMMP technical support document, "Beneficial Uses of Dredged Material for Habitat Creation, Enhancement, and Restoration in Harbor", hereafter referred to as the Beneficial Use report, describes in more detail beneficial use applications in the Harbor (USACE 2001).

DESCRIPTION

All of the beneficial uses of dredged material for habitat creation, enhancement, and restoration listed below were identified in the NYD's report Beneficial Uses of Dredged Material for Habitat Creation, Enhancement, and Restoration in NY/NJ Harbor (USACE, 2001). What follows is a brief description of each, along with information regarding their application or potential application to the NY/NJ Harbor (Harbor). Those that have been implemented or have support or interest by individual sponsors are included for consideration in the DMMP.

Wetland Restoration

In highly urbanized areas such as the NY/NJ area where thousands of acres of wetland have been lost to filling and erosion or degraded by pollution and colonization by invasive plants, it is incumbent upon the responsible agencies to examine the feasibility of beneficially using dredged material as a substrate for wetland enhancement and restoration. Dredged material applied to wetland creation, enhancement, or restoration has the potential to provide better stabilization of eroding shorelines, improved water quality in inter-pier and other enclosed areas, and improved habitat and aesthetics.

A preliminary comparison of acres of lost tidal wetland in the NY metropolitan area with potential areas for wetland creation, enhancement and restoration indicates that there is a substantial amount of inter-tidal and sub-tidal acreage available for this option. As a general rule, habitat creation, enhancement and restoration should be accomplished where similar habitat formerly existed, and/or adjacent to existing similar habitat. However, in urbanized regions, this is often very difficult and innovations need to be promoted.

The wetland creation/enhancement/restoration beneficial use application (and any other application that involves converting intertidal or shallow sub-tidal habitat to another type of habitat) remains a point of controversy in the regulatory community because such action involves a habitat trade-off. Any significant implementation of this option would have to demonstrate that the functional value of the habitat created is greater than what is lost. However, the effort to build a consensus regarding habitat trade-off issues is worthwhile since implementation of this beneficial use application may represent a significant contribution in aiding dredged material management and helping to restore lost habitat in the highly urbanized NY area.

Intertidal Marsh Creation, Enhancement, and Restoration

Intertidal marshes typically occur in low-energy coastal or riverine environments and span the entire estuarine salinity gradient. Ecological functions attributed to intertidal wetlands include shoreline stabilization, storage of floodwaters, maintenance of surface water and groundwater quality, and the provision of nursery habitat for a myriad of estuarine-dependent finfish and shellfish species.

The restoration and creation of intertidal marshes has received much attention in coastal engineering. This is likely due to the considerable acreage of tidal marsh that has been lost along U.S. coastlines, recent recognition of the important functions provided by intertidal marshes, and the relative ease in which tidal marsh vegetation can be propagated on dredged material. Many potential opportunities exist to create, restore or enhance intertidal marshes in Harbor. However, issues associated with habitat trade-offs are conflicting with large-scale tidal marsh development projects Harbor-wide (NJ Department of Environmental Protection [NJDEP] 1997). Shallow estuarine habitats are apparently functioning well in many areas of the Harbor, and supporting diverse and abundant benthic invertebrate and finfish populations.

Creation of large parcels of Spartina marsh upon areas filled with dredged material will displace existing subtidal habitat. The new intertidal habitat may benefit some shallow water species already present; however, many species in the Harbor do not depend on intertidal wetlands, and will likely be displaced. Other ecological functions provided by intertidal marshes, such as shoreline stabilization, surface water and ground water filtration, and provision of nesting/foraging habitat for wildlife should also be considered in an analysis of habitat trade-offs. Proposed intertidal marsh creation projects in the Harbor will need to be evaluated individually, with consideration of the anticipated benefits of the wetland habitat to be created relative to the existing ecological functions of the open-water habitat to be replaced.

Mudflat Creation, Enhancement, and Restoration

Like wetlands, inter-tidal mudflats have been lost in the Harbor area since early Colonial times. Mudflats often contain highly productive algae communities, benthic communities, and are bird and fish feeding areas. Some mudflats are valuable commercially (e.g., bait worms, soft clams, mussels).

Mudflats are usually associated with adjacent wetlands, either contiguously or intermixed, but at a lower elevation, so they are treated in generally the same way as wetlands within the DMMP. Mudflat restoration has similar issues and concerns as wetland restoration.

Submerged Aquatic Vegetation (SAV) Bed Creation, Enhancement, and Restoration

The major submerged aquatic vegetation (SAV) species in the Harbor area is *Zostera marina* (eelgrass). This species has suffered devastating loses in this century, the causes of which are still unclear. Disease, reduction in water quality (particularly nitrogen eutrophication), changes in bottom topography, increased resuspension of sediments and decreased light penetration into the water column have all been implicated. It seems likely that a combination of these factors is to blame. Attempts to reestablish eelgrass beds in the Harbor area have so far met with failure. Thus, the District does not consider the investigation of the use of dredged material as a substrate for establishing eelgrass beds a wise investment at this time. Future studies and potential improvement in water quality may allow a reconsideration of this position. Other attempts, outside the DMMP, that do not rely solely on using dredged material to restore eelgrass beds will likely continue, and progress will be carefully monitored to see if dredged material may play a role later on.

Unvegetated Estuarine Habitat Creation, Enhancement, and Restoration

Vegetated habitats such as wetlands and SAV are often the focus of estuarine habitat restoration projects. However, shallow *unvegetated* estuarine habitats also constitute a significant resource and provide spawning, refuge and feeding habitat for a variety of fish and decapod crustaceans (USACE 2001). Among many other sites around the world, creation of shallow, unvegetated estuarine habitat was attempted on the west coast of the U.S. by creating "in-bay terraces". Both clean and contaminated sediments have been used in the construction of in-bay terraces. There currently exists substantial opportunities to restore, create or enhance unvegetated shallow water habitat in the Harbor, particularly where existing surficial sediments are a source of contaminant toxicity and/or bioaccumulation to the existing benthic community.

Oyster Reef Creation, Enhancement, and Restoration

Prior to the urbanization and industrialization of the Harbor, oysters were ubiquitous in the Harbor Estuary and supported a thriving commercial industry. However, rapid population growth and increased demand eventually depleted many of the natural oyster beds. Extensive coastline development and the introduction of pollutants and higher solids loading further depleted oyster populations. Today, some naturally occurring populations still exist and the commercial industry survives by artificially "seeding" some areas of the harbor. But in general, oyster populations have suffered a dramatic decrease over the last few hundred years.

Although it is unlikely that restoration efforts could ever restore oyster populations to historical levels, improved water quality over the last decade has sparked interest in investigating the feasibility of oyster reef restoration. In 2002 the NY/NJ Baykeeper (American Littoral Society), in partnership with the National Oceanic and Atmospheric Administration (NOAA) and the Marine Academy of Science and Technology, conducted oyster reef restoration experiments at Liberty Flats in Harbor and Keyport Harbor in Raritan Bay (NJDEP Division of Fish and Wildlife [NJDEP/DFW] 2002). The general conclusion of their study was that both reefs exhibited the capability to support planted oysters. Although within the first year no oyster spat was observed on either of the artificial shell reefs they constructed, the report indicated that spat development would likely take several years. Other organizations are also showing interest in this type restoration, as evidenced by the efforts of the Raritan Bay Baymen's Association attempts to restart an oyster fishery, also in Raritan Bay.

Dredged material can be used to create the core of artificial oyster reefs. This "sediment" core replaces many layers of shells, which would otherwise be unavailable for use as habitat or structure by organisms that colonize only the surface of the reef. As such, this practice conserves the short supply of available shells and limits their use to capping substrate only. Harbor maintenance projects in the proximity of potential restoration sites could provide the material for the construction of the reef cores. However, non-HARS material would not be considered for this purpose. While the amount of appropriate dredged material for this application would be relatively small, the ecological benefits could be quite substantial.

Before the NYD can engage in or even support oyster restoration activities in the Harbor, the potential for restored reefs becoming an attractive nuisance needs to be addressed. This issue arises from restoring oyster populations in areas where water quality is still too poor to allow harvesting. The problem of inadvertently creating an attractive nuisance is discussed in detail in the oyster restoration chapter of the Beneficial Use report (USACE 2001).

Lobster Reef Creation, Enhancement, and Restoration

Dredged bedrock can be used to create artificial reefs that provide an environment suitable for lobsters. Lobsters are shelter-oriented organisms that utilize structure as habitat, especially the type of habitat provided by a rock reef. However, adult and juvenile lobsters exhibit different habitat needs with respect to body size and compatible spatial requirements. For example, because early life stage lobsters and smaller juveniles are especially susceptible to predation, they require protective spaces much smaller than those needed by adults. This difference in habitat preference presents a challenge in constructing lobster reefs that are protective of all its life stages. Optimal space size for juveniles is common within cobble types of structures. However, reefs constructed of the relatively large fragments of blasted bedrock from dredging operations may be deficient in the smaller spaces preferred by post-larval and juvenile lobsters. Therefore it is critical that cobble sized material be incorporated into the reef structure to accommodate these critical life stages.

As part of the District's pursuit to use dredged material beneficially, blasted granite from the Kill Van Kull portion of the NY/NJ Harbor Deepening Project (HDP) was supplied to the Atlantic Beach, Sandy Hook, and Shark River artificial reefs to supplement marine habitat creation programs for lobsters and other marine fauna (see also Fish Reef below). Located about 3 nautical miles south of Atlantic Beach, Long Island, the Atlantic Beach artificial reef received almost 500,000 cubic yards (CY) of rock between 1999 and 2001. During that same period, about 300,000 CY of rock was place at Sandy Hook reef 1.4 nautical miles off Sea Bright, NJ. The Shark River reef, located about 16 miles offshore of Shark River inlet, received over 2 million cubic yards (MCY) of rock to create 4 under-sea ridges, ranging from 40 to 60 feet high, and having a combined length of over 2 miles.

Shellfish Bed Creation, Enhancement, and Restoration

Historically, shellfish have been abundant throughout the Harbor Estuary and in many areas shellfish beds continue to flourish. In terms of biodiversity, they are an integral part of a healthy estuarine ecosystem in their contribution to improving water quality and as an essential food source for other marine organisms.

The Harbor Estuary has lost some of its capacity to sustain shellfish beds as a result of centuries of coastal development. Hardened shorelines, increased solids and nutrient loads, loss of wetlands and SAV, and pollutant contamination are thought to have created conditions unfavorable for shellfish recruitment and colonization in some areas of the Harbor. Using dredged material beneficially to restore impacted areas to more favorable conditions for shellfish propagation offers the opportunity to improve the overall health of shellfish community, thereby increasing the health and functional value of the Estuary.

Two clam species common to the Harbor Estuary are hard clams or Northern quahogs (*Mercenaria mercenaria*) and softshell clams (*Mya arenaria*). Since northern quahogs are currently abundant, efforts to increase stocks would not be a priority. In recent years populations of softshell clams have declined for reasons that are not well understood. Softshell clams are sensitive to the sediment composition of the bed, preferring sandy, low-silt bottom areas. The use of clean dredged material for the purposes of promoting their propagation will require grading of the material to produce the appropriate grain size composition. However, attempts to create large-scale soft clam beds using dredged material would be better served if the cause of their decline was determined first or until small-scale projects demonstrate likely success. In 1999, the National Marine Fisheries Service and NYD staff initiated a plan for the placement of clean sand from the Shrewsbury River maintenance dredging project (Sandy Hook, NJ) to create several soft clam beds in the Shrewsbury River Basin. However, implementation of the plan has been postponed pending availability of funding.

There is one potential drawback to taking actions intended to expand the shellfish community. Many species of shellfish are pollutant tolerant and can bioaccumulate contaminants and harmful bacteria from sources such as sewage discharges. While creating shellfish beds in areas with pollutants may be viable ecologically, it poses a potential environmental risk to the public. This risk entails the potential for the area becoming an attractive nuisance, for example, harvesting of shellfish from a restricted area because they are abundant and hence easy to gather. Therefore, the development of any plans to restore shellfish beds must evaluate the potential for increasing human health risk and determine ways to reduce risk.

Fish Reef Creation, Enhancement, and Restoration

The coastal waters of NY and NJ are large expanses of relatively flat, almost featureless sand and mud bottoms with a limited diversity of habitat for marine organisms to take up residence. By constructing artificial reefs, we can increase and provide additional diverse habitat. Results from NJDEP/DFW reef colonization studies (NJDEP/DFW 2004) have indicated that the reefs have hundreds of times more marine life than areas of the sea floor with no reefs. The first artificial reefs occurring along our coasts were not planned but were accidental sinkings of colonial sailing vessels. Fisherman quickly realized that the wrecks provided hearty fishing grounds. The first artificial reef in NJ was construction in the mid 1930's off of Cape May. Other reefs were constructed several years later off of Atlantic City and then Manasquan. Now, as then, a variety of materials have been used for reef construction.

Bedrock is known to make excellent material for artificial reefs. Dredged rock has been successfully used for reef creation since the late 1980s. As mentioned in the lobster reef restoration section, rock blasted from the Kill van Kull portion of the HDP has been placed at a number of artificial reef sites to expand habitat for an abundance of marine life. It is anticipated that the use of dredged rock for this purpose will continue as the HDP proceeds. However, while rocky material is clearly suitable for artificial reefs, it is unclear whether stable berms made of fine material could also provide habitat value. Pending further study, the NYD has no near-term plans for using fine dredged material to construct berm reefs.

Since 1984 the NJDEP/DFW has constructed many artificial reefs as part of their Ocean Reef Building Program. According to their 2004 edition of NJ Reef News (NJDEP/DFW 2004), the reef patches (made primarily of rock) now span along much of the NJ coastline and are home to more than 150 species of fish and other marine life. In addition to providing marine habitat, the reefs also serve as popular sites for recreational fishing and diving. Artificial reef patches have also been constructed off the shores of Long Island, initiated by a number of government agencies and non-government environmental organizations that share the District's interest in using dredged material beneficially.

Bird Habitat Creation, Enhancement and Restoration

Several potential applications for bird habitat enhancement with dredged material have been identified in the NY/NJ area. These are the creation of upland habitat at Floyd Bennett Field in Brooklyn, mudflat/marsh restoration at South Brother Island (East River) for colonial water bird feeding habitat, and nesting/feeding applications at Prall's Island (Arthur Kill) and Shooters Island (Kill van Kull). The District is also considering the deposition of dredged material on Hoffman-Swinburne Islands to create upland bird habitat for species such as least terns. Permission from the National Park Service is required for some of these projects (e.g., Hoffman-Swinburne Islands and Floyd Bennett Field). All these potential applications are described in more detail in the bird habitat restoration chapter of the Beneficial Use report (USACE 2001).

Filling of Dead-end Basins

Although difficult to quantify, sediments in some poorly flushed urban waterways may be contributing significantly to bioaccumulation of contaminants in benthos and fish. Additionally, it is well documented that many of these basins (particularly in the upper ends) are hypoxic/anoxic. Many parts of greater Harbor, particularly the Brooklyn waterfront, parts of Jamaica Bay and industrialized parts of NJ, suffer from these conditions, which are caused primarily by shoreline geometry that does not promote regular mixing and flushing of overlying waters.

Some of these waterways, because of their location in the estuary, their shoreline geometry, and proximity to sources of contaminants (such as street runoff, stormwater outfalls and combined sewer outfalls (CSO), which are often located at the headwaters of these tributaries), can be considered essentially "unrestorable" without significant changes to morphology. It is recognized by many that this is a controversial point. Further, some urban waterways, although grossly polluted, serve as *de facto* settling basins for organics and toxins, which might otherwise migrate out into the outer waterways and affect more valuable areas. This must be considered in selecting sites for filling. In some cases, stormwater outfalls would need to be extended or rerouted.

Examples of dead-end basins that have sediment contamination problems are Newtown Creek, the Gowanus Canal, and Bergen and Thurston basins. While these basins are listed as potential restoration sites under the Hudson-Raritan Estuary Ecosystem Restoration Project (HRE), development of restoration plans have not yet moved forward on Newtown Creek and Bergen and Thurston basins due to funding limitations. However, for Gowanus Canal – an HRE spin-off site – the Gowanus Bay and Canal Ecosystem Restoration Feasibility Study is now underway and making progress toward developing restoration alternatives. Investigations and data gap analyses that have been conducted for the Feasibility Study include bathymetry delineation, upland sites assessment, wetland creation opportunities, aquatic and benthic biota characterization, terrestrial flora and fauna characterization, and a sediment physiochemical evaluation.

Creation of Treatment Wetlands

This involves creating wetlands with dredged material in inter-pier or similar moderately flushed areas to serve primarily as a natural water purification system. These might be particularly useful in close proximity to CSOs or other high organic load outfalls, especially where other clean-up or abatement efforts are planned or underway. Wetlands also trap sediments under certain conditions and can potentially be utilized to reduce sediment flux to the estuary, along with sediment-associated contaminants. Possible locations are the Brooklyn waterfront inter-pier areas, Bowery Bay (Queens) and Thurston and Bergen basins (Jamaica Bay).

This application requires engineering evaluation to determine critical minimum sizes for the wetland to be of value in filtering contaminants. Further, although the science of utilizing constructed wetlands for water treatment is well developed for controlled freshwater situations (such as where the wetland treatment is associated with a sewage treatment facility), little work has been done with the use of tidal areas for this application. Implementation of this application would require an initial project action to determine its long-term value and feasibility in Harbor (USACE 2001).

Habitat Restoration of Aquatic Sites

Aquatic sites refer to a man-made depression in the bottom of a waterway, typically dredged to acquire construction grade sand. The Harbor contains several of these man-made depressions, the largest of which are borrow pits located in Jamaica and Lower bays (Figure A-3-2). Some aquatic sites have remained viable habitat for fish and other estuarine organisms. Several have become traps for fine-grained sediments that contain contaminants. In extreme cases, aquatic sites can exhibit permanent and/or seasonal hypoxia/anoxic events and subsequent dysfunctional or diminished benthic communities.

The Beneficial Use report (USACE 2001) estimated that approximately 85 MCY of capacity, potentially exists for dredged material in the aquatic sites located in Figure A-3-2, should they be shown thru further studies to be degraded and could benefit from the restoration of natural bathymetry using dredged material. Further, impacted areas within the estuary may also benefit from being capped with suitable dredged material to restore healthy benthic conditions as well as to contain contaminants in the sediments. Given the potential volume of material that could be beneficially reused through the restoration of habitat in selected aquatic sites, and the cost-effectiveness of the operation (potentially equivalent to the HARS), this option is may be valid to pursue in further detail. The CAC aquatic site in the Lower Bay and the Jamaica Bay aquatic sites were studied for several physical, chemical and biological aspects from April 1997 to January 1998 (USACE Waterways Experiment Station [WES] draft 1998). Also, benthic data from theses aquatic sites (as part of the overall harbor benthic survey) were collected and analyzed from October 1994 to June 1995 (NOAA, 1995-Oct 2000 report is online from NOAA). However, pending the results of the Jamaica Bay Borrow Pit Evaluation effort in partnership with NYSDEC, the NYD has no plans to evaluate further the benthic conditions of Lower Bay Pits or the potential to use dredged material as a means to restore them.

In general, the surveys were intended to serve as a preliminary assessment of potential use and value to benthic and fish communities. The baseline ecological survey completed for Norton Basin and Little Bay is thorough and comprehensive. Depending on time and location, data collected included sediment texture and percent organics, benthic grabs, underwater photography (sediment profiling imagery), fish hydroacoustics, dissolved oxygen, temperature, salinity and fish trawls. The results suggest that the some areas of Jamaica Bay are poor environments for marine life. There are many factors that contribute to this condition. Some of these are the accumulation of oxygen demanding sediments, geometry (relatively deep holes with steep sides in a naturally shallow estuary) and the lack of sufficient hydrodynamic flux resulting in high residence times (particularly in Little Bay).

Hydrodynamic and water quality monitoring of parts of Jamaica Bay was undertaken as part of the USACE/New York City Department of Environmental Protection (NYCDEP) Jamaica Bay Ecosystem Restoration Project. Results show that recontouring some of the channels and aquatic sites could improve water quality in the bay. Consequently, the filling of aquatic sites such as Grassy Bay could play an important part in Jamaica Bay restoration. Conflicting policy issues (as well as several technical issues relating to existing habitat use of Grassy Bay) need to be addressed before this controversial issue can be resolved. It is important to point out that most of the water quality studies done thus far in Jamaica Bay have concentrated on the application of improvements in general circulation and meeting state water quality use standards. This is quite different from the goal of habitat restoration, which might have much stricter goals (e.g., prevention of summer time dissolved oxygen (DO) levels falling below 3 milligrams per liter (mg/l) for extended periods).

In October 2004, the NYSDEC and the NYD completed an evaluation of the habitat function of Norton Basin and Little Bay. In their statement of findings, the Interagency Technical Committee (made up of the USACE, NYSDEC, NOAA, United States Fish and Wildlife Service (USFWS), National Park Service, and USEPA) concluded that the Little Bay below the surface layer was severely impaired due to an apparent permanent state of anoxia or severe hypoxia, and Norton Basin was seasonally impaired due to significant hypoxia. Lack of circulation and poor sediment quality were found to contribute to these conditions, resulting in the virtual absence of fish and invertebrate life in Little Bay below the surface layer, and low benthic abundance and species richness in Norton Basin, although fish do occur seasonally in Norton Basin. As a result of these findings, the Interagency Technical Committee has recommended that the NYSDEC and the NYD proceed with hydrodynamic and water quality modeling to evaluate the potential for net environmental benefits by increasing water exchange in these areas by recontouring them to various depths, and/or by increasing water flow through a restored channel constructed through the Edgemere peninsula. For the entire statement of findings see:

http://www.dec.state.ny.us/website/reg2/jbborrow/findings.html.

A preliminary estimate of the total volume of dredged material that could fill all Jamaica Bay degraded aquatic sites is approximately 40 MCY. This figure assumes that each area is filled to ambient adjacent bottom. The environmental benefits of helping to restore Jamaica and Lower Bays, although un-quantified at this point in time, are potentially substantial and investigations to evaluate these benefits should be pursued.

POTENTIAL IMPACTS

The approaches discussed above for habitat creation, enhancement, and restoration assume the use of clean sediments, or contaminated sediments isolated from the environment by capping with clean sediments, for all applications except reef construction (which assumes only rock or glacial till to be used) and oyster, other shellfish, and SAV habitat enhancement and restoration (which assumes only all clean sediments will be used).

Wetland Creation, Enhancement and Restoration

Potential Beneficial Impacts:

- Replace/enhance lost wetland
- Erosion control
- Make use of current bio-technology
- Eliminate/reduce use of more structurally dependent/less environmentally friendly erosion control technologies
- Enhance most other Clean Water Act wetland values

Potential Adverse Impacts:

- Loss of existing habitat under the new wetland footprint (with some exceptions)
- Potential physical and chemical effects of contaminants leaching from the sediments, i.e., smothering and bioaccumulation and sublethal effects (can be controlled)

- Cost
- Cultural resources

Intertidal Marsh Creation, Enhancement and Restoration
Essentially the same potential benefits and impacts as wetlands.

Mudflat Creation, Enhancement and Restoration
Essentially the same potential benefits and impacts as wetlands.

(SAV Bed Creation, Enhancement and Restoration
Essentially the same potential benefits and impacts as wetlands.

Unvegetated Estuarine Habitat Creation, Enhancement and Restoration
Potential Beneficial Impacts:

- Provides spawning, refuge and feeding habitat.
- Eliminates/reduces toxicity, sublethal effects and/or bioaccumulation induced from existing contaminated sediments
- Eliminates/reduces contaminated sediments as a source of contaminants to other parts of the estuary

Potential Adverse Impacts:

- Loss of existing habitat under new footprint
- Loss of existing habitat for depth-dependent species (if depth change is relatively large)
- Recontamination of cap by pore-water diffusion of buried contaminants (can be controlled)
- Cultural resources

Oyster Reef Habitat Creation, Enhancement and Restoration
Potential Beneficial Impacts:

- Contribute to the resurgence of the local oyster population and oyster industry
- Support diverse and abundant communities of other marine fauna.
- Improves water quality

Potential Adverse Impacts:

- Loss of existing habitat under footprint of reef
- May indirectly contribute to the attractive nuisance problem of illegal harvesting
- Competition with other uses of the estuary (which can be reduced or eliminated through good planning)
- Cultural resources

Lobster Reef Habitat Creation, Enhancement and Restoration
Potential Beneficial Impacts:

- Contributes to increasing the local lobster population.
- Increase local marine species habitat and populations that utilize artificial reefs.
- Expands recreational fishing grounds and diving opportunities.

Potential Adverse Impacts:

- Loss of existing habitat under footprint of reef
- Cultural resources

Shellfish Bed Habitat Creation, Enhancement and Restoration
Similar potential benefits and impacts as oyster habitat.

Fish Reef Creation, Enhancement and Restoration
Potential Beneficial Impacts:

- Increase local marine species habitat and populations that utilize artificial reefs (encrusting organisms, shellfish, fish)
- Create/expand recreational fishing grounds and diving opportunities
- Provide fishing grounds for commercial fisherman

Potential Adverse Impacts:

- The habitat trade-off issue; depending on the target species, location, and many other factors, the concentration of fish resources may result in deleterious increased harvest (presumably offset by the fact that only state approved reef enhancement sites would be used)
- Cultural resources

<u>Bird Habitat Creation, Enhancement and Restoration</u>
Essentially the same potential impacts as wetlands.

<u>Filling of Dead-end Basins</u>
Potential Beneficial Impacts:

- Removal of contaminated sediments from the estuary and reduction of contaminant uptake
- Replacement of existing bottom sediments with cleaner sediments
- Improvement of water circulation

Potential Adverse Impacts:

- Loss of existing habitat (which must be low function value)
- Temporary release of contaminants at the dredging and placement site, which should also be short term and of very limited spatial extent
- Long-term maintenance of the disposal site
- Cost
- Cultural resources

<u>Creation of Treatment Wetlands</u>
Potential impacts essentially similar to creating habitat wetlands.

<u>Habitat Restoration of Aquatic Sites</u>
Potential Beneficial Impacts:

- Restoration of historic natural bottom topography (to the extent possible)
- Improved water circulation and water quality
- Improved benthic and fish habitat
- Improved recreational opportunities
- Creation of synergistic environmental improvement opportunities (complementing CSO abatement and wetland/upland restoration)
- Elimination of contaminant uptake from areas of the degraded aquatic habitat that are affected
- Elimination of seasonal hypoxia/anoxia generated by oxygen demanding sediments accumulating at the bottom of these degraded aquatic sites and lack of water circulation at depth

Potential Adverse Impacts:

- Loss of existing habitat
- Temporary resuspension of sediments at dredging site
- Temporary loss of some contaminants at the placement site
- Small loss over time of dissolved contaminants in pore water squeezed out of consolidating sediments in the degraded aquatic site

IMPLEMENTATION

1. Wetland Habitat Creation, Enhancement and Restoration
   - Step 1 – Survey the Harbor area for potential sites
   - Step 2 – Identify potential volumes, engineering requirements, costs and all other pertinent requirements for each site to be implemented
   - Step 3 – Screen and prioritize sites
   - Step 4 – Implement selected projects, including acquisition of all permits, site specific engineering design and construction costs, etc
   - Step 5 – Analyze the results of the initial projects, and use those results and conclusions to finalize sites for further implementation, final volumes, identify precise source of sediments, etc
   - Step 6 – Implement remaining projects as appropriate, including acquisition of all necessary permits

2. Intertidal March Habitat Creation, Enhancement and Restoration

   Similar implementation process to wetlands.

3. Mudflat Habitat Creation, Enhancement and Restoration

   Similar implementation process to wetlands.

4. SAV Bed Habitat Creation, Enhancement and Restoration

   No implementation steps planned at this time.

5. Unvegetated Estuarine Habitat Creation, Enhancement and Restoration

   No implementation steps planned at this time.

6. Oyster Reef Habitat Creation, Enhancement and Restoration

   Similar implementation process to wetlands.

7. Lobster Reef Habitat Creation, Enhancement and Restoration

   Already part of on-going projects. Continued coordination with the States needed. Identify additional sites and proceed as with step 3 of wetlands.

8. Shellfish Bed Habitat Creation, Enhancement and Restoration

   Similar implementation process to wetlands.

9. Fish Reef Creation, Enhancement, and Restoration

   Already part of on-going projects. Continued coordination with the States needed. Identify additional sites and proceed as with step 3 of wetlands.

10. Bird Habitat Creation, Enhancement and Restoration.
    - Step 1 – Analyze results of previous surveys. Proceed as with wetlands, starting with Step 3.

11. Filling of Dead-end Basins.

    Similar process to wetlands, except that, at already identified sites (e.g., Newtown Creek and Gowanus Canal), proceed straight to implementation of demonstration projects, after initial data collection and analysis, if possible.

12. Creation of Treatment Wetlands

    Similar implementation process to wetlands.

13. Habitat Restoration of Aquatic Sites
    - Step 1 – Study each aquatic site to determine level of habitat use
    - Step 2 – Monitor placement of dredged material to ensure no water quality impacts
    - Step 3 – Conduct post-construction monitoring to determine level of restoration
    - Step 4 – Apply knowledge gained from each project on subsequent projects until all the aquatic sites are filled that are amenable to restoration

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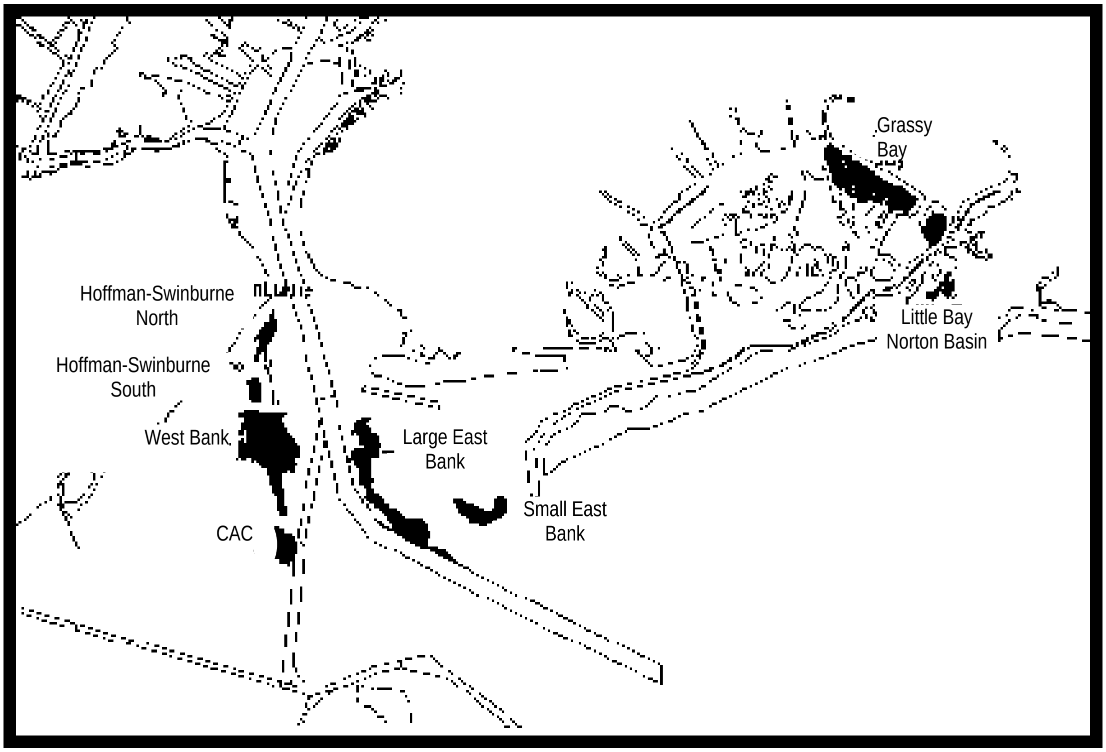

Figure A-3-2. Potential Aquatic Sites for Restoration of Shallow Water Habitat

A.3.3 LAND REMEDIATION

DESCRIPTION

This option combines the beneficial use of dredged material, primarily processed non-HARS suitable material, with the environmental and economic restoration of degraded lands. Degraded lands include, but are not limited to, active and inactive landfills, brownfields (former industrial sites), quarry sites, and abandoned coal mines. All of these sites have disturbed environments and limited natural resource value in their present condition. Many also generate substantial leachate and surface runoff that contaminate surrounding soils, aquifers, and surface water.

Landfills and brownfields offer unique opportunities for the beneficial use of stabilized dredged material, because these sites often have environmental safeguards incorporated into the site's design or remedial strategy, such as liners and leachate collection systems in the case of landfills and groundwater containment and monitoring on brownfields sites. These safeguards, together with institutional controls are required regardless of whether dredged material is beneficially used on these sites. Capping with dredged material has proven to be an economical and safe component of degraded site remediation programs. After being properly restored, many of these sites, especially in urban areas, can be developed for industrial, commercial, or recreational use. In this way, environmental restoration could be linked with economic development and community revitalization. Alternatively, a restored site can be used for wildlife habitat (Section A.3.2).

Dredged material used for land remediation under properly controlled conditions should not result in additional deterioration of the environment. The soils and any waste materials present on these sites are generally much more contaminated than the dredged material that would be used for capping. For example, most dredged material would likely meet the NJDEP Nonresidential Soil Cleanup Criteria guidance levels for most contaminants (NJDEP 1997). Once placement is completed, the dredged material is usually capped with clean material, further containing and isolating the contaminants from the ecosystem. A site-monitoring program during and after placement of dredged material would ensure that the remediation is successful and poses no significant risk to the environment or public health. The use of dredged material would be one component, albeit a key one, in the complete restoration of a site. For example, an inactive solid-waste landfill may also require a landfill-gas venting system and a leachate-collection system as part of its closure/remediation plan.

Prior to use as grading/closure material at these types of sites, dredged material is typically amended or processed with additives, or binding agents, to reduce the water content, improve structural/geotechnical properties, and better immobilize the contaminants within the material. Binding agents that have been shown to be effective include Portland cement, fly ash, coal ash, lime, and kiln dust. Proprietary additives may also be used. After blending, the material is allowed to "set" into a hardened, granular soil-like condition, with lower water content and improved structural/geotechnical properties (e.g., shear strength, compactability). The right types and proportions of admixtures are tailored to meet the engineering specifications and standards for a generally accepted and similarly manufactured product. Beneficial uses for a soil-like product include structural or nonstructural fill, grading material, daily/intermediate landfill cover, and final landfill cover. Being predominately fine-grained, dredged material has the low hydraulic conductivity (typically 10^{-6} centimeter per second [cm/sec] or less) desirable for cover/capping material (subsequent to satisfying quality control and quality acceptance requirements to ensure acceptable uniform quality). In the NY/NJ region, earthen material used for such purposes typically sells for $5–$12/ton as delivered.

The process of blending in binding agents is referred to as solidification/stabilization (S/S). S/S is considered a decontamination technology (see Section A-4, and Section 2.4 in the DMMP – Implementation Report) because it enhances the immobilization of contaminants in the material. Contaminants generally become more tightly bound to the matrix, preventing significant levels from leaching into aquifers and water bodies or otherwise becoming biologically available. The high alkalinity found in commonly used binders further aids in reducing the leaching potential of most toxic metals. Material that has undergone S/S is sometimes referred to as "stabilized" material.

Two other ways to process dredged material to make it suitable for land remediation are dewatering and manufactured soil production. Previous studies (Malcolm Pirnie 1982, 1983 and 1987) have indicated that dewatered dredged material without using any admixtures should generally have structural/geotechnical properties suitable for landfill cover and similar applications.

Dewatering could be accomplished by passive dewatering (e.g., spreading it on open land to dry) or mechanical dewatering (*e.g.,* centrifuge, belt-filter press). However, passive dewatering is not considered practical for large volumes in this region due to the lack of large open tracts of land along the waterfront. Mechanical dewatering is a possibility, but may be as costly as S/S without matching the latter's benefits. S/S does a better job in improving structural/geotechnical properties further immobilizing any contaminants, as well as reducing the water content. More contaminated sediments may need to be decontaminated prior to processing into manufactured soil (see Section A-4, and Section 2.4 in the DMMP – Implementation Report).

For remediation sites located in remote or restricted areas, dredged material could be used to make a manufactured topsoil to support a vegetative cover. This may be an economical alternative for those sites that need to import topsoil cover. In the NY/NJ region, topsoil from commercial suppliers typically sells for $15-20/ton as delivered. To make fertile topsoil in this process, dredged material is blended with a cellulose waste (e.g., yard waste, compost, wood chips) and biosolids (*e.g.,* sewage sludge, cow manure). A greater proportion of these organic admixtures would be used than that of binders in S/S, resulting in less dredged material needed to make a given volume of end product. These organic admixtures would also enhance immobilization of the contaminants and, over time, promote microbial degradation of many organic contaminants. (Fertile soils harbor immense populations of microorganisms.) The topsoil-production process can also be combined with phytoremediation (growing select plant species to stabilize or clean up contaminants). For these reasons, manufactured-topsoil production is considered a decontamination technology (see Section A-4, and Section 2.4 in the DMMP – Implementation Report). Using the end product as a topsoil cover would be limited to remote or restricted sites, such as abandoned coal mines in rural areas, to minimize any potential public exposure to contaminants present in the material.

The NYD has prepared a user's manual entitled "Beneficial Use of Dredged Material – A Manual for Using Dredged Material for Remediating Contaminated Upland Sites" (LMS 2003). The purpose of this manual is to educate and encourage local communities and private enterprises in this type of beneficial use. In addition, the USACE Waterways Experiment Station (WES) has prepared several technical documents on the subject over the past decade. These include a general guidance manual on various beneficial uses of dredged material, including land remediation (USACE 1987); a report on the feasibility of passive dewatering in the NY/NJ region (USACE 1987); and a technical manual for using dredged material for landfill cover in the NY/NJ region (WES draft 1998a).

The NJDOT/OMR is currently working on a Geographic Information System (GIS)-based database of degraded sites located in NJ that may be suitable candidates for using dredged material for capping and remediation. While initial screening of the NJDEP databases has yielded encouraging results, additional work is necessary before sites can be recommended as part of the DMMP. The database currently does not include extensive site-specific information, such as site status, acreage availability, and the nature and extent of site contamination.

For upland use in NJ, NJDEP issues an Acceptable Use Determination (AUD) on a case-by-case basis. The AUD is issued in conjunction with a Waterfront Development Permit for a specific dredging project provided the project is designed and managed in a manner consistent with all the environmental statutes applicable to the project. This is addressed in NJDEP's guidance manual entitled "The Management and Regulation of Dredging Activities and Dredged Material in New Jersey Tidal Waters" (NJDEP 1997).

Recently, NYSDEC's Remediation Program and Dredge Team committed to developing an information database that would include information on proposed dredging projects and remediation sites within the State of NY. The purpose of the database will be to provide timely information on possible placement locations for material generated by local dredging projects. For upland projects in NY, the NYSDEC Division of Solid Waste issues a Beneficial Use Determination (BUD) on a case-by-case basis. NYSDEC has begun the process of revising the State's Solid Waste Management Regulations, 6 NYCRR Part 360 (Part 360), the authority by which the State sets standards and criteria for solid waste and its managing facilities. This rulemaking will consider specific language regarding dredged materials, which will facilitate the beneficial use of those materials for site-specific applications.

In Pennsylvania (PA), efforts in using dredged material are currently focused on reclaiming abandoned coal mines. Upon passing engineering and environmental criteria, the PA Department of Environmental Protection (PADEP) would classify processed dredged material as clean fill material and issue a Beneficial Use approval. The PADEP would then perform a Class III unlined landfill analysis to evaluate use of the material for coal mine reclamation. Recently, the PADEP has approved a "safe fill" protocol, under which dredged material may be evaluated. Material meeting these criteria could be placed at a site that has received a General Permit for reclamation using dredged material, or other wastes.

TECHNIQUES

A. Daily & Intermediate Cover at Active Solid-Waste Landfills

Instead of disposing of dredged material at active solid-waste landfills intended for other wastes (and incurring a high tipping fee), this option would use processed dredged material as daily or intermediate cover. Other possible uses at these landfills are constructing levees and lining disposal areas. Active landfills have an extra benefit over other degraded lands by being designed to contain contaminants and manage runoff. Past studies for this region (Malcolm Pirnie 1982, 1983 and 1987) have shown that this alternative is feasible.

B. Final Cover at Abandoned/Inactive Solid-Waste Landfills

Many abandoned or otherwise inactive solid-waste landfills in this region have never been formally closed. Such an action would require a state-approved closure plan and post-closure plan. Processed dredged material could be used for capping these landfills. Land remediation using processed dredged material has already been implemented successfully at full-scale in this region. In 1997, the Jersey Gardens Mall Site in Elizabeth, NJ (formerly called the OENJ Orion Site). The site was developed into a retail shopping mall. Approximately 850,000 CY of processed dredged material was placed as structural fill for a parking lot at a cost of $56/CY (including dredging). The last load of dredged material was placed in November 1998.

The OENJ Site in Bayonne, NJ encompasses an inactive municipal landfill and a brownfield site. The site underwent a remedial investigation and an approved remedial action work-plan was developed. The beneficial use of dredged material on this site was incorporated into that remedial action work-plan by using dredged material as a low permeability cap and structural fill. Approximately 3 MCY of processed dredged material was placed on the site as structural fill material in the remediation of a landfill site. The site had the capacity to accept 5.1 MCY of dredged material and recyclables. The use of dredged material on this site offers several environmental benefits. Uncapped landfills in the region are estimated to generate approximately 400,000 gallons of leachate per acre per year. The low permeability of the dredged material cap will reduce the amount of precipitation infiltrating contaminated historic fill on the property. This results in a substantial reduction of contaminants leaching into the Upper Bay. In addition, the use of dredged material as structural fill has allowed the site's developer to fund the more expensive elements of the remedial action work-plan, including a groundwater barrier system and a leachate collection system. Once the fill had been placed, a 2-foot thick clean fill cap was placed over the dredged material. This cap not only provides a growing medium for plants to be established on the site but also eliminates any potential environmental exposure to the dredged material or the existing contaminants on the site. The site is currently being developed into a golf course.

Without the beneficial use of dredged material, it is not likely that this site would have been remediated at any time within the foreseeable future. Existing contamination at the site would continue to leach into the Upper Bay, wildlife would continue to be exposed to surficial contaminants, and the site would have no public utility. Consequently, the use of dredged material at this site has had both environmental and socio-economic benefits.

EnCap Golf, Inc., is remediating four landfills in the NJ Meadowlands. This Brownfield Redevelopment Project encompasses three orphaned landfills and an adjacent fourth landfill for a total of approximately 700 acres. It is estimated that these landfills will need a minimum of 2.5 MCY, and up to a maximum of 5.0 MCY, of dredged material and/or processed dredged material as the shaping and grading layer beneath and as part of the cap(s) for these landfills. Upon completion of the remedial and closure activities, the site will be converted into three golf courses and commercial, resort development. The site is currently accepting material. Placement costs at the site have been negotiated to remain static at $5.23/CY of processed dredged material, which does not include the possible processing and upland transportation costs.

The NJDEP has identified hundreds of other landfills across the State of NJ, which may require remediation and final, proper closure. Of these, the New Jersey Meadowlands Commission (NJMC) has identified approximately eight major landfills within their jurisdiction. The NJDEP is working in conjunction with the NJMC and NJDOT/OMR to develop Closure Plans for these landfills using a minimum of 5 MCY of processed dredged material and Pleistocene red-brown clay from the deepening of the Federal navigation channels in the Kill Van Kull, Newark Bay, and Port Jersey Channel.

Under a dredged material pilot study, New York City (NYC) evaluated the potential for using dredged material for the contour layer, barrier protection layer (above the geomembrane liner) and as a final planting medium for the restoration of a coastal plant community at the Pennsylvania Avenue and Fountain Avenue landfills. The study confirmed that dredged material can be effectively used as a rough grading material and has been used in several cases for this purpose. The final report for this portion of the study was released in November 2004. The establishment of coastal grassland and a mixture of indigenous deciduous and evergreen plants at these sites will greatly improve the environment surrounding Jamaica Bay. Processed dredged material from the following projects was placed at the landfills: Pier 79 (36,000 CY), the Kill van Kull (60,000 CY), and Flushing Creek (80,000 CY) have been placed at the landfills as grading material.

The State of NY and NYC have closed most of the municipals landfills in the State over the last two decades. Presently, there remain only two former NYC municipal landfills in the harbor area undergoing closure (Fresh Kills Landfill and Brookfield Landfill), offering the potential for using approximately 4 MCY of dredged material.

C. Brownfield Remediation

As defined by USEPA, brownfields are abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by actual or perceived environmental contamination (though typically with contaminant levels too low to be considered hazardous-waste sites). Many of these sites are located in urban areas, where they could be restored to productive use. Due to the heavy historic industrial development in this region, there are numerous brownfields that could potentially benefit. Recently, USEPA and the States have developed programs to expedite the investigation, cleanup, and restoration of brownfields. As part of this effort, they're promoting the use of non-conventional material, including dredged material, as an economic alternative to cap suitable brownfields.

The previously mentioned OENJ Bayonne Site in Bayonne, NJ encompasses a brownfield (as well as an inactive landfill). At it's closing in December 2003, the site had accepted approximately 3 MCY of dredged material for use in the remediation of the site.

The Port Liberte site is a brownfield site located in Jersey City, NJ. The site accepted approximately 0.2 MCY of processed dredged material at a cost of approximately $29/CY. Dredged material was amended at the Clean Earth Dredging Technologies, Inc. processing facility (formerly known as Consolidated Technologies Inc.), located on the adjacent Claremont Terminal, and transported by truck to the Port Liberte site for use as structural fill for a golf course that is currently under construction.

The Koppers Coke site in Kearny, NJ is a brownfield identified for remediation and reuse as a manufacturing or warehousing facility. The site accepted 1.1 MCY of processed dredged material prior to the expiration of the permit. The site is owned by the Hudson County Improvement Authority. Additional dredged material (approximately 400,000 CY) may be permitted for placement at the site pending resolution of a remediation strategy for the site. Cost of processing and placement ranges between $29–$42/CY.

The NJDOT/OMR and the NJDEP are currently evaluating additional degraded sites in NJ for their suitability in using up to several MCY each. Several other brownfields in this region have already been identified, including NL Industries (Sayreville, NJ), Allied Signal (Elizabeth NJ), and Military Ocean Terminal (Bayonne NJ) (MOTBY), are anticipated to have a combined dredged material capacity of approximately 7 MCY (Table 2–1 in the DMMP-Implementation Report). NJDOT/OMR has estimated that project costs (excluding dredging and transportation) for the majority of the Land Remediation projects including treatment and transport to the site will be $29–$42/CY. FDP Enterprises (Jersey City, NJ) is another brownfield site originally permitted in 1998 to accept about 700,000 CY of material. Since that time, the site has undergone further permit modifications and has taken processed dredged material as part of the remediation plan for the site. As the site's future capability to accept more material is presently under regulatory review, to be conservative, no future dredged material is planned for the site as part of this DMMP update.

NY is a national leader in brownfield issues, and with recent passage of historic legislation refinancing and reforming NY State's programs to cleanup contaminated properties, the stage has been set to accelerate the pace of brownfield remediation and revitalization. The NYSDEC's programs promote environmental restoration and preservation, public health protection, economic development, job creation, and community revitalization throughout the State.

NY has several brownfield sites within the area of the Harbor falling under one of several brownfield programs (Resource Conservation and Recovery Act [RCRA], State Superfund, and Voluntary Clean-Up Program). The NYSDEC is presently evaluating the potential of using dredged material in the remediation of these sites.

- The Motor Sports Entertainment Complex (MSEC) site on Staten Island is presently undergoing remediation and representatives from MSEC have approached the NYSDEC about the possibility of using dredged material in the remediation process. MSEC is presently in the process of preparing the required plans to obtain the necessary permission from the State. Capacity at the site is approximately 5 MCY at a cost ranging between $29–$42/CY (Table 2–1 in the DMMP- Implementation Report).

With NY's new brownfields program complimented by NYSDEC's commitment to encouraging the use of dredged material in remedial work plans when appropriate, NY expects to continually discover new opportunities for the beneficial use of dredged material.

D. Quarry Reclamation

Quarries are open excavations for extracting aggregate, limestone, slate, or similar materials. Benefits of quarry reclamation include habitat restoration and economic development opportunities. Dredged material can be used beneficially to restore contours at quarry sites, thereby eliminating the safety hazards associated with the cut face of the quarry. In addition, restored contours often result in the creation of areas suitable for further habitat restoration or economic development.

The Upland Confined Disposal Siting Study (USACE 1996) identified six potential quarry sites in the region, all located along the Hudson River waterfront in upstate NY. Preliminary estimates indicate that the total potential capacity exceeds 17 MCY. Currently, there is a lack of local sponsorship or support for the use of processed dredged material at these sites. In NJ, Pattenburg Quarry (i.e., Hunterdon Quarry) has been identified as a possible placement site for processed dredged material with a capacity of approximately 30 MCY. This site is equipped with rail access to and from the Harbor/Newark Bay area so the upland transport and placement cost is expected to be in the neighborhood of $7/CY (not including any necessary processing costs). This cost is largely associated with the washing of the dredged material to remove any salt prior to placement at the quarry.

E. Abandoned Coal Mine Reclamation

Abandoned mine sites cause a variety of serious environmental problems, including land subsidence, underground mine fires, dangerous high-walls, and most significantly, acid mine drainage (AMD). AMD is the major cause of water pollution in every Appalachian coal-mining state, and impacts over 3,000 miles of PA's rivers and streams alone. Using dredged material to reclaim abandoned coal mines offers the potential of vast disposal volume. Both strip mines and deep mines can benefit from the placement of dredged material. Thousands of abandoned mines dot the eastern U.S. in relative proximity to the Port, many with capacities in excess of 100 MCY each.

The PADEP permitted a demonstration project in June 1997 for using treated dredged material for abandoned coal mine reclamation. The mine site chosen for the demonstration project is the Bark Camp Mine Reclamation Laboratory located in Huston Township in Clearfield County, PA. The site was permitted to accept 0.735 MCY of processed dredged material. While the costs of this demonstration project range from $42-$86/CY, depending on volume, to date the costs have been heavily subsidized by the State of NJ (NJDOT/OMR) for the user. Water run-off and well samples from the Bark Camp test site after placement of the initial volume of material showed no difference in contaminant levels from background levels tested prior to placement. Using established leachate procedures, all contaminants passed the state standards, with most contaminants below the detection limit (PADEP 2003).

This use of dredged material for acid mine reclamation has been highly successful, prompting the PADEP to issue a General Permit for the use of properly characterized amended dredged material for the closure of the Lehigh Coal and Navigation mine in Lehighton, PA (the Springdale Pit) in early 2004. This mine has a capacity in excess of 25 MCY. The cost of this option is projected to be about at $29/CY. However, economies of scale through reduced railroad transport and the contribution of mine reclamation funding, along with a contribution from funds for use of cement, fly ash, lime, and kiln dust (which also constitute waste streams that require management) to offset costs, may result in a net cost to the Port of $20-26/CY for this application. A complete report of the project is available (PADEP 2003).

Using dredged material for mine reclamation is not unprecedented. Back in 1978, for example, contaminated dredged material from the Calumet River was used to restore an acid coal mine tailing area at Ottawa, Illinois (WES draft 1998b).

POTENTIAL IMPACTS

Land-remediation projects, by definition, take place only in degraded lands with low natural resource value. Many of these sites have been abandoned with the subsequent return of limited vegetation and wildlife species. Species present are typically those most adaptable to human activity and disturbed habitat. Impacts associated with a site that has revegetated would be the loss of habitat at the facility footprint. These impacts are not expected to be significant, however, since these sites rarely have the return of substantial species diversity without active management.

Wastewater from any de-watering process would be either discharged to a sewage treatment plant or discharged directly to surface water. This effluent could impact the water column of the receiving water body by causing increased turbidity, salinity, and/or inflow of small amounts of contaminants. Procedures imposed by the presiding state's permitting process would reduce the risk.

Direct impacts on aquatic resources are not anticipated, but indirect impacts could be associated with spillage and surface runoff to waterways. Reasonable, prudent measures would be used to prevent spillage and surface runoff.

There's also a concern of the dispersal of contaminants from the processed dredged material, especially leaching of contaminants due to percolation and stormwater runoff. Once placement of dredged material is completed, an additional layer of clean material would typically be placed on top, thus reducing long-term impacts.

Upland animals are highly unlikely to be directly impacted by the use of a developed site. If the site were to be used as habitat, the site would be capped with clean cover. As for endangered species, the potential threat would be minimal because it is most likely that any site chosen would be disturbed as a result of the past/present activities of humans. Coordination on a case-by-case basis with Federal and state resources agencies would be conducted for this option.

Air quality impacts would be largely due to transport of contaminants associated with particulate emission and volatilization from staging and placement sites. NJDOT/OMR is funding a research project to assess the volatility of contaminants from dredged material processing sites. Investigators at the Stevens Institute of Technology and Rutgers University utilized state-of-the-art technology to evaluate the potential for PCBs and Hg to volatilize during the amendment and placement process. The results indicate that these chemicals do volatilize, however the mass and extent of transport was difficult to predict due to heavy background contamination at the Bayonne, NJ test site. In the worst case, the concentrations detected are far below the threshold for either acute or chronic human health impacts (Korfiatis *et al.* 2003). Further work, utilizing controlled laboratory settings is underway as of the time of this writing. Preliminary results indicate that the time of release of contaminants during the amendment process is very short, on the order of hours, and the amending materials eventually reduce the volatilization potential below that of raw dredged material. The information from this study will be used to conduct a human health risk assessment.

The potential for cultural resources on landfill sites is low due to disturbance associated with the construction and operation of landfill structures. Brownfields, quarries, and abandoned mines, however, may have cultural resources associated with them if there were any historic operations.

IMPLEMENTATION

The private sector has taken the lead in implementing land-remediation projects in this region using processed dredged material. Projects are summarized in Table 2–1 in the DMMP- Implementation Report. Taken together, the private sector processed more than 10 MCY of dredged material by end of 2003 for beneficial use in regional land remediation projects.

The NYD will continue to support ongoing efforts, maintain coordination with the lead agencies and private firms proposing such uses, and facilitate the beneficial use of dredged material. NYD will provide assistance in locating and evaluating suitable sites requiring remediation, and provide technical support in handling, transport, placement, and monitoring at a given site.

A. Rehandling / Processing Facilities

Currently there are three independent dredged material processing facilities permitted in NJ. They are: Don Jon Marine (operational), Metals Management (operational) and Clean Earth Dredging Technologies (formerly Consolidated Technologies) (operational). The processing capacity of these facilities is estimated at between 1.2 and 2.4 MCY/year each. Dewatering of material for most facilities must be done at the site of dredging (or decanted water returned to dredging site), with the exception of the Clean Earth Dredging Technologies facility, which has been issued a NJ Pollutant Discharge Elimination System (NJPDES) permit. Prices for management vary, with the costs ranging from $29–$36/CY. Currently, there are two new processing facilities going through the permitting process: the Bayshore Recycling Facility in Keasbey, NJ and Great Lakes Dredge and Dock Co is re-permitting the Koppers Seaboard site in Kearny, NJ. The Bayshore facility is planned to handle a variety of sediment types including clean clay and sand, as well as more contaminated materials for conventional processing and decontamination. Bayshore is in the process of constructing 50,000 CY of raw dredged material storage capacity, helping alleviate the logistics issues resulting from the disparity between dredging production rates and decontamination processing rates. The facility will be online in July of 2005. Demonstrations of several decontamination technologies including the BioGenesis and Upcycle Aggregate technologies are planned to be demonstrated at Bayshore. The Koppers site will have conventional pugmill processing and has capacity for placement of 400,000 CY on site and is easily accessible to other sites in the NJ Meadowlands as they are permitted.

Presently New York has one fully permitted dredged material processing facility, Interstate Materials Corp, located at 11 Johnson Street in Staten Island. Construction of the site is expected to be complete by late 2005. Additionally, NYSDEC is presently reviewing an application from Vanbro for the construction of a dredged material processing facility at their Staten Island location on South Street. Vanbro's application proposes processing/handling a variety of dredged materials including sand, clay, glacial till, rock and fine-grained material. Application review and permit decision is expected to be complete by late 2005.

For the land-remediation options in general, the development of a regional bi-State rehandling facility for low-end processing and shipment of amended dredged material could help ensure continued full-scale use of this option. Such a facility could accept material from many dredging sites throughout the Harbor and export processed material to various remediation sites as needed. The NYD will continue working with the States in siting and developing a rehandling facility that would accept material from both States. Toward this end, a team of regional stakeholders, led by NYD, is developing a conceptual design of a generic dredged material rehandling facility (LMS draft 1998, LMS 2003). This will complement a previous report (A.D. Little, Inc. 1998) on a conceptual design of a 0.5 MCY/year treatment facility. The rehandling-facility design will address the following: 1) regulatory review, 2) site selection, 3) engineering design criteria, 4) environmental enhancement and beneficial use elements, 5) alternative layouts, 6) facility management and operation, 7) construction methods, schedule, and costs, and 8) a summary and analysis of alternatives.

B. Cost Estimates

As in all options that have passed the environmentally acceptable criterion, price is the overriding factor on whether this option will be widely implemented in this region. Development of costs for land remediation includes capital, operating, environmental protection, and transportation costs for both the processing/rehandling facility and the placement site. Costs are site-specific and depend on the location, capacity, method of transportation, site preparation, types of equipment used, site topography, prevailing labor wage rates, and land costs. Transport costs, in particular, should be given close attention because it can account for a disproportionately large share of the costs. For recent activities (including dredging, processing, transport, and placement) taking place at the OENJ Bayonne Site, costs were running $40–$50/CY. The NJDOT/OMR estimates current processing facility costs of $12/CY for handling, a processing cost of $12–$17/CY, and sale of the manufactured-soil product at $8–$11/CY.

Other economic concerns include the USACE policy of selecting the lowest-cost disposal options with little regard for the possibilities of beneficial use (33 CFR Section 335.4); and disputes over whether the incremental expense of beneficial use should be borne by the project sponsor or the beneficiary of the restored site. The benefits of beneficial use often accrue to third parties, whereas the added expense is generally borne by the project sponsor, which is typically the Federal or state government (NRC 1997).

C. Timeline

Major activities leading to startup of a land remediation project include identification of a suitable processing/rehandling site and placement site (these could be one and the same site), public and political acceptance, site investigations, National Environmental Policy Act (NEPA) documentation, site-usage agreement, permitting, design, site preparation, and construction. The permitting process may vary from nine months to several years, depending on the nature of the project. Contracting engineering studies, conducting the studies, and preparing the required documentation could take an additional year. Use of an owner-sponsored site may facilitate the early developmental stages of the project, but not shorten design and permit needs nor necessarily allay public opposition.

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A-4 DECONTAMINATION

DESCRIPTION

Decontamination technologies reduce the harmful effects of contaminated dredged material by destroying contaminants, separating and removing contaminants from sediments, and/or immobilizing contaminants to minimize release to the environment. The objective is to have the treated material meet established environmental criteria/guidelines and geotechnical properties for a designated beneficial use. Technologies could involve physical, chemical, thermal, stabilization and biological processes or any combination thereof. Material undergoing treatment would have less restricted and more varied beneficial uses than untreated material. Depending on the process used, some end products have measurable market value, such as clean soil, lightweight aggregate, construction-grade cement, structural fill, and architectural glass tiles, to help offset processing costs. Thermal technologies can produce steam and electrical generation as part of their process for either recycling internal energy or for sale.

For the Port, the formidable challenge posed for this management approach is to process, in a environmentally protective and cost-effective manner, relatively large volumes of contaminated dredged material with high fine-grained fractions, enriched total organic carbon contents, estuarine salinity, and high water content. Most of these sediments contain a wide range of organic and inorganic contaminants at low concentrations relative to those typically found on state and Federally regulated hazardous waste sites. However, it should be noted that several sediment "hot spots" exist in areas outside navigational channels with significantly higher contaminant levels. These hot spots could also serve as potential candidates for treatment through an environmental dredging program.

To be used beneficially, the treated material must meet applicable state and Federal environmental, health, and safety guidelines. Processed material must also meet the material and engineering specifications for its proposed end-use. Since the States, and not the Federal government, have jurisdiction of upland management of dredged material, the presiding state determines the end-use testing criteria and issues the acceptable/beneficial-use determination for the end product of any treatment process. The NJDEP has a guidance manual entitled "The Management and Regulation of Dredging Activities and Dredged Material in New Jersey Tidal Waters" (NJDEP 1997). The NYSDEC is in the process of finalizing its guidance manual. The acceptability, and therefore the success, of treated dredged material will be based on the ability of a given process to meet these standards at an affordable price.

Section 405 of the Water Resources Development Act (WRDA) of 1992, Section 226 of WRDA of 1996, and Section 204 of WRDA 1999 (Section 405 amended) authorized the USEPA and the USACE to jointly conduct an investigation and demonstration of decontamination and treatment technologies applied to contaminated dredged material in the NY/NJ Harbor Sediment Decontamination Technologies Demonstration Program. This program was charged to determine the environmental, economic and engineering, feasibility of decontaminating at least 500,000 CY/YR of dredged material with the manufacturing of beneficial use products. USEPA-Region 2 leads this effort in cooperation with the NYD. The U.S. Department of Energy Brookhaven National Laboratory, Rennselaer Polytechnic Institute, and Montclair State University provide technical program support. Several previous investigations have been conducted for this region (Tetra Tech 1994; Malcolm Pirnie 1995) and in the Great Lakes region (USEPA 1994b; Environment Canada 1996). The WRDA/USEPA program is working in partnership with the NJDOT/OMR Sediment Decontamination Program. More information on both these federal and state programs can be found at the following websites:

www.bnl.gov/wrdadcon/
www.state.nj.us/transportation/maritime

TECHNIQUES

Decontamination technologies range from "low-end" to "high-end" processes in terms of relative complexity, energy consumption, and cost. The low-end processes include dewatering, physical separation, S/S, and untreated manufactured-soil production. These methods involve minimal handling and processing and are relatively inexpensive. However, other costs, especially those associated with materials handling and site acquisition, could add substantially to total costs. S/S has already found full-scale application in the region, with land and/or brownfield remediation as the primary beneficial use. It is addressed as a separate DMMP option (see Sections 2.3.3 and A.3.3).

The high-end processes are those technologies that destroy or remove contaminants in dredged material at a processing facility. Those that have been evaluated include sediment washing, solvent extraction, thermal desorption, and thermal destruction. In comparison to low-end processes high-end processes are typically more expensive, complex, and energy-intensive, and require greater handling, more unit operations, and/or high operating pressures and temperatures (requiring increased energy consumption). In addition, these processes may generate multiple waste streams (*e.g.*, wastewaters, stack emissions, waste oils, solid residues) that must then undergo separate treatment and/or disposal. However, high-end processes have the potential to produce end products with a higher market value (such as clean topsoil or blended cement), thus generating a revenue stream to help offset the higher processing costs.

Under the USEPA/NYD demonstration project, laboratory testing (5-10 gallons each) of ten technologies was completed by 1996, and pilot-scale testing (2-22 CY each) on five of these technologies was completed by 1997. The Federal agencies have also worked with other technology firms, supplying them with sediment for process testing and helping them evaluate their processes. The next step in achieving full potential of these technologies is implementing a commercial-scale demonstration. These demonstrations are needed to improve cost estimates, resolve engineering scale-up challenges and "fine tune" and optimize treatment effectiveness. The key objective is to demonstrate the economic feasibility of processing large volumes (at least 0.5 MCY per year) on a long-term, self-sustaining basis (WRDA 1996).

The following is a list of technologies that have undergone bench/pilot demonstrations through both the Section 405 (WRDA) Program and NJDOT/OMR Decontamination Programs:

- **BioGenesis Enterprises, Inc. Milwaukee, WI**: The Biogenesis sediment washing process utilizes high-energy scrubbing, biosurfactant chemical additives and chelating agents to isolate and oxidize (destroy) the contaminants from the sediment particles. Resulting process water is treated to remove remaining contaminants. The end product is a clean manufactured soil material usable for fill cover or landscape topsoil applications. Under the NJDOT/OMR decontamination programs, a consortium of three firms was assembled to move it to the next full/commercial phase. This included BioGenesis of NJ, Inc., Montgomery Watson Harza, Inc. and BioGenesis Enterprises, Inc. (BGW). The beneficial use component would be a blended manufactured soil suitable for use as topsoil, construction material, landfill cover, and in brownfields remediation. BGW was a finalist in the USEPA decontamination program and was awarded a 700 CY pilot that was successfully completed during the spring of 1999. BGW has completed final design engineering for a commercial-scale facility capable of processing 250,000 CY/YR (40 CY/hour). Commercial-scale operations will be a combined USEPA/NJDOT/OMR 43,500 CY dredged material project. These will include dredged material volumes from (1) Darling International and (2) Amerada Hess – both located in upper Newark Bay, and (3) Passaic River - Harrison Reach as part of the USEPA/NJDOT/OMR Passaic River Restoration Dredging Treatability and Sediment Decontamination Pilot Project. July 2005 is the anticipated start-up for the 250,000 CY/YR sediment washing system that will process 43,500 CY as part of the USEPA/NJDOT/OMR demonstration. Processing time will take approximately four months. Processing of the Passaic River sediment is expected to commence in October 2005.

- **Gas Technology Institute (GTI),** a not-for profit research company of Des Plaines, IL, is a thermo-chemical process that uses a rotary kiln to produce a pozzolanic material, which is then mixed with Portland cement to yield a construction-grade blended cement. This would be marketed to the construction industries as a substitute to regular Portland cement. Their process has undergone bench (1995) and pilot scale testing (1996) in the Section 405 Program and is moving forward towards full/commercial scale operation. NJDOT/OMR has awarded a contract to GTI to test their technology at a demonstration scale plant at an industrial site in Bayonne, NJ. The full-scale test will evaluate destruction efficiencies and air emissions on 350 CY of dewatered dredged material from northern Newark Bay. This demonstration in cooperation with the USEPA Program will utilize a full-scale test kiln. Commercial scale operations would require construction of a larger facility in order to be economically viable. Construction of the kiln began in 2003, and start-up of the kiln commenced in November 2004. Following troubleshooting and addressing start-up mechanical problems, the plant was winterized for

Phase 1 processing. A total of 80 CY were processed under Phase 1. Under the NJDOT/OMR Passaic River Restoration Dredging and Sediment Decontamination Treatability Pilot Study, it was decided to go forward with a GTI Phase 2 demonstration of 2,500 CY. Kiln operations are expected to commence in November 2005.

- **JCI/Upcycle** is a joint venture between Jay Cashman, Inc. (JCI) of Boston, MA and Upcycle Aggregates. JCI/Upcycle proposes to decontaminate Harbor sediments using a rotary kiln technology that thermally destroys organic contaminants and fixes metals in the mineral matrix of a lightweight aggregate product. Lightweight aggregate is used in construction throughout the NY/NJ metropolitan region and is in high demand (approximately 0.9 MCY/YR in the northeast). A small-scale pilot project (4 CY) was conducted during the winter of 2000/2001 using a test rotary kiln in Conshohocken, PA (Fuller Research). The sediments were dredged from a facility in northern Newark Bay/Passaic River and dewatered using conventional belt press technology with polymer addition. The dewatered sediments were transported via truck to the kiln and mixed with shale fines, pressed into pellets, and fired in the kiln at temperatures in excess of 2000° F. The resulting lightweight aggregate met or exceeded all ASTM standards. There were no leachable metals or detectable organics in the final product. A demonstration is currently being planned to bring 15,000 CY of dredged material to an existing commercial scale lightweight aggregate plant in Virginia. This kiln could support 600,000 CY of dredged material on a yearly basis. It is anticipated that a commercial demonstration will commence in the first quarter of 2006.

- **BEM Systems of Florham Park, NJ,** piloted the use of enhanced mineralization (Georemediation™) to decontaminate Harbor sediments during 2001/2002. A catalyzing reagent was mixed into the raw dredged material and allowed to react for at least 28 days in open holding/curing basins. Bench scale tests indicated that organic contaminants were reduced and metals were integrated into the crystalline mineral matrix of the sediment. BEM proposes that the decontaminated sediment can be used to make a manufactured soil product that is suitable for use as non-structural fill in roadway construction, brownfields remediation, or as landfill cover. Results of a 500-gallon pilot project conducted in 2001 with sediments from several harbor locations were inconclusive. There are no plans to perform a large-scale demonstration of this technology.

- **Harbor Resource Management Environmental Group (HRM) (formerly National Utility Investors Environmental Group [NUI] of Union, NJ),** proposed to use an enhanced stabilization technology with oxidation to decontaminate Harbor sediments. The intended product is a manufactured soil that could be used as fill material or brownfield/landfill cover. The treatment consists of mixing super-ionized water and chemical oxidants followed by pozzolanic material addition to reduce concentrations of organics and bind the metals. The intended use is for those navigational dredged material projects that are slightly in excess of permitted upland standards. NUI conducted a successful 1600-gallon pilot in the winter of 2001 at their site in Elizabeth, NJ. HRM dredged 2,500 CY in January 2005 from Darling International, upper Newark Bay. The material was placed in scows for processing at the Bayshore Recycling facility. HRM processed a total of 250 CY. Challenges related to up-front material handling and pumping from the dredging scow to the dewatering units were problematic. The processed material has shown impressive geotechnical properties when placed upland at the EnCap site. Final data report is expected in July 2005.

The PANY/NJ has conducted its own sediment-treatment demonstration projects. The PANY/NJ began its Matrix Evaluation Project in 1997. Four technology firms have conducted treatability studies of their processes. End products are either lightweight aggregate or flowable fill. The objective is to evaluate whether the selected processes can economically produce construction material from Harbor dredged material that meets ASTM and other applicable standards without any significant adverse environmental impacts. Treatability studies identified three companies: JCI/Upcycle (See above), Plasmarc and Riefill with end products meeting or exceeding the standards for use in PANY/NJ construction projects.

All decontamination technologies are preference 1 options.

POTENTIAL IMPACTS

Siting of any decontamination facility would likely be at previously developed sites, including former or current industrial facilities. These sites currently have little natural-resource value. Some potential sites may have been abandoned, with the return of some vegetation and wildlife. The species present are typically those most adaptable to human activity and disturbed habitat. Impacts associated with a site that has re-vegetated would be the loss of habitat at the facility footprint. These impacts are not expected to be significant, however, since these sites rarely have the return of substantial species diversity without active management.

Wastewater effluent from any de-watering or some other unit operation would either be discharged to a sewage treatment plant or discharged directly to surface water. This effluent could impact the water column of the receiving water body by causing increased turbidity, salinity, and/or inflow of small amounts of contaminants. Procedures imposed by the individual state's permitting process would evaluate the risk to the receiving water body. Direct impacts on aquatic resources are not anticipated, but indirect impacts could be associated with spillage and surface runoff to waterways. Reasonable and prudent measures would be used to prevent spillage and surface runoff.

Upland animals are highly unlikely to be directly impacted by the use of a developed site. As for endangered species, the potential threat would be minimal because any site chosen would be already disturbed as a result of the past/present activities. Coordination on a site-by-site basis with Federal and state resources agencies would be conducted for this option.

Under the USEPA and NJDOT/OMR demonstrations air quality data will be collected to determine the potential for impacts. The initial data will be used in a qualitative assessment of air quality impacts and will aid in the design of more effective future controls. Air quality impacts largely depend on whether a thermal or non-thermal process is selected. For a non-thermal process, impacts would be associated with particulate emission and volatilization of contaminants from staging and processing areas. NJDOT/OMR is funding a research project to assess the volatility of contaminants from processing sites (See Section A.3.3). With respect to specific volatilization of PCBs and dioxins, it is unclear how laboratory experiments translate to large-scale dredging and materials handling operations. These impacts would be minimized by proper dredged material handling, operational controls and management. The air quality impacts from thermal processes are of greater concern. Thermal facilities require air permits from the presiding state and employ advanced air-pollution control equipment typically associated with hazardous waste handling facilities.

Apart from air-quality impacts, any health risk would largely be due to handling of the pretreated dredged material by facility workers. NJDOT/OMR is currently conducting a study on the risk of exposure to contaminants resulting from working with dredged materials in an upland setting. There is the potential to encounter cultural resources at new or historic facilities. Cultural resource surveys will be programmed when proposed locations are defined.

IMPLEMENTATION

Low-end S/S processes (in conjunction with land remediation as the beneficial use) have already found commercial application in the region. (Sections 2.33 and A.3.3). Some of the commercial-scale demonstrations of treatment processes (other than S/S) were initiated in the fall of 1999. These demonstrations will allow direct comparison of the decontamination technologies and the other management options. The role decontamination technologies will play in the long-term dredged material solution will depend on several factors.

The key factor is assessing the benefit to the ecological and human health of the region. Towards this end, assuming project reauthorization and congressional appropriations, USEPA/USACE will perform a human-health and ecological risk assessment for any technology seriously considered for full-scale operation. The complete treatment train will be taken into account, from off-loading to final disposition of end products and waste streams.

A Cost Estimates

In the U.S. and around the world, treatment technologies (beyond S/S and other low-end processes) have not been widely applied in full-scale projects for soil or sediments, so reliable cost estimates are difficult to obtain at this time. Historical cost data on the pretreatment and treatment components are also very limited, and in some cases, the only data available are projections made by technology firms based on bench-scale and pilot-scale testing.

Cost elements include site acquisition, site preparation, permitting and regulatory requirements, capital equipment, start-up and shakedown, labor, disposal, transport of treated sediments, monitoring and analyses, maintenance and repair, contingency costs and cost recovery through sale of end products. Some of these costs are still uncertain at this time but it is expected that technological advances and economics will select the most effective and efficient processes as they scale-up to full scale processing. It is expected that Decontamination could be utilized on up to 1 MCY/YR of material by 2007 and the cost will have been reduced to a competitive $35–$55/CY.

High-end decontamination may remain more expensive than some of the other options discussed, which could limit its application. The navigation channels along Hackensack River, Arthur Kill, Kill van Kull, and Newark Bay may be possible candidates for subsidized treatment if upcoming studies show that the incremental expense (an estimated $6/CY) of full-scale decontamination is justified through the environmental and public health benefits to the region. Congress has recognized that there may be a need to specially manage, through removal of material, areas where contamination levels are very high. Sediment “hot spots” refer to these underwater areas and mud flats lying outside active Federal navigation channels that act as sinks of more contaminated sediment that spread or could spread contaminant plumes to cleaner parts of the Harbor, including the channels. Section 312 of WRDA 1990, as amended by Section 205 of WRDA 1996, authorized USACE to conduct “environmental dredging” for the purpose of remediating these areas. However, to date the USACE has not used this authority anywhere in the nation. The siting of a reasonable cost, large volume, decontamination facility in the region may help bring this authorization closer to fruition.

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A-5 CONFINED AQUATIC DISPOSAL (CAD) FACILITIES (SUBAQUEOUS AQUATIC SITES)

DESCRIPTION

A confined aquatic disposal (CAD) facility is a depression excavated into the bottom of a bay or other body of water (including channels and berthing areas). Dredged material is then placed into this CAD facility and covered or capped with a layer of clean sediment to isolate the disposed material from the overlying water and from the marine/estuarine organisms living in both the water column and the upper portion of adjacent sediments. If capped, the cap can be placed over the disposed material so that it extends above the natural bottom (forming a mound), be level with the adjacent ocean bottom, or be below natural bottom depth (leaving a shallow pit). The need to isolate the dredged material and the method of cap placement depends on the chemical and physical character of the covered sediments. Factors in choosing cap type include the source of the dredged material, its proximity to the CAD facility, and the anticipated value of the topographic relief (to fish, shellfish, etc.) in and adjacent to the CAD facility.

New CAD facilities have the potential to offer a large volume of disposal capacity at a cost-effective price for HARS unsuitable dredged material. Such containment facilities would have the advantage of being sited and engineered specifically to contain dredged material and minimize impacts. Furthermore, they could also restore degraded areas of the estuary by excavating contaminated surface sediments from berths and channels as well as the CAD site itself and containing them within the facility. Just as siting criteria are employed to select areas with reduced resource use, design and operational measures could be utilized to greatly restrict the loss of material in the water column during disposal, thus confining it to a waterbody that has already been exposed to the same material. A final cap, if necessary, would be placed to facilitate benthic recovery of the site after the facility is filled, making any resource impacts temporary. Management methods/techniques and operational practices that would be applied to this option to minimize habitat impacts and contaminant loss are discussed in more detail below.

At present, the use of CAD facilities as a placement option for dredged material is not part of this DMMP, and is considered a non-preferred option in Table 2–1 in the DMMP – Implementation Report. But while the NYD has no immediate plans for further evaluating the potential use of CAD facilities, it remains a technically viable option that may be reconsidered in the future should the need arise. The following discussion on CAD facilities is based on analyses performed in support of the 1999 draft DMMP and is provided here for informational purposes only.

TECHNIQUES

Three basic variations on CAD facilities have been evaluated. Their capacities and costs are summarized in Table A-5-1. Each variation is described in greater detail below:

UTILIZING EXISTING BORROW PITS: A number of existing borrow pits of varying depths and sizes are located within the Harbor area. These sites, a secondary result of the excavations for sand earmarked for beach nourishment projects and construction fill, were identified in a Final Supplemental Environmental Impact Statement (FSEIS) on the Use of Subaqueous Borrow Pits for the Disposal of Dredged Materials from the Port (USACE 1991). The FSEIS recommended the use of four of the larger sites in Lower NY Bay (Figure A-5-1) as the preferred alternative for containing contaminated dredged material. All four existing borrow pits sites have a potential capacity of approximately 22.9 MCY. Since the sites already exist and are closer to most channels than the HARS, costs for the use of this option, beyond actual dredging and transport, would be minimal.

Ancillary costs associated with their use could include some interior partitioning or other revisions to maximize safe use of the borrow pit, as well as a pre-, interim and post-placement monitoring program. Each site could be available for use in a short time frame, provided a WQC were issued.

In 1992, based on the FSEIS findings, the NYD applied for a Water Quality Certification (WQC) from the NYSDEC to use the East Bank Pit to dispose of an estimated 4 MCY of Category II and III material (unsuitable for unrestricted ocean disposal). At that time in 1992, approval of the WQC would have meant that the option could have been implemented and thus would have met 10 years of maintenance dredging needs. To date NYSDEC has not issued a WQC for the use of any of the four sites.

NEW CAD FACILITIES: The NY Bight Restoration Group (1984), a sub-committee of the Public Information and Coordination Group (PICG), proposed creating new CAD facilities specifically for containment of dredged material, as an alternative to using the existing borrow pits. The group recommended four sites, two of which were in the Lower Bay. The other two sites were in the ocean and thereby ruled out as disposal sites under the criteria of the Marine Protection and Sanctuaries Act. Using a more extensive and updated database, a GIS analysis applied environmental, engineering and other siting criteria and weighing factors to the data to identify suitable areas for new CAD facilities (WES draft 1998a). A great deal of new information went into this siting analysis, including an extensive survey of the benthic community and surficial sediments (Iocco *et al.* 2000), modeling of currents, waves and erosion (WES draft 1998b), and bathymetric, side-scan and sediment profiling (USDOI/USGS 1999 unpublished).

The initial GIS analysis resulted in two potential zones (Figure A-5-1), one in Raritan Bay (Zone 1) and another in Upper Bay, Newark Bay, and Lower Bay (Zone 2). Each zone is large enough for many small CAD facilities. Each site, in turn, can be excavated to fill the coming years projected volume of maintenance and (when applicable) new work dredged material deemed unsuitable for use at the HARS (a total annual volume ranging from 1.5–6 MCY). This strategy would create over time a series of sites within a zone. Contaminated surface material from the digging of the first CAD facility would be disposed in an approved facility or treated to render its contaminants harmless. Clean material from the construction of the remainder of the first CAD facility would be used beneficially to remediate the HARS or other degraded habitats, or to nourish area beaches depending upon its grain size and engineering suitability. Unsuitable material from maintenance and/or new work dredging would then be placed into the CAD facility along with any contaminated surface material excavated to construct the next CAD facility in the sequence. The first site would then be capped with some of the clean material removed in constructing the next site, with any remaining clean material being used beneficially.

The capacity for containing dredged material in both zones, a total of 7,000 acres, has yet to be determined. However, preliminary estimates indicate that only one of these zones would have to be used to create CAD facilities that would far exceed the total projected volumes of material unsuitable for HARS remediation. Additional modeling and new biological data suggest that use of Zone 1 (Raritan Bay) may have a greater long-term potential for effecting shoreline erosion and water quality than CAD facilities in Zone 2 (Upper Bay, Newark Bay, and Lower Bay). Although Zone 2, in the Lower Bay, on the other hand represents habitat of lower value and would now appear to be the better location for new CAD facilities, the potential for short-term impacts to the Bay still exist for this option.

To create each CAD facility requires the excavation of a volume of material equal to or greater by 25% than the intended capacity of the facility. With only a small amount of the excavated material required to cap the preceding site, an estimated 48–80 MCY of clean, excavated material could be available for beneficial uses. This total volume of clean material provides an enormous surplus that could be put to use remediating other degraded areas.

In addition to safely containing the dredged material, and returning the area to its previous condition (with no long-term loss of habitat or benthic communities), these new CAD facilities, if excavated in areas likely to have contaminated sediments (like Zone 1) would also serve to remediate those areas, by replacing the contaminated surface sediments with a clean sediment cap.

One of the major points brought out in the course of public agency review of previous DMMP documents was the desire to locate aquatic options within the same basin as the dredged material is excavated from. In the unlikely event that contaminants are lost during disposal they would, for the most part, be confined to the same waterbody they were already impacting before they were dredged. To meet this added protective measure, a number of smaller sites for CAD facilities were identified in the inner harbor (Upper Bay and Newark Bay). Using a list of potential sites developed by the Dredged Material Management Integration Work Group (DMMIWG), the NYD screened each site through a series of evaluation criteria; benthic data (Iocco *et al.* 2000), subsurface sediment cores, bedrock, contaminant levels and other pertinent statistics (NY/NJ Harbor Partnership draft 1998) to arrive at several potential areas for new CAD facilities (Figure A-5-1). As with the scenario proposed for the Lower Bay facilities, these inner harbor sites would both provide a contained disposal site for unsuitable dredged material, as well as the contaminated surface sediments from the sites dug to hold the subsequent year's material. By restricting both the Lower Bay and inner harbor sites to material taken from the same geochemical/geological or lithological stratum/formation/ litho-stratigraphy in which the CAD facilities are located, concerns regarding the spreading of contaminants from one part of the Port to another would be successfully addressed.

Preliminary analysis of new CAD facilities in the upper harbor indicates that the smaller area of bottom present in the upper harbor, limits the location to those areas of the inner harbor that have been identified and their overall capacity to 17.5 MCY. The depth to bedrock and contamination levels in subsurface sediments are also factors that would limit the locations. However, new facilities could be used in conjunction with Lower Bay sites either to provide supplemental capacity or to separate disposal options by sub-basin or waterway.

IN-CHANNEL CAD FACILITIES: New CAD facilities could also be excavated within the confines of a channel or berthing area below it's authorized depth. This option would minimize the impact to undisturbed areas and the introduction of contaminated sediments to areas outside the channel being dredged. It could also optimize dredging operations and lessen costs by reducing the transport distances of dredged material. However, if the channel bottom were already close to the underlying bedrock, the capacity could be less, and future deepening of the channels may be more costly if the disposed sediment had to be re-excavated. Potential impacts from resuspending the same sediment twice would also be a concern.

An analysis of areas where this option might be most suitable (NY/NJ Harbor Partnership draft 1998) identified the Port Newark/ Elizabeth Pierhead channel, Wards Point Bend/Raritan Bay channel, Bay Ridge/Red Hook channel and the Port Jersey channel as potentially feasible for creation of in-channel CAD facilities (Figure A-5-1). Preliminary screening resulted in removing both the Wards Point Bend and the Hudson River Channel because the sites would be located primarily within the anchorage areas and could be adversely affected by ship anchors. Within the remaining three areas, there is an estimated capacity for an additional 14.5 MCY of unsuitable material, after taking into consideration the volume of potentially contaminated surface material that would have to be disposed of in creating the CAD facilities and the volume used up to cap each facility with HARS suitable materials. A similar volume of clean sediment, capable of being put to a beneficial use, would also be produced in excavating the new pits.

Due to the short transport distances, in-channel CAD facilities are especially attractive for material that comes from the channel in which the facility was excavated. Another cost saving component worth considering is eliminating the need for capping. One of the principal purposes of a cap is to isolate the contaminated material from the benthic community that would reestablish in the area when the site was filled. However, the channel would continue to be disturbed by shipping, minimizing its potential to be repopulated. Rather than fill the site completely, a depression could be left to allow natural sedimentation to fill in the site over time. Further, since it is no longer critical to isolate the material quickly, it would be retained within a depositional environment below the depths at which ship movement could resuspend it. Besides saving the cost of obtaining and placing the cap, the depression would likely serve as a detention basin in which sediment would accumulate below the authorized channel depth, thus reducing the frequency for maintenance dredging. Consolidation of the deposit would further increase the depression, allowing for even more material to be deposited overtime before maintenance is needed. Modeling using field verified data would be used to help predicate the depth to which such a site could be filled and left uncapped without loss of material.

DISPOSAL STRATEGIES: Many concerns raised at the public meetings, as well as several of the regulatory agencies, center around the loss of material during disposal in a CAD facility. Studies from around the country summarized by the Waterways Experiment Station (WES 1986) have shown that, depending on a number of conditions, no more than 5% of the total volume of material disposed would be lost to the water column before it reaches the bottom. In that the contaminants are most frequently associated with the fine grain fraction that tends to comprise the majority of material lost during disposal, there was still some concern for perceived large-scale spread of contaminants to areas outside the intended disposal site. When modeled specifically for the sheltered and shallow water conditions in Zone 2 of the Lower Bay Complex, the loss barely exceeded 1.5% of the fine-grain fraction of material in a barge under the worst-case conditions of disposal during maximum flood or ebb tidal flows (WES 1998a). If (1) dredging is restricted to the use of clamshell dredges (to increase the compactness and decrease the loss of material during disposal), (2) is restricted to the slower periods of tidal velocities, and (3) the material placed in the portion of the CAD facility upstream of the dominant flow (center of facility at slack tide), then the model predicts that the total portion of fines that might be transported outside the CAD facility area would not exceed 0.02%.

Mechanical devices (e.g., Tremie tubes and diffusers) could also be used to minimize dispersal of material as it descends through the water into the CAD facility. Though the process does get material to the bottom with little contact with the water column, the material is more fluid (to allow it to move through the tube) and thus potentially more susceptible to resuspension and even loss during storm events. Geo-textile fabric bags were tested as a delivery system during the early part of the DMMP studies. From a logistical point of view, the operation proved to be very difficult and exceptionally costly (WES 1997). Given the operational controls discussed above, there would appear to be little to gain from this extra step.

In addition to potential dredged material placement restrictions (e.g., direct shunting, silt curtains, etc.) in the CAD facility, these facilities could be sited in close proximity to the areas of the Harbor from which the material is dredged to help confine any contaminant dispersion/loss from the filling process to the already impacted area. Also, subaqueous CAD facilities could be constructed, filled and capped annually to reduce the area physically impacted each year, minimize exposure of the benthic biota to the material, and hasten recovery of the impacted area. During annual CAD facility operation, a series of sites could be sized to contain the volume of material needing to be disposed of in the upcoming year as well as any existing contaminated surface sediment that may be dredged in constructing the subsequent year's cell. Construction time to get the first cell ready for use would be approximately six months. Construction of a subsequent cell would be timed to ensure availability when the preceding cell nears capacity and becomes ready for closure. In areas of the Port where there is a very limited amount of dredging, this approach may be less effective due to placement considerations (e.g., water quality impacts, benthic impacts, etc.) related to local environmental effects. In these areas, adding the material into larger CAD facilities created in other areas with greater dredging volumes may prove to be more environmentally protective.

In certain areas of the Port, seasonal restrictions (e.g., dredging windows) have been applied to the dredging phase of projects. These restrictions could significantly influence the utilization of CAD facilities in the Port. Often these seasonal restrictions are based on environmental and water quality concerns and have been overcome, in dredging projects, by employing specialized mechanical equipment (e.g., Tremie tubes) or management techniques/practices. These include, but are not limited to, disposing during a specific tide, closed clamshell environmental buckets, regulating bucket lift speed, not allowing barge overflow and employing silt curtains. Such management alternatives designed to reduce or contain sediment resuspension during disposal events are not as reliable or as easily implemented during disposal within a CAD facility. Therefore, it may be difficult to obtain waivers of seasonal restrictions for subaqueous disposal alternatives. If waivers cannot be obtained, these restrictions/limitations could pose unique management complications by limiting the time and potentially increasing the costs for dredging operations that plan to use the CAD facility.

Construction techniques also offer another avenue for addressing loss of material. The PANY/NJ and the State of NJ built the Newark Bay Confined Disposal Facility (NBCDF) in a shallow water area seaward of Port Newark/Elizabeth, for the disposal of dredged material that is not suitable for ocean disposal. NBCDF was named a Confined Disposal Facility (CDF), but it is actually a CAD facility. Operations of the NBCDF are managed by the PANY/NJ. A channel cut through the shoals of the Port Elizabeth Channel provides access to the site. The site configuration places the barge within the walls of the facility when it discharges its load, allowing the facility walls themselves to act as barriers to material that might otherwise spread into the bay. This approach may not be possible in channels or the deeper waters of the Lower Bay complex. However, the condition could be mimicked in the Lower Bay by using part of the excavated clean material to create a berm around the CAD facility to confine material lost during discharge to the proximity of the site long enough for it to settle within the facility boundaries.

CAPPING STRATEGIES: Capping, the practice of placing a layer of clean dredged material over an underlying deposit of contaminated sediments, has been used effectively to isolate material of this type from the surrounding environment. The technique is systematically practiced in both aquatic and terrestrial environments. In the Port the procedure has been used often at the regional open water (e.g., ocean) dredged material disposal site, the Mud Dump. Twice in the past five years (1993 and 1997) the practice of placing clean sand over contaminated fine-grained dredged material removed from specific berthing facilities in the Port was carried out. Although never put into practice in the inner harbor areas of the Port, there is no reason to expect that the practice is not feasible in that setting.

In exercising the CAD Facility option, placing a layer of clean material over sediments that have various levels of contaminants may not be the best use of clean material, especially in the areas where the surrounding material is invariably contaminated and is likely to be dispersed. Sedimentation from the surrounding areas of the newly excavated sub channel CAD facilities will most likely take place and could potentially serve to isolate (biologically, chemically, and physically) the dredged material disposed.

POTENTIAL IMPACTS

Use of new CAD facilities would result in the removal of a portion of bay or channel bottom and the organisms that live within it. Though the habitat type (depth and sediment) would be restored within a year or two of construction, this would tend to be of lesser concern within a channel, where sediments are already often subject to regular disturbances from ship traffic and continued maintenance dredging. Outside the channel the impact would depend on the nature and productivity of the habitat that is removed. Within the Lower Bay complex, the two zones designated for new CAD facility construction were selected in part based on a benthic screening analysis that sought to avoid areas of greater ecological value, thereby reducing the environmental impact of the loss (Iocco *et al*, 2000). Within the upper harbor, at Constable Hook and Newark Bay, the benthic populations tended to be less productive. In addition, by digging only small CAD facilities that would be filled in a year, the portion of habitat removed is minimized (generally 50 acres or less), hastening recolonization from surrounding areas. By using coring data to identify areas of deepest sand deposits, the surface area of bottom removed can be reduced even further, with similar disposal capacity being secured by digging the facility deeper instead of wider.

Existing CAD facilities have had many years to develop their own habitats. The 1991 FSEIS (USACE 1991) characterized these habitats as marginal in terms of benthic use, containing many pioneer organisms suggestive of disturbed habitats. More recent investigations have shown the facilities to be somewhat different from each other, especially those in the East versus West banks (WES draft 1998c). Still, the communities present do not represent particularly productive or unique habitats. Filling these artificial features provides an opportunity to return these habitats to conditions more closely resembling their natural state.

Another concern is the potential impact to water quality from the resuspension of contaminants during and after disposal. These concerns can be minimized through proper use of disposal techniques (as described in the preceding section). Using the tidal currents to confine any dispersal within the site boundary could be a very effective strategy. Constructing several CAD facilities in different areas of the Port, and limiting disposal within each to material dredged from that same area would also help confine the contaminants to the waterbody from which they were removed. This technique would confine the loss of contaminants to the very area from which they came, thereby minimizing impacts to areas of little or no contamination, and avoid the need for increased cost for delivery systems or design features. Such a practice may necessitate constructing some very small CAD facilities in areas that may have limited dredging volumes some years (driving up their overall cost), or allowing the sites to be used over several years (keeping them open longer and increasing the impacts to the benthic community and their time for recovery).

Other potential impacts from use of CAD facilities involve the stability of the cap, their effect on shore erosion (redirecting currents or waves), and contamination of underground aquifers. All of these are major factors in the siting process that identified each zone (WES 1998a). On the positive side, use of CAD facilities could help restore areas now contaminated by removing the surface layers of contaminated sediments and replacing them with cleaner material that should support more productive and healthier organisms.

Impacts to prehistoric resources have been initially assessed through a geomorphologic study of Zone 2 and in the proposed in-channel placement areas: Port Jersey/Newark Bay, Hudson River, Bowery Bay, Constable Hook, Red Hook/Bay Ridge and Ward's Point. During the late Pleistocene and Holocene periods these areas were on a relatively dry coastal plain that may have been inhabited by Native American populations. Preliminary analysis suggests that all areas examined have some potential to preserve prehistoric sites, although some are more sensitive than others (LaPorta *et al.* 1998). The area rated to have a "high potential" is Ward's Point. Constable Hook was designated as having a "moderate potential." Bowery Bay and Red Hook/Bay Ridge were classified as "moderate to low." The Port Jersey/Newark Bay area was deemed to have a "low potential" primarily because modern construction has disturbed any remains of prehistoric occupation. The Hudson River channel was assessed as "low potential" for the middle channel where a river channel has been in place prior to any occupation of the area but the outer portions of the river channel have been assessed as "moderate to high."

Background historical research and a magnetic and acoustic remote sensing survey were conducted. No underwater archaeological investigations were undertaken. Current project plans call for the avoidance of targets and anomalies within the project area but if avoidance is not a viable option, additional archaeological investigations of the identified targets will be undertaken. Remote sensing was not conducted for the in-channel disposal options, as the historic dredging in the channels and anchorage areas would have likely removed any historic wrecks or debris.

Existing degraded aquatic habitat represents a disturbed environment from a cultural resources point of view. Any cultural resources that may have existed in these areas would have been significantly disturbed, if not completely destroyed, by sand mining activities. It is unlikely that intact cultural resources eligible for listing on the National Register of Historic Places (NRHP) will remain in existing degraded aquatic habitat if all disposal activities are limited to areas previously disturbed by pit construction.

IMPLEMENTATION

Preliminary CAD facility design was developed for the Lower Bay and the inner harbor (NY/NJ Harbor Partnership draft 1998; WES draft 1998d). Actual availability would take a somewhat longer time than use of existing borrow pits, as they still must go through the permit review process and then be constructed. Construction time to get the first CAD facility ready would, however, be relatively short (under a year) given its likely small size (several MCY depending on a given year's needs). Construction of subsequent sites would be timed to ensure their availability when the preceding site is ready for closure. Table A-5-1 displays estimated costs and capacities for new CAD facilities. It should be noted that the cost for construction of the CAD facility could be offset, at least in part, by selling the clean material or using it for beach nourishment (if suitable). An environmental benefit could be gained if the clean material were to go to remediate the HARS and other degraded habitats within the estuary or ocean.

Because of the potential for excavating sediments that contain contaminants in constructing new CAD facilities in both Newark Bay and the Upper Bay, their costs are relatively high, in the order of, \$24–\$50/CY. Comparatively, costs to construct similar CAD facilities in the Lower Bay were estimated at about \$15/CY for both in Zone 1and Zone 2. The cost to restore existing CAD facilities in the Lower Bay was relatively low at \$1/CY.

As with CAD facilities outside the channel, in-channel CAD facilities could be planned in small cells. The primary concern is not so much preventing recolonization inside the facility but rather decreasing the size of the cell to provide a more cost-effective means of disposing the silty surface material containing contaminants that is dredged during a CAD facility's construction. By creating cells, the preceding site provides a ready place to put material excavated to create the next cell. Obviously, if the silty layer were thick, most, if not all, of a site's capacity would be wasted in disposing of the sediment from the next CAD facility. This explains in part why this option is limited to areas where there is sufficient depth between bedrock and the silty surface layer that contains contaminants.

In-channel CAD facilities, which have the smallest overall capacity (18.5 MCY), could meet the short-term and more immediate disposal needs of the Port through 2005, as projected by Mud-1 (PANY/NJ 1998). Their life expectancy would, however, be significantly shortened if the in-channel sites were used to hold new work as well as maintenance material. The inner harbor sites have a bit more capacity (29 MCY), and in conjunction with in-channel CAD facilities, could meet the Ports maintenance and planned deepening needs through all of the Mud-1 timeframe. Additional zones for potential CAD facility construction were identified within both the Lower (Zone 2) and Raritan (Zone 1) Bays. Preliminary volume estimates indicate that both zones have sufficient capacity to meet all maintenance and new work needs through the middle of the next century. The combination of the two zones could provide a mid- to long-term solution to the Port's dredging needs if a series of CAD facilities were constructed over time. Based on feedback from various resource agencies, Zone 1 is not now considered feasible (preference 5) due to concerns of impacts on biological resources in the Raritan Bay. Zone 2, while located further from the significant habitat complex of the Raritan and Sandy Hook Bays, also generated concerns regarding its potential use. Therefore, at this time the option is considered the least desirable that may potentially be feasible. However, the determination on the feasibility of this zone is pending further evaluation. Consequently, it is not utilized in the formulation of any of the plans in this report. Should future conditions necessitate reevaluation of this option, it may then be reconsidered as viable.

Sequencing the use of CAD facilities over many years would provide the flexibility to respond to changes in sediment quality that may come about as a result of implementing contaminant reduction and/or decontamination measures. If these initiatives function well enough to markedly reduce the future volumes of HARS unsuitable dredged material, the construction of additional CAD facilities could be phased out with no loss of capital investment, as the facilities would only be constructed on an as needed basis. Funding could be requested on an annual or less frequent basis and appropriations adjusted as other options come on line or are unable to meet projected schedules or capacities.

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Table A-5-1. Estimated Costs and Capacities for CAD Facility Options

OPTION	COST	CAPACITY
Utilizing Existing Borrow Pits		
- Lower Bay	$2-$3/CY	28 MCY
New CAD Facilities		
- Newark Bay	$25/CY	16 MCY
- Upper Bay	$35-40/CY	7 MCY
- Lower Bay (Zone 2)	$15/CY	TBD
In-Channel CAD Facilities		
- Newark Bay	$24/CY	10 MCY
- Bay Ridge/ Red Hook	$31/CY	8 MCY

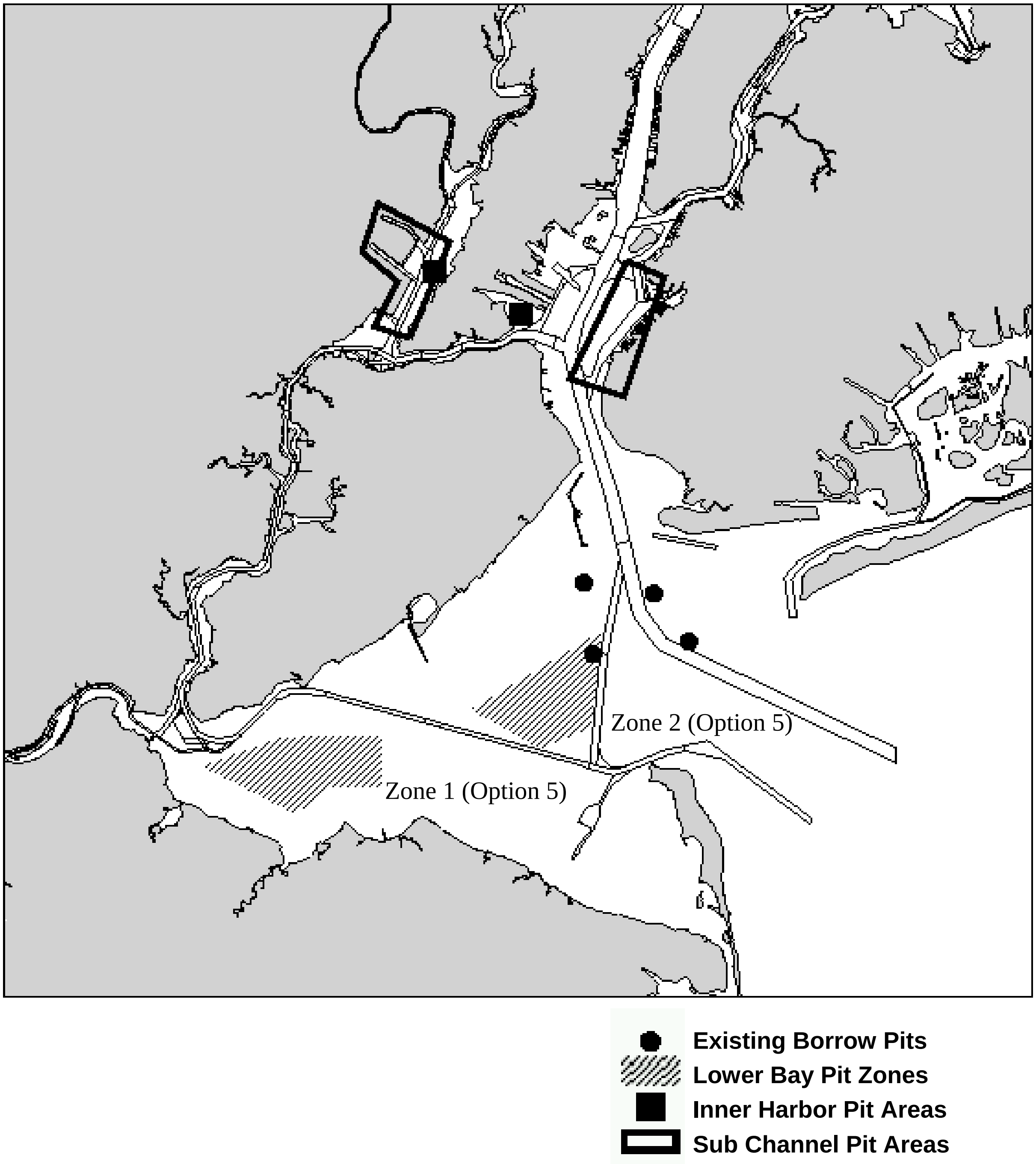

Figure A-5-1. Location of CAD Facility Option

A-6 CONFINED DISPOSAL FACILITIES (CDF)

A CDF involves the construction of dikes or other retention structures lined with impermeable material to contain dredged material isolating it from exposure to the environment. Dredged material can be placed within the dikes of the CDF through a variety of methods. Monitoring is typically conducted periodically in areas adjacent to the CDF to ensure safe containment of the dredged material. Excess surface water is clarified by ponding, treated, as necessary, to meet applicable effluent standards, and released. Active or passive consolidation techniques may be employed to maximize the usable capacity of the CDF. Once filled, the CDF is capped with appropriate material, permanently isolating the dredged material. The CDF dikes can be built on land, in water adjacent to land and in open waters to create an upland, nearshore or island CDF, respectively. Upland, nearshore, and island CDFs have been used in the U.S. and other countries for the disposal of contaminated dredged material.

A.6.1 UPLAND CONFINED DISPOSAL FACILITY

DESCRIPTION

Upland disposal involves the construction of dikes or other retention structures with impermeable material or liners on land to contain dredged material. The upland CDF is then capped when it has been filled to its design capacity. The effluent is tested prior to discharge from the facility, and the adjacent surface and ground water is monitored to ensure that the material is properly contained (USACE 1997). Upland CDFs can be used to contain sediments that do not pass testing protocol for HARS placement.

Containment dikes can be constructed of almost any type of soil material with the exception of very wet fine-grained soils and those containing a high percentage of organic matter. High plasticity clays may present a problem because of detrimental swell-shrink behavior when subjected to cycles of wetting and drying (USACE 1987).

Geotextiles are used in dike construction to provide tensile reinforcement where it will increase the overall strength of the structure. A liner may need to be constructed within the facility along with a storm water collection system or a water treatment facility to provide safeguards against loss of material through leaching (USACE 1996).

The general construction sequence for a containment dike is foundation preparation, transportation, and placement of the dike materials in the embankment, and manipulation and possibly compaction of the materials to the final form and shape (USACE 1987).

POTENTIAL IMPACTS

Any water bodies on upland CDF sites are likely to be adversely impacted. This could include streams that may need to be rerouted or ponds that may be lost. Chemical impacts revolve around the loss of contaminants from the site, which is minimized by a number of design techniques and control measures such as effluent treatment and geotextile liners.

Use of upland CDF sites would effectively eliminate their use by flora and fauna until the sites cease to be used. The final use of the site would dictate its value for fish and wildlife. Secondary impacts might arise in conjunction with loss of contaminants, a risk that is reduced by factors designed into each site-specific facility.

People at risk include those who consume fish from nearby bodies of water where bioaccumulation of compounds of concern is an issue. Site location and design would minimize or eliminate this risk, and site monitoring would ensure the site was operating as designed.

In general, this option has the potential to impact a wide range of cultural resources if modern construction or land clearing activities has not already disturbed the proposed site. Potential resources may include standing historic structures, prehistoric and historic archaeological sites and historic landscapes. A cultural resources assessment will be undertaken for specific upland sites once they are determined.

IMPLEMENTATION

The DMMP Interim Report (USACE 1996) identified 16 potential upland CDF sites that met preliminary site screening criteria. Six primary criteria were used for the site screening study:

1. Located within the limits of the defined study area,
2. Located within a defined distance from tidal waters,
3. Suitable existing site land uses,
4. Satisfied minimum size requirements,
5. Satisfied minimum dimension requirements, and
6. Contained suitable topographic constraints.

In the spring of 1997, the NYD held a series of public information meetings at which local citizens and public officials provided feedback regarding potential upland CDF sites. Based on the comments from those meetings and subsequent letters and feedback from the States indicating that there was lack of support for many of the sites, only one site remained under consideration. This site is located in Belford, Monmouth County, NJ (designated UD-7 in the Interim Report). The Belford site covers a relatively small area with an estimated volume capacity of 275,000 CY. However, since the volume of dredged material from the projects located in this area is also small, a CDF designed and constructed on this site may provide many years of maintenance capacity for those local projects. A 20-acre portion of this site, commonly referred to as N61, was historically used for disposal of material dredged from the area. Dredged material could be placed in the facility and allowed to de-water over time. The ultimate placement of the de-watered dredged material will be for an 85-acre landfill closure project adjacent to the N61 site. Given the currently proposed use of the site to remediate the landfill, further evaluation of this site has been transferred to land remediation in the beneficial use section of this report (See Section A.3.3, and Section 2.3.3 Land Remediation in the DMMP – Implementation Report).

At the request of State and County officials, the Belford CDF site may potentially be utilized in the future for disposal of material generated only from navigation projects located in the waters of Monmouth County. However, at this time the likelihood of future use of the site for temporary or permanent placement of dredged material from Monmouth County water is unknown. Given the uncertain nature of the future use of the site though, it is classified as a preference 3 option and not included in the formulation of the DMMP. Consequently, now there are no sites being investigated strictly as upland CDF sites.

The DMMP Interim Report (USACE 1996) provided a generic upland disposal expense of $25–$35/CY, with most sites initially identified having total capacities of only 1.3–3.3 MCY of sediment.

Ultimately, the decision on the acceptability of dredged material placement in an upland site is made by the states under their guidance for end-use acceptability.

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A.6.2 NEARSHORE CONFINED DISPOSAL FACILITIES

DESCRIPTION

Nearshore CDFs involve the construction in coastal waters of an enclosing dike, attached to land, isolating the interior ponded water from exchange to the ecosystem. Once the dike is constructed, the inner area is filled with dredged material and then capped to isolate the material from the environment. Nearshore CDFs have been used extensively nationally and internationally for containment of contaminated sediments. Craney “Island” in Norfolk, Virginia is a peninsular containment facility built in the 1970’s to contain dredged material from the inner areas of the Port of Norfolk. Highly contaminated sediments from a Superfund site in the Puyallop River in the Port of Tacoma, Washington were used to fill an adjacent nearshore CDF to expand Port facilities and to remediate the Superfund site. The largest CDF in the world, the Slufter in the Port of Rotterdam, the Netherlands, was constructed to contain approximately 200 MCY of contaminated sediments dredged from inner areas of the Port.

This disposal method has been used extensively over the past two centuries for creating land throughout the Port using a broad variety of materials. Given the limited area available in the inner portions of Harbor, most sites that have been discussed are generally limited to total volume capacities of a few million cubic yards capacity. Further, if sites are selected and implemented, their size limitations would make effective consolidation of material placed within the site difficult. Consequently, additional active consolidation techniques would likely need to be employed if the ultimate use of the site (e.g., container port facility) required structural stability.

Several materials could potentially be used for constructing the dikes, depending upon several factors (e.g., physical environment - wave regime, sediment strata, etc.). Built of materials such as armored stone/sand, steel sheet pile and geotextiles, the dike would be designed to withstand coastal and potential shipping forces that it would be exposed to. Once the dike structure is built and isolation of the interior waters achieved, dredged material would be placed into the CDF. Effluent from the site would be treated, as necessary, to meet applicable water quality standards. Once filling is complete, the site is then capped with materials such as sand, soil, and geotextile membranes to isolate the fill material from exposure to the upland environment. The land created from this process can then be utilized for a variety of purposes including upland habitat creation, commercial development (typically Port related), or recreational uses.

POTENTIAL IMPACTS

While environmental impacts would need to be evaluated in detail once a specific site is proposed for implementation, the main environmental impact that would result from the implementation of a nearshore CDF is the permanent loss of nearshore aquatic habitat and associated species. With the development and urbanization of the Port region in the past several hundred years, a substantial acreage of nearshore habitat has been lost to filling activities. Consequently, any potential implementation of a nearshore CDF in the region would likely require some type of “out-of-kind” mitigation to generate an equivalent or net beneficial environmental impact. The Empire State Development Corporation (ESDC) has recently initiated a three-year investigation of nearshore habitats to assess their use, value and potential mitigation need. The study will also evaluate reef-like modules for their potential to replace structure and low energy habitats lost if this option were to be implemented.

Other environmental impacts that would need to be evaluated with a nearshore CDF include the effect of effluent on adjacent water quality conditions, groundwater contamination, human health and ecological risk assessment of potential contaminant uptake. These factors have been shown in other regions with similar material to be controllable through proper site design and management. These potential effects would be evaluated on a case-by-case basis in a supplemental environmental impact statement or other NEPA document in a suitable time before the options were needed (see schedule below).

Two types of cultural resources, prehistoric and historic, may be potentially impacted as a result of implementation of a nearshore CDF. Prehistoric archaeological sites may exist in the near-shore area, but would probably be buried under thick accumulations of sediment or considerable landfill. Additional studies may be required. Many near-shore resources in the NY area, such as piers and waterfront structures, have been listed on or determined as eligible for listing on the National Register of Historic Places (NRHP). Some of these historic properties however, may have been recorded and removed as specific projects proceeded. Additional studies to identify other resources may be required. Indirect impacts to historic sites will also need to be assessed. This work should evaluate the effects of the proposed facility on landscape and setting as well as on the viewsheds of significant properties like the Statue of Liberty and Ellis Island, two National Historic Landmarks. Historic resources of particular concern for CDFs proposed immediately adjacent to the shoreline are derelict vessels and waterfront structures such as bulkheads, wharves and piers related to industry and historic landfilling. Dredging may have occurred along segments of shoreline that could have adversely impacted resource preservation.

IMPLEMENTATION

To implement the nearshore CDF option, a site would have to be identified, preliminary plans developed against which potential impacts could be assessed. Additional NEPA evaluations and documentation would be prepared concurrent to physical characterization and design of the facility as specific sites are identified and proposed. Following these tasks and with the acquisition of the necessary Federal and state permits, the project cooperation agreement (PCA) would be executed (for a Federal action) and the facility constructed. Table A-6-1 displays a tentative schedule for completion of implementation tasks as part of the NEPA process.

Table A-6-1. Implementation Tasks Tentative Schedule

	Year				
Main Tasks Needed to Implement Option	1	2	3	4	5
Identify Site & Prepare Preliminary Site Plans	→				
Prepare NEPA Documentation (e.g., EA, EIS)	→	→			
Characterize Sediments at Site	→				
Prepare Designs/Plans & Specs	→	→			
Obtain Permits, Acquire site, Execute PCA & Construct Facility		→	→		
Operate Facility			→	→	→

Several sites have been discussed for potential nearshore CDF construction in the Port. Three nearshore CDF sites have been identified that may use dredged material. These sites are OENJ Bayonne, Phase 2 (Constable Hook flats), NJ; Atlantic Basin, NY; and South Brooklyn Piers, NY. If all these sites were implemented, their total capacity is approximately 12.75 MCY. The placement cost per cubic yard for these nearshore CDF sites is dependent on the size and end use, however costs have been estimated to range from approximately $29–$42/CY.

Other nearshore fill sites are also under consideration for Port expansion by the PANY/NJ, the NYC Economic Development Corporation (NYCEDC) and other agencies. Given that these facilities are under consideration primarily for Port expansion and not necessarily for dredged material disposal, it is now uncertain whether dredged material would be used for fill material at these facilities and, if so, what the price and capacity would be. Should they be designed to use dredged material (presumably stabilized) and be comparably priced with other potential dredged material options, they would then be incorporated into this DMMP.

Given the limited available nearshore habitat in the inner Harbor, none of the identified sites are preferred. Based on the existing habitat and the potential for water-dependent development in the different regions of the Port, the preference of the three identified nearshore CDF sites ranges from 4–5.

A.6.3 ISLAND CONFINED DISPOSAL FACILITY (CDF)

Environmental assessment of this option has determined that while the project is feasible from an engineering standpoint, and would be cost effective, both potential and perceived environmental impacts are unacceptable. An island CDF is therefore a non-preferred option in the DMMP and is no longer under consideration. The following is provided solely for information purposes.

DESCRIPTION

An island CDF (also known as a containment island) involves the construction in open bay or ocean waters of an enclosing dike isolating the interior from exchange to the ecosystem. Once the dike is constructed and interior containment achieved, the inner area is filled with dredged material (typically over many years or decades) and ultimately capped to isolate the material from the environment.

The dike of an island CDF is a maintainable, permanent structure designed to withstand extreme coastal storms without failure or loss of material. Dredged material is placed inside the facility by pumping or mechanical transfer methods. As dredged material fills the isolated interior area, water is displaced. Excess water is treated (as necessary to meet applicable water quality standards) and released from the facility through a weir system. To ensure proper containment, periodic monitoring of the waters, sediments and biota surrounding the facility would be performed.

Once dredged material fills the facility to the point that it is exposed out of the water, passive and/or active consolidation and dewatering techniques would likely be employed to consolidate the sediments. This would maximize the useable volume capacity of the facility and/or minimize the size (i.e., acreage) needed for a selected volume capacity. Natural/passive sediment treatments have been found to occur or are typically incorporated into CDF options. These include sand separation/reclamation, mineralization, bioremediation, photolytic degradation, etc. When applicable, these treatments can be used to reclaim usable materials from the sediments (e.g., sand), or to stabilize/decontaminate the sediments further reducing their potential adverse environmental impacts.

Once filling is completed, the structure would be capped with clean fill material, resulting in newly created land that may be used for a variety of purposes. These purposes could include commercial development, stationing harbor operations/management, siting decontamination processing facilities, recreational uses (e.g., beach facilities), and wildlife uses (e.g., upland habitat creation).

Similar to nearshore CDFs, island CDFs have been used around the world, including the eastern seaboard of the U.S. Hart-Miller Island, a 1,140 acre CDF, was constructed in the early 1980's in the Chesapeake Bay north of Baltimore Harbor to contain contaminated sediments dredged from the inner areas of the Port of Baltimore. A new island CDF known as Poplar Island is under construction in Chesapeake Bay for containment of dredged material, as part of a habitat restoration effort.

TECHNIQUES & SITES

The primary feature defining an island CDF is the perimeter dike. Many methods and materials can be utilized to construct the dike to ensure both containment of the material placed within the facility and protection of the facility from coastal storms. Coastal storm events, such as Nor'easters or hurricanes, can transfer large amount of dynamic forces upon the dike structure. The design of the dike structure must encompass factors such as wave height, wave period, currents, storm surge, water depth, foundational sediment strata and physical characteristics, anomalous geologic events (e.g., earthquakes), and the characteristics of the material to be placed within the facility. As most of these factors are affected by physical and geological conditions, siting of the island CDF is directly related to the dike design.

During the early stages of the DMMP study, the Corps reevaluated preliminary siting efforts performed in the region in the past two decades to develop siting criteria to identify suitable locations in the Harbor and Bight for island CDFs. These siting criteria included biological factors (bottom-dwelling organisms, fish distributions, and habitat types); geological conditions (surficial, subsurface, sediment transport, seismicity); cultural resources (historic features, aesthetics); chemical make-up (sediment chemistry, biological test results); and physical factors (bathymetry, baseline data, wave, current and storm characterizations). Based on the siting criteria, the NYD identified three areas or zones of siting feasibility for the potential construction of an island CDF or CAD facilities (USACE 1996). These three zones were identified as Zone 1 (south-central part of Lower Bay including part of Raritan Bay), Zone 2 (central part of Lower NY Bay), and Zone 3 (north-central part of the NY Bight Apex, near Diamond Hill / Ambrose Light).

A preliminary evaluation of subsurface conditions, along with feedback from the States, environmental organizations, the fishing industry, and other stakeholder agencies, resulted in a revision to the siting criteria and data identifying the two zones of siting feasibility (Zone 2 and 3) for potential island CDF construction (Figure A-6-1). (Note: Zone 1 in Raritan Bay was previously only identified for potential CAD facility construction, which has subsequently been dropped from further consideration). The NYD has coordinated the siting criteria and GIS-based data layers used in this siting effort with the involved Federal, state and local agencies (WES draft 1998). Comments from other Federal and state agencies have been received along with the preparation of preliminary engineering design information on Zones 2 and 3. With this information, Zones 2 and 3 will undergo further revision to reflect this information.

An island CDF would be sited within one of these zones or their revised locations when finalized. Site-specific studies would need to be performed in the selected zone in conjunction with planning and design constraints to identify its exact size and location. Based on current projected dredging needs an island CDF would occupy a fraction of the area of either Zone 2 or 3. For example, using construction methods that minimize the area impacted, the largest island CDF potentially needed to meet the regions long-term dredging needs would have approximately 100 MCY capacity. It would take up approximately 625 acres or 18% of Zone 2 or, if sited in Zone 3, 525 acres or 21% of the zone.

Extensive data and modeling efforts have been performed and are underway to better characterize the region for the siting and design for construction of a potential island CDF. Geophysical surveys, corings, vibracores, surficial sediment grabs, sediment profile imagery, and cultural magnetometer surveys have been performed in these zones to further characterize their engineering, biological and cultural suitability. Numerical modeling of wave climatology, nearfield currents, water quality, shoreline impacts, etc. has been performed to evaluate the siting and design of potential island CDFs in Zones 2 and 3.

The primary materials under consideration for potential construction of an island CDF dike are an armored stone/sand dike (Zone 2 or 3) or concrete caisson (Zone 3). The design of the dike structure has been evaluated from many different engineering perspectives (Moffatt & Nichol Engineers draft 1998). These factors include dike height, island size and shape, project life, cellular (or modular) construction, etc.

Containment of contaminants into an island CDF is fundamental to the primary purpose of the facility. Evaluations of non-HARS dredged material composited from several Federal navigation projects in the Port indicate that once material were placed within an island CDF, clarifying the effluent (by ponding) will treat the supernatant to make it acceptable for release. Also, tests of the harbor composite dredged material show that an island CDF would allow up to approximately 30% consolidation of sediments placed within the facility over time. This consolidation would increase the final capacity and/or reduce the impacted area for a specified volume capacity.

Several construction and operation methods may be used to minimize the impact that the acreage needed for a selected capacity would have. One method involves excavating the interior area of the facility to minimize its footprint. While this may not be possible in currently identified Zone 3 due to the existing water depth, it would reduce the size by approximately 40% in Zone 2 for the same disposal capacity. The excavated material may then be used in the construction of the facility or used beneficially (e.g., beach nourishment, construction aggregate, and habitat restoration/creation). An alternative method involves the construction of modular or sectional island CDF cells. While utilizing this method would increase the price per cubic yard of this option, it would allow for greater flexibility in planning and a reduced impact to the environment, particularly if future conditions demonstrate that full construction of the facility is no longer necessary.

Due to the economies-of-scale, the price/CY of material placed within an island CDF decreases as the size of the facility increases (including construction, engineering and design, supervision and administration, and operation and maintenance expenses for a 50-year project life). Due to the deeper water and increased wave heights, this is particularly notable with an island CDF sited within Zone 3. To be cost-effective, island CDFs are generally constructed and used for dredged material disposal over many years or decades due to the relatively large initial cost of construction. Due to the economies-of-scale and the prices of other options, an island CDF in Zone 2 is not considered viable at volumes of less than approximately 50 MCY. Similarly, an island CDF in the currently identified Zone 3 is considered less favorable than an island CDF in Zone 2 due to the considerably increased price.

Due to the potential environmental impact that an island CDF would have on the loss of bottom habitat, mitigation would likely be necessary. Since in-kind mitigation (i.e., creating more bottom habitat) is not feasible, out-of-kind mitigation methods would need to be employed as acknowledged at an interagency scoping session held on May 1, 1998. These methods may include creation of reef-like structures around the island CDF dike for varied fish habitat, restoration of degraded *Phragmites australis*-dominated wetlands in the area, restoration of anadromous fish runs (by removing dams and other obstacles), restoration of shellfish habitats in other impacted areas, creation of bird habitat in other areas of the harbor, etc. Identification of specific mitigation methods would be evaluated and incorporated into the price of an island increasing its total price and price/CY.

An island CDF could generate ancillary benefits in the potential end-use of the land created. Any potential economic benefits to be attributed to such an island are a function of its eventual uses. It should be noted that benefits attributable to an island as land are impossible to evaluate without knowledge of the services (e.g., utilities, transportation) that may be available on the island. As a result, a preliminary list of possible uses for such an island serves as a means of arriving at a general estimate of these potential benefits.

The most immediate uses of such an island are recreational. For example, the Port of Baltimore's Hart-Miller Island, 1,140 acres in size, currently offers recreational opportunities to visitors who arrive by boat. If utilities are provided on such an island, additional uses are also possible. The Sandy Hook Pilots have expressed an interest in establishing a pilots' station on an island CDF to facilitate the harbor movements of the pilots. An island CDF may also serve as a logical location for a sediment treatment/decontamination facility. In fact, physical sediment treatments (e.g., sand separation) would likely be employed to recover usable sand from the material when feasible. This technique has been used in both the Hart-Miller Island in the Port of Baltimore and at the SLUFTER CDF in the Port of Rotterdam, the Netherlands. In addition and on a more ambitious scale, an island CDF may also serve as a site for a power-generation plant or a small airport. Examples of such uses exist in Asia.

POTENTIAL IMPACTS

The most notable impact resulting from the potential construction of an island CDF, both in the bay and the ocean, would be the permanent loss of the benthos, and, to a lesser extent, the water column. As partial offset for the loss of bottom habitat, a relatively small amount of "reef-like" surface area would be created from construction of the dike structure, more so at Zone 3 than 2 due to the greater water depth.

Biological sampling associated with siting for either site for a potential island CDF indicates that neither site has unique benthic communities. Further, Zone 2 is sited in an area of the Lower bay that has relatively lower benthic community productivity. Once the facility is filled and capped, an equivalent amount of upland would be created, and could be made available for wildlife (especially birds).

Slow moving fish or immobile megainvertebrates would be directly impacted by the construction of an island CDF; however partial mitigation by transplanting and/or relocation of certain megainvertebrates (e.g., clams) may be possible prior to construction. A preliminary ecological screening-level risk assessment (Cura *et al.* draft 1998) has indicated that care would need to be given during the filling of the facility to minimize the avian colonization of the interior of the facility. Cetaceous mammals (e.g., whales and dolphins) would also be indirectly impacted through the loss of water column habitat however when compared to the total amount of water column available, this loss is not considered substantial. Pinniped mammals (seals) would also lose foraging habitat but would also potentially gain winter haul-out areas along protected areas of the dike structure.

Endangered and threatened species that inhabit and/or migrate through the study area include four species of sea turtle, the peregrine falcon, the bald eagle, the piping plover, the roseate tern, and several species of cetaceans. If this option were selected for further evaluation and/or implementation as a part of the DMMP, coordination with the USFWS or NOAA Fisheries, as appropriate, would be undertaken to assess the likelihood and magnitude of the potential impacts and any reasonable and prudent actions that need to be used to avoid the impacts.

Due to concern for the potential adverse impacts to the local benthos and water column from effluent of an island CDF, environmental testing was conducted of sediments that would be placed into the potential facility. The results indicated that contaminants, which tend to remain bound to the sediment particles, would be retained within the structure by allowing sufficient ponding of the supernatant. This settling process would make the effluent acceptable for release into the water column (WES *in preparation*).

Due to the distance from shoreline and the wider window of prominent wave attack, shoreline impact modeling studies indicate that an ocean island CDF would not affect adjacent shorelines. However, an island CDF in Zone 2 of the Lower Bay may protect shorelines along the eastern to southeastern sections of Staten Island due to the sheltering effect the island would create. If this option were selected for further evaluation and/or implementation, additional shoreline impact studies would be needed to determine the potential beneficial or adverse impacts that this sheltering may create.

Monitoring and notices by the U.S. Coast Guard would counter any shipping/navigation hazards that an island CDF may create to ensure the safety of commercial shipping. Noise and air quality impacts resulting from the potential construction and operation of an island CDF in either Zone 2 or 3 are anticipated to be minimal given the distance of the zones from the mainland, the prevailing wind direction, and the control measures that are possible to minimize volatilization of contaminants or fugitive dust release from the facility. Aesthetic considerations were included as both exclusionary and ranking criteria in the siting of Zones 2 and 3. As Zones 2 and 3 are also in areas of notable recreational use, aesthetic concerns related to fishing and boating activities as well as potential recreational impacts would need to be evaluated further.

A geomorphological study is currently being conducted to assess the potential for prehistoric resources in Zones 2 and 3. The data generated from this study will be used to reconstruct the paleo-environment and ascertain areas that may have been favorable for site locations and that are more likely to be preserved, having withstood geological and human scouring processes. Preliminary analysis suggests that Zone 2 has a high potential to preserve prehistoric data although some areas within the zone are more sensitive than others while Zone 3 has been assessed as possessing a "moderate potential" (LaPorta 1998).

For Zone 2, background historical research and a magnetic and acoustic remote sensing survey were conducted in March and April 1998. No underwater archaeological investigations were undertaken. The preliminary analysis of the data suggests that two targets have the potential to be submerged cultural resources (Cox 1998). Current project plans call for the avoidance of targets and anomalies within the project area. If avoidance were not a viable option, additional archaeological investigations of the identified targets would be undertaken.

IMPLEMENTATION

An initial engineering and environmental siting process identified potential sites in the Lower Bay and NY Bight Apex for an island CDF. Given the volume and potential lifespan under consideration for an island CDF, an approximate capacity of 50–100 MCY, an approximate size of 350–625 acres, and an estimated placement cost of $13-$30/CY (not including potential mitigation costs) are projected. Due to the economies-of-scale involved with island CDFs, the minimum capacity under consideration has been 50 MCY, unless a modular or cellular construction method was employed. Preliminary environmental assessment of this option has determined that while the project is feasible from an engineering standpoint, and would be cost effective, both potential and perceived environmental impacts for an island CDF in these waters are unacceptable. An island CDF is therefore a non-preferred (preference 5) option in the DMMP, and is no longer under consideration (status 5).

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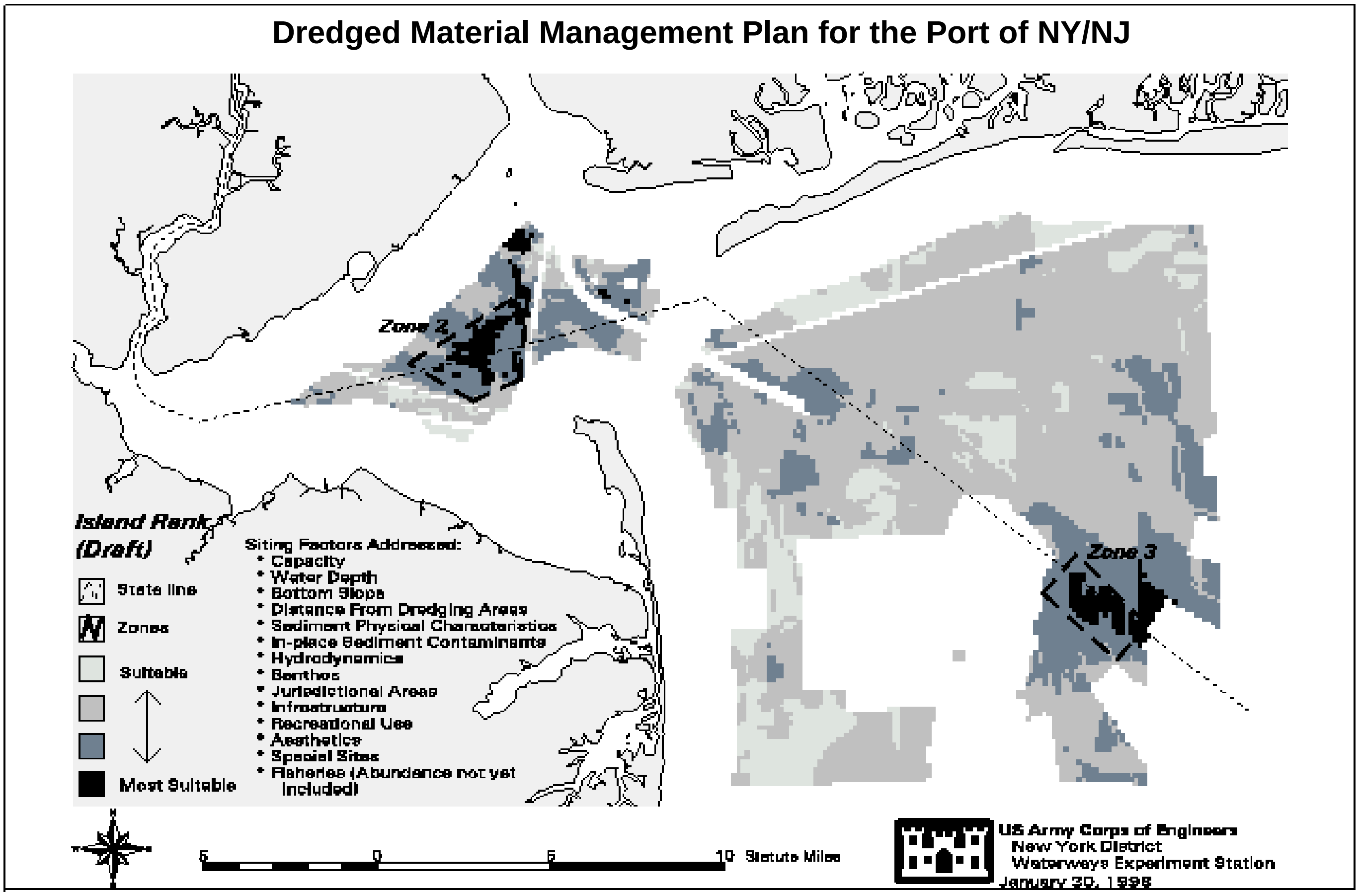

Figure A-6-1. Potential Island CDF (Containment Island) Zones of Siting Feasibility

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B VOLUME PROJECTION ANALYSIS & DETAIL

B-1 DATA SOURCES AND ASSUMPTIONS

Based on information provided by the Corps, the States of NY and NJ (States), and the Port Authority of NY and NJ (PANY/NJ), a detailed database of projected dredging projects was prepared for the Dredged Material Management Plan for the Port of New York and New Jersey (DMMP) (see Table B-2-1). For purposes of developing this database, several factors that can effect future dredging could not be taken into account. These factors include timely authorization and funding of dredging projects, future shoaling rates and anomalous storm events, channel usage, changes in testing protocols, availability of sufficient dredging equipment, and final determination of the acceptability (for ongoing deepening studies). Consequently, these figures should be considered the maximum likely dredging that is anticipated to occur during the DMMP planning period (i.e., 2005–2065), based on current conditions and testing methods. Further, as these figures are subject to constant change, they should be viewed as a “snapshot” in time of anticipated future dredging needs. For the purposes of the DMMP (i.e., identifying options and an approach for their use), small changes in the amount or sequencing of the dredging projections should not affect the overall plan developed substantively.

In the database, each project was broken down into the following fields:

- Corps or non-Corps dredging
- New work (deepening) or maintenance dredging
- Type of material to be dredged (see below)
- State boundaries (NY, NJ, or Shared Waters)
- Waterbody (see below)

As the purpose for the DMMP is primarily to identify sufficient management options for Corps dredged material for at least the next 20 years, the database separated dredging projections by Corps and non-Corps dredging. Figure B-2-1 presents the volumes of Corps and non-Corps dredging projected for the next 10 years. It clearly shows that the vast majority of dredging that is projected to occur over the next 10 years is to be performed by the Corps, as part of either deepening or maintenance work.

For maintenance material, project-specific projections were used for years 2005–2065 and were based on past dredging records. For deepening material, the most recently available volume projections and schedules for construction from each of the ongoing Corps’ deepening projects were used. The following Corps deepening projects were used:

- Kill Van Kull & Newark Bay Channels, 50’
- Arthur Kill to Howland Hook Channel, 40–50’
- Port Jersey Channel, NJ, 44.5–53.5’
- NY & NJ Harbor Navigation Anticipated Recommended Channels
    - Ambrose Channel, 53’
    - Anchorage Channel, 50’
    - Port Jersey Channel, NJ, 44.5–53.5’
    - Kill Van Kull Channel, 50’
    - Arthur Kill to Howland Hook, 40–50’
    - Newark Bay Channels, NJ, 50’
    - Bay Ridge Channel, NY, 50’

Figure B-2-2 plots the total projected maintenance and deepening (new work) material projected for the next 10 years. For most years, the majority of material to be dredged is from one or more of the deepening projects listed above. For each area of the Harbor that is deepened, the predicted incremental increase in maintenance dredging (due to increased sedimentation from the deeper water) is included once the deepening is completed. These incremental increases vary considerably throughout the harbor and are synergistic in nature.

Since many different dredged material options under consideration are limited to or targeted for dredged material with specific chemical or physical properties, the volume projections were broken down into 7 different types of material. These material types are as follows:

- Sandy HARS (Historic Area Remediation Site) suitable material (A) – Potentially suitable for HARS remediation, habitat restoration/creation, beach nourishment, construction aggregate, etc.
- Fine-grained HARS suitable material (B) – Potentially suitable for HARS remediation or habitat restoration/creation.
- Glacial Till/Mixed HARS suitable material (C) – Potentially suitable for HARS remediation or other beneficial uses.
- Stiff Clay HARS suitable material (D) – Potentially suitable for HARS remediation, fill for habitat restoration/creation, land remediation (e.g., landfill cover/cap), etc.
- Rock Material (E) – Potentially suitable for fish reef creation or construction material.
- Non-Ocean Placement (i.e., HARS unsuitable, or Non-HARS) material (F) – Potentially suitable for inshore disposal at selected habitat restoration/creation sites (e.g., degraded aquatic habitat), land remediation (typically stabilized), or for construction material (typically stabilized or decontaminated).
- Non-Ocean, Unsuitable for Upland Placement material (G) – Elevated contaminant levels to the extent that decontamination rather than solidification/stabilization (S/S) methods are desired prior to upland placement (e.g., land remediation, construction material) or other uses.

Figure B-2-3 shows the amount of each of these types of material projected to be dredged over the next 10 years. Given the substantial amount of deepening projected to occur over this time period, the total amount of HARS suitable material is approximately twice that of non-HARS material. This is essentially the reverse proportion between HARS and non-HARS material than what is projected into the out-years for maintenance material alone.

Since one of the major constraints to developing a DMMP for the Port is the state boundary, the volume projections distinguished each project to the waters from which the material is to be dredged. All private projects and some Federal projects were classified into either of the two States while some Federal projects which lie upon the state line were identified as being in both State's waters (i.e., shared waters). Figure B-2-4 shows the anticipated amounts of material coming from each of these three areas (NY waters, NJ waters, and shared waters). From it, one can see that the largest amount of dredging over the next 10 years is from shared waters (which is exclusively Corps material), followed by NJ and NY, respectively. This again illustrates the large volumes of material projected to be dredged from deepening projects in shared waters over the next 10 years (e.g., Kill Van Kull, Arthur Kill, and Ambrose channel).

Lastly, given the desire to keep the material as close as is feasible to the location from which it was dredged, the volume projections were characterized by geographic location (i.e., the waterbody from which the material is to be dredged). For this, 8 different geographic waterbody areas were defined and used in the database. These 8 areas are as follows:

- Newark Bay & tributaries (NB) – Bayonne Bridge to Shooter's Island and upstream tributaries, Passaic and Hackensack rivers
- Arthur Kill (AK) – Shooter's Island to Wards Point
- Kill Van Kull (KVK) – Constable Hook to Bayonne Bridge
- Upper Bay (UB) –Battery to Constable Hood to Narrows
- Hudson River (HR) – Battery to Tappan Zee
- East River and Western Long Island Sound (ERLIS) – Battery to Sound
- Jamaica Bay (JB) – Within Breezy Point/Coney Island Transect
- Lower Bay, Transect and NY Bight Apex (LBA) – Including tributaries, Narrows to Wards Point (including Raritan River, Shrewsbury and Navesink rivers) to Sandy Hook to Rockaway Peninsula to NY Bight Apex (outside transect)

Figure B-2-5 shows the volume projections by geographic areas. Since much of the dredging projected to occur over the next 10 years is produced from deepening of the Port, and since deepening typically is performed from outward boundaries (Apex) inward to the berthing facilities, the figure reflects this general geographic progression resulting from the deepening. Large amounts of dredging are planned in the Lower Bay area followed by the Upper Bay area then the KVK/AK/NB areas.

B-2 LONG-TERM PROJECTIONS

The detailed dredging volume projections for the Project (2005–2065) are presented in Table B-2-1. Additionally, a two-page summary of the future dredging requirements from 2005–2014 is shown on Table B-2-2. In this table, long-term maintenance amounts are based on flat-line projections of HARS and non-HARS material (i.e., no contaminant reduction). However as described in Section A-2 of this Appendix, contaminant reduction efforts are now underway and the targets established are assumed to be realized in the outyears (beginning in 2012 and on). Figure A-2-10 illustrates the significant amount of non-HARS material that is projected to be converted to HARS material through ongoing and future contaminant reduction efforts. If over the period of 2012–2065, the contaminant reduction targets can be met, then approximately 52 MCY of HARS unsuitable material will have been converted to HARS suitable material.

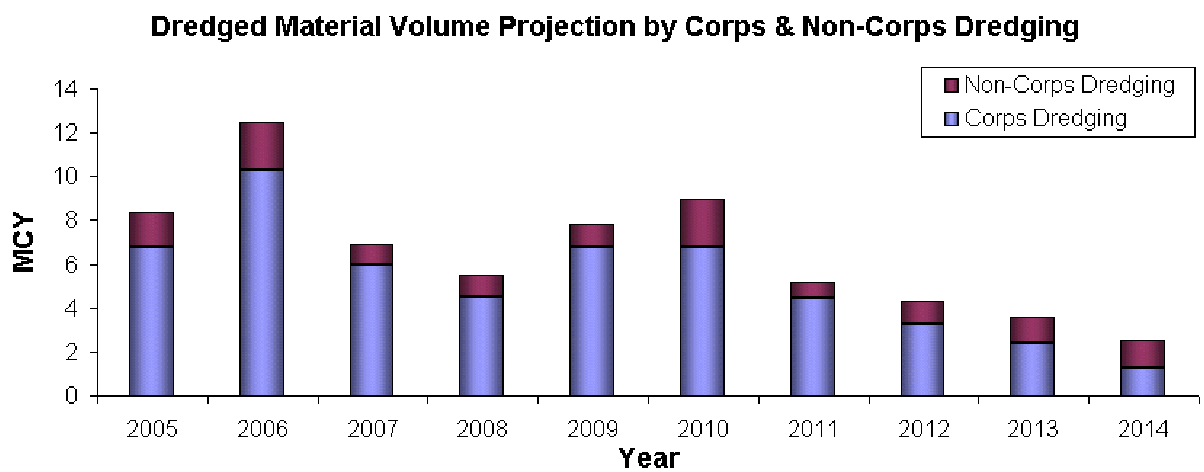


Figure B-2-1. Dredged Material Volume Projections by Corps and Non-Corps Dredging

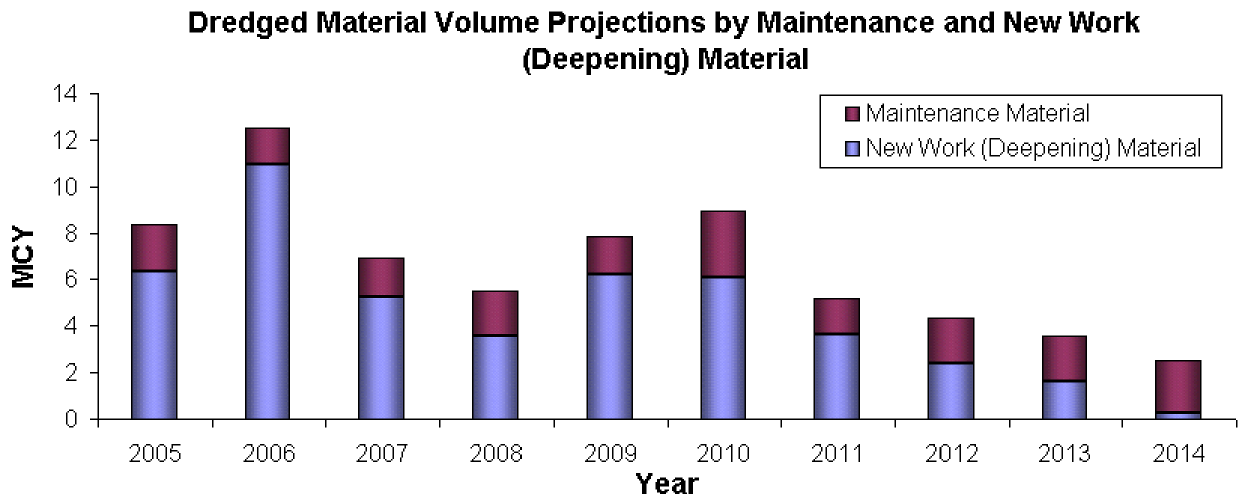
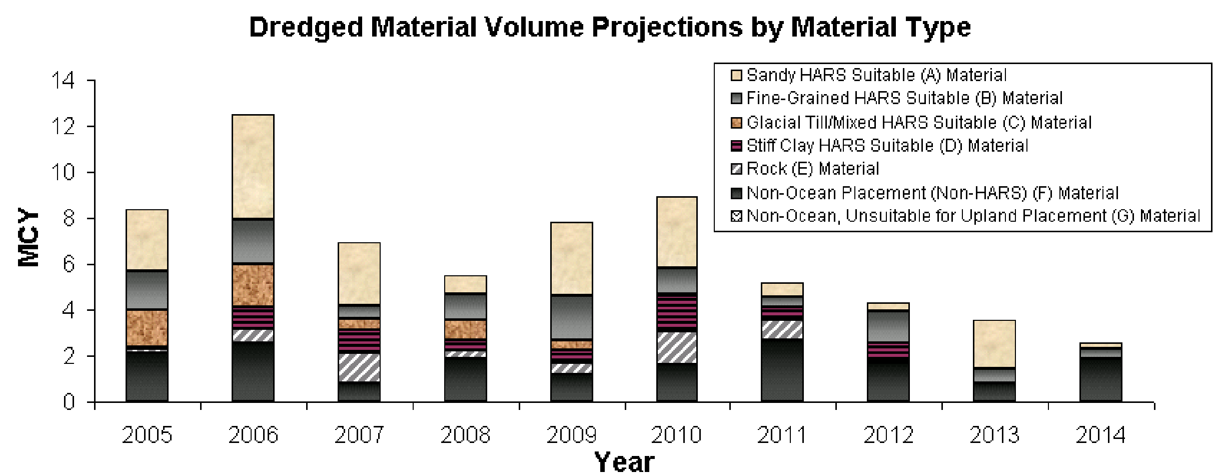


Figure B-2-2. Dredged Material Volume Projections by Maintenance and Deepening Material



Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Figure B-2-3. Dredged Material Volume Projections by Material Type

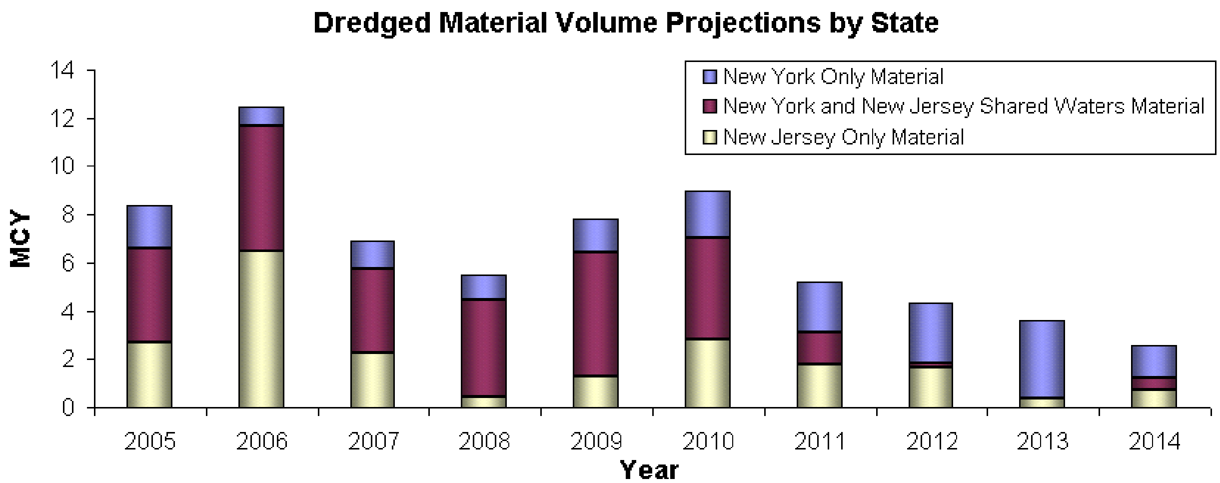


Figure B-2-4. Dredged Material Volume Projections by State

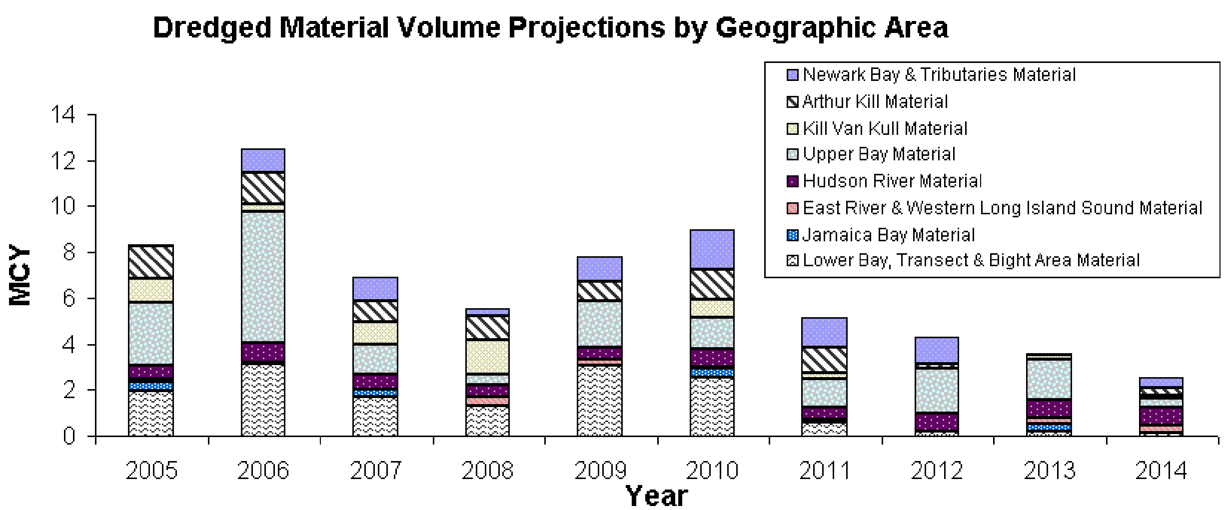


Figure B-2-5. Dredged Material Volume Projections by Geographic Area

Table B-2-1: Detailed Dredged Material Volume Projections

Project/Location Name	Data Source (person)	Data Source (organization)	Corps or Non-Corps	New Work or Maint. Material	HARS, Non-HARS, or Rock	Projected Material Type	NY, NJ, or SHARED	Sub-Basin/ Waterbody Location	Estimate Confidence	From Depth (ft)	To Depth (ft)	Rotation rate (yrs) (0 = only one time)	Projected volume per rotation (CY)	Total Volume (2005-2014)	2005 2005	2006 2006
NYCEDC, Passenger Ship Terminal, NY, NY	Andrew Genn	NYCEDC	NC	M	Non-HARS	B	NY	HR	2			1	440,000	4,400,000	440,000	440,000
Pier 79 West Side Ferry Terminal	Andrew Genn	NYCEDC	NC	M	Non-HARS	F	NY	ERLIS	3			5	30,000	60,000	30,000	
South Brooklyn Marine Terminal	Andrew Genn	NYCEDC	NC	M	Non-HARS	F	NY	UB	3			2	20,000	100,000		20,000
Bronx River, NY	John Tavolaro	USACE	C	M	Non-HARS	F	NY	ERLIS	3			5	60,000	180,000		
Buttermilk Channel, NY	John Tavolaro	USACE	C	M	Non-HARS	F	NY	UB	1			5	125,000	350,000	100,000	
East River, NY	John Tavolaro	USACE	C	M	Non-HARS	F	NY	ERLIS	1			4	200,000	480,000		80,000
East Rockaway Inlet	John Tavolaro	USACE	C	M	HARS	A	NY	LBA	1			2	200,000	1,000,000	200,000	
Eastchester Creek, NY	John Tavolaro	USACE	C	M	Non-HARS	F	NY	ERLIS	3			15	70,000	70,000		
Flushing Bay & Creek, NY	John Tavolaro	USACE	C	M	Non-HARS	F	NY	ERLIS	2			6	80,000	160,000		
Hudson River Channel, NY	John Tavolaro	USACE	C	M	Non-HARS	F	NY	HR	2			6	260,000	360,000		100,000
Jamaica Bay, NY	John Tavolaro	USACE	C	M	HARS	A	NY	JB	1			3	350,000	1,400,000	350,000	
Main Ship Channel (Chappel Hill), (NY Harbor)	John Tavolaro	USACE	C	M	HARS	A	SHARED	LBA	2			20	350,000	0		
Newark Bay, H&P Rivers (Hackensack River)	John Tavolaro	USACE	C	M	Non-HARS	F	NJ	NB	3			15	200,000	200,000		
Newark Bay, H&P Rivers (Newark Bay Channels)	John Tavolaro	USACE	C	M	Non-HARS	F	NJ	NB	2			5	200,000	400,000		
NY Harbor (Gravesend Bay)	John Tavolaro	USACE	C	M	HARS	B	NY	LBA	2			6	100,000	100,000		
NY Harbor (Red Hook Flats)	John Tavolaro	USACE	C	M	HARS	B	NY	UB	2			6	300,000	300,000		
NY Harbor (Sandy Hook Ch.)	John Tavolaro	USACE	C	M	HARS	A	NJ	LBA	2			10	100,000	100,000		
NY/NJ Channels (Arthur Kill)	John Tavolaro	USACE	C	M	Non-HARS	F	SHARED	AK	1			3	200,000	600,000		
NY/NJ Channels (Raritan Bay)	John Tavolaro	USACE	C	M	HARS	B	SHARED	LBA	2			4	200,000	500,000	100,000	
Portchester Harbor	John Tavolaro	USACE	C	M	Non-HARS	F	NY	ERLIS	3			15	75,000	75,000		
Raritan River / Arthur Kill Cutoff	John Tavolaro	USACE	C	M	Non-HARS	F	SHARED	LBA	1			6	150,000	300,000		
Raritan River, NJ	John Tavolaro	USACE	C	M	Non-HARS	F	NJ	LBA	2			5	300,000	425,000		125,000
Shrewsbury River	John Tavolaro	USACE	C	M	Non-HARS	F	NJ	LBA	2			10	100,000	100,000		
Westchester Creek, NY	John Tavolaro	USACE	C	M	Non-HARS	F	NY	ERLIS	3			15	150,000	150,000		
ConEd 59th St. Generation Plant, NY, NY	Mark Roth	USACE	NC	M	Non-HARS	F	NY	HR	3			10	35,000	35,000	35,000	
Duraport Marine Rail, KVK, NJ	Mark Roth	USACE	NC	M	Non-HARS	F	NJ	KVK	3			3	170,000	510,000		
Interstate Materials Corp, Staten Island NY	Mark Roth	USACE	NC	M	Non-HARS	F	NY	AK	3			5	217,000	434,000	217,000	
NY Waterways, Weehawken, NJ construction followed by 140K maintenance	Mark Roth	USACE	NC	M	HARS	B	NJ	HR	3			10	140,000	140,000		
NYC DOS, Multiple Transfer Stations, NY	Mark Roth	USACE	NC	M	Non-HARS	F	NY	ERLIS	3			5	113,000	452,000	113,000	
NYCDEP, Newtown Creek, Brooklyn, NY	Mark Roth	USACE	NC	M	Non-HARS	G	NY	ERLIS	3			5	23,000	46,000		23,000
NYCDOT, St. George Ferry, NY, NY	Mark Roth	USACE	NC	M	Non-HARS	F	NY	UB	3			5	10,000	20,000	10,000	
St Lawrence Cement, Flushing NY	Mark Roth	USACE	NC	M	Non-HARS	F	NY	ERLIS	3			2	1,000	5,000		1,000
The American Sugar Refining Company, Yonkers, NY	Mark Roth	USACE	NC	M	Non-HARS	F	NY	HR	3			1	80,000	800,000	80,000	80,000
U.S. Dept of the Interior, Nat'l Park Service, Ellis Island	Mark Roth	USACE	NC	M	HARS	B	NJ	UB	3			10	50,000	50,000		
U.S. Gypsum, NY	Mark Roth	USACE	NC	M	Non-HARS	F	NY	HR	3			6	125,000	250,000		
Vanbro Corporation	Mark Roth	USACE	NC	M	Non-HARS	F	NY	HR	3			5	5,000	10,000	5,000	
Howland Hook Marine Terminal Berths, (Harbor Nav)*	P. Dunlop	PANYNJ	NC	NW	Non-HARS	F	NJ	AK	3			0		10,000		10,000
Howland Hook Marine Terminal Berths, (Harbor Nav)*	P. Dunlop	PANYNJ	NC	NW	Rock	E	NJ	AK	3			0		164,000		164,000
PANY/NJ, Auto Marine Terminal, Bayonne, NJ	P. Dunlop	PANYNJ	NC	M	Non-HARS	F	NJ	UB	3			4	28,000	56,000		
PANY/NJ, Brooklyn Marine Terminal, Brooklyn, NY	P. Dunlop	PANYNJ	NC	M	HARS	F	NY	UB	3			4	200,000	600,000	200,000	
PANY/NJ, Elizabeth/ Newark	P. Dunlop	PANYNJ	NC	M	Non-HARS	F	NJ	NB	3			2	200,000	1,000,000		200,000
PANY/NJ, Howland Hook Term., Stat. Is., NY	P. Dunlop	PANYNJ	NC	M	Non-HARS	F	NY	AK	3			2	100,000	500,000		100,000
Port Elizabeth Berths, (Harbor Nav)*	P. Dunlop	PANYNJ	NC	NW	Non-HARS	F	NJ	NB	3			0		15,000		5,000
Port Elizabeth Berths, (Harbor Nav)*	P. Dunlop	PANYNJ	NC	NW	HARS	D	NJ	NB	3			0		187,600		67,000
Port Elizabeth Berths, (Harbor Nav)*	P. Dunlop	PANYNJ	NC	NW	HARS	E	NJ	NB	3			0		13,400		
South Brooklyn Marine Terminal Berths, (Harbor Nav)*	P. Dunlop	PANYNJ	NC	NW	HARS	C	NY	UB	3			0		60,000		
South Brooklyn Marine Terminal Berths, (Harbor Nav)*	P. Dunlop	PANYNJ	NC	NW	Non-HARS	F	NY	UB	3			0		15,000		
PVSC Newark Boat and Barge Dock, NJ	Patricia Lopes	y Sewerage Comm	NC	M	Non-HARS	F	NJ	NB	2		25	10	26,000	26,000	26,000	
Amerada Hess: Newark Bay	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	NB	3			3	21,000	84,000	21,000	
Chevron	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	AK	3			3	20,000	60,000		
Citgo	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	AK	3			3	35,000	105,000		35,000
City of Perth Amboy - Marina	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	AK	3			10	19,000	19,000	19,000	
Claremont - C	Scott Douglas	NJDOT/OMR	NC	NW	Non-HARS	F	NJ	UB	3			0	530,000	530,000		530,000
Claremont - M	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	UB	3			3	90,000	180,000		
Coastal Oil Bayonne	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	KVK	3			3	20,000	80,000	20,000	
Darling International	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	NB	1			10	23,000	23,000		
Exxon Bayonne	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	KVK	3			3	30,000	90,000		
GATX	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	AK	3			4	16,000	48,000	16,000	
Global	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	UB	3			5	30,000	60,000	30,000	
HNSE Berths	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	UB	2			3	30,000	90,000		30,000
IMTT Bayonne	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	KVK	3			4	50,000	150,000		50,000
Motiva	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	NB	3			10	40,000	40,000		
Navy: Earle base - M	Scott Douglas	NJDOT/OMR	NC	M	HARS	B	NJ	LBA	3			6	400,000	400,000		
Navy: Earle base - M	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	LBA	3			6	100,000	100,000		
Navy: Earle base (pier 3 job) - C	Scott Douglas	NJDOT/OMR	NC	NW	HARS	B	NJ	LBA	1			0	222,500	222,500		222,500
Navy:Earle base (pier 3 job) - C	Scott Douglas	NJDOT/OMR	NC	NW	Non-HARS	F	NJ	LBA	1			0	298,500	298,500	298,500	
OENJ, Parcel D Marina, Elizabeth, NJ	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	NB	3			3	5,000	15,000		5,000
Port Imperial Marina	Scott Douglas	NJDOT/OMR	NC	M	HARS	F	NJ	HR	3			4	230,000	690,000		230,000
Shell	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	NB	3			10	20,000	20,000	20,000	
Stolthaven	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	AK	3			10	5,800	5,800		
Stratus Petroleum	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	NB	2			10	18,000	18,000		
SUN	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	NB	3			10	1,200	1,200		
Tosco	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	AK	3			3	12,000	36,000		12,000
Weehawken Ferry Terminal	Scott Douglas	NJDOT/OMR	NC	M	Non-HARS	F	NJ	UB	2			5	15,000	15,000		
S-KVK-1	Steve Weinberg	USACE	C	NW	HARS	A	SHARED	KVK	3		50	0		0		
S-KVK-1	Steve Weinberg	USACE	C	NW	HARS	C	SHARED	KVK	3		50	0		856,475		
S-KVK-1	Steve Weinberg	USACE	C	NW	HARS	B	SHARED	KVK	3		50	0		505,525		
S-KVK-1	Steve Weinberg	USACE	C	NW	HARS	D	SHARED	KVK	3		50	0		0		
S-KVK-1	Steve Weinberg	USACE	C	NW	Rock	E	SHARED	KVK	3		50	0		783,000		
S-KVK-1	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	KVK	3		50	0		110,000		

Table B-2-1: Detailed Dredged Material Volume Projections

															2005	2006
Project/Location Name	**Data Source (person)**	**Data Source (organization)**	**Corps or Non-Corps**	**New Work or Maint. Material**	**HARS, Non-HARS, or Rock**	**Projected Material Type**	**NY, NJ, or SHARED**	**Sub-Basin/ Waterbody Location**	**Estimate Confidence**	**From Depth (ft)**	**To Depth (ft)**	**Rotation rate (yrs) (0 = only one time)**	**Projected volume per rotation (CY)**	**Total Volume (2005-2014)**	2005	2006
KVK maintenance (Constable hook + Bergen point)	Steve Weinberg	USACE	C	M	Non-HARS	F	SHARED	KVK	3		50	3	92,100	92,100		
S-KVK-2	Steve Weinberg	USACE	C	NW	HARS	C	SHARED	KVK	3		50	0		1,229,191	1,019,670	209,521
S-KVK-2	Steve Weinberg	USACE	C	NW	HARS	D	SHARED	KVK	3		50	0		0		
S-KVK-2	Steve Weinberg	USACE	C	NW	Rock	E	SHARED	KVK	3		50	0		771,000		17,878
S-KVK-2	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	KVK	3		50	0		0		
S-NB-1	Steve Weinberg	USACE	C	NW	HARS	C	NJ	NB	3		50	0		0		
S-NB-1	Steve Weinberg	USACE	C	NW	HARS	D	NJ	NB	3		50	0		1,345,000		530,000
S-NB-1	Steve Weinberg	USACE	C	NW	Rock	E	NJ	NB	3		50	0		109,000		
S-NB-1	Steve Weinberg	USACE	C	NW	Non-HARS	F	NJ	NB	3		50	0		362,000		250,000
S-NB-2	Steve Weinberg	USACE	C	NW	HARS	B	NJ	NB	3		50	0		186,000		
S-NB-2	Steve Weinberg	USACE	C	NW	HARS	C	NJ	NB	3		50	0		0		
S-NB-2	Steve Weinberg	USACE	C	NW	HARS	D	NJ	NB	3		50	0		2,484,400		
S-NB-2	Steve Weinberg	USACE	C	NW	Rock	E	NJ	NB	3		50	0		148,900		
S-NB-2	Steve Weinberg	USACE	C	NW	Non-HARS	F	NJ	NB	3		50	0		201,700		
S-E-1	Steve Weinberg	USACE	C	NW	HARS	C	NJ	NB	3		50	0		0		
S-E-1	Steve Weinberg	USACE	C	NW	HARS	D	NJ	NB	3		50	0		898,000		
S-E-1	Steve Weinberg	USACE	C	NW	Rock	E	NJ	NB	3		50	0		28,000		
S-E-1	Steve Weinberg	USACE	C	NW	Non-HARS	F	NJ	NB	3		50	0		593,000		
S-AK-1	Steve Weinberg	USACE	C	NW	HARS	C	SHARED	AK	3		50	0		0		
S-AK-1	Steve Weinberg	USACE	C	NW	HARS	D	SHARED	AK	3		50	0		304,000		94,345
S-AK-1	Steve Weinberg	USACE	C	NW	Rock	E	SHARED	AK	3		50	0		409,000		
S-AK-1	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	AK	3		50	0		109,000		109,000
S-AK-2	Steve Weinberg	USACE	C	NW	HARS	C	SHARED	AK	3		50	0		0		
S-AK-2	Steve Weinberg	USACE	C	NW	HARS	D	SHARED	AK	3		50	0		389,000		
S-AK-2	Steve Weinberg	USACE	C	NW	Rock	E	SHARED	AK	3		50	0		332,000		
S-AK-2	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	AK	3		50	0		38,000		
S-AK-3	Steve Weinberg	USACE	C	NW	HARS	C	SHARED	AK	3		50	0		432,000		
S-AK-3	Steve Weinberg	USACE	C	NW	HARS	D	SHARED	AK	3		50	0		0		
S-AK-3	Steve Weinberg	USACE	C	NW	Rock	E	SHARED	AK	3		50	0		1,405,000		
AK1	Salvatore DiDato	USACE	C	NW	Rock	E	SHARED	AK	3	35	40/41	0		40,000	40,000	
AK-2/3	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	AK	3		41	0		517,000	517,000	
AK-2/3	Steve Weinberg	USACE	C	NW	HARS	A	SHARED	AK	3		41	0		776,000	498,000	278,000
AK-2/3	Steve Weinberg	USACE	C	NW	Rock	E	SHARED	AK	3		41	0		456,000	150,000	306,000
AK4	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	AK	3		41	0		11,000		5,500
AK4	Steve Weinberg	USACE	C	NW	HARS	A	SHARED	AK	3		41	0		260,000		130,000
AK4	Steve Weinberg	USACE	C	NW	Rock	E	SHARED	AK	3		41	0		255,000		127,500
AK5	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	AK	3		41	0		109,000		
AK5	Steve Weinberg	USACE	C	NW	HARS	A	SHARED	AK	3		41	0		304,000		
AK5	Steve Weinberg	USACE	C	NW	Rock	E	SHARED	AK	3		41	0		409,000		
S-PJ-1	Steve Weinberg	USACE	C	NW	HARS	B	NJ	UB	3		50	0		1,107,000	1,107,000	
S-PJ-1	Steve Weinberg	USACE	C	NW	HARS	C	NJ	UB	3		50	0		2,305,800	582,555	1,273,248
S-PJ-1	Steve Weinberg	USACE	C	NW	HARS	D	NJ	UB	3		50	0		0		
S-PJ-1	Steve Weinberg	USACE	C	NW	Rock	E	NJ	UB	3		50	0		5,500		
S-PJ-1	Steve Weinberg	USACE	C	NW	Non-HARS	F	NJ	UB	3		50	0		21,767	21,767	
PJ-2A	Bryce Wisemiller	USACE	C	NW	HARS	A	NJ	UB	3	existing	44.5	0		57,600	57,600	
PJ-2A	Bryce Wisemiller	USACE	C	NW	Non-HARS	F	NJ	UB	3	existing	44.5	0		0		
PJ-3	Bryce Wisemiller	USACE	C	NW	HARS	A	NJ	UB	3	varied	53.5	0		1,496,000	149,600	1,122,000
PJ-3	Bryce Wisemiller	USACE	C	NW	HARS	B	NJ	UB	3	varied	53.5	0		597,000	59,700	447,750
PJ-3	Bryce Wisemiller	USACE	C	NW	HARS	C	NJ	UB	3	varied	53.5	0		507,000	50,700	380,250
PJ-3	Bryce Wisemiller	USACE	C	NW	HARS	D	NJ	UB	3	varied	53.5	0		319,000	31,900	239,250
PJ-3	Bryce Wisemiller	USACE	C	NW	Rock	E	NJ	UB	3	varied	53.5	0		22,000	0	0
PJ-3	Bryce Wisemiller	USACE	C	NW	Non-HARS	F	NJ	UB	3	varied	53.5	0		720,000	180,000	540,000
Port Jersey Channel (maintenance)	Bryce Wisemiller	USACE	C	M	Non-HARS	F	NJ	UB	3			4	212,000	212,000		
NY Harbor - Anchorage Channel (maintanence)	Bryce Wisemiller	USACE	C	M	NA	B	SHARED	UB	3			self scouring	0	0		
S-BR-1	Steve Weinberg	USACE	C	NW	HARS	A	NY	UB	3		50	0		2,262,110		
S-BR-1	Steve Weinberg	USACE	C	NW	HARS	B	NY	UB	3		50	0		697,890		
S-BR-1	Steve Weinberg	USACE	C	NW	HARS	D	NY	UB	3		50	0		0		
S-BR-1	Steve Weinberg	USACE	C	NW	Non-HARS	F	NY	UB	3		50	0		1,853,000		
Red Hook+Bay Ridge	Steve Weinberg	USACE	C	M	Non-HARS	F	NY	UB	3		40/50	1	512,700	0		
S-AN-1	Steve Weinberg	USACE	C	NW	HARS	A	SHARED	UB	3		50	0		622,710		270,557
S-AN-1	Steve Weinberg	USACE	C	NW	HARS	B	SHARED	UB	3		50	0		854,851		854,851
S-AN-1	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	UB	3		50	0		205,439	174,482	30,957
S-AN-2	Steve Weinberg	USACE	C	NW	HARS	A	SHARED	UB	3		50	0		1,020,460		
S-AN-2	Steve Weinberg	USACE	C	NW	HARS	B	SHARED	UB	3		50	0		1,187,228		
S-AN-2	Steve Weinberg	USACE	C	NW	Non-HARS	F	SHARED	UB	3		50	0		550,312		
S-AM-1	Steve Weinberg	USACE	C	NW	HARS	A	SHARED	LBA	3		53	0		5,624,500	1,387,276	2,751,934
S-AM-2	Steve Weinberg	USACE	C	NW	HARS	A	SHARED	LBA	3		53	0		5,624,500		
TOTAL														**65,721,958**	**8,357,750**	**12,498,041**

Note: All material type designations are projections based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Table B-2-1: Detailed Dredged Material Volume Projections

	Calendar Year																				
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Project/Location Name	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
NYCEDC, Passenger Ship Terminal, NY, NY	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000
Pier 79 West Side Ferry Terminal				30,000					30,000					30,000					30,000		
South Brooklyn Marine Terminal		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000	
Bronx River, NY		60,000	60,000					60,000					60,000					60,000			
Buttermilk Channel, NY			125,000					125,000					125,000					125,000			
East River, NY			200,000				200,000				200,000				200,000				200,000		
East Rockaway Inlet	200,000		200,000		200,000		200,000		200,000		200,000		200,000		200,000		200,000		200,000		200,000
Eastchester Creek, NY								70,000													
Flushing Bay & Creek, NY		80,000						80,000						80,000						80,000	
Hudson River Channel, NY						260,000						260,000						260,000			
Jamaica Bay, NY	350,000			350,000			350,000			350,000			350,000			350,000			350,000		
Main Ship Channel (Chappel Hill), (NY Harbor)																350,000					
Newark Bay, H&P Rivers (Hackensack River)								200,000													
Newark Bay, H&P Rivers (Newark Bay Channels)	200,000					200,000					200,000					200,000					200,000
NY Harbor (Gravesend Bay)			100,000						100,000						100,000						100,000
NY Harbor (Red Hook Flats)				300,000						300,000						300,000					
NY Harbor (Sandy Hook Ch.)					100,000										100,000						
NY/NJ Channels (Arthur Kill)		200,000			200,000			200,000			200,000			200,000			200,000			200,000	
NY/NJ Channels (Raritan Bay)		200,000				200,000				200,000				200,000				200,000			
Portchester Harbor				75,000															75,000		
Raritan River / Arthur Kill Cutoff		150,000						150,000						150,000						150,000	
Raritan River, NJ					300,000					300,000					300,000					300,000	
Shrewsbury River		100,000										100,000									
Westchester Creek, NY		150,000															150,000				
ConEd 59th St. Generation Plant, NY, NY									35,000										35,000		
Duraport Marine Rail, KVK, NJ	170,000			170,000			170,000			170,000			170,000			170,000			170,000		
Interstate Materials Corp, Staten Island NY				217,000					217,000					217,000					217,000		
NY Waterways, Weehawken, NJ construction followed by 140K maintenance							140,000										150,000				
NYC DOS, Multiple Transfer Stations, NY		113,000			113,000			113,000			113,000			113,000			113,000			113,000	
NYCDEP, Newtown Creek, Brooklyn, NY					23,000					23,000					23,000					23,000	
NYCDOT, St. George Ferry, NY, NY				10,000					10,000					10,000					10,000		
St Lawrence Cement, Flushing NY		1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000	
The American Sugar Refining Company, Yonkers, NY	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
U.S. Dept of the Interior, Nat'l Park Service, Ellis Island						50,000										50,000					
U.S. Gypsum, NY	125,000						125,000						125,000						125,000		
Vanbro Corporation				5,000					5,000					5,000					5,000		
Howland Hook Marine Terminal Berths, (Harbor Nav)*																					
Howland Hook Marine Terminal Berths, (Harbor Nav)*																					
PANY/NJ, Auto Marine Terminal, Bayonne, NJ	28,000				28,000				28,000				28,000				28,000				28,000
PANY/NJ, Brooklyn Marine Terminal, Brooklyn, NY			200,000				200,000				200,000				200,000				200,000		
PANY/NJ, Elizabeth/ Newark		200,000		200,000		200,000		200,000		200,000		200,000		200,000		200,000		200,000		200,000	
PANY/NJ, Howland Hook Term., Stat. Is., NY		100,000		100,000		100,000		100,000		100,000		100,000		100,000		100,000		100,000		100,000	
Port Elizabeth Berths, (Harbor Nav)*			10,000																		
Port Elizabeth Berths, (Harbor Nav)*			120,600																		
Port Elizabeth Berths, (Harbor Nav)*			13,400																		
South Brooklyn Marine Terminal Berths, (Harbor Nav)*				60,000																	
South Brooklyn Marine Terminal Berths, (Harbor Nav)*				15,000																	
PVSC Newark Boat and Barge Dock, NJ									26,000										26,000		
Amerada Hess: Newark Bay		21,000			21,000			21,000			21,000			21,000			21,000			21,000	
Chevron	20,000			20,000			20,000			20,000			20,000			20,000			20,000		
Citgo			35,000			35,000			35,000			35,000			35,000			35,000			35,000
City of Perth Amboy - Marina									19,000										19,000		
Claremont - C																					
Claremont - M			90,000			90,000			90,000			90,000			90,000			90,000			90,000
Coastal Oil Bayonne		20,000			20,000			20,000			20,000			20,000			20,000			20,000	
Darling International								23,000										23,000			
Exxon Bayonne	30,000			30,000			30,000			30,000			30,000			30,000			30,000		
GATX			16,000				16,000				16,000				16,000				16,000		
Global				30,000					30,000					30,000					30,000		
HNSE Berths			30,000			30,000			30,000			30,000			30,000			30,000			30,000
IMTT Bayonne				50,000				50,000				50,000				50,000				50,000	
Motiva	40,000										40,000										40,000
Navy: Earle base - M				400,000						400,000						400,000					
Navy: Earle base - M				100,000						100,000						100,000					
Navy: Earle base (pier 3 job) - C																					
Navy:Earle base (pier 3 job) - C																					
OENJ, Parcel D Marina, Elizabeth, NJ			5,000			5,000			5,000			5,000			5,000			5,000			5,000
Port Imperial Marina				230,000				230,000				230,000				230,000				230,000	
Shell									20,000										20,000		
Stolthaven		5,800										9,000									
Stratus Petroleum								18,000										18,000			
SUN							1,200										1,200				
Tosco			12,000			12,000			12,000			12,000			12,000			12,000			12,000
Weehawken Ferry Terminal				15,000					15,000					15,000					15,000		
S-KVK-1																					
S-KVK-1		856,475																			
S-KVK-1		505,525																			
S-KVK-1																					
S-KVK-1			7,299	532,757	242,944																
S-KVK-1		110,000																			

Table B-2-1: Detailed Dredged Material Volume Projections

	Calendar Year																				
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Project/Location Name	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
KVK maintenance (Constable hook + Bergen point)								92,100			92,100			92,100			92,100			92,100	
S-KVK-2																					
S-KVK-2																					
S-KVK-2	753,122																				
S-KVK-2																					
S-NB-1																					
S-NB-1	740,000	75,000																			
S-NB-1			109,000																		
S-NB-1	112,000																				
S-NB-2			186,000																		
S-NB-2																					
S-NB-2			455,971	1,555,413	473,016																
S-NB-2					148,900																
S-NB-2			201,700																		
S-E-1																					
S-E-1					109,959	788,041															
S-E-1						28,000															
S-E-1					593,000																
S-AK-1																					
S-AK-1	209,655																				
S-AK-1	409,000																				
S-AK-1																					
S-AK-2																					
S-AK-2		389,000																			
S-AK-2		332,000																			
S-AK-2		38,000																			
S-AK-3			432,000																		
S-AK-3																					
S-AK-3			398,168	925,677	81,155																
AK1																					
AK-2/3																					
AK-2/3																					
AK-2/3																					
AK4	5,500																				
AK4	130,000																				
AK4	127,500																				
AK5					109,000																
AK5					304,000																
AK5					409,000																
S-PJ-1																					
S-PJ-1	449,997																				
S-PJ-1																					
S-PJ-1	5,500																				
S-PJ-1																					
PJ-2A																					
PJ-2A																					
PJ-3	224,400																				
PJ-3	89,550																				
PJ-3	76,050																				
PJ-3	47,850																				
PJ-3	22,000																				
PJ-3	0																				
Port Jersey Channel (maintenance)						212,000				212,000				212,000				212,000			
NY Harbor - Anchorage Channel (maintanence)																					
S-BR-1						393,218	1,612,637	256,255													
S-BR-1						697,890															
S-BR-1																					
S-BR-1				200,499	1,180,358	472,143															
Red Hook+Bay Ridge									512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700
S-AN-1	352,153																				
S-AN-1																					
S-AN-1																					
S-AN-2			274,264	746,196																	
S-AN-2			1,187,228																		
S-AN-2		451,314	98,998																		
S-AM-1	1,485,290																				
S-AM-2		821,810	2,751,934	2,050,756																	
TOTAL	**6,922,567**	**5,519,924**	**7,839,562**	**8,959,298**	**5,176,332**	**4,314,292**	**3,584,837**	**2,549,355**	**1,939,700**	**3,458,700**	**2,334,800**	**2,174,700**	**2,140,700**	**2,748,800**	**2,343,700**	**3,603,700**	**2,008,000**	**2,423,700**	**2,825,700**	**2,632,800**	**1,772,700**

Note: All material type designations are projections based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Table B-2-1: Detailed Dredged Material Volume Projections

	Calendar Year																				
	2028	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**
Project/Location Name	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
NYCEDC, Passenger Ship Terminal, NY, NY	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000
Pier 79 West Side Ferry Terminal			30,000					30,000					30,000					30,000			
South Brooklyn Marine Terminal	20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000
Bronx River, NY		60,000					60,000					60,000					60,000				
Buttermilk Channel, NY		125,000					125,000					125,000					125000				
East River, NY		200,000				200,000				200,000				200000				200,000			
East Rockaway Inlet		200,000		200,000		200,000		200,000		200,000		200,000		200000		200000		200,000		200000	
Eastchester Creek, NY		70,000															70000				
Flushing Bay & Creek, NY					80,000						80,000						80000				
Hudson River Channel, NY			260,000						260,000						260000						260000
Jamaica Bay, NY	350,000			350,000			350,000			350,000			350,000			350000			350000		
Main Ship Channel (Chappel Hill), (NY Harbor)															350000						
Newark Bay, H&P Rivers (Hackensack River)		200,000															200000				
Newark Bay, H&P Rivers (Newark Bay Channels)					200,000					200,000					200000					200000	
NY Harbor (Gravesend Bay)						100,000						100,000						100,000			
NY Harbor (Red Hook Flats)	300,000						300,000						300,000						300000		
NY Harbor (Sandy Hook Ch.)				100,000										100000							
NY/NJ Channels (Arthur Kill)		200,000			200,000			200,000			200,000			200000			200000			200000	
NY/NJ Channels (Raritan Bay)	200,000				200,000				200,000				200,000				200000				200000
Portchester Harbor													75,000								
Raritan River / Arthur Kill Cutoff					150,000						150,000						150000				
Raritan River, NJ				300,000					300,000					300000					300000		
Shrewsbury River	100,000										100,000										100000
Westchester Creek, NY											150,000										
ConEd 59th St. Generation Plant, NY, NY								35,000										35,000			
Duraport Marine Rail, KVK, NJ	170,000			170,000			170,000			170,000			170,000			170000			170000		
Interstate Materials Corp, Staten Island NY			217,000					217,000					217,000					217,000			
NY Waterways, Weehawken, NJ construction followed by 140K maintenance						150,000										150000					
NYC DOS, Multiple Transfer Stations, NY		113,000			113,000			113,000			113,000			113,000			113,000			113,000	
NYCDEP, Newtown Creek, Brooklyn, NY				23,000					23,000					23,000					23,000		
NYCDOT, St. George Ferry, NY, NY			10,000					10,000					10,000					10,000			
St Lawrence Cement, Flushing NY	1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000
The American Sugar Refining Company, Yonkers, NY	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
U.S. Dept of the Interior, Nat'l Park Service, Ellis Island					50,000										50000						
U.S. Gypsum, NY				125,000						125,000						125,000					
Vanbro Corporation			5,000					5,000					5,000					5,000			
Howland Hook Marine Terminal Berths, (Harbor Nav)*																					
Howland Hook Marine Terminal Berths, (Harbor Nav)*																					
PANY/NJ, Auto Marine Terminal, Bayonne, NJ				28,000				28,000				28,000				28000				28000	
PANY/NJ, Brooklyn Marine Terminal, Brooklyn, NY		200,000				200,000				200,000				200000				200,000			
PANY/NJ, Elizabeth/ Newark	200,000		200,000		200,000		200,000		200,000		200,000		200,000		200000		200000		200000		200000
PANY/NJ, Howland Hook Term., Stat. Is., NY	100,000		100,000		100,000		100,000		100,000		100,000		100,000		100000		100000		100000		100000
Port Elizabeth Berths, (Harbor Nav)*																					
Port Elizabeth Berths, (Harbor Nav)*																					
Port Elizabeth Berths, (Harbor Nav)*																					
South Brooklyn Marine Terminal Berths, (Harbor Nav)*																					
South Brooklyn Marine Terminal Berths, (Harbor Nav)*																					
PVSC Newark Boat and Barge Dock, NJ								26,000										26,000			
Amerada Hess: Newark Bay		21,000			21,000			21,000			21,000			21000			21000			21000	
Chevron	20,000			20,000			20,000			20,000			20,000			20000			20000		
Citgo			35,000			35,000			35,000			35,000			35000			35,000			35000
City of Perth Amboy - Marina								19,000										19,000			
Claremont - C																					
Claremont - M			90,000			90,000			90,000			90,000			90000			90,000			90000
Coastal Oil Bayonne		20,000			20,000			20,000			20,000			20000			20000			20000	
Darling International							23,000										23000				
Exxon Bayonne	30,000			30,000			30,000			30,000			30,000			30000			30000		
GATX		16,000				16,000				16,000				16000				16,000			
Global			30,000					30,000					30,000					30,000			
HNSE Berths			30,000			30,000			30,000			30,000			30000			30,000			30000
IMTT Bayonne			50,000				50,000				50,000				50000				50000		
Motiva										40,000										40000	
Navy: Earle base - M	400,000						400,000						400,000						400000		
Navy: Earle base - M	100,000						100,000						100,000						100000		
Navy: Earle base (pier 3 job) - C																					
Navy:Earle base (pier 3 job) - C																					
OENJ, Parcel D Marina, Elizabeth, NJ			5,000			5,000			5,000			5,000			5000			5,000			5000
Port Imperial Marina			230,000				230,000				230,000				230000				230000		
Shell								20,000										20,000			
Stolthaven	9,000										9,000										9000
Stratus Petroleum							18,000										18000				
SUN						1,200										1200					
Tosco			12,000			12,000			12,000			12,000			12,000			12,000			12,000
Weehawken Ferry Terminal			15,000					15,000					15,000					15,000			
S-KVK-1																					
S-KVK-1																					
S-KVK-1																					
S-KVK-1																					
S-KVK-1																					
S-KVK-1																					

Table B-2-1: Detailed Dredged Material Volume Projections

	Calendar Year																				
	2028	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**
Project/Location Name	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
KVK maintenance (Constable hook + Bergen point)		92,100			92,100			92,100			92,100			92,100			92,100			92,100	
S-KVK-2																					
S-KVK-2																					
S-KVK-2																					
S-KVK-2																					
S-NB-1																					
S-NB-1																					
S-NB-1																					
S-NB-1																					
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S-AK-3																					
AK1																					
AK-2/3																					
AK-2/3																					
AK-2/3																					
AK4																					
AK4																					
AK4																					
AK5																					
AK5																					
AK5																					
S-PJ-1																					
S-PJ-1																					
S-PJ-1																					
S-PJ-1																					
S-PJ-1																					
PJ-2A																					
PJ-2A																					
PJ-3																					
PJ-3																					
PJ-3																					
PJ-3																					
PJ-3																					
PJ-3																					
Port Jersey Channel (maintenance)	212,000				212,000				212,000				212,000				212,000				212,000
NY Harbor - Anchorage Channel (maintanence)																					
S-BR-1																					
S-BR-1																					
S-BR-1																					
S-BR-1																					
Red Hook+Bay Ridge	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700
S-AN-1																					
S-AN-1																					
S-AN-1																					
S-AN-2																					
S-AN-2																					
S-AN-2																					
S-AM-1																					
S-AM-2																					
TOTAL	**3,244,700**	**2,549,800**	**2,372,700**	**2,378,700**	**2,691,800**	**2,071,900**	**3,229,700**	**2,113,800**	**2,520,700**	**2,583,700**	**2,568,800**	**1,717,700**	**3,517,700**	**2,517,800**	**2,665,700**	**2,106,900**	**2,937,800**	**2,327,700**	**3,326,700**	**1,946,800**	**2,306,700**

Note: All material type designations are projections based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Table B-2-1: Detailed Dredged Material Volume Projections

	Calendar Year																
	2049	**2050**	**2051**	**2052**	**2053**	**2054**	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**	**2064**	**2065**
Project/Location Name	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065
NYCEDC, Passenger Ship Terminal, NY, NY	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000
Pier 79 West Side Ferry Terminal		30,000					30,000					30,000					30,000
South Brooklyn Marine Terminal		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000	
Bronx River, NY	60,000					60,000					60,000					60,000	
Buttermilk Channel, NY	125000					125000					125000					125000	
East River, NY	200000				200000				200000				200000				200,000
East Rockaway Inlet	200000		200000		200000		200,000		200000		200000		200000		200000		200,000
Eastchester Creek, NY											70000						
Flushing Bay & Creek, NY		80,000						80000						80000			
Hudson River Channel, NY						260000						260,000					
Jamaica Bay, NY	350000			350000			350,000			350000			350000			350000	
Main Ship Channel (Chappel Hill), (NY Harbor)														350000			
Newark Bay, H&P Rivers (Hackensack River)											200000						
Newark Bay, H&P Rivers (Newark Bay Channels)				200000					200000					200000			
NY Harbor (Gravesend Bay)			100000						100000						100000		
NY Harbor (Red Hook Flats)				300000						300000						300000	
NY Harbor (Sandy Hook Ch.)			100000										100000				
NY/NJ Channels (Arthur Kill)		200,000			200000			200000			200000			200000			200,000
NY/NJ Channels (Raritan Bay)				200000				200000				200,000				200000	
Portchester Harbor							75,000										
Raritan River / Arthur Kill Cutoff		150,000						150000						150000			
Raritan River, NJ			300000					300000					300000				
Shrewsbury River										100000							
Westchester Creek, NY					150000												
ConEd 59th St. Generation Plant, NY, NY							35,000										35,000
Duraport Marine Rail, KVK, NJ	170000			170000			170,000			170000			170000			170000	
Interstate Materials Corp, Staten Island NY		217,000					217,000					217,000					217,000
NY Waterways, Weehawken, NJ construction followed by 140K maintenance					150000										150000		
NYC DOS, Multiple Transfer Stations, NY		113,000			113,000			113,000			113,000			113,000			113,000
NYCDEP, Newtown Creek, Brooklyn, NY			23,000					23,000					23,000				
NYCDOT, St. George Ferry, NY, NY		10,000					10,000					10,000					10,000
St Lawrence Cement, Flushing NY		1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000	
The American Sugar Refining Company, Yonkers, NY	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
U.S. Dept of the Interior, Nat'l Park Service, Ellis Island				50000										50000			
U.S. Gypsum, NY	125,000						125,000						125,000				
Vanbro Corporation		5,000					5,000					5,000					5,000
Howland Hook Marine Terminal Berths, (Harbor Nav)*																	
Howland Hook Marine Terminal Berths, (Harbor Nav)*																	
PANY/NJ, Auto Marine Terminal, Bayonne, NJ			28000				28,000				28000				28000		
PANY/NJ, Brooklyn Marine Terminal, Brooklyn, NY	200000				200000				200000				200000				200,000
PANY/NJ, Elizabeth/ Newark		200,000		200000		200000		200000		200000		200,000		200000		200000	
PANY/NJ, Howland Hook Term., Stat. Is., NY		100,000		100000		100000		100000		100000		100,000		100000		100000	
Port Elizabeth Berths, (Harbor Nav)*																	
Port Elizabeth Berths, (Harbor Nav)*																	
Port Elizabeth Berths, (Harbor Nav)*																	
South Brooklyn Marine Terminal Berths, (Harbor Nav)*																	
South Brooklyn Marine Terminal Berths, (Harbor Nav)*																	
PVSC Newark Boat and Barge Dock, NJ							26,000										26,000
Amerada Hess: Newark Bay		21,000			21000			21000			21000			21000			21,000
Chevron	20000			20000			20,000			20000			20000			20000	
Citgo			35000			35000			35000			35,000			35000		
City of Perth Amboy - Marina							19,000										19,000
Claremont - C																	
Claremont - M			90000			90000			90000			90,000			90000		
Coastal Oil Bayonne		20,000			20000			20000			20000			20000			20,000
Darling International						23000										23000	
Exxon Bayonne	30000			30000			30,000			30000			30000			30000	
GATX	16000				16000				16000				16000				16,000
Global		30,000					30,000					30,000					30,000
HNSE Berths			30000			30000			30000			30,000			30000		
IMTT Bayonne		50,000				50000				50000				50000			
Motiva									40000								
Navy: Earle base - M				400000						400000						400000	
Navy: Earle base - M				100000						100000						100000	
Navy: Earle base (pier 3 job) - C																	
Navy:Earle base (pier 3 job) - C																	
OENJ, Parcel D Marina, Elizabeth, NJ			5000			5000			5000			5,000			5000		
Port Imperial Marina		230,000				230000				230000				230000			
Shell							20,000										20,000
Stolthaven										9000							
Stratus Petroleum						18000										18000	
SUN					1200										1200		
Tosco			12,000			12,000			12,000			12,000			12,000		
Weehawken Ferry Terminal		15,000					15,000					15,000					15,000
S-KVK-1																	
S-KVK-1																	
S-KVK-1																	
S-KVK-1																	
S-KVK-1																	
S-KVK-1																	

Table B-2-1: Detailed Dredged Material Volume Projections

	Calendar Year																
	2049	**2050**	**2051**	**2052**	**2053**	**2054**	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**	**2064**	**2065**
Project/Location Name	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065
KVK maintenance (Constable hook + Bergen point)		92,100			92,100			92,100			92,100			92,100			92,100
S-KVK-2																	
S-KVK-2																	
S-KVK-2																	
S-KVK-2																	
S-NB-1																	
S-NB-1																	
S-NB-1																	
S-NB-1																	
S-NB-2																	
S-NB-2																	
S-NB-2																	
S-NB-2																	
S-NB-2																	
S-E-1																	
S-E-1																	
S-E-1																	
S-E-1																	
S-AK-1																	
S-AK-1																	
S-AK-1																	
S-AK-1																	
S-AK-2																	
S-AK-2																	
S-AK-2																	
S-AK-2																	
S-AK-3																	
S-AK-3																	
S-AK-3																	
AK1																	
AK-2/3																	
AK-2/3																	
AK-2/3																	
AK4																	
AK4																	
AK4																	
AK5																	
AK5																	
AK5																	
S-PJ-1																	
S-PJ-1																	
S-PJ-1																	
S-PJ-1																	
S-PJ-1																	
PJ-2A																	
PJ-2A																	
PJ-3																	
PJ-3																	
PJ-3																	
PJ-3																	
PJ-3																	
PJ-3																	
Port Jersey Channel (maintenance)				212,000				212,000				212,000				212,000	
NY Harbor - Anchorage Channel (maintanence)																	
S-BR-1																	
S-BR-1																	
S-BR-1																	
S-BR-1																	
Red Hook+Bay Ridge	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700	512,700
S-AN-1																	
S-AN-1																	
S-AN-1																	
S-AN-2																	
S-AN-2																	
S-AN-2																	
S-AM-1																	
S-AM-2																	
TOTAL	**2,528,700**	**2,616,800**	**1,955,700**	**3,385,700**	**2,396,000**	**2,291,700**	**2,437,700**	**2,764,800**	**2,160,700**	**3,112,700**	**2,161,800**	**2,504,700**	**2,766,700**	**2,909,800**	**1,683,900**	**3,361,700**	**2,501,800**

Note: All material type designations are projections based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Table B-2-2. Dredging Requirements Volume Projection Summary

By Type of Dredging, Type of Material, and State Boundaries

	Calendar Year												
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005. ..2014	2015. ..2065	2005. ..2065
Maintenance Dredging	**2,032,000**	**1,531,000**	**1,683,000**	**1,940,800**	**1,593,000**	**2,873,000**	**1,525,000**	**1,935,000**	**1,972,200**	**2,293,100**	**19,378,100**	**129,646,400**	**149,024,500**
HARS Material	1,090,000	440,000	990,000	640,000	740,000	1,490,000	740,000	690,000	1,130,000	440,000	8,390,000	45,940,000	54,330,000
NY	990,000	440,000	990,000	440,000	740,000	1,090,000	640,000	440,000	990,000	440,000	7,200,000	37,190,000	44,390,000
Shared	100,000	-	-	200,000	-	-	-	200,000	-	-	500,000	3,650,000	4,150,000
NJ	-	-	-	-	-	400,000	100,000	50,000	140,000	-	690,000	5,100,000	5,790,000
Sandy	550,000	-	550,000	-	200,000	350,000	300,000	-	550,000	-	2,500,000	12,700,000	15,200,000
NY	550,000	-	550,000	-	200,000	350,000	200,000	-	550,000	-	2,400,000	11,150,000	13,550,000
Shared	-	-	-	-	-	-	-	-	-	-	-	1,050,000	1,050,000
NJ	-	-	-	-	-	-	100,000	-	-	-	100,000	500,000	600,000
Fine-Grained	540,000	440,000	440,000	640,000	540,000	1,140,000	440,000	690,000	580,000	440,000	5,890,000	33,240,000	39,130,000
NY	440,000	440,000	440,000	440,000	540,000	740,000	440,000	440,000	440,000	440,000	4,800,000	26,040,000	30,840,000
Shared	100,000	-	-	200,000	-	-	-	200,000	-	-	500,000	2,600,000	3,100,000
NJ	-	-	-	-	-	400,000	-	50,000	140,000	-	590,000	4,600,000	5,190,000
Non-HARS Material	942,000	1,091,000	693,000	1,300,800	853,000	1,383,000	785,000	1,245,000	842,200	1,853,100	10,988,100	83,706,400	94,694,500
NY	790,000	404,000	205,000	604,000	665,000	538,000	216,000	461,000	605,000	649,000	5,137,000	50,150,700	55,287,700
Shared	-	-	-	350,000	-	-	200,000	-	-	442,100	992,100	6,165,700	7,157,800
NJ	152,000	687,000	488,000	346,800	188,000	845,000	369,000	784,000	237,200	762,000	4,859,000	27,390,000	32,249,000
New Work (Deepening) Dredging	**6,325,750**	**10,967,041**	**5,239,567**	**3,579,124**	**6,246,562**	**6,086,298**	**3,651,332**	**2,379,292**	**1,612,637**	**256,255**	**46,343,858**	**-**	**46,343,858**
HARS Material	4,944,001	8,871,206	3,804,945	2,647,810	5,407,997	4,412,365	886,975	1,879,149	1,612,637	256,255	34,723,340	-	34,723,340
NY	-	-	-	-	-	60,000	-	1,091,108	1,612,637	256,255	3,020,000	-	3,020,000
Shared	2,904,946	4,589,208	2,177,098	2,572,810	4,645,426	2,796,952	304,000	-	-	-	19,990,440	-	19,990,440
NJ	2,039,055	4,281,998	1,627,847	75,000	762,571	1,555,413	582,975	788,041	-	-	11,712,900	-	11,712,900
Sandy	2,092,476	4,552,491	2,191,843	821,810	3,026,198	2,796,952	304,000	393,218	1,612,637	256,255	18,047,880	-	18,047,880
NY	-	-	-	-	-	-	-	393,218	1,612,637	256,255	2,262,110	-	2,262,110
Shared	1,885,276	3,430,491	1,967,443	821,810	3,026,198	2,796,952	304,000	-	-	-	14,232,170	-	14,232,170
NJ	207,200	1,122,000	224,400	-	-	-	-	-	-	-	1,553,600	-	1,553,600
Fine-Grained	1,166,700	1,525,101	89,550	505,525	1,373,228	-	-	697,890	-	-	5,357,994	-	5,357,994
NY	-	-	-	-	-	-	-	697,890	-	-	697,890	-	697,890
Shared	-	854,851	-	505,525	1,187,228	-	-	-	-	-	2,547,604	-	2,547,604
NJ	1,166,700	670,250	89,550	-	186,000	-	-	-	-	-	2,112,500	-	2,112,500
Glacial Till/Mixed	1,652,925	1,863,019	526,047	856,475	432,000	60,000	-	-	-	-	5,390,466	-	5,390,466
NY	-	-	-	-	-	60,000	-	-	-	-	60,000	-	60,000
Shared	1,019,670	209,521	-	856,475	432,000	-	-	-	-	-	2,517,666	-	2,517,666
NJ	633,255	1,653,498	526,047	-	-	-	-	-	-	-	2,812,800	-	2,812,800
Stiff Clay	31,900	930,595	997,505	464,000	576,571	1,555,413	582,975	788,041	-	-	5,927,000	-	5,927,000
NY	-	-	-	-	-	-	-	-	-	-	-	-	-
Shared	-	94,345	209,655	389,000	-	-	-	-	-	-	693,000	-	693,000
NJ	31,900	836,250	787,850	75,000	576,571	1,555,413	582,975	788,041	-	-	5,234,000	-	5,234,000
Rock Material	190,000	615,378	1,317,122	332,000	527,867	1,458,434	881,999	28,000	-	-	5,350,800	-	5,350,800
NY	-	-	-	-	-	-	-	-	-	-	-	-	-
Shared	190,000	451,378	1,289,622	332,000	405,467	1,458,434	733,099	-	-	-	4,860,000	-	4,860,000
NJ	-	164,000	27,500	-	122,400	-	148,900	28,000	-	-	490,800	-	490,800
Non-HARS Material	1,191,749	1,480,457	117,500	599,314	310,698	215,499	1,882,358	472,143	-	-	6,269,718	-	6,269,718
NY	-	-	-	-	-	215,499	1,180,358	472,143	-	-	1,868,000	-	1,868,000
Shared	691,482	145,457	5,500	599,314	98,998	-	109,000	-	-	-	1,649,751	-	1,649,751
NJ	500,267	1,335,000	112,000	-	211,700	-	593,000	-	-	-	2,751,967	-	2,751,967
TOTALS (New and Maintenance)	**8,357,750**	**12,498,041**	**6,922,567**	**5,519,924**	**7,839,562**	**8,959,298**	**5,176,332**	**4,314,292**	**3,584,837**	**2,549,355**	**65,721,958**	**129,646,400**	**195,368,358**
HARS Material	6,034,001	9,311,206	4,794,945	3,287,810	6,147,997	5,902,365	1,626,975	2,569,149	2,742,637	696,255	43,113,340	45,940,000	89,053,340
NY	990,000	440,000	990,000	440,000	740,000	1,150,000	640,000	1,531,108	2,602,637	696,255	10,220,000	37,190,000	47,410,000
Shared	3,004,946	4,589,208	2,177,098	2,772,810	4,645,426	2,796,952	304,000	200,000	-	-	20,490,440	3,650,000	24,140,440
NJ	2,039,055	4,281,998	1,627,847	75,000	762,571	1,955,413	682,975	838,041	140,000	-	12,402,900	5,100,000	17,502,900
Sandy	2,642,476	4,552,491	2,741,843	821,810	3,226,198	3,146,952	604,000	393,218	2,162,637	256,255	20,547,880	12,700,000	33,247,880
NY	550,000	-	550,000	-	200,000	350,000	200,000	393,218	2,162,637	256,255	4,662,110	11,150,000	15,812,110
Shared	1,885,276	3,430,491	1,967,443	821,810	3,026,198	2,796,952	304,000	-	-	-	14,232,170	1,050,000	15,282,170
NJ	207,200	1,122,000	224,400	-	-	-	100,000	-	-	-	1,653,600	500,000	2,153,600
Fine-Grained	1,706,700	1,965,101	529,550	1,145,525	1,913,228	1,140,000	440,000	1,387,890	580,000	440,000	11,247,994	33,240,000	44,487,994
NY	440,000	440,000	440,000	440,000	540,000	740,000	440,000	1,137,890	440,000	440,000	5,497,890	26,040,000	31,537,890
Shared	100,000	854,851	-	705,525	1,187,228	-	-	200,000	-	-	3,047,604	2,600,000	5,647,604
NJ	1,166,700	670,250	89,550	-	186,000	400,000	-	50,000	140,000	-	2,702,500	4,600,000	7,302,500
Glacial Till/Mixed	1,652,925	1,863,019	526,047	856,475	432,000	60,000	-	-	-	-	5,390,466	-	5,390,466
NY	-	-	-	-	-	60,000	-	-	-	-	60,000	-	60,000
Shared	1,019,670	209,521	-	856,475	432,000	-	-	-	-	-	2,517,666	-	2,517,666
NJ	633,255	1,653,498	526,047	-	-	-	-	-	-	-	2,812,800	-	2,812,800
Stiff Clay	31,900	930,595	997,505	464,000	576,571	1,555,413	582,975	788,041	-	-	5,927,000	-	5,927,000
NY	-	-	-	-	-	-	-	-	-	-	-	-	-
Shared	-	94,345	209,655	389,000	-	-	-	-	-	-	693,000	-	693,000
NJ	31,900	836,250	787,850	75,000	576,571	1,555,413	582,975	788,041	-	-	5,234,000	-	5,234,000
Rock Material	190,000	615,378	1,317,122	332,000	527,867	1,458,434	881,999	28,000	-	-	5,350,800	-	5,350,800
NY	-	-	-	-	-	-	-	-	-	-	-	-	-
Shared	190,000	451,378	1,289,622	332,000	405,467	1,458,434	733,099	-	-	-	4,860,000	-	4,860,000
NJ	-	164,000	27,500	-	122,400	-	148,900	28,000	-	-	490,800	-	490,800
Non-HARS Material	2,133,749	2,571,457	810,500	1,900,114	1,163,698	1,598,499	2,667,358	1,717,143	842,200	1,853,100	17,257,818	83,706,400	100,964,218
NY	790,000	404,000	205,000	604,000	665,000	753,499	1,396,358	933,143	605,000	649,000	7,005,000	50,150,700	57,155,700
Shared	691,482	145,457	5,500	949,314	98,998	-	309,000	-	-	442,100	2,641,851	6,165,700	8,807,551
NJ	652,267	2,022,000	600,000	346,800	399,700	845,000	962,000	784,000	237,200	762,000	7,610,967	27,390,000	35,000,967

Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Table B-2-2. Dredging Requirements Volume Projection Summary (continued)

By Type of Material and Sub-Basin/Waterbody Location

	Calendar Year												
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005. ..2014	2015. ..2065	2005. ..2065
Total HARS Material	**6,034,001**	**9,311,206**	**4,794,945**	**3,287,810**	**6,147,997**	**5,902,365**	**1,626,975**	**2,569,149**	**2,742,637**	**696,255**	**43,113,340**	**45,940,000**	**89,053,340**
Newark Bay & Tributaries	-	597,000	740,000	75,000	762,571	1,555,413	582,975	788,041	-	-	5,101,000	-	5,101,000
Kill Van Kull	1,019,670	209,521	-	1,362,000	-	-	-	-	-	-	2,591,191	-	2,591,191
Arthur Kill	498,000	502,345	339,655	389,000	432,000	-	304,000	-	-	-	2,465,000	-	2,465,000
Upper Bay	2,039,055	4,587,906	1,240,000	-	1,461,492	1,106,196	-	1,141,108	1,612,637	256,255	13,444,649	2,950,000	16,394,649
Hudson River	440,000	440,000	440,000	440,000	440,000	440,000	440,000	440,000	580,000	440,000	4,540,000	23,190,000	27,730,000
East River & Western Long Island Sound	-	-	-	-	-	-	-	-	-	-	-	-	-
Jamaica Bay	350,000	-	350,000	-	-	350,000	-	-	350,000	-	1,400,000	5,950,000	7,350,000
Lower Bay & NY Bight Apex	1,687,276	2,974,434	1,685,290	1,021,810	3,051,934	2,450,756	300,000	200,000	200,000	-	13,571,500	13,850,000	27,421,500
Total Rock Material	**190,000**	**615,378**	**1,317,122**	**332,000**	**527,867**	**1,458,434**	**881,999**	**28,000**	**-**	**-**	**5,350,800**	**-**	**5,350,800**
Newark Bay	-	-	-	-	122,400	-	148,900	28,000	-	-	299,300	-	299,300
Kill Van Kull	-	17,878	753,122	-	7,299	532,757	242,944	-	-	-	1,554,000	-	1,554,000
Arthur Kill	190,000	597,500	536,500	332,000	398,168	925,677	490,155	-	-	-	3,470,000	-	3,470,000
Upper Bay	-	-	27,500	-	-	-	-	-	-	-	27,500	-	27,500
Total Non-HARS Material	**2,133,749**	**2,571,457**	**810,500**	**1,900,114**	**1,163,698**	**1,598,499**	**2,667,358**	**1,717,143**	**842,200**	**1,853,100**	**17,257,818**	**83,706,400**	**100,964,218**
Newark Bay & Tributaries	67,000	460,000	352,000	221,000	216,700	200,000	614,000	405,000	1,200	462,000	2,998,900	8,729,000	11,727,900
Kill Van Kull	20,000	50,000	200,000	130,000	-	250,000	20,000	-	200,000	162,100	1,032,100	5,905,700	6,937,800
Arthur Kill	769,000	271,500	25,500	343,800	63,000	337,000	309,000	147,000	36,000	300,000	2,601,800	9,793,000	12,394,800
Upper Bay	716,249	1,150,957	28,000	471,314	543,998	290,499	1,208,358	824,143	200,000	145,000	5,578,518	36,262,700	41,841,218
Hudson River	120,000	410,000	205,000	80,000	80,000	315,000	80,000	340,000	205,000	310,000	2,145,000	10,185,000	12,330,000
East River & Western Long Island Sound	143,000	104,000	-	404,000	260,000	106,000	136,000	1,000	200,000	324,000	1,678,000	7,231,000	8,909,000
Jamaica Bay	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower Bay & NY Bight Apex	298,500	125,000	-	250,000	-	100,000	300,000	-	-	150,000	1,223,500	5,600,000	6,823,500
TOTAL (all types)	**8,357,750**	**12,498,041**	**6,922,567**	**5,519,924**	**7,839,562**	**8,959,298**	**5,176,332**	**4,314,292**	**3,584,837**	**2,549,355**	**65,721,958**	**129,646,400**	**195,368,358**
Newark Bay	67,000	1,057,000	1,092,000	296,000	1,101,671	1,755,413	1,345,875	1,221,041	1,200	462,000	8,399,200	8,729,000	17,128,200
Kill Van Kull	1,039,670	277,399	953,122	1,492,000	7,299	782,757	262,944	-	200,000	162,100	5,177,291	5,905,700	11,082,991
Arthur Kill	1,457,000	1,371,345	901,655	1,064,800	893,168	1,262,677	1,103,155	147,000	36,000	300,000	8,536,800	9,793,000	18,329,800
Upper Bay	2,755,304	5,738,863	1,295,500	471,314	2,005,490	1,396,695	1,208,358	1,965,251	1,812,637	401,255	19,050,667	39,212,700	58,263,367
Hudson River	560,000	850,000	645,000	520,000	520,000	755,000	520,000	780,000	785,000	750,000	6,685,000	33,375,000	40,060,000
East River & Western Long Island Sound	143,000	104,000	-	404,000	260,000	106,000	136,000	1,000	200,000	324,000	1,678,000	7,231,000	8,909,000
Jamaica Bay	350,000	-	350,000	-	-	350,000	-	-	350,000	-	1,400,000	5,950,000	7,350,000
Lower Bay & NY Bight Apex	1,985,776	3,099,434	1,685,290	1,271,810	3,051,934	2,550,756	600,000	200,000	200,000	150,000	14,795,000	19,450,000	34,245,000

Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

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C FORMULATION OF PLANS

C-1 EVALUATION FACTORS

Given the magnitude of dredging requirements of the Port of NY and NJ (Port), no single option or site has been identified that is sufficient to meet all the dredged material management needs of the Port. Complicating matters further, there are many uncertainties regarding actual dredging needs, as well as the future quality of sediment from different parts of the NY and NJ Harbor (Harbor), and the cost effectiveness and efficiency of a number of newer and developing management options. The challenge of developing a Dredged Material Management Plan for the Port of NY and NJ (DMMP) is determining the combination of the various options that will meet the short and long-term needs of the Port in an economical and environmentally acceptable manner. The more traditional United States Army Corps of Engineers (USACE) approach of a fixed plan based strictly on proven solutions and lowest cost is not adequate to meet this particular challenge. For this plan to succeed in its implementation, it must be open-ended and flexible enough to respond to and incorporate changing needs and opportunities as they occur. Since the timeframe agreed to among the stakeholders for this DMMP is 60 years, some of the decisions in implementing evolving management strategies can be programmed for the future. This will afford the opportunity to test and evaluate a number of promising techniques now under development.

When combining the various options into a comprehensive plan, a number of factors must be taken into account. Careful consideration of the factors listed below provided the basis of the recommended plan.

- Environmental Protection/Enhancement
- Availability
- Reliability
- Flexibility
- Capacity & Project Life
- Localizing Impacts
- Bi-State Equity
- Economic Benefits & Costs

ENVIRONMENTAL PROTECTION/ENHANCEMENT – A major concern related to using dredged material for environmental applications is the presence of contaminants. Historically, much of the material dredged from the navigation channels has been too contaminated for direct application to upland sites. In many areas of the Harbor this trend continues to persist. To protect the environment, contaminated material must be treated or stabilized before it can be used for environmental applications.

Fundamental to the management of non-HARS (Historic Area Remediation Site) suitable material is the concurrent implementation of additional contaminant reduction measures (*e.g.*, point and non-point pollution source control, remediation of existing sediment hot spots, etc.) to reduce and eventually eliminate the future generation of HARS unsuitable material. Currently, the options for managing non-HARS suitable material are limited to decontamination, treatment/stabilization, or approved containment. Until the goal of significantly reducing the generation of this material is realized, the costs associated with its disposal will remain significantly higher.

For HARS suitable material, there are a variety of beneficial use options that can be implemented as alternatives to placing the material at the HARS. These options include beach nourishment, filling existing degraded aquatic sites, habitats creation, brownfield and landfill capping, and mine reclamation. To the extent practicable, the availability of beneficial use opportunities like these must be considered first before material can be placed at HARS.

AVAILABILITY – Availability addresses the time required to implement the various available options used in the development of the DMMP. Options whose implementation requires extended lead-time are less favorable than options that can be implemented relatively quickly. Some options (e.g., land remediation) can be implemented in a relatively short period of time while others (e.g., an island Confined Disposal Facility [CDF]) require considerably more lead-time. Ideally, a DMMP is best served by the availability of multiple options that are relatively easy to implement, and offer long-term capacity. Moreover, greater availability of options can bolster contingency capacity, which is often necessary to address unanticipated needs.

RELIABILITY – A critical component to the successful implementation of a DMMP is the reliability of the options. Investments in Port development, both public and private, are generally based on long-term forecasts of cost and stability. For a DMMP to be successful from an economic perspective it must have sufficiently reliable options at its disposal to allow for timely and cost effective maintenance and expansion of Port facilities as needed. Some options or methods of managing dredged material have been in existence in the region for several decades while others are at preliminary stages of investigation. While the DMMP may consider and even recommend options with little proven reliability, it will also consider the risk, uncertainty, and potential contingencies of such options in the event they are not implemented as fully as anticipated.

FLEXIBILITY – Flexibility is defined as the ability to readily change from one option to another, or to vary placement volumes as needed. Site-specific land remediation, for example, can be implemented with some degree of flexibility in the quantity of material used. This can be an important factor in helping to accommodate shifting needs. Island CDFs, on the other hand, are economical constrained by design capacity and construction schedule, and therefore are not as flexible in terms of how much, and when, material can be placed there.

CAPACITY & PROJECT LIFE – Options that can manage anticipated dredging needs for as long as possible are preferable to those that can only mange short-term or otherwise limited needs. Under-projecting the yearly dredging need has, in other areas of the country, caused substantial disruptions in the ability to maintain and expand Port facilities. According to the USACE regulations (Engineer Regulation [ER] 1105-2-100 Appendix E, section 15) (USACE 2000), a DMMP should demonstrate sufficient dredged material disposal capacity for a minimum of 20 years. Further, according to the Digest of Water Resources Policies and Authorities (Engineer Pamphlet [EP] 1165-2-1) (USACE 1999), the maximum planning horizon for channel deepening studies is 50 years. As several channel deepening studies/projects are currently underway, options that offer a longer project life is preferable.

LOCALIZING IMPACTS – As part of dredging operations, dredged material must be transported to a disposal or processing site. Although controls measures are employed to minimize overflow and spillage during operations and transport, there is always some loss of material throughout the process. As material is transported between the dredging site and the placement site, the material lost en route can serve as a mechanism for transporting contaminants around the harbor. Therefore placement options that are close or adjacent to the dredging site are preferable in order to minimize this concern.

BI-STATE EQUITY – Because the States share the Port, both States generate dredged material, and therefore both must manage its disposal. Consequently, options that partition the impact equitably between their jurisdictions are preferred over those that utilize one state’s resources, or rely on one state’s territory, more than the other’s.

ECONOMIC BENEFITS & COST – Economic benefits and costs are a major factor in the long-term maintenance and viability of the Port. Historically, the placement cost of ocean disposal of dredged material (the predominant management method used in this region prior to the implementation of the revised Green Book testing protocols) was essentially \$0–\$2/CY. Shortly following the implementation of the more environmentally protective protocols, dredging and disposal costs for material unsuitable for direct beneficial use peaked at over \$100/CY. Subsequent to the development of newer treatment and stabilization technologies, placement costs dropped to an average \$29/CY. This increase in cost for disposal and/or reuse of dredged material necessitates an economic evaluation when considering the various placement options. Options that are of particular interest are those that generate additional economic benefits such as creating aggregate products that have resale value, creating usable land, or extending natural habitat to enhance ecological function and value.

C-2 FORMULATION OF THE DMMP

The Final 2005 DMMP Implementation Report, Programmatic Environmental Impact Statement (PEIS), and Technical Appendix are the culmination of a multi-year effort by many state and Federal agencies, and public review and comment. In the development of the 1999 draft, the many stakeholders of the Dredged Material Management Integration Work Group (DMMIWG) and Senior Executive Review Group (SERG) reviewed the

DMMP. The SERG was made up of representatives from USACE, U.S. Environmental Protection Agency (USEPA), U.S. Coast Guard, the State of NY, the State of NJ and the Port Authority of NY and NJ (PANY/NJ). A working draft of the PEIS was reviewed by these agencies, which agreed to serve as the cooperative agencies under National Environmental Policy Act (NEPA).

As part of the public involvement under NEPA, public meetings were held in November 1999 to receive comments on the draft PEIS, Implementation Report and Technical Appendix. Written comments and comments made verbally at meetings were taken into account in the promulgation of a final PEIS. Written comments and the NY District (NYD) responses are contained in the Public Involvement Appendix (PIA) that accompanies this volume.

Following the release of the 1999 draft DMMP, the SERG directed the formation of a work team to work with the NYD to update the DMMP based on agency review and public comment. In the development of this 2005 update, the NY/NJ Regional Dredging Team (RDT), comprised of representatives from the PANY/NJ, NYD, the States of NY and NJ, NJDOT/OMR, and USEPA, have been meeting regularly to evaluate the current dredged material management options and come to consensus on those that should be part of the plan. As with the 1999 draft, this was accomplished by assigning a preference to each option based on its potential to beneficially use dredged material (especially for environmental restoration/remediation), or safely contain it. The following rankings indicate the preference level of each option. These rankings were used as the primary selection criteria for developing the recommended plan:

1. Preferred option: Options that beneficially use dredged material, often with a positive impact on the estuary.
2. Fall-back option: Options that can safely manage HARS unsuitable material and not pose an unacceptable risk to the estuary when properly sited and utilized.
3. Uncertain option: Options that require more analysis regarding technical or economic feasibility but warrant continued consideration because of their potential to beneficially use dredged material.
4. Least preferred option: Options that have either a low potential for beneficial use and/or a potential for unacceptable risk to the estuary.
5. Non-preferred option: Options that have potentially unacceptable impacts or are not technically or economically feasible.

In the 1999 draft version of the DMMP, three other alternative plans were developed for evaluation. These alternative plans were the No-Action Alternative, the Environmentally Preferred Plan, and the Base Plan. These alternatives are discussed in detail in the PEIS that accompanies this Technical Appendix. The estimated annual total placement cost of the Recommended Plan is presented in Figure C-2-1. Annual costs are based on estimates of available capacity and placement cost per cubic yard, as summarized in Table C-2-1.

REFERENCES

States of New York and New Jersey (NY/NJ). 1996. Joint Dredging Plan for the Port of New York and New Jersey. October 1996.

USACE. 1999. Digest of Water Resources Policies and Authorities. United States Army Corps of Engineers, Engineer Pamphlet (EP) 1165-2-1. Washington, DC.

USACE. 2000. Planning Guidance Notebook. United States Army Corps of Engineers, Engineer Regulation (ER) 1105-2-100. Washington, DC.

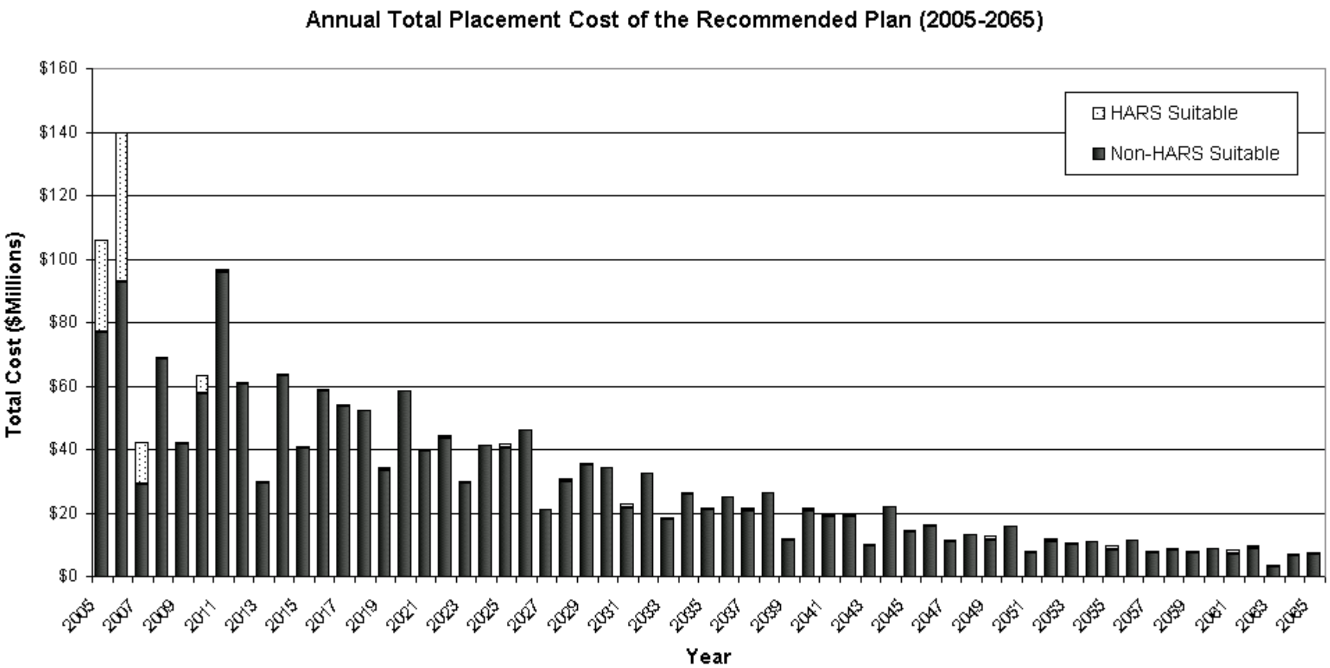

Figure C-2-1. Annual Total Placement Cost of the Recommended Plan (2005–2065).

Table C-2-1: Recommended 2005 - 2065 Dredged Material Management Plan for the Port of New York and New Jersey

Summary Information

	Volume (CY)	Total Cost ($)	Mean $/CY for Recommended plan
HARS suitable for Benefical use	19,143,000	$ 121,418,898	$ 6.34
Rock Material for Beneficial Use	5,350,800	$ -	$ -
HARS suitable to the HARS (including Rock)	121,715,529	$ -	$ -
Non-HARS suitable	49,159,029	$ 1,769,725,054	$ 36.00
Grand Total	195,368,358	$ 1,891,143,952	$ 9.68

Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Dredging Volume Projections (CY)

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
HARS Suitable Material (Not Including Rock)	**New York Waters**	990,000	440,000	990,000	440,000	740,000	1,150,000	640,000	1,547,050	2,623,446	728,734	798,116	1,150,569	777,698	597,700	1,171,158
	Sand	550,000	0	550,000	0	200,000	350,000	200,000	393,218	2,162,637	256,255	200,000	350,000	200,000	0	550,000
	Fine-Grained	440,000	440,000	440,000	440,000	540,000	740,000	440,000	1,153,832	460,809	472,479	598,116	800,569	577,698	597,700	621,158
	Glacial Till	0	0	0	0	0	60,000	0	0	0	0	0	0	0	0	0
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Shared Waters	3,004,946	4,589,208	2,177,098	2,772,810	4,645,426	2,796,952	304,000	200,000	0	21,588	0	200,000	32,512	0	0
	Sand	1,885,276	3,430,491	1,967,443	821,810	3,026,198	2,796,952	304,000	0	0	0	0	0	0	0	0
	Fine-Grained	100,000	854,851	0	705,525	1,187,228	0	0	200,000	0	21,588	0	200,000	32,512	0	0
	Glacial Till	1,019,670	209,521	0	856,475	432,000	0	0	0	0	0	0	0	0	0	0
	Stiff Clay	0	94,345	209,655	389,000	0	0	0	0	0	0	0	0	0	0	0
	New Jersey Waters	2,039,055	4,281,998	1,627,847	75,000	762,571	1,955,413	682,975	850,530	147,010	35,173	19,862	486,174	33,057	121,264	46,217
	Sand	207,200	1,122,000	224,400	0	0	0	100,000	0	0	0	0	0	0	0	0
	Fine-Grained	1,166,700	670,250	89,550	0	186,000	400,000	0	62,489	147,010	35,173	19,862	486,174	33,057	121,264	46,217
	Glacial Till	633,255	1,653,498	526,047	0	0	0	0	0	0	0	0	0	0	0	0
	Stiff Clay	31,900	836,250	787,850	75,000	576,571	1,555,413	582,975	788,041	0	0	0	0	0	0	0
	Total	**6,034,001**	**9,311,206**	**4,794,945**	**3,287,810**	**6,147,997**	**5,902,365**	**1,626,975**	**2,597,580**	**2,770,456**	**785,496**	**817,977**	**1,836,743**	**843,267**	**718,963**	**1,217,376**
Rock Material	**New York Waters**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shared Waters	190,000	451,378	1,289,622	332,000	405,467	1,458,434	733,099	-	-	-	-	-	-	-	-
	New Jersey Waters	-	164,000	27,500	-	122,400	-	148,900	28,000	-	-	-	-	-	-	-
	Total	**190,000**	**615,378**	**1,317,122**	**332,000**	**527,867**	**1,458,434**	**881,999**	**28,000**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Non-HARS Material	**New York Waters**	790,000	404,000	205,000	604,000	665,000	753,499	1,396,358	917,201	584,191	616,521	831,584	676,131	968,002	816,000	721,542
	Shared Waters	691,482	145,457	5,500	949,314	98,998	-	309,000	-	-	420,512	-	-	259,588	-	-
	New Jersey Waters	652,267	2,022,000	600,000	346,800	399,700	845,000	962,000	771,511	230,190	726,827	290,138	945,826	263,943	639,736	201,783
	Total	**2,133,749**	**2,571,457**	**810,500**	**1,900,114**	**1,163,698**	**1,598,499**	**2,667,358**	**1,688,712**	**814,381**	**1,763,859**	**1,121,723**	**1,621,957**	**1,491,533**	**1,455,737**	**923,324**

Management Options in the Recommended Plan

DREDGED MATERIAL ACCOMMODATED IN 5 YEAR TIMEFRAMES

HARS Suitable Material (Not Including Rock)

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Beneficial Uses - Habitat Creation, Enhancement & Restoration			weighted mean cost									
Capacity for HARS suitable Material (in 5 year blocks)		2,600,000	$6.44	$16,750,000	various	900,000	0	1,200,000	0	0	500,000	0
Beneficial Uses - Landfill, Brownfield, Quarry, & Mine Remediation												
Capacity for HARS suitable Material (in 5 year blocks)		2,113,000	$36.00	$76,068,000	no Stiff Clay	813,000	1,300,000	0	0	0	0	0
Beneficial Uses - Other Uses												
Capacity for HARS suitable Material (in 5 year blocks)		14,350,000	$2.00	$28,700,000	Various	250,000	200,000	350,000	200,000	250,000	1,100,000	1,250,000
Other Marketable Processes												
Capacity for HARS suitable Material (in 5 year blocks)		N/A				0	0	0	0	0	0	0
Aquatic Disposal												
Capacity for HARS suitable Material (in 5 year blocks)		130,000	$0	$0	Sand material only	0	0	0	0	0	130,000	0

Note: If "Earliest Projected Date of Possible Use" from Table 2-2 is "TBD", then for consideration in the Recommended Plan, the earliest projected date of use was assumed to be 2010, and will be adjusted as necessary in subsequent DMMP updates.

Note: For all years EXCEPT 2065, the amount of HARS suitable material dredged is greater than the placement capacity of beneficial uses, so that the amount of HARS suitable material going to Beneficial Uses is limited by the amount of placement capacity. In 2065, only 200,000 CY of material (Sand) is available, and 25

	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Sum of HARS Suitable Material (not including Rock) to Beneficial Uses			**5,463,000**			**1,730,000**	**1,250,000**
	1,963,000	**1,500,000**	**1,550,000**	**200,000**	**250,000**		
Practicable to HARS: Summary Data — Sand Material Only	250,000	200,000	350,000	200,000	250,000	1,230,000	1,200,000
Fine-Grained Material, plus excess Sand not previously accommodated	1,500,000	0	100,000	0	0	0	0
Glacial Till Material, plus excess Sand and Fine-Grained not previously accommodated	213,000	1,300,000	0	0	0	0	0
Stiff Clay Material, plus excess Sand, Fine-Grained, and Glacial Till not previously accommodated	0	0	1,100,000	0	0	500,000	0

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Historic Area Remediation Site and other Ocean Remediation												
Capacity for HARS suitable Material (in 5 year blocks)		TBD	$0	$0	Various	4,071,001	7,811,206	3,244,945	3,087,810	5,897,997	11,952,871	4,234,327

	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Sum of HARS Suitable Material (not including Rock) to HARS			**24,112,959**			**11,952,871**	**4,234,327**
HARS Placement: Summary Data — Sand To HARS - 5 year blocks	679,476	3,052,491	1,191,843	621,810	2,976,198	4,833,062	100,000
Fine-Grained To HARS - 5 year blocks	1,706,700	1,965,101	529,550	1,145,525	1,913,228	4,133,380	4,134,327
Glacial Till To HARS - 5 year blocks	1,652,925	1,863,019	526,047	856,475	432,000	60,000	0
Stiff Clay To HARS - 5 year blocks	31,900	930,595	997,505	464,000	576,571	2,926,429	0

Note: Breaking down the estimates of material to HARS by material type required making assumptions about which material would be accepted by the other placement options. The volume estimate for use were calculated assuming that all possible sand was used first, then all possible fine-grained, then glacial till, and ther

	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Total 5 Year Block Costs for HARS Suitable Material:			**$90,295,555**			**$7,437,914**	**$2,378,453**
	$29,116,636	**$47,196,409**	**$13,090,590**	**$396,409**	**$495,511**		

Note: Costs were estimated by multiplying the weighted mean cost per placement category (i.e., sand; sand and fine-grained; sand, fine-grained, and glacial till; all HARS suitable) by the volume of material that is projected to be placed, based on material type restrictions, at the identified storage areas.

Rock Material

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Beneficial Uses - Habitat Creation, Enhancement & Restoration												
Capacity for HARS suitable Material (in 5 year blocks)		5,350,800	$0	$0	Rock	190,000	615,378	1,317,122	332,000	527,867	2,368,433	0
Sum of HARS Suitable Material (Rock only) to Beneficial Uses								**2,982,367**			**2,368,433**	**0**
Historic Area Remediation Site and other Ocean Remediation												
Capacity for HARS suitable Material (in 5 year blocks)		TBD	$0	$0	Rock	0	0	0	0	0	0	0

Note: Although rock is technically allowed to be disposed of at the HARS, there is potential that this would create an attractive nuisance (e.g., fishing reef at the remediation site); instead, all rock is used beneficially for reef creation.

	2005 - 2009	2010 - 2014	2015 - 2019
Sum of HARS Suitable Material (Rock only) to HARS	**0**	**0**	**0**
Total 5 Year Block Costs for Rock Material:	**$0**	**$0**	**$0**

Non-HARS Material

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Beneficial Uses - Landfill, Brownfield, Quarry & Mine Remediation												
Capacity for Non-HARS Material (in 5 year blocks)		43,313,000	$36.00	$1,559,268,000	includes Non-HARS	23,313,000	0	0	0	0	20,000,000	0
Decontamination Technologies and Other Marketable Processes												
Capacity for Non-HARS Material (in 5 year blocks)		30,175,000	$36.00	$1,086,300,000	includes Non-HARS	175,000	500,000	500,000	500,000	500,000	2,500,000	2,500,000
Aquatic Disposal												
Capacity for Non-HARS Material (in 5 year blocks)		500,000	$36.00	$18,000,000	includes Non-HARS	500,000	0	0	0	0	0	0

Note: If "Earliest Projected Date of Possible Use" from Table 2-2 is "TBD", then for consideration in the Recommended Plan, the earliest projected date of use was assumed to be 2010, and will be adjusted as necessary in subsequent DMMP updates.

	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Sum of Non-HARS Material Placement Options			**25,988,000**			**22,500,000**	**2,500,000**
	23,988,000	**500,000**	**500,000**	**500,000**	**500,000**		
Sum of Non-HARS Material Placed at Placement Options			**8,579,518**			**8,532,810**	**6,614,273**
	2,133,749	**2,571,457**	**810,500**	**1,900,114**	**1,163,698**		

Note: The sum of Non-HARS material placed at placement options includes placement at placement sites identified in previous years with remaining available capacity.

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Remaining Available Capacity												
Excess Available Capacity in 5 year blocks		NA	$36.00	NA	includes Non-HARS	21,854,251	19,782,794	19,472,294	18,072,180	17,408,482	31,375,672	27,261,400

	2005	2006	2007	2008	2009	2010 - 2014	2015 - 2019
Total 5 Year Block Costs for Non-HARS Material:			**$308,862,648**			**$307,181,145**	**$238,113,824**
	$76,814,964	**$92,572,452**	**$29,178,000**	**$68,404,104**	**$41,893,128**		

Table C-2-1: Recommended 2005 - 2065 Dredged Material Management Plan for the Port of New York and New Jersey

Summary Information

	Volume (CY)	Total Cost ($)	Mean $/CY for Recommended plan
HARS suitable for Benefical use	19,143,000	$ 121,418,898	$ 6.34
Rock Material for Beneficial Use	5,350,800	$ -	$ -
HARS suitable to the HARS (including Rock)	121,715,529	$ -	$ -
Non-HARS suitable	49,159,029	$ 1,769,725,054	$ 36.00
Grand Total	195,368,358	$ 1,891,143,952	$ 9.68

Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Dredging Volume Projections (CY)

		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
HARS Suitable Material (Not Including Rock)	**New York Waters**	710,583	1,014,453	1,304,073	925,538	858,884	1,568,734	827,050	1,003,492	1,422,613	1,310,657	1,069,448	1,387,746	943,175	1,313,047	1,623,292
	Sand	0	200,000	350,000	200,000	0	550,000	0	200,000	350,000	200,000	0	550,000	0	200,000	350,000
	Fine-Grained	710,583	814,453	954,073	725,538	858,884	1,018,734	827,050	803,492	1,072,613	1,110,657	1,069,448	837,746	943,175	1,113,047	1,273,292
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Shared Waters	301,914	0	350,000	91,543	200,000	0	181,831	0	200,000	137,151	0	0	442,935	0	0
	Sand	0	0	350,000	0	0	0	0	0	0	0	0	0	0	0	0
	Fine-Grained	301,914	0	0	91,543	200,000	0	181,831	0	200,000	137,151	0	0	442,935	0	0
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	New Jersey Waters	113,458	236,012	741,537	172,569	220,917	128,987	343,713	188,989	789,187	120,670	352,138	395,821	403,584	257,564	891,331
	Sand	0	100,000	0	0	0	0	0	0	0	0	0	100,000	0	0	0
	Fine-Grained	113,458	136,012	741,537	172,569	220,917	128,987	343,713	188,989	789,187	120,670	352,138	295,821	403,584	257,564	891,331
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	**1,125,955**	**1,250,466**	**2,395,610**	**1,189,651**	**1,279,802**	**1,697,722**	**1,352,595**	**1,192,481**	**2,411,800**	**1,568,478**	**1,421,586**	**1,783,567**	**1,789,694**	**1,570,611**	**2,514,623**
Rock Material	**New York Waters**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shared Waters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	New Jersey Waters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-HARS Material	**New York Waters**	898,117	741,247	499,627	570,162	739,816	910,966	542,650	329,208	381,087	690,043	606,252	342,954	403,525	419,653	365,408
	Shared Waters	340,186	-	-	200,557	-	-	260,269	-	-	154,949	-	-	199,165	-	-
	New Jersey Waters	384,542	351,988	708,463	47,631	404,083	217,013	477,287	251,011	451,813	136,330	344,862	252,179	299,416	81,636	349,669
	Total	**1,622,845**	**1,093,234**	**1,208,090**	**818,349**	**1,143,898**	**1,127,978**	**1,280,205**	**580,219**	**832,900**	**981,322**	**951,114**	**595,133**	**902,106**	**501,289**	**715,077**

Management Options in the Recommended Plan

HARS Suitable Material (Not Including Rock)

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2020 - 2024	2025 - 2029	2030 - 2034
Beneficial Uses - Habitat Creation, Enhancement & Restoration			weighted mean cost					
Capacity for HARS suitable Material (in 5 year blocks)		2,600,000	$6.44	$16,750,000	various	0	0	0
Beneficial Uses - Landfill, Brownfield, Quarry, & Mine Remediation								
Capacity for HARS suitable Material (in 5 year blocks)		2,113,000	$36.00	$76,068,000	no Stiff Clay	0	0	0
Beneficial Uses - Other Uses								
Capacity for HARS suitable Material (in 5 year blocks)		14,350,000	$2.00	$28,700,000	Various	1,100,000	1,250,000	1,100,000
Other Marketable Processes								
Capacity for HARS suitable Material (in 5 year blocks)		N/A				0	0	0
Aquatic Disposal								
Capacity for HARS suitable Material (in 5 year blocks)		130,000	$0	$0	Sand material only	0	0	0
						0,000 CY of placement capacity is available. Therefore, in the year 2065, the amount of HARS suitable material to Beneficial Uses is limited by the amount of material dredged, not on the placemer		
Sum of HARS Suitable Material (not including Rock) to Beneficial Uses						**1,100,000**	**1,250,000**	**1,100,000**
Practicable to HARS: Summary Data					**Sand Material Only**	900,000	1,250,000	1,200,000
					Fine-Grained Material, plus excess Sand not previously accommodated	0	0	0
					Glacial Till Material, plus excess Sand and Fine-Grained not previously accommodated	0	0	0
					Stiff Clay Material, plus excess Sand, Fine-Grained, and Glacial Till not previously accommodated	0	0	0
Historic Area Remediation Site and other Ocean Remediation								
Capacity for HARS suitable Material (in 5 year blocks)		TBD	$0	$0	Various	6,341,484	6,973,075	7,880,082
Sum of HARS Suitable Material (not including Rock) to HARS						**6,341,484**	**6,973,075**	**7,880,082**
HARS Placement: Summary Data					Sand To HARS - 5 year blocks	300,000	50,000	0
					Fine-Grained To HARS - 5 year blocks	6,041,484	6,923,075	7,880,082
					Glacial Till To HARS - 5 year blocks	0	0	0
					Stiff Clay To HARS - 5 year blocks	0	0	0
Total 5 Year Block Costs for HARS Suitable Material:						**$1,783,840**	**$2,477,555**	**$2,378,453**

Rock Material

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2020 - 2024	2025 - 2029	2030 - 2034
Beneficial Uses - Habitat Creation, Enhancement & Restoration								
Capacity for HARS suitable Material (in 5 year blocks)		5,350,800	$0	$0	Rock	0	0	0
Sum of HARS Suitable Material (Rock only) to Beneficial Uses						**0**	**0**	**0**
Historic Area Remediation Site and other Ocean Remediation								
Capacity for HARS suitable Material (in 5 year blocks)		TBD	$0	$0	Rock	0	0	0
Sum of HARS Suitable Material (Rock only) to HARS						**0**	**0**	**0**
Total 5 Year Block Costs for Rock Material:						**$0**	**$0**	**$0**

Non-HARS Material

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2020 - 2024	2025 - 2029	2030 - 2034
Beneficial Uses - Landfill, Brownfield, Quarry & Mine Remediation								
Capacity for Non-HARS Material (in 5 year blocks)		43,313,000	$36.00	$1,559,268,000	includes Non-HARS	0	0	0
Decontamination Technologies and Other Marketable Processes								
Capacity for Non-HARS Material (in 5 year blocks)		30,175,000	$36.00	$1,086,300,000	includes Non-HARS	2,500,000	2,500,000	2,500,000
Aquatic Disposal								
Capacity for Non-HARS Material (in 5 year blocks)		500,000	$36.00	$18,000,000	includes Non-HARS	0	0	0
Sum of Non-HARS Material Placement Options						**2,500,000**	**2,500,000**	**2,500,000**
Sum of Non-HARS Material Placed at Placement Options						**5,886,416**	**4,802,625**	**3,664,718**
Remaining Available Capacity								
Excess Available Capacity in 5 year blocks		NA	$36.00	NA	includes Non-HARS	23,874,983	21,572,358	20,407,640
Total 5 Year Block Costs for Non-HARS Material:						**$211,910,993**	**$172,894,491**	**$131,929,862**

Table C-2-1: Recommended 2005 - 2065 Dredged Material Management Plan for the Port of New York and New Jersey

Summary Information

	Volume (CY)	Total Cost ($)	Mean $/CY for Recommended plan
HARS suitable for Benefical use	19,143,000	$ 121,418,898	$ 6.34
Rock Material for Beneficial Use	5,350,800	$ -	$ -
HARS suitable to the HARS (including Rock)	121,715,529	$ -	$ -
Non-HARS suitable	49,159,029	$ 1,769,725,054	$ 36.00
Grand Total	195,368,358	$ 1,891,143,952	$ 9.68

Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Dredging Volume Projections (CY)

		2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
HARS Suitable Material (Not Including Rock)	**New York Waters**	1,250,510	1,066,738	1,713,827	1,138,535	1,267,480	1,810,353	1,437,136	1,138,129	1,515,209	1,301,780	1,709,168	1,652,184	1,187,922	1,203,616	2,026,780
	Sand	200,000	0	550,000	0	200,000	350,000	200,000	0	550,000	0	200,000	350,000	200,000	0	550,000
	Fine-Grained	1,050,510	1,066,738	1,163,827	1,138,535	1,067,480	1,460,353	1,237,136	1,138,129	965,209	1,301,780	1,509,168	1,302,184	987,922	1,203,616	1,476,780
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Shared Waters	172,387	200,000	0	289,664	0	200,000	199,610	350,000	0	525,407	0	0	220,643	200,000	0
	Sand	0	0	0	0	0	0	0	350,000	0	0	0	0	0	0	0
	Fine-Grained	172,387	200,000	0	289,664	0	200,000	199,610	0	0	525,407	0	0	220,643	200,000	0
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	New Jersey Waters	107,382	558,690	296,994	413,010	134,438	930,566	357,192	651,496	327,422	505,521	222,137	1,240,402	233,998	541,437	183,024
	Sand	0	0	0	0	0	0	100,000	0	0	0	0	0	0	0	0
	Fine-Grained	107,382	558,690	296,994	413,010	134,438	930,566	257,192	651,496	327,422	505,521	222,137	1,240,402	233,998	541,437	183,024
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	**1,530,279**	**1,825,428**	**2,010,821**	**1,841,209**	**1,401,918**	**2,940,919**	**1,993,938**	**2,139,626**	**1,842,630**	**2,332,708**	**1,931,305**	**2,892,586**	**1,642,563**	**1,945,053**	**2,209,805**
Rock Material	**New York Waters**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shared Waters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	New Jersey Waters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-HARS Material	**New York Waters**	392,190	369,962	393,873	358,165	250,220	330,347	331,564	275,571	192,491	299,920	320,532	174,516	157,778	210,084	265,920
	Shared Waters	119,713	-	-	152,436	-	-	92,490	-	-	116,693	-	-	71,457	-	-
	New Jersey Waters	71,618	325,310	179,006	216,990	65,562	246,434	99,808	250,504	71,778	188,479	75,863	259,598	75,002	151,563	52,976
	Total	**583,521**	**695,272**	**572,879**	**727,591**	**315,782**	**576,781**	**523,862**	**526,074**	**264,270**	**605,092**	**396,395**	**434,114**	**304,237**	**361,647**	**318,895**

Management Options in the Recommended Plan

HARS Suitable Material (Not Including Rock)

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2035 - 2039	2040 - 2044	2045 - 2049
Beneficial Uses - Habitat Creation, Enhancement & Restoration			weighted mean cost					
Capacity for HARS suitable Material (in 5 year blocks)		2,600,000	$6.44	$16,750,000	various	0	0	0
Beneficial Uses - Landfill, Brownfield, Quarry, & Mine Remediation								
Capacity for HARS suitable Material (in 5 year blocks)		2,113,000	$36.00	$76,068,000	no Stiff Clay	0	0	0
Beneficial Uses - Other Uses								
Capacity for HARS suitable Material (in 5 year blocks)		14,350,000	$2.00	$28,700,000	Various	1,250,000	1,100,000	1,250,000
Other Marketable Processes								
Capacity for HARS suitable Material (in 5 year blocks)		N/A				0	0	0
Aquatic Disposal								
Capacity for HARS suitable Material (in 5 year blocks)		130,000	$0	$0	Sand material only	0	0	0
Sum of HARS Suitable Material (not including Rock) to Beneficial Uses						**1,250,000**	**1,100,000**	**1,250,000**
Practicable to HARS: Summary Data					**Sand Material Only**	950,000	1,350,000	1,300,000
					Fine-Grained Material, plus excess Sand not previously accommodated	0	0	0
					Glacial Till Material, plus excess Sand and Fine-Grained not previously accommodated	0	0	0
					Stiff Clay Material, plus excess Sand, Fine-Grained, and Glacial Till not previously accommodated	0	0	0
Historic Area Remediation Site and other Ocean Remediation								
Capacity for HARS suitable Material (in 5 year blocks)		TBD	$0	$0	Various	7,659,656	9,899,821	9,321,312
Sum of HARS Suitable Material (not including Rock) to HARS						**7,659,656**	**9,899,821**	**9,321,312**
HARS Placement: Summary Data					Sand To HARS - 5 year blocks	0	200,000	0
					Fine-Grained To HARS - 5 year blocks	7,659,656	9,699,821	9,321,312
					Glacial Till To HARS - 5 year blocks	0	0	0
					Stiff Clay To HARS - 5 year blocks	0	0	0
Total 5 Year Block Costs for HARS Suitable Material:						**$1,882,942**	**$2,675,760**	**$2,576,657**

Rock Material

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2035 - 2039	2040 - 2044	2045 - 2049
Beneficial Uses - Habitat Creation, Enhancement & Restoration								
Capacity for HARS suitable Material (in 5 year blocks)		5,350,800	$0	$0	Rock	0	0	0
Sum of HARS Suitable Material (Rock only) to Beneficial Uses						**0**	**0**	**0**
Historic Area Remediation Site and other Ocean Remediation								
Capacity for HARS suitable Material (in 5 year blocks)		TBD	$0	$0	Rock	0	0	0
Sum of HARS Suitable Material (Rock only) to HARS						**0**	**0**	**0**
Total 5 Year Block Costs for Rock Material:						**$0**	**$0**	**$0**

Non-HARS Material

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2035 - 2039	2040 - 2044	2045 - 2049
Beneficial Uses - Landfill, Brownfield, Quarry & Mine Remediation								
Capacity for Non-HARS Material (in 5 year blocks)		43,313,000	$36.00	$1,559,268,000	includes Non-HARS	0	0	0
Decontamination Technologies and Other Marketable Processes								
Capacity for Non-HARS Material (in 5 year blocks)		30,175,000	$36.00	$1,086,300,000	includes Non-HARS	2,500,000	2,500,000	2,500,000
Aquatic Disposal								
Capacity for Non-HARS Material (in 5 year blocks)		500,000	$36.00	$18,000,000	includes Non-HARS	0	0	0
Sum of Non-HARS Material Placement Options						**2,500,000**	**2,500,000**	**2,500,000**
Sum of Non-HARS Material Placed at Placement Options						**2,895,044**	**2,496,079**	**1,815,288**
Remaining Available Capacity								
Excess Available Capacity in 5 year blocks		NA	$36.00	NA	includes Non-HARS	20,012,596	20,016,517	20,701,229
Total 5 Year Block Costs for Non-HARS Material:						**$104,221,589**	**$89,858,833**	**$65,350,365**

Table C-2-1: Recommended 2005 - 2065 Dredged Material Management Plan for the Port of New York and New Jersey

Summary Information

	Volume (CY)	Total Cost ($)	Mean $/CY for Recommended plan
HARS suitable for Benefical use	19,143,000	$ 121,418,898	$ 6.34
Rock Material for Beneficial Use	5,350,800	$ -	$ -
HARS suitable to the HARS (including Rock)	121,715,529	$ -	$ -
Non-HARS suitable	49,159,029	$ 1,769,725,054	$ 36.00
Grand Total	195,368,358	$ 1,891,143,952	$ 9.68

Note: All material type designations are projections of what the material types may be based on past history of dredging operations and the knowledge and understanding of the dredging programs. Dredged material may be subjected to material type testing/verification to confirm material types on a case by case basis.

Dredging Volume Projections (CY)

		2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2005 - 2065
HARS Suitable Material (Not Including Rock)	**New York Waters**	1,374,413	1,240,950	1,674,679	1,682,027	1,408,457	1,906,482	1,229,917	1,591,888	1,705,276	1,476,280	1,517,671	1,995,818	1,242,720	1,268,712	1,894,531	1,901,346	78,597,795
	Sand	0	200,000	350,000	200,000	0	550,000	0	200,000	350,000	200,000	0	550,000	0	200,000	350,000	200,000	15,812,110
	Fine-Grained	1,374,413	1,040,950	1,324,679	1,482,027	1,408,457	1,356,482	1,229,917	1,391,888	1,355,276	1,276,280	1,517,671	1,445,818	1,242,720	1,068,712	1,544,531	1,701,346	62,725,685
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60,000
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Shared Waters	352,752	0	200,000	236,893	0	0	573,676	0	0	249,447	200,000	0	739,690	0	200,000	259,147	28,019,230
	Sand	0	0	0	0	0	0	0	0	0	0	0	0	350,000	0	0	0	15,282,170
	Fine-Grained	352,752	0	200,000	236,893	0	0	573,676	0	0	249,447	200,000	0	389,690	0	200,000	259,147	9,526,394
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,517,666
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	693,000
	New Jersey Waters	449,789	511,115	1,205,843	197,200	573,993	297,232	641,695	361,965	1,180,706	230,182	547,098	573,074	681,994	328,681	1,087,802	148,801	34,241,504
	Sand	0	100,000	0	0	0	0	0	0	0	0	0	100,000	0	0	0	0	2,153,600
	Fine-Grained	449,789	411,115	1,205,843	197,200	573,993	297,232	641,695	361,965	1,180,706	230,182	547,098	473,074	681,994	328,681	1,087,802	148,801	24,041,104
	Glacial Till	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,812,800
	Stiff Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,234,000
	Total	**2,176,954**	**1,752,064**	**3,080,522**	**2,116,119**	**1,982,450**	**2,203,714**	**2,445,288**	**1,953,852**	**2,885,982**	**1,955,910**	**2,264,769**	**2,568,892**	**2,664,404**	**1,597,394**	**3,182,333**	**2,309,293**	**140,858,529**
Rock Material	**New York Waters**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Shared Waters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,860,000
	New Jersey Waters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	490,800
	Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5,350,800**
Non-HARS Material	**New York Waters**	234,287	114,750	129,021	213,673	190,243	173,218	139,783	140,812	98,424	124,420	158,029	134,882	103,980	63,988	94,169	141,354	25,967,905
	Shared Waters	89,348	-	-	55,207	-	-	68,424	-	-	42,653	-	-	52,410	-	-	32,953	4,928,761
	New Jersey Waters	116,211	88,885	176,157	11,000	119,007	60,768	111,305	66,035	128,294	38,818	81,902	62,926	89,006	22,519	85,198	18,199	18,262,363
	Total	**439,846**	**203,636**	**305,178**	**279,881**	**309,250**	**233,986**	**319,512**	**206,848**	**226,718**	**205,890**	**239,931**	**197,808**	**245,396**	**86,506**	**179,367**	**192,507**	**49,159,029**

Management Options in the Recommended Plan

HARS Suitable Material (Not Including Rock)

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2050 - 2054	2055 - 2059	2060 - 2064	2065	2005 - 2065
Beneficial Uses - Habitat Creation, Enhancement & Restoration			weighted mean cost							
Capacity for HARS suitable Material (in 5 year blocks)		2,600,000	$6.44	$16,750,000	various	0	0	0	0	**2,600,000**
Beneficial Uses - Landfill, Brownfield, Quarry, & Mine Remediation										
Capacity for HARS suitable Material (in 5 year blocks)		2,113,000	$36.00	$76,068,000	no Stiff Clay	0	0	0	0	**2,113,000**
Beneficial Uses - Other Uses										
Capacity for HARS suitable Material (in 5 year blocks)		14,350,000	$2.00	$28,700,000	Various	1,100,000	1,250,000	1,100,000	250,000	**14,350,000**
Other Marketable Processes										
Capacity for HARS suitable Material (in 5 year blocks)		N/A				0	0	0	0	**-**
Aquatic Disposal										
Capacity for HARS suitable Material (in 5 year blocks)		130,000	$0	$0	Sand material only	0	0	0	0	**130,000**
Sum of HARS Suitable Material (not including Rock) to Beneficial Uses						**1,100,000**	**1,250,000**	**1,100,000**	**200,000**	**19,143,000**
Practicable to HARS: Summary Data					**Sand Material Only**	850,000	1,300,000	1,450,000	200,000	**14,430,000**
					Fine-Grained Material, plus excess Sand not previously accommodated	0	0	0	0	**1,600,000**
					Glacial Till Material, plus excess Sand and Fine-Grained not previously accommodated	0	0	0	0	**1,513,000**
					Stiff Clay Material, plus excess Sand, Fine-Grained, and Glacial Till not previously accommodated	0	0	0	0	**1,600,000**
Historic Area Remediation Site and other Ocean Remediation										
Capacity for HARS suitable Material (in 5 year blocks)		TBD	$0	$0	Various	10,258,110	10,144,747	10,827,792	2,109,293	**121,715,529**
Sum of HARS Suitable Material (not including Rock) to HARS						**10,258,110**	**10,144,747**	**10,827,792**	**2,109,293**	**121,715,529**
HARS Placement: Summary Data					Sand To HARS - 5 year blocks	0	0	100,000	0	**14,104,880**
					Fine-Grained To HARS - 5 year blocks	10,258,110	10,144,747	10,727,792	2,109,293	**96,293,183**
					Glacial Till To HARS - 5 year blocks	0	0	0	0	**5,390,466**
					Stiff Clay To HARS - 5 year blocks	0	0	0	0	**5,927,000**
Total 5 Year Block Costs for HARS Suitable Material:						**$1,684,738**	**$2,576,657**	**$2,873,964**	**$396,409**	**$121,418,898**

Rock Material

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2050 - 2054	2055 - 2059	2060 - 2064	2065	2005 - 2065
Beneficial Uses - Habitat Creation, Enhancement & Restoration										
Capacity for HARS suitable Material (in 5 year blocks)		5,350,800	$0	$0	Rock	0	0	0	0	**5,350,800**
Sum of HARS Suitable Material (Rock only) to Beneficial Uses						**0**	**0**	**0**	**0**	**5,350,800**
Historic Area Remediation Site and other Ocean Remediation										
Capacity for HARS suitable Material (in 5 year blocks)		TBD	$0	$0	Rock	0	0	0	0	**-**
Sum of HARS Suitable Material (Rock only) to HARS						**0**	**0**	**0**	**0**	**-**
Total 5 Year Block Costs for Rock Material:						**$0**	**$0**	**$0**	**$0**	**$0**

Non-HARS Material

Option Type	Option Site	Total Capacity	User Placement Cost $/CY	Total Option Cost	Material Type Restricions	2050 - 2054	2055 - 2059	2060 - 2064	2065	2005 - 2065
Beneficial Uses - Landfill, Brownfield, Quarry & Mine Remediation										
Capacity for Non-HARS Material (in 5 year blocks)		43,313,000	$36.00	$1,559,268,000	includes Non-HARS	0	0	0	0	**43,313,000**
Decontamination Technologies and Other Marketable Processes										
Capacity for Non-HARS Material (in 5 year blocks)		30,175,000	$36.00	$1,086,300,000	includes Non-HARS	2,500,000	2,500,000	2,500,000	500,000	**30,175,000**
Aquatic Disposal										
Capacity for Non-HARS Material (in 5 year blocks)		500,000	$36.00	$18,000,000	includes Non-HARS	0	0	0	0	**500,000**
Sum of Non-HARS Material Placement Options						**2,500,000**	**2,500,000**	**2,500,000**	**500,000**	**73,988,000**
Sum of Non-HARS Material Placed at Placement Options						**1,537,790**	**1,192,953**	**949,008**	**192,507**	**49,159,029**
Remaining Available Capacity										
Excess Available Capacity in 5 year blocks		NA	$36.00	NA	includes Non-HARS	21,663,439	22,970,486	24,521,477	24,828,971	**24,828,971**
Total 5 Year Block Costs for Non-HARS Material:						**$55,360,450**	**$42,946,318**	**$34,164,297**	**$6,930,240**	**$1,769,725,054**

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