Dredge-RU4474

Development of a Dredge Planning and Decision Support Tool

FINAL REPORT
December 2004

Submitted by

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In cooperation with

Piraeus Port Authority S.A.
and
State of New Jersey
Department of Transportation
And
U.S. Department of Transportation
Federal Highway Administration

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. Dredge-RU4474	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Development of a Dredge Planning and Decision Support Tool		5. Report Date December 2004
		6. Performing Organization Code CAIT/Rutgers
7. Author(s) Dr. Ali Maher		8. Performing Organization Report No. Dredge-RU4474
9. Performing Organization Name and Address Center for Advanced Infrastructure & Transportation (CAIT) Civil & Environmental Engineering Rutgers, The State University Piscataway, NJ 08854-8014		10. Work Unit No.
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Research & Innovative Technology Administration (RITA) 400 7th Street, SW Washington, DC 20590-0001		13. Type of Report and Period Covered Final Report 1/1/2004-8/31/2004
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The report presented herein is a comprehensive overview of the practice of harbor dredging at the Port of New York and New Jersey, USA. The study was commissioned by the Port Authority of Piraeus, Greece with the objective of creating a database for the state-of-practice in harbor dredging in complex and large scale port operations. An important objective of the study was to present a dynamic decision support tool to dredging managers in Greece based on the extensive experience of their counterparts in the U.S.

17. Key Words	18. Distribution Statement
Dredged materials, Contaminants, Sediments, Environment	

19. Security Classif (of this report)	20. Security Classif. (of this page)	21. No of Pages	22. Price
Unclassified	Unclassified	35	

Form DOT F 1700.7 (8-69)

Acknowledgements

In preparing this report, we received significant input from a diverse group of planners, engineers and agency officials who are at the forefront of harbor dredging planning, engineering and management in the Port of New York and New Jersey. The most notable contributors to the report are:

1. Mr. W. Scott Douglas, Harbor Dredging Manager, New Jersey Dept. of Transportation.
2. Mr. Farhad Jafari, President, Soilteknik Inc., Basking Ridge,
3. New Jersey.
4. Mr. Nestor Soler, Principal, Icon Engineering, Princeton, New Jersey
5. Mr. Leon Velikoselsky, Chief Technical Officer, ATC Brunswick, Inc., Hoboken, New Jersey.

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Abstract

The report presented herein is a comprehensive overview of the practice of harbor dredging at the Port of New York and New Jersey, USA. The study was commissioned by the Port Authority of Piraeus, Greece with the objective of creating a database for the state-of-practice in harbor dredging in complex and large scale port operations. An important objective of the study was to present a dynamic decision support tool to dredging managers in Greece based on the extensive experience of their counterparts in the U.S.

Introduction

The report covers relevant and important background information used in practice in the U.S., with an emphasis on the Port of New York and New Jersey, in the last decade and provides a step-by-step list of action items in the form of a decision support flow-chart covering planning, engineering and management of harbor dredging operations.

Organization of the Interactive CD-ROM

The presentation of this report is made electronically using “Flash Player 6”. The extensive volume of background information makes the use of this medium efficient and effective, and eliminates the inclusion of bulky reference materials. A short user-guide is provided herein to aid in the navigation of the report.

CD-ROM Outline

1. Introduction
2. Background
3. Methods of Dredging
4. Disposal Strategies
5. Treatment Strategies
6. Case Studies
7. Decision Support Flow-Chart
8. References

Background

The US Army Corps of Engineers (USACE) has been responsible for the development and maintenance of navigable waterways in the United States ever since 1824. Development and maintenance of navigable necessitates that accumulated sediments be removed through dredging.

The viability of the economy of the United States is clearly dependent upon the continued development and maintenance of the nation's waterways, ports, and harbors for navigation.

Transportation and environmental protection agencies as well as local port authorities have been tasked with developing efficient dredging and dredged material management techniques that are both economically efficient and environmentally protective.

In 1983, the USACE estimated that its annual dredging volume for the nation's waterways was approximately 287 million cu yd of material, including both maintenance (225.7 million cu yd) and deepening (60.9 million cu yd)

Since there has been a substantial increase in ability to measure contaminants in the environment as well as a higher public environmental awareness associated with dredging and dredged material management. This has resulted in a much more restrictive regulatory environment with regards to dredging and disposal of contaminated sediments. Previously acceptable practices such as ocean disposal have either been eliminated or are strictly limited in most US Ports.

Some of the most innovative work toward environmentally safe and economic solutions has been conducted in and around New York/ New Jersey Harbor. The harbor is home to the Port of New York and New Jersey, the largest port on the eastern seaboard, and the third largest in the United States.

The greater New York/New Jersey metropolitan area is home to over 20 million people. The Port of NY and NJ contributes approximately $30 billion to the regional economy and generates nearly 250,000 jobs.

The Port of NY and NJ depends on over 250 miles of engineered waterways. To maintain or modify the channel depths to those required by modern maritime vessels, between 4 and 6 million cubic yards of sediment must be dredged each year. Unfortunately, historical mismanagement of wastes has resulted in a legacy of contaminated sediments, resulting in approximately half of that material being too contaminated for in-water disposal. Some investigators insist that even more contaminated sediments will require removal from outside of shipping channels in order to improve sediment quality.

The Port of New York and New Jersey lies in the oldest industrialized watershed in the country. Sediments found in the New York/New Jersey Harbor are widely contaminated with organic and inorganic compounds of anthropogenic origin.

As a result, the environmental health of the harbor has deteriorated and the efficient operation of the Port compromised by difficulties in disposing of sediments removed during development and maintenance of navigational channels.

More stringent ocean placement testing regulations in the Port region have necessitated a search for other means of developing dredged material management strategies that focus on beneficial use alternatives for the management of contaminated dredged materials.

Goals for Managing Dredged Material

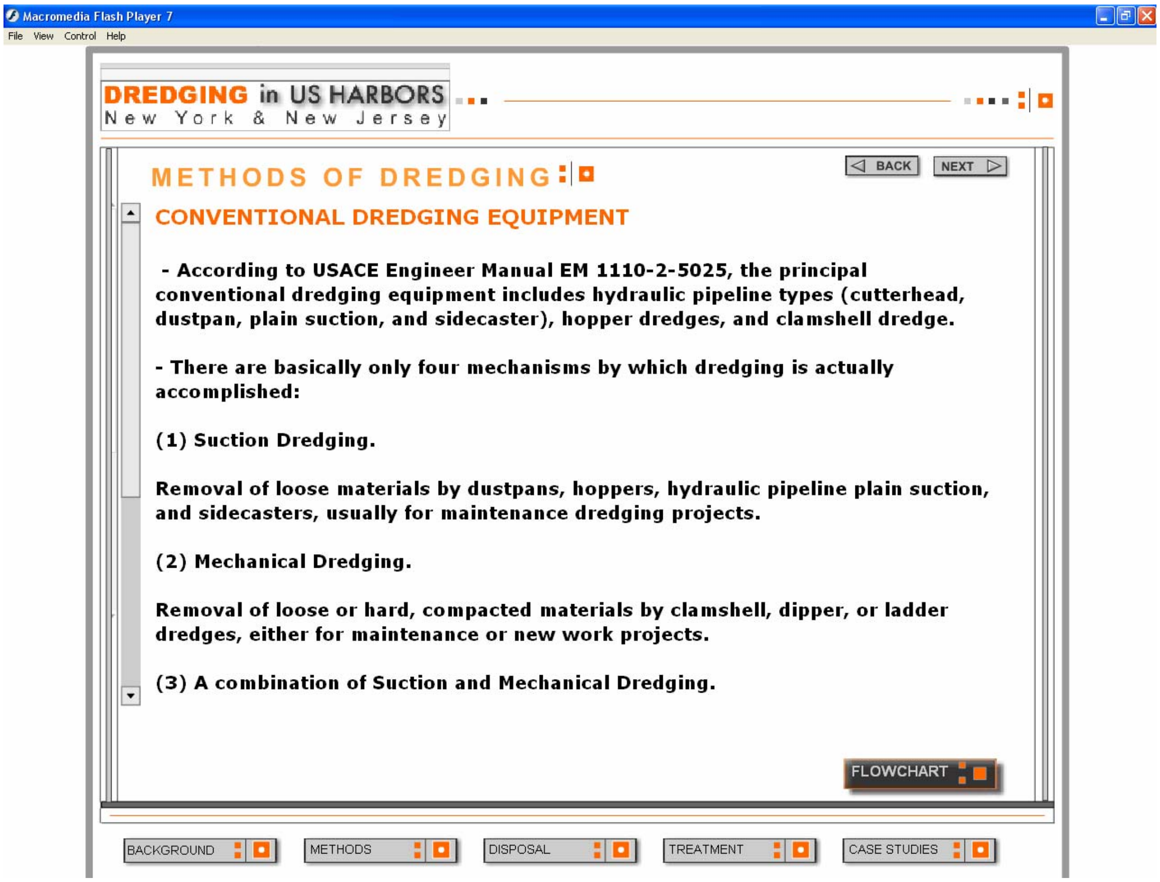
Main goals for managing contaminated dredged materials in the Port of New York and New Jersey can be outlined as follows:

1. At the Source: Continuous search for the best available dredging and dewatering technologies to minimize impacts to the existing aquatic ecosystem.
2. Solutions Now: While better treatment/disposal options are being developed, it is imperative that the safest management options currently available are used for contaminated dredged materials (e.g. beneficial use of processed dredged materials, PDM, at upland environmentally-controlled sites such as Brownfields and Landfills).
3. Reducing Future Sources: Reduce contaminant loading to sediments by implementing a broad environmentally sensitive Watershed Management Program.
4. Development of Enhanced Solutions: Federal and State agencies are sponsoring large-scale demonstrations of dredged material decontamination technologies for the NY/NJ Harbor. The goal of the project is to encourage the commercialization of manufacturing plants that use dredged material as a feedstock to create environmentally benign products for beneficial use.

The management of contaminated dredged material requires the integration of scientific, engineering, business, and policy issues on matters that include basic knowledge of sediment properties, contaminant distribution visualization, sediment toxicity, dredging and dewatering techniques, decontamination technologies, and product manufacturing technologies and marketing.

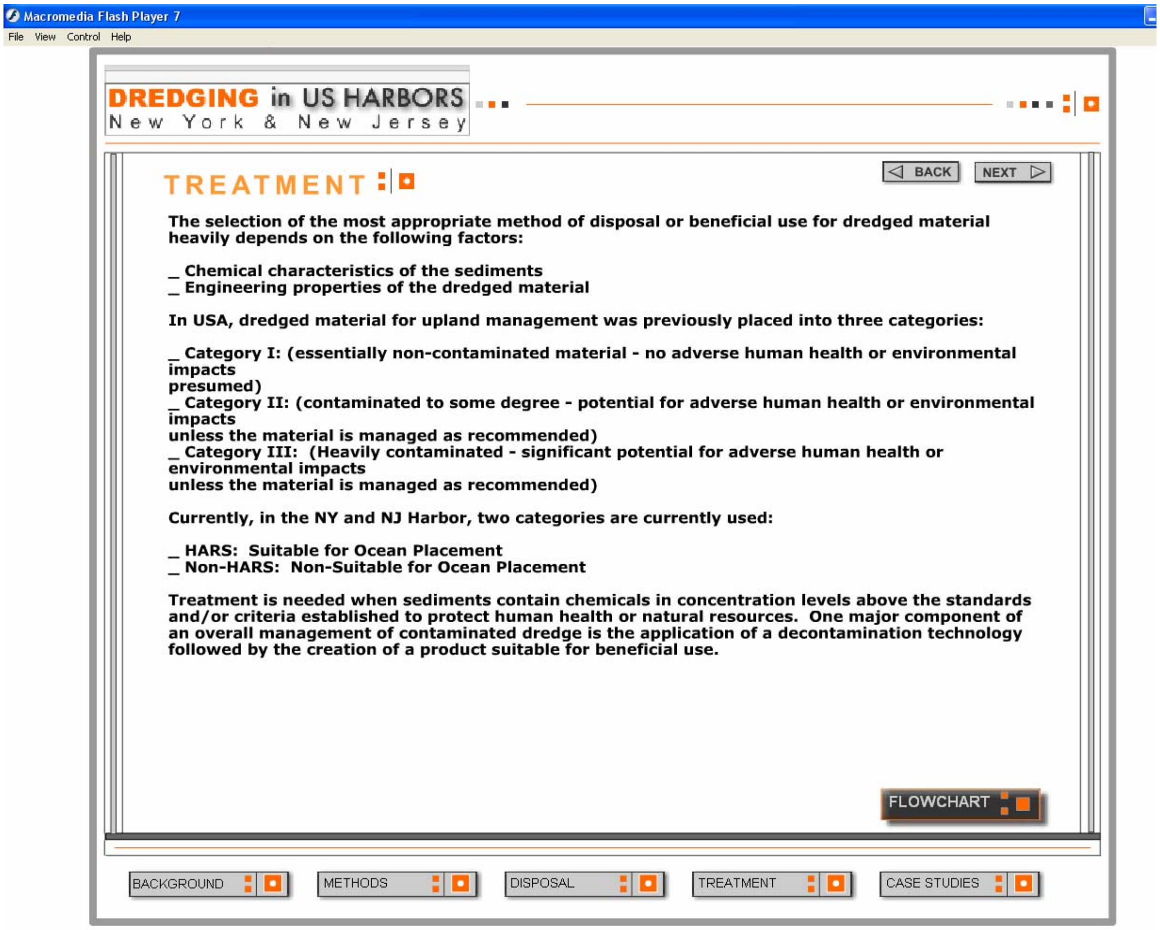
Sample Screen Captures from Each Primary Section

Methods of Dredging

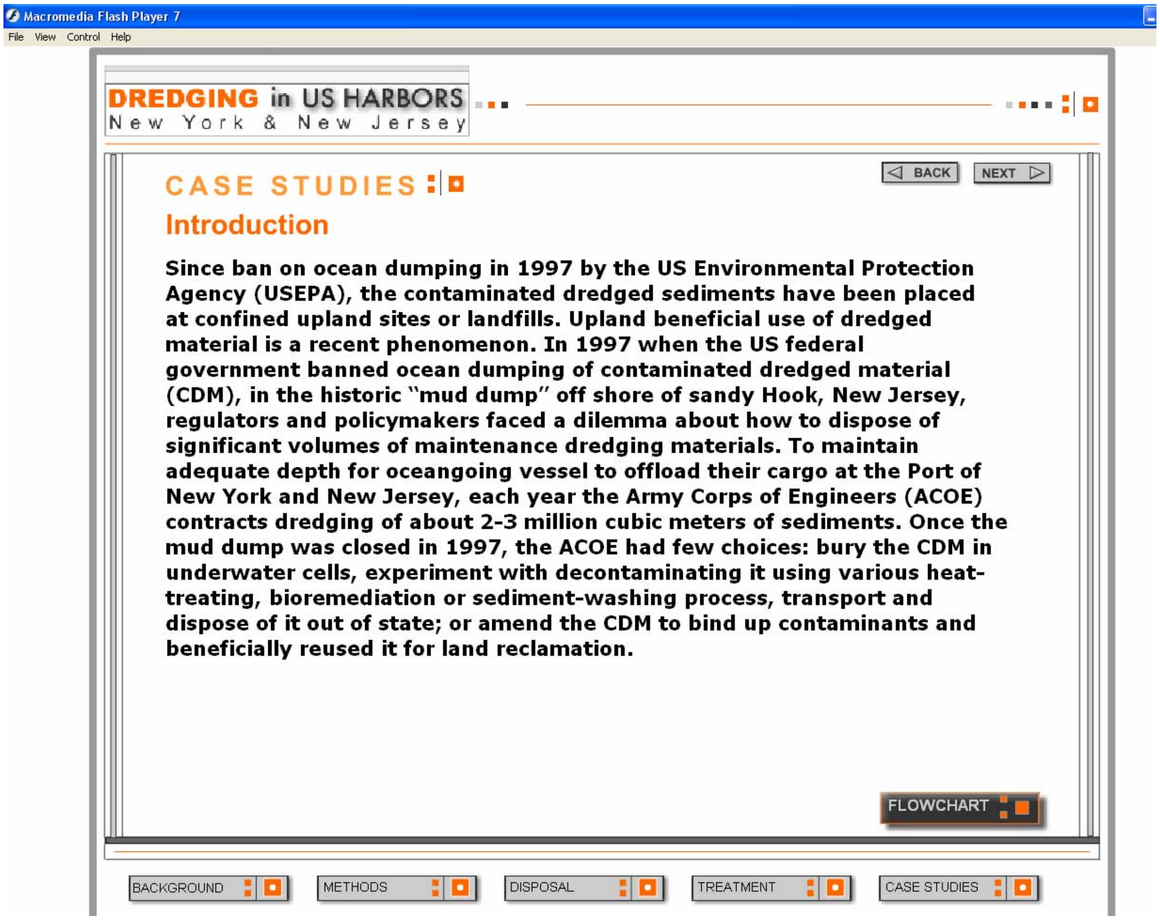


Disposal Options

Treatment

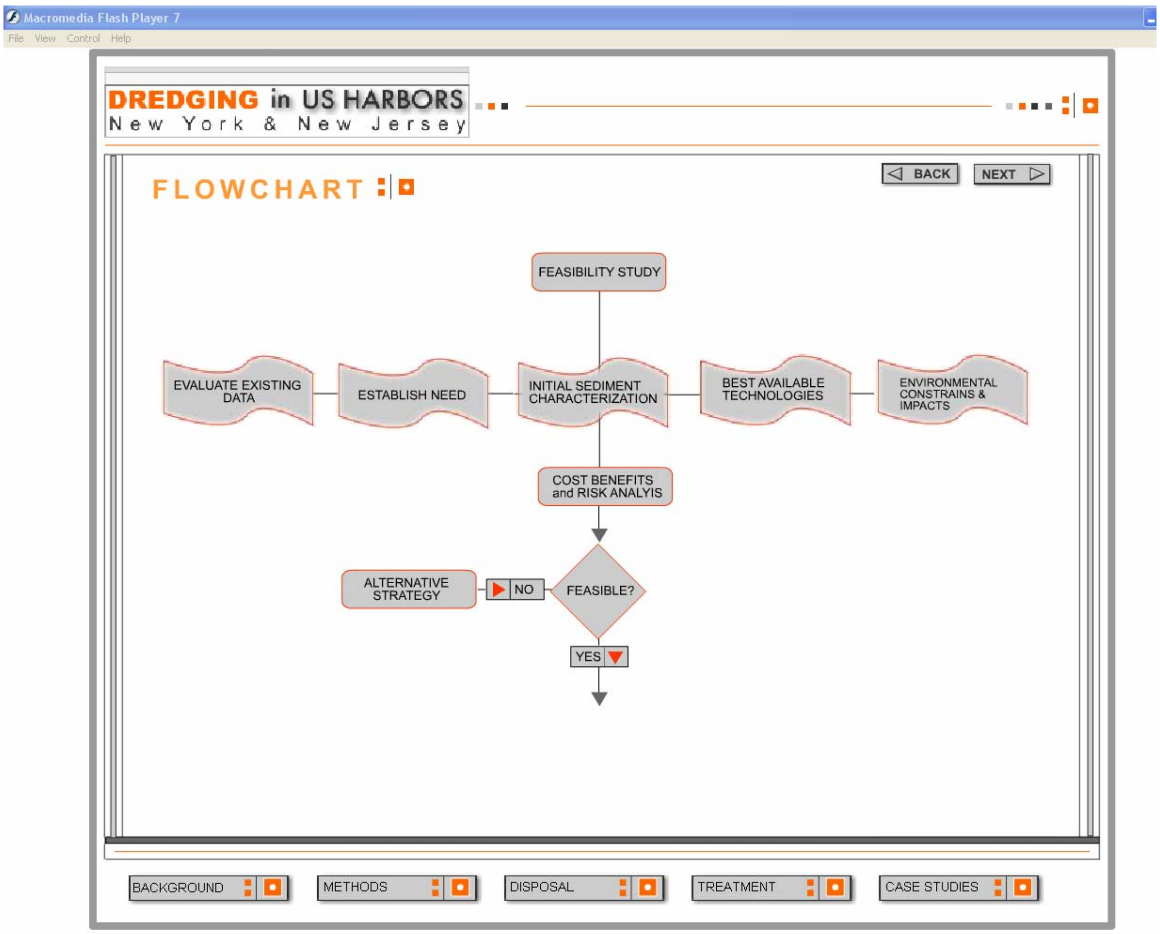

Macromedia Flash Player 7
File View Control Help
DREDGING in US HARBORS
New York & New Jersey
TREATMENT
BACK
NEXT
The selection of the most appropriate method of disposal or beneficial use for dredged material heavily depends on the following factors:
_ Chemical characteristics of the sediments
_ Engineering properties of the dredged material
In USA, dredged material for upland management was previously placed into three categories:
_ Category I: (essentially non-contaminated material - no adverse human health or environmental impacts presumed)
_ Category II: (contaminated to some degree - potential for adverse human health or environmental impacts unless the material is managed as recommended)
_ Category III: (Heavily contaminated - significant potential for adverse human health or environmental impacts unless the material is managed as recommended)
Currently, in the NY and NJ Harbor, two categories are currently used:
_ HARS: Suitable for Ocean Placement
_ Non-HARS: Non-Suitable for Ocean Placement
Treatment is needed when sediments contain chemicals in concentration levels above the standards and/or criteria established to protect human health or natural resources. One major component of an overall management of contaminated dredge is the application of a decontamination technology followed by the creation of a product suitable for beneficial use.
FLOWCHART
BACKGROUND
METHODS
DISPOSAL
TREATMENT
CASE STUDIES

Case Studies



Flow Charts for Decision Support

An interactive Flow Chart was prepared to provide a dynamic decision support tool for the users. The Flow Chart provides a step-by-step list of action items in the form of a decision support flow-chart covering planning, engineering and management of harbor dredging. Supporting information for various stages of the process is available electronically on the CD-Rom and is presented in the following sections.



Establish Need

a. Economic Justification Analysis

The first step in any dredging project is to perform a full evaluation of the need of the project. If the project is determined necessary for navigational safety, this is sufficient as long as the channel is actually being utilized. The cost to remove the material should not exceed the benefits achieved from the maintained channel. New construction should include an analysis of the future costs of maintenance of the new or improved channel, berth or marina.

b. Controlling Depths Reports

The channels need to be regularly surveyed to publish the safe navigational depths. In addition, the use of the channels (ship trips, functional draft, product value, recreational use) should be recorded in a database in order to facilitate future economic analyses. Users and tenants need to be polled to establish past and current use as well as projections of future needs.

c. Growth Plans

The modern Maritime Transportation System includes both landside and maritime infrastructure. The capacity, and therefore the value, of maritime infrastructure are constrained by the efficiency with which cargo can be moved out of the Port District. Maritime planners need to be aware of both future growth potential for their industry as well as existing and future expansions and use of the landside (road and rail) infrastructure. Unbalanced infrastructure will result in underutilization of valuable capital investments.

Initial Sediment Characterization

Sampling and Testing Plan

Using historical data, volume projections, and geotechnical data, sampling points within the project area are identified for environmental characterization. Sampling intensity will vary depending on available management alternatives and regulatory agency oversight, but in general, sampling is more intensive in those areas with recently deposited silts and clays, known point sources or historical contamination. Testing will also vary depending on location and management alternatives. At a minimum, geotechnical data (grain size and organic matter content) is required, as well as bulk sediment chemistry (volatile organics, semi-volatile organics, pesticides and trace metals).

NJODST Dredging manual (not available online)
Sediment Assessment Plans: http://www.nj.gov/dep/srp/regs/sediment
Soil Cleanup Criteria: http://www.nj.gov/dep/srp/regs/scc/index.html

Environmental Constrains& Impacts

Environmental Concerns

Impacts from dredging may be of concern in essential fish habitat, and while this usually will not prohibit dredging, permits may require cessation of work during breeding or migration periods. Dredging may also be restricted if sediments are contaminated and likely to impact surrounding water quality. Best management practices may increase cost and time required for the project. The dredged material management requirements of these projects must be carefully reviewed and compared to existing capacity for both clean and contaminated sediments. Management of dredged material should be in compliance with an approved dredged material management plan. Air quality impacts may need to be addressed for larger duration projects, especially in non-attainment zones.

DMMP links:
http://www.epa.gov/owow/oceans/ndt/guidance.pdf
http://www.nan.usace.army.mil/business/prjlinks/dmmp/index.html

Environmental Impacts

Ocean vs. Upland

Placement of dredged material in open water has been highly regulated by both the US Army Corps of Engineers and the US Environmental Protection Agency since the early 1970s. Prior to the 1972 Marine Protection Research and Sanctuaries Act, dredged material was disposed wherever convenience dictated. By 1977, the Corps had released the first testing manual for evaluation of biological effects of dredged material ever written. Regional Corps districts were required to develop their own region-specific guidance from this document. In 1990, the national guidance was updated, in concert with the USEPA. This document, and subsequent regional guidance, resulted in a re-evaluation of dredged material management in NY/NJ Harbor. Practically overnight, the management of dredged material shifted from primarily open-water disposal, to confined aquatic disposal and sanitary disposal in secured landfills. Eventually, this shifted to primarily upland beneficial use.

In the NY/NJ Harbor, only non-toxic sediments that do not result in unacceptable bioaccumulation in both shellfish and infaunal organisms may be placed in the ocean. However, sediments are routinely placed in confined disposal sites based solely on bulk sediment chemistry.

Relevant testing manuals: http://www.wes.army.mil/el/dots/guidance.html
HARS information:
http://www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/hars.html
http://www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/pdf/sitemmp.pdf

For upland beneficial use an artificial leachate test such as Sequential Batch Leaching Test, is required to evaluate potential impacts to groundwater. Bulk sediment information is used to assess potential risk to terrestrial receptors. Institutional and engineering controls are used to limit the potential for loss of contaminants to the environment. In many cases, the contamination of the sediment is less than the contamination present in those areas identified for placement of dredged material (abandoned industrial sites and landfills). Controls for fugitive and volatile emissions will be based on bulk sediment chemistry characterization as well. In some cases, the concentrations of contaminants in sediments will require the use of sediment decontamination technologies or confined disposal.

This dichotomy between aquatic and terrestrial testing requirements is often confusing to the layperson. However, terrestrial ecosystem is often considerably less sensitive than aquatic ecosystems, unless the sediments are placed in confined and capped underwater disposal pits (CAD). In NY/NJ Harbor the non-point source inputs from unremediated landfills and Brownfields are a significant contributor to continuing sediment contamination. By removing contaminated sediments from the water, risk to the harbor ecosystem is reduced once and a second time when the sediments are used to cap a source of contaminants. If those sediments are then capped with clean material and isolated from the ecosystem, a third reduction in risk is reduced.

Beneficial use case studies:
http://www.wes.army.mil/el/dots/budm/index.html
http://www.glc.org/dredging/publications/benuseForm.html

Fish Windows

While it is well known that benthic communities are often quick to recover from the effects of dredging, the National Marine Fisheries Service (NMFS) requires an assessment of impacts to fisheries in areas that have been identified by the Magnusen-Stevens Act as Essential Fish Habitat. During periods of higher sensitivity (breeding or migration) dredging may be reduced or prohibited in order to protect these valuable resources. An Essential Fish Habitat Assessment is required of all dredging projects. Read more about the Magnusen-Stevens Act:
http://www.nmfs.noaa.gov/ess_fish_habitat.htm

Permits

Once a dredging and dredged material management plan has been selected, permits applications can be filed with the appropriate regulatory agencies. There is a "cradle to grave" policy with regards to dredged material; all material must be tracked from the moment of removal to its final placement site and all phases must be fully permitted before dredging can start.

State of New Jersey

The State of NJ regulates dredging and dredged material management through the Office of Dredging and Sediment Technology in the Department of Environmental Protection. Regulatory jurisdiction is provided in the Coastal Zone Management Act, Land Use Regulation, Site Remediation, and Solid and Hazardous Waste, and Water Pollution Control Act. New Jersey has exempted dredged sediments from the Solid Waste regulations, but the existing models for solid waste disposal are used for upland placement of dredged material. Some dredged material amendments (fly ash, auto shredder residue, fluidized bed resin ash, municipal incinerator ash) are regulated under solid waste rules. Dredged material is encouraged for use in capping of contaminated sites, but it must not be more contaminated than the material already present on the site. Dredging operations must be approved so as to confirm that water quality criteria are not violated. All processing facilities for dredged material must be permitted for control of impacts through air emissions, stormwater runoff and control of spillage of raw sediments.

Processing Facility Requirements
Waterfront Development Permit (if on waterfront)
General Land Use Permit (if not on waterfront)
Acceptable Use Determination
Dredging Permits
Water Quality Certification
Federal Consistency Determination (Federal Projects only)
Acceptable Use Determination
Tidelands Conveyance (if not federal channel or granted)

Links to rules

Technical Rules for Site Remediation: http://www.state.nj.us/dep/srp/regs/techrule/
Tech. Manual for Groundwater: http://www.state.nj.us/dep/dwq/pdf/gwtechman.pdf
Tech. Manual for Stormwater: http://www.state.nj.us/dep/dwq/pdf/swtechmn.pdf
Tech rules for surface water: http://www.state.nj.us/dep/dwq/sw.htm
Tidelands program: http://www.state.nj.us/dep/landuse/coast/tideland/tideland.html
Solid Waste Rules: http://www.nj.gov/dep/dshw/resource/rules.htm
Coastal Zone Management: http://www.state.nj.us/dep/landuse/njac/njac.html
Waterfront Development Act: http://www.state.nj.us/dep/landuse/njsa/njsa.html

Federal

The Corps of Engineers is responsible for permitting all dredging and construction actions in waters of the United States through Section 10 of the Rivers and Harbors Act. In addition, Section 404 of the Clean Water Act and 103 of the MPRSA regulate dredging and disposal of dredged material in US waters. Click on this link for the text of these regulations: http://www.spk.usace.army.mil/cespk-co/regulatory/regs

An Essential Fish Habitat assessment will also be required to obtain a Federal permit for any dredging project in the NY/NJ Harbor. Click on this link for a primer on EFH consultations in the Northeast.
http://www.nero.noaa.gov/ro/doc/appguide1.html

Cost Benefits and Risk Analysis

Economic Justification Analysis

The first step in any dredging project is to perform a full evaluation of the need of the project. If the project is determined necessary for navigational safety, this is sufficient as long as the channel is actually being utilized. The cost to remove the material should not exceed the benefits achieved from the maintained channel. New construction should include an analysis of the future costs of maintenance of the new or improved channel, berth or marina.
Given the importance of timely construction or maintenance of channels for safe navigation, both cost and schedule must be considered. Alternatives that exceed the value of the delivered channel will likely be excluded (see #1). Also, alternatives that cannot be realized in time for nearest need may not be practical.

Logistical Concerns

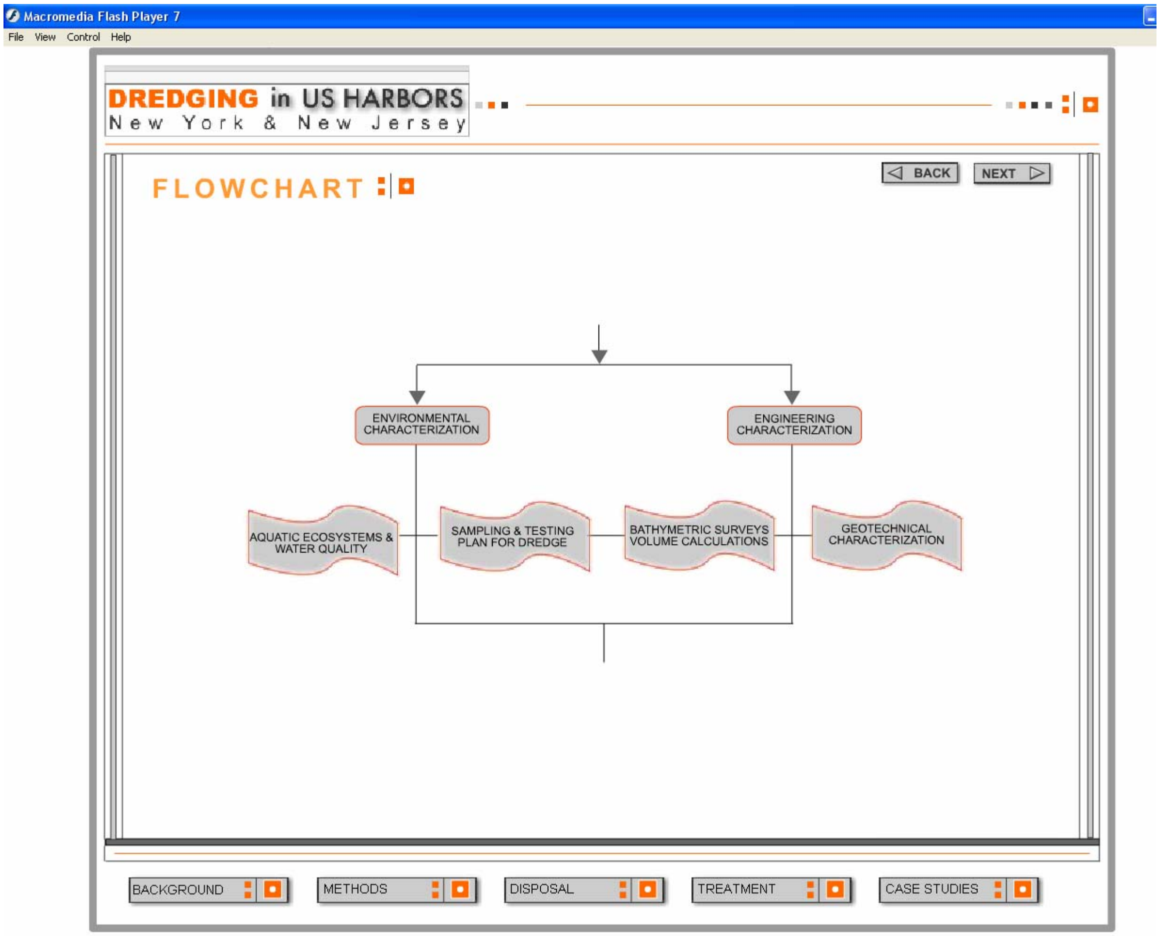
In order for a management alternative to be viable, it needs to be both economically and environmentally sound as well as logistically feasible. Processing facilities require extensive capital construction costs. Long landside transportation links are not sustainable. Management processes must also be capable of meeting the production rate of the dredging plant unless long-term storage of raw dredged material is developed. Verify that dredged material volumes and types coincide with available management alternatives and capacities.

Environmental Concerns

Using the data collected from the sediments, a full list of management alternatives can be developed. Only those representing acceptable risks to the environment can be considered for use. A fully integrated dredged material management plan will contain alternatives for all types of material likely to be dredged. It is the responsibility of the project team to select the alternative that is the most environmentally protective given the economic and logistical realities of the given project.

Alternative Strategy

The cost of both construction and maintenance of navigational channels, especially in areas with contaminated sediments, is a critical component of the planning process. Contaminated dredged material will always be more expensive to manage than uncontaminated material. In some cases the contamination of sediments may result in the deferral of dredging if management alternatives are not available or if the cost exceeds the value of the channel.



Environmental Characterization

The environmental characterization in any dredging project is essential to any management program.

We distinguish two major categories:

- In minimizing the potential detrimental aquatic impacts during dredging, the environmental conditions - e.g. ecosystems and aquatic habitat - of the areas where actual removal of sediments would occur should be characterized. If land of ocean disposal is pursued, then the environmental conditions of the disposal area should be also investigated to provide proper controls.
- The sediments to be dredged should be chemically characterized. The characterization and testing of a dredged material must be matched to a particular beneficial use.

Aquatic Ecosystems & Water Quality

- Evaluating the potential environmental consequences associated with dredging and dredged material disposal requires the collection of large amounts of complex technical information.

- Decisions about potential impacts are often made on "best professional judgment" or on proper risk assessments.

To assess ecological impacts, the USACE (TR DOER-4) recommends the following steps:

1. Describe the dredged material management activity.

2. Identify the kinds and spatial extent of habitats that are present in and around the management area.

3. Identify the species and humans that may use these habitats and that may be potential receptors.

4. Specify the contaminants of concern.

5. Describe mechanisms which may bring a contaminant into contact with a human or other organism.

6. Describe the potential routes of contact between the contaminant and the receptor.

7. Describe the complete exposure pathway.

Constraints placed upon the conduct of dredging or dredged material disposal operations in order to protect biological resources or their habitats from potentially detrimental effects are related to:

- Environmental Windows: Environmental windows are based on the simple logic that potential conflicts or detrimental effects can be avoided by preventing dredging or disposal during times when biological resources are present or most sensitive to disturbance.

- Turbidity
- Suspended Sediments
- Sedimentation
- Hydraulic Entrainment on Aquatic Resources

NOTE: more information available on CD-ROM

Sampling & Testing Plan for Dredge

- Depending upon dredge management options, sediment quality is compared to specific soil and water quality standards.

- In New Jersey, for upland disposal, sediment quality may be compared to Residential and Non-Residential soil cleanup criteria as follows. The list is not complete and only includes parameters commonly found in a specific area. Complete references are found in the web page of each State environmental agency.

NOTE: more information available on CD-ROM

Bathymetric Surveys Volume Calculations

Hydrographic Survey and Volume Calculations

Hydrographic surveys are principle dredged contract management tool. Hydrographic surveys should be made prior to dredging to determine the existing depths within the project area and after dredging to determine the depths that were attained as a result of the dredging. Hydrographic surveys must be made in a timely manner immediately before initiation of dredging activities and immediately following completion of dredging. Quantity calculations must be made from survey data and based on precisely established horizontal and vertical controls.

Hydrographic Survey is typically conducted using:

• Single-Beam Surveying; and
• Multi-Beam Surveying

Historically, single beam survey equipment was for hydrographic surveys. Due to its inaccuracy and poor coverage of areas surveyed, recently the ACOE and the dredging companies in the NY/NJ region adapt the multi beam survey equipment.

As the term implies, it is a system that has a number of beams, each is independent and looking at a certain part of the seafloor. Typically the beams are adjacent to each other and result in a wide area of coverage. Using sonar, each beam looks at the seafloor and provides information on what it sees.

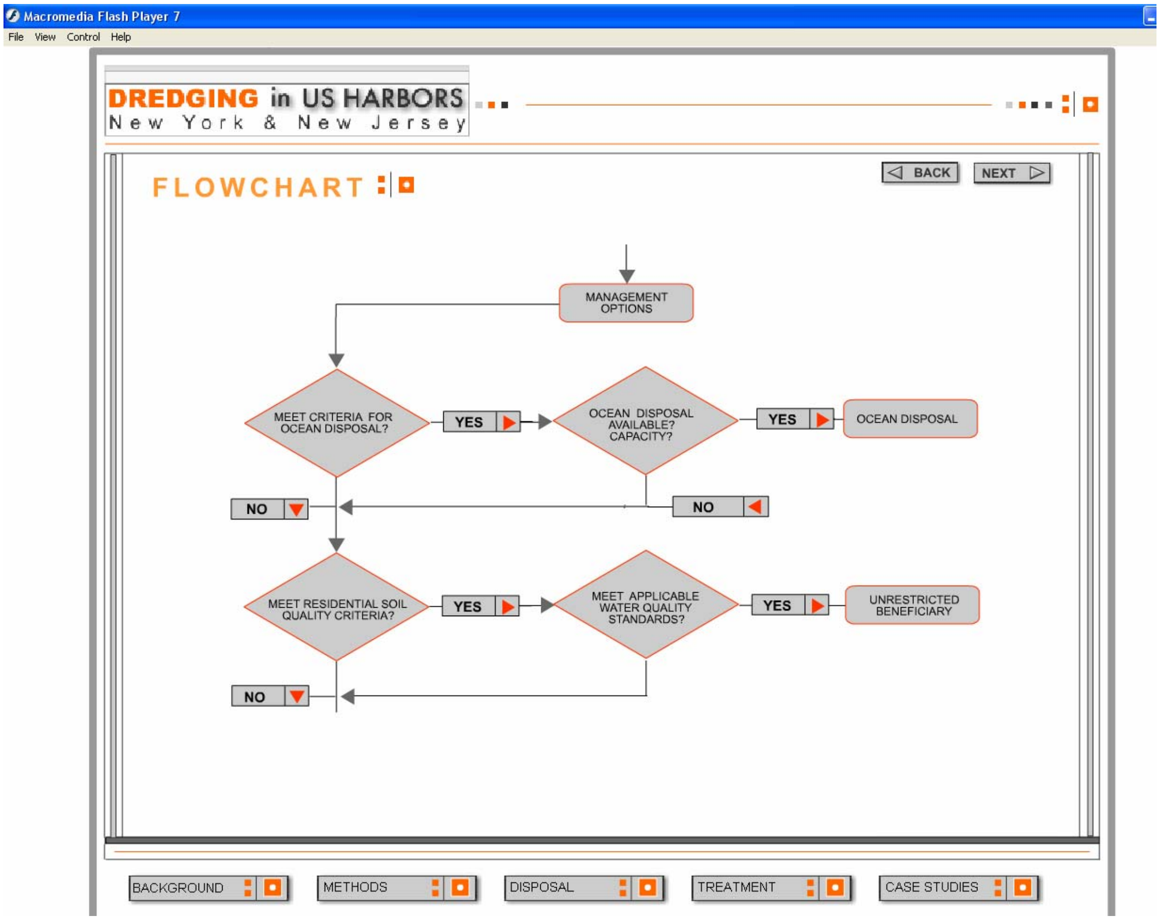
Once the hydrographic survey is completed, volume calculation is conducted by determining the volume of the prism formed between the sea floor surfaces prior and after dredging. The accuracy of the volume calculation depends upon the density of points surveyed. The advantage of multi beam over single beam is in the number of points it collects at any given time.

Geotechnical Characterization

1) Physical Properties:
- Index Properties (ASTM D2487)
- Particle Size (ASTM D422)
- Moisture-Density Relationship (ASTM D1557)
- Bulk Density
- Organic Content (ASTM D2974)
- P.H.

2) Engineering Properties:
- Shear Strength (ASTM D-4767, 2850-87); Strength gain/loss overtime
- Compressibility (ASTM D-2435)
- Ambient Temperature effects on strength development

NOTE: more information available on CD-ROM



Meet Residential Soil Quality Criteria?

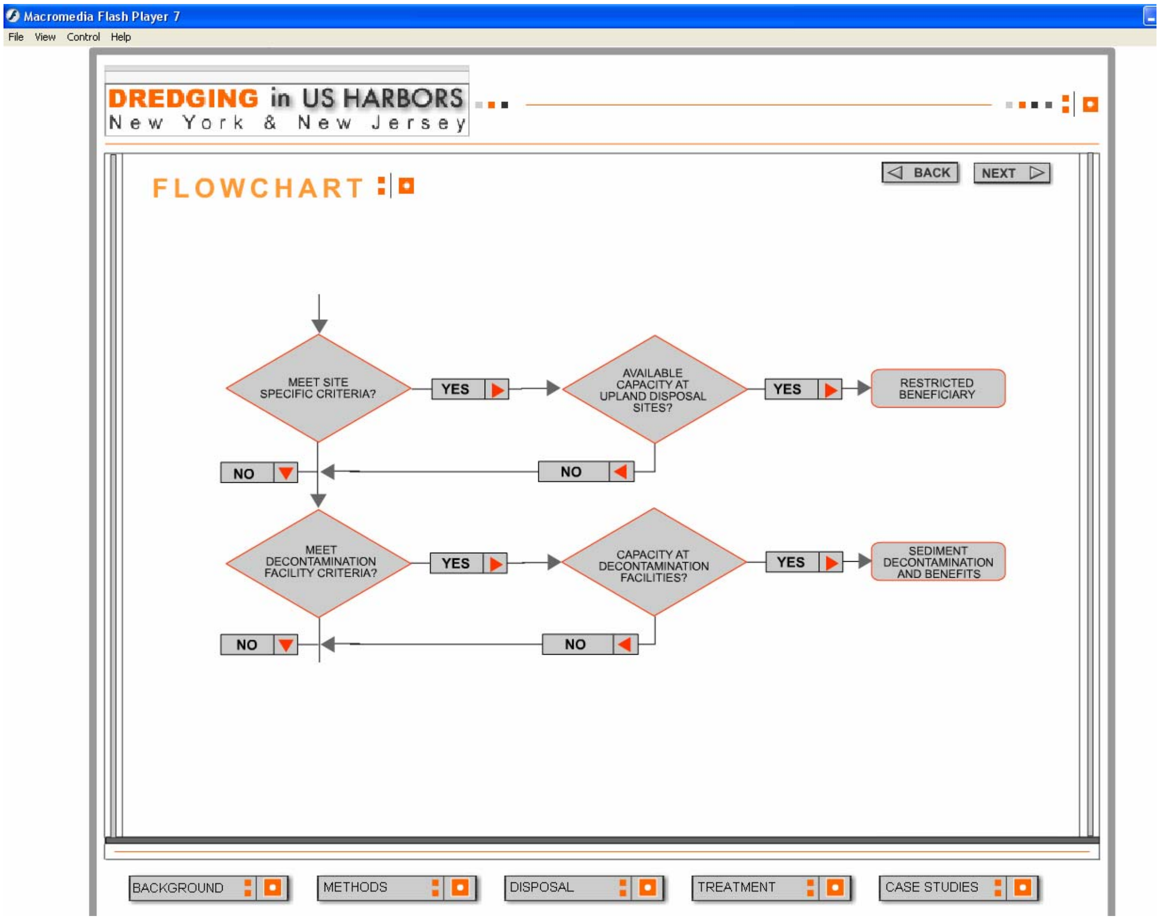
To find out more about Soil Cleanup Criteria, please visit:

http://www.state.nj.us/dep/srp/regs/scc/

Meet Applicable Water Quality Standards?

To find out more information about Water Monitoring and Standards, please visit:

http://www.state.nj.us/dep/wmm/



Meet Site Specific Criteria

In general, an upland confined disposal facility (CDF) can accept contaminated dredged sediments once the operator demonstrates that placement of dredged material would not result in adverse impacts to the ecosystems and human health. The major potential adverse environmental impacts are surface and groundwater contamination. The discharge of contaminants from upland CDF to surface water must be minimized.

The magnitude of those impacts are dependent on the following:

A) Location of the facility and site specific conditions (including compatibility with adjacent and nearby land uses);

B) Characteristics of the dredged material proposed for placement at the facility (meets residential, non-residential, alternate soil clean-up criteria or else);

C) Design and construction of the facility (environmental controls such as leachate collection system or perimeter containment in place);

D) Operation of the facility; and

E) Final closure and use of the facility site (developed for industrial, residential, retail, recreational use).

Ref: The Management and Regulation of Dredging Activities and Dredged Material in NJ's Tidal Waters, NJDEP

Meet Decontamination Facility Criteria?

Starting January of 2004, Sediment Washing demonstration project will start processing contaminated sediments in New Jersey at a rate of 32 cubic meters per hour. During the course of the pilot project, 55,000 cubic meters of contaminated sediments from a site in Newark, New Jersey will be treated. In this technology, the connection between the sediments and the contaminants is reduced to facilitate future removal. The contaminants will enter into liquid phase and separated from the solids.

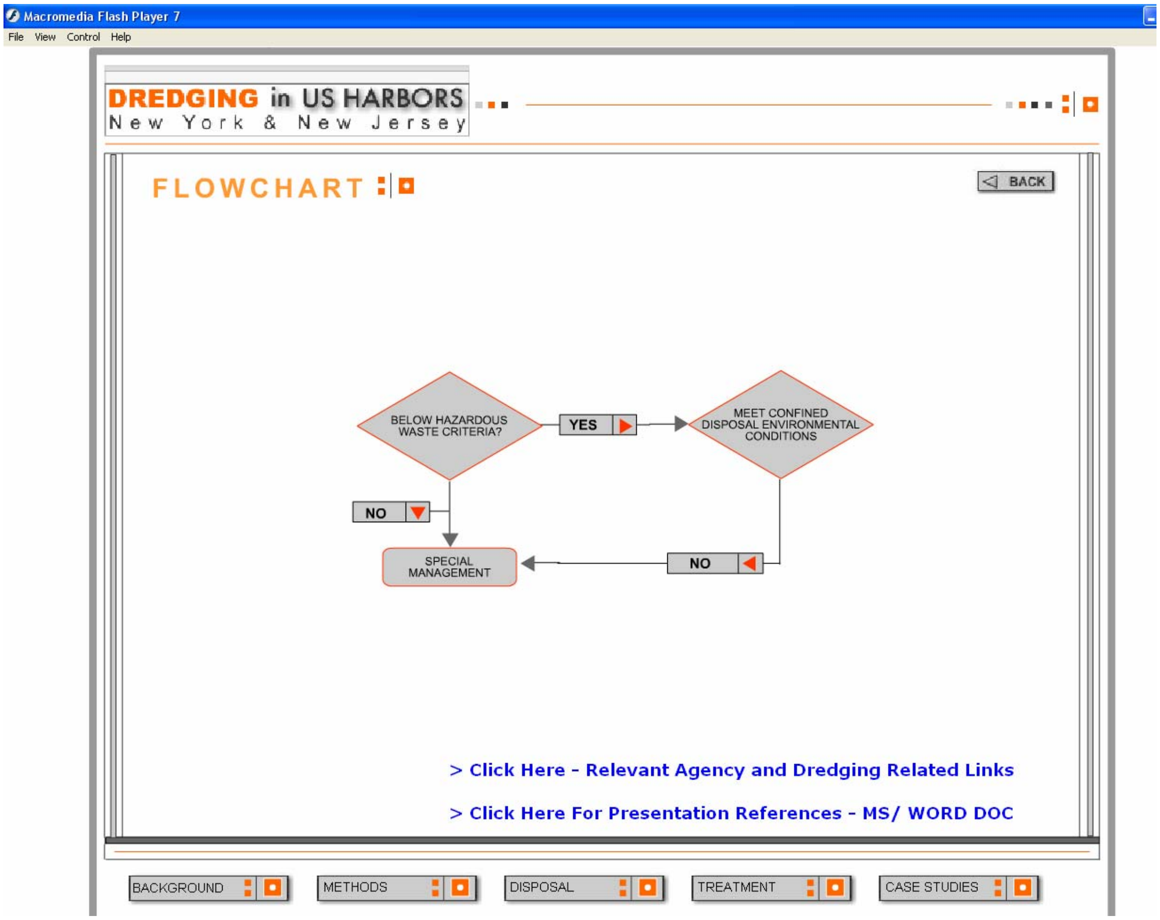
Second technology consists of processing of contaminated sediments by exposing the sediment and modifier mix to temperatures from 1200° to 1400°. As a result organic contaminants are destroyed and metals are locked in the matrix.
Starting September of 2003, a sediment melting plant located in Bayonne, New Jersey will start processing sediments at a rate of 1 ton/hour.

According to the pioneers of the two technologies, no limitations are associated with the level of contamination in the sediments that could be accepted and treated by each technology.

Once the performance of each technology is evaluated, decisions will be made on full-scale implementation of the technology with lager plants capable of processing contaminated sediments at higher rates.

For more details on the above technologies, please refer to the following study:

Jessica L.Wargo. 2002. New York/New Jersey Harbor:Alternative Methods for Ex-Situ Sediment Decontamination and Environmental Manufacturing. A report prepared for U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response Technology Innovation Office, Washington D.C. http://clu-in.org



Below Hazardous Waste Criteria

In accordance with EPA regulations, the following characteristics define whether or not a material is hazardous waste:

- IGNITABILITY
- CORROSIVITY
- REACTIVITY
- TOXICITY

NOTE: more information available on CD-ROM

Conclusions

In summary, there is a practical need to integrate policy makers, scientists, engineers, private industry and business in creating a Harbor that meets environmental, recreational, and commercial needs. Management of dredged material requires a well crafted approach which integrates practical aspects of sediment dredging with environmentally friendly beneficial uses and funding constraints.

Relevant Agency and Dredging Related Links:

NJ Department of Transportation	www.state.nj.us/transportation/maritime
NJ Department of Env. Protection	www.state.nj.us/dep/srp/about/odst.htm
US Army Corps of Engineers	
NY District	www.nan.usace.army.mil
HARS	www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/hars.htm
New England District	www.nae.usace.army.mil
Waterways Experiment	www.wes.army.mil/el/dots
US Environmental Protection Agency	
Region 2	www.usepa.gov/region02/water/dredge/
Office of Water	www.epa.gov/owow/oceans/ndt
NOAA	www.noaa.gov/ocean.html
Sediment Decontamination	
WRDA Decontamination	www.bnl.gov/wrdadcon
BioGenesis Enterprises	www.biogenesis.com
GTI/ENDESCO	www.gastechnology.org
GLNPO	www.epa.gov/glnpo/sediments
EPA SITE Program	www.epa.gov/ORD/SITE
Remedial Tech. Develop. Forum	www.rtdf.org
Port Authority of NY and NJ	www.panynj.gov
Delaware River Port Authority	www.drpa.org
SETAC	www.setac.org
Hudson-Delaware Chapter	www.hdcsetac.org
Dredging Companies	
Bean Stuyvesant	www.cfbean.com
Dredging International	www.dredging.com
Weeks Marine	www.weeksmarine.com
Great Lakes	www.gldd.com
Don Jon Marine	www.donjon.com
Jay Cashman	www.jaycashman.com
Interntnl Assoc. of Dredgers	www.dredgline.net
Dredgers Association	www.dredgingcontractors.org
Shipping Companies	
Maersk	www.maersk.com
Maher Terminals	www.maherterminals.com
Photos of Ships	http://members.tripod.com/shumsw

Non-governmental groups

Clean Ocean Action	www.cleanoceanaction.org
Sediment Management Work Group	www.smwg.org
Baykeeper	www.nynjbaykeeper.org
Hackensack Riverkeeper	www.hackensackriverkeeper.org
Passaic River Coalition	www.passaicriver.org
Hudson River Foundation	www.hudsonriver.org
General Electric	www.hudsonvoice.com
NJ Marine Sciences Consortium	www.njmsc.org

Research

Pollution Engineering	www.pollutionengineering.com
Worldwide Dredging	www.sandandgravel.com
General NY/NJ Port Info	www.cpiponline.org

Links to Dredging and Sediment Documents Online

National Dredging Team Guidance	www.epa.gov/owow/oceans/ndt/guidance.pdf
Beneficial Use Case Studies	www.wes.army.mil/el/dots/budm/index.html
Ocean Disposal Testing	www.wes.army.mil/el/dots/guidance.html
Inland Testing Manual	www.wes.army.mil/el/dots/guidance.html
Upland Testing Manual	www.wes.army.mil/el/dots/guidance.html
NY/NJ Harbor DMMP	www.nan.usace.army.mil/business/prjlinks/dmmp/index.html
Federal Dredging Regulations	www.spk.usace.army.mil/cespk-co/regulatory/regs
HARS SMMP	www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/pdf/sitemmp.pdf
NJ Sediment Assessment	www.nj.gov/dep/srp/regs/sediment
NJ Soil Cleanup Criteria	www.nj.gov/dep/srp/regs/scc/index.html
NJ Groundwater Manual	www.state.nj.us/dep/dwq/pdf/gwtechman.pdf

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http://www.cleanoceanaction.org/Reports/contaminated_seds/basicfacts/Cont_Sed_BasicFacts_food.htm

“Effects to Marine Life,”
http://www.cleanoceanaction.org/Reports/contaminated_seds/basicfacts/Cont_Sed_BasicFacts_effects.htm

“How Widespread is the Problem?”
http://www.cleanoceanaction.org/Reports/contaminated_seds/basicfacts/Cont_Sed_BasicFacts_widespread.htm

“Our Recommendations”
http://www.cleanoceanaction.org/Reports/contaminated_seds/basicfacts/Cont_Sed_recommendations.htm

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