New York - New Jersey
Harbor Estuary Program

Regional Sediment Management Plan

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New York/New Jersey
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Executive Summary

This report presents a Regional Sediment Management (RSM) Plan for the New York & New Jersey Harbor Estuary (Harbor Estuary) for your review and concurrence. This plan embodies the consensus of the Regional Sediment Management Workgroup (Workgroup) charged with this purpose.

The Workgroup, composed of representatives of a variety of federal, state, and local agencies and non-government public interest groups was formed as an *ad hoc* committee to develop a plan for an RSM Program that integrates sediment management activities for the Harbor Estuary. The Harbor Estuary Program (HEP) Policy Committee approved the *ad hoc* approach and charged the Workgroup with developing a scope and structure for the RSM Program, which offers:

- Specific goals and targets to improve the Harbor Estuary ecosystem, public health, and the local/regional economy
- Sustainability in carrying out future tasks at the Harbor Estuary
- Technical credibility and regional support

As such, this RSM Plan initiates a proactive, long-term, regional management perspective that reaches across state lines to coordinate various stakeholders involved in sediment management to control sources of sediment and contaminants, reduce dredging needs and impacts, promote beneficial use of dredged material, link dredging to brownfields and economic development, and restore a healthy ecosystem.

Why Regional Sediment Management?

Sediment is an essential and dynamic part of the Harbor Estuary; its quality and quantity are integral to ecosystem health and a fundamental component of the regional economy. Although sediment and the pollutants that contaminate it originate throughout the 16,300-square mile watershed, our management of sediment has historically taken a highly localized and narrowly focused approach – one that is largely based on the tightly-defined concerns of agencies and authorities directly responsible for maintaining navigable waterways in the Harbor Estuary. This "end of the pipe" management approach does not address the causes of sediment-related problems, nor does it provide the policy and regulatory framework required to improve sediment management throughout the Harbor Estuary. Uncertainties and controversy have stalled sediment cleanup and restoration projects, deferred maintenance of our port infrastructure, and led to lost opportunities to beneficially reusing dredged material.

Rather than a localized issue, sediment management in the Harbor Estuary is really a regional issue that can only be successfully implemented as a joint effort between federal, state, and local entities and the public. All parties must work to cooperatively and effectively manage the three major components of the RSM Plan:

1. Sediment quality

2. Sediment quantity

3. Dredged material management

Increased public and governmental understanding of the physical, biological, social, and economic linkages between all parts of the watershed and the Harbor Estuary are necessary to effectively bring such a regional plan to action.

General Approach of the RSM Plan

While this RSM effort is a relatively new concept, similar management approaches have been implemented successfully elsewhere in the United States and Europe. Existing strategic plans worldwide were reviewed to generate an inclusive list of basic, generally-accepted principles for the RSM Plan for the Harbor Estuary, including those established by the following entities:

- National Dredging Team – a federal interagency group formed in 1995 established principles to guide implementation of the National Dredging Policy[1]

- U.S. Army Corps of Engineers (Corps) – established Environmental Operating Principles to guide the full spectrum of Corps activities and regulatory decision-making[2]

- European Sediment Research Network (SedNet) – a network of scientists, agencies and industries funded by the European Union (EU) to incorporate sediment issues and knowledge into European environmental management strategies and fulfill EU directives[3]

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[1] National Dredging Team 2002. Dredged Material Management Action Agenda for the Next Decade based on a Workshop sponsored by the National Dredging Team in Jacksonville, Florida, January 21-23, 2001. *EPA842-B-04-002.* http://www.epa.gov/owow/oceans/ndt/actionagenda.html

[2] Headquarters U.S. Army Corps of Engineers Environmental Operating Principles. http://www.hq.usace.army.mil/cepa/envprinciples.htm

[3] European Sediment Research Network. 2004. SedNet Position Paper 2002-2004.

With guiding principles established, the Workgroup determined specific objectives for each of the major components – sediment quality, sediment quantity, and dredged material management – describing the challenges, status, and recommended actions for each objective. A total of eight objectives and 45 separate actions were recommended and are presented herein as the consensus of the Workgroup.

The Workgroup emphatically agreed that State Sediment Management Advocates in both New York and New Jersey are essential for implementing the RSM Program according to these generally accepted principles. The State Sediment Management Advocates envisioned by the Workgroup must be senior-level, non-regulatory positions focused entirely on sediment management. The advocates must have sufficient authority to influence decision makers at the state-level to coordinate and link sediment issues to all applicable programs, such as watershed management, stormwater management, brownfield revitalization, habitat restoration and protection, water quality enhancement, resource sustainability, and urban waterfront planning.

A key challenge for the Advocates will be instigating an inclusive culture in which the public is fully engaged in the process, from planning through implementation. Shifting from local management plans that involve sediment to RSM requires increasing local agency and public recognition of the linkages of all parts of the watershed to the Harbor Estuary. Successful implementation of the recommended actions will require engaging the public in meaningful collaboration for setting and implementing priorities for action. This much needed approach replaces the practice of seeking public acceptance for plans that are developed by high-level agencies with a practice of involving the public in the development of plans.

Costs and Benefits

The costs and benefits of creating and implementing the RSM Plan are discussed, and, although specific costs for creating and implementing some recommended actions for the RSM Plan are not practical to estimate at this time (because the exact nature of the action has yet to be determined), the benefits are clear. Elsewhere in the United States and in Europe, significant cost savings and other benefits have resulted from RSM[4] efforts.

[4] U.S. Army Engineer Research and Development Center Regional Sediment Management Fact Sheet February 2008 www.erdc.usace.army.mil

The RSM Plan is a long-term plan with anticipated near-term economic returns. The Dredged Material Management Plan for the Port of New York and New Jersey (DMMP) estimates that achieving the goal of clean sediments throughout the harbor can save at least $25,000,000 per year in the costs of maintaining our water transportation infrastructure. Other economic drivers for implementing the RSM Plan also include increased and improved opportunities for recreation, tourism, and fisheries – industries valued at over $20 billion per year that depend on a clean Harbor Estuary.

Based on the results of other RSM efforts, adopting a regional approach to managing sediment can benefit the Harbor Estuary in many ways, including:

- *Cost savings* resulting from reduced re-handling of material; extended dredging cycles, equipment sharing in linked projects, information sharing among parties, and elimination of redundant data collection efforts.

- *Improved habitat quality* resulting from the remediation of contaminated sediments and restoration of the remediated areas.

- *Improved environmental conditions* based on reintroduction of sediment into "sand starved" littoral systems to sustain habitat for threatened and endangered species.

- *Shared regional-scale data management systems, models and other tools* improve project-level decisions and help achieve greater consistency in analytical results among studies and projects within a region.

- *Improved interagency and stakeholder relationships* that produce opportunities for collaboratively leveraging financial and manpower resources in data collection and analysis, tool development, and project implementation.

- *Improved predictability of regulatory processes* resulting from improved intergovernmental collaboration and coordination.

Implementation

To effectively implement the RSM Program outlined in the plan, a new workgroup should be formed under the HEP whose sole mission would be the implementation of this RSM Plan. This new RSM Workgroup would be a primary steering committee that would include State Sediment Management Advocates or their representatives, and would report to the Management Committee and Policy Committee as all other HEP workgroups do. Sub-workgroups would be formed to address the three priorities of sediment quality, sediment quantity, and dredged material management.

The RSM Workgroup would be composed of agency representatives, technical experts, and representatives of non-government organizations who all are empowered to speak for their respective groups, have the ability to reach out to a wide constituency, and are motivated to see this program successfully implemented. The RSM Workgroup would be responsible for investigating each recommended action, ensuring their intent is clearly defined and achievable, and then laying out the steps required to implement the recommended actions. Without an RSM Workgroup to keep the issues focused and provide leadership, the RSM Program for the Harbor Estuary is not likely to succeed.

Conclusions

The RSM Plan concludes that:

- The eight objectives and 45 recommended actions represent the consensus of the Workgroup members and need to be considered in their entirety.

- Sediment Management Advocates in both the States of New York and New Jersey are needed to overcome institutional and organizational barriers that have hampered past efforts to manage sediment effectively.

- It is essential that the public is fully engaged in the decision-making process, because many of the issues involved in RSM are “bottom-up” community-related efforts.

To realize the benefits of this RSM Program, the vision, objectives, and recommended actions presented in this RSM Plan must first be adopted in its entirety. It is the hope of the Workgroup that this RSM Plan is implemented to begin the process of managing the sediment issues at the Harbor Estuary effectively.

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Acronyms and Abbreviations

BMP	Best Management Practices
CARP	Contaminant Assessment and Reduction Program
Corps	U.S. Army Corps of Engineers
cy	cubic yard
DM	Dredged Material
DMMP	Dredged Material Management Plan for the Port of New York and New Jersey
EU	European Union
GIS	Geographic Information System
Harbor Estuary	New York & New Jersey Harbor Estuary
HARS	Historic Area Remediation Site
HEP	Harbor Estuary Program
HRE	Hudson Raritan Estuary
HREP	Hudson River Estuary Program
NJ	State of New Jersey
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NY	State of New York

Acronyms and Abbreviations

NYCEDC	New York City Economic Development Corporation
NYSDEC	New York State Department of Environmental Conservation
ODST	NJDEP Office of Dredging and Sediment Technology
OMR	New Jersey Department of Transportation, Office of Maritime Resources
PANYNJ	Port Authority of New York & New Jersey
PPF	public processing facility
QL	Sediment Quality
QT	Sediment Quantity
RDT	Regional Dredging Team
REMAP	EPA Regional Environmental Mapping and Assessment Program
RMW	Remediation Materials Workgroup
RSM	Regional Sediment Management
RSM Plan	Regional Sediment Management Plan
RSM Program	Regional Sediment Management Program
RSM Workgroup	Regional Sediment Management Workgroup
SedNet	European Sediment Research Network
the States	New York and New Jersey
TIE	Toxicity Identification Evaluation
TMDL	Total Maximum Daily Load

Acronyms and Abbreviations

U.S.	United States of America
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
Workgroup	Regional Sediment Management Workgroup

Regional Sediment Management Workgroup

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1. Introduction

Sediment is an essential and dynamic part of the New York & New Jersey Harbor Estuary (Harbor Estuary). The quality and quantity of sediment are integral to ecosystem health and a fundamental component of the regional economy. These connections are implicit in the goals established by the Harbor Estuary Program (HEP), especially in Goal 4 of the 2008 Action Plan[5]:

> ***Support an Economically and Ecologically Viable Estuary and Port -*** *The Port of New York and New Jersey will be an integral and complementary part of the world-class NY-NJ Harbor Estuary that is environmentally sustainable, economically efficient, and safe for commercial and recreational navigation.*

Though sediment and the pollutants that contaminate them originate throughout the 16,300-square mile watershed, our management of sediment historically has taken a highly localized approach that is largely the concern of agencies and authorities directly responsible for maintaining navigable waterways in the Harbor Estuary.

Acknowledging the need for a better management approach, an *ad hoc* committee, the Regional Sediment Management Workgroup (Workgroup), was formed to develop a plan for a Regional Sediment Management Program (RSM Program) that integrates the various sediment management activities of the Harbor Estuary. The Harbor Estuary Program (HEP) Policy Committee approved that approach and charged the Workgroup with developing a scope and structure for the RSM Program that includes:

- A plan with specific goals and targets to improve the ecosystem, public health and the economy.
- Sustainability in carrying out future tasks.
- Technical credibility and regional support.

Why Regional Sediment Management (RSM)?

Federal, state and local agencies in concert with existing HEP initiatives such as the Contamination Assessment and Reduction Project (CARP) have made progress toward the targets set by the Comprehensive Conservation and Management Plan (CCMP), but problems remain such as:

[5] New York-New Jersey Harbor Estuary Program. 2008. Action Plan for the New York-New Jersey Harbor Estuary Program February 8, 2008. http://harborestuary.org/actionplan.htm

- Contaminated sediments that adversely affect the estuarine ecosystem, public health and the economy of the region.

- Patterns of sediment that impair habitats and navigation. Since the quantity of sediments depositing within the estuary can be both beneficial (e.g., in maintaining wetlands) and detrimental (e.g., in filling navigation channels), we need additional tools and knowledge of the Harbor Estuary system in order to get sediment to where it is needed to maintain habitat and protect shorelines, and to reduce sedimentation in navigation channels and other areas where it is not needed.

- Diffuse management of sediment quality and quantity among many authorities and jurisdictions.

- Uncertain availability of upland placement sites for dredged material and inconsistent management criteria that create uncertainties and render permitting unpredictable for public and private proponents of dredging projects.

- Lack of traditional authorization to resolve some issues, such as contaminant reduction of dredged material.

- No current HEP or other framework exists to effectively address sediment issues on a regional scale.

- Limited opportunities for public participation in sediment issues.

The current “end of the pipe” management approach does not address the causes of these problems nor does it provide the policy and regulatory framework required to improve sediment management. Uncertainties and controversy have stalled cleanup and restoration projects, deferred maintenance of our port infrastructure, and led to lost opportunities to beneficially use dredged material. We need to recognize that sediment is a regional issue. A proactive, long-term, regional management perspective that reaches across state lines is needed to coordinate various stakeholders involved in sediment management to control sources of sediment and contaminants, reduce dredging needs and impacts, promote beneficial use of dredged material, link dredging to brownfields and economic development, and to restore a healthy ecosystem.

Shifting from narrowly focused programs, such as dredged material management or effluent discharge permitting, to RSM requires increased public and governmental understanding of the linkages between all parts of the watershed and the Harbor Estuary. RSM will encompass and support existing programs such as:

- Navigation improvements and maintenance (Harbor deepening, Historic Area Remediation Site [HARS] remediation).
- Superfund cleanup projects (such as Passaic River, Hudson River, and Newark Bay).
- CARP.
- Hudson Raritan Estuary (HRE) Comprehensive Restoration Plan.
- Hudson River Estuary Program (HREP).
- State watershed management programs.
- State stormwater management programs.
- State-administered Non-Point Source Discharge Elimination System programs.
- State soil and water conservation districts.

Benefits of Regional Sediment Management

Elsewhere in the United States and in Europe, significant cost savings and other benefits have resulted from RSM. These cost savings and benefits are related to navigation maintenance, sediment remediation, beach nourishment, ecosystem restoration, as well as other needs and opportunities raised by sediment stakeholders in a region. Some examples of the benefits that have been realized in other areas implementing RSM actions include[6]:

- Cost savings resulting from reduced re-handling of material, extended dredging cycles, sharing equipment in linked projects, shared information and avoided duplication of data collection.
- Improved environmental conditions based on reintroduction of sediment into "sand starved" littoral systems to sustain habitat for threatened and endangered species.
- Shared regional-scale data management systems, models and other tools improve project-level decisions and help achieve greater consistency in analytical results among studies and projects within a region.

[6] U.S. Army Engineer Research and Development Center Regional Sediment Management Fact Sheet February 2008 www.erdc.usace.army.com

- Improved interagency and stakeholder relationships produce opportunities for collaboratively leveraging financial and manpower resources in data collection and analysis, tool development and project implementation. Additionally, intergovernmental collaboration and coordination streamlines regulatory processes.

Why Now?

The time is right to implement RSM for the Harbor Estuary. Harbor deepening is well underway; however, adequate funding to maintain the port waterways is an uncertainty that could be mitigated by RSM. HEP has established Targets and Goals[7] for water quality, ecosystem restoration and dredged material management. The Harbor Roundtable has highlighted sediment issues as an area of concern[8] and groups such as the HREP are working to coordinate stakeholders to address sediment issues comprehensively[9]. CARP data and modeling tools are now available. The New Academy of Sciences completed a multi-year study of the flow of specific contaminants[10] and sediment[11] into the Harbor Estuary that included a series of publications, workshops and public outreach. Workgroups are developing sediment quality guidelines, Total Maximum Daily Load (TMDL) standards and methodology to evaluate the causative agents of toxicity. HRE comprehensive restoration planning is still in the early stages of development. The successful application of these efforts depends on an integrated, inclusive RSM Program.

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[7] New York-New Jersey Harbor Estuary Program. 2008. Action Plan for the New York-New Jersey Harbor Estuary Program February 8, 2008. http://harborestuary.org/actionplan.htm

[8] Pabst, D, et al. 2006. Using Sediment Systems in Applying a Watershed Approach to Coastal Geographic Regions: Case Study on New York/New Jersey Harbor and Harbor Estuary Program. National Dredging Team/Subcommittee on Integrated Management of Ocean Resources *Conference on Managing Sediments in the Watershed: Bringing Dredged Material and Watershed Managers Together*, August 29-31, 2006, Portland, Oregon. http://www.epa.gov/owow/oceans/ndt/managingsediments.html

[9] New York State Department of Environmental Conservation – Hudson River Estuary Program. 2007. Hudson River Estuary Action Agenda 2005-2009, 2007 Update. December 2007. http://www.dec.ny.gov/docs/remediation_hudson_pdf/actagen07.pdf

[10] New York Academy of Sciences. 2008. Safe Harbor: Bringing People and Science Together to Improve the New York/New Jersey Harbor. New York Academy of Sciences, New York, NY January 2008.

[11] Munoz, G. and M. Panero. 2008. Sources of Suspended Solids to the New York/New Jersey Watershed. New York Academy of Sciences, New York, NY.

Consensus of the Workgroup on Regional Sediment Management

This RSM Program represents the consensus of the Workgroup members and needs to be considered in its entirety. The RSM Program is described in the following sections. Section 2 discusses the key elements needed for RSM, namely generally accepted guiding principles, strong, highly placed advocates for RSM and increased public involvement. Section 3 presents the Workgroup's vision for RSM in the Harbor Estuary and the eight objectives and 45 recommended actions that are needed to achieve that vision (the 45 recommended actions are summarized in Appendix 1). Section 4 describes the proposed implementation plan for RSM, including the organizational structure and issue resolution procedures. A more detailed description of the proposed implementation is presented in Appendix 2. White papers prepared early in the RSM planning process to identify issues and concerns in the three general sediment management areas are presented in Appendix 3 and Appendix 4 provides the Summary of CARP Accomplishments and Findings.

2. Approach to Regional Sediment Management

We need a fresh mindset to solve sediment problems from a regional, rather than local perspective. While this RSM effort is a relatively new concept for many people, similar approaches have been implemented successfully in the U.S. and Europe. This section describes the general principles that will guide the overall effort, who will drive the plan forward and how the Workgroup ensures the public's involvement in the decision-making process.

Generally Accepted Sediment Management Principles

The Workgroup recognized the necessity of establishing a set of sediment management principles to guide the development of this proposed RSM Plan, and to guide decision-makers in implementing it. Before creating a unique set of sediment management principles, we reviewed established and generally accepted principles that guide national and international organizations in the area of sediment management and related efforts.

The National Dredging Team, a federal interagency group formed in 1995 to improve the dredging process in the U.S., established the following principles to guide implementation of the National Dredging Policy[12]:

- *The regulatory process must be timely, efficient, and predictable, to the maximum extent practicable.*

- *Advanced dredged material management planning must be conducted on a port or regional scale by a partnership that includes the Federal government, the port authorities, state and local governments, natural resource agencies, public interest groups, the maritime industry, and private citizens. To be effective, this planning must be done prior to individual Federal or non-Federal dredging project proponents seeking individual project approval.*

- *Dredged material managers must become more involved in watershed planning to emphasize the importance of point and non-point source pollution controls to reduce harbor sediment contamination.*

- *Dredged material is a resource, and environmentally-sound beneficial use of dredged material for such projects as wetland creation, beach nourishment, and development projects must be encouraged.*

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[12] National Dredging Team 2002. Dredged Material Management Action Agenda for the Next Decade based on a Workshop sponsored by the National Dredging Team in Jacksonville, Florida, January 21-23, 2001. *EPA842-B-04-002.* http://www.epa.gov/owow/oceans/ndt/actionagenda.html

The U.S. Army Corps of Engineers (Corps) established the following Environmental Operating Principles to guide the full spectrum of Corps activities and regulatory decision-making[13]:

- *Strive to achieve environmental sustainability. An environment maintained in a healthy, diverse and sustainable condition is necessary to support life.*
- *Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances.*
- *Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.*
- *Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.*
- *Seeks ways and means to assess and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.*
- *Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.*
- *Respect the views of individuals and groups interested in Corps activities, listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the nation's problems that also protect and enhance the environment.*

The European Sediment Research Network (SedNet) is a network of scientists, agencies and industries funded by the European Union (EU) to incorporate sediment issues and knowledge into European environmental management strategies and fulfill EU directives to "establish a framework for the protection of inland surface water, transitional waters and groundwater." SedNet adopted the following principles to guide sustainable sediment management[14]:

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[13] Headquarters U.S. Army Corps of Engineers Environmental Operating Principles. http://www.hq.usace.army.mil/cepa/envprinciples.htm

[14] European Sediment Research Network. 2004. SedNet Position Paper 2002-2004.

- *Sediment needs to be managed at an appropriate scale: Sediment management needs to be planned in context to catchment scales and integrated into existing frameworks at this scale, such as river basin management plans.*

- *Sediment is part of the soil/water system. Management of sediments should be planned in the context of the soil/groundwater/water/sediment system (the subsurface).*

- *Work with nature: Management strategies for sediment should respect nature: working with nature, not against it. Thus it is crucial to use and improve our understanding of river system functioning and the role of sediment therein.*

- *Sediment balance: Taking sediment out of the system can cause sediment deficits resulting in habitat loss and destabilization of river system functioning. Therefore, sediment management must also consider the sediment balance and its dynamic role in the hydrological and geomorphologic processes within each river.*

- *The stakeholder values and views on sediment. The perception of sediment is depends on a variety of roles, values and definitions and is influenced by stakeholder interests. In order to maintain a dialogue, definitions and terms used to describe sediment must be neutral and all-embracing, and sympathetic to stakeholder values and views.*

- *SedNet builds on the multi-value (society, economy, environment) use of sediment.*

- *Interventions should not result in unwanted impacts elsewhere in the river basin (up- or downstream) and/or should not have an adverse impact in the future.*

- *Integrated solutions, embracing the whole soil/water system, are needed.*

- *Solutions need to respect natural processes and functioning.*

- *Solutions should be found in the context of the whole river system and in close interaction with the stakeholders.*

These generally accepted principles underscore the dual nature of sediment both as a challenge and a resource to humans and the environment. They recognize that sediment management is a regional issue because sediments and the pollutants that contaminate them originate in uplands and tributaries throughout the watershed and flow continuously downstream to the Harbor Estuary and the ocean. They emphasize the need for increased interdisciplinary, multi-jurisdictional and public /private cooperation in managing sediments. They are consistent with the intent of this plan and provide a firm foundation on which to build the vision, objectives and recommended actions we propose.

The Need for Advocates

Translating these principles into effective action requires removal of barriers that have hampered sediment management to date. Sediment management is a regional issue that cuts across State and local jurisdictions. No federal laws or regulations specifically direct sediment management. Many agencies and special interests are involved in diverse, locally-focused programs relating to sediment, such as stormwater, soil erosion, dredging and point discharge control, but we lack a unifying program that encompasses sediment quality, quantity and dredged material management at the watershed scale.

The Workgroup emphatically agreed that State Sediment Management Advocates in both New York and New Jersey are essential for implementing the RSM Program according to these generally accepted principles. In the past, programs to manage dredging and the disposal of dredged material in both New Jersey and New York only succeeded when there was a high-level advocate ensuring that all parties were working towards common objectives. Without the focused efforts of such advocates, the shift to RSM will not be realized.

The State Advocates envisioned by the Workgroup must be in a position to influence decision makers to coordinate and link sediment issues to all applicable programs, such as watershed management, stormwater management, brownfield revitalization, habitat restoration and protection, water quality enhancement, resource sustainability and urban waterfront planning. The Advocate for each state must:

- Be a senior-level, non-regulatory position entirely focused on improving the management of sediment and dredged material at the state level.
- Have access to high-level decision makers to facilitate changes at the state level and to expedite permit decisions and policy solutions. This requirement is critical to ensure consistency between the New York and New Jersey programs.
- Have a broad knowledge of programs that regulate or beneficially use sediment, as well as permitting programs.
- Be able to link sediment and port issues to local economies.
- Have the authority to cut across program boundaries in New York and New Jersey, and to reach out to adjacent states, such as Connecticut and Pennsylvania.

The Need for Increased Public Participation

A key challenge for the Advocates will be instigating an inclusive culture in which the public is fully engaged in the management process, from planning through implementation. Shifting from local management plans that involve sediment to RSM requires increasing public and local agency recognition of the linkages of all parts of the watershed to the Harbor Estuary. From a practical standpoint, managing sediment in the Harbor Estuary means managing sediment and contaminant inputs to nearly 14,000 miles of streams that are tributaries to the Harbor Estuary. Characterizing, monitoring and managing these tributaries to achieve RSM objectives require a massive effort that is feasible only with public support and voluntary participation.

This much needed approach replaces the practice of seeking public acceptance for plans that are developed by high-level agencies with a practice of involving the public in the development of plans. This is essential to creating the public and agency recognition of the watershed/Harbor Estuary linkages, the sense of ownership that leads to stewardship of the resource, and the political support needed to maintain management emphasis by senior executives of state government. Therefore, successful implementation of the recommended actions set forth in each of the three elements of RSM (sediment quality, sediment quantity and dredging) will require engaging the public in meaningful collaboration for setting and implementing priorities for action.

Consequently, a vital aspect of the RSM Plan is to create and maintain executive management interest in sediment issues through press releases, grass roots support and web-based connection to citizens. This role is critical because RSM currently has no stable funding, mandate, or legal requirement. If the RSM Plan has demonstrated public support, then the Government will find a way to implement the RSM Plan.

Summary

Improving sediment quality and quantity and, to some extent, our handling of dredged material, involves changing our management perspective from local to regional. Sediment management is a regional issue that is multi-jurisdictional, interdisciplinary and involves linking economic, environmental and social interests that are often conflicting. It involves diverse programs such as ecological restoration, port maintenance, stormwater management, point and nonpoint discharge control, soil erosion and sediment control and recreation. The objectives and recommended actions for sediment management presented in the next section of this plan build upon a foundation of generally accepted sediment management principles. Meaningful public involvement promotes stewardship and creates the political support necessary to ensure that sediment issues, which affect the health and economy of the Harbor Estuary, become a high priority. With this support, highly-placed advocates with the authority to cut across jurisdictional lines, can effect the needed actions.

3. Objectives

Vision

The guiding vision behind RSM efforts for the Harbor Estuary is as follows:

> The sediments of the New York / New Jersey Harbor Estuary will support and sustain both a healthy ecosystem, including sensitive species at sensitive life stages, and a robust regional economy.

Sediments will be managed as a resource to achieve this vision. The Workgroup identified three interactive elements that are the major components of this plan: Sediment Quality, Sediment Quantity and Dredged Material Management. Eight objectives and 45 recommended actions were developed to support these three elements. Many of the recommended actions are interrelated, and many support multiple objectives. Effective implementation of these recommended actions will require a coordinated RSM effort, and a detailed work plan to accomplish them.

In the following subsections, each of the elements, objectives and recommended actions are described and justified in detail. A structured organization for implementing the recommended actions is described in Section 4.

Sediment Quality

Sediments are the backbone of the estuarine ecosystem, and as such, support not only the ecological well-being of the system, but also the recreational, commercial and industrial use of the system. Sediments serve the important ecosystem function of providing benthic habitat, yet they also serve as both a source and sink of anthropogenic pollutants. The higher the sediment quality, the more likely there will be a healthy benthic ecosystem that supports an overall healthy estuarine ecosystem.

Sediment quality has an important role in achieving HEP's goal (Goal 1B): *"Eliminate toxicity or bioaccumulation impacts on living resources by reducing contaminant inputs and cleaning up contaminated sites, and manage risk to humans from seafood consumption."*.[15] The Target Ecosystem Characteristics established by the HRE also recognize the importance of sediment quality to ecosystem health by setting an interim (2012) target to "*Isolate or remove one contaminated sediment zone of at least 25 acres* " and the long-term (2050) target to "*Continue*

[15] HEP. 2007.

removing or isolating contaminated zones until all HRE sediments are considered uncontaminated."[16] Improving sediment quality faces many difficulties including:

- A wide range of historical and active pollutant sources, many of which cannot be easily identified or controlled.
- Incomplete understanding of physical and biological processes that transport, alter and concentrate pollutants in the watershed system.
- Diffuse and fragmented regulatory structure that does not specifically address sediment quality.
- Lack of consensus on sediment quality standards.
- Poor recognition by stakeholders of the connection between the upper parts of the watershed and the Harbor Estuary.

As a general approach to effectively improve sediment quality, we need to identify the sources of contamination, develop a plan to remove or control these sources, take the necessary actions and monitor the results. In doing so, we need to consider that sediment and pollutants may enter the Harbor Estuary from tributaries, overland flow and municipal outfalls, the air, and the ocean. Sediment may pass through in suspension or may settle out, potentially depositing, becoming resuspended, and then redepositing several times. We also need to consider the various ways that sediments become contaminated and the many pathways that contaminants are transferred between sediments, Harbor Estuary waters and biological communities.

We developed four objectives regarding sediment quality that address the quality of sediments within the Harbor Estuary.

Objective QL-1 - Ensure new sediments are clean

Challenges:

New sediments entering the Harbor Estuary are, for the most part, originating outside of the Harbor proper from erosion of various parts of the watershed. This watershed is approximately 16,300 square miles, a dauntingly large area where the land use character of the many sub-basins

[16] Bain, M., et al. 2007. Target Ecosystem Characteristics for the Hudson Raritan Estuary: Technical Guidance for Developing a Comprehensive Ecosystem Restoration Plan. A report to the Port Authority of NY/NJ. Hudson River Foundation, New York, NY. 106 pp.

influences the amount and quality of sediments delivered to the main tributaries, and ultimately the Harbor. While the current federal and state regulatory system has adopted numerous enforceable criteria and standards for water and biota, there are no such criteria or standards for sediments. Only a few benchmarks are being used in this New York/New Jersey region to determine potential effects of contaminated sediments on human health and the environment. From a source control standpoint, there are accepted methods available to assess the bioaccumulation potential of sediment-bound contaminants. However, it is a major challenge to understand and identify the contaminants that are sources of chronic and acute toxicity. Scientifically accepted methods for toxicity identification evaluation (TIE), chronic sediment testing and rapid monitoring are either non-existent or controversial, and currently there are no sediment quality guidelines. Further development of some or all of these tools may be necessary to achieve the goals of this plan and must involve a transparent and inclusive process with a participatory role for the interested public. Understanding what is causing chronic and acute toxicity is critical to focusing on the right contaminants and to targeting contaminant sources to ensure that sediments entering the estuary are clean and remain clean. Finally, there is considerable controversy regarding removal, treatment and/or management options for toxic sediments once they are identified.

Bringing groups and agencies not typically involved in Harbor Estuary issues together presents another significant challenge. Hudson River watershed groups are divided between upstate and downstate. Upstream populations, whose activities affect the quality of sediment, often do not realize the connection between their activities and sediment problems in the Harbor Estuary. There is no known partnering across Harbor Estuary watersheds (such as the Passaic, Hackensack, Raritan and Hudson). It is this group's opinion that the best way to resolve this issue is to expand the mandate of a program that already has cross-boundary responsibility, such as the HEP.

Status:

HEP set the goal (Goal 4A: Sediment Quality): *"Reduce sediment hot spots, and point and non-point sources of contaminants entering the Harbor, such that levels of toxics in newly deposited sediments do not inhibit a healthy, thriving ecosystem and can be dredged and beneficially reused."* [17]

The cleanup of major contaminant sources (such as on the Hudson and Passaic Rivers) is proceeding. The USEPA and State of New Jersey were funded to develop economically viable sediment treatment processes for navigational dredged material from the Harbor Estuary. While substantial funding was utilized to evaluate several different decontamination technologies for environmental dredging operations that involve high levels of contaminants, none of the technologies evaluated have moved beyond the demonstration level to date. Currently, navigational dredged material that is not appropriate for placement at HARS is being processed

[17] HEP. 2007.

using relatively low-tech solidification technologies. This processed dredged material is consequently utilized in landfill and brownfield remediation programs in New Jersey and New York. These programs represent the best available option for the beneficial reuse of contaminated harbor dredged material and have the added benefit of reducing localized sources of contamination.

CARP identified and evaluated the significance of certain contaminant sources such as tributaries, legacy sediments, sewage treatment plants, landfills, wastewater, combined sewer overflow discharges and stormwater through the collection of data and the creation of a modeling tool that will now allow managers to assess the most effective strategies for reducing toxic contamination. Additionally, the development of TMDL standards for toxics in the Harbor Estuary is underway. Contaminants within sediments are recognized as a concern in many areas of the Harbor Estuary and will be considered in the TMDL assessment. Basic research into methods to evaluate the causative agents of toxicity is ongoing through the U.S. Environmental Protection Agency (EPA) and the Hudson River Foundation and must proceed if the toxicity-causing compounds are to be targeted for reduction or elimination.

The U.S. Geological Survey (USGS) and the New York State Department of Environmental Conservation (NYSDEC) are monitoring sediment loading to the Hudson River from several watersheds in New York as a follow-up to CARP. Some watersheds appear to yield higher sediment loads than previously thought, while others yield less. To better understand the discharge of sediments and contaminants from watersheds during extreme flooding events, and to evaluate the effectiveness of contaminant reduction efforts, additional monitoring of both sediments and contaminants throughout the system will be required at appropriate intervals in the future.

Benthic community monitoring is another means to evaluate the effects of human activities on biological communities. USEPA's Regional Environmental Mapping and Assessment Program (REMAP), which includes chemical measurements and an index of biological integrity, has conducted three separate surveys spanning over 10 years. The National Oceanic and Atmospheric Administration's (NOAA's) National Centers for Coastal Ocean Science conducts and supports the Mussel Watch Program, which analyzes sediment and bivalve tissue chemistry for a suite of organic contaminants and trace metals in order to identify trends. Data from these programs will continue to be valuable in analyzing trends throughout the harbor.

Recommended Actions:

QL-1.1. Identify specific sources of contamination within the Harbor Estuary and reduce them to levels that protect sensitive species at sensitive life stages.

QL-1.2. Monitor and reduce/eliminate contaminant sources of significance, as determined by CARP.

QL-1.3. Monitor heads of tide for sediment quality in order to track down and eliminate upstream sources of contamination.

QL-1.4. Complete the Hudson River and Passaic River cleanup projects.

QL-1.5. Develop a process for the evaluation and categorization of existing sediment contamination levels in the Harbor Estuary for prioritization of targeted remedial activities.

QL-1.6. Where specific watersheds have been identified as sources of particular contaminants, coordinate upstream groups and agencies through an awareness workshop that brings the Harbor Estuary's issues (and resources) to light for these groups, and work together to reduce/eliminate identified sources.

QL-1.7. Conduct research into linkages between sediment quality and ecosystem health. Continue developing and implementing rapid monitoring tools for sediment, with the objective of identifying and eliminating the causative agents of acute toxicity in Harbor Estuary sediments.

QL-1.8. Evaluate the economic benefits of improved sediment quality and ecosystem health.

QL-1.9. Coordinate with environmental and health-based organizations in the watershed to educate and inform the public about ways to reduce/eliminate sources of contamination.

QL-1.10. Engage the public in setting priorities for action, thus ensuring political support.

Objective QL-2 - Ensure new sediments entering the Harbor Estuary system remain clean

Challenges:

The responsibility for this objective rests largely with the Harbor Estuary stakeholders. Unfortunately, this still requires the coordination of multiple jurisdictions and agencies. Many of the same technical issues regarding testing and monitoring of sediment quality mentioned above apply here as well. The trackdown (locating sources of contaminants) and control of contaminant sources is complicated by the number of sources and the diversity of chemicals (and breakdown products) involved. Further complicating this objective is the large reservoir of contaminated sediment from historical sources, which has become a source itself. Estuarine circulation patterns move and mix these sediments, making sources difficult to pinpoint, especially for legacy contaminants (contaminants from historical sources).

Status:

The CARP monitoring and modeling program has performed the initial evaluation of sources and sinks in the estuary, however detail is insufficient to pinpoint exact sources, requiring more sophisticated trackdown. Some trackdowns have been accomplished in both New York and New Jersey, but these were tedious and slow. The landfill/ brownfield remediation program also has been successful at reducing loading to the Harbor Estuary. Additionally, the development of the Harbor Estuary toxics TMDL standards is ongoing and will include sediment quality as a component.

Recommended Actions:

QL-2.1. Identify specific sources of contaminated sediments to the estuary by continuing to support source inventory and trackdown programs initiated by CARP.

QL-2.2. Reduce/eliminate sources of pollution that may serve to contaminate clean sediments.

QL-2.3. Conduct a periodic (approximately every 5 years) contaminant assessment and monitoring program (limited CARP re-evaluation).

QL-2.4. Continue supporting landfill/brownfield remediation programs, especially those that utilize dredged Harbor Estuary sediments.

QL-2.5. Include dredged material regulatory criteria and benchmarks in the development of Harbor Estuary toxics TMDLs.

QL-2.6. Ensure that contaminated sediments are considered source components in developing Harbor Estuary toxics TMDL.

Objective QL-3 - Reduce direct exposure

Challenges:

The Harbor Estuary suffers from widespread contamination of sediments at the surface and at depth from current and historical sources. Bioavailable contamination has resulted in reduced water quality, reduced recreation, reduced habitat quality and reduced fisheries. Contamination of navigational dredged materials has resulted in multi-fold increases in dredging costs over the past decade. Although very few of the Harbor Estuary sediments can be considered clean, there are insufficient funds to remediate the entire bottom of the Harbor Estuary. Economic benefits of remediation projects are not easily defined. Remediation technologies continue to be low volume, high-cost options that have some use for highly contaminated sediments, but are not suited to the full scope of the Harbor Estuary's widespread sediment contamination problem. Multi-jurisdictional

confusion has resulted in a lack of movement on identified sediment quality remediation projects, evaluation of needed projects, and development of cost effective remedial alternatives. Estuarine dynamics, coupled with widespread contamination, blur the boundaries between the sites of contamination, confuse responsibility determinations and threaten recontamination of sites/areas that already have been remediated. Meanwhile, stakeholders are directly impacted, but have little involvement in decision-making on the use of Harbor Estuary resources or in setting priorities for government action to resolve sediment contamination problems.

One tool that is needed to help stakeholders assimilate the diverse information already available for the Harbor Estuary system is a sediment characterization map. Enabling stakeholders to visualize the problems and linkages will facilitate participation in developing restoration solutions. The sediment characterization map should include overlying layers that represent sediment quality guidelines (such as ERL/ERMs[18], New Jersey Department of Environmental Protection (NJDEP) and NYSDEC dredge material criteria and HARS suitability criteria), erosion/ accretion zones, fish/crab tissue criteria exceedances, fish advisories and benthic index data and other appropriate and informative data sets. This map should be developed in a workgroup setting that includes the public in establishing remediation priorities and should be made available through the CARP website. These maps, however, will not replace or supersede sediment quality testing requirements for different management options.

Status:

CARP has produced a state-of-the-art model that identifies those areas presenting the greatest threat to different water body uses today and in the future. This model allows for the determination of the impact of management scenarios on future surficial sediment quality in the Harbor Estuary. Maps made from output of this model and other layers of available data and sediment quality guidelines can be important tools for public outreach and to foster public interest and involvement. These products will be tangible visuals to drive public participation and help stakeholders understand the connections between upper watershed and estuary. This information can identify management problems and opportunities, can help local organizations focus on effectively addressing upstream sources, and support the initiation of local cleanup projects.

Fishing and shell fishing is restricted throughout the Harbor Estuary and is illegal in certain areas for some species. Communication to stakeholders and the general public of existing threats to human health from contaminated sediments and biota is marginal. Opportunities for public involvement in decision making and priority setting are extremely limited and need to be increased and strengthened in order to achieve RSM objectives.

[18] Effects Range – Low (ERL) and Effects Range – Median (ERM)

Recommended Actions:

QL-3.1. Use CARP and other information to develop a map characterizing sediments in the Harbor Estuary by differences in sediment quality and the potential for transport to other areas. Use the sediment characterization zone map to prioritize remedial activities and source control priorities.

QL-3.2. Develop an economic evaluation for remediation in each sediment quality zone requiring remediation.

QL-3.3. Include sediment characterization zones in the Harbor Estuary toxics TMDL process.

QL-3.4. Reduce cross-jurisdictional differences in sediment and water quality goals for the Harbor Estuary.

QL-3.5. Expedite timely implementation of large-scale cleanups (such as Passaic and Hudson Rivers).

QL-3.6. Inform and engage Harbor Estuary stakeholders about sediment quality issues and recommended actions.

QL-3.7. Reduce sources of pollution that may serve to contaminate clean sediments.

Objective QL-4 - Reduce transport of contaminants to other areas

Challenges:

Because the Harbor Estuary is a dynamic system, current patterns of surficial and buried sediments can only be considered temporary since sediments can erode from one location and deposit in a new location as their conditions change and shift. Legacy sediments can be a greater source to sediment and water column contamination than more traditional sources for some contaminants. Due to changes in land use, ownership, dynamic sediment mixing and natural breakdown, determining the parties responsible for contamination is difficult. Our lack of basic understanding of sediment transport dynamics in parts of the estuary, as well as an incomplete sediment budget, make it difficult to recommend appropriate management actions to reduce the risk of contaminated sediment transport.

Status:

The CARP model provides a tool for understanding actions that can reduce sediment contamination system wide. However, additional tools are still required before true transport mechanisms and the effectiveness of remedial actions can be fully understood and predicted.

Clean Water Act provisions that allow lawsuits against those who discharge sediments and/contaminants to the Harbor Estuary have not been fully utilized. Ongoing remedial projects at "hot spots" in the Hudson and Passaic Rivers have been delayed. These and similar sites in the Harbor Estuary remain a source of contamination to the entire system.

Recommended Actions:

QL-4.1. Identify and implement priorities for the remediation of highly mobile contaminated sediments.

QL-4.2. Improve scientific understanding of hydrodynamics and sediment transport in the Harbor Estuary, including attenuation and impacts of Harbor Estuary deepening.

QL-4.3. Communicate continuing threat of "hot spots" in the Passaic and Hudson Rivers to Harbor Estuary stakeholders and to the agencies responsible for those projects.

Sediment Quantity

The quantity of sediment and how it moves throughout the Harbor Estuary system affects environmental quality and navigational safety. The key to effective sediment quantity management is to ensure that sediment transport within the system is conducive to a healthy ecosystem, minimizes shoaling in navigation channels and achieves the correct balance concerning input and output to the system.

Much of the sediment dredged annually in the Harbor Estuary originates outside of the Harbor Estuary proper from the erosion of various parts of the watershed. While the Harbor Estuary is nearly built-out, urban sprawl above the Harbor Estuary continues. Development that converts agricultural and forested land to impervious surface can create surges of stormwater runoff that erode streambeds and banks, resulting in high sediment loads to the Harbor Estuary that can damage aquatic systems and fill channels in the port. Sediment runoff rates from construction sites can be 1,000 to 2,000 times greater than those of forested lands. In a short period, construction activity can contribute more sediment to streams than would be discharged over several decades.

The issue of sediment quantity is not a centralized focus area within most environmental or regulatory agencies. Generally, there is not consistency within agencies or across agencies in legal or regulatory programs concerning classification or regulation of sediment quantity/erosion. To be successful in managing sediment quantity, agencies will need to focus on a consistent set of policies among a diffuse set of responsibilities in each agency. And consistency across agencies will be even more challenging. The challenges ahead of us in trying to establish the connection between the upper parts of the watershed and the Harbor Estuary to meaningfully manage sediment quantity in this RSM Plan include:

- Size and diverse uses of the watershed.
- Diffuse nature of the program, involving many agencies and local planning groups and municipalities.
- Lack of regulatory controls over issues that have been historically considered local and subject to "home rule."
- Multitude of activities that would be applicable (individual construction projects, farming, large developments, road work, etc.).

In order to balance environmental quality and navigational safety, we need to understand how sediments move throughout the Harbor Estuary system. We also need a better understanding of the dynamic equilibrium of the Harbor Estuary: what happens to our maintenance requirements over time as we deepen and improve the access network? The foundation for understanding and managing sediment quantity is to develop an overall sediment budget for the Harbor Estuary core area, including sediment transport modeling that can be adapted to future conditions.

We developed two objectives regarding sediment quantity.

Objective QT-1 - Ensure sufficient sediment to support healthy ecosystem processes

Challenges:

In a healthy ecosystem there is a balance between the amount of sediment entering and exiting the system. A certain amount of sediment is required to maintain biological health and diversity in the Harbor Estuary, but too much or too little can cause adverse impacts. In one extreme, the net erosion of coastal areas, islands, mudflats and other types of aquatic habitat can occur when sediment quantity is too low. The opposite extreme involves too much sediment, which can cause burial of or stress to aquatic organisms and communities, reduction of primary productivity by lowering submarine light levels and a general shallowing of aquatic habitat.

Currently, there is insufficient knowledge of transport processes to understand sediment movements through the system at various scales and the lack of a predictive sediment transport model. We have a better understanding of the sediment mass balance, but do not have the knowledge and capabilities to develop a predictive model today. We need more information on sediment inputs and sources throughout the watershed to develop a sediment budget. We need a better understanding of the relationship between sediment quantity and ecosystem processes in order to develop predictive tools for management at appropriate scales. Habitats most affected by sediment quantity need to be identified. Clear endpoints and targets to prioritize restoration efforts need to be articulated. Specific restoration sites need to identified and prioritized. To address these questions, a sediment transport model at navigation channel-scale is needed to identify existing data gaps and then to direct the necessary data collection efforts to fill those gaps.

Responsibility to address sediment quantity problems is spread over many agencies, none of which has clear authority to integrate the various programs to comprehensively address sediment problems. Stakeholder interests regarding sediment quantity are varied and often directly conflicting. Extensive outreach to educate and involve the public will be needed to ensure public and agency support.

Status:

HEP set a goal (Goal 4B Sediment Quantity): "*Achieve a quantity of sediments entering the Harbor system that supports the ecological health of the estuary, including protection of shallow water habitats, such as oyster reefs, without excessively impairing navigational activities.*"[19]

Detailed mapping of New York tidal wetlands greater than 0.5 acre in size along the Hudson River south of the Troy Dam has been completed by NYSDEC and is being analyzed to assess changes over time. The information is being incorporated into a Geographic Information System (GIS) database that will be accessible to the public. We need a better understanding of the role of sediment in watershed-wide ecosystem processes. Currently, key habitats are being mapped throughout the watershed, including shorelines, tidal and freshwater wetlands, aquatic vegetation and river bottom.

We have a good understanding of sediment inputs from point discharges, but a network of stream gauges to measure suspended sediment loads is not yet complete. More information is needed to know which tributaries contribute the most sediment. We need to incorporate tributary sediment loads into GIS layers and sediment transport models.

Recommended Actions:

QT-1.1. Develop new sediment transport models and sediment budgets to predict input and delivery of sediment at the appropriate scale, and collect new information as appropriate.

QT-1.2. Evaluate how sediment influences Harbor Estuary ecosystem processes.

QT-1.3. Identify habitats adversely affected by sediment quantity issues.

[19] HEP. 2007.

Objective QT-2 - Reduce sediment deposition in shipping channels/berths

Challenges

Periodic dredging is required to maintain commercial ports, ferry terminals and marinas and to maintain safe navigation in waterways. Typically, the sediments that are dredged to maintain these facilities have various levels of contamination. Sediments with even low levels of contamination can be costly to handle and disposal sites for these sediments are limited. The costs associated with permitting, dredging and disposal of contaminated sediments, combined with limited funds for maintenance dredging is a significant problem for the economic viability of maritime industry and recreational businesses in the Harbor Estuary.

Controlling sediment loads and contaminants at the upstream source can reduce the volume of sediment that requires dredging from channels and berths in the Harbor Estuary. Engineering measures can keep sediments moving past shipping channels and berths and reduce accumulation. Watershed-wide modeling will ensure that the limited funds available are directed toward identifying problem areas and the most effective control measures. Care must be taken that the implementation of control measures does not adversely affect habitats or areas that require sediment.

Many programs and initiatives that relate to sediment quantity in the waterways are managed on the local level. Additionally, numerous citizen-based stewardship programs, formed to address specific local problems, help monitor the over 14,000 linear miles of streams that discharge sediment and contaminants to the Harbor Estuary waters. HEP should fund and support local groups that work to solve specific problems that benefit the Harbor Estuary. The RSM Program needs to make the Harbor Estuary relevant to local watershed groups and large-scale stakeholders, such as highway departments, that are not traditionally involved with waterways. Completion of the watershed sediment budget and sediment quality maps will be instrumental in making this connection and focusing restoration efforts on the areas with the greatest need.

Status:

New York and New Jersey have stormwater management regulations that require Best Management Practices (BMPs) to reduce sediment discharges from construction and have initiated educational and technical assistance programs to promote compliance and educate local governments, developers, contractors and designers on design practices that can reduce and improve the quality of stormwater discharges. The NJDEP and the NYSDEC (especially the HREP) have partnered with county and local governments to adapt strategies protective of water quality, such as riparian and wetland buffers, comprehensive planning and stormwater ordinances. Increased coordination is needed between the Natural Resources Conservation Service (NRCS) and branches of the NJDEP and the NYSDEC that manage soil erosion and sediment control with agencies involved with Harbor Estuary issues. In the Dredged Material Management Plan for the

Port of New York and New Jersey (DMMP), the Corps has evaluated reducing dredging needs through engineering approaches to keep sediment out of or moving past maritime facilities.

The HREP has conducted extensive outreach to improve public understanding of the interconnection of Hudson Valley streams to the Harbor Estuary, and has assisted in establishing and supporting watershed conservation groups and programs on the Hudson River. Groups and programs such as the NJDEP, NYSDEC, CARP, USGS, NRCS, Hudson River Watershed Alliance, Sea Grant and colleges and universities are working to collect, coordinate and disseminate sediment data to the public. A model that can be used to predict dredging needs and problem areas, as well as reductions in sediment deposition from source control or engineering solutions, remains to be developed.

Recommended Actions:

QT-2.1. Develop sediment transport model and sediment budget to predict input and delivery of sediment at the appropriate scale (e.g. navigation channels), and collect new information as appropriate.

QT-2.2. Evaluate how sediment source controls and engineering solutions can affect sedimentation throughout the Harbor Estuary system and in the most frequently dredged channels.

QT-2.3. Identify habitats adversely affected by sediment quantity issues and restore them.

QT-2.4. Identify watersheds that are contributing excessive amounts of sediment to shipping channels. Work with appropriate organizations (e.g., NRCS districts, watershed alliances, etc.) to formulate and implement comprehensive soil conservation solutions.

Dredged Material

Currently about 3 million cubic yards (cy) per year must be dredged to maintain shipping channels and berths. Maintenance dredging of the more than 250 miles of navigable channels is prioritized by the annual tonnage of freight transported through each channel. Tight budgets and the high cost of dredging and disposal of dredged material have caused the Corps to defer maintenance of all but the most heavily used channels. As unmaintained channels shoal, operators are forced to use smaller vessels with shallower drafts, further reducing the annual tonnage, and thus further reducing the channel as a federal maintenance priority. Eventually, shipping operations become uneconomical, the channels are abandoned and the freight that was previously moved by barges is transported by trucks, which significantly increases the number of trucks on our roads and highways. Since 40 -160 trucks or more are needed to transport the freight carried by a single barge, the economic, social and environmental costs of the loss of water transportation infrastructure are considerable.

Sediment that accumulates in navigation channels is a renewable resource that can replace non-renewable resources in a wide variety of applications. Clean sediment can be used for habitat restoration or mixed with compost to create topsoil. Sediment with relatively low to moderate levels of contamination can be stabilized and used for capping brownfields and landfills, and as structural and non-structural fill material.

However, dredging can adversely affect water quality and aquatic communities by increasing turbidity, spreading contaminated sediment, and increasing the bioavailability of these contaminants. Dredging can also alter or destroy aquatic habitat, remove benthic invertebrates that fish and wildlife feed upon and interrupt spawning and other activities critical to the fish life cycles.

Dredging and dredged material management is the aspect of sediment management with the greatest visibility and economic impact to the Harbor Estuary. If this necessary activity is poorly managed, the environmental impacts are nearly all adverse. With a coordinated regional management approach, adverse impacts can be reduced, and dredging can be an important tool for restoring water quality and habitat, and can reduce the demand on non-renewable resources such as aggregate and topsoil. Public investment in a dredged material processing facility could help improve the management of dredged material and increase opportunities for beneficial reuse.

To be effective, regional management must include:

- Improvements to dredging operations to reduce adverse environmental impacts through the establishment of BMPs, improved monitoring and innovative technology.
- Coordinated seasonal dredging windows derived through a consistent technical approach.
- Improved coordination between the States on sampling standards, testing criteria, placement standards, and regulatory oversight based on a consistent set of RSM principles.
- Improved planning of dredging projects and coordination with brownfield rehabilitation.
- Informed, engaged and active public participation.
- Public and agency support for a public processing facility (PPF).

We developed two objectives regarding dredging and dredged material management:

Objective DM-1 - Improve dredging operations

Challenges:

Poor construction practices such as overfilling barges, excessive hoist speeds and the use of improper or poorly maintained buckets can compound dredging impacts or result in unintended effects such as the release of contaminants in transit to the processing site. Residuals, that is, contaminated sediments that remain after dredging or have spread to previously clean areas during dredging, result from resuspended sediment that settles after dredging is completed or from the failure of steep dredge-cut slopes. Residuals reduce the effectiveness of sediment cleanup projects and may require additional dredging.

Protective BMPs to reduce turbidity, the dispersal of sediment-bound contaminants, and residuals need to be improved, implemented consistently and monitored. The specific BMPs required would be those appropriate for the nature and quality of the dredged material, and vary accordingly, but would also be consistent between the various regulatory jurisdictions. BMPs also could include feasible engineering modifications/structures to re-direct sediment to minimize dredging footprints and/or quantity over time.

Seasonal windows have been established to protect fish resources, but are no longer based on state-of-the-art knowledge. Their effectiveness in protecting fishery resources has been questioned by the implementing agencies. Seasonal dredging windows should be consistent between both States, as they are designed to protect the same resources. The windows should be designed using scientifically-valid information from the peer-reviewed literature as well as comments and advice from experts from all involved agencies.

Status:

Typical BMPs include seasonal restrictions on dredging, and requirements for specialty equipment and operational controls. Engineering performance standards regarding residuals and monitoring are often not required for navigational dredging projects. The Corps and private industry continue to research and develop technologies and practices to reduce the adverse impacts of dredging. Tamper-proof automated data collection and storage systems are already in use, such as the global positioning system-based Automated Disposal Surveillance System to verify HARS placement and systems that monitor barge spillage during transit. Technology exists to monitor most aspects of a dredging project and help ensure adherence to BMPs and permit conditions. We should continue to seek and require innovative technologies that provide real-time monitoring of dredging activities.

Recommended Actions:

DM-1.1. The States of New York and New Jersey, in coordination with the Army Corps of Engineers, should develop and implement a consistent minimum set of BMPs for navigation dredging projects.

DM-1.2. Both States should establish consistent seasonal dredging window requirements that are designed to protect the same resources in the same waterways. The windows should be periodically reviewed and updated using the latest peer-reviewed scientific information available and advice from outside scientific experts. Research, monitoring or modeling should be conducted in those instances where knowledge of the likelihood and severity of impact to an important resource is lacking and is contributing to agency and public disagreements. Monitoring should also be conducted to determine the effectiveness of the windows.

DM-1.3. The Corps should investigate and implement as appropriate state-of-the-art means of monitoring and inspecting dredging projects for adherence to operational BMPs.

DM-1.4. The Corps should investigate and evaluate innovative dredging techniques and equipment that is designed to minimize resuspension of sediment during navigation dredging projects.

Objective DM-2 - Improve dredged material management

Challenges:

Inconsistent regulations, polices and standards make planning and permitting of dredging projects unpredictable and costly. We need to establish a single set of testing protocols and to improve consistency and predictability in the technical requirements for dredging decisions.

The States and the federal government should develop a policy on how to consider RSM in regulatory decisions. Initial dredging and maintenance dredging issues need to be considered in the development plans before permits are issued. In their permit applications, applicants should provide a dredged material management plan that identifies the long-term maintenance strategy for their facility. This is a regional management issue, especially important in light of the limited number of available and acceptable means of managing dredged material. Potential synergies for regional approaches to sediment management may be realized if the U.S. Department of Agriculture, the USEPA, the Corps and state governments more closely coordinate the sediment management components of their authorizations and appropriations.

The USEPA established Regional Dredging Teams (RDTs) to improve local coordination on dredged material management issues. The New York/New Jersey Harbor RDT currently meets monthly to discuss and problem-solve specific and general dredging and disposal concerns that affect the Harbor Estuary, with particular emphasis on beneficial use of dredged material; the RDT, however, does not have public representation. A new interagency group (i.e., the Dredged Material Management Subgroup) that includes the appropriate agencies, stakeholders and the public is needed to foster inclusive communication and long-term regional dredging planning. Coordinating new projects and maintenance dredging projects through this new interagency group is a means to ensure stakeholder acceptance and decrease costs.

The USEPA has also formed the Remediation Materials Workgroup (RMW) whose mission is to improve HARS placement testing and technical evaluative criteria. Much good work has been done but overall progress has been slow.

In order to expand and enhance beneficial reuse options, we must foster innovation through research and development of dredged material management technologies. The States and federal government must articulate clear policies and define priorities for beneficial use of dredged material. Beneficial use projects are often proposed in an *ad hoc* fashion by the entity that appears to benefit most from the dredging (or filling), automatically making it suspect to the community at large, regardless of the true intentions of those that propose it. The current piecemeal approach to sediment management creates challenges in beneficially linking dredging to beneficial uses in brownfields, landfill closures and manufactured sediment-derived products. Matching up potential beneficial use projects with dredging projects could be best accomplished by development of a beneficial use plan, coordinated with the RDT. Failure to complete this project leaves stakeholders with uncertainty regarding the management of all moderately contaminated dredged material and foments distrust between the environmental groups and agencies.

With improved coordination between operations and availability of sites for beneficial use, brownfield/landfill remediation can benefit harbor maintenance by providing demand and placement sites for dredged material. We need a stronger link between processed dredged material and the remediation projects that could use the dredged material beneficially. A critical component of this link is establishing consistent sampling, testing and placement/reuse criteria across the States. Additionally, increased public involvement is needed to foster public acceptance of beneficial use of dredged sediments.

Creating a PPF to centralize processing of dredged material could reduce dredged material disposal costs, enhance options for beneficial use and provide more predictability to meet the dredged material processing needs in the Harbor Estuary. The PPF might also serve as a host site for research and development for enhancing and expanding beneficial reuse options. Discussions are underway to develop a PPF through a public-private partnership. Such a partnership is necessary to address the complex issues of financing, siting, permits, operation and community acceptance. Public involvement is important to raise awareness and acceptability of dredged material-derived products produced by the facility and to foster support for the siting of a PPF in a Harbor Estuary community.

The State of New Jersey has taken numerous steps to facilitate the beneficial use of dredged material. Legally, not only has dredged material been explicitly exempted from solid waste regulation but processed dredged material is specifically encouraged for use as a fill and capping material under the "Brownfields Law" (Public Law 1997, Chapter 278, C.58:10B-1 *et seq*). The NJDEP carefully regulates dredging and dredged material management through its Office of Dredging and Sediment Technology (ODST). The ODST connects dredging proponents and those wishing to process or utilize dredged materials. The New Jersey Department of Transportation, Office of Maritime Resources (OMR) provides policy and planning assistance. The OMR and

ODST work closely to provide seamless government oversight and assistance and this has resulted in a successful beneficial use program (more than 11 million cy of processed dredged material used to cap and close numerous contaminated properties since 1997).

The NYSDEC, which has regulatory jurisdiction over dredging and upland placement of sediments, authorizes upland reuse of sediments through Beneficial Use Determinations. However, a larger, cooperative, multi-agency initiative is needed in New York State to facilitate prompt, environmentally sound dredging and dredge material management projects. Given the Port's economic significance to the metropolitan region, such an effort should team NYSDEC with the state-wide Empire State Development Corporation and with the New York City Economic Development Corporation (NYCEDC), Department of Environmental Protection, and the Department of Sanitation. The NYCEDC has significant interests in important waterfront development activities and would lead the City's participation by providing both economic and planning assistance. The Corps and the Port Authority of New York & New Jersey (PANYNJ), with the greatest interests in port dredging, must continue to work with the States to identify and develop economically viable, environmentally sound dredge material management alternatives.

Status:

HEP set the goal (Goal 4C): *"Navigation-related projects in the Harbor are designed and implemented in an environmentally beneficial manner."* [20]

Under the U.S. Ocean Action Plan, the Subcommittee on Integrated Management of Ocean Resources was established to promote and strengthen interagency coordination and regional planning. The DMMP technically evaluates all potential dredged material placement options, discusses environmental impacts and makes long-term projections. The 5-year matrix would be the active management tool to link up dredging projects with placement sites, and would be dynamic enough to accommodate change. Updates to the DMMP would not be necessary unless a new placement option (not a new site alone) was identified, or significant environmental impacts were identified for an existing placement option not covered in the original document.

We have made great strides towards recognizing and utilizing dredged material as a resource material with a wide variety of applications. The Corps, its co-sponsor the PANYNJ, the USEPA, and the States of New Jersey and New York have demonstrated and authorized dredged material use in the closure of the HARS, beach nourishment, habitat creation, landfill closure, brownfield rehabilitation and as topsoil. Two commercial firms stabilize and beneficially use hundreds of thousands of cubic yards of dredged material annually in landfill closure and converting brownfields to higher value uses. More upland sites are needed that can be used in a cost-effective manner for processed dredged material, particularly in New York. Water Resources Development Acts of

[20] HEP. 2007.

1990, 1992 and 1996 set forth a program consisting of a series of progressive steps to lead to a full-scale demonstration of one or more decontamination technologies with a processing capacity of at least 500,000 cy per year. Currently, decontamination technologies are being focused on highly contaminated sediment remediation, but not on navigation dredging.

Recommended Actions:

DM-2.1. The DMMP should be finalized to complete its role as the parent document for identification and status of dredged material placement options.

DM-2.2. Utilize the resources of the RDT to efficiently coordinate private and public dredging projects with dredged material management options.

DM-2.3. Both States should move forward as expeditiously as possible with the identification and permitting of sites for the placement of dredged materials to ensure that navigational projects can proceed in a timely manner. It is important to have sites in both States that can handle the full range of contaminants encountered in our shipping channels and berths.

DM-2.4. The Dredged Material Management Subgroup should be formed and periodically update a comprehensive 5-year plan for managing upcoming dredging projects. This plan and its updates should be published and made available on-line for public review.

DM-2.5. The RMW should reconvene and expedite completion of criteria development. The RMW should coordinate with the RDT to determine the impacts of HARS criteria changes on planned dredging projects and existing and future placement sites to better prepare for change.

DM-2.6. Establish regional priorities for beneficial use of dredged material in the form of a regional beneficial use plan. States should consider using dredged material for state projects requiring fill before considering other sources of fill material.

DM-2.7. Studies of the PPF should be expedited and public involvement must be incorporated into the planning process.

DM-2.8. Agencies responsible for making regulatory decisions on dredging projects should develop a regional approach to dredged material sampling and testing.

4. Conclusions and Next Steps

In this report we discussed the reasons for developing an RSM Plan for the Harbor Estuary. We reviewed existing strategic plans worldwide and highlighted basic, generally-accepted principles that would help guide our efforts to create a plan. The report then described specific objectives for each of the major components – Sediment Quality, Sediment Quantity and Dredged Material Management – describing the challenges, status and recommended actions for each objective. A total of 45 separate actions were recommended (summarized Appendix 1).

The overarching conclusions of the Workgroup were:

- The eight objectives and 45 recommended actions represent the consensus of the Workgroup members and need to be considered in their entirety.

- Sediment Management Advocates in both the States of New York and New Jersey are needed to overcome institutional and organizational barriers that have hampered past efforts to manage sediment effectively.

- Because many of the issues involved in RSM are "bottom-up" community-related efforts, it is essential that the public is fully engaged in the decision-making process, rather than "sold" a largely completed plan or project.

A Structure to Implement the Program

The next step is to address the basic question – what do we do next?

Throughout this report, we focused on explaining what is needed to have a comprehensive RSM Program. We did not try to solve the problem of how to implement the recommended actions in order to avoid becoming trapped in the details and losing track of the big picture necessary to implement the RSM Plan. We recognize that many of these recommended actions advance a new way of thinking that entails substantial institutional, political, technical and funding challenges and that there needs to be an organizational element that works to overcome these challenges.

We recommend the formation of a new workgroup under the HEP whose sole mission would be the implementation of the RSM Plan presented in this report. This RSM Workgroup would be a primary steering workgroup that would include State Sediment Management Advocates or their representatives, and would report to the Management Committee and Policy Committee as all other HEP workgroups do. Sub-workgroups would be formed to address Sediment Quality, Quantity and Dredged Material recommended actions, respectively. A more detailed description of this RSM Workgroup and how it would conduct itself is contained in Appendix 2.

The RSM Workgroup would be comprised of agency representatives, technical experts and representatives of non-government organizations who all are empowered to speak for their respective groups, have the ability to reach out to a wide constituency and who are motivated to see this program successfully implemented. The RSM Workgroup would be responsible for investigating each recommended action, ensuring their intent is clearly defined and achievable, and then for laying out the steps required to implement the recommended actions. Recommended actions that they are empowered to implement would be done by the workgroup and its member organizations. Recommended actions that need to be elevated would be carried out through the Management and Policy Committees. Without a workgroup to keep the issues focused and to provide leadership in implementing the recommended actions, RSM for the Harbor Estuary is not likely to succeed.

Estimated Costs

One of the first tasks is to bring together the RSM Workgroup parties to develop foundation documents that would include a project management plan; a list of priorities for actions and studies; a budget and timeline for the proposed work; and an implementation plan that includes an estimate of costs, timelines and benefits of the various recommended actions. The RSM Workgroup should also estimate the administrative funding that would be necessary to support plan development, and should submit this early on to the HEP management structure. A rough estimate of the administrative funding required is $250,000. Concurrently, the State Advocates need to be identified and put in place

It is not practical at this time to estimate the cost of creating and implementing an RSM Plan. There are recommended actions that would require extensive expenditures of time and resources to fully implement, but estimating costs at this time is not practical because the exact nature of the action has not yet been determined. It is also critical that the RSM Workgroup, including the State Advocates, meet first and identify priorities for action and study.

<u>Some of these actions include:</u>

- Reducing sources of pollution.
- Improving aquatic habitat quality.
- Remediating landfills and brownfields.
- Expediting large-scale cleanups, such as the Passaic and Hudson Rivers.
- Implementing soil conservation solutions in the watershed.
- Implementing sediment source controls in the Harbor Estuary.

Some initial monitoring and studies include:

- Develop a sediment characterization map.
- Conduct periodic re-evaluation and update the CARP model.
- Develop a sediment transport model and sediment budget.
- Monitor suspended sediment loadings in the Hudson River (and other tributaries).
- Complete a regional beneficial use plan for dredged material.

Economic Benefits

Though this is a long-term plan, we anticipate near-term economic returns. For example, each cubic yard of dredged material that is clean enough for disposal in the HARS reduces maintenance dredging costs by about $45 per cubic yard (2008 prices). The DMMP estimates that achieving the goal of clean sediments throughout the harbor can save at least $25,000,000 per year in the costs of maintaining our water transportation infrastructure.

Reducing harbor maintenance costs is one benefit of effective sediment management; however RSM is not entirely about dredging. Other economic drivers for RSM also include recreation, tourism and fisheries – industries valued at over $20 billion per year that depend on a clean Harbor Estuary.

Summary

We expect that adopting a regional approach to managing sediments can benefit the Harbor Estuary in many ways, based on the results of RSM in other areas. Expected benefits include:

- *Cost savings* resulting from reduced re-handling of material; extended dredging cycles, sharing equipment in linked projects, shared information and avoided duplication of data collection.
- *Improved habitat quality* resulting from the remediation of contaminated sediments.
- *Improved environmental conditions* based on reintroduction of sediment into “sand starved” littoral systems to sustain habitat for threatened and endangered species.

- *Shared regional-scale data management systems, models and other tools* improve project-level decisions and help achieve greater consistency in analytical results among studies and projects within a region.

- *Improved interagency and stakeholder relationships* produce opportunities for collaboratively leveraging financial and manpower resources in data collection and analysis, tool development and project implementation.

- *Improved predictability of regulatory processes* resulting from improved intergovernmental collaboration and coordination.

For the RSM Plan to achieve these benefits, the following actions are needed:

- Adopt the Vision, Objectives and Recommended Actions presented in this report.

- Provide administrative funding early on to support plan development.

- Establish a formal RSM Workgroup.

- Identify and empower Sediment Management Advocates in each state.

- Establish and sustain public involvement in all aspects of this plan.

- Support the technical, policy and research objectives.

- Establish a long-term funding mechanism.

Appendix 1

Summary of Recommended Actions

APPENDIX 1

SUMMARY OF RECOMMENDED ACTIONS

SEDIMENT QUALITY RECOMMENDED ACTIONS

Objective QL-1 - Ensure new sediments are clean

QL-1.1. Identify specific sources of contamination within the Harbor Estuary and reduce them to levels that protect sensitive species at sensitive life stages.

QL-1.2. Monitor and reduce/eliminate contaminant sources of significance, as determined by CARP.

QL-1.3. Monitor heads of tide for sediment quality in order to track down and eliminate upstream sources of contamination.

QL-1.4. Complete the Hudson River and Passaic River cleanup projects.

QL-1.5. Develop a process for the evaluation and categorization of existing sediment contamination levels in the Harbor Estuary for prioritization of targeted remedial activities.

QL-1.6. Where specific watersheds have been identified as sources of particular contaminants, coordinate upstream groups and agencies through an awareness workshop that brings the Harbor Estuary's issues (and resources) to light for these groups, and work together to reduce/eliminate identified sources.

QL-1.7. Conduct research into linkages between sediment quality and ecosystem health. Continue developing and implementing rapid monitoring tools for sediment, with the objective of identifying and eliminating the causative agents of acute toxicity in Harbor Estuary sediments.

QL-1.8. Evaluate the economic benefits of improved sediment quality and ecosystem health.

QL-1.9. Coordinate with environmental and health-based organizations in the watershed to educate and inform the public about ways to reduce/eliminate sources of contamination.

QL-1.10. Engage the public in setting priorities for action, thus ensuring political support.

Objective QL-2 - Ensure new sediments entering the Harbor Estuary system remain clean

QL-2.1. Identify specific sources of contaminated sediments to the estuary by continuing to support source inventory and trackdown programs initiated by CARP.

QL-2.2. Reduce/eliminate sources of pollution that may serve to contaminate clean sediments.

QL-2.3. Conduct a periodic (approximately every 5 years) contaminant assessment and monitoring program (limited CARP re-evaluation).

QL-2.4. Continue supporting landfill/brownfield remediation programs, especially those that utilize dredged Harbor Estuary sediments.

QL-2.5. Include dredged material regulatory criteria and benchmarks in the development of Harbor Estuary toxics TMDLs.

QL-2.6. Ensure that contaminated sediments are considered source components in developing Harbor Estuary toxics TMDL.

Objective QL-3 - Reduce direct exposure

QL-3.1. Using CARP and other information, develop a map characterizing sediments in the Harbor Estuary by differences in sediment quality and potential for transport to other areas. Use the sediment characterization zone map to prioritize remedial activities and source control priorities.

QL-3.2. Develop an economic evaluation for remediation in each sediment quality zone requiring remediation.

QL-3.3. Include sediment characterization zones in Harbor Estuary toxics TMDL process.

QL-3.4. Reduce cross-jurisdictional differences in sediment and water quality goals for the Harbor Estuary.

QL-3.5. Support timely implementation of large-scale cleanups (such as Passaic and Hudson Rivers).

QL-3.6. Inform and engage Harbor Estuary stakeholders about sediment quality issues and recommended actions.

QL-3.7. Reduce sources of pollution that may serve to contaminate clean sediments.

Objective QL-4 - Reduce transport of contaminants to other areas

QL-4.1. Identify and implement priorities for the remediation of highly mobile contaminated sediments.

QL-4.2. Improve understanding of hydrodynamics and sediment transport in Harbor Estuary, including attenuation and impacts of Harbor Estuary deepening.

QL-4.3. Communicate continuing threat of "hot spots" in the Passaic and Hudson Rivers to Harbor Estuary stakeholders and to the agencies responsible for those projects.

SEDIMENT QUANTITY RECOMMENDED ACTIONS

Objective QT-1 - Ensure sufficient sediment to support healthy ecosystem processes

QT-1.1. Develop new sediment transport models and sediment budgets to predict input and delivery of sediment at the appropriate scale, and collect new information as appropriate.

QT-1.2. Evaluate how sediment influences local ecosystem processes.

QT-1.3. Identify habitats adversely affected by sediment quantity issues.

Objective QT-2 - Reduce sediment deposition in shipping channels/berths

QT-2.1. Develop sediment transport model and sediment budget to predict input and delivery of sediment at the appropriate scale (e.g. navigation channels), and collect new information as appropriate.

QT-2.2. Evaluate how sediment source controls and engineering solutions can affect sedimentation throughout the Harbor Estuary system and in the most frequently dredged channels.

QT-2.3. Identify habitats adversely affected by sediment quantity issues and restore them.

QT-2.4. Identify watersheds that are contributing excessive amounts of sediment to shipping channels. Work with appropriate organizations (e.g., Natural Resource Conservation Service districts, watershed alliances, etc.) to formulate and implement comprehensive soil conservation solutions.

DREDGED MATERIAL RECOMMENDED ACTIONS

Objective DM-1- Improve dredging operations

DM-1.1. The States of New York and New Jersey, in coordination with the Army Corps of Engineers, should develop and implement a consistent minimum set of BMPs for navigation dredging projects.

DM-1.2. Both States should establish consistent seasonal dredging window requirements that are designed to protect the same resources in the same waterways. The windows should be periodically reviewed and updated using the latest peer-reviewed scientific information available and advice from outside scientific experts. Research, monitoring or modeling should be conducted in those instances where knowledge of the likelihood and severity of impact to an important resource is lacking and is contributing to agency and public disagreements. Monitoring should also be conducted to determine the effectiveness of the windows.

DM-1.3. The Corps should investigate and implement as appropriate state-of-the-art means of monitoring and inspecting dredging projects for adherence to operational BMPs.

DM-1.4. The Corps should investigate and evaluate innovative dredging techniques and equipment that is designed to minimize resuspension of sediment during navigation dredging projects.

Objective DM-2 - Improve dredged material management

DM-2.1. The Dredged Material Management Plan (DMMP) should be finalized to complete its role as the parent document for identification and status of dredged material placement options.

DM-2.2. Utilize the resources of the Regional Dredging Team (RDT) to efficiently coordinate private and public dredging projects with dredged material management options.

DM-2.3. Both States should move forward as expeditiously as possible with the identification and permitting of sites for the placement of dredged materials to ensure that navigational projects can proceed in a timely manner. It is important to have sites in both States that can handle the full range of contaminants encountered in our shipping channels and berths.

DM-2.4. The Dredged Material Management Subgroup should be formed and periodically update a comprehensive 5-year plan for managing upcoming dredging projects. This plan and its updates should be published and made available on-line for public review.

DM-2.5. The Remediation Materials Workgroup (RMW) should reconvene and expedite completion of criteria development. The RMW should coordinate with the RDT to determine the impacts of HARS criteria changes on planned dredging projects and existing and future placement sites to better prepare for change.

DM-2.6. Establish regional priorities for beneficial use of dredged material in the form of a regional beneficial use plan. States should consider dredged material for state projects requiring fill before considering other sources of fill material.

DM-2.7. Studies of the Public Processing Facility should be expedited and public involvement must be incorporated into the planning process.

DM-2.8. Agencies responsible for making regulatory decisions on dredging projects should develop a regional approach to dredged material sampling and testing.

Appendix 2

Implementation of the Regional Sediment Management Program

APPENDIX 2

IMPLEMENTATION

OF THE

REGIONAL SEDIMENT MANAGEMENT PROGRAM

OVERVIEW

This appendix presents a proposed implementation structure for the Regional Sediment Management Program (RSM Program). The overall authority to implement the RSM Program is the New York & New Jersey Harbor Estuary Program (HEP) who would adopt or modify this proposed structure. The guiding document for implementation of the program will be the Regional Sediment Management Plan (RSM Plan), as adopted and approved by the HEP Policy Committee. A new group, the Regional Sediment Management Workgroup (Workgroup) and its subgroups – Quality, Quantity and Dredged Material - would be formed to administer the RSM Program. Consistent with its role of management assistance to the Policy Committee, the HEP Management Committee would assist the RSM Workgroup in implementing the program. The RSM Workgroup would have great latitude and discretion in administering the program.

GENERAL STRUCTURE

The general structure of the RSM Workgroup would follow the general management structure of the HEP (see Figure 1). The RSM Workgroup would report to the HEP Policy Committee who would provide overall policy direction, final issue resolution decisions, and support to the RSM Program. The HEP Management Committee would assist the RSM Workgroup in implementing the RSM P, help with issue resolution, and ensure that overall policy, as directed by the Policy Committee, is followed.

The New York and New Jersey State Advocates would be key members of the RSM Workgroup, as well as direct links to the executive office of their respective States to ensure support and implementation. A fundamental component would be public participation on the RSM Workgroup, so that citizen concerns and issues can directly influence the results.

RSM Workgroup

The RSM Workgroup would implement the RSM Program, coordinating the activities of the RSM sub-groups. The RSM Workgroup would consist of a core group of federal, State and local agency representatives, and representatives from involved non-governmental groups. This core group would be selected by the Policy Committee, based on recommendations of the *ad hoc* RSM Workgroup, and provide input as appropriate from the Management Committee. Other members may be added on an as-needed basis depending on the issues, subject to consensus from the core RSM workgroup (Policy Committee approval of new members would not be required if there is consensus among the core group members). The State Advocates, or their representatives, also would be members of the core RSM Workgroup. The State Advocates would be appointed by their respective States.

RSM Sub-groups

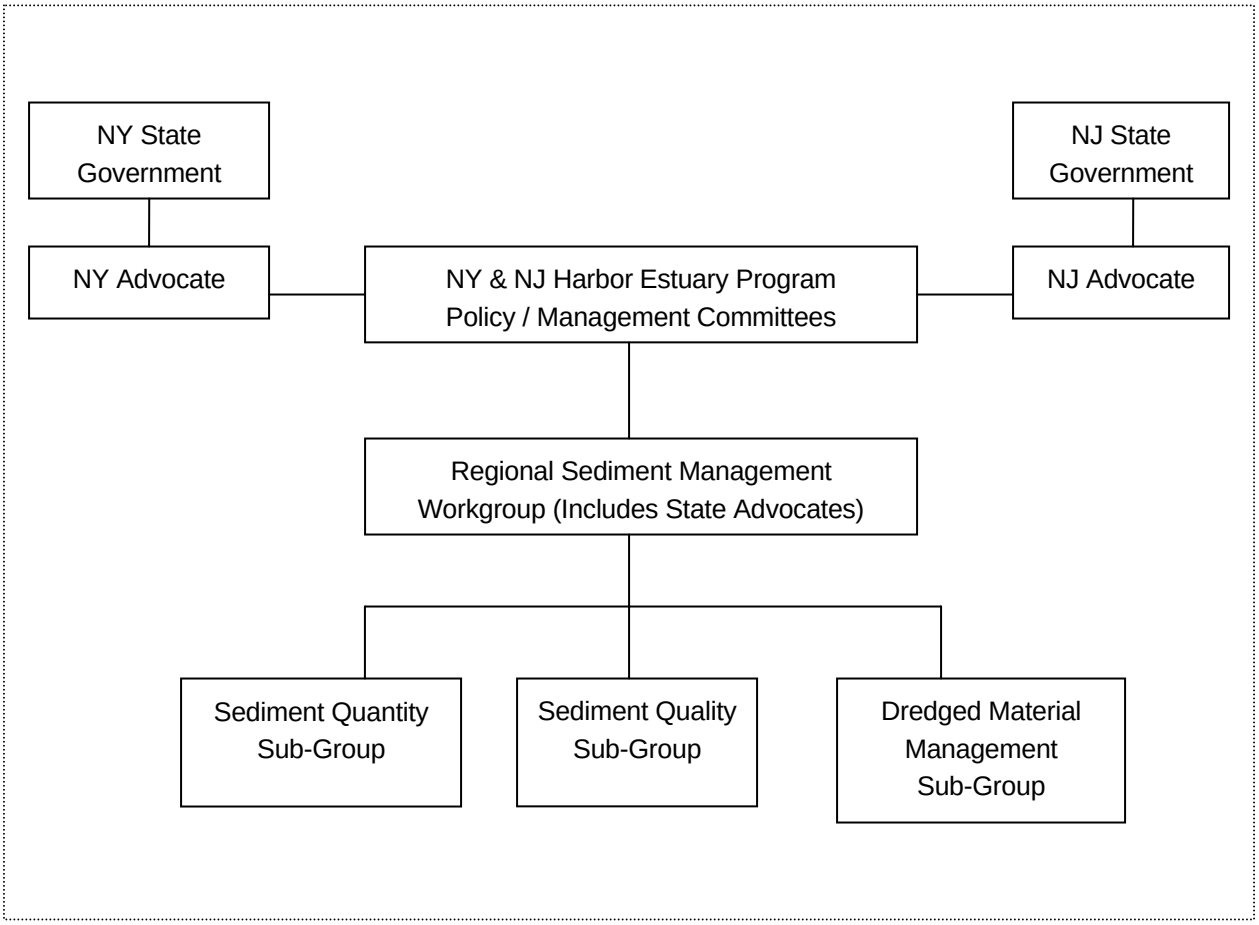
- RSM sub-groups would be formed to focus on implementing the three major parts of the RSM Program – Sediment Quantity, Sediment Quality and Dredged Material Management – and to make recommendations as appropriate on policy and implementation issues. The subgroups would work under the guidance and supervision of the RSM Workgroup. Members on the respective sub-groups would be selected by the core RSM Workgroup, based on consensus agreement. Policy Committee or Management Committee approval would not be required for participation on a RSM sub-group.

- Each RSM sub-group would select one or two representatives by consensus to be part of the RSM Workgroup. The representative's role would be to facilitate communication between the sub-group and RSM Workgroup, and to raise sub-group issues of concern to the RSM Workgroup.

State Advocates

- The two State Advocates would be key members of the core RSM Workgroup and critical components of the RSM Program as a whole. Each State Advocate would be selected by their respective States and could choose to select a representative or alternate to participate on the RSM Workgroup. The role of the State Advocates would be to convey RSM implementation or coordination matters directly to their respective States, to foster consistency between New York and New Jersey in sediment management and to influence decision makers to coordinate and link sediment issues to all applicable programs in accordance with the RSM Plan.

Figure 1 RSM Management Structure



ISSUE RESOLUTION PROCESS

In every human endeavor there will come a time when there are differences of opinion among dedicated and well-meaning individuals, requiring a fair and impartial process to achieve resolution. Below is presented an objective issue resolution process for implementation of the RSM Program:

1. RSM Workgroup defines the issue to resolve. If there is a lack of consensus on the definition of the issue, all dissenting opinions on the subject would be acknowledged and presented.

2. The issue(s) for resolution would first be brought before the Management Committee for their advice and guidance. If the issue is resolved at the Management Committee level, to the satisfaction of the RSM Workgroup and all dissenting opinions, no further action is required.

3. If the Management Committee cannot resolve the issue to the satisfaction of the RSM Workgroup and all dissenting opinions, it would be presented to the Policy Committee for resolution. The Policy Committee would make the final decision.

4. If there is still dissatisfaction with the Policy Committee resolution of the issue, the RSM Workgroup can request a meeting with the Policy Committee for discussion.

Appendix 3

White Papers

APPENDIX 3

WHITE PAPERS

This appendix contains separate white papers that selected individuals of the Clean Sediment and Navigation Workgroup wrote early in the RSM planning process to identify issues and concerns in the three general sediment management areas we identified – sediment quality, sediment quantity and dredged material. These are initial thoughts, which evolved through Workgroup discussions and later were expanded upon into the challenges, status and recommended actions included in this report.

Regional Sediment Management Plan

Sediment Quality

By Dennis Suszkowski, Hudson River Foundation and Scott Douglas, New Jersey Department of Transportation, Office of Maritime Resources

Goal: The sediments of the New York/New Jersey Harbor Estuary (Harbor Estuary) will support and sustain both a healthy ecosystem and a robust regional economy. Sediments will be managed as a resource in order to achieve this goal.

Introduction

Sediments of the NY/NJ Harbor Estuary are a key component of the estuarine ecosystem and are a major factor in determining the environmental, economic and public health conditions of the region. Due to a variety of historical and ongoing human activities, the sediments throughout the estuary are contaminated to some extent. More than three quarters of all maintenance dredged material is unsuitable for direct beneficial use due to excessive toxicity or bioaccumulation potential. Public health officials still warn against consumption of estuarine marine life because of high levels of contamination, much of which is regulated by sediments. While scientific biological monitoring of the estuarine marine life has not been routinely performed, historical declines in both abundance and species diversity were at least, in part, due to unacceptable sediment quality. Managing sediment quality in the Harbor Estuary is challenging for a number of specific reasons. This harbor is at the hydrologic terminus of one of the oldest industrialized watersheds in North America, and is at the heart of the most densely populated region of the United States. The estuarine dynamics are complicated by having multiple rivers entering a system of bays, inlets and channels, making the fate and transport of sediments exceedingly difficult to predict. Despite these difficulties, the success of the Harbor Estuary Regional Sediment Management (RSM) Program rests on a successful management program for the sediments in the estuary.

Purpose

The purpose of this white paper is to propose an approach to define and manage sediment quality in the Harbor estuary and watershed by mapping and categorizing sediment quality data against sediment quality benchmarks.

Background

Sediments are the backbone of the estuarine ecosystem, and as such, support not only the ecological well-being of the system, but also the recreational, commercial and industrial use of the system. Sediments serve the important ecosystem function of providing benthic habitat, yet they also serve as both a source and sink of anthropogenic pollutants. The higher the sediment quality, the more likely there will be a healthy benthic ecosystem that supports an overall healthy estuarine

ecosystem. At the same time, sediment serves as a useful sink for pollutants, and can help to scavenge pollutants from the water column and reduce their bioavailability. Unfortunately for this estuary, this function has resulted in sediments at some locations posing a threat as a continuing source of contaminants to the system.

Contaminated sediments can threaten the ecology and human use of the estuary through a number of mechanisms. Sediment-bound contaminants seek to be in equilibrium with the overlying water; therefore, those sediments that contain high enough concentrations of contaminants or that have low binding capacity present a threat to water quality. While some of the most highly contaminated sediments are found buried at depth in the estuary, evidence is mounting that the highly dynamic nature of the estuary, particularly in regard to extreme events, may preclude permanent burial of contaminants by natural processes. Efforts to improve water quality through the Total Maximum Daily Load process must consider both surficial and vulnerable buried sediments as either active or potential sources.

Sediments can contain either high concentrations of a single contaminant, or mixtures of lower levels of contaminants, that make them incompatible with the survival of many marine organisms. These sediments are referred to as acutely toxic, and acute sediment toxicity has been routinely observed throughout the estuary. While this is an obvious ecological problem, it also poses an economic threat for navigational dredging due to restrictions on open water placement of acutely toxic sediments. Acute toxicity can be measured in the laboratory, but it is difficult to track in-situ. In addition, methods for determining the causes of the observed sediment toxicity are not reliable, making it difficult to determine remedial actions that would result in reduction or elimination of acute toxicity.

Even if sediments are clean enough to pose no threat to survival or bioaccumulation, they can be chronically toxic, resulting in impairments to ecosystem health by reducing the fitness of populations of benthic and pelagic organisms, particularly via impacts to sensitive life stages. Chronic toxicity often includes impacts resulting from low-level long-term exposure, and sub-lethal impacts to growth, reproduction or behavior. While chronic toxicity is not currently measured in the estuary, our overall goal cannot be realized without considering the impacts of low levels of contaminants and combinations of contaminants. Unfortunately, chronic toxicity is even harder to predict or to develop causal relationships for than acute toxicity.

Sediment-bound contaminants also present a risk for bioaccumulation in the tissues of marine organisms, and in some cases biomagnification up the food chain. Bioaccumulation can result in a number of deleterious impacts including fish consumption advisories and narcotic toxicity of benthic organisms, as well as the failure of dredged material to meet ocean placement criteria.

Bioaccumulation has obvious human health and economic ramifications for sustenance, recreational and commercial fisheries. Commercial fisheries, especially shellfisheries, depend heavily on clean sediments to support the organisms and to ensure that harvested organisms are clean enough for unlimited human consumption. It is not immediately known what the economic impact is of this loss of fisheries use.

From industry's perspective, sediments may be an impediment to efficient transportation, or they can be an asset for construction and development. A regional RSM Plan needs to include mechanisms to improve and maintain sediment quality in order to minimize the cost of managing maritime infrastructure. At this time, ocean placement is still the least expensive option for dredged material management. The next least costly option is beneficial use in upland remedial and construction activities. Unfortunately, most maintenance dredged material is silty and requires special treatment prior to use that drives up the cost of dredging by a factor of 5-10. This presents an immediate economic impact of tens of millions of dollars every year. However, the use of dredged sediments in remedial programs has the additional benefit of reducing sources of pollutants to the harbor from contaminated sites.

Sediment quality affects recreational use if the sediments pose a direct contact hazard or contribute to reduced dissolved oxygen or algal blooms. In addition to posing human health risks, impaired sediment and water quality can generate odors, breed nuisance species and lower aesthetic appeal that can diminish the property values of adjacent waterfront land. The economic impact of this loss is not immediately known.

Management Challenges

Ultimately, it would be desirable for all sediments that are dredged to improve and maintain the Harbor's transportation network to be clean enough for unrestricted placement on land or in the ocean. While a completely clean system where all sediments were suitable for all uses would be desirable, it is not immediately achievable. However, it is important to now lay the groundwork for a concerted effort to improved sediment quality.

Sediment conditions vary considerably, reflecting differences in estuarine processes (e.g., hydrodynamics, erosion rates, sediment trapping mechanisms, etc.) and differences in present and past inputs of both sediments and contaminants. A regional plan; therefore, must reflect the spatial variability of controlling processes and conditions in light of the benchmarks to be chosen.

Managing sediments implies that conscious decisions must be made whether or not to take action to improve or maintain the quality and quantity of sediments to achieve desired conditions. RSM; therefore, requires agreement on a suite of benchmarks that define those desired conditions and illuminates a plan of action where existing harbor conditions are found to fall short of one or more of the benchmarks.

From a practical standpoint, there are significant differences in the regulatory criteria and standards used by the two states within the watershed to define and address sediment quality. We propose to create a sediment quality map to identify and prioritize areas of indisputably impacted sediment and avoid assigning numbers that could be subject to disagreement. Using several layers that overlay regulatory and non-regulatory benchmarks and other criteria in a geographic information system (GIS) framework will facilitate a weight-of-evidence approach that should allow us to define a sediment management approach that will receive widespread support.

Management Approach

Our approach to managing sediment quality is to categorize the sediments by varying degrees of quality such that those sediments that meet our goals are preserved, while those the do not are prioritized for remedial action (direct or indirect). Because of the sheer magnitude of the estuary and its watershed, we are proposing to divide the estuary into "management zones" so that available resources can be prioritized to those sediments that pose the greatest impediment to reaching our goals at any given point in time. This categorization would be a planning tool, not an absolutist policy, leaving the door open to appropriate or necessary expenditures of resources outside of this framework. Another advantage to categorization of sediment quality is that it allows for a more reasonable, step-wise approach to remediation that would eliminate the need for holistic remediation of the entire system before any individual actions are taken.

The first step to developing a plan for managing the quality of sediments is to define the actual and potential use of the resource. The RSM Work Group strongly endorses the concept of defining "management zones" that clearly articulate the spatial dimensions of the challenges and opportunities for sediment management. It is essential to have a classification system that is based upon end-use-relevant benchmarks that have readily available data associated with them. Management options could then be identified to address violations of benchmark thresholds at specific locations. In addition, areas could be identified that require no intervention.

Fortunately, the region has already invested heavily in research directed towards a better understanding of sediment quality, fate and transport in the estuary. The Contaminant Assessment and Reduction Program (CARP) has developed a model that continues to dramatically increase our understanding of the system. This state-of-the-art contaminant fate and transport model coupled with sediment transport and estuarine hydrodynamics will be critical to management of sediment quality and implementation of this RSM Plan. The CARP model will provide a tool for predicting the outcome of remedial actions for sediments, both direct and indirect. Additionally, considerable progress has been made in the scientific community in understanding the mechanisms for contaminant binding in sediments and bioaccumulation, making it possible to make fairly reliable correlations between sediment quality and these impacts to the resource. The CARP model will allow managers to determine those sediments most at risk for unacceptable bioaccumulation.

To proceed with the identification and mapping of sediment management zones, it is recommended that following course of action be taken:

- Select a suite of appropriate benchmarks
- Determine the availability of field data to quantify the benchmarks
- Determine the availability of model results to quantify the benchmarks
    - "Mine" existing CARP model runs
    - Conduct new model runs
- Determine at what spatial scale the benchmarks can be quantified
- Create GIS overlays of the benchmark spatial distributions
- Develop a categorization of management zones based upon several factors, including:
    - Which benchmarks are exceeded
    - The severity of impacts (i.e., to what degree the benchmarks are exceeded)
    - The number of benchmark exceedances
    - Likely management solutions to resolving the identified problems
- Map the management zones

It is likely that this effort could be completed within a timeframe of several months.

Benchmarks

Developing a full suite of technically sound and management-relevant sediment benchmarks will require further discussion among management agencies, the scientific community, environmental organizations and others. However, several benchmarks currently exist that could be used to initially characterize the Harbor Estuary.

Table 1 lists several benchmarks that relate to ecosystem health, public health and the economy of the region. Each of the benchmarks has relevance to at least two of the conditions that a Regional RSM Plan would attempt to protect and restore. If data are available throughout the estuary to quantify these benchmarks, matrices and/or GIS overlay maps can be produced that describe the spatial differences in these characteristics. The estuary can then be mapped and divided into

geographically-specific zones where sediments are truly acting as a resource or where they are causing problems. Where problems exist, management zones can be identified that articulate whether the sediments pose ecosystem health, public health and/or economic concerns. The magnitude and numbers of benchmark exceedances can be used to further categorize the problematic zones into a manageable set that informs decision-makers about the severity and extent of the problems. This categorization will be extremely helpful in defining management strategies and establishing priorities for acting on them.

Table 1: Sediment benchmarks that could be used to characterize the Harbor Estuary

Benchmark	Ecosystem Health	Public Health	Economy
HARS-suitable bioaccumulation	✓	✓	✓
HARS-suitable toxicity	✓		✓
Bioaccumulation of sediment contaminants in edible fish & crabs	✓	✓	✓
Sediment contaminant concentrations	✓	✓	✓
Evidence of sediment contaminant movement to other areas	✓	✓	✓
Sediment accumulation	✓		✓
New Jersey Residential and non-Residential Direct Contact Soil Cleanup Criteria		✓	
NYDEC TAGM		✓	
ERL-Q, ERM-Q	✓		
Other sediment quality guidelines??	✓		

Classification

The following represents a proposal for the categorization and prioritization of sediments in the estuary. Following the mapping exercise, this classification strategy should be updated and revised accordingly. Note that chemistry, biology and fate and transport potential are all used to categorize sediments, making this an effective way to allocate resources to those sediments posing the greatest threat to the estuary and our overall goals.

Zone 1: Sediments that have been shown to be an ongoing source of contaminants to the system at levels that impair or threaten even the least sensitive industrial uses. Sediments that have been shown to exceed upland dredged material placement criteria and therefore require decontamination or other special management. Sediments that have been shown through a combination of contaminant concentration and binding ability to impact promulgated State water quality standards.

Zone 2: Sediments that are either acutely toxic to marine organisms or produce unacceptable levels of bioaccumulation in target species. These sediments fail to meet HARS suitability tests. These sediments result in significant impacts to ecological health and all levels of human use.

Zone 3: Sediments that are either deeply buried and not an immediate threat to release contaminants, or sediments that pose a threat to ecological health due to chronic or sub-lethal toxicity only. These sediments fail to meet regional goals in one or more use categories: economic, ecological or recreational.

Zone 4: Sediments that are clean enough for unrestricted beneficial use (terrestrial or aquatic) and are capable of supporting a healthy aquatic ecosystem. Sediments that do not impede unrestricted recreational use.

A major factor that has inhibited the mapping of management zones is the lack of representative field data from all sections of the watershed. With the completion of the CARP (Contamination Assessment and Reduction Project) model, projections of future sediment, water and biological conditions in light of ongoing contaminant loadings, including the transport of pollutants from legacy contamination still residing in harbor sediments have already been developed. CARP will be a critical part of the development of the sediment quality map.

Implementation

Sediment quality categories have several uses. First, they will allow for the allocation of resources toward those areas that present the greatest risk. In order to fully realize the power of this tool, the harbor should be mapped using GIS tools to show those areas of the estuary that fall into each category. This spatial tool should have the resolution of the CARP model, and can be used to not only point out which areas are in need of attention, but as the plan is implemented, these maps will be a clear way to document progress. Obviously, this requires that the map be updated on a regular basis, perhaps as part of the Harbor Estuary Program annual reporting procedures.

Another valuable use of the category approach will be to allow for a non-controversial way to set cleanup standards for a particular site. Some of our sediment quality problems can be clearly defined in both magnitude and extent; others cannot due to factors of time and the fact that many users have polluted the system over time with many different contaminants. As mentioned before, contamination is both pervasive and widespread, as well as being dynamic. Given this fact, it

makes relatively little sense to clean some areas to a given level if that area will rapidly become recontaminated by the surrounding sediments. Some have argued that this is a good reason to simply ignore the problem and wait for "natural attenuation." While it may be obvious that Zone 1 sediments require removal or stabilization, it is not easy to decide on how stringent the cleanup criteria can or should be. Without stepping into legal requirements, some of the complexity can be reduced by simply requiring cleanup targets that will result in attainment of the use level of the surrounding sediments. In such time as the surrounding sediments are targeted, then the entire area can again be remediated to meet the next lower use level. This will allow for a step-wise remediation of the entire harbor without the risk of "wasting" money on over-cleaning areas that are destined to be recontaminated. This could have the benefit of encouraging a more rigorous approach to source control and watershed management.

Goal	Action	Responsible Agency	Cost	Funding
Manage sediment quality to provide a healthy ecosystem and a robust regional economy.	Perform spatial analysis that shows the extent of sediments harbor-wide by Category using historical sediment database	CARP		
	Develop regionally calibrated Sediment Quality Guidelines for Category 2 and 3 sediment	USEPA NJDEP NYSDEC		
	Determine those sediments that are serving as source or are potential sources (Category 4)	CARP		
	Develop rapid screening tool for use in monitoring program	USEPANOAA		
	Create detailed monitoring program as outlined in this plan	CARP		
	Continue to Develop Sediment TIE Procedures	USEPA		
	Develop plan to Achieve Category 1 Sediments throughout the estuary	USEPA USACE NJDEP NYSDEC		
	Develop Watershed Management Plan that ensures only Category 1 sediments enter waterways	USEPA NJDEP NYSDEC		

Perhaps one of the biggest challenges in implementing a sediment quality management plan is the development of tools to monitor existing conditions and progress. Many of the benchmarks are not single point estimates, but rather integrated practical endpoints that are difficult or, at least, expensive and time consuming to measure. The problem is also multi-faceted as it concerns both the concentrations of contaminants and the bioavailability of those contaminants.

To facilitate adaptive management, we recommend the following suite of tools to assess sediment quality in the Harbor Estuary:

1. Annual benthic surveys for biotic integrity using sediment imagery that has been calibrated by traditional benthic survey

2. Surficial sediment quality evaluations that result in complete harbor coverage on a rolling five year basis

3. Monitoring of "new" sediments through a public database of ALL dredged material quality evaluations, including sediment chemistry and toxicity/bioaccumulation (HARS testing and upland testing)

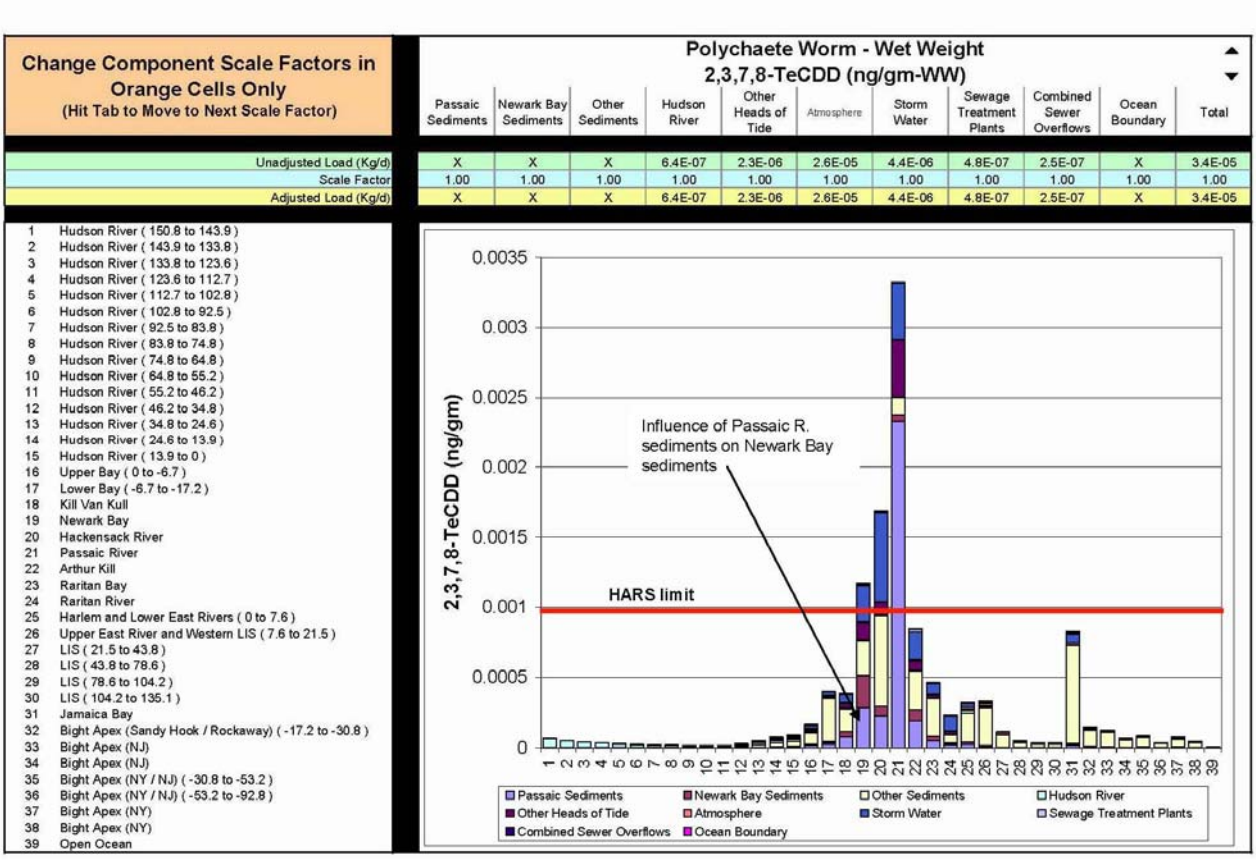
4. Monitoring of existing surficial sediments through bioassay/bioaccumulation evaluations (HARS testing) of key mudflat areas in each major water body on a 5 year rotating basis

5. Developing an in-situ rapid assessment method for higher frequency monitoring and monitoring of remediation activities

6. Developing chronic sediment toxicity testing methods suitable for evaluation of Zone 3 sediments and further refinement of regional Sediment Quality Guidelines

7. Developing sediment Toxicity Identification Evaluation (TIE) methods to determine causal relationships between sediment chemistry and toxic effects

Figure 1: Information from the CARP modeling that can be used to map sediment management zones (draft, not for public release)



Regional Sediment Management Plan

Sediment Quantity

By John Tavalaro, U.S. Army Corps of Engineers

The quantity of sediment and how it moves throughout the Harbor Estuary system affects environmental quality and navigational safety. In a healthy ecosystem there is a balance between the amount of sediment entering and exiting the system. A certain amount of sediment is required to maintain biological health and diversity in the estuary, but too much or too little can cause unacceptable impacts. In the extreme, net erosion of coastal areas, islands, mudflats and other types of aquatic habitat can occur when sediment quantity is too low. And on the opposite extreme, too much sediment can cause shoaling in navigation channels, burial of or stress to aquatic organisms and communities, and general shallowing of aquatic habitat.

The key to effective sediment quantity management is to ensure that sediment transport within the system is conducive to a healthy ecosystem, minimizes shoaling in navigation channels and achieves the correct balance concerning input and output to the system. In order to do this correctly, one first needs to understand how sediments move throughout the system. Therefore the first recommended action for understanding and managing sediment quantity is to develop an overall sediment budget for the Harbor Estuary core area, including sediment transport modeling.

Challenge – sediment transport issues do not generally have a strong proponency in State and Federal agencies. Generally there is more leadership on the issue in academia.

Some sediment quantity related issues specifically brought up that need to be further discussed:

Extent of sediment management – how far upstream do we need to track and manage sediment before they enter the core area (transect to head of tides)? Some stated that we need to understand and trace the impacts back to their origins, but we should focus on management within the core area only.

Ecological factors that are affected:

- Maintenance of wetlands and mudflats – need to discuss what is meant by “maintenance” and mechanisms to do that.

- Erosion of islands – specific projects (e.g., Elders Island) can address some of these issues. What else can be done to stem erosion? Who is lead?

- Other issues?

Related sediment quantity efforts:

- New York Academy of Sciences – looking at sediment budgets in core area
- ADCP – USGS fluxes in suspended sediment
- SWEM Model – has a suspended sediment transport component
- CARP – has a basic sediment model
- Specific projects – HRE studies; Superfund projects in core area

Regional Sediment Management Plan

Dredging

By Monte Greges, U.S. Army Corps of Engineers

Dredging, along with natural processes, are the largest components of moving sediment within the Harbor Estuary and surrounding system. For purposes of this paper, we are referring to navigation dredging, as opposed to environmental or "clean-up" dredging, which will be addressed under the heading of "sediment quality."

The RSM Team has identified the following four topics, along with a number of associated issues, which need to be evaluated further to meet the goals of RSM:

Planning

What kind of sediment planning currently exists for Harbor Estuary sediments? We need to identify both the needs for material and the need to dredge.

- Deepening Project Plans: plans should be provided that list all current and future projects, with sediment/project details (e.g., start dates, sediment volumes, sediment type, projected disposal site); currently gathered and updated by the Regional Dredging Team (RDT); the RDT will also look for opportunities to contact Project Managers to "piggyback" other projects

- 5 Year Maintenance Dredging Plans: need similar info as noted above; plan will be periodically updated by RDT and placed on NYD website

- DMMP – very general prediction of what dredging projects will occur and how sediments will be managed; mostly based on deepening project information; technically evaluates all potential dm placement options, discusses environmental impacts, and makes long term projections; updates needed only if new placement sites are identified, or significant impacts occur at existing sites

- Regional Dredging Team (RDT): Probably the best source for the most current information on disposal needs and available disposal capacity, since those who are managing the projects and disposal sites are part of the team

- Remediation Workgroup (RMW) : group evaluating new risk-based criteria for HARS placement; RMW documentation must include an analysis of how their criteria changes will impact dm volumes for existing projects and placement sites so future "dredging crises" can be avoided; should coordinate this analysis with RDT; RMW has not met for several years

- ADISS: system currently used to track barges and volumes for HARS placement; proposed as a requirement for upland disposal as well; will aid in getting volume numbers "after the fact"

- Public Processing Facility (PPF): Corps led study to establish a processing, storage and transfer site that would prepare material for beneficial use and insure a steady supply of sediment; Corps should expedite study, encourage more public involvement and emphasize benefits to the community; note that decon component not required for a successful PPF

- Decontamination: seen by many as the "magic bullet"; can this realistically be applied on a large-scale given current cost estimates?

- Beneficial Use: each project plan should evaluate options for look at beneficial use of material

- Scheduling: is it better to independently schedule projects, or combine projects to minimize disruption to the environment and avoid impacts over a longer period of time? For example, private projects can be "piggybacked" onto federal ones so they can all be dredged during the same year.

Operations

What can be done during the operation phase of a dredging project to help meet RSM goals?

- Using Best Management Practices (BMPs) during the dredging operation: Regulatory agencies can require the use of BMPs so resuspension and redistribution of contaminated sediments can be reduced; New York and New Jersey should coordinate with Corps to develop a minimum "baseline" set of BMPs that are consistent between all regulatory jurisdictions.

- Inspection: regular inspection during the dredging operation can help ensure that BMPs are being followed and the project is being performed correctly. Inspection should depend more on technical, rather than human, means; Corps should investigate and implement innovative, electronic, tamper-proof monitoring systems (e.g., ADISS); crews need to know info is being collected and evaluated for compliance. What will the role of human inspectors be, how are they trained and who pays for them?

- Equipment: The Corps should investigate and evaluate innovative dredging techniques and equipment that is designed to minimize resuspension of sediments during navigation dredging operations. Will we require certain types of equipment or processes in federal contracts and for private permittees?

- Seasonal windows: Narrow windows mean that dredging will be concentrated in a specific time period. Is this advantageous from an environmental standpoint? Should windows be relaxed to allow more leeway both from an environmental and economic (i.e., Corps funding) standpoint? Recommend that State agencies evaluate the basis for requiring specific windows to see if window's goals will be met (e.g., what resource is window protecting; what does the resource need protection from; how does dredging impact the concern). Windows should be consistent between states.

General Sediment Issues

Dredging and disposal support the economy of the region, but do these activities support the goal of getting a healthy ecosystem?

- Sediments As Resources: sediment should be managed as both an economic (e.g., building material) and environmental (e.g., brownfield remediation; wetland creation) resource.

- Sampling and Testing: Lack of consistency in sampling and testing programs and criteria between different agencies and programs results in conflicting or confusing designation of material; e.g.: what may be considered "contaminated" in one program may be considered "clean" in another. Is this a "public relations" or scientific issue?

- Economic Development: development projects can affect sediment quality, quantity and dynamics, which in turn can affect general environmental quality; projects need better coordination between federal, state and local permitting agencies; policies and regulatory guidance need to consider sediment management principles; new facilities should be placed in areas that can be more easily maintained (e.g., transportation access) environmentally.

- Policy: Need a cohesive policy to expedite a RSM Program (e.g., LTMS)

Beneficial Use

What issues do we need to evaluate to get a better handle on Beneficial Use (BU) of dredged material?:

- Definition: how do we define BU?…sometimes tough to get stakeholders to agree on what is beneficial and what isn't

- Matching Right Material with Right Site: Need to align a number of factors to successfully match dm with BU location; should have a list of "global principles" for particular type of BU as opposed to "I'll know it when I see it"; e.g.:

    - Grain size…different criteria for beaches; wetland creation, land fills; does beach material need to be 90% sand, or just compatible with a particular beach?

    - Does all material for landfills need to be treated/amended/processed? Can all grain sizes be placed at a landfill?

    - Quality (contaminant levels)

    - Non-sediment issues: project sponsors, land easements, transportation

    - Regulatory requirements: how do NY requirements differ from NJ? What are state criteria for different BU scenarios; what, and how long, is the approval process?

- Advocacy: Need to have an advocate for creating stronger links between processed dredged material and a specific remediation project that can use it; should be State level person with knowledge of remediation needs

- HARS: Is HARS placement considered a BU

- Regional BU Plan: Should be a regional plan with priorities for BU of dm; could be part of a larger plan for environmental projects (e.g., restoration, clean up, habitat protection); should RSM group or the RDT look into creating a plan?

Specific Recommendations:

1. An advocate, preferably on the State level, is needed to create a link between processed dredged material and remediation projects.

2. Development decisions by agencies need to consider sediment management decisions.

3. Establish regional priorities for beneficial use of dredged material.

4. Agencies responsible for making regulatory decisions on dredging projects need to develop a regional approach to dredged material testing.

Appendix 4

Summary of CARP Accomplishments and Findings

Summary of Accomplishments and Findings

November 2007

Background

The *Contamination Assessment and Reduction Project (CARP)* is a landmark project bringing together federal, state and non-government partners in a determined effort to reduce contamination within the NY/NJ Harbor Estuary, particularly as it relates to dredged material management. Contamination of sediments by PCBs, dioxin and other toxic chemicals is widespread. This has resulted in significantly increased dredging and disposal costs in the Harbor as well as other impacts to the health of the estuary.

Major Accomplishments

- CARP identified and quantified major sources of contaminants of concern to the NY/NJ Harbor Estuary.
- CARP produced a large set of baseline data characterizing levels of contaminants in sediment, water, biota and wastewaters (sewage treatment plants effluents, stormwater and combined sewer overflows) throughout the estuary.
    - Sampling and analytical methods were refined to quantify very low concentrations of contaminants, particularly in water, that in the past were reported as non-detectable.
    - The publicly available CARP database allows easy access to more than 750,000 measurements.

- A series of numerical models have been developed and calibrated to simulate movement of contaminants through the estuary and to predict the concentrations of these contaminants in water, sediment, and biota in future years under a variety of scenarios.

    - Model simulations predict how continuing contaminant inputs (from atmospheric deposition, sewage treatment plants, combined sewer overflows, stormwater, tributaries, runoff, in-place sediments and the ocean) affect concentrations of contaminants in water, sediment and biota in the estuary over the next three decades.

    - Using the model simulations, an interactive spreadsheet ("Component Response Matrix") has been developed to allow users to see how specific load reductions affect contaminant levels in water, sediment and biota throughout the estuary.

    - Scenarios involving implementation of the Hudson River PCBs Superfund Site dredging and remediation of the highly contaminated sediments in the lower Passaic River were modeled over a more than three decade simulation period. The scenarios predict the effect that remediation will have on the suitability of future dredged sediments for placement at the Historic Area Remediation Site (HARS).

Overall Findings

- The estuary is a dynamic system where, in some cases, contaminants have been transported great distances from their sources and have dispersed throughout many of the interconnected waterways.

- Sediments in the Harbor still contain large quantities of persistent contaminants from historic releases. These legacy sediments are a continuing source of contamination and generally play a larger role than current external loadings in controlling contaminant levels in water, sediment and aquatic organisms in the estuary.

- In general, model simulations indicate that levels of contaminants in all media will continue to decline even if current loads remain constant.

- Burial of contaminated sediments by "cleaner" sediments and resuspension with transport to other areas are the dominant natural processes that result in lower surficial sediment concentrations over time. Severe storms were not modeled, but they could be mechanisms for mobilizing deeper layers of contaminated sediments.

- Over the next 10-20 years, legacy sediments are expected to be the dominant influence in controlling contaminant levels in all media of the estuary. Sediment remediation will therefore likely be the most significant future method of source control.

- Though not specifically designed to do so, municipal sewage treatment plants were shown to effectively limit the concentrations of contaminants in wastewater discharged to the estuary.

PCBs

- PCB contamination is widespread throughout the entire estuary. Data and modeling results show that most of the Harbor's surficial sediments (i.e., the top ten centimeters) are exceeding the benchmark limits established to determine whether dredged sediments can be used as remediation material at the Historic Area Remediation Site (HARS) in the Atlantic Ocean.

- CARP data show that average concentrations of PCBs in white perch and American eel currently exceed U.S. Federal Food and Drug Administration FDA limits (for interstate commerce involving edible fish) at most locations sampled in the Harbor and in the mid-Hudson at Poughkeepsie.

- The Upper Hudson River PCBs Superfund Site is the dominant external source of PCBs to the Harbor. It is estimated that three quarters of the PCB load currently entering the Harbor originates in the Upper Hudson River.

- Modeling shows that PCBs from the Hudson upriver source are transported throughout the estuary, including Newark Bay.

- If PCB loadings continue at current levels, modeling indicates that surficial sediments in most of the Harbor are likely to remain unsuitable for HARS placement due to PCB bioaccumulation, even three decades from now. In addition, white perch and American eel will continue to exceed FDA tolerance limits in portions of the Hudson River.

- If the Hudson River PCBs Superfund dredging is accomplished upriver (and the Record of Decision's estimated load reductions are attained) and Passaic River sediments are remediated, modeling indicates that much of the Harbor's surficial sediments are likely to become HARS-suitable with respect to PCBs within three decades.

- Organic pigment manufacturing was found to be producing and releasing inadvertently synthesized PCBs. During the CARP sampling period, approximately 45% of sewage treatment inputs of PCBs to the Harbor (or 5% of the total PCB load) came from pigment manufacturing companies discharging via sewage treatment plants. At least one of these companies no longer discharges these PCBs.

- Two sewage treatment plants were discovered to be receiving and discharging unusually high concentrations of commercial PCBs. Trackdown investigations found the PCBs to be widely distributed in their sewersheds. Specific sources have yet to be identified.

Dioxins

- Dioxins are a family of 17 different compounds. Various types of sources to the estuary can show different relative abundances, or signatures, of these compounds. CARP found dioxin signatures associated with defoliant manufacture (which produced relatively high amounts of 2,3,7,8-TCDD), urban waste water, and incineration activities.

- Even though 2,3,7,8-TCDD is the dominant problematic dioxin compound in sections of the Harbor (i.e., the Passaic and Hackensack Rivers, Newark Bay and the Arthur Kill), other dioxin compounds are being introduced throughout the estuary, resulting in exceedances of the New York State water quality criterion.

- Current sources of 2,3,7,8-TCDD to the Harbor are very small in relationship to the historic discharge of this compound that resulted in extremely high levels that still persist in sediments of the lower Passaic River region Of the small current inputs, stormwater is largest contributor, accounting for more than half of the current external load to the Harbor.

- In the absence of major storms or other events that would result in the resuspension of highly contaminated buried sediments in the Passaic River, model simulations indicate that surficial sediments in Newark Bay may become HARS-suitable with respect to dioxin within three decades even without sediment remediation in the Passaic River. However, sediment remediation in the Passaic will reduce the time needed to achieve this benchmark.

Other Contaminants

- In addition to PCBs and dioxin, twenty six other contaminants, measured or modeled by CARP, have been identified as potentially being in violation of state or federal (enforceable and non-enforceable) guidelines or criteria. Contaminants of greatest concern include: lead, mercury, polynuclear aromatic hydrocarbon (PAH) compounds, DDT and its metobolites, and several pesticides.

Next Steps

- The U.S. Environmental Protection Agency (EPA), along with the states of New York and New Jersey, will utilize the CARP data and modeling products to inform their determinations about which contaminants require development of Total Maximum Daily Loads (TMDLs) to meet appropriate water quality criteria.

- The NY/NJ Harbor Estuary Program will use CARP products to formulate contaminant reduction targets.

- CARP data and models will likely be used to develop sediment remediation strategies in connection with the U.S. Army Corps of Engineers' Hudson-Raritan Comprehensive Restoration Program and the Harbor Estuary Program's Regional Sediment Management strategy.

- CARP products have been used, and may be used in the future, in connection with the Lower Passaic River Restoration Project.

- The CARP data and model projections will be used in the further development of the NJ Toxics Reduction Workplan and its implementation plan. The implementation plan will identify significant contamination problems and develop source trackdown and pollution prevention strategies that can be applied to these

- It is recommended that additional research be conducted and data be collected to increase confidence in the model projections, measure progress and trends, and better understand relevant effects of contaminants. Important topics include:

    - Understanding sediment transport and deposition mechanisms in Newark Bay and the Hudson River;
    - Improving estimates of contaminant loading from stormwater and combined sewer overflows;
    - Evaluating sampling and analytical procedures for PAHs;
    - Determining how varying levels of sediment contamination affect bioaccumulation; and
    - Determining the factors causing sediment-related toxicity.

For More Information

- Visit the CARP website **– www.carpweb.org**

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