Long Island Sound Studies
Feasibility Report

Public Review Draft

Dredged Material Containment

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US Army Corps of Engineers
New England Division

LONG ISLAND SOUND STUDIES

DREDGED MATERIAL CONTAINMENT FACILITIES

Feasibility Report

New England Division
U.S. Army Corps of Engineers
Waltham, MA

June 1985

TC 423.3.L66 1985

SUMMARY

PURPOSE AND SCOPE

The coastal resources and their accessibility have shaped the development patterns of the Long Island Sound (LIS) region and have contributed significantly to its economic well-being and recreational enjoyment. The ports and harbors and waterfront facilities which serve the shipping and boating industries have historically played a major role throughout the region's development. Currently, the extent and nature of today's shipping have evolved to the point where heavy reliance is placed on safe and unimpeded access to port facilities. In most cases, this level of service is contingent on dredging. The States of Connecticut and New York have taken the position that dredging must continue as needed if the ports and harbors are to retain their prominence in handling waterborne commerce and recreational boating traffic. However, this is not to imply that dredging and accompanying disposal is being permitted at any cost - either economically or environmentally.

Over the years, the dredging and disposal of dredged material have evolved into carefully planned and monitored procedures under the ever increasing watchfulness of Federal and State agencies and the public. Nevertheless, even after 100 years of management of this program in LIS, it remains a very controversial issue. In this period, dredging interests have seen disposal options narrow to a closely regulated situation today which has directed the majority of dredged material disposal to four open-water sites in Long Island Sound. Historical records from 1961 to 1979 indicate 70 percent of disposal was at open-water sites, with the remaining 30 percent at land disposal areas.

It was because of the continuing evaluation of disposal policy and the persistent controversy over both open water and land disposal that the LIS congressional interests requested the Corps to study the feasibility of dredged material containment facilities in the Sound. Accordingly, the Corps initiated the study in FY78 and during its course has:

1. Examined the past and future dredging and disposal needs in the region and estimated that 60 million cubic yards of dredged material from LIS harbors must be dealt with over the next 50 years.

2. Developed procedures and criteria for identifying and screening potential sites. Identified factors considered to be most important include:

   Site Bathymetry/available containment volume
   Shoreline ownership
   Significant wetlands and ecological areas
   Major public beaches
   Wave energy
   Land ownership compatibility/reuse potential.

3. Examined the coastal and offshore areas of LIS for potential containment facilities. This process alone identified and evaluated over 300 potential sites for containment facilities.

4. Addressed many potential environmental and socioeconomic impacts that are related to containment.

5. Performed detailed engineering, economic and environmental studies on selected prototype sites to test the feasibility of constructing a containment facility in the LIS environment.

6. Initiated a public involvement effort through a program of brochures, workshops, media appearances, public appearances and maximum availability and exposure to the public.

7. Examined policy issues related to containment.

POTENTIAL BENEFITS OF CONTAINMENT FACILITIES

Whereas the concept of containment facilities for dredged material disposal has been widely accepted in other parts of the United States and other parts of the world it has not seen widespread use in the LIS region. In other parts of the nation, especially at mid-and southern Atlantic ports and in the Great Lakes, containment facilities have been used for economical and environmentally acceptable disposal of dredged material. Facilities such as Craney Island in Norfolk Harbor, Virginia; Dickinson Island on Lake St. Claire and the Pt. Mouille facility in Michigan; and the Hart and Miller Island site in Maryland are a few of the many sites where joint federal and local interests have built successful containment facilities. Consequently, the LIS coastal community initially greeted the concept of dredged material containment with enthusiasm, viewing it as a potential supplement to open water disposal in specific situations where environmentally and/or economically advantageous and to gain productive use of material.

The disposal of dredged material in LIS, at both land or open water sites, remains environmentally controversial. NED is presently achieving a high level of success in minimizing environmental impacts from open-water disposal, but along with other agencies and environmental interests, continues to press for further evidence of the effectiveness of disposal operations as well as the potential long range impacts. As absolute answers are not available, these are topics of significant study by the Corps. Although containment is not able to offer assurances of no impact, under certain conditions it may provide a more acceptable means of disposal.

It is Corps policy to seek maximum practicable benefits through productive use of the materials dredged from the nation's ports and harbors, provided such use is in the public interest. Potential uses may include creation of wetlands, nourishment of beaches, erosion control and land reclamation.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF
Planning Division
Basin Management Branch

July 3, 1985

To Interested Parties:

Enclosed for your review are the draft feasibility report for the Long Island Sound Dredged Material Containment Study and accompanying public announcement.

Any comments that you may have pertaining to the report should be sent within thirty (30) days of the date of this letter to:

Division Engineer
New England Division
U. S. Army Corps of Engineers
Attn: NEDPL-BC
424 Trapelo Road
Waltham, MA 02254

Sincerely,

Joseph L. Ignazio
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

NEDPL-BC

July 3, 1985

PUBLIC ANNOUNCEMENT
COMPLETION OF STUDY OF
DREDGED MATERIAL CONTAINMENT
FOR LONG ISLAND SOUND

The Corps of Engineers has completed a study which examined the feasibility of constructing containment facilities for the disposal of dredged materials in Long Island Sound. The results of the study are presented in a draft feasibility report which is currently available for review by Federal, State and local interests.

The study was conducted in response to a Congressional Resolution adopted on 10 May 1977 by the House Committee on Public Works and Transportation. The study of containment facilities, considered to be a possible alternative disposal method, received widespread support from Long Island Sound environmental groups and marine transportation interests.

Over 300 potential containment sites in the New York and Connecticut waters of Long Island Sound were identified during the study. These sites were screened for technical, environmental and social criteria to indicate the most promising sites. Public participation played an important role in evaluating the sites and adapting plans to meet local conditions, desires and concerns. The study verified that the public and resource agencies feel very strongly toward protecting environmental resources that are present along the Long Island Sound coastline. In many cases, siting of a containment facility was rejected because of environmental resources -especially shellfish areas.

The plan formulation process, which included site identification, site screening, economic and environmental considerations and public review, identified five potential containment sites which were evaluated in more detail as prototype sites. The five sites were :

1. Clinton Harbor - Marsh creation site.

2. Black Ledge - Island Creation site for use as a regional disposal area.

3. Milford Harbor - Shoreline extension site for use by local harbor.

4. Penfield Reef - Shoreline extension site for use as a regional disposal area.

5. Sherwood "Hole" - Aqueous borrow pit.

The findings of the detailed studies indicated that filling at the Sherwood site and at the other aqueous borrow areas could be advantageous. However, at the other diked containment areas, the study concluded that under present conditions containment was not a feasible alternative.

Of the sites studied in detail, Clinton Harbor initially exhibited the highest degree of positive results. The project competed favorably economically, could provide environmental benefits, and generated public support. However, the project would conflict with Federal barrier beach legislation, local aquaculture plans, and the state designated natural area at Hammonassett State Park and is not being recommended.

While the general finding of this study indicates a lack of feasibility of containment on a Long Island Sound-wide basis and no visible role for the Federal government, it does conclude that local interests may determine that construction of containment facilities may be feasible on a case-by-case basis. Also, the data and reports generated by this study will provide useful guidance and information for future considerations.

For the interim, disposal of the bulk of dredged material in LIS will continue at four designated open water sites. These regional disposal areas are the Central Long Island Sound site off New Haven, The Cornfield Shoals site off the Connecticut River, the New London site off the Thames River, and the newly designated (1982) Western (WLIS III) site off South Norwalk. All four sites are being closely monitored by the New England Division, Corps of Engineers through its Disposal Area Monitoring System, commonly known as DAMOS. Monitoring of these carefully controlled open-water disposal areas as well as any land disposal activities have to date revealed insignificant or acceptable impacts. Because of this, there is general institutional and private support for their use.

Written communication related to this announcement should be mailed within 30 days of the date of this announcement to:

Division Engineer
ATTN: NEDPL-BC
New England Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

If you know of any other persons who may be interested in this subject, please give them the foregoing information.

Carl B. Sciple
Colonel, Corps of Engineers
Division Engineer

In specific cases, disposal of dredged material at containment facilities may offer economic advantages to the Federal Government and local interests when compared to disposal at one of the currently designated open-water sites. In LIS where the number of open water disposal areas has been reduced from 19 to 4 and the use of land disposal restricted, the costs associated with increased transportation distances has placed considerable economic pressure on private marina owners and small dredging companies. Faced with increased cost, these interests are not able to achieve the economies of scale available to the Federal Government and other large operations.

STUDY FINDINGS

The containment study identified over 300 potential containment sites in the New York and Connecticut waters of LIS. From this large number of sites, five were identified as being deserving of more detailed investigation and represent the basis of this report. The five sites include: Clinton Harbor, Black Ledge, Penfield Reef, Milford Harbor and Sherwood Hole. Many other sites exhibiting still higher rankings for technical feasibility were the subjects of intense local opposition for social or environmental reasons which eliminated them from further consideration.

CLINTON HARBOR

The Clinton Harbor containment proposal was formulated as a marsh creation site adjacent to the Clinton Harbor federal navigation channel and local boating facilities. The $2 million containment site could store up to one million cubic yards of dredged material and meet the local disposal needs for up to 25 years. Under these conditions dredged material could be pumped directly into the containment facility with a low-cost hydraulic dredging operation which makes this site economically competitive with other disposal options despite the costs to construct the containment dikes.

The proposed facility abuts Hammonasset State Park and the Cedar Island spit area which is a designated coastal barrier beach. As such this designation restricts federal participation and limits development activity in general. However, environmental benefits could be realized as the marsh is filled and planted with wetland vegetation, which would add to the existing Hammonasset wetland areas.

BLACK LEDGE

The Black Ledge site was formulated as a large offshore island which could accommodate the dredged material disposal needs for the eastern Connecticut coastal area, from Niantic Harbor eastward, for up to 50 years. With a capacity of 7.5 million cubic yards, the facility would require about 9200 feet of dike constructed in 5 to 35 feet of water at an estimated cost of $40 million. This cost level makes the facility economically infeasible.

It would be possible to create wetland areas as the facility is filled. However, the Black Ledge site is presently a productive habitat area supporting a diversity of species with dense concentration of blue mussels. The environmental impacts and unfavorable economics currently make this site infeasible.

PENFIELD REEF

The Penfield Reef containment facility was considered at two configurations at the site of an eroded peninsula off the town of Fairfield coast. The original was an $8 million facility holding about one million cubic yards of dredged material. As such the facility could accommodate the disposal needs for the Bridgeport area through hydraulic dredging operations with the help of booster pumps for distances beyond a mile. Alternatively, the outer portion of the peninsula could be widened to accommodate up to 4 million cubic yards for $8.6 million. This larger facility could serve regional disposal needs. Because of the first cost neither alternative is economically feasible.

The major drawbacks of a site here center around environmental concerns. The Penfield Reef area is considered an environmentally productive habitat area supporting a large, diverse population of species. While the containment facility would have habitat value of its own and could be sited to avoid the highest value existing habitat, the overall impact would be negative.

The town of Fairfield is interested in a containment facility at this location, not primarily as a disposal area, but as a structure which could provide protection from waves and beach erosion.

MILFORD HARBOR

The Milford Harbor containment proposal was sited at the mouth of Milford Harbor adjacent to the federal navigation channel. A one quarter million cubic yard facility could be constructed for about $2.6 million and could handle disposal needs for Milford Harbor for up to 50 years. Considerable savings could be realized from possible use of a hydraulic dredging operation but not enough to offset the costs of the containment facility. Other drawbacks include the close proximity of the town's Gulf Beach facility. Environmental sampling at nearby areas indicate that this area is not particularly productive and major environmental impacts would not be expected.

SHERWOOD HOLE

Sherwood Hole is representative of aqueous borrow pits that exist along the coast of LIS. Unlike the other containment sites examined by this study these areas already exist and would entail no construction costs. The isolated nature of these borrow pits has generally resulted in an anoxic environment which supports only reduced numbers and species of

life. If these areas were to be filled, the environment would more resemble that of the surrounding area. Future use as a disposal area is a worth-while consideration.

CONCLUSIONS

While there is controversy surrounding disposal of dredged material there is an overriding general acceptance of current disposal options-namely open water disposal at four designated sites and land disposal whenever possible. Findings of this study reveal that under present conditions containment does not offer a feasible alternative for the disposal of dredged material in Long Island Sound and, in general, containment does not compete favorably with other disposal options. However, such a finding does not rule out the need or desirability for others to continue consideration of containment on a case-by-case basis. This study has concluded that evaluation factors of economics, environment, and public support rule out widespread reliance on containment for the disposal of dredged material in LIS.

In retrospect, the findings of this study provide insight into long standing questions concerning the feasibility and applicability of dredged material containment studies in LIS. Directly it provides the response to the 1977 Congressional Resolution which authorized this study to determine the feasibility of containment. The study also responds to long standing, open ended questions raised by two earlier publications: namely the Interim Plan for Disposal of Dredged Material in LIS (NERBC, 1980) and the Programmatic EIS for Disposal of Dredged Material in the LIS Region (Corps of Engineers, 1982). Both documents gave approval to open water disposal and deferred questions regarding the feasibility of containment to completion of this study.

While the general finding of this study indicates a lack of feasibility of containment on an LIS-wide basis and no visible role for the federal government, as stated above, it does conclude that local interests may determine that it may be feasible on a case-by-case basis. This report and the following supplemental data reports generated by this study will provide useful guidance and information for future considerations.

Reconnaissance Report	(1979)
Site Screening Report -	Interim (July 1980)
Site Screening Report -	Addendum (January 1981)
Workshop Digest -	(1981)
Market User Survey -	(August 1981)
Social and Economic Impacts -	(September 1981)
Geology and Design Considerations -	(April 1982, October 1982, November 1982, April 1984 and August 1984)
Environmental Assessment -	October 1982
Island Shoal Screening -	February 1983

Progress Report	(February 1983)
Environmental Baseline Data for Clinton Harbor	(March 1982)
Environmental Baseline Data for Black Ledge	(March 1982)
Benthic Algae and Fauna of Clinton, CT.	(June 1982)
Ecological Surveys of Penfield Reef and Milford Harbor	(November 1982)
Wave Energy Analysis and Sediment Transport Study at Clinton Harbor	(February 1983)
Analysis and Site Evaluation at Black Ledge, Penfield Reef and Sherwood Borrow Pit	(May 1984)
Benthic Sampling from Mamaroneck Harbor	(July 1984)
U.S. Fish and Wildlife Planning Aid Letters	(1980, 1982, 1984, 1985)

Each of these reports either has been provided or is available for public use.

In addition to the above sources of data and analysis, the study process gave to the LIS coastal community the opportunity to discuss the pros and cons of containment facilities and an opportunity to choose an alternative to current disposal practices.

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ATTACHMENT

1	U.S. Fish and Wildlife Report (Review of Draft Feasibility Report)	

1

INTRODUCTION

INTRODUCTION

BACKGROUND

Long Island Sound has been used for the disposal of dredged material and other urban-industrial wastes for more than 100 years. The management of these disposal activities in the sound began in 1888 when the Port Supervisors Act prohibited disposal outside of designated areas. Since then, 20 open water sites as well as many more land sites have been used for dredged material disposal.

While dredging and disposal of dredged material in the sound continue to be closely scrutinized and in some cases curtailed completely, the need for such disposal has not diminished. Dredging is critical to the maintenance of the region's commercial and recreational harbors, particularly if they are to retain their prominence in handling waterborne commerce and an ever increasing recreational boating need. The disposal of dredged material is being managed to reflect a combination of environmental, social and economic factors.

CURRENT DISPOSAL PLAN

The issues surrounding the disposal of dredged material continue to receive considerable attention from navigation interests and federal, State and local governments. A plan has been implemented that established use of four open-water disposal areas to handle the bulk of dredged material. These regional dredged material disposal areas are the Central Long Island Sound site off New Haven, the Cornfield Shoals site off the Connecticut River, the New London site off the Thames River and the Western Long Island Sound (WLIS) III site off South Norwalk. All four sites are being closely monitored by the New England Division of the Corps of Engineers (NED) through its Disposal Area Monitoring System commonly known as DAMOS. Monitoring of these carefully controlled open-water disposal areas as well as any land disposal activities have to date revealed insignificant or acceptable impacts. Because of this, there is general institutional and private support for their use.

Environmental Concerns. The process of developing projects and assessing their merits is being continuously evaluated for environmental reasons. The Corps follows procedures that are in line with Federal and State regulations which call for consideration of alternatives. Therefore, a full array of alternatives is considered and analyzed for each project so as to minimize and avoid environmental impacts while giving consideration to economic and technical feasibility. Each alternative brings with it advantages and disadvantages.

Economic Considerations. In the past, as a general practice and for economic reasons, approved disposal sites were not far removed from harbors to be dredged. However, when open-water sites were reduced from 19 to three (and then increased to four) sites and as land disposal sites became filled or unavailable, many dredgers began to feel the impacts of

increased cost. With the regional sites concept, the distance from some harbors to disposal areas increased significantly. In the case of larger operations some of these increased costs can be absorbed or reduced through economies of scale, but such opportunities are not available for the smaller dredgers.

Alternatives. Available alternatives for meeting future disposal needs while responding to present issues and problems include:

- Open-Water Disposal - Continued use of existing or new open-water sites but subject to carefully controlled and monitored operations.

- Land Disposal - Although available on a limited project specific basis, stringent water pollution regulations, coastal wetlands restrictions and shore front development continue to curtail this option as an available alternative.

- Containment Facilities - Used successfully in other regions of the United States but not in Long Island Sound.

- Beach Nourishment - Feasible on a project specific basis particularly if a nearby beach is available and the dredged material is compatible.

In as much as disposal methods are determined on a project specific basis the approach of selecting the least cost alternative which results in the least environmental harm generally favors open water disposal.

PURPOSE AND SCOPE

This study considered the feasibility of locating containment facilities for dredged material disposal in Long Island Sound. The study area covered the entire Long Island Sound region in Connecticut and New York. Containment, as considered in this report, generally involves disposal of dredged material in a diked area as conceptually shown in Figure 1. The study objective was to determine containment feasibility by identifying potential sites; develop screening criteria; discuss the future dredging and disposal needs, obtain public participation and reaction to the concept of containment; identify the issues associated with containment; develop detailed engineering, environmental and economic analysis of selected potential containment facilities; and explore the potential of constructing one or more of these facilities as a "prototype site".

STUDY AUTHORITY

The authority to conduct this study is contained in a resolution of the Committee on Public Works and Transportation, U.S. House of Representatives adopted 10 May 1977 which reads as follows:

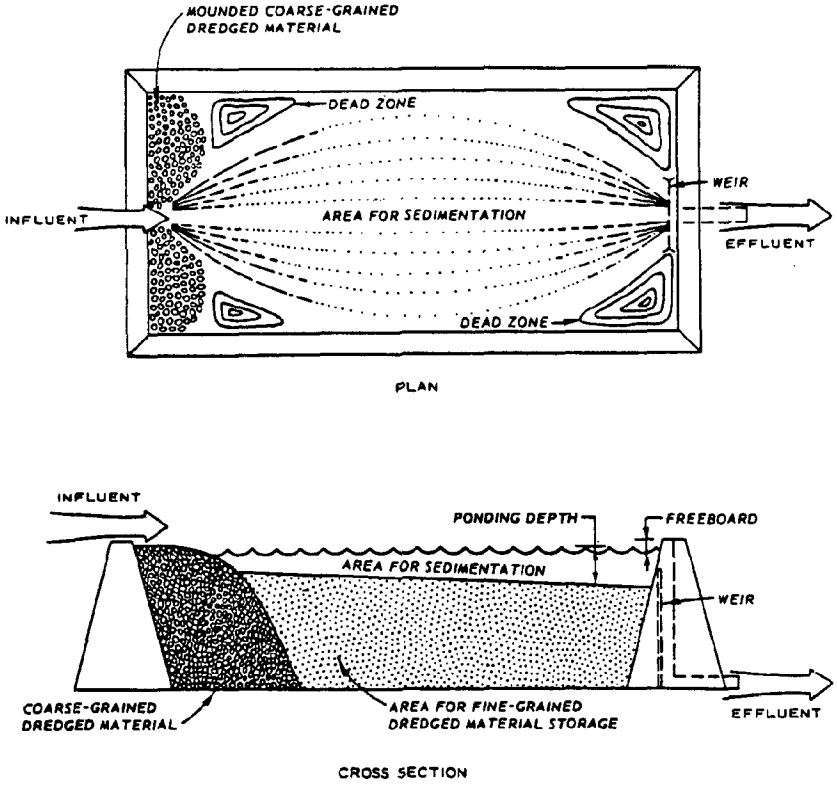

FIGURE 1 CONCEPTUAL DIAGRAM OF A DREDGED MATERIAL CONTAINMENT AREA

> Resolved by the Committee on Public Works and Transportation of the House of Representative, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on the Land and Water Resources of the New England-New York Region, published as Senate Document Numbered 14, Eighty-fifth Congress, First Session, and other pertinent reports, with a view to determining the feasibility and impacts of the treatment and use of the dredged materials to result from the continued maintenance and anticipated improvements of Long Island Sound harbors, as well as from any newly created Federal harbors, to build artificial islands in Long Island Sound for recreation, conservation, marsh building, development, and other purposes. The study should also consider the utilization of dredged materials from projects other than Federal (i.e., State, community, and private), and the feasibility and acceptability of utilizing solid wastes other than dredged materials for island building.

Since no waste disposal activities other than for dredged material are permitted in the sound, the study did not consider disposal of solid wastes.

STUDY AREA

Long Island Sound is one of the nation's unique and irreplaceable natural resources. The study limits include the area within Long Island Sound and Fishers Island Sound extending from Throgs Neck Bridge in New York eastward to the Connecticut-Rhode Island State line. Its 1300-square mile water surface area is an almost fully enclosed arm of the ocean bordered by nearly 600 miles of coastline (see Figure 2). The sound is 113 miles long and 21 miles wide and contains about 125 islands. About seventy-five rivers and streams of various length including the Connecticut, Housatonic and Thames Rivers, drain a 16,000-square mile area surrounding Long Island Sound. Long Island Sound exhibits estuarine characteristics in its western and central parts and embayment characteristics in its eastern third. Depths vary greatly throughout the sound, averaging 80 feet with a maximum depth of 320 feet. Due to the effects of tides and freshwater inflow conditions, movement of water within a major estuary such as Long Island Sound is complex.

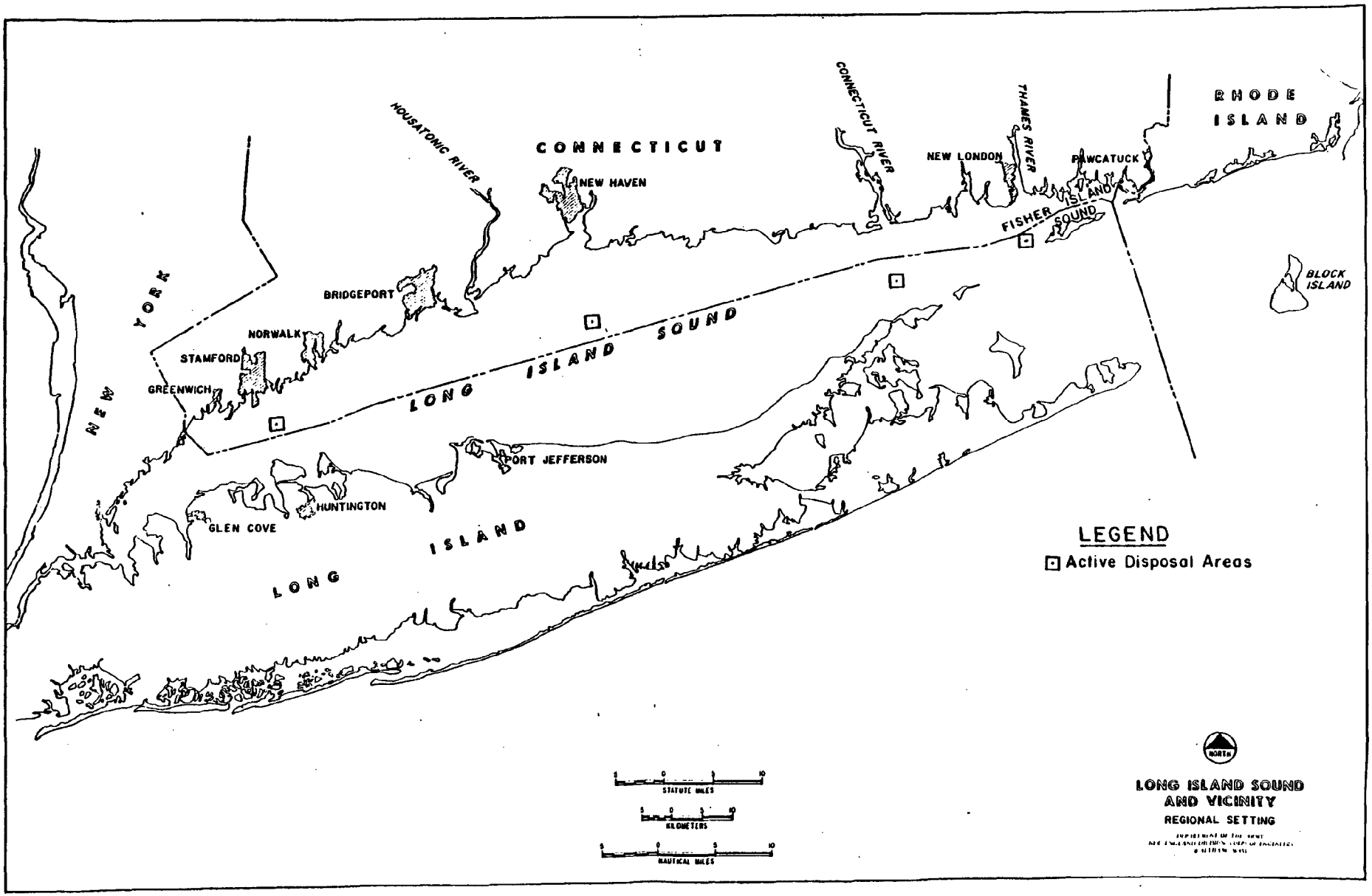
CONNECTICUT
HOUSATONIC RIVER
CONNECTICUT RIVER
THAMES RIVER
RHODE ISLAND
NEW LONDON
PAWCATUCK
NEW HAVEN
FISHER ISLAND SOUND
BLOCK ISLAND
NEW YORK
BRIDGEPORT
NORWALK
STAMFORD
GREENWICH
LONG ISLAND SOUND
PORT JEFFERSON
HUNTINGTON
GLEN COVE
LONG ISLAND
LEGEND
Active Disposal Areas
STATUTE MILES
KILOMETERS
NAUTICAL MILES
NORTH
LONG ISLAND SOUND AND VICINITY
REGIONAL SETTING

FIGURE 2

II

RELATED REPORTS AND PROGRAMS

RELATED REPORTS AND PROGRAMS

This study is related to other LIS studies concerning dredged material management. Recently completed study efforts are described as Prior Reports. There is also a section on Related Programs which describes monitoring and research programs for dredged material management. Similarly, this report is the culmination of a comprehensive study effort for which many supplemental data reports have been prepared. A synopsis of these reports is included here.

PRIOR REPORTS

Programmatic Environmental Impact Statement (June 1982)

The Programmatic Environmental Impact Statement (PEIS) by NED for the disposal of dredged material in the Long Island Sound Region assesses several potential open water disposal sites throughout the region and generically discusses other disposal alternatives; specifically, upland, containment, beach restoration, incineration and resource reclamation. This document provides an informational basis upon which supplemental statements or assessments can be developed for individual projects.

The following appendices were prepared as part of the PEIS document:

Appendix A - Environmental Report for Open-Water Disposal

Appendix B - Long-Term Impacts of Open-Water Disposal

Appendix C - Economic Analysis of Future Dredged Material Disposal

Appendix D - Federal Institutional Requirements

Appendix E - Public Participation.

The Environmental Impact Statement for the Designation of a Disposal Site for Dredged Material in Western Long Island Sound - WLIS III (Feb 1982)

The EIS for WLIS III is tiered to the PEIS. It specifically addresses the need and the impacts of using the proposed site drawing upon information from the PEIS as well as more specific data generated via the Corps' Dredged Material Research Program (DMRP) and the Disposal Area Monitoring System (DAMOS). The final EIS was published in February 1982 and use of the site began in March 1982.

Interim Plan for the Disposal of Dredged Material from Long Island Sound (August 1980)

The Interim Plan is the culmination of discussion and negotiation among New York, Connecticut, Federal and interstate agencies responsible for regulating dredging and disposal in Long Island Sound. The New England River Basins Commission served as a forum. The result was a concensus to continue open water disposal at three designated areas on an interim basis until a thorough evaluation of alternative courses of action (such as upland disposal, island building and marsh creation) would be completed and a long-term management plan formulated. Currently, disposal continues in a carefully controlled and monitored manner at disposal areas near New London, Cornfield Shoals, New Haven, and more recently at the Western LIS III site.

New Haven Harbor Coastal Development for Navigation (1981)

The New England Division prepared this feasibility report for improving New Haven Harbor which is the largest port in Connecticut, and also the largest source of dredged material with some 12 million cubic yards of Federal dredging projected for the 1985 to 2035 time frame. The report recommends removal of an estimated 4.4 million cubic yards of dredged material to improve the harbor.

Bucket dredges are proposed for dredging. All material would be transferred into dump scows and transported to two open-water sites. Disposal operations would take place in the harbor about 1 mile east of the ship channel at Morris Cove by filling a manmade hole, left by earlier mining operations, with about 900,000 cubic yards of suitable materials including 27,200 cubic yards of rock. The remaining volume, some 3.5 million cubic yards, would be deposited at the Central Long Island Sound Disposal site located about 6 nautical miles south of the entrance to New Haven Harbor. The Morris Cove site, one of the containment sites being evaluated by this study, was also studied under the DAMOS program but was found unsuitable for disposal of fine material because of strong currents and circulation patterns.

DREDGED MATERIAL CONTAINMENT STUDY SUPPLEMENTAL DATA REPORTS

Reconnaissance Report (January 1979)

This initial effort outlined the purpose and scope of the study and provided preliminary information on dredged material volume and previous and existing disposal locations. Plan formulation efforts centered around locating and evaluating large volume regional sites. The Reconnaissance Report compared rock dikes with sheet pile structures and concluded that rock dikes were less expensive and more appropriate for most containment facilities in LIS except where space was at a premium.

Dredged Material Containment in Long Island Sound - Site Screening (Interim) Report (July 1980)

This status report presents an overview of the feasibility of containing dredged material along Long Island Sound and addresses several major points including:

1. Evaluated historical dredging quantities.
2. Projected future dredging requirements for a 50-year period 1985 to 2035.
3. Identified engineering and design considerations.
4. Developed the methodology for site identification and screening.
5. Applied the methodology to Long Island Sound, resulting in the identification of 133 potential containment sites which in all cases were located adjacent to publicly owned shoreline.
6. Of the 133 identified sites, 24 sites were ranked as the highest based on screening criteria.

Dredged Material Containment in Long Island Sound - Site Screening (Addendum) Report (January 1981)

The interim report described above, located and evaluated 133 public shorefront sites. This Addendum expanded the screening process to include 121 other sites located adjacent to private or other public shorefront. This effort used a screening process similar to the previous report but went further by performing sensitivity analyses of screening and weighting factors. Of the 121 sites so identified, about 50 were ranked superior to the rest.

18-21 May 1981 Workshop Digest (1981)

The Workshop Digest documented for those attendees and other interested individuals, a summary of the topics discussed as well as the issues and questions raised at the four workshops held in May 1981. The digest includes an outline and explanation of the workshop format, the purpose of these meetings, a summary of each session, and the issues, concerns, and questions of the participants. The public information program is explained. Samples of all the press releases, announcements and articles publicizing the workshops are also exhibited followed by samples of the media coverage generated by the workshops. Written communication received from State officials, local leaders and concerned citizens, together with a list of workshop attendees, are included.

Market User Survey (August 1981)

This report summarizes the navigation activities at the 50 ports and harbors located on or adjacent to Long Island Sound. Projections of port

activities included in this market user survey are based on recent trends, planned port development, and anticipated changes in shoreline activities, including possible conversion of electrical generating plants from oil to coal. Survey findings conclude that harbors can expect continued high demand from commercial shippers and recreational boaters for continued dredging, along with continued concern over the availability and costs of disposal options.

Social and Economic Impacts of Prototype Dredged Material Containment Facilities in Long Island Sound (September 1981)

This study analyzed social and economic impacts associated with the construction of dredged material containment facilities at six potential locations along the Connecticut shoreline; namely Fayerweather Island in Black Rock Harbor, Yellow Mill Channel in Bridgeport Harbor, Morris Cove in New Haven Harbor, Clinton Harbor, Twotree Island off Waterford, and Black Ledge at the mouth of New London Harbor. The study examines the short-term impacts during construction of dikes, filling with dredged material, dewatering, final capping, contouring and planting; as well as long-term impacts involving final use.

Dredged Material Containment Study - Prototype Report - Clinton Harbor and Black Ledge (April 1982)

This New England Division report documents regional geology of the LIS Region and site geology at two prototype containment facilities: Clinton Harbor and Black Ledge. The report also discusses design considerations and develops construction cost estimates for the facilities. Site conditions were studied employing field reconnaissance, subsurface explorations and survey.

Environmental Assessment of Prototype Marsh Creation and Containment Facility Sites (October 1982)

This report describes the existing physical and biological conditions at two prototype sites: Clinton Harbor and Black Ledge. Study findings are based on literature review, coordination with resource agencies, and limited on-site biological surveys. This information provided the basis for determining the most effective configuration of the facility, the potential for habitat creation versus commercial/industrial development, and the potential impact upon the adjacent environment. The report also addresses the resource value of the new habitat.

Dredged Material Containment Study - Site Screening Report (November 1982)

This report is similar to the geology and design report discussed above but deals with five other potential containment facilities. These are Milford Harbor, Yellow Mill Channel, Thames River, Penfield Reef and Mamaroneck Harbor. Site conditions are less detailed as no detailed field investigations were obtained.

Island Shoal Screening (February 1983)

This report reflects a preliminary screening effort to assess the feasibility of nine Connecticut off-shore coastal areas for use as containment facility sites.

Dredged Material Containment Feasibility Study Progress Report (February 1983)

This document reports on study progress and represents a reference source which presents in detail all aspects of the study including background, problems and needs, plan formulation process, public coordination effort and detailed site reports.

Dredged Material Containment Study-Penfield Shoal Site, CT. (April 1984)

This study represents a detailed geotechnical and engineering evaluation for the Penfield Reef site in Fairfield, Connecticut. The detail is similar to the analyses completed for Clinton and Black Ledge in the Prototype Report.

Dredged Material Containment Study-Milford Harbor Site, CT. (August 1984)

This report presents a detailed geologic and engineering evaluation for the Milford Harbor site in comparable detail to the Clinton, Black Ledge and Penfield sites.

ENVIRONMENTAL DATA AND SITE EVALUATIONS

Environmental Data for Clinton Harbor (March 1982)

This site specific report presents the following subjects:

1. Tidal Hydrodynamic Simulation
2. Sediment Profile Photogrammetry
3. Biotic Survey
4. Marsh Creation Feasibility and Design.

Environmental Data for Black Ledge (March 1982)

This study provides data on existing biotic communities at Black Ledge and compared the potential habitat of a containment facility with the present habitat.

Benthic Algae and Fauna of Clinton, CT (June 1982)

This document presents the results of a biological survey of soft and hard bottom benthic communities at Clinton.

Ecological Surveys of Penfield Reef and Milford Harbor (November 1982)

This report summarizes the results of biological surveys at Penfield Reef and the Burns Point Jetty site at Milford Harbor.

Wave Energy Analysis and Sediment Transport Study at Clinton Harbor (February 1983)

This report presents probable sediment transport effects, wave energy conditions and possible changes associated with the placement of a containment facility in Clinton Harbor.

Analysis and Site Evaluation at Black Ledge, Penfield Reef and Sherwood Borrow Pit (May 1984)

This report includes:

1. A discussion of wave modeling methodology and the wave climate for Long Island Sound.

2. A description of the physical and biological environment at Black Ledge and the impacts of a containment facility on waves, and physical, chemical and biological characteristics.

3. A description of the existing marine biological resources at Penfield Reef and Sherwood Borrow Pit and the potential impacts of a containment facility.

Results of Benthic Sampling from the Mamaroneck Harbor, NY (July 1984)

This is a report on a benthic survey conducted at three sites in outer Mamaroneck Harbor: Hen Island, Black Tom and Scotch Cape.

RELATED CORPS OF ENGINEERS' PROGRAMS

Disposal Area Monitoring System (DAMOS)

The Corps of Engineers (NED), as part of its mission of regulating open water disposal, initiated DAMOS which is a program of scientific inquiry into environmental effects of that activity. DAMOS addresses siting considerations, the relation of site recovery processes to biological succession, how much disturbance to permit at any one time, quantification of effects, and capping of contaminated material. There

are 10 major sites monitored in New England, in two tidal systems, and in ocean depths ranging from 60 to in excess of 200 feet and reaching distances of up to more than 10 miles offshore.

The DAMOS program uses oceangraphic surveys including state of the art navigation and electronic instrumentation, underwater photography, diver observations and biological analysis. The findings of the program provide guidance for disposal and site management policies.

Dredged Material Research Program (DMRP)

Congress recognized a need for a comprehensive nationwide research program on the effects of dredged material disposal; accordingly, it authorized the Corps of Engineers to accomplish the Dredged Material Research Program (DMRP) between 1973 and 1978. In contrast to previous, largely site-specific, project investigations, these studies were generic in nature with the intent of developing methods of predicting effects before a project is carried out. Results of conceptual and laboratory studies were tested in the field under actual project conditions so as to improve predictive capability.

Specific goals of the DMRP were to define the water quality and biological effects of open-water, upland, and wetland disposal; improve the effectiveness and acceptance of confined land disposal where it is considered a desirable alternative; test and evaluate concepts of wetland and upland habitat development using dredged material; and develop and test concepts of using dredged material as a productive natural resource.

A significant conclusion drawn from the DMRP is that no single disposal alternative (e.g., open-water disposal, confined upland disposal) is presumptively suitable for a geographic region or group of projects. What may be desirable for one project may be completely undesirable for another. Consequently, each project must be evaluated on a case-by-case basis. Additionally, each project evaluation must be made in full consideration of long-term as well as short-term disposal needs and possible interactions among projects.

Regarding the effects of open-water disposal, studies conclude that, unless the dredged material is highly contaminated, physical impacts are likely to be of greater potential consequence than their chemical or biological impacts. Serious short-term water quality effects are not likely unless the disposal site is geochemically dissimilar to the dredging site. Biological effects of an adverse nature are similarly unlikely due to the resiliency of most organisms (except in larval stages) and the demonstrated ability of many organisms to rapidly recolonize disposal sites. Over a longer term, certain aquatic organisms will uptake chemical contaminants; however, the patterns of uptake still remain unpredictable. Except in coral areas and during times of fish migrations

and spawning activities, turbidity is much more likely to be only an aesthetic problem rather than a biological problem. Irrespective of this, certain turbidity control measures are feasible under certain circumstances as indicated by field tests.

Confining dredged material on land can offer increased environmental protection, but is not without problems and is not always beneficial. Soil geochemical conditions in diked containment areas sometimes can enhance rather than retard contaminant release; thus effluents and leachates must be carefully evaluated as to their potential effects. As a result of DMRP research results where confined sites are desirable, they can be improved greatly over present practice in terms of design, construction, operation, and management. Particular areas of improvement include effluent regulation, storage capacity, dike design, and internal environmental conditions and aesthetics.

Several major DMRP field test and demonstration projects have proven the viability of using dredged material to develop both wetland and upland wildlife habitats in a variety of environmental situations. As a result of specific studies, guidance is now available as to what species to plant for a desired habitat, how and when to plant them, how to place and protect the dredged material, and what subsequent site management may be necessary. Additional information was generated on the relative productivity of various marsh plant species (data important in determining relative wetland-area values), the recovery of species buried by disposal, factors involved in ecological succession, and methods of predicting the possible uptake of chemical contaminants by marsh plants.

FIELD VERIFICATION PROGRAM (FVP)

The joint Corps and EPA Field Verification Program (FVP) is a cooperative effort to field verify dredged material testing procedures for predicting the impact of open-water disposal, upland disposal and wetland creation.

In the spring of 1983, approximately 77,000 cubic yards of dredged material from Black Rock Harbor were placed in the northeast corner of the Central Long Island Sound disposal area. A joint Corps/EPA monitoring effort was conducted at the site prior to, during, and after disposal. Scientists at the EPA lab in Narragansett, RI, are currently conducting experiments to validate on-site evaluation. Also, a test site has been leased on United Illuminating (UI) property in Bridgeport for evaluation of the upland and wetland portions of the FVP. In the fall of 1983 approximately 6,500 cubic yards of material dredged from Black Rock Harbor were used at the UI site to construct 1.1 acres of upland and wetland to enable the effects of dredged material to be studied in these different settings. This study is expected to be completed by the end of 1987.

III

THE ROLE

OF THE PUBLIC

THE ROLE OF THE PUBLIC DURING THE STUDY

PUBLIC INVOLVEMENT PROGRAM

Objective

Having had experience in dredging through its navigation and regulatory programs, the Corps was well aware of the high level and intensity of public interest regarding dredging and disposal. Cognizant of this interest, the Corps developed a comprehensive program to effectively merge public interest into the study. The program was outlined to accomplish the following:

1. Educate the public on the technology of containment.

2. Inform the public on study status and findings.

3. Seek out feedback on various concepts and proposals.

4. Encourage active participation of all interests.

Some of the public involvement tools are described below.

Brochures

Spring 1981 Information. The public involvement program essentially began with the dissemination of a public information brochure to approximately 2,500 State and local officials, newspapers, radio and television stations, commercial and industrial interests, public interest groups and individuals. The brochure entitled, "Long Island Sound Dredging and Disposal: The Search for a Solution" was designed to increase the public's awareness and understanding of the containment concept, one of several dredged material disposal alternatives. The nature of the study, the issues and problems associated with containment, the unique Long Island Sound ecosystem, the characteristics of dredged material, the site selection criteria and the planning process were also explained in the brochure. The brochure is reprinted in the Progress Report.

October '81 Update. This public information update, distributed to approximately 2000 people and groups, was intended to serve as a follow-up to the brochure and the workshop meetings held in May. This update included a brief summary of the work items recently completed or underway, various analysis and screenings being conducted, and the reports which were completed or being written.

Autumn '82 Update. The Update was similar to the '81 Update reporting briefly on the reports and activities which had been completed in the interim.

Workshops

A series of four extensively publicized workshops were held 18-21 May 1981 to supplement and expand upon the information supplied in the brochure. All four meetings; (held in New London, CT; New Haven, CT; Stamford, CT; and Great Neck, NY) were well attended with approximately 60 people at each, representing a wide range of interests and knowledge. The Long Island Sound Taskforce, which is the regional chapter of the Oceanic Society, served as moderator at each of the workshops. The workshops served as an excellent medium to transfer information to the public concerning the study. Likewise, the sessions provided a chance to hear the following primary concerns of the public regarding containment

1. The potential for release of toxic and other polluting substances into the marine environment

2. The ecological impact centering on the effects of construction

3. The costs of containment versus other disposal options including the responsibilities of cost sharing

4. The process of site consideration and selection including the availability of baseline data and involvement of the public

The exchange of information and discussion of issues provided a valuable study input. The Taskforce prepared a Workshop Digest, which is a summary of the proceedings and open discussion sessions.

Local Meetings and Media Releases

The high level of interest in this study, and in dredging and disposal in Long Island Sound, was evidenced by the number of requests for information from the media and local interests. Therefore, Corps personnel responded with many public appearances and presentations at meeting of local officials, civic and resource groups, and planning boards. Information was similarly made available to media through releases and interviews.

Progess Report - February 1983

This progress report takes a comprehensive look at the study as of that time frame. Its purpose was two fold:

1. To inform the public of study status.

2. To disseminate the available information and technical analysis generated by the study to enable the public to participate in further planning activities. It remains a valuable reference source because of its detail and completeness.

AGENCY COORDINATION

We have coordinated our planning efforts with all pertinent local, regional, county and State agencies. Representatives of many of the various agencies attended the May 1981 workshop meetings. In addition to telephone contacts and letters, communications have been maintained through the Public Information Brochure and updates. Coordination with the State of Connecticut has been through their Department of Enviromental Protection and Department of Transportation. Regional planning agencies which have been kept informed of our activities are: Southeastern Connecticut, Connecticut River Estuary, Greater Bridgeport and Southwestern. Cooperation of local waterfront and harbor groups would be extremely important in implementing a containment project.

In the State of New York, coordination has been through the Department of Environmental Conservation. Also in New York we have contacted the Nassau County Department of Public Works (DPW), the Suffolk County DPW, and the New York City Ports and Terminals. We have also met with the Long Island Regional Planning Board to discuss the containment study and its applicability to Long Island.

PARTICIPATION IN PLAN FORMULATION

The public involvement in the plan formulation process included the identification of potential containment sites as well as review of the sites identified in the site screening process. This was valuable input since local interests had a good understanding of their harbors in terms of dredging and disposal operations and potential interest in containment facilities. This containment study was the catalyst to start community action and the potential avenue to move a project forward. The sites that were advanced to the detailed study phase were initially suggested or endorsed by the public.

THE OCEANIC SOCIETY

EDUCATION • RESEARCH • CONSERVATION

EXECUTIVE OFFICES
Magee Avenue
Stamford, Ct. 06902
(203) 327-9786

Dear Coastal Citizen:

You are invit-
examining the
areas alo-
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in a feasibility study
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for use as dredged
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on.

WORKSHOP MEETING DATES AND LOCATIONS

ALL MEETINGS AT 7:30 P.M.

New London, Conn.--May 18, 1981
Room 113
New London Hall
Connecticut College

New Haven, C

Stamford

Great Neck, New

Bowdi...
U S Maritime ...

US Army Corps of Engineers
New England Division

LONG ISLAND SOUND
DREDGING AND DISPOSAL
THE SEARCH FOR A SOLUTION

DREDGED MATERIAL CONTAINMENT

For more information contact:

Richard Quinn, Project Manager
Corps of Engineers
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Waltham, MA 02254
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US Army Corps of Engineers
New England Division

LONG ISLAND SOUND
OCTOBER 1981

DREDGED MATERIAL CONTAINMENT

PUBLIC INFORMATION UPDATE

IV

DREDGING ACTIVITY

HISTORICAL AND PROJECTED

NEEDS AND OPPORTUNITIES
HISTORICAL AND PROJECTED DREDGING ACTIVITY

Planning for the location and sizing of potential dredged material containment facilities required developing projections of dredging activities in the LIS region. As part of this process, historical data and information were listed and analyzed.

HISTORICAL DREDGING

Dredging activity, which is evident throughout the LIS region, can be categorized into two classes.

1. Improvement and maintenance dredging done by the Corps of Engineers. There are 45 Federal projects in the LIS area, 19 in New York and 26 in Connecticut. These are listed in Table 1.

2. Dredging done by other government agencies and the general public under Federal permits issued by the Corps. Most, but not all, of these areas are concentrated near Federal projects.

The incidence of improvement dredging, both Federal and non-Federal, has varied considerably in the past, but in general, it is declining. This can be attributed to several reasons including a slowdown in new waterfront development and activity due, in part, to existing extensive development, consolidation of port facilities, increased costs and issues concerning economic, environmental and social problems.

Maintenance dredging, though variable, has been much more consistent. Dredging is necessary to remove the sediment and silt that gradually accumulate in existing navigation channels. The sediments are derived from both marine and upland sources and the rates remain relatively constant over time. While the need for such dredging is based upon surveys and consideration of navigation difficulties, execution of individual projects depends on funding and regulatory approvals.

Examination of dredging records gives some indication of dredging quantities and where disposal was accomplished in the past. Generally, for Federal projects, over 80 percent of the dredged material has been disposed of in open water. Private permitted dredging was about equally divided between land and open-water disposal. Data for these assessments are given in Table 2, which presents data through 1979. In the past 5 years the trend has been away from land disposal. Two other observations have been made regarding historical trends. First, costs for upland disposal have averaged 30 to 50 percent of the costs for open water disposal. Second, the costs of open water disposal have more than doubled since the mid-1960's. These two trends provide the basis for understanding the concerns of small private dredgers over the cost of disposal since the closing of local dumping grounds and the increasing unavailability of land disposal sites.

Table 1

FEDERAL PROJECTS ON LONG ISLAND SOUND

NEW YORK

Westchester County

1. Port Chester Harbor
2. Milton Harbor
3. Mamaroneck Harbor
4. Echo Harbor
5. New Rochelle Harbor

Nassau County

6. Hempstead Harbor
7. Glen Cove Harbor

Suffolk County

8. Huntington Harbor
9. Northport Harbor
10. Port Jefferson Harbor
11. Mattituck Harbor
12. Greenport Harbor

New York City

13. Eastchester Creek
14. Little Neck Bay
15. Westchester Creek
16. Bronx River
17. Flushing Bay and Creek
18. Harlem River
19. East River

CONNECTICUT

Western Coastal Area

1. Greenwich Harbor
2. Mianus River
3. Stamford Harbor
4. Westcott Cove
5. Fivemile River Harbor
6. Wilson Point Harbor
7. Norwalk Harbor
8. Westport Harbor and Saugatuck River
9. Southport Harbor
10. Bridgeport Harbor
11. Housatonic River

Central Coastal Area

12. Milford Harbor
13. New Haven Harbor
14. Branford Harbor
15. Stony Creek
16. Guilford Harbor
17. Clinton Harbor
18. Duck Island Harbor
19. Patchogue River
20. Connecticut River below Hartford

Eastern Coastal Area

21. Niantic Bay and Harbor
22. New London Harbor
23. Thames River
24. Mystic River
25. Stonington Harbor
26. Pawcatuck River

Table 2
Disposal Methods in Long Island Sound
(1961 to 1979 unless noted)
Volumes in thousands of cubic yards)

Area	Total Volume	Land Volume	Disposal Percent	Open Water Volume	Disposal Percent
FEDERAL OPERATION AND MAINTENANCE [1/]					
CT	5,535	1,026	29	3,909	71
NY	650	50	8	600	92
FEDERAL IMPROVEMENT [1/]					
CT	2,872	814	28	2,058	72
NY	4,503	41	1	4,462	99
TOTAL FEDERAL PROJECTS [1/]					
CT Totals	8,408	2,440	29	5,968	71
NY Totals	5,153	91	2	5,062	98
Totals	13,561	2,531	19	11,030	81
PERMITTED DREDGING					
NY [2/] 1959-1979	11,015	6,079	55	4,936	45
1968-1977	1,951				
CT [3/] 1968-1977	4,018 [4/]	2,259	56	1,759	44

Notes:
1/ Source: Progress Report, Table III-I, FEDERAL refers to Corps of Engineers.
2/ Source: Interim Report, Table 2-8 and 2-10
3/ Source: Reconnaissance Report, Table 2-9
4/ Excludes 1974 New London Improvement Project by U.S. Navy (2,880,000cy)

PROJECTIONS OF DREDGED MATERIAL QUANTITY

Future dredging requirements at Long Island Sound ports depend largely on the level of future port activity. Changing conditions in type and level of activity determine the need for channel improvements, as well as for Federal maintenance dredging by the Corps of Engineers. A large amount of dredging by non-Federal sources is also common at dockside and between the dock and Federal Channel, at private marinas and yacht clubs, and beyond the limits of Federal channels and anchorages. Projections of future quantities to be dredged from these harbors are expressed in ranges corresponding to the Minimum Growth/Minimum Change, the Most Probable Future, and the Maximum Growth/Maximum Change Scenarios. Total quantities at Federal projects are calculated and based on historical dredging trends

of individual ports and anticipated future trends. Projected non-Corps dredging is more difficult, if not impossible, to establish on a port-by-port basis and projections are made on a regional basis.

Minimum Growth/Minimum Change Scenario. For Federal maintenance work, minimum growth assumes that funding would be limited over the 50-year period and that most ports would be dredged only when navigation in the channels was actually impeded. In the same vein, Federal improvement would include future work that is currently proposed plus an additional amount of dredging estimated at 200,000 cubic yards (cy) in each coastal area.

For non-Corps projects, future dredging is estimated to be at a rate 20 percent below current levels. This level is predicated on the assumption of a lagging recreational boating industry, postponement of Federal improvement projects, disposal areas were not available and the outmoding of waterborne commerce due to changes in New England requirements.

Most Probable Future Scenario. The projections for this scenario generally assume a continuation of present program levels for Federal and permitted dredging. For Federal operation and maintenance, funds would be allocated for individual port maintenance at approximately the same intervals as in the past with an emphasis on regular maintenance of large commercial ports. Improvement projects would include projects presently proposed plus an additional 300,000 cubic yard allowance.

Maximum Growth/Maximum Change Scenario. Under this scenario, it is assumed that funds would actually be available to maintain all ports at regular intervals to their optimum conditions. Federal improvement projects would include those currently proposed plus a 500,000 cubic yard allowance for unproposed projects. For the private sector, the assumption of future dredging is 20 percent greater than current levels. This accounts for a future scenario that would include implementation of future Federal improvement projects, rapid growth of the recreational boating industry, continued expansion of the commercial fishing industry, and increased emphasis of waterborne transportation.

Total anticipated quantities of dredged materials resulting from all categories of dredging activity over the study period for each possible future scenario defined are summarized in Table 3. Although the total range from minimum to maximum quantities is broad, approximately 39 million cubic yards of material compared with 73 million cubic yards respectively, the estimates reflect the need for flexible planning over a period of 50 years. The transitional nature of port activity in the Long Island Sound region and the unpredictable nature of the primary channel use in major commercial ports also dictates a flexible posture in estimated dredged material quantities.

TABLE 3

SUMMARY OF PROJECTED DREDGED MATERIAL QUANTITIES (C.Y.)
1985-2035

Scenario	Coastal Area	Federal Maintenance Dredging	Non-Federal Dredging	Federal Improvement Dredging	Total
Connecticut:					
Minimum	Western	4,290,000	2,992,000	350,000	7,632,000
Growth	Central	9,520,000	7,856,000	460,000	17,836,000
	Eastern	940,000	3,696,000	200,000	4,836,000
	Total	14,750,000	14,544,000	1,010,000	30,304,000
Most	Western	5,615,000	3,740,000	2,950,000	12,305,000
Probable	Central	12,330,000	9,820,000	7,760,000	29,910,000
Future	Eastern	1,630,000	4,620,000	1,900,000	8,150,000
	Total	19,575,000	18,180,000	12,610,000	50,365,000
Maximum	Western	7,255,000	4,488,000	3,150,000	14,893,000
Growth	Central	14,135,000	11,784,000	7,960,000	33,879,000
	Eastern	2,360,000	5,544,000	2,100,000	10,004,000
	Total	23,750,000	21,816,000	13,210,000	58,776,000
New York:					
Minimum	Westchester County	310,000	640,000	100,000	1,050,000
Growth	Nassau County	120,000	556,000	100,000	776,000
	Suffolk County	187,000	3,228,000	100,000	3,515,000
	New York City	1,930,000	1,128,000	200,000	3,358,000
	Total	2,547,000	5,552,000	500,000	8,599,000
Most	Westchester County	410,000	800,000	400,000	1,610,000
Probable	Nassau County	180,000	695,000	150,000	1,025,000
Future	Suffolk County	327,000	4,035,000	150,000	4,512,000
	New York City	2,465,000	1,410,000	300,000	4,175,000
	Total	3,382,000	6,940,000	1,000,000	11,322,000
Maximum	Westchester County	530,000	960,000	600,000	2,090,000
Growth	Nassau County	220,000	834,000	400,000	1,454,000
	Suffolk County	409,000	4,842,000	400,000	5,651,000
	New York City	2,935,000	1,692,000	500,000	5,127,000
	Total	4,094,000	8,328,000	1,900,000	14,322,000
Total					
Minimum Growth		17,297,000	20,096,000	1,510,000	38,903,000
Most Probable Future		22,957,000	25,120,000	13,610,000	61,687,000
Maximum Growth		27,844,000	30,144,000	15,110,000	73,098,000

Source; Progress Report. Table IV - 8.

CHARACTERISTICS OF MATERIALS DREDGED IN LIS WATERWAYS

The observed physical and chemical characteristics of sediments dredged within the harbors bordering LIS vary widely. Harbor sediments receive contamination from treated and untreated sewage discharges, industrial discharges, oil spills, urban runoff, and river discharges, depending on location. Within any given year, runoff from spring snowmelt or isolated precipitation events can drastically alter the sediment picture. Normal or low flows might be capable of moving only fine-grained particles, but the high discharges during floods can scour a river or estuary bed and transport even coarse-grained material long distances. Chemical/organic characteristics also will vary, but on a more predictable seasonal basis. Fertilizers, herbicides and pesticides, for example, will be introduced into the sediments via runoff from agricultural areas.

The mean concentrations of trace metals in Connecticut are consistently much higher than those observed in New York sediments. This is probably due to more intense industrial activity and to the greater annual runoff and sediment loads which occur in Connecticut Harbors as opposed to New York Harbors, especially those on the north shore of Long Island where drainage basin size is relatively small.

In the absence of more definitive knowledge on the pollution effects of dredged material, or the effects of specific pollutants found in dredged sediments at the disposal sites, physical and chemical parameters are used to provide guidance for biological testing of sediments and placing conditions on the disposal of the dredged material. Dredged material sediment as classified by NERBC in the Interim Plan is as follows:

	Class I	Class II	Class III
Percent oil and grease (hexane extract)	<0.2	0.2-7.5	>.75
Percent volatile solids (NED method)	<5	5-10	>10
Percent water	<40	40-60	>60
Percent silt-clay	<60	60-90	>90

Relative to the subjective probability for adverse environmental impact these parameters are ranked in descending order of significance: oil and grease > volatile solids > percent water > percent silt-clay.

Class I sediments are often relatively coarse-grained with high solids content. Volatile solids, oil and grease, heavy metals, and

potential pollutant concentrations are low. Class I materials include non-recent and recent sediments which are suitable for capping materials at open-water dump sites, for habitat creation projects, or rehandling for productive uses which include beach nourishment and landfill cover.

Class II sediments are often relatively fine-grained with moderate solids content. Class II materials may contain a moderate amount of potential pollutants, volatile solids, oil and grease, and metals, at levels often sufficient to be a cause for concern. A subjective evaluation of the dredge site and metals is needed to designate such materials as either "non-degrading" or "potentially degrading". Potentially degrading Class II material will be treated as Class III material. On the other hand, evaluation may show that some Class II material is suitable for habitat creation projects, capping Class III material, or landfill cover.

Class III sediments are usually fine-grained with low solids content. These materials often contain high levels of potential pollutants, volatile solids, oil and grease, and metals. Class III sediments may be judged "potentially degrading" or "potentially hazardous" based on the relative concentrations of pollutant constituents. The probability for Class III sediments being "toxic" to marine bottom fauna may be high. Subjective evaluation of metals and other pollutants, and objective review of bioassay and/or bioaccumulation test results, may be required to determine the suitability of Class III material for open water disposal at Long Island Sound regional disposal areas.

As a general policy, Class III material is not dumped at regional disposal sites unless it is capped with suitable Class I or Class II material. Therefore, the conditions under which Class III material may be disposed of may include both temporal and seasonal restrictions relating to the availability of suitable material for capping, or alternative management techniques directed towards the goal of maximum environmental protection. In addition, there may be certain circumstances under which open water disposal may be prohibited.

V

REGULATIONS AND POLICY

REGULATIONS AND POLICY PERTAINING TO DREDGING AND DISPOSAL

THE REGULATORY PROCESS

The construction and operation of dredged material containment facilities in Long Island Sound are regulated at the Federal and State level. Federal participants include the Corps of Engineers and the Environmental Protection Agency (EPA). Coordination is also required with the U.S. Fish and Wildlife Service (US F&WS) and the National Marine Fisheries Service (NMFS). At the State level in New York and Connecticut, environmental protection agencies participate directly in permit issuance. Local zoning and/or public health and safety ordinances may also apply for those cases where shoreline extension projects are planned.

Federal Regulations

Four major Federal statutes directly affect all dredging and disposal actions:

1. Section 10 of the River and Harbors Act of 1899 provides that the construction or alteration of any structure in any navigable waters is prohibited without the authorization of the Corps of Engineers.

2. Section 401 of the Clean Water Act of 1977 requires the issurance of a water quality certification by the State prior to any dredging. Certification involves consideration of water quality impacts at the dredging site and the disposal site if located within State waters.

3. Section 404 of the Clean Water Act authorizes the Corps to issue permits for the discharge of dredged or fill material into U.S. waters. The selection and use of disposal sites will be in accordance with guidelines developed and administered by EPA.

4. Section 103 of the Ocean Dumping Act (Marine Protection Research and Sanctuaries Act of 1972) pertains to the transport of dredged material for ocean disposal at selected and approved disposal sites.

Other Federal and State acts which may directly influence dredging and disposal decisions are listed in table 4.

State Approvals

The States of New York and Connecticut have participated in developing the interim disposal plan for Long Island Sound. Their role is continuous since one of the first steps in the dredging and disposal process is to obtain the necessary State permits and State water quality certification. Lead agencies for the States are the Department of Environmental Protection (DEP) in Connecticut and the Department of Environmental Conservation (DEC) in New York.

Table 4

Environmental Statutes Applicable to Dredging and Disposal in Connecticut and New York

Federal

National Environmental Policy Act, as amended 42 U.S.C. 4321, et seq.
Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq.
Endangered Species Act, as amended, 16 U.S.C. 1531, et seq.
Coastal Zone Management Act, as amended, 16 U.S.C.
Rivers and Harbors Act of 1899, 33 U.S.C. 401 et seq.
National Historic Preservation Act of 1962, 16 U.S.C. 4321 et seq.
Marine Protection, Research and Sanctuaries Act of 1972, 22 U.S.C. 1401, et seq.
Clean Water Act of 1977 as amended, 33 U.S.C. 1251, et seq.
Resource, Conservation and Recovery Act of 1976, 42 U.S.C. 6901 et seq.
Safe Drinking Water Act of 1974, 42 U.S.C. ss 1421 et seq.
National Shellfish Sanitation Program
Clean Air Act as amended, 42 U.S.C. 7401, et seq.
Protection of Wetlands (E.O. 11990)

States

Connecticut Coastal Management Act of 1978 (Sections 22a-90 through 22a-112, Connecticut General Statutes)
Tidal Wetlands Statutes (Sections 22a-28 through 22a-35, Connecticut General Statutes and Regulations thereunder)
Inland Wetlands and Water Courses Act (Sections 22a-36 through 22a-45, Connecticut General Statutes and Regulations thereunder)
Structures and Dredging in Tidal, Coastal and Navigable Waters (Section 22a-359 through 22a-363 Connecticut General Statutes)
Mining of Sand and Gravel in Tidal and Coastal Waters (Section 22a-383 through 22a-390, Connecticut General Statutes)
Stream Channel Encroachment Lines (Sections 22a-342 through 22a-349, Connecticut General Statutes)
Water Discharge Permits (Section 22a-416 et seq., Connecticut General Statutes and Regulations therein)
Solid Waste Permit (Sections 22a-207 et seq., Connecticut General Statutes and Regulations thereunder)
Air Compliance Permits (Sections 22a-174 et seq., Connecticut General Statutes and Regulations thereunder)
Connecticut Environmental Policy Act (Sections 22a-1 through 22a-1f, Connecticut General Statutes)
Harbor Management Act (Sections 113K-113t, Connecticut General Statutes)
Tidal Wetlands Protection Law of 1973 (Codified Laws of N.Y., Art. 24 SS 0101-0602)
Freshwater Wetlands Protection Act of 1975 (Codified Laws of N.Y., Art. 24 SS 0101-1303)
Stream Protection Law of 1966 (Codified Laws of N.Y., Art. 15 SS 0501-0505)
Environmental Quality Review Law of 1976 (Codified Laws of N.Y., SS 0101-0115)
Local Land Use Authority of 1926 (Codified Laws of N.Y., Art. 16 SS 260-284)

In Connecticut, the State coastal management plan provides a common basis for the review of impacts of uses on both coastal resources and future water dependent development. The Coastal Management Act of 1972 (Public Act 78-152) provides the legal authority for insuring the State and local agencies review coastal impacts by means of unified goals and policies.

The Coastal Area Management (CAM) Unit within the Department of Environmental Protection, coordinates, supervises and assists the activities of existing State and local agencies in implementing coastal management requirements. The CAM Unit is responsible for reviewing the consistency of all Federal and private activities and development projects, which might significantly affect the coastal area. These activities and projects must be consistent with the management program to the "maximum extent practicable" (capable of being done to the fullest degree permitted by existing Federal law).

DREDGED MATERIAL DISPOSAL

In planning Federal navigation projects, the general policy of the Corps is to require local interests to provide without cost to the United States all suitable areas required for initial and subsequent disposal with dredged material and all necessary retaining dikes, bulkheads and embankments. This requirement applies specifically to disposal on land or behind bulkheads. Likewise, if a containment facility were identified as the designated site, the costs of the dikes and other containment features would become a local responsibility. However, for disposal at one of the four open water sites there are generally no separate local costs for the interim unless a more economical disposal option existed.

Maintenance of Navigation Projects

It has been past policy that maintenance and operation of Federal navigation projects shall be Federal responsibility accomplished at Federal cost. The provision and preparation of disposal areas is the responsibility of local interests unless authorizing legislation provides otherwise. However, Policy Issue No. 79-19 states that retaining structures (dikes) will be provided by the Corps unless the authorizing documentation indicates explicitly that such structures are a local responsibility. Should retaining structures become a new requirement for maintenance of the project for environmental reasons, the Corps would recommend that the local cooperation requirements be modified to include retaining structures unless an exception is justified based on special circumstances. The Corps will provide the necessary retaining structures until Congress modifies the local cooperation requirements.

Maximizing Use of Dredged Material
Section 148 of Public Law 94-587.

This legislation calls for encouraging the use of management practices to extend the capacity and useful life of dredged material disposal areas so that the need for new disposal areas is kept to a minimum. The management practices, which may include construction of dikes, consolidation and dewatering of dredged material and construction of drainage and outflow facilities, may be implemented at Federal expense.

Section 150 of Public Law 94-587

This law authorizes the Corps of Engineers to expend up to $400,000 to establish wetland areas using dredged material as part of an authorized water resources development project. For Section 150 to be applicable the following provisions must be met:

1. The environmental, economic and social benefits justify the increased costs.

2. The increased cost should not exceed $400,000

3. The wetland will not be altered or destroyed by natural or manmade causes.

This law also requires that when a report on water resources development project is submitted to Congress the establishment of wetland areas shall be considered in the report. In the economic computations, the benefits of establishing a wetland shall be at least equal to the cost, which shall be borne by the United States.

The money expended under this authority must result in a complete, functioning wetland. The program is not designed to supplement the cost of a containment dike with the expectation of creating a wetland 30 years into the future. Shorter term results are sought and can be obtained through incremental, or phased construction. Non-Federal interests would normally retain ownership, be responsible for operation and maintenance, and provide assurances that the beneficial values of the wetland would be maintained.

VI

PLAN FORMULATION

PLAN FORMULATION

OBJECTIVES

The goal of the plan formulation process was to develop the information and procedures which could lead to conclusions concerning the overall study objective and determine the feasibility of dredged material containment facilities in Long Island Sound. To accomplish this, the process was directed at addressing the following planning objectives.

1. Identify potential containment facility sites for the disposal of dredged material which may be generated from Federal and non-Federal dredging activities in Long Island Sound.

2. Develop containment designs for Long Island Sound which are feasible from an engineering, construction and operational aspect.

3. Minimize the economic costs to potential users of containment facilities.

4. Minimize the environmental and social impacts of containment facilities.

5. Maximize the long and short term use potential of both dredged material and containment facilities.

6. Explore the legal, institutional and financial arrangements associated with containment of dredged material in Long Island Sound.

Disposal of dredged material at containment facilities is a new concept for Long Island Sound except for instances where shoreline or land disposal areas have been diked. There was also an earlier study and report, "Artificial Island and Platforms in Long Island Sound", prepared in 1974 by John McAleer as a consultant for the New England River Basins Commission. Approximately 60 possible sites, mostly islands and shoals, were identified but no recommendations were presented.

SITE IDENTIFICATION

The site identification and screening process evolved through several different studies and methods of analysis. In total, screening identified nearly 300 potential sites distributed throughout the sound. The multi-step screening process arrayed the sites into the following categories.

1. Large regional sites constructed either as shoreline extension or offshore islands.

2. Smaller shoreline extensions and nearshore sites further disaggregated into:

a. Sites adjacent to publicly owned shoreline
b. Sites adjacent to private or other public shoreline.

The identification and screening process for each group is described in more detail below.

Large Volume Regional Sites

During preparation of the Reconnaissance Report (January 1979) initial planning efforts concentrated on identifying large regional sites. Planning centered on finding either A) a single facility to receive all dredged material for the study area for the study period 1985 to 2035, or B) three facilities to receive all the dredged material with one facility to be located in each coastal area. Investigations were completed for capacities of 12, 30, 37, and 59 million cubic yards.

Considerations included three types of projects and siting zones: shoreline extension, nearshore islands, or offshore islands. Design details included using a circular configuration and containment by either rock dikes or steel sheet pilings.

Siting analyses, performed by a multidiscipline study team, included consideration of water depths, ecological factors, land use on adjacent shoreline, and wave and current energy regimes. Sites located and screened are listed in Table 5. The findings indicate that these large regional sites are costly to construct singularly (about $150,000,000 to contain all material). Further, they would induce major impacts because of their structural magnitude. Further consideration was therefore deferred pending analysis of smaller sites. Subsequently, the more promising of these sites and areas were reevaluated for the Island/Shoal Screening Report.

Shoreline Extension/Nearshore Sites

Initial planning efforts described earlier evidenced that considerable potential existed for smaller local, and/or regional containment facilities, constructed as shoreline extension or nearshore sites. This next phase of the site screening process was carried forward for two groups namely publicly owned and privately owned shoreline.

Table 5

Sites Considered In Reconnaissance Study

Groton-Fisher Island
New London - Open Water Dump
Bartlett Reef - Offshore Waterford
Hatchett Reef - Offshore Old Lyme
Cornfield Shoals - Open Water Dump
Clinton - Six Mile Reef to Cornfield Shoals
Clinton - Six Mile Reef
Long Sand Shoal
Duck Island Lighthouse & Breakwater Offshore-Westbrook
Guilford - Falkner Island
New Haven - Tidal Flat E. Side of Hbr. Adjacent to E. Shore Park
New Haven - Tidal Flat W. Side of Harbor Near Wharf
New Haven - Tidal Flat Breakwater Mouth of Old Field Creek & Sandy Point Breakwater
New Haven - 20 Square Miles Near Historic Dump Site
Welches Point - West Haven
Charles Island - Offshore Milford
Milford Point - Milford
Point-No-Point - Stratford
Bridgeport Breakwater, W. Breakwater & Tongue Point
Pine Creek Point - Fairfield
Cockenoe Island - Norwalk Islands
Greens Ledge - Offshore Norwalk
Cable and Anchor Reef
Georges Rock
Stamford - Breakwaters to the Cows
Stamford - R32A Shoals
Goose Island - Offshore Greenwich
Little Captain Island - Offshore Greenwich
Area Outside Calf Island - Offshore Greenwich

Siting Method. The plan formulation presented in the Interim Report (July 1980) and the Addendum (January 1981) represents a preliminary siting analysis for shoreline extension containment opportunities for all of Long Island Sound. The four-step preliminary siting method includes:

1. Identify and rank primary screening criteria for selecting alternative sites.
2. Apply the criteria to Long Island Sound to obtain specific site alternatives.
3. Preliminarily rank the alternative sites in relative order of desirability.
4. Investigate the use of sites individually or in combinations to determine the potential of using more than one site.

Steps 1 and 2, by identifying the coastal areas of Long Island Sound showing the most promise for containment facility siting, served to greatly reduce the number of sites needing detailed investigation. Step 3 applied additional, but more specific, criteria. Step 4 formulated preliminary design of projects considering site specific issues, construction feasibility, operation, and other site specific factors. This site identification and screening process is outlined in more detail in table 6.

Publicly-Owned Shoreline Sites. The shoreline was screened for potential sites that were adjacent to publicly held shoreline at locations such as parks, beaches, transportation corridors and military and institutional sites. The incentive for these sites is that there are potentially fewer adverse impacts on residential and other private property, minimal land aquisition costs, and possibly less social/political opposition. The disadvantage is that, compared to privately owned shoreline on LIS, the public shoreline is severely limited in extent such that potential alternatives for consideration are in fact limited.

This primary screening siting process identified 133 public shoreline and existing disposal areas sited along the coast of LIS in New York and Connecticut. Of the 133 sites, 24 survived the initial screening (17 in NY and 7 in CT). Through the secondary screening process the number of sites was narrowed to eight (five in NY, three in CT). These are ranked in order as follows:

New York Sites

1.	State Maritime Academy	Throgs Point
2.	Fort Totten/Little Bay Park	Willets Point
3.	Garvies Point	Hampstead Harbor
4.	US Military Reservation	Hart Island
5.	Ferry Point Park	Upper East River

Connecticut Sites

1.	Bayview Park	New Haven Harbor
2.	Seaside Park	Bridgeport
3.	East Shore Park	New Haven

After coordination of the findings with State officials, the top ranked sites were deemed to have unacceptable impacts.

Privately Owned (and other Public) Sites. Site screening was expanded to include potential containment sites adjacent to the private shoreline. The publicly owned shoreline as mentioned above was found to be too restrictive and bypassed opportunities for facility siting. This expansion offered advantages including: 1) it opened up a larger proportion of the shoreline for consideration, and 2) it allowed for more consideration

TABLE 6

SITE IDENTIFICATION AND SCREENING PROCEDURE

Step 1. Identify and rank primary screening criteria
1) Bathymetry
2) Shoreline Ownership
3) Significant ecological areas
4) Wetlands
5) Major Public Beaches
6) Wave Energy
7) Land Use Compatibility/Reuse Potential

Step 2. Apply the criteria to LIS. Working maps of LIS were first prepared. An overlay system was used to apply the various screening considerations.

Step 3. Preliminary ranking of alternative sites to characterize the desirability of each site (Secondary screening). Step 3 used two distinct sets of numerical values: weighting factors and criteria points. Weighting factors are assigned according to the perceived importance of each factor. The criteria points represented the physical and geographic characteristics of alternative sites. See table 6 for work sheet. Criteria points were assigned based on site specific conditions. For instance if a site is located within 3 miles from shellfish beds (assigned 2 criteria points), it would have a lesser impact than if it were within 1 mile (zero points). These criteria points were multiplied by the weighting factors to establish an overall score. The greater the score, the lower the environmental impact.

(criteria points) x (weighting factor) = overall points

Step 4. Investigate the use of sites individually or in combinations to determine the potential of using more than one site. Step 4 entailed preliminary design of projects considering site-specific issues, construction feasibility, and operational factors. The siting method was designed to produce a collection of potential sites for detailed review and evaluation. Reiteration of the first two or three steps was often necessary before the siting was completed.

SITE-SPECIFIC SECONDARY SCREENING CRITERIA

Siting Criteria

Name:_____ County:_____ Map #_____ Location#_____

1. Shorefront Ownership and Shorefront Disposal Sites
   a. Site Ownership: (Federal, State, County, Town, Private)

2. Proximity of Site to Significant Ecological Areas
   a. Shellfish Beds: ____ miles ____ d. Waterfowl Areas: _____ miles
   b. Lobster Locations: _____ miles e. Wetland Areas: _____ miles
   c. Finfish Concentrations: ____ miles
   f. Water Quality Conditions: poor/fair/good

3. Bathymetry
   a. Nearshore Slope: _____ ft/mile c. Available Volume Below MSL:
   b. Available Surface Area: _____ acres _____ cu. yards

4. Exposure Considerations (within 1 mile either side of site)
   a. Wave Energy: (high, moderate, low)
   b. Critical Erosion Areas: _____ %
   c. Flood Zone Area: _____ %
   d. Endangered Structures: (buildings, homes, jetties, etc.)
   e. Cost of Flood Damages: (high/medium/low)

5. Soil/Foundation Characteristics
   a. Soil/Sediment Physical Characteristics: % sand, % clay, % silt
      or USCS Classification: _____
   b. Permeability: _____

6. Existing and Projected Land Use (within 1 mile radius of site)
   a. Residential: ____ % ____ %
   b. Recreational: ____ % ____ %
   c. Commercial: ____ % ____ %
   d. Industrial: ____ % ____ %
   e. Wetlands: ____ % ____ %
   f. Public: ____ % ____ %
   g. Open Space: ____ % ____ %
   h. Agricultural: ____ % ____ %

7. Volume and Types of Dredged Material Available for Containment
   a. Present Disposal Method: % Water (site), % Land (site)
   b. Volume of Dredged Material Projected:
      Within Quadrangal: ____ CY/year
      Within Surrounding Quads: _____ CY/year
   c. General Characteristics of Material (Phys-chem): _____

8. Compatability with Adjacent Land/Re-use Potential
   a. Site Land use: (Res/Rec/Comm/Ind/Wetlands/Open Space)
   b. Adjacent Land Use: (Res/Rec/Comm/Ind/Wetlands/Open Space)
   c. Types of Industrial/Commercial Uses: (Port, sand/gravel, petroleum, etc.) _____
   d. Access by Water: (channels, docking facilities)
   e. Access by Land: (roads/bridges)
   f. Area-wide Plan: (industrial/commercial expansion)
      (need for recreation)
      (market for re-use of dredged material)

9. Proximity to Cultural Resources
   a. Cultural: (closest) miles ____ (number) ____ 10 mile radius
   b. Types: (historical, archaeological, etc.)

10. Existing and Historical Spoil Disposal Location
    a. Existence of Containment Structures, Dikes and Weirs:
       (condition, dimensions)
    b. Use of Material Previously Disposed: (construction fill, beach nourishment, etc.) _____
    c. Volume of Material Previously Disposed: _____ CY

of reuseable containment facilities. This phase of the site screening is reported in an Addendum (January 1981) to the Interim Report mentioned above.

In this second group, an additional 121 sites were located and were grouped into the following categories:

18	Shallow Water Sites
31	Municipal Waste Water Treatment Plants
14	Power Generating Sites
21	Corps Navigation Projects, Jetties and Breakwaters
11	Industrial Wastewater Discharge
20	Petroleum Facilities
4	Sand and Gravel Pits
2	Other Sites
121	Total Sites

Of the 121 sites, nearly one half of the sites (54) were ruled out due to the lack of adequate construction space while eight were eliminated because of close proximity to public beaches. The remaining 59 sites that showed the most potential were subjected to secondary screening.

Results of the Site Indentification and Screening Process.

The intent of the site identification and screening process was to locate where containment facilities using available resource information. Therefore, the process used various coastal resource maps, county maps, planning board maps, published reports and coordination with State and local officials.

This phase of the plan formulation process located 283 potential containment sites based on available resource information. A breakdown by type is as follows:

Category	Total Number of Sites	Number of High Rankins
Large volume regional sites	29	10
Public shoreline	133	24
Private and other public shoreline	121	59
	283	93

Based on criteria used, the screening process indicated that public sites and industrial sites generally offered the most potential whereas shallow water sites had the lowest overall ranking.

The screening analysis pointed to 83 shoreline and 10 offshore sites as scoring the highest in overall ranking. This list of sites, supplemented by public input, formed the basis from which sites were selected for further investigation.

SELECTION OF SITES FOR FURTHER INVESTIGATION

The site identification and screening process developed information and rankings on nearly 300 potential sites identifying the most promising sites as well as the least promising. The study moved on to actively involve the public in the identification of sites for further investigation. The three planning tools of coordination to select sites for further investigation were:

1. Review and coordination with State and federal officials
2. Review at public workshops
3. Coordination with local interests.

This was an important part of the plan formulation process inasmuch as it was through this coordination that public support or criticism of the sites was identified. This process also resulted in shifting the location of sites, or identifying entirely new sites which reflected local needs and knowledge of shoreline conditions. The public also expressed its opinion as to the value of impacted resources and the local need, or desire, for containment facilities.

State Coordination. The top ranked site groups were coordinated in each State with appropriate State officials. In New York, officials determined that all of the sites presented environmental conflicts, primarily because of the presence of shellfish stocks and tidal wetlands. In Connecticut, State officials also noted problems with some of the sites. However, while environmentally significant areas abound, it was acknowledged that not every foot of shoreline was critical in ecological significance. Based on this coordination and review, the sites located in New Haven Harbor were felt to result in unacceptable impacts to shellfish areas and were removed from further consideration.

Federal Coordination. The Corps has coordinated with other federal agencies through a series of meetings, workshops and distribution of reports. The U.S. Fish and Wildlife Service has played a particularly active role preparing reports under authority of the Fish and Wildlife Coordination Act. They have contributed planning aid letters in 1980, 1982 and 1984 and also a 1985 fish and wildlife report which is reprinted and attached to this report.

The Fish and Wildlife Service has been active in their support of the concept of containment for Long Island Sound, looking specifically for ways that dredged material can be used to benefit the environment.

Public Coordination. The public involvement proceeded along different avenues including correspondence, workshops, and numerous local meetings with towns, business and trade organizations. This process succeeded in a further screening of sites and identification of additional sites. A general observation of this process indicated that, with local

interest and support, potential containment facilities could be sited throughout the sound. Conversely, without local interest, it is improbable that any site could be advanced beyond general consideration.

Selected Sites

The coordination process resulted in 22 sites that were selected for individual investigation. These are described below and shown on figure 3. The sites were evaluated for technical feasibility and environmental, economic and social considerations. Information was obtained from previously prepared reports and imput from individuals and agencies having knowledge of the area(s).

1. Captain Harbor, Greenwich,CT. Captain Harbor was the best site in western Long Island Sound of those proposed for review in this study. This site consists of an area of open water and islands about 1.25 miles offshore near Byram, Greenwich, and Cos Cob Harbors. This site is technically feasible, however, a lack of local support and opposition from coastal residents presently reduces the the incentive to pursue this site as a potential containment facility.

2. Norwalk Island, Norwalk and Westport, CT. is an area of open water and islands at the entrance to Norwalk harbor. Biological productivity, high concentrations of shellfish and finfish, along with the recreational land use patterns prompt rejection of this site for further consideration. In addition, navigational hazards could be increased by a containment facility in this busy boating area. Further, recently enacted barrier island protection legislation may bar construction of a containment facility in much of this archipelago.

3. Milford Point, Milford, CT. consists of a barrier beach and adjacent mudflat area located at the mouth of the Housatonic River on the eastern shore. The study area considered is located in a triangular shaped area between Milford Point on the northwest, the outer breakwater flasher to the south, and Laurel Beach to the east. This site is ruled out from further consideration by biological productivity, importance of wildlife habitat, and barrier island legislation recently enacted by Congress.

4. Thimble Islands, Branford, CT. is an open water and rocky island archipelago located to the east of Branford Harbor and west of Sachem Head. More than a dozen sizable islands make up "The Thimbles." Although technically feasible, public comment received reflects strong community opposition which renders utilization of this area impractical as a containment facility site. Biological productivity, shellfish concentration, finfish concentrations, surrounding land use patterns and navigational hazards are among the factors supporting elimination of this location from further consideration.

5. Falkner Island, off Guilford, CT. is an area located approximately 3 nautical miles south of the entrance to Guilford Harbor. The site consists of two major islands, Falkner and Goose Island and several rock outcroppings. This site, although technically feasible, has several environmental issues including the loss of rock and bottom habitat and the need for undisturbed shorebird nesting, especially for the tern. The site is located in a high energy zone which would entail a large and costly containment structure. In 1984, the Falkner Islands were designated as a National Wildlife Refuge area. On this basis the site was eliminated from further consideration.

6. Sixmile Reef, off Clinton, CT. is a shoal area located approximately 3 nautical miles south of Hammonasset Point. This site was rejected from consideration due to high biological productivity, the potential for creating a navigational hazard, and high costs related to construction in deep water.

7. Duck Island Roads, Clinton and Westbrook, CT. is a harbor of refuge formed by 3 breakwaters constructed in 1917 by the Corps of Engineers. A containment proposal here could be located on the western edge of the harbor and not impact on it. This site is designated as warranting further investigation with future studies addressing environmental impacts, shoreline erosion and design considerations. However, because of concerns of nearby residents and the lack of local support, further consideration was deferrd.

8. Menunketesuck Island, Westbrook, CT. lying due east of Duck Island Roads, is a slender island with associated sand flats extending southwest from the entrance of the Patchogue River. Limitation on size and capacity combined with disruption of habitat utilized by shorebirds rule out further consideration of this site. High biological productivity, significant shellfish concentrations, and proximity to municipal beaches further support its elimination.

9. Bartlett Reef, off Waterford, CT. represents an area of shoals located south of Seaside Point, east of Niantic Bay and west of New London Harbor. A few rock outcroppings of the reef are visible at low tide though the majority of the reef lies 2-12 feet below low tide. High biological productivity, potential for creating navigational hazards, strong currents and a significant potential for erosion combine to make this location undesirable for further consideration.

10. Stratford Shoals, off Stratford, CT. is a shoal area located midway between Stratford Point and Crane Neck on Long Island. Initial analysis indicates that this site is an important lobstering area and a popular fishing area. It also a high wave energy zone requiring costly containment dikes, with adverse environmental impacts and no public sponsorship, this site was not advanced for further study.

11. Black Ledge, Groton/New London, CT. is located about 1 mile outside the entrance to New London Harbor. The site, originally considered by the U.S. Navy, was recommended for further consideration by the city of Groton Conservation Commission and Harbor Study Commission. With a capacity of 7.5 million cubic yards the site could serve as a regional disposal area and was advanced for detailed investigation. Site conditions established during detailed studies included high wave energy and water depths to 35 feet. The resultant $40 million cost make the facility economically infeasible.

12. The Clinton Harbor, CT. site is located in Clinton and Madison in the outer harbor area. The facility is planned as a marsh creation site adjacent to the present wetland area on Hammonasset State Park. The site has support from town and business interests in Clinton and was advanced for detailed investigation.

Subsequent detailed studies indicated that the site showed economic feasibility, but three events impacted on the feasibility of the project:

1. the town of Madison surfaced aquaculture plans that they had prepared for the area.

2. the state of Connecticut raised several environment issues regarding the proposal, and

3. the containment site was in an area designated as coastal barrier beach.

13. Fayerweathers Island, Bridgeport, CT. is located between Bridgeport Harbor and Black Rock Harbor. The facility would have a capacity of 1.4 million cubic yards. The site would result in significant impacts to a seed oyster cultivation area. Opposition to the site was very strong from abutters west of Black Rock Harbor, and the site was eliminated from further consideration.

14. Yellow Mill Channel, Bridgeport, CT is a 16.5 acre site on the upper reaches of the channel with a capacity of 136,000 cubic yards. The proposed site would be filled in 1 to 2 years, and, after capping with clean fill could be turned into a recreation area. Plans were underway to expand the wharf of Jacob Brothers Scrap Iron further upstream, significantly reducing the area which could be used as a containment facility. Also, city officials indicated that they prefered to use the channel as a spoil site for refuse. Following these discussions with city officials, this site was ruled out.

15. Two Tree Island is a submerged rock outcropping located about 1 mile off Millstone Point in Westbrook, CT. An 80-acre containment facility could provide capacity for 3.4 million cubic yards of dredged material. Local conservationists envisioned this as a future wildlife area. However, use of the site was strongly opposed by the Millstone

nuclear powerplant owners who felt that the facility may interfere with the intake of cooling water needed for the plant's operation. Also it was felt that nearby Black Ledge was a better site so further study at this site was deferred.

16. Borrow Pits in LIS (Sherwood Island, Morris Cove, and Prospect Beach). These sites were recommended by the Connecticut Division of Aquaculture which proposed the filling of these aqueous borrow pits. The Sherwood Island site was studied in detail as the representative of this type of disposal area.

17. Mamaroneck Harbor, NY. There are actually three alternative sites in this harbor area that were recommended for consideration by local interests. A facility at the primary location could hold about 500,000 cubic yards of dredged material. All are located in a highly sensitive shoal area in an area of extensively developed shoreline. All three were rejected for environmental and social reasons.

18. Gold Star Bridge, New London, CT. This site is located on the Thames River immediately upstream of the Gold Star Bridge at I-95. The site, recommended by the Connecticut Department of Transportation, is located adjacent to dredging operations, is protected from high waves, and adjoins State-owned land. However, the site was rejected following geological screening which indicated very poor foundation conditions.

19. Penfield Reef, Fairfield, CT. This potential site for a containment facility was recommended as a shoreline extension facility with a capacity ranging from 1 to 4 million cubic yards. At the smaller size, the facility would receive dredged material from Black Rock Harbor. If developed as a larger facility, it could function as a regional containment facility. Accordingly this site was advanced for further study.

During detailed studies, the site drew considerable support from the town of Fairfield Conservation Commission, in part because of its potential to reduce tidal flooding and wave damage and to reverse shoreline erosion processes. However, the site is not cost effective and could impact negatively on this environmentally sensitive area.

20. Mianus River, Greenwich, CT. This site, located on the Mianus River, was viewed as a local disposal site. However, because of infrequent dredging and limited dredging material volume, it was eliminated from further consideration.

21. Milford Harbor, Milford, CT. The site would be located just outside Milford Harbor adjacent to the Federal channel. The facility, with a capacity up to 400,000 cubic yards, was recommended by the Milford Harbor Commission and received further detail study. A facility at Milford would fit into the town's harbor plans, impede erosion along the

town beach and meet their disposal needs for up to 50 years. However, cost estimates indicate that the $2.6 million structure would not be cost effective.

22. Flushing Bay, New York, NY. This site was recommended by the New York-New Jersey Port Authority and is actually located out of the study area on the East River. The New York District of the Corps of Engineers is continuing investigation of the potential for creating a small marsh restoration project at this location. Therefore, no further consideration was given to the site in this study.

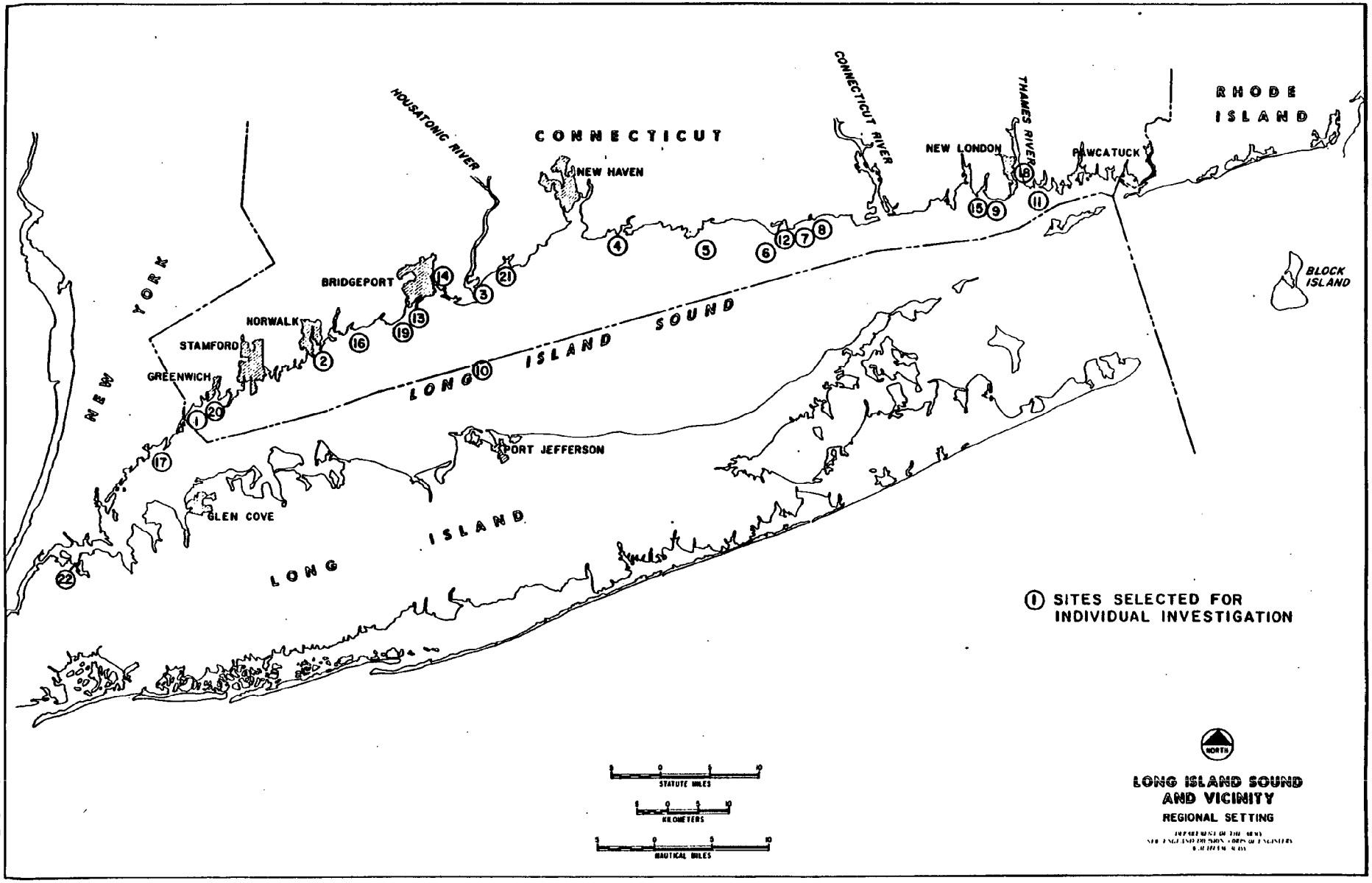
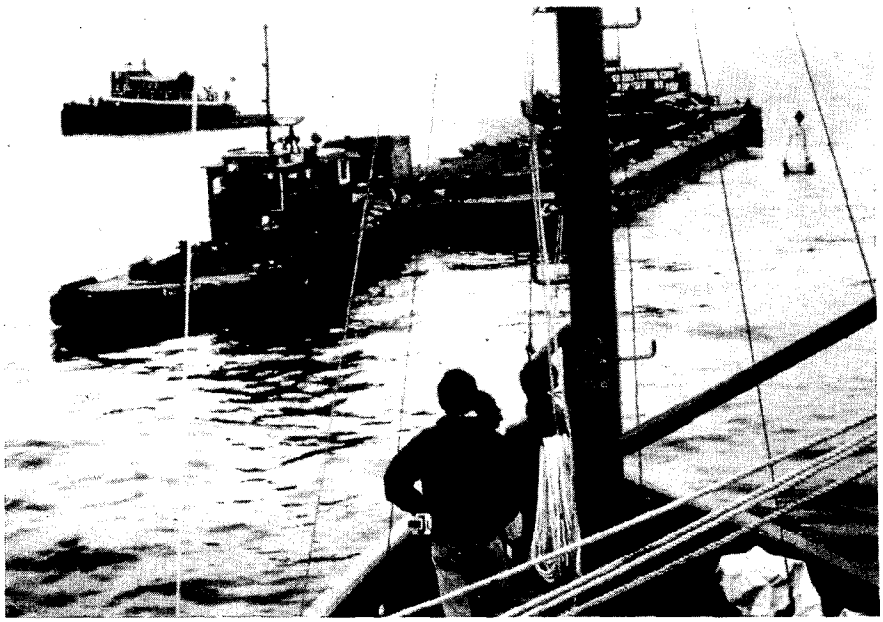

CONNECTICUT
HOUSATONIC RIVER
CONNECTICUT RIVER
THAMES RIVER
RHODE ISLAND
NEW LONDON
PAWCATUCK
NEW HAVEN
BRIDGEPORT
NORWALK
STAMFORD
GREENWICH
NEW YORK
LONG ISLAND SOUND
PORT JEFFERSON
GLEN COVE
LONG ISLAND
BLOCK ISLAND
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 19 20 21 22
① SITES SELECTED FOR INDIVIDUAL INVESTIGATION
STATUTE MILES
KILOMETERS
NAUTICAL MILES
NORTH
LONG ISLAND SOUND AND VICINITY
REGIONAL SETTING

FIGURE 3

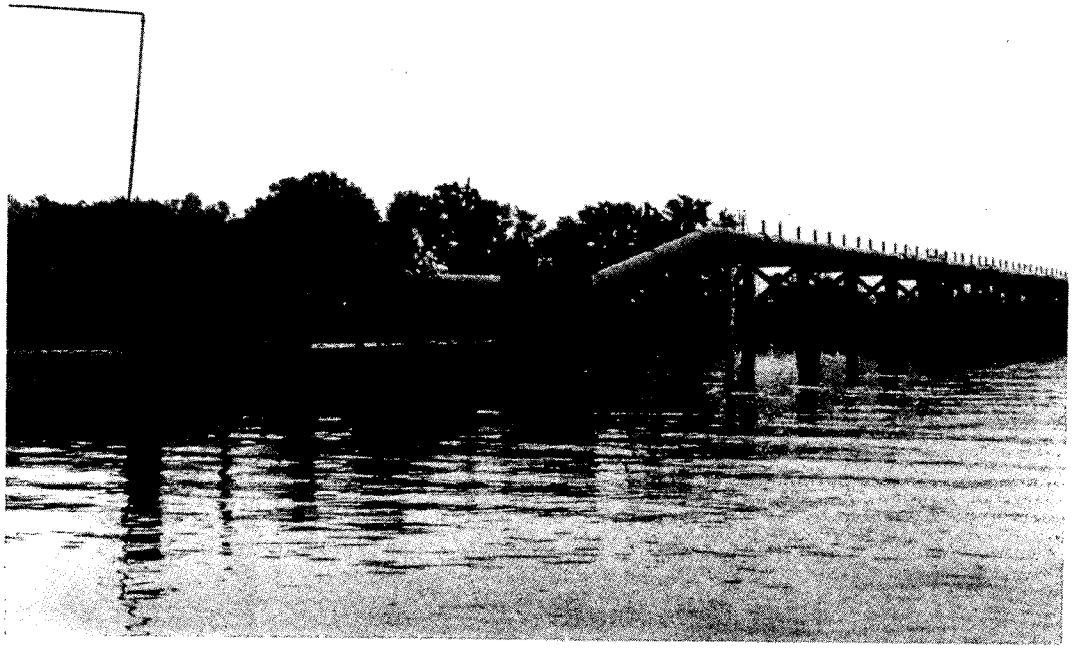
Dredging operations are an essential part of keeping LIS harbors, such as at Guilford, CT shown here, open to boating traffic.

Land disposal containment sites such as this Guilford, CT site are becoming less available because existing sites are filling up or because of regulatory controls.



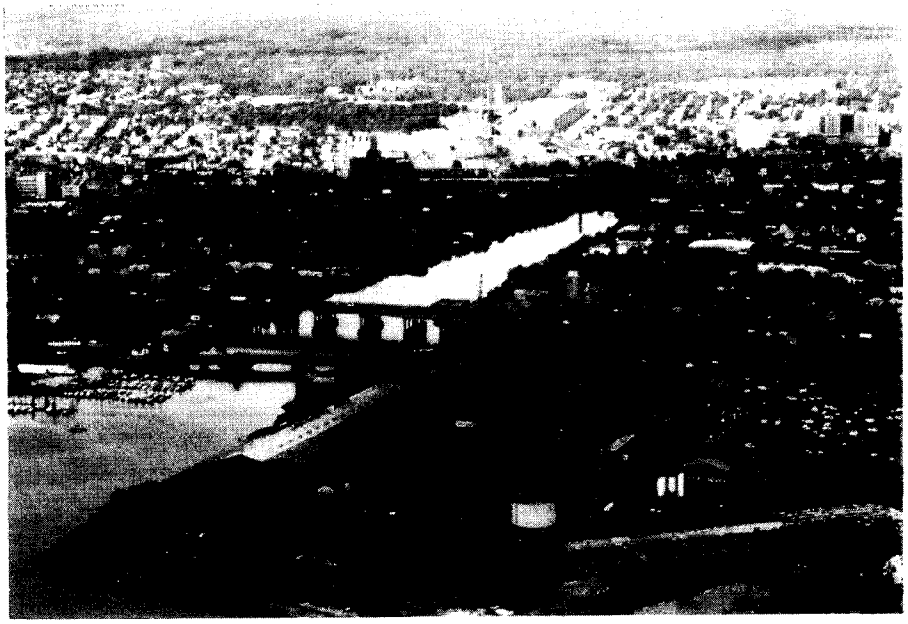
The majority of dredged material from LIS harbors is disposed of at open water sites. Short and long-range impacts are closely monitored by the DAMOS program conducted by the New England Division.

The Corps is continuing research into the effects of alternative disposal techniques. Here the Corps constructed a wetland containment facility for field testing.



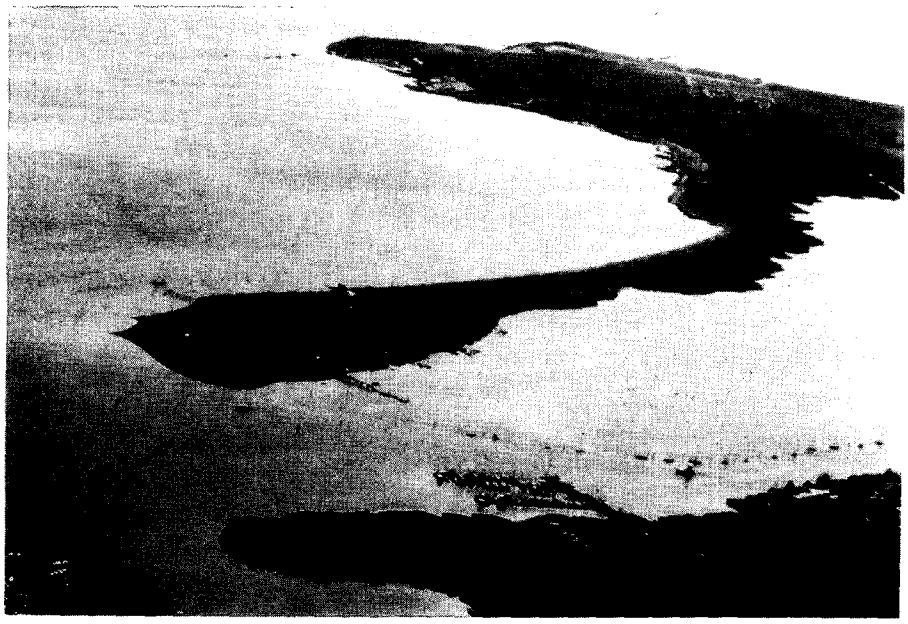
While the use of containment is not common in LIS it has seen widespread use in other parts of the country as evidenced by this dredge mooring and rehandling facility at Dickinson Island in the Great Lakes.

In the Great Lakes, the use of containment has been mandated in the short term to prevent further dumping of contaminated materials in open water. Shown here is a containment facility at Point Mouillee.



Over 300 potential containment sites were identified in LIS such as this site in Yellow Mill Creek in Bridgeport, CT. Very few sites received local support.

Many potential sites, such as this one at Scotch Caps in Mamaroneck, NY were sited adjacent to harbors. In this instance, as well as many others, local interest cited unacceptable environmental impacts.

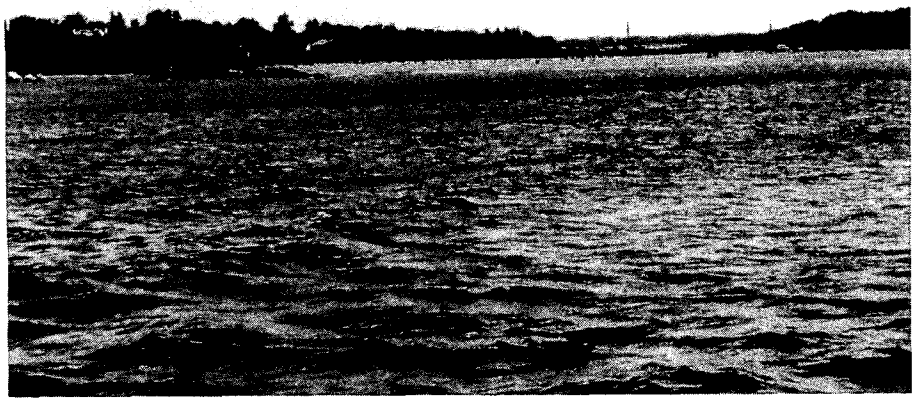


Clinton Harbor interests were supportive of constructing a containment facility in the outer harbor area adjacent to the federal channel and private marinas.

The facility at Clinton would be vegetated and function as a wetland similar to this area in the Great Lakes.

A containment facility at Penfield Reef (in background) in Fairfield, CT was considered as a potential disposal area for Black Rock and other harbors.

Much of the LIS coastline is developed and many areas such as this residential area adjacent to Penfield Reef would be directly impacted by a shoreline extension containment facility.



Town interest led to consideration of a containment facility at the Milford Harbor entrance. A facility here could be incorporated into the town's recreation area and prevent erosion to Gulf Beach.

The Milford site, as well as others, were planned as shoreline extension sites. Containment dikes would be constructed of rock and gravel from material hauled by trucks as seen here at Point Mouillee.

VII

PROTOTYPE

SITES

DETAILED ANALYSIS OF PROTOTYPE SITES

Detailed analysis were designed to generate the information needed to assist in making the determination of the feasibility of containment facilities in Long Island Sound.

Public participation played an important role in adapting plans to meet local conditions and desires as well as gaging the level of local interest.

The plan formulation process, which included site identification, site screening, and public review and recommendations, produced five potential containment sites, which represented different categories of sites, had public interest and support and warranted further analysis. The five sites which were advanced for more detail analysis to test the feasibility of these individual prototype sites are:

Clinton Harbor	-	Marsh creation site.
Black Ledge	-	Island creation site for use as a regional disposal area.
Milford Harbor	-	Shoreline extension site for use by local harbor.
Penfield Reef	-	Shoreline extension site for use as a regional disposal area.
Sherwood "Hole"	-	Aqueous borrow pit.

Methodology. The detailed analysis allowed a closer look at the engineering design, environmental resources and impacts, project economics, wave energy and sediment transport, and socio-economic considerations.

Engineering studies for individual sites included site geology, foundation conditions (determined by field investigations and laboratory analysis), hydrographic surveys, construction considerations and tidal hydraulics.

Environmental considerations were based on LIS resource reports and field surveys including benthic sampling, diver observations and laboratory analysis. In addition, oceanographic observations and computer modeling for wave energy analysis and sediment transport were undertaken at the Clinton, Black Ledge and Penfield sites.

Economic analysis were aimed at comparing the costs of disposal at each containment site with open water in LIS and open water ocean disposal at The Race (located at the eastern end of the sound). The major factors affecting dredging and disposal costs were assumed to be transport distance, type of dredging operation and project size. These added

dredging costs were added to mobilization costs and, in the case of containment, the cost of the facility. First costs were amortized at 8-3/8 percent Federal discount rate for the expected time to fill the facility - generally 25 years.

Social considerations of the acceptability and possible impacts associated with containment facilities were based on literature research, site visits, the public workshop and research interviews.

CLINTON HARBOR DREDGED MATERIAL CONTAINMENT FACILITY

Background.

Clinton Harbor, located in the Connecticut towns of Clinton and Madison, is formed between Hammonasset and Kelsey Points by two headlands projecting into Long Island Sound (LIS). The Cedar Island Peninsula divides the harbor into "inner" and "outer segments. The harbor is one of the main recreational boating harbors on LIS, accommodating 15 marinas and town docking facilities. It is served by a Federal navigation project consisting of a channel 8 feet deep at mean low water (mlw), 100 feet wide and 1.1 miles in length, and an 8-foot deep anchorage area. The Corps of Engineers completed the project in January 1951 and performed maintenance dredging in 1958, 1965, 1973, 1976, 1981, 1982 and 1984.

Recent changes in dredge material disposal options have affected Clinton Harbor. Historical disposal locations included wetlands in the harbor area and use as construction material in Hammonasset State Park. Because site capacities have been reached or wetland policies have curtailed use, neither of these options presently exist in this area. The historic dumping ground located about 2 miles offshore is also closed. Disposal options now include open water sites at Cornfield Shoals (8 miles away) or New Haven (25 miles away) as identified in the Interim Plan for the Disposal of Dredged Material from Long Island Sound. Most material dredged from Clinton is taken to Cornfield Shoals, which limits disposal to "clean" material. There are, however, inner harbor sediments that would not meet the criteria and would have to go to New Haven disposal area - a costly alternative. This could directly affect consideration of any further navigation improvements which may be desired by the town.

Small private marinas and dredgers are the group most severly impacted by the changes in disposal patterns. They are unable to rely on the economies of scale that would be needed to offset increased hauling costs. Faced with these recently increased costs and the potential for further restrictions and cost increases, harbor interests have identified the potential for a dredged material containment site which would be located in the outer harbor area adjacent to Hammonasset State Park, and immediately west of the Federal channel.

Site Description

The containment facility site is located in the outer harbor area as shown in Figure 4. The topography of the area is generally flat and located adjacent to extensive wetland areas which are part of Hammonasset State Park. Offshore, the area is generally flat with boulders providing some relief. Minimum offshore elevation at the site is about -8 feet NGVD (-6 MLW). Glacial deposits are dominant in the offshore area with overburden thickness of about 50 feet over igneous bedrock. The surficial deposits consist of granular soil overlying very soft organic silt.

Project Formulation

The containment facility is being considered as a disposal area only for dredged material that would come from Clinton Harbor. The facility is adjacent to present and prospective future dredging areas. As such, hydraulic dredging operations with direct pipeline to the disposal area will be possible. Material from other harbors is not being considered for disposal at Clinton.

The containment facility is sized with a capacity to store up to 1 million cubic yards of dredged material (see Table 7). Under the Most Probable Future scenario, the facility would have a useful life in excess of 25 years. Alternatively, a smaller facility with a capacity of 500,000 cubic yards was also considered and would be appropriate for minimum growth or other possible scenarios that might consider the use of the containment facilitly and Cornfield Shoals for future disposal areas.

Table 7

Dredged Material Disposal Needs - Clinton Harbor
(Cubic Yards)

Type of Dredging	Most Probable Future	Min. Growth
Federal O&M	105,000 (4200/yr)	90,000 (3600/yr)
Permit	500,000 (20,000/yr)	250,000 (10,000/yr)
Improvement Dredging[1]	150,000	150,000
Total	755,000	490,0000

[1]Assumes modification/extension of existing Federal project.

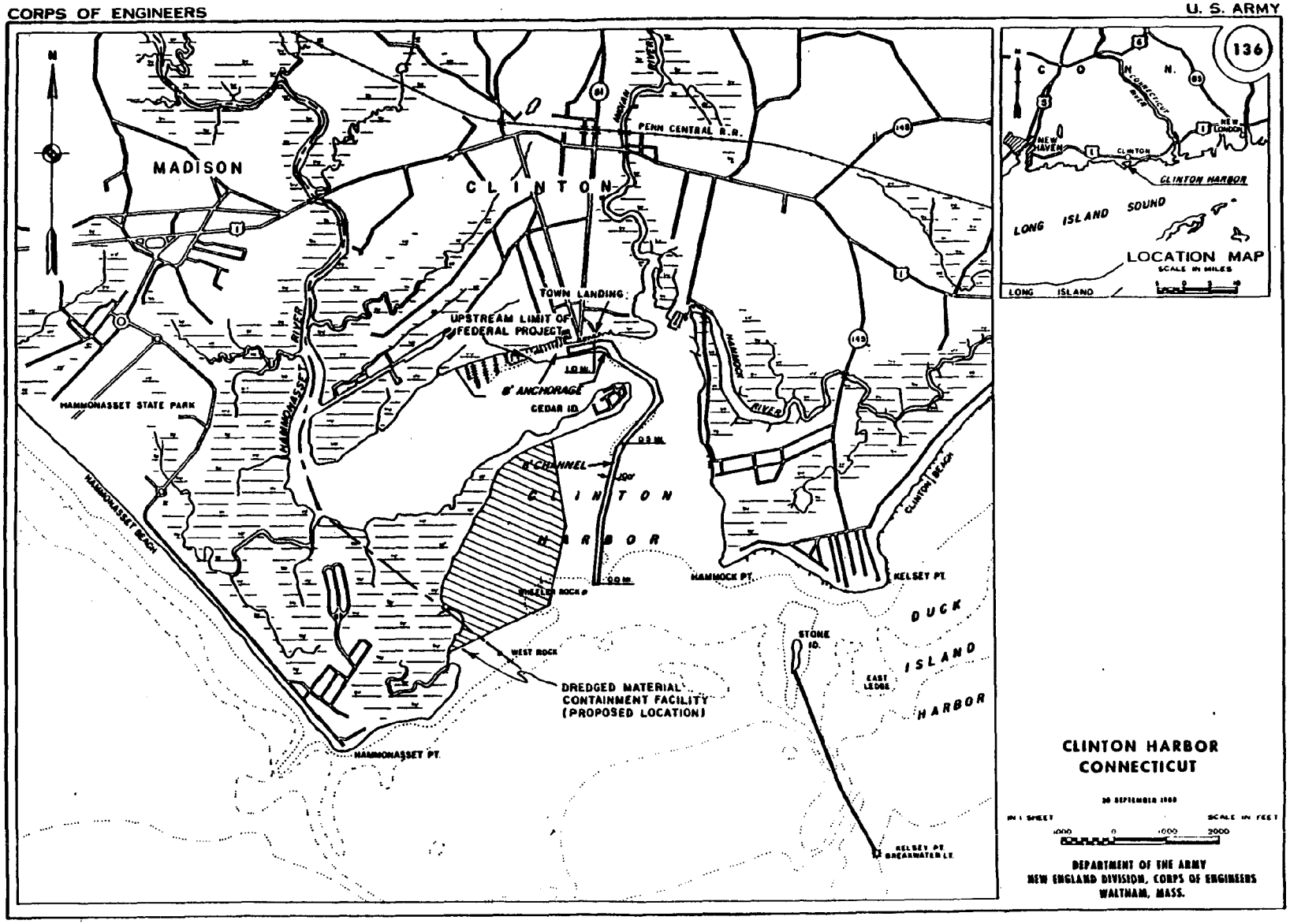

CORPS OF ENGINEERS
U. S. ARMY
MADISON
CLINTON
PENN CENTRAL R.R.
TOWN LANDING
UPSTREAM LIMIT OF FEDERAL PROJECT
HAMMONASSET RIVER
HAMMONASSET STATE PARK
8' ANCHORAGE
CEDAR ID.
9' CHANNEL
CLINTON HARBOR
HAMMONASSET BEACH
HAMMONASSET PT.
HAMMOCK RIVER
HAMMOCK PT.
KELSEY PT.
CLINTON BEACH
WHEELER ROCK
WEST ROCK
STONE ID.
EAST LEDGE
DUCK ISLAND HARBOR
DREDGED MATERIAL CONTAINMENT FACILITY (PROPOSED LOCATION)
KELSEY PT. BREAKWATER LT.
136
CONN.
CONNECTICUT RIVER
NEW HAVEN
CLINTON
NEW LONDON
CLINTON HARBOR
LONG ISLAND SOUND
LOCATION MAP
SCALE IN MILES
LONG ISLAND
CLINTON HARBOR
CONNECTICUT
SCALE IN FEET
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

FIGURE 4

The Clinton project, although referred to as a containment facility, is being planned as a marsh creation project. As such, tidal circulation over the marsh and dredged material is necessary for the facility to function as a wetland area. Planning and design reflect attempts to contain the material in a facility that will blend favorably with the existing wetland area on Hammonasset Park. Retaining dikes would be built to help protect the existing and newly created marsh. Their final elevation would be +6 mean low water, or an elevation which corresponds to the various naturally occuring rock formations along the shoreline at the site where the facility would tie into high ground. In addition, there are numerous boulders located in the water which form a relatively straight alignment (out towards Wheeler Rock). They, too are in the +4 to +6 mean low water range and could easily blend in as part of the retaining dike system.

Design Consideration

Facility designs were based on project formulation concepts, foundation soils and hydrologic conditions. Foundation soils, as determined by subsurface exploration and laboratory analyses, are highly compressible and limit the elevation of the dike to approximately 6 feet above mean low water (+6 MLW). The top of the dike elevation coincides with the elevation of natural rock features in the area where the facility ties into high ground. At this elevation, tides and waves would frequently overtop the dike and flood the containment area.

The proposed dike would be constructed of rock and gravel in zero to 8 feet of water. These water depths are too shallow to allow any significant placement by barge. The most economical construction method would be to truck the material from local land sources and spread the material from the shore outward using bulldozers.

The dike would be approximately 4800 feet long with a maximum height of 12 feet at the point of maximum water depth. The dike core would consist of quarry spalls sized up to 400 pounds, a size that would be strong enough to support construction equipment and be heavy enough to resist erosion during construction. Armor stone - slope protection is required on the ocean side of the dike to protect the structure from design wave heights of 4 to 6 feet. This rock slope protection would extend over the top of the dike and would require stone sizes up to 1,500 pounds. A gravel blanket, and, if found necessary, a filter fabric would be placed on the inside of the dike to retain dredged mateiral fines within the facility. Based on preliminary estimates the following quantities of material are needed, which are expected to be available from commercial sources within 30 miles of the site.

Table 8

Construction Materials - Clinton

Material	Quantity, cy
1,000 - 1,500 lb. Armor Stone	13,100
200 - 400 lb. Armor Stone	4,900
1 - 150 lb. Quarry Chips	44,750
Gravel (Bank Run)	3,000

A weir structure approximately 50 feet wide would be required to control circulation in and out of the 100-acre containment facility.

Dredging would be a hydraulic operation with the material pumped directly into the facility. As the dredged material is deposited within the retaining dikes, the elevations of the "mounds" would be carefully observed. The high points would be approximately +7 mean low water while the low points would be submerged at mean low water. This would produce a landscape similar in appearance to the adjacent existing marsh. The marsh creation project would not interfere with the existing marsh, reduce its present size, nor create any undue stress upon it. Rather it would help protect portions (the westernmost area) which are presently subject to slight erosion. When filled to capacity, about 55 acres of Spartina alterniflora marsh would be created on fine gravel materials at elevations between 4 and 5 feet mean low water. Thirteen acres of S. alterniflora would be developed in the predominantly sand structures adjacent to the retaining dikes at elevations between 2.5 and 5 feet mean low water.

Economic Analysis

The economic analysis for Clinton Harbor considered dredging and disposal costs for four alternatives disposal sites: the containment facility, Cornfield Shoals, New Haven and The Race. Two levels of dredging activity, which corresponds to most Probable Future and Minimum Growth scenarios were evaluated. Factors used to evaluate the economics included first costs (containment facility), mobilization and demobilization costs, and dredging costs which are specifically affected by type of dredged plant to be used, project size and transport distance. Hydraulic dredging was assumed for disposal at the containment facility, while a bucket/scow operation was assumed for other disposal alternatives. The costs for each alternative are shown in Table 9.

Table 9

Clinton Harbor Containment Facility
Costs by Alternative

Disposal Site	Dredged Material Quantity 1 MCY	0.5 MCY
Containment Facility		
First Cost [1]		
Dike	$1,347,000	$ 700,000
Wetland Planting	80,000	60,000
Contingency (25%)	357,000	190,000
Subtotal	$1,784,000	$ 950,000
Engineering & Design	71,000	38,000
Supervisions & Administration	107,000	57,000
Total	$1,962,000	$1,045,000
Annual Cost [2]		
Facility	$ 190,000	$ 101,000
Mobilization & Demobilization	69,000	69,000
Dredging	284,000	139,000
Total	$ 543,000	$ 309,000
New Haven Dump Site		
First Cost	--	--
Mobilization & Demobilization	$ 93,000	$ 93,000
Dredging	487,000	238,000
Total	$ 580,000	$ 331,000
The Race Dump Site		
First Cost	--	--
Mobilization & Demobilization	$ 93,000	$ 93,000
Dredging	528,000	257,000
Total	$ 621,000	$ 350,000
Cornfield Shoals		
First Cost	--	--
Mobilization & Demobilization	$ 93,000	$ 93,000
Dredging	406,000	203,000
Total	$ 499,000	$ 296,000

[1] 1984 Costs

[2] Amortized at 8-3/8% for 25 years.

Results. The economic analysis indicates that disposal at the containment facility would be about 9 percent more costly than disposal at Cornfield Shoals; but 7 percent less costly than disposal at New Haven. In effect, the containment facility option is economically competitive with open water disposal because of substantial cost savings associated with hydraulic dredging techniques which offset the first costs of containment.

Socioeconomic Impacts

The socioeconomic impacts of the marsh creation project are summarized below:

- Creation of additional new marsh using dredged material adjacent to an existing but eroding marsh is viewed as a net benefit to the area. This conclusion is based on expressed desires to protect the existing marsh and to add to wildlife habitat in the area.

- The site is relatively distant from residential areas so that potential aesthetic impacts, such as odors and noise, would be small.

- There is potential for increasing existing vector problems. Mitigation measures should be considered if found necessary.

Environmental Considerations

Environmental considerations for Clinton Harbor are based upon information contained in the report entitled, "Environmental Baseline Data Collections and Site Evaluations - Long Island Sound Container Disposal Study Clinton Harbor, Connecticut" prepared in March, 1983 as part of this study. The inshore area, where the proposed containment area would be is located, is subject to chronic physical disturbance, therefore the benthic community is reduced in terms of low richness and density. A September and October sampling program in 1981 indicates that the area is occupied by a community different from that found offshore; species which were common at the inshore location tended to be absent from offshore. The community that occupied this area was closely related to that seen in the shallow subtidal zone, but also contained species generally seen further offshore.

No shellfish were found in any of the subtidal samples. But, Mercenaria mercenaria (hard-shell clam) and Aequipecten irradians (bay scallop) do exist in the area. A local population of Crassostrea virginica (oyster) exists in the intertidal zone at Hammonasset State Park. An insignificant population of Mya arenaria (softshell-clam) is present intertidally.

Only fifteen finfish species were collected during this study with Pseudopleuronects americanus (winter flounder), Paralicthys dentatus (summer flounder), and Menidia meniolia (silverside) the dominant three species. No algae species were found; the soft bottom habitat at the proposed containment area is unsuitable for algae colonization.

In addition to the summer migrations of Pomatomus saltatrix (bluefish) and those collected during the September and October sampling periods, the following marine species are common to the Clinton Harbor area: Morone saxatillis (striped bass), M americana (white perch), Stenotomus chrysops (porgy), Brevoortia tryannus (menhaden), Callinectes sapinus (blue crab), and Mytilus edulis (mussel). (Deleuw et al. 1981).

The proposed containment area has a high potential for biological enhancement of the existing intertidal shores. The proposed dredge disposal areas could be designed and managed to provide for expanded areas of saltmarsh habitat. Both high and low saltmash habitat could be created with protected shallow water areas for fish nursery areas. In addition, the containment would be designed to confine any pollutants present in the dredged material.

Limited mathematical modeling has indicated that placement of a containment facility may restrict tidal flows more toward the eastern portion of the Midddle Harbor as well as modify wave refraction/-diffraction and increase peak velocities (2 to 3 times) in that area. These flow modifications may change bottom and shore topography which could alter the benthic communities. The sediment profile photogrammetry shows rippled bottom generated by undirectional tidal flow. Net average velocities were from 36 to 63 cm/sec.

The potential impacts of locating a containment area in western Clinton Harbor would consist of the following: loss of approximately 100 acres of existing benthic habitat (approximately 145 species and 5,000 to 13,000 individuals per square meter); changes in water circulation patterns, changes in topography due to displacement of currents; and visual aesthetics would change from open water to salt marsh and breakwater.

For the purpose of shellfish control, the containment area is under the jurisdiction of the town of Madison. The Madison Shellfish Commission, which opposes the containment facility, has developed a management plan for aquaculture, shellfish transplanting and cultivation and recreational shellfishing.

As presently considered, the marsh development should be predominately planted with Spartina alterniflora and S pattens marsh. High elevations should be planted with Panicum virgatum and Ammorphilia breviligulata. The dike would present a rocky habitat suitable for colonization by attachment organisms.

The Hammonasset State Park on the western boundary of the proposed site is a significant recreational and biological area. The creation of additional marsh, should mitigate physical impacts of the proposed facility. The existing biological resources are considered important and may require relocation (e.g. clam habitat and fishery spawning areas). Final design should include features to minimize changes in circulation

patterns and existing topography. To assure containment the facility would have to confine all pollutants, and monitoring of organisms, sediments, and the water column would be required. Analysis of productivity and ecological interrelationships would have to be undertaken if the project were to go forward. Additional site-specific investigations would determine the potential for the containment facility to improve the biological habitat value as mitigation. Monitoring would be required to assess mitigiation success and assure pollutant containment.

Inasmuch as portion of the Cedar Island spit has been designated as a barrier beach under the Coastal Barrier Resources Act of 1982 certain restrictions apply. The provisions of this legislation, restricts Federal activities in such areas and would be addressed prior to further consideration of a containment facility in this coastal reach.

BLACK LEDGE

Background

The concept of a dredged material containment facility (DMCF) at Black Ledge was originally considered by the Navy in their final EIS (1976) concerning dredging in the Thames River. It was stated in that report that a "steel pile containment structure approximately 1.5 miles in perimeter" would be required along with the "deposition of between 60,000 and 100,000 cubic yards of riprap material." The riprap, "would be placed on both sides of the piles." While no precise cost estimates were attempted, this disposal alternative was rejected "not economically feasible" and creating "an additional navigation hazard." However, the city of Groton Conservation Commission and Harbor Study Commission (by letter 21 Nov 1977 and 12 April 1979) recommended further consideration of the site as a possible containment facility location.

Site Description

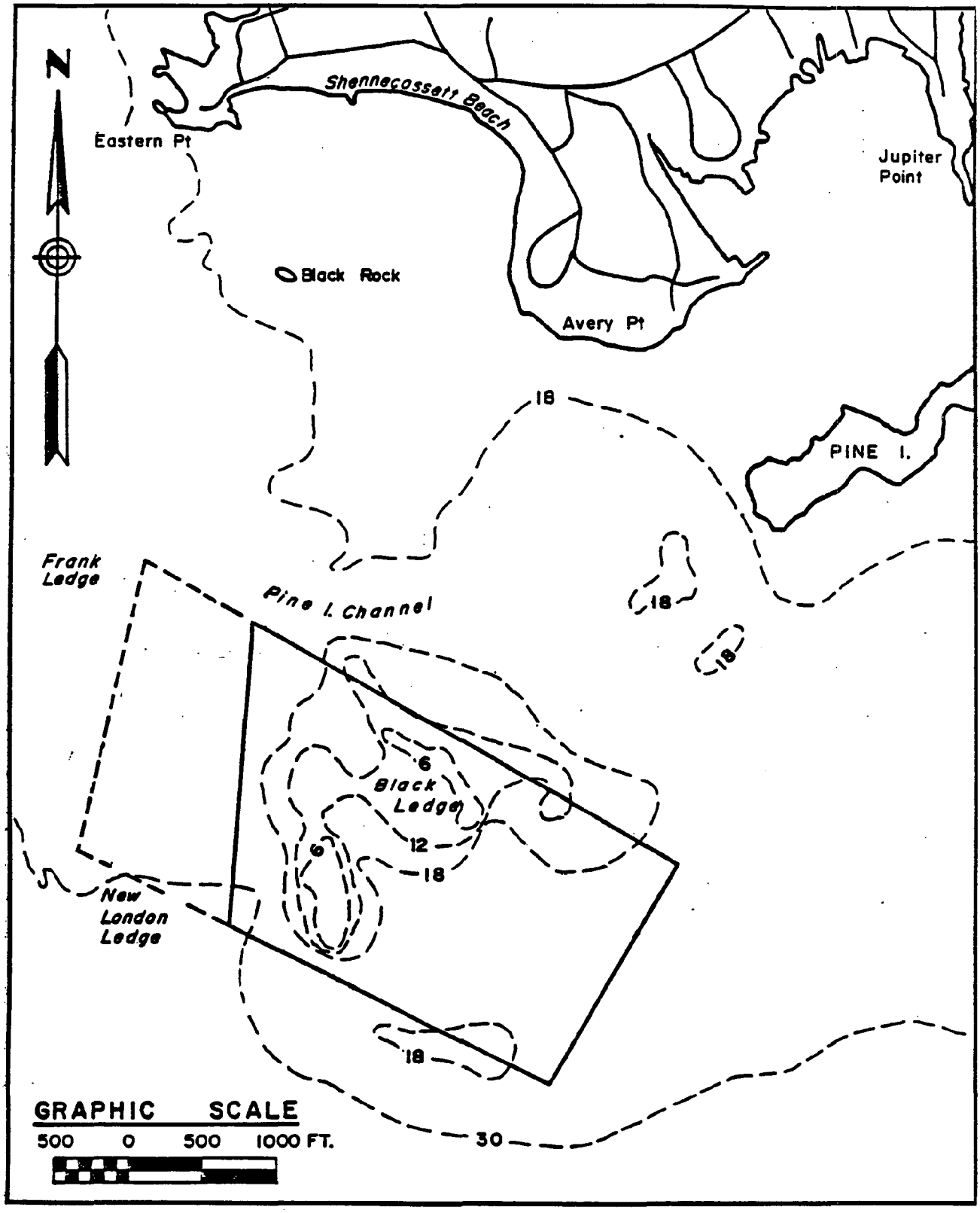
The identified DMCF site at Groton-New London, shown in Figure 5, is located approximately 1 mile outside of the entrance to New London harbor to the east of the harbor entrance channel. The site comprises a rocky shoal area known as Black Ledge where water depths rise rapidly from the surrounding 20- to 30- foot depths (MLW) to less than 10 feet (MLW) over much of the shoal. A small pile of rocks approximately $10m^2$ near the western limit of the ledge is exposed at most tidal elevations. The total area of the shoal (depths within the 18-foot isobath) is approximately $320,000m^2$, or about 0.1 square mile.

The topography of the area is primarily controlled by bedrock, although glaciation has extensively modified the original topography. Maximum land elevations in the area are about 50 feet NGVD. The offshore area is generally flat, with numerous areas of resistant bedrock, such as Black Ledge, providing relief. Minimum offshore elevation at the site is approximately -14 feet NGVD.

Based on the borings and probes performed at Black Ledge, the thickness and nature of the overburden is quite variable. Thicknesses ranged from exposed bedrock to over 40 feet of cover. Up to 8 feet of recent organic, silty sand was recovered. Underlying this material was a sequence of compact gravel, sand, silt and varved clay, which may be glacial in origin. Refusals encountered by the probes were assumed to be bedrock and two of the five borings recovered apparent bedrock samples.

Project Formulation

Black Ledge was considered as a regional containment facility with the primary source of dredged material to come from the Thames River-Groton-New London area. This regional facility could accept material from surrounding harbor such as Niantic Bay and Harbor Mystic River, Stonington



LOCATION MAP, BLACK LEDGE, GROTON, CONNECTICUT

FIGURE 5

Harbor and the Pawcatuck River, or largely, the Eastern Connecticut section of the sound.

The Black Ledge containment facility could meet the disposal needs of the eastern coastal area for a 50-year period. As seen in Table 10 the needs for the region vary from 4.7 million to 9.5 million cubic yards depending on the scenario and future dredging activity. The containment facility could hold about 7.5 million cubic yards of material.

Table 10
DREDGED DISPOSAL NEEDS - EASTERN CONNECTICUT (1985-2035)

Volume of Material, cubic yards

Harbor	Minimum Growth	Most Probable Future	Maximum Growth
FEDERAL MAINTENANCE			
Niantic	80,000	120,000	160,000
Thames	600,000	800,000	1,000,000
New London		500,000	500,000
Mystic	25,000	50,000	75,000
Stonington	--	--	--
Pawcatuck	75,000	100,000	125,000
Subtotal	780,000	1,570,000	1,860,000
FEDERAL IMPROVEMENT			
New London		1,600,000	1,600,000
Others	200,000	300,000	500,000
Subtotal	200,000	1,900,000	2,100,000
PERMIT DREDGING	3,696,000	4,620,000	5,544,000
Total	4,676,000	8,090,000	9,504,000

Source: Long Island Sound Dredged Material Containment Study - Progress Report. Feb 1983

The Black Ledge site would probably be established as a marine wildlife sanctuary. After completion of the outside retaining dikes, filling would be accomplished within interior containment cells which would allow wetlands to be established soon after project completion. The plan for ultimate use would require that approximately 2 feet of fill be placed on top to properly isolate any contaminated material.

Design Consideration

The proposed dike would be constructed of rock and gravel in 5 to 35 feet of water. The dike would be approximately 9250 feet long, extending completely around Black Ledge and creating a 125-acre containment facility. Soil conditions in the foundation area consist of up to 6 feet of surficial deposits of very loose silty sand with shell fragments and plant matter. Original alignments were modified to avoid greater depths (up to 12 feet) of soft compressible soil. The change in alignment also placed the facility 1000 feet more distant from the navigation channel, thereby reducing the potential navigation hazard.

The elevation of the structure would be about +13.5 MLW (+14.5 NGVD). Since the maximum depth of water at the site is up to 35 feet, the dike would rise as much as 50 feet above the floor of Long Island Sound. Design wave heights in the area of the facility are expected to be up to 6 feet high. Overtopping of the dike might occur with waves of this magnitude. Therefore, slope protection would be placed on the ocean side of the dike and over the top of the crest and down the inside slope.

Since Black Ledge is located about 3000 feet offshore, all materials would be transported to the site by barge. Placement of the core material would be by bottom dump barges to about -10 feet MLW. Above this elevation, placement would be by cranes operating from floating barges. Over 1.2 million cubic yards of material would go into building the containment facility, exclusive of two interior dikes which would create the three interior cells.

Table 11
CONSTRUCTION MATERIALS, BLACK LEDGE SITE

MATERIAL	QUANTITY
1,000 - 2,000 lb. Armor Stone	88,800 cy
300 - 600 lb. Armor Stone	27,000 cy
100 - 200 lb. Underlayer Stone	162,000 cy
30 - 60 lb. Underlayer Stone	42,000 cy
Quarry spalls to 50 lb.	883,800 cy
TOTAL	1,204,200 cy

Quarried rock material of suitable quality and sufficient resistance to weathering and disintegration is available from commercial suppliers within a 40-mile radius of the study site. It may be necessary to obtain the desired quantity of quarry spalls from a combination of suppliers.

The Black Ledge containment facility is located far enough offshore to mandate a conventional bucket/scow operation rather than the much more economical hydraulic dredging. The use of barges necessitates a rehandling facility, thereby adding to the cost of the structure and normal dredging operations.

Economic Analysis

The cost of the Black Ledge containment facility is estimated at $40,385,000, exclusive of a weir structure, compartment dikes and a possible rehandling system. Representing an annual cost of nearly 5 million dollars, disposal at the containment facility is more than 4 times more costly than open-water disposal. With the site of the containment facility near the New London open water disposal site, there are no transportation savings and no operational savings since hydraulic dredging would not be used. A summary of the economic analysis is shown below.

Table 12
Black Ledge
Estimated Cost by Disposal Alternatives

Containment Facility	
First Cost	
Dike	$30,595,000
Contingency 20%	6,119,000
36,714,000	
E&D 4%	1,468,000
S&A 6%	2,203,000
Total First Cost	40,385,000
Annual Cost	
Int & Amort (.08395)	3,390,000
Mob & Demob	135,000
Dredging	1,287,000
Total Annual Cost	$4,812,000
New Haven Dump Site	
First Cost	
Mob & Demob	$ 93,000
Dredging	1,188,000
Total Cost	$ 1,281,000
The Race Dump Site	
First Cost	
Mob & Demob	$ 93,000
Dredging	1,188,000
Total Cost	$ 1,281,000

Socio Economic Issues

The socio-economic impacts as summarized below include:

- The large volume of dike material required could result in significant traffic congestion and construction hazards particularly during the short term construction period.

- Because of the large volume of recreational and commercial boat traffic at the entrance of New London Harbor, boating hazards associated with vessel movements to and from the DMCF during development and operation could result. The long operating life of the facility could extend these concerns over a long period of time.

- The island creation project would displace marine life.

- Although the site is some distance offshore, its size would reduce the panoramic view from shoreline. The DMCF island, however, would be similar in appearance to other nearby islands.

- The issue of jurisdiction of the created lands would need resolution.

- Local authorities are concerned that the DMCF could become an attractive nuisance to area boaters and would be difficult to supervise.

- The placement of a containment facility at Black Ledge would act as a barrier and reduce wave heights in the Avery Point area, thereby reducing tidal flood damages.

Environmental Considerations

Black Ledge: The following environmental summary discussion of Black Ledge is based on the report entitled "Environmental Baseline Data Collections and Site Evaluations, Long Island Sound Container Disposal Study-Black Ledge, Groton-New London Harbor, Connecticut". The bottom substrate is composed of three areas consisting of rock (including large angular boulders), sand/gravel (including muddy sand; 0.23 mm average diameter), and silts and clay. The benthic sampling showed 184 taxa representing over five major groups. The dominant groups were polychaetes (41.3%) , crustaceans (26.1%), and molluscs (25.0%). The density ranged from 4,637/M^2 to 65,250/M^2, in the study area. The species diversity ranged from 0.6973 to 4.4363 and the species evenness ranged from 0.1301 to 0.8006, in the study area. The silt/clay substrate stations had the greatest densities (36,672/M^2) followed by the rock stations (9,907M^2) and the sand/gravel stations (7,311/M^2). Species diversity at the shallow rock substratum stations was higher than at the silt/clay stations despite lower species richness and densities. Intermediate depth sand/gravel stations had highest diversities with least faunal densities. The patterns appear to be related to bottom stability.

There appear to be four community types in the study area corresponding to the four sedimentary types. The deposit-feeding community in the muddy area west of the ledge corresponds to the Nucula-Nephtys (bivalve-polychaete) assemblage described by Sanders (1960). The anphipod dominated community was found on the muddy sands with surface particle feeding mode. A mixed community of surface particle and filter feeders with low dominance is found on the gravel. A hard-bottom community dominated by Mytilus edulis is found on the ledge.

Fifty-two species of algae were recorded from subtidal stations. Rhodophyta species (Red Algae) comprised between 64 and 70 percent of the total species recorded at each station. Species richness and dominance was not related to depth or location. Chondria tenuissima (red algae) was the dominant species. The dominance patterns were strongly influenced by the dense concentrations of Mytilus edulus (blue mussel). Epiphytic and ephemeral species were dominant because of the substrate provided by M edulus and competition for hard substrate.

The Black Ledge area is a heterogeneous benthic habitat supporting a diversity of species. The high abundance of organisms suggests that the area provides food and habitat for large invertebrates and fish. The area experiences strong and periodic scouring. The placement of uncontained material would experience rapid dispersal.

The proposed facility would affect directly about 150 acres of productive benthic resources and remove approximately 75 percent of the existing Mytilus edulus community from the area. The facility would cause accumulation of finer grained sediments on the leeward side which may affect the surrounding benthic habitat.

The construction of the containment breakwater would replace some rocky habitat for Mytilus edulis and associated orgainism. A saltmarsh could be planted within the containment facility to provide a high value habitat. The proposed containment facility would impact on approximately 150 acres of significant biological resources. With proper design and alignment, impacts could be reduced and mitigated by new marsh creation.

If this project were to proceed, site specific studies would have to be undertaken to determine the kind and extent of mitigation required to compensate for the biological and other impacts. These studies would include existing natural resources, commercial and recreational fisheries, biological productivity, visual changes, odor, noise, aesthetic affects, land use, and archaeological resources.

PENFIELD REEF

The Fairfield Conservation Commission recommended consideration of this site, which is located offshore of the town's beach area. The primary use would be to provide a containment facility for dredged material disposal and at the same time provide a secondary use as a tidal flood and shoreline protection structure.

Background

Extensive shoreline changes have occured in the Fairfield coastal and Penfield Reef areas. At the time Fairfield was settled in 1639, a 2-mile barrier beach and system of sand dunes existed on the coastline. Historical records show that a peninsula and island extended well over a mile from Shoal Point. Early accounts describe a 100-200 acre peninsula used by early colonial farmers to pasture sheep and cows. In addition to grazing, the peninsula was also used as a source for ballast stones by early shipping interests. The overgrazing and removal of stones left the island without protection from natures forces. Wind and waves began to erode the soil and the peninsula soon became an island, then a hammock, then a bar, and today a reef of constantly decreasing elevation. The material from the reef first moved to extend the barrier beach. After removal of the material from the peninsula that served to replenish the beach, the beach began to erode, much to the concern of shoreline residents who moved onto the beach. Therefore, the town of Fairfield, through construction of the containment facility, hopes to meet not only navigation related needs as well as recreating a shoreline configuration that existed 300 years ago.

Site Description

Penfield Reef now consists of a small offshore island and a cobble covered submerged ridge extending about 1 mile from the shoreline at Shoal Point. The ridge elevations vary from -2.7 NGVD (+0.2 MLW) at the west end shoreline -13.7 (-10.8 MLW) at the east end. The eastern one-fourth is submerged at mean low water. The mean tide range at the site is 6.9 feet with a spring tide range of 7.9 feet. The 100-year stillwater tide elevation is 10.4 feet NGVD. Design wave heights are 6.5 feet from the north and 5.0 feet from the south.

Soils in the area vary from sand and silt to sand and gravel. Although borings and probes were carried to depths of up to 40 feet bedrock was not encountered.

Project Description

Project formulation considered two configurations for a containment facility at Penfield Reef (see Figure 6). The initial plan, envisioned a long narrow peninsula extending more than 1 mile from shoreline closely duplicating the original peninsula which was eroded away. The site would

contain about one million cubic yards of material at a cost of about $8 million. Alternatively, if the outer portion of the peninsula were widened into a containment island, up to 4.3 million cubic yards could be contained. Even with a higher cost of $8.6 million, the result would be a significantly more efficient structure. This facility would contain the 4.3 million cubic yards with a dike about 16,000 feet long in an area of about 300 acres.

The dike would be constructed of rock and gravel in zero to 15 feet of water. The most economical construction method would be to truck material obtained from local land sources spreading it from shore outward using bulldozers. Water depths are shallow so as to preclude use of barges. The dike would be designed with a crest elevation of 10.6 feet NGVD. This crest could be overtopped if the 6.5-foot design wave were to occur. Armor stone of up to 2750 pounds each would be placed on the ocean side and extended over the top to provide slope protection.

An optional feature of the containment facility as proposed by Fairfield was to provide a reservoir of clean sand outside of the diked area. This would serve as a sacrificial sandbar varying in size depending on current scouring action and rate of replacement. Littoral drift would sweep this sand westerly to replenish the Fairfield coastal beaches which are rapidly eroding and receding. This process would duplicate the process of the last 200 years which saw the gradual deterioration of the peninsula. To verify the effectiveness of this concept, along with the design of the near-shore area, requires more study.

Dredging Operations

The Penfield containment facility could meet the disposal needs of several surrounding harbors for at least a 25-year period. These harbors, including Westport Harbor/Saugatuck River, Southport, Bridgeport/Black Rock Harbor and the Housatonic River, are from 2 to 8 miles distant from Penfield. Actual distances and comparable distances to open-water disposal areas are shown below.

Table 13
Distance to Alternative Disposal Site (Miles) - Penfield

Harbor	New Haven	WLIS III	Penfield
Westport/Saugatuck River	25	10	7
Southport	20	14	3
Bridgeport	15	19	4
Black Rock	18	19	2
Housatonic	11	23	8

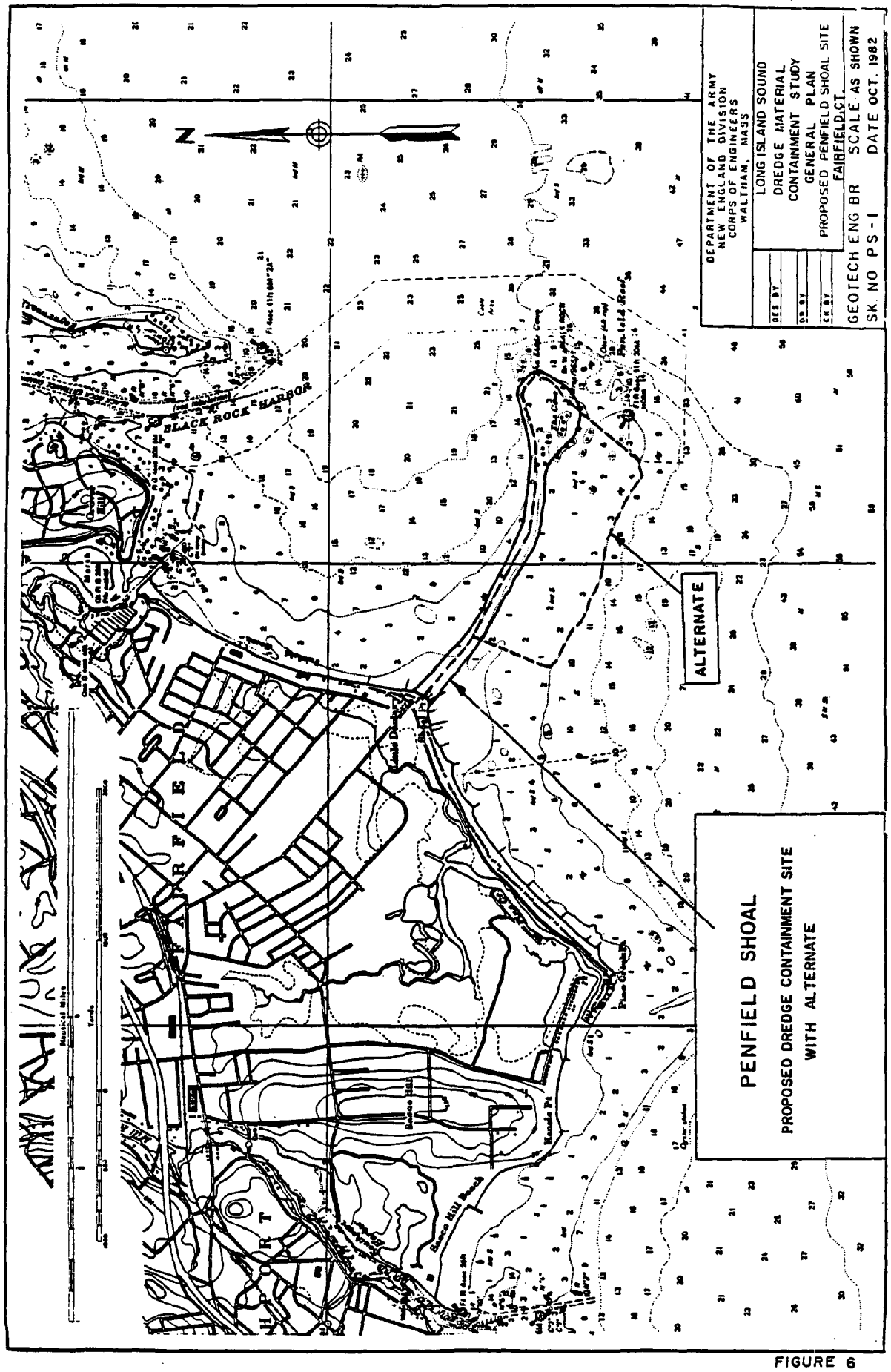

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS
LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
GENERAL PLAN
PROPOSED PENFIELD SHOAL SITE
FAIRFIELD, CT.
GEOTECH ENG BR
SCALE AS SHOWN
SK NO PS-1
DATE OCT. 1982
DES BY
DR BY
CK BY
ALTERNATE
BLACK ROCK HARBOR
PENFIELD SHOAL
PROPOSED DREDGE CONTAINMENT SITE
WITH ALTERNATE

FIGURE 6

The volume of material that could be expected from the above mentioned harbors has been estimated for the 50-year period 1985-2035. Table 13 summarizes these volumes for the Minimum Growth and Most Probable Future conditions for both Federal and non-Federal dredging operations. Based on these volumes and the 4.3 million-cubic yard capacity, the containment facility would meet disposal needs for these harbors from 24 to 41 years depending on level of activity.

Table 14
Penfield Reef Containment Facility
Potential Contributors and Volume of Dredged Material (1985-2035)

	Volume of Material (cubic yards)	
FEDERAL MAINTENANCE		
Harbor	Min. Growth	Most Probable Future
Westport/Saugatuck	20,000	70,000
Southport	100,000	150,000
Bridgeport	1,925,000	2,475,000
Housatonic	800.000	1,000,000
Sub Total	2,895,000	3,695,000
FEDERAL IMPROVEMENT		
Bridgeport	0	2,500,00
Black Rock	150,000	150,000
Others	200,000	300,000
Sub Total	350,000	2,950,000
NON-FEDERAL		
Subtotal	1,996,000	2,495,000
Total	5,241,000	9,140,000
Ave. volume per year	105,000	183,000
Years to fill a 4,300,000 cy DMCF	41	24

A hydraulic dredge could be used at Black Rock Harbor, but with distances of from 2 to 3 miles, a booster pump would be required. For other harbors, mechanical dredging with bucket/skow would be the most likely method of operation. This could necessitate either a pump-out facility or rehandling basin at the containment facility to offload the barges.

Economics

The estimated first cost of the Penfield containment facility is $8.6 million. The annual costs are summarized below.

Table 15
Costs by Disposal Alternative

	Min Growth	Most Prob.
CONTAINMENT		
First Cost		
Dike	$ 8,596,000	
Contingency 25%	2,149,000	
	10,745,000	
E&D 4%	430,000	
S&A 6%	645,000	
	$11,820,000	
Annual Cost		
Amort. 8-3/8 %	$ 1,031,000 (40 yr)	$ 1,143,000 (25 yr)
Mob & Demob. (2)	270,000	270,000
Dredging	1,365,000	2,379,000
Total	$ 2,666,000	$ 3,792,000
NEW HAVEN		
Mob & Demob. (2)	$ 186,000	$ 186,000
Dredging	1,260,000	2,196,000
Total	$ 1,446,000	$ 2,382,000
THE RACE		
Mob & Demob. (2)	$ 186,000	$ 186,000
Dredging	1,575,000	2,745,000
Total	$ 1,761,000	$ 2,931,000

Disposal at the Penfield DMCF is about 1.5 times more costly on an annual basis than open water disposal, reflecting primarily the cost of the containment facility.

Environmental Considerations

The following environmental information is based on a report entitled, "Analysis the Site Evaluation for Long Island Sound Container Disposal Sites" (May 1984). Penfield Reef is comprised of the eroded remants of an offshore island and a tombolo extending approximately 1 mile west to the Shoal Point shoreline. The tombolo is exposed at low water and provides shelter to Fairfield Beach and Black Rock Harbor to the north. The seaward side of the tombolo is fronted by a terrace of hard

sand, extending roughly 2000 feet offshore to the 6-foot depth contour (MLW). The crest is armored with coarse gravel and cobble, evidence of the repeated agitation provided by breaking waves during high tides. Under less extreme conditions, the shallow, mild sloping profile of the terrace produces a wide surf zone characterized by spilling breakers.

In 1982, a summer benthic survey found the hard-bottom macrofaunal and algal communities of the shoals to be productive. The area supported 122 benthic invertebrate taxa and 23 species of algae. The dominant forms were the amphipods Jessa falcata, Corophium sp, and Caprella penantis. These three taxa in equal proportions, represent approximately 80 percent of the total number of individuals recorded. These organisms are typical of hard-bottom northeast environments. The soft-bottom density averaged 1230 individuals per square meter for the 11 stations sampled. The polychaetes Mediomastus sp, Spiophanes bombyx, and Streblospio benidicti were the dominants at several stations, while the bivalve Mulinia lateralis, the gastropod Actecina canaliculata, and several oligochaetes were dominant at two stations.

During summer 1983, a benthic survey of the area recorded 112 macrofaunal taxa which were represented by polychaetes (45%), crustaceans (23%), and molluscs (20%). The density was 5516 per square meter for the 15 stations sampled. The capitellid polychaete Mediomastus ambiseta was the most dominant organism followed by the bivalve Tellina agilis.

The variation in density and species composition is an indication of the changing environment in the area of the proposed containment facility. The area appears typical of this kind of habitat for the northeast and does not appear to support any unique species or community assemblages.

If the proposed dredged material containment facility were to consist of a diked structure aligned with the axis of the tombolo, it would not extensively encroach on the terrace. The facility would lie within the present limits of the surf zone and might prevent overwash to the northern side of the reef which would minimially decrease the supply of sediment to this area. Water quality impacts would occur during construction of the facility. The proposed facility would eliminate approximately 300 acres of productive benthic habitat, which includes some hard-bottom habitat. In addition, potential impacts include: creation of salt-marsh habitat, aesthetics change from open water to a containment facility, noise, odor and dust increases, and confinement of pollutants.

The containment area, however, would offer potential for expanded areas of saltmarsh habitat and would confine any pollutants present in the dredged material.

If Penfield Reef is considered further for a containment facility, then additional site-specific studies would have to be undertaken to assure that the alignment impacts the least productive area and that

adequate mitigation/compensation measures are indentified. These studies would include: biological productivity, water quality, sedimentology, social concerns (eg noise, odor, dust, aesthetics), and archaeological resources.

Other Impacts

The Fairfield Conservation Commission has summarized other positive and adverse impacts. Benefits would include:

- Increased storm and hurricane wave protection to the hundreds of homes along the shoreline.
- Increased protection for any direct beach nourishment program.
- Provision for continually resupplying sand to the naturally eroding beaches through programmed depletion and resupply of sacrificial sand around the peninsula.
- Restored protection to Black Rock Harbor from south and southwest waves by reducing their fetch from 20 miles to 1 mile.
- A tendency to reduce the normal drift of available sand due to a lower wave energy regime in the lee of the peninsula.
- Provision for enhanced public and private property values in Fairfield and Bridgeport.
- Public recognition and commitment to correct a serious beach erosion problem which will result in loss of dense residential development. Such commitment could include establishing a shore management board, guiding the public and private use, restoration and management of the barrier beach, peninsula, shore, dunes and tidal wetlands in Fairfield.
- Utilization of an existing hazard to navigation thereby reducing its threat to commercial and recreational boating. By recreating the peninsula above the existing reef, local mariners will be less inclined to "jump the bar" and go around as a result.
- Provision for long-term, cost-effective maintenance and expansion of harbors, channels and marine-oriented facilities in the Greater Bridgeport Region.
- Provision for recycling dredge spoil currently viewed as a waste product by most people today.
- Provision for creating new wildlife habitat.
- Expansion of existing public park and marine areas. Since the Peninsula would be developed from the sea floor as an extension of Fairfield, it is anticipated it would remain as a public resource.
- Expansion of public recreational beach for fishing and swimming with maintenance responsibility contingent upon the uses approved by the town.
- Possibility of increasing shellfish production by decreasing the opportunity for sewage effluent/suspended sediment from reaching the beds during the critical summer spawning period. Because of this effect, local oyster companies have indicated preliminary support for this proposal.
- Increased protection of the sanitary sewer outfall, thereby reducing the likelihood of pipe failure in the nearshore area.

Adverse effects of recreating Penfield Peninsula could include:

- Possible objection of beachfront property owners in close proximity to the base of the peninsula during the construction period.
- Outright loss of habitat for fish, shellfish, lobsters, etc., due to the physical covering of the reef by the "footprint" of the peninsula. However, new sediments deposited in the area could actually increase fish and bottom-dwelling organisms by introducing more diversity in habitat.
- Loss of small-boat navigation over the Reef at high tide.

In general this area currently produces excellent fishing for striped bass, tautog, blue fish and weak fish and would be expected to continue to do so. Public harvests of shellfish would not be affected because the area is closed due to the proximately of the sewer outfalls from Fairfield and Black Rock Harbor.

MILFORD HARBOR

Background

The Long Island Sound Dredged Material Containment Study identified six potential containment sites along the Milford shoreline as part of its site screening process. This list was supplemented by three additional sites which were recommended by local interests. One of these sites, which was identified by the Milford Harbor Improvement Commission was selected for detailed study. The site is situated in the outer harbor area adjacent to the Federal channel and is easily accessible to dredging operations.

Site Description

Milford Harbor is located at the mouth of the Wepawaug River midway between Bridgeport and New Haven. It is used chiefly for recreational boating. The Federal navigation project at Milford provides for two riprap jetties at the mouth of the river, a channel into the outer harbor, about 4000 feet of channel into the inner harbor and about 10 acres of anchorage area. Extension of the anchorage was investigated, but action was deferred at the request of the city.

The coast in this area has an irregular shoreline with points and headlands separated by coves which, at this location, is referred to as "the Gulf." Currents and sediment transport in this coastal reach have created wide sandy beaches to the west while Gulf Beach on the east shore is naturally cobbly and narrow because of erosion. A beach restoration project here has provided for a sandy 1200-foot long public beach about 100 feet wide.

Project Formulation

In identifying a potential containment facility at Milford, local interests were interested in providing a site to accomodate dredged material from their harbor. This concept is set forth in the town's Coastal Management Plan with the possibility of using such a containment area for expanding the public lands in the coastal area. A site located adjacent to the harbor entrance would allow public access and be within pumping distance for hydraulic dredging operations.

The Harbor Commission originally identified a site offshore from Burns Point and Fort Trumbull Beach (see Figure 7) on the west side of the Federal channel. A facility about 500 feet x 1000 feet would hold about 400,000 cubic yards, which would accommodate dredging needs for nearly 50 years.

Table 16
Milford Harbor
Dredged Material Disposal Needs 1985 - 2035

	Dredged Material Volume, 1/ cubic yards		
	Minimum Growth	Most Probably Future	Maximum Growth
Federal Maintenance	120,000	240,000	240,000
Federal Improvement		(None envisioned)	
Permit Dredging 2/	95,000	190,000	190,000
	215,000	430,000	430,000

1/ Source: Progress Report
2/ Based on same percent of regional total as Federal Maintenance

During early site review and coordination, the Milford City Engineer, suggested the facility site be moved to the eastern side of the channel to take advantage of the ocean currents and the littoral drift process. If the containment facility were located on the westerly side of the channel the erosion process at Gulf Beach would result in a build up of sand within the harbor channel and require more frequent maintenance. If the containment were constructed on the easterly side of the channel the sand buildup would occur in the Gulf Beach area due to the westerly nature of littoral drift. The sand accretion would benefit the beach area, while the scouring action on the west side of the containment would tend to prevent littoral sand accumulation in the harbor channel. As presently sized, the facility would contain about 270,000 cubic yards which would accommodate from 25 to 50 years of dredging - depending on level of activity.

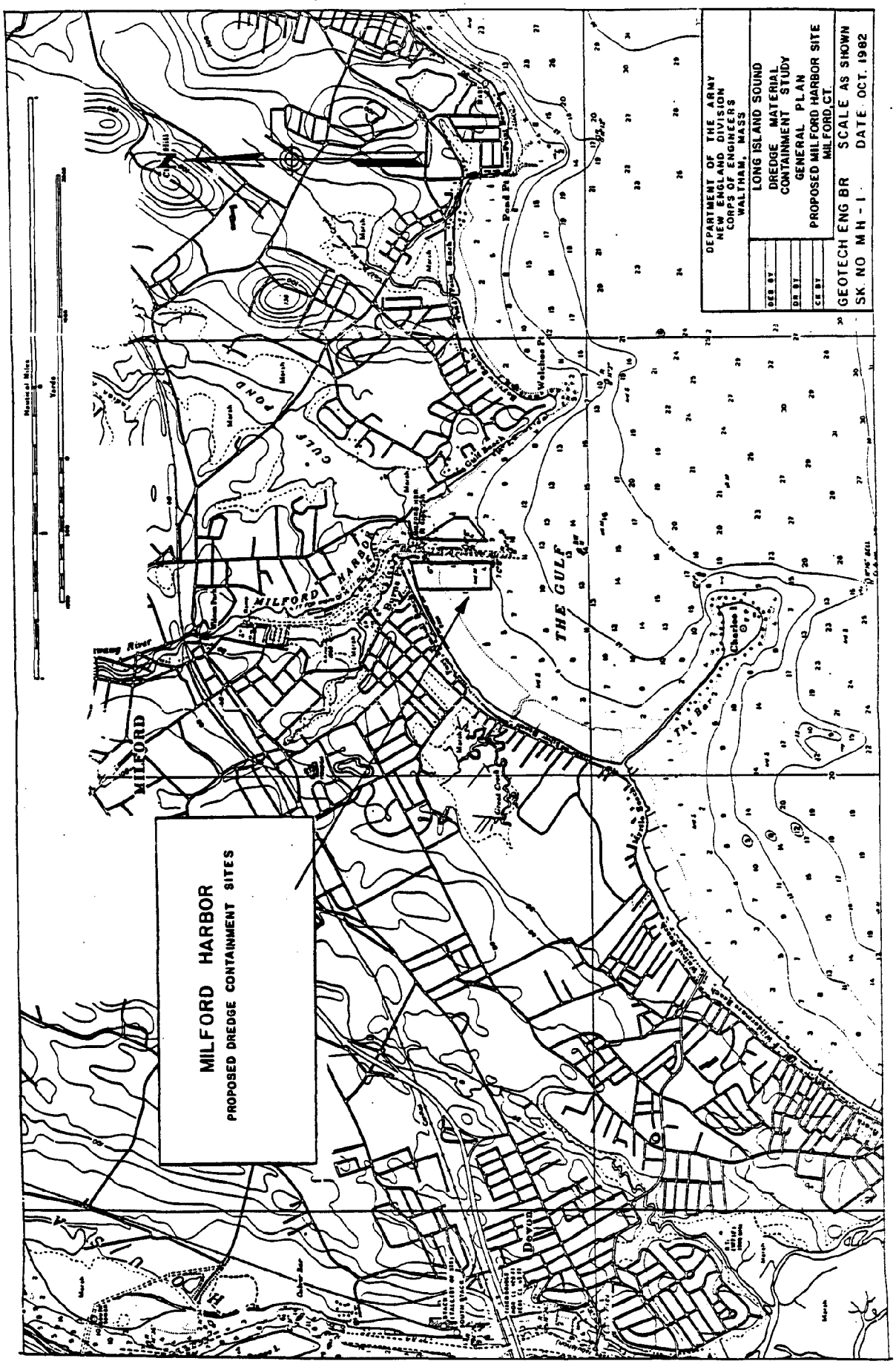

MILFORD HARBOR
PROPOSED DREDGE CONTAINMENT SITES
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS
LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
GENERAL PLAN
PROPOSED MILFORD HARBOR SITE
MILFORD, CT.
GEOTECH ENG BR
SCALE AS SHOWN
SK. NO MH-1
DATE OCT. 1982
MILFORD
MILFORD HARBOR
THE GULF
GULF POND
Devon

FIGURE 7

Design Considerations

Subsurface conditions at the eastern site appear suitable to support a dike constructed of quarry chips protected by armor stone. Overburden soils, as determined by subsurface explorations, are predominantly loose to dense granular materials. The facility would be located in water depths from zero to 14 feet at mean high tide. The most economical method to construct the dike core would be to dump material obtained from local borrow areas, and then spread the material from the shoreline outward using bulldozers. Barge placement of the dike core would not appear possible due to the shallow water depths.

The material selected for the dike core must be strong enough to support construction equipment and heavy enough to resist erosion from tidal fluctuations during construction. Quarry chips up to 150 pounds in weight would meet the above criteria, however, they would probably be too pervious to retain the dredged material. Therefore, an 18-inch thick gravel blanket would be placed on the containment sideslope to retain the dredged material.

The ocean sideslope could be impacted by up to 5.5-foot design waves. A 4-foot layer of 750-pound to 1250-pound armor stone would be required to protect the ocean side from erosion. The armor stone could be placed using crane(s) situated at the crest of the dike core.

The crest (elevation 9.5) of the proposed dike would be protected from overtopping waves by extending the armor stone over the crest of the core. The gravel blanket that would be placed on the containment side slope of the dike to retain dredged material could be damaged by the overtopping waves. It is expected that periodic maintenance would be required to repair the gravel blanket until the containment facility was filled.

The following material would be required to construct the proposed Milford Harbor dredged material containment facility:

Table 17
Construction Materials - Milford

Materials	Quantity
750 to 1250 lb. Armor Stone	20,900 CY
Quarry Chips to 150 lb.	73,700 CY
Gravel	4,200 CY

The construction materials listed above are available from developed and undevelopeed sources within a 30-mile radius of the proposed site.

Economic Analysis

Based on analyses to date, the cost of the Milford Harbor dredged material containment facility is estimated at $2,612,000 (see Table 18) exclusive of a weir structure and interior compartment dikes if necessary. Considerable savings ($93,000 or $160,000) in dredging costs are available from possible use of a hydraulic dredging operation instead of transporting the material to the New Haven Disposal Area with a bucket/scow dredging operation. However, these are not enough to offset the costs of a containment facility, and annual costs are about 50 percent higher than open water disposal. These increased costs would have to be balanced against other benefits such as sand accretion in the Gulf Beach area, possible reduced maintenance requirements in the Federal channel, potential future public use of the containment facility and reduction of wave heights in the harbor.

Environmental Considerations

Environmental consideration are based on a report prepared for this study entitled, "Ecological Surveys of Penfield Reef and Milford Harbor" (November, 1982). Benthic sampling was conducted during the summer 1982 but biologist-divers were restricted by both high wave surge and low visibility problems during the entire survey. The Milford Harbor represents a typical productive northeast estuarine habitat. The qualitative visual impressions of the substrate were: few lobsters in area, high number of flounder, many crabs: Limulus polyphemus and Pagurus sp., several sponges, and algae cover: Laminaria sp, Fucus sp. The substrate appears to be predominantly reef with cobble and gravel and some interspersed sandy areas.

The data indicated a unique assemblage of taxa on the reef dominated by three (3) amphipods: Caprilla penantis, Jassa falcata, and Corophium sp. In addition, there was a high diversity of species associated with hard substrates. The soft substrate is dominanted by polychaetes Staeblospio Benedicti, Scoloplos sp., and Scolecolepides sp. Twelve stations were surveyed. The number of taxa ranged from 8 to 48 with density from 284 to 24,872 per square meter. The dry biomass was generally low and ranged from 0.01 to 20.59 gm. The stations appear to have high species diversity.

Limited information is available on the biological resources of the containment area. The Milford area supports the leading market area for both oysters and hard-shell clams. Site specific studies would have to be undertaken if this area is considered further for a proposed containment facility. These studies would include: existing biological resources at the containment site (data presented above is from a nearby area); biological productivity; recreational and commercial fisheries; water quality, circulation and current patterns; social concerns (eg. aesthetics, noise, dust, odor); and existing land uses. Based on given

Table 18
Milford Harbor
Costs by Disposal Alternative

Containment Facility	
First Cost	
Dike	$1,900,000
Contingency 25%	475,000
	2,375,000
E&D	95,000
S&A	142,000
Subtotal	$2,612,000
Annual Cost	
Int & Amort (.08291)	$ 216,000
Mob & Demob	$ 69,000
Dredging	$ 93,100
TOTAL COST	$ 378,000
New Haven Dump Site	
First Cost	-
Mob & Demob	$ 93,000
Dredging	159,600
TOTAL COST	$ 252,600
The Race Dump Site	
First Cost	-
Mob & Demob	$ 93,000
Dredging	186,200
TOTAL COST	$ 279,200

information and with proper alignments of the proposed facility, it is felt that significant biological impacts could be mitigated.

SHERWOOD ISLAND BORROW HOLE - WESTPORT

During construction of the Connecticut Turnpike, fill was obtained from several subaqueous borrow pits along the LIS coast. The Sherwood Hole is one of the sites suggested as a possible dredged material disposal area by the Aquaculture Division of the Connecticut Department of Agriculture. As such, the Sherwood Hole is not a containment facility per se even though the material is contained.

The Sherwood Hole is located about 1000 feet offshore of Sherwood Island State Park (see Figure 8) and situated in an area where water depths are normally about 20 feet. At the borrow hole, however, depths of an additional 30 feet are present. Volumes calculated for the capacity of the hole, based on hydrographic surveys, indicate that the about 750,000 cubic yards could be contained based on filling to an elevation of -30 MLW. Such a capacity could handle the dredged material needs from the Westport/Saugatuck River area, Southport Harbor, and other areas for the next 50 years (see Table 19).

Table 19
Dredged Material Disposal Needs (1985 -2035)
Westport, Saugatuck R. and Southport Harbor

	Volume of Material		
Federal Maintenance	Minimum Growth	Most Probable Furture	Maximum Growth
Westport/Saugatuck R.	70,000	70,000	140,000
Southport	100,000	150,000	200,000
	170,000	220,000	340,000
Federal Improvement		(None envisioned)	
Permit Dredging 1/	170,000	220,000	340,000
TOTAL	340,000	440,000	680,000

1/ Assumed same as Federal Maintenance.

The Sherwood Hole is representative of other such borrow pits along the LIS coastline, specifically Morris Cove and Prospect Beach in New Haven and Laurel Beach in Milford. Three issues need to be considered regarding their use as disposal areas.

1. Environmental conditions are generally anoxic/anaerobic with little life. Filling the hole would serve to reclaim these areas.

2. The areas may be surrounded by environmentally sensitive areas such as shellfish beds. Generally only clean material should be disposed of in these areas.

3. Filling in the holes may preclude further use as a borrow pit.

These sites could meet the disposal area needs for small harbors such as Westport, but they do not exist in sufficient numbers to meet disposal needs for the LIS region.

Environmental Considerations

In the summer of 1983, benthic grab samples were undertaken at 15 stations recording 49 taxa represented by polychaetes (39%), Molluscs (33%), and crustaceans (14%). Mulinia lateralis (filter-feeding bivalve) accounted for 55 percent of the individuals collected followed by Mediomastus ambiseta a deposit-feeding capitellid accounting for 21 percent M lateralis is an opportunistic bivalve requiring a stable bottom environment (Rhoads, 1974). The second survey (also taken in summer 1983) show similar results but with a decrease in the number of taxa and density. The most dominant species was M lateralis, but the second was Streblospio Benedicti, an opportunistic polychaete. The sediments within the pit appeared to be somewhat anoxic and, therefore, the benthic community was greatly reduced.

The density of infauna within the pit was less than half of the density for the entire study area. The exception to this is the number of taxa, species diversity, and species evenness for two of the five pit stations which were higher than the mean for the entire study. The higher number of taxa, species diversity, and species evenness for two stations within the pit indicates that the pit may be filling in at those locations. If the pit were to be filled to within several feet or the surrounding substrate, the benthic community would resemble that of the surrounding area.

The filling and capping of this area should produce negligible changes in wave and current charachteristics in the area. With an overlaying cover of coarse sand, it is probable that a stable cap would not erode and disperse the contained fill beneath. There appears to be low potential for water quality impacts if appropriate capping procedures are followed.

The area appears not to be ecologically significant. With the filling of the pit, the area would gradually return to an ecological environment similar to other areas along the coast. Extensive hard clam and oyster beds lie in close proximity to the pit. Care in handling and timing of disposal should minimize impacts to these resources.

With the existing proposal and the low numbers of organisms, the only additional studies required would be to assure that disposal methodologies would contain all pollutants within the pit.

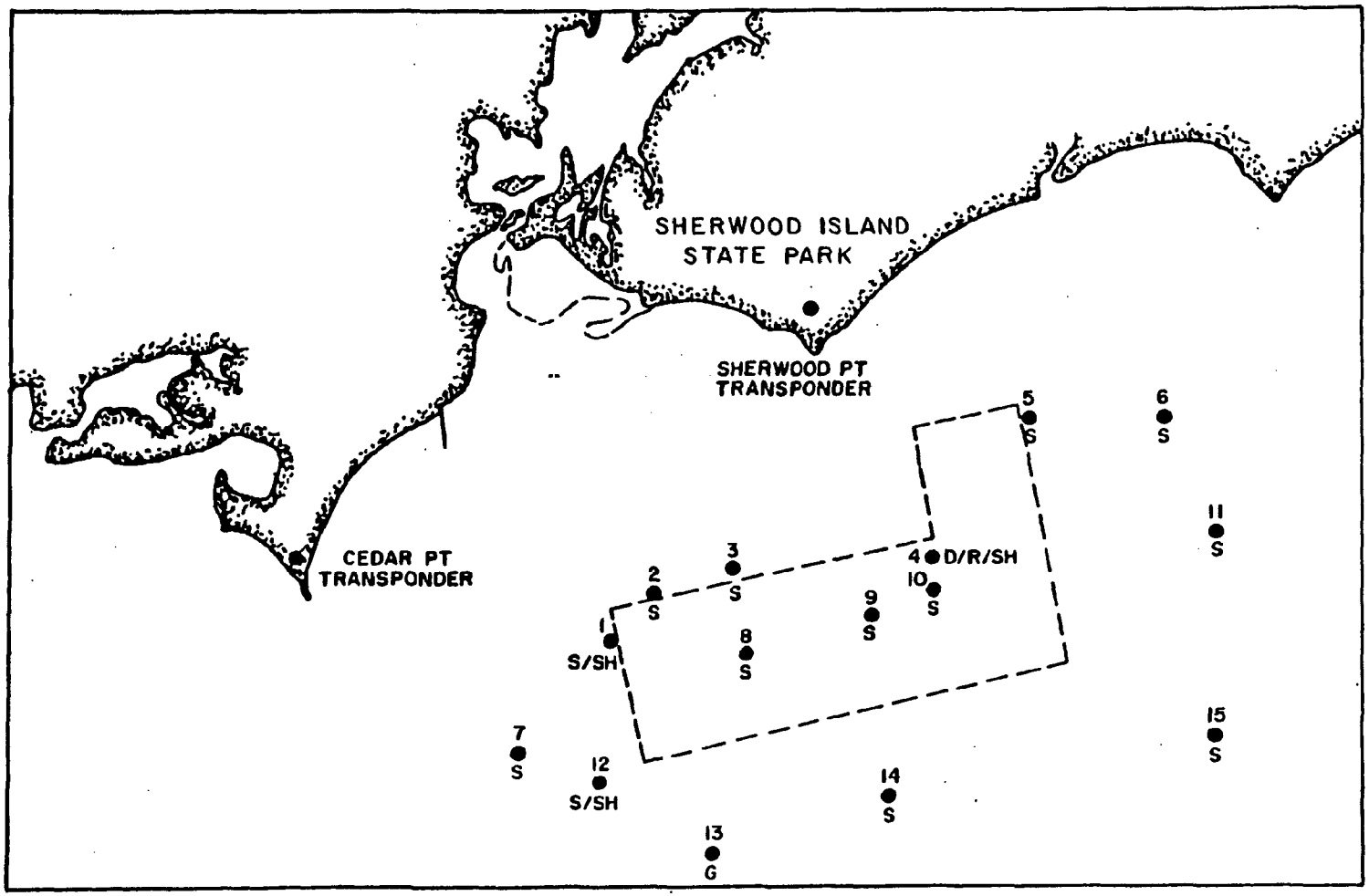


Figure 8 Station locations and sediment types at the Sherwood Island Borrow Pit Site, July 1983. D: detritus; G: gravel; R: rock; Sh: shell debris; S: silt.

VIII

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

Discussion of Results

This study determined that general resource maps and screening information provide a valuable start to analyzing environmental and engineering aspects of containment sites. However, the LIS coastline exhibits considerable variation, so that progressively more detail is needed to test project feasibility. For instance, a site on the Thames River in New London, Connecticut seemed optimally situated for a containment facility. However, examination of existing data records indicated very poor foundation conditions so as to make any construction infeasible. In other areas such as Clinton Harbor, it was only when subsurface explorations were completed that soft, silty sands were discovered which required special, more costly design considerations.

Similar variations exist with regard to environmental resources. Potential facility locations that were identified based on shellfish resource maps were found to be completely unacceptable by local interests. In other instances, environmental sampling and testing indicated that even in areas with generally high environmental value, there are pockets of lesser biological activity where containment facilities could be sited without major impacts.

The actual location of potential containment facilities plays an important role in determining their economic feasibility. With sites located adjacent to, or within 1 mile of, the dredging location, it is feasible to use a hydraulic dredging operation at a savings over a bucket/scow operation. Therefore, Clinton tested out marginally feasible, while other sites were far from feasible. However, as evidenced by the analysis at Milford, assuming hydraulic dredging does not guarantee economic feasibility.

Data obtained during this study are found in a series of reports covering major topics such as site screening, socialeconomic studies, environmental studies and engineering studies. These reports are listed in this report in the section on "Related Reports and Programs". They provide a starting point for any future consideration of containment in LIS and more specific information for the five sites studied in detail. Of course, updates and more detailed studies would be necessary if any site progressed toward implementation. For instance, no formal environmental reports or review procedures have been conducted to date since there are no project proposals associated with this study.

CONCLUSIONS

The containment study has generated considerable public interest, in part because the Sound touches the lives of many people, and also because the disposal of dredged material has been a long standing and emotional issue in the region. Reaction to the study was generally favorable on the part of those who were seeking alternatives to the present disposal scheme. Public involvement continued very high during the site identification and screening phase of the study. During this process, a considerable amount of negative reaction evolved as people reacted to siting of facilities in their harbors.

The study process identified over 300 potential containment sites. These were screened based on technical criteria and public input resulting in 22 sites which were given individual consideration. A summary of these sites is shown in table 20.

This study verified that the public and resource agencies feel very strongly toward protecting environmental resources that are present along the LIS coastline. In our experience, more often than not, siting of a containment facility was rejected because of environmental resources - especially shellfish areas.

There were instances where public attitudes, project economics and environmental considerations did come together in favorable combinations. Of the sites studied in detail, Clinton Harbor initially exhibited the highest degree of such positive results. The project competed favorably economically, could provide environmental benefits, and generated public support. However, the outlook for the project remains dim because of conflicts with federal barrier beach legislation, aquaculture plans, and the State designated natural area at Hammonassett State Park. The summary of findings at Clinton and at the other sites studied in detail is shown in table 21.

It is Corps policy that local interests must provide the disposal area for Federal projects and be responsible for associated costs which may include dikes. The current cost-sharing policy for Federal maintenance of waterways and harbors favor a town decision to stay with open-water disposal as it requires no local cost-sharing nor other capital expenditures. This economic incentive is not available to private dredging interests.

The findings of this study conclude that under present conditions containment is not a feasible alternative for the disposal of dredged material in Long Island Sound. This does not rule out the need or desirability to evaluate the use of containment on a local case-by-case basis. Nor does it rule out possibilities where containment may be the optimal disposal solution, for example, when dredged material does not meet ocean dumping criteria or when it must be capped if ocean disposed.

TABLE 20
SITES SELECTED FOR INDIVIDUAL INVESTIGATION
SUMMARY OF EVALUATION CRITERIA

Number	Site	Location	Technical	Environmental	Economic	Social
1.	Captains Harbor	Greenwich Conn. - 1.25 miles offshore	Feasible, but limited size, high erosion forces.	Open water and islands high biological productivity.	N/E	Opposed by coastal residents.
2.	Norwalk Island	Norwalk Harbor, Conn.	Increased navigation hazards.	High biological productivity and concentrations of finfish and shellfish. Barrier island designation.	Near dredging operations.	Public concerns over environmental value and nearby recreation.
3.	Milford Point	Milford, Conn. at mouth of Housatonic River	No problems identified.	Important wildlife habitat and natural area. Designated barrier beach.	Adjacent to Housatonic River dredging.	Identified by local officials.
4.	Thimble Islands	Branford, Conn. - Offshore Island	Limited size potential.	High biological productivity and shellfish concentrations.	N/E	Very strong opposition because of environmental values and residential and recreational land use.
5.	Falkner Island	Guilford, Conn. - 2.5 miles offshore	High wave energy zone.	National Wildlife Refuge area. Important shorebird and reef habitat.	Costly	Away from major social impacts.
6.	Six Mile Reef	Clinton, Conn. - 3 miles offshore	High wave energy zone. Increase navigation hazard.	High concentration of shellfish and finfish.	Costly	Mixed support and opposition.
7.	Duck Island Roads	Clinton and Westbrook, Conn.	Tied to existing breakwater.	Undocumented oyster and lobster area.	Close to small recreational harbors.	Adjacent to existing harbor of refuge.
8.	Menunketesuck	Westwood, Conn.	Capacity limited by shallow water depth.	High biological productivity and concentration of shellfish and finfish. Least tern habitat.	Close to small recreational harbors.	Concerns over loss of habitat and proximity to town beaches.

TABLE 20 (Continued)
SITES SELECTED FOR INDIVIDUAL INVESTIGATION
SUMMARY OF EVALUATION CRITERIA

Number	Site	Location	Technical	Environmental	Economic	Social
9.	Bartlett Reef	Waterford, Conn. - 850 yards offshore	High wave energy zone.	High biological productivity and concentrations of shellfish and finfish.	Close to New London and Niantic Harbors.	Concerns over loss of habitat.
10.	Stratford Shoals	At "Middle Ground" off Stratford, Conn.	High Energy Zone	High biological productivity. Sizeable populations of lobster and finfish.	Costly	Concerns from recreational fishermen.
11.	Black Ledge	Groton, Conn. - 1 mile offshore	High energy area. Solid foundation.	Productive benthic habitat.	Costly. Potential for regional use.	Identified by Groton Conservation and Harbor Commission.
12.	Clinton Harbor	Clinton, Conn. - Adjacent to Clinton Harbor.	Soft, but adequate foundation.	Potential extension of the Hammonassett marsh.	Favorable.	Strongly supported by town of Groton and private marinas.
13.	Fayerweather Island	Bridgeport, Conn.	Moderate wave exposure, silt and sand foundation.	Important seed oyster cultivation area.	Located adjacent to dredging.	Strong opposition from nearby residents. Adjacent to Seaside Park.
14.	Yellow Mill Channel	Bridgeport, Conn.	Weak, but adequate foundation, protected from waves.	Degraded, low fish and wildlife values.	Change from marine to non-marine use.	Potential for park development. City officials opted for other use.
15.	Town Tree Island	Westbrook, Conn. - 1 mile offshore.	Rock outcrop. High energy area. Close to Millstone Nuclear Power Plant.	Significant shellfish and finfish area.	Close to New London and Niantic Harbors.	Nearby beach and concern over possible impact on nuclear plant.
16.	Borrow Pits in LIS	Along LIS coast at Sherwood Island, Westport; Morris Cove, New Haven; Prospect Beach, New Haven.	No construction needed.	Conditions in hole are generally anaerobic. Surrounding area productive.	No construction cost.	Not evaluated.
17.	Mamaroneck Harbor	Rye, N.Y.	Multiple sites. High energy area.	Excellent habitat for shellfish and finfish.	Close to dredging site.	Strong opposition from nearby residents.

TABLE 20 (Continued)
SITES SELECTED FOR INDIVIDUAL INVESTIGATION
SUMMARY OF EVALUATION CRITERIA

Number	Site	Location	Technical	Environmental	Economic	Social
18.	Gold Star Bridge	New London, Conn. on Thames River	Very poor foundation. Protected from waves.	Currently supports shellfish population and shoreline fishing activity.	Adjacent to Federal channel.	Identified by Conn. Dept. of Transportation.
19.	Penfield Reef	Fairfield, Conn.	High energy area. Rock outcrops.	Nearby areas are highly productive.	Costly. Local or regional site.	Identified by Fairfield Conservation Commission. Could provide flood and beach protection.
20.	Mianus River	Greenwich, Conn.	Small local disposal site - infrequent dredging and use.	Not evaluated.	Not evaluated.	Identified by local officials.
21.	Milford Harbor	Milford, Conn. - in outer harbor area.	Sites considered on east and west side of Federal channel. Moderate wave energy.	Heavy waterfowl use in area. Lobster and clam population.	Adjacent to dredging area.	Identified by town of Milford officials. Adjacent to town beach.
22.	Flushing Bay	New York, N.Y.	(The New York District of the Corps of Engineers is currently studying this site.)			

TABLE 21
PROTOTYPE SITES SELECTED FOR DETAILED ANALYSIS

Criteria	Clinton Habor	Black Ledge	Penfield Reef	Milford Harbor	Sherwood Borrow Pit
PROJECT DESCRIPTION					
Type	Marsh Creation	Island Creation	Shoreline Extension	Shoreline Extension	Aqueous Borrow Pit
Capacity (cy)	1,000,000	7,500,000	4,300,000	400,000	750,000
Years to Fill (yrs)	25+	50	24	50	50
Dike	Rock	Rock	Rock	Rock	None
Size (acres)	100	125	300	11	100
Waves	High Energy	High Energy	High Energy	Moderate Energy	Moderate
Foundation	Granular over very soft organic silt.	Rock and loose silty sand.	Sand, silt, gravel.	Loose to dense granular.	Granular.
Operation	Hydraulic dredging.	Bucket & scow w/offload.	Local: hydraulic dredge >2 miles: bucket & scow	Hydraulic dredging	Bucket & scow
ECONOMICS					
Initial Cost	$1,962,000	$40,385,000	$11,820,000	$2,612,000	None
Annual Cost	$543,000	$4,812,000	$3,792,000	$378,000	No evaluated
Annual Costs of Alt.					
Open Water	Cornfield - $499,000 New Haven - $580,000	New Haven - $1,281,000	New Haven - $2,382,000	New Haven - $253,000	Not evaluated
Ocean	The Race - $621,000	The Race - $1,281,000	The Race - $2,931,000	The Race - $279,000	Not evaluated
ENVIRONMENTAL					
Shellfish	Low populations.	Extensive blue mussel bed.	Large population of oysters, clams, lobsters, blue mussels.	Population of lobsters & crabs.	Adjacent population of clams & oysters.
Finfish	Low population.	Commercial & recreation species.	Large population.	Not evaluated.	Adjacent sport fishery.
Biological Resource Value	Medium	High	High	Not evaluated	Low
Significant Resources	Adjacent Hammonasset marsh, potential aquaculture area, barrier beach designation.	Rock habitat.	Large shellfish and fish population. Heavy use by waterfowl.	No evaluated	Adjacent commercial and recreational fisheries.

TABLE 21 (Continued)
PROTOTYPE SITES SELECTED FOR DETAILED ANALYSIS

Criteria	*Clinton Habor*	*Black Ledge*	*Penfield Reef*	*Milford Harbor*	*Sherwood Borrow Pit*
Major Impacts	Loss of existing habitat, changes in circulation and sedimentation patterns, expansion of marsh area.	Loss of existing habitat, island added to seascape, changes in circulation patter, potential marsh habitat creation.	Loss of existing habitat, changes in circulation and sedimentation pattern.	Loss of habitat, interruption of tidal currents and coastal erosion.	Restore habitat to that in surrounding areas.
SOCIAL					
Land Use	Adjacent marsh	Provide wave protection to shore.	Nearby residential area.	Nearby residential area.	1,000 feet offshore.
Recreation	Adjacent State park.		Adjacent beaches.	Adjacent beaches.	Sherwood State Park.
Public Opinion	Strong support from town of Clinton and private marinas. Objection by town of Madison Shellfish Commission. Concerns expressed by State of CT.	Identified by Conservation Commission. Opposed by shoreline residents.	Identified by Fairfield Conservation Commission. Provide wave protection and beach nourishment.	Identified by town of Milford.	Suggested by State of Conn., Aquaculture Division.

This study has concluded that critical factors including economics, environmental and public inputs rule out widespead reliance on containment for the disposal of dredged material in LIS. Further, we concluded that there is an apparent general acceptance of current disposal options - namely open-water disposal and continued use of the closely monitored four designated sites, with land disposal in some specific instances where possible. Economic analysis of containment facilities reveals that it is more costly than other disposal alternatives although substantial savings in dredging costs could be realized if a containment facility were placed adjacent to the dredging location. In such cases the use of hydraulic dredging operations are feasible at less expense than the more commonly used bucket/scow operation.

Although this study was able to identify potential sites for containment facility projects, current dredging and disposal operations are favored over containment alternatives not only on an economic and sometimes environmental basis but also because of public inputs and interests.

RECOMMENDATIONS

I have reviewed and evaluated the information and findings in this report and other documents concerning dredged material disposal in Long Island Sound (LIS). I have met with and considered the view of local officials, other agencies and LIS interests.

Accordingly, I recommend no Federal interest at this time in the implementation of containment facilities for the disposal of dredged material in LIS.

I base this recommendation on the findings that containment facilities are generally not cost effective, nor socially or environmentally acceptable. Also they do not carry widespread local support needed to commit substantial local financial resources that are not required for ocean disposal under current policies. Federal policy provides that local interests supply disposal areas for Federal and Non-Federal dredging projects. Further, local interests are responsible for associated costs such as dikes if applicable.

ATTACHMENT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. BOX 1518
CONCORD, NEW HAMPSHIRE 03301

MAY 23 1985

Colonel Carl B. Sciple
Division Engineer
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Colonel Sciple:

This is our Fish and Wildlife Report on the Long Island Sound Dredged Material Containment Study, Connecticut and New York. It has been prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

Your draft Feasibility Report indicates that over 300 potential containment sites were identified in the New York and Connecticut waters of Long Island Sound. Screening for technical and economic feasibility, environmental impacts and public acceptance severely reduced the number of sites and only five were identified for detailed invesitgation as prototype sites. The five sites, all in Connecticut, include: Black Ledge, Penfield Reef, Clinton Harbor, Milford Harbor, and Sherwood Island Borrow Hole. The findings of these detailed investigations are presented in the draft Feasibility Report.

The Black Ledge containment facility would store about 7.5 million cubic yards of dredged material and would create a 125 acre offshore island. Diking for the project would cost an estimated $40 million. The proposed facility would directly affect 150 acres of productive benthic habitat supporting a diversity of species and dense concentrations of blue mussels. Your study finds that the adverse environmental impacts and unfavorable economics currently make this site infeasible. We do not support development of a containment facility at this site for environmental reasons.

The Penfield Reef containment facility would be a shoreline extension project capable of storing about 4 million cubic yards of dredged material. Diking for the project would cost an estimated $8.6 million. The proposed facility would eliminate about 300 acres of productive bottom habitat supporting a dense and diverse benthic community. Your study finds that the project is not economically feasible and would result in negative environmental impacts. We regard potential environmental impacts as severe and do not support development of a containment facility at this site.

The Clinton Harbor containment proposal, a marsh creation project, could store up to one million cubic yards of dredged material and would expand the existing Hammonasset wetland areas. Your study finds that this containment facility is economically feasible and has high potential for biological

enhancement. However, the proposed facility abuts Hammonasset State Park and a portion of the Cedar Island spit which has been designated as a barrier beach under the Coastal Barrier Resources Act of 1982. The provisions of this legislation which restricts Federal participation and limits development activity in general would have to be addressed prior to further consideration of a containment facility at this site. We concur with your study findings.

The Milford Harbor containment facility was sited on the east side of the entrance channel as a shoreline extension project capable of storing about 270,000 cubic yards of dredged material. Your study finds that, based on sampling at nearby areas, this area is not particularly productive and major environmental impacts would not be expected. We believe that this containment facility could be developed as a marsh creation project but that additional site specific studies would be required in order to determine if environmental impacts are acceptable.

The Sherwood Island Borrow Hole is a large aqueous borrow pit that could hold/contain about 750,000 cubic yards of dredged material. Your study finds that the isolated nature of this area has generally resulted in an anoxic environment which supports a relatively low number of organisms. If the pit was filled and suitably capped the resulting environment would closely resemble that of the surrounding area which supports extensive hard clam and oyster beds. Use as a disposal area is a worthwhile consideration in the future. We are in general agreement with your study findings, however, we believe this area should be proposed for a site specific study.

Your draft Feasibility Report does not propose implementation of any project. The report concludes that under present conditions containment is not a feasible alternative and that critical factors including economics, environmental and public inputs rule out widespread reliance on containment for the disposal of dredged material in Long Island Sound. Although the study was able to identify potential sites for containment facility projects, current dredging and disposal operations are favored over containment alternatives not only on an economic and sometimes environmental basis but more specifically on cost sharing arrangements. Therefore, you have recommended no Federal interest at this time in the implementation of containment facilities for the disposal of dredged material in Long Island Sound.

We disagree with the conclusions of your feasbility study regarding containment of contaminated dredge material and beneficial uses of clean material in Long Island Sound. In our opinion, the practicality of utilizing confined disposal sites has been adequately demonstrated in the Great Lakes since the late 1950's. The major difference between study conditions in Long Island Sound and the Great Lakes is that people utilize the Great Lakes as a

source of drinking water and therefore are much more concerned about waste disposal practices in that system. We believe that Long Island Sound and the remainder of our coastal waters deserve the same level of protection as the Great Lakes since they are of major importance as food producing areas, have high ecological values including spawning and nursery areas for nearly all of our marine vertebrate and invertebrate species, provide migration pathways for fish and wildlife and contribute immense recreational and aesthetic values to man.

One of the major basic faults with the Long Island Sound study is the economic analysis which basically compares the existing open water disposal practice against confined and/or beneficial dredge material disposal practices. We believe a more appropriate economic analysis would be to compare alternative confined disposal sites against each other in a fashion similar to that done under P.L. 91-611 for the Great Lakes. The present analysis is deemed inappropriate in that it is skewed in favor of open water disposal since the appropriate monetary values have not or cannot be accurately predicted for the true environmental and societal costs for open water disposal of contaminated materials.

We are confident that many environmentally acceptable sites for confined disposal facilities exist in Long Island Sound. The proper conclusion of your feasibility study would be to actively pursue site specific studies for containment facilities within reasonable distances from the major commercial harbors in the Sound and elsewhere along the New England coast.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Area

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