FINAL

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR THE DISPOSAL OF DREDGED MATERIAL IN THE LONG ISLAND SOUND REGION

1982

US Army Corps of Engineers
New England Division

FINAL
PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT
FOR THE
DISPOSAL OF DREDGED MATERIAL
IN THE
LONG ISLAND SOUND REGION

PREFACE

This Programmatic Environmental Impact Statement (PEIS) is the result of a 1976 out of court agreement (". . . to prepare a composite Environmental Impact Statement (CEIS) for the disposal of dredged material from the Long Island Sound Area, and will consider therein the availability of disposal sites in Block Island Sound and other nearby ocean waters") between the Natural Resources Defense Council (NRDC) et al. and the U.S. Army Corps of Engineers, New England Division. It addresses the assessment of generic impacts associated with a range of disposal alternatives for dredged materials and provides an informational basis upon which future supplemental Environmental Impact Statements/Assessments (EIS/EA) may be developed for site specific projects within the Long Island Sound (LIS) vicinity. Proponents of the dredging projects will be able to tier their EIS/EA's to eliminate repetitive discussions of similar issues and focus on issues particular to their project. Tiering is defined in Section 1508.28 of the Council of Environmental Quality regulations (November 29, 1978 Federal Register) "as the coverage of several matters in broader environmental impact statements (such as program or policy statements) with subsequent narrower statements or environmental analysis (such as regional or basinwide or ultimately site specific statements) incorporating by reference in the general discussion and concentrating solely on the issues specific to the statement subsequently prepared."

Disposal alternatives are described in Section IV of this report. In general, the feasibility of each alternative is summarized in Table 7 for engineering, cost and regulatory considerations. Similarly socioeconomic, environmental and cultural impacts of each alternative are displayed in Table 11 of Section VI. Engineering, economic, regulatory and impact considerations should be assessed when determining an appropriate method for site specific disposal. Consideration tables are designed to allow a numerical rating (representing a value judgement) to be assigned for each consideration under a given alternative. A rating system can be based on a scale from 0 to 4: Considerations ...

0) will eliminate,
1) will significantly limit,
2) are likely to limit,
3) are not likely to limit,
4) are not limiting to

... implementation of this alternative.

The number "0" in the analysis would eliminate the alternative altogether whereas "4" would not limit a disposal alternative. The values for each consideration may be averaged, assuming equal weight, or weighted according to an overriding factor(s) that may occur in a specific situation. The resulting number will indicate a relative order of acceptability of a particular alternative in comparison to the others listed.

This document indicates information gaps where further study is required for assessing the long-term ramifications of disposal alternatives. The development of new information, technology and perhaps alternatives would add to the present document's value to the decision maker. It is designed to be updated as the new information is developed and therefore serve as a "living document." Studies sponsored or carried out by the Corps of Engineers which can contribute to this data base are referred to in Section V of this report.

Recently, in response to the economic need of a regional disposal site in Western Long Island Sound, the Corps of Engineers, New England Division, issued a Final Environmental Impact Statement for the selection and utilization of such a site - WLIS III (CE, 1982b). Implementation of this site was evaluated and compared with the Bridgeport East Disposal Site (Site A, Appendix A). The document contains supplemental information to this Programmatic EIS and uses this document as an information base for generic impacts as well as for data on the Bridgeport East Site.

FINAL
PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR THE
DISPOSAL OF DREDGED MATERIAL IN THE LONG ISLAND SOUND REGION

Abstract: The improvement and maintenance dredging of Long Island Sound harbors and inlets is necessary for the continued well-being and growth of the region's economy, recreational opportunities and national defense. Dredging of the naturally deposited sediments requires disposal or use of the excavated material. The Corps of Engineers studied six major disposal alternatives available to the Long Island Sound region. These are: (1) open water disposal in the deep ocean (off the continental shelf), near shore (on the shelf) or in river or harbors; (2) upland disposal in any inland habitat type for construction purposes, wildlife habitat or recreational development; (3) containment involving the development of a facility to contain the material as an island or on a shoreline which may be used for construction, wildlife or recreational purposes; (4) beach restoration with clean sandy dredged material; (5) incineration involving the combustion of dredged material to reduce its volume as well as volatile organics; (6) resource reclamation for use of dredge material as a sanitary land fill cover, a soil enhancer for landscaping or agriculture purposes, or as a construction material. Each alternative is described with regard to general engineering and economic feasibility, legal constraints, and potential impacts to environmental, socio-economic and historical/archaelogical resources. As site specific dredging projects are proposed, the above factors should be included to assist in developing the most appropriate manner of disposal.

A 30 day review period will end on June 25, 1982

If you desire further information on this statement, please contact:

Mr. David Tomey
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02254
Commercial Telephone: (617) 894-2400
Extension: 234
FTS Telephone: 839-7234

TABLE OF CONTENTS

SECTION		PAGE
	ABSTRACT: Programmatic Environmental Impact Statement For the Disposal of Dredged Material In The Long Island Sound Region	
	PREFACE	
	Table of Contents	i
	List of Tables	iv
	List of Figures	v
	SUMMARY	S-1
	A. Major Findings and Conclusions	S-1
	B. Areas of Controversy and Concern	S-3
	C. Unresolved Issues	S-5
	D. Environmental Requirements	S-5
I.	ACTION	I-1
	A. Dredging Methods Employed in Long Island Sound	I-4
	B. Disposal of Long Island Sound Dredged Materials	I-5
	C. Authority for Dredging and Disposal	I-5
II.	NEED FOR THE ACTION	II-1
III.	ALTERNATIVE METHODS OF DREDGED MATERIAL DISPOSAL	III-1
	A. Identification of Alternatives	III-1
	B. Feasibility	III-1
	1. Open Water Disposal	III-1
	a. Deep Ocean Disposal	III-2
	b. Near Shore Disposal	III-2
	c. River/Harbor Disposal	III-3
	2. Upland Disposal	III-4
	3. Containment	III-5
	4. Beach Restoration	III-7
	5. Incineration	III-7
	6. Resource Reclamation	III-8
	7. No Action	III-8
	C. Relationship to Laws and Regulations	III-9
IV.	THE AFFECTED ENVIRONMENT	IV-1
	A. Oceanography	IV-1
	B. Biology	IV-2
	1. Plankton	IV-2
	2. Benthos	IV-3
	3. Fisheries and Shellfisheries	IV-3
	4. Threatened and Endangered Species	IV-5
	C. Prehistoric/Historic Resources	IV-6
	1. Prehistoric Background	IV-6
	2. Historic Background	IV-7

TABLE OF CONTENTS (Cont'd)

SECTION		PAGE
	D. Socioeconomic Environment	IV-7
	1. Population	IV-7
	2. Recreational Boating Demands	IV-7
	3. Economic Activity	IV-8
	E. Characteristics of the Dredging and Disposal Sites	IV-8
	1. Long Island Sound Harbor Sediment Characteristics: the Source Sediments	IV-8
	2. Long Island Sound Disposal Sites	IV-9
V.	ENVIRONMENTAL EFFECTS	V-1
	A. Open Water Disposal	V-1
	1. Environmental Impacts	V-1
	a. Generic Impacts of Open Water Disposal	V-1
	(1) Generic Short-Term Impacts	V-1
	(2) Generic Long-Term Cumulative Impacts	V-4
	b. Deep Ocean Disposal	V-6
	c. Near Shore Disposal	V-7
	(1) Impacts and Mitigating Measures at the Candidate Sites	V-7
	(2) Conclusions	V-10
	(3) Future Studies	V-12
	d. River/Harbor Disposal	V-13
	2. Socioeconomic Impacts	V-14
	a. Deep Ocean Disposal	V-14
	b. Near Shore Disposal	V-14
	c. River/Harbor Disposal	V-14
	3. Historical/Archaelogical Impacts	V-15
	a. Deep Ocean Disposal	V-15
	b. Near Shore Disposal	V-15
	c. River/Harbor Disposal	V-16
	B. Upland Disposal	V-16
	1. Environmental Impacts	V-16
	2. Socioeconomic Impacts	V-18
	a. No Further Use Intended	V-18
	b. For Construction	V-18
	c. For Habitat or Recreation Development	V-19
	3. Historical/Archaelogical Impacts	V-19
	C. Disposal in Containment Facilities	V-20
	1. Environmental Impacts	V-20
	2. Socioeconomic Impacts	V-21
	a. For Construction	V-21
	b. For Habitat or Recreation Development	V-22
	3. Historical/Archaeological Impacts	V-22
	D. Beach Restoration	V-22
	1. Environmental Impacts	V-22
	2. Socioeconomic Impacts	V-23
	3. Historical/Archaeological Impacts	V-23

TABLE OF CONTENTS (Cont'd)

SECTION		PAGE
	E. Incineration	V-24
	1. Environmental Impacts	V-24
	2. Socioeconomic Impacts	V-24
	3. Historical/Archaeological Impacts	V-25
	F. Resource Reclamation	V-25
	1. Environmental Impacts	V-25
	2. Socioeconomic Impacts	V-25
	3. Historical and Archaeological Impacts	V-25
	G. No Action	V-26
	1. Environmental Impacts	V-26
	2. Socioeconomic Impacts	V-26
	3. Historical/Archaelogical Impacts	V-27
VI.	COORDINATION	VI-1
	A. General	VI-1
	B. Federal and State Agencies	VI-1
	C. Public Participation	VI-1
	D. Comments and Responses	VI-2
VII.	LIST OF PREPARERS AND CONTRIBUTORS	VII-1
VIII.	REFERENCES	VIII-1
IX.	APPENDICES	YEAR ISSUED
	A. Environment Impact Report -- Open Water Disposal of Dredged Material in Long Island Sound, Block Island Sound and Adjacent Waters.	1981
	B. Long Term Impacts of Open Water Disposal of Dredged Material	1981
	C. Economic Analysis of Future Dredged Material Disposal in Long Island Sound	1982
	D. Federal Institutional Requirements	1981
	E. Public Participation	1982

LIST OF TABLES

TABLE		PAGE
1.	Public Interest Issues/Analysis of Controversy	S-4
2.	Relationship of PEIS to Existing Plans and Programs	S-6
3.	Relationships of Disposal Alternatives to Relevant Environmental Requirements	S-7
4a.	Federally Authorized Navigation Projects in the Long Island Sound Region, New England Division	I-2
4b.	Federally Authorized Navigation Projects in the Long Island Sound Region, New York District	I-3
5.	Summary of Federal Environmental Statutes and Relationship to Dredged Material in the Long Island Sound Region	III-10
6.	Relationship of Federal Environmental Statutes to Disposal Alternatives	III-11
7.	Summary of Considerations for the Feasibility of Dredged Material Disposal Alternatives in Long Island Sound	III-12
8.	Location and Physical Characteristics of the Candidate Sites	IV-11
9.	Biological Resources On and Around Candidate Sites	IV-12
10.	Summary of Potential Impacts and Available Mitigation Measures for Candidate Sites	V-11
11.	Summary of Potential Impacts of Dredged Material Disposal Alternative in the Long Island Sound Region	V-28

LIST OF FIGURES

FIGURE		FOLLOWING PAGE
1.	Regional Setting	I-1
2.	Disposal Sites and Federally Authorized Navigation Projects	I-1
3.	Fisheries Resources	IV-4
4.	Shellfisheries Resources	IV-4

SUMMARY

A. MAJOR FINDINGS AND CONCLUSIONS.

The objective of this document is to outline and discuss the feasibility and generic impacts of alternative methods for dredged material disposal available to the Long Island Sound (LIS) region.

Findings:

(1) Dredging of the harbors and rivers along the Long Island Sound coastline is necessary to provide clear and safe waterborne access for commercial, recreational and military activities. Dredging requires disposal of the excavated material in an economically and environmentally acceptable manner.

(2) There are six general disposal alternatives potentially available to the Long Island Sound region which fall under different jurisdictions.

(a) Open Water:

Appendix A identified and evaluated four new open water disposal areas. Currently, none of these sites offer any advantages to using the existing three sites presented in the Connecticut-New York Interim Plan (NERBC, 1980b). Authority for open disposal in Long Island Sound falls under the jurisdication of the Corps of Engineers through the Section 404 of the Clean Water Act or Section 103 of Ocean Dumping Act and the State of Connecticut through its Water Quality Certification program.

(b) Upland Disposal:

Upland disposal on a limited basis would be feasible on a project specific basis provided a site is available. Jurisdiction would come under the State and local authority. Feasibilty studies are currently underway by the State of Connecticut and the Corps of Engineers, New York District, to identify potential sites in Connecticut and the New York Metropolitan area.

(c) Containment:

The feasibility of implementing an aquatic containment facility in the Long Island Sound area is currently being studied by the Corps of Engineers, New England Division. Two prototype facilities are being planned in Connecticut.

(d) Beach Restoration:

Beach restoration would be feasible on a project specific basis if a nearby beach is available and the dredged material was clean and compatible with that beach. Authority would come under the Corps of Engineers and the State or local authorites.

(e) Incineration:

Incineration of dredged material is not currently feasible in the Long Island Sound area because of the lack of a facility. In addition, technology has not yet made such treatment of large volumes cost effective. Presence of a facility and future advances could make this alternative more viable.

(f) Resource Reclamation:

Studies have shown that dredged material may be used as a sanitary landfill cover or as a soil enhancer for landscaping or agricultural purposes. Future studies could provide an additional use of dredged material as a construction material.

(3) Review of current literature indicates that no long term adverse environmental impacts have been directly attributed to open water disposal of dredged material. In cases where environmental impacts have been attributed to open water disposal, the disposal areas were also subjected to large input of industrial wastes and sewage sludge.

(4) The current literature also suggests that bulk chemical analysis of dredged sediments alone should not be used as an indicator of environmental impacts.

Conclusions:

(1) Four of the six potential alternatives are currently feasible in the Long Island Sound region: Open water disposal, upland disposal, beach restoration, and resource reclamation. Containment and incineration would require the presence of facilities in the region. Containment is the subject of a current study whereas incineration would require more advances in technology to be cost effective. The three open water sites presented in the Interim Plan (NERBC, 1980b), the Central Long Island Sound Disposal Site (off New Haven), the Cornfield Shoal Site (off the Connecticut River), and the New London Site are identified as regional disposal sites. Designation of upland or beach sites or use of any dredged material would be determined on project-specific basis depending on the availability of a suitable site and the nature of the dredged material.

(2) The most appropriate alternative chosen for disposal would be determined on a project-specific basis. Generally, the most appropriate alternative would be the most economically feasible with the least environmental harm. The chosen alternative can be expected to vary depending upon conditions prevalent at the time a project is proposed.

(3) This document can serve as a generic basis for supplemental environmental impact statements which would be prepared when a site-specific project is proposed.

B. AREAS OF CONTROVERSY AND CONCERN.

Table 1 summarizes the preferences for alternatives and the economic and environmental concerns expressed by various Federal, State and private agencies and interests impacted by dredging and disposal activities. Review of these issues indicate or imply the following general concerns or controversy.

(1) Which alternative(s) is (are) the most suitable for disposal of dredged material?

(2) Should disposal activities occur prior to the identification and assessment of long term cumulative impacts?

(3) Who regulates the various disposal alternatives?

Concerns (1) and (2) remain controversial whereas concern (3) may be addressed as follows. The Corps of Engineers regulates the disposal of dredged material under Section 404 of the Clean Water Act, Section 103 of the Ocean Dumping Act, and Section 10 of the Rivers and Harbors Act of 1899. Under provisions of the Clean Water Act, states are allowed to implement their own 404 program to regulate disposal with the approval of the Environmental Protection Agency; although none of the states have done so. States also have authority over dredging and open water disposal operations under Section 401 of the Clean Water Act which authorizes states to certify activities which might effect state waters. No activity is permitted without such certification. Regulatory authority over other disposal alternatives would have to be determined on site-specific basis when a disposal alternative is chosen because the Corps does not have authority in upland areas. Unless a project is under congressional, continuing or special authority, final regulation of disposal alternatives other than open water or wetlands, would come under State and/or local authority.

Table 1

Public Interest Issues/Analysis of Controversy

	PREFERENCE OF ALTERNATIVES	ECONOMIC	ENVIRONMENTAL	MITIGATION, MANAGEMENT & PLANNING
STATE AGENCIES				
New York				
Dept. of Environmental Conservation and Planning Groups	Open water disposal in LIS would occur in Connecticut waters as agreed in Interim Plan. Upland disposal recommended for only small projects due to scarcity of land. Should consider regionlization of ports.		Contaminant resuspension should be evaluated and impacts considered. Concern for long term impacts. Uptake into food web should be carefully studied and monitored.	Should be consistent with Interim Plan (NERBC, 1980b) and Long Island Sub-Plan (CEMI, 1972). Site and material characteristics should be key considerations. Communication inadequate.
Parks & Recreation	Alternatives should be studied equal to open water.		Local water quality improving; continued dumping may reverse this trend. Concern for ground water impacts with land disposal.	Detoxification should be evaluated.
Atty. General's Office	Prohibit open water disposal.	Consider all water uses.	Should quantify cumulative effects. Long term health impacts.	Need dynamic model of LIS.
Health Departments Nassau and Suffolk Counties	Upland disposal discouraged for contaminated material due to potential groundwater degradation.		Water quality of Western LIS is improving; new areas open to commercial shellfishing. Disposal in Western LIS a step backward. Consider cumulative, long-term effect especially ground water quality with upland disposal.	Suitable site specific study prior to use. Maintain monitoring.
Connecticut				
Department of Environmental Protection, and Coastal Area Management	Land disposal not a viable option. Use existing open water sites.	Disposal site needed in western Long Island Sound.	Open water disposal has minimal effect on water quality.	Consistent with Interim Plan. Continuing public participation. Use Interim Plan classification scheme on harbor by harbor sediments.
Department of Health			Land disposal may contaminate ground water. Marsh creation may create a mosquito problem.	Should dredge when water temperature is below 40°F, shellfish metabolism low.
Planning Groups		Dredging needed to maintain ports.	High concern for marine resources. Water quality impacts of greatest concern.	Regionalize ports.
Rhode Island				
Dept. of Environmental Management, Coastal Resources Management	State encourages alternatives.	Site needed which is economically accessible to Providence Harbor.	Impacts of clean fill disposal minimal.	
CONGRESSIONAL REPRESENTATIVES				
Connecticut & Rhode Island		Dredging needed to maintain economic viability. Impact on fishermen balanced with lower oil prices.		Identify environmental trade-offs, minimize impacts.
New York	Should evaluate deep water disposal.		Potential severe impact on fisheries and shellfisheries. Concerned with potential uptake into food web.	Opposed to all dumping in LIS without guarantees. Should adopt ocean dumping regulations for LIS. Doubt capping technique success.
FEDERAL AGENCIES				
U.S. Environmental Protection Agency Regions I & II	The continental shelf should be fully evaluated for a potential site. Consider dispersal and other studies.		Consider bioassay limitations.	Would like harbor by harbor sediment data. Continue monitoring existing sites and new sites for data.
United States Fish and Wildlife Service	Hard data needed before any disposal decisions can be made.			
National Marine Fisheries Service	Site selection process of Appendix A is questioned.			
United States Coast Guard Districts I & II	Site D should be moved to avoid major track from Point Judith to LIS. Site G noted as potential hazard although no incidents on record other than buoy displacement. Tugs should monitor channel 13.			Minimum depths should be maintained to provide safe passage for current and potential vessels which transit sites.
Food and Drug Administration	Monitoring costs for open water with sites beyond territorial waters significant.	Consider total economic impact of shellfish closure on overall fishery.	Consider ocean quahog and surf clam impacts. Impacts of dispersion should be evaluated. Site closure is routine during disposal operations.	Should notify F.D.A. of disposal activities to allow for action under the National Shellfish Sanitation Program.
LOCAL POLITICAL OFFICIALS				
Connecticut/Rhode Island	Land disposal will encounter strong local opposition.	Dredging needed to maintain viable facilities and property values.	Weight environmental impacts against economic impacts of not dredging. Water quality and beach fouling greatest concern.	Should employ most economically viable alternative.
New York	Alternatives to open water not given adequate consideration. Land sites available in Huntington. Should prohibit all disposal in open water.		Dredging might increase potential for salt water intrusion into drinking water aquifers. Corps' knowledge of impacts lacking.	Should adopt ocean dumping regulations for Long Island Sound. Contingency plan should be explained.
ENVIRONMENTAL GROUPS	Alternatives to open water should be studied. Pursue port specialization to reduce need for dredging. Wetlands should never be filled with dredged material.	Relate cost/benefit ratio to long term impacts.	Dumping organic material may create oxygen depleted areas. So-called "dead" areas should be identified. Filling wetlands reduces spawning capabilities. Potential uptake of heavy metals into food web.	Capping only one portion of material disposal. Use bioassay results to classify material. Some groups oppose all dumping without guarantees. Utilize Interim Plan framework.
FISHERMANS GROUPS	Wetlands should not be filled. Should not dispose in deep water or in Block Island Sound to protect valuable fisheries.	Fishermen receive detrimental economic impacts while others benefit.	Concerned with short and long-term adverse impacts to spawning areas and sedimentation of oyster beds. Conflicting reports of improved fishing at previous dump sites: Norwalk improved, Brenton Reef no change, i.e. Would like proof of no adverse impacts. Potential decline in water quality of great concern. Confinement doubted to fineness material.	Should not dredge from July to mid-September to protect oysters. • Some groups against any open water dumping. "Short dumpers" should be penalized to the full extent of the law. • Bucket & scow suggested as least impact method. Capping technique questioned.
DREDGING COMPANIES, SHIPPING COMPANIES, BUSINESS & TRADE ASSOCIATIONS	Nearby open water disposal considered most efficient method for most material. Filling in wetlands might be appropriate in some areas.	Dumping off continental shelf not economically feasible due to time, weather, equipment and volume of material. Smaller dredgers feeling impacts of limited disposal sites. Recreational boating industry considered more important than commercial fishing in Conn. and R.I. Dredging necessary to maintain viability.	Lightering tankers offshore increases chance of spill. Environmental impacts of open water to disposal minimal, practice should continue. Use of smaller barges increase chance of spill. Dredging considered best spill preventing action.	Use of "Mud Dump" (N.Y. Bight) for W. LIS material considered. Regulatory agencies should expedite permit process. Should consider zoning LIS. Longer distances to dumps may encourage short dumps. Need sources for cap material.

C. UNRESOLVED ISSUES.

Two major controversial issues remain unresolved:

(1) Which alternative(s) is(are) the most suitable for disposal of dredged material?

Table 2 summarizes past, present and planned studies which have addressed or intend to address this issue. This document identifies three regional open water sites in the Long Island Region. Appendix A identifies four new potential open water disposal sites for the future disposal needs of the region. Feasibility studies of upland and container disposal are currently planned or are in progress by the Connecticut Department of Environmental Protection and the Corps of Engineers. Such studies coupled with other feasibility and impact studies developed by the Corps of Engineers' Dredged Material Research Program (DMRP) further define the most viable options for the LIS region. Based on present information, the most suitable method of disposal would be best determined when a site specific dredging project is proposed and is dependent upon prevalent conditions.

(2) Should disposal activities occur before the identification and assessment of long term cumulative impacts?

Section VI and Appendices A and B of this report discuss the availability of information with regard to long term impacts of open water disposal. The Disposal Area Monitoring System (DAMOS) (Table 2) is currently addressing this issue. The DAMOS program is also studying the effectiveness of capping, and will meet the need for on-site study of disposal sites as addressed in Table 1. The Long-term Effects of Dredging Operations (LEDO) Program (Table 2) will also address cumulative impacts of aquatic and terrestrial disposal projects.

D. ENVIRONMENTAL REQUIREMENTS.

Table 3 presents the relationship of the disposal alternatives to relevant environmental requirements. Federally proposed dredging projects must comply with Federal laws and Executive Orders and must be consistent with State coastal zone management and water quality certification programs. State statutes may regulate the ultimate disposal of dredged material (e.g. upland disposal of incinerated residue) which may not fall under Federal jurisdiction.

Table 2

Relationship of PEIS to Existing Plans and Programs

Plan or Program	Sponsor	Objective	Relationship	Status
Disposal of Dredged Material Within the New York District (Conner *et al.*, 1979; Leslie *et al.*, 1980)	U.S. Army Corps of Engineers, New York District.	To provide a comprehensive analysis of all available alternative disposal options and select potential sites for consideration.	Provides information, state of the art strategy, and evaluation and analysis of alternative disposal methods for N.Y. area.	Final report issued February 1980.
Interim Plan - for the Disposal Dredged Material in Long Island Sound (NERBC, 1980b).	New England River Basin Commission (NERBC) with Long Island Sound Dredge Mgmt. Work Group.	To provide a basis for agreement among participating State and Federal agencies on the standards and procedures to be followed in conducting a disposal management program.	Provides complementary guidance concerning the management of dredged material disposal in Long Island Sound.	Report completed August 1980.
Open Water Disposal of Dredged Material for Long Island Sound, Block Island Sound and adjacent waters (Appendix A).	U.S. Army Corps of Engineers, New England Division.	To systematically identify and study suitable open water sites and assess the impacts of disposal at each.	Provides integration of environmental and social factors with public concerns to select preliminary sites for consideration in this document.	Appendix A to this document.
Dredged Material Containment in Long Island Sound (CE, 1979a, 1980a).	U.S. Army Corps of Engineers, New England Division.	To study the feasibility, problems, needs, and opportunities to create containment facilities for disposal of dredged material in LIS.	Provides comparable consideration for containment of dredged material as alternative disposal method.	Ongoing - study initiated 1979 expected completion, 1984.
DAMOS - Disposal Area Monitoring System (NUSC, 1979; SAI, 1980).	U.S. Army Corps of Engineers, New England Division.	To monitor various environmental parameters at selected open water disposal sites throughout New England.	Existing and historical disposal sites in Long Island Sound and vicinity are included in system - monitoring provides indications of environmental effects.	Ongoing - initiated 1977 should continue indefinitely.
MARS - Marine Analysis Reporting System (CE, 1980b).	U.S. Army Corps of Engineers, New England Division.	To monitor marine sediments in harbors throughout New England to provide data to typify harbors through statistical analysis of sediment constituents.	Will supplement DAMOS to allow better prediction capabilities as necessary to manage dredged material disposal.	In preliminary design.
DMRP - Dredged Material Research Program (Saucier *et al.*, 1978).	U.S. Army Corps of Engineers, Environmental Laboratory, Waterways Experiment Station, Vicksburg, Miss.	To collect information to allow more comprehensive analysis of environmental effects of dredged material disposal and recommend measures for minimizing undesirable impacts.	Provides planning and implementation concepts and analysis of environmental effects of several alternative disposal methods applicable to Long Island Sound and vicinity.	Completed in 1979 - numerous reports available.
LEDO - Long-term Effects of Dredging Operations Program (CE, 1982a)	U.S. Army Corps of Engineers, Environmental Laboratory, Waterways Experiment Station, Vicksburg, Miss.	To provide a broadened technical basis for Corps implementation of its environmental responsibilities under Section 103 of the Ocean Dumping Act and Section 404 of the Clean Water Act.	Field studies will assess long-term effects and methods of minimizing any adverse impacts of the disposal of dredged material.	Will begin in Fiscal Year 1982.
Disposal of Dredged Material in Rhode Island (Seavey and Pratt, 1979).	Coastal Resources Center - University of Rhode Island.	To provide an evaluation of past practices and future options including all alternatives.	Provides recommendations for programatic disposal in Rhode Island portion of study area.	Report completed 1978.
State of Rhode Island Coastal Management Program and Final EIS (DOC, 1978).	State of Rhode Island and National Oceanic and Atmospheric Administration (Office of Coastal Zone Management).	To provide a comprehensive program for coastal land and water use activities appropriate to resource considerations and impacts.	Provides base for planning of dredged material disposal affecting resources in Rhode Island.	Final issued March 1978
State of Connecticut Coastal Management Program and Final EIS (DOC, 1980).	Connecticut Department of Environmental Protection and National Oceanic and Atmospheric Administration.	To provide a comprehensive program for coastal land and water use activities appropriate to resource considerations and impacts.	Provides base for planning of dredged material disposal affecting resources in Connecticut.	Final issued May 1980.
Upland Disposal in Connecticut.	Connecticut Department of Environmental Protection -- Water Resources Council.	To study feasibility of upland disposal in Connecticut.	Provides information to allow upland disposal to receive equal consideration with other alternatives.	Ongoing.
Final Environmental Impact Statement for the Designation of a Disposal Site for Dredged Material in Western Long Island Sound -- WLIS-III.	Corps of Engineers New England Division in cooperation with the States of New York and Connecticut.	To select a regional open water disposal site in Western Long Island Sound.	Supplements information presented in this document. This document served as generic information base.	Final Released February 1982.

Table 3

Relationships of Disposal Alternatives to Relevant Environmental Requirements

	Open Water	Upland	Containment	Beach Restoration	Incineration	Resource Reclamation
Federal						
National Environmental Policy Act as amended 42 U.S.C. 4321, et seq.	P	P	P	P	P	P
Fish and Wildlife Coordination Act as amended, 16 U.S.C. 661, et seq.	P	P	P	P	P	P
Endangered Species Act as amended, 16 U.S.C. 1531, et seq.	P	P	P	P	N	N
Coastal Zone Management Act as amended, 16 U.S.C.	P	P	P	P	P	P
Rivers and Harbors Act of 1899, 33 U.S.C. 401 et seq.	P	P	P	P	N	N
National Historic Preservation Act of 1962, 16 U.S.C. 4321 et seq.	P	P	P	P	P	P
Marine Protection Research and Sanctuaries Act of 1972, 22 U.S.C. 1401, et seq.	P	N	P	N	N	N
Clean Water Act as amended, 33 U.S.C. 1251, et seq.	P	P	P	P	N	P
Resource, Conservation and Recovery Act of 1976, 42 U.S.C. 6901 et seq.	N	P	N	N	N	P
Safe Drinking Water Act of 1974, 42 U.S.C. ss 1421 et seq.	N	P	N	N	N	P
National Shellfish Sanitation Program	P	N	P	N	N	N
Clean Air Act as amended, 42 U.S.C. 7401, et seq.	N	N	N	N	P	N
Protection of Wetlands (E.O. 11990)	P	P	P	P	P	N
State*						
Connecticut Coastal Management Act of 1978 (P.A. 78-152 as amended by P.A. 79-535)	P	P	P	P	P	P
Tidal Wetlands Statutes (Sections 22a-28 through 22a-35, Connecticut General Statutes)	N	P	P	P	P	P
Inland Wetlands and Water Courses Act (Sections 22a-36 through 22a-45, Connecticut General Statutes)	N	P	P	P	P	P
Structures, Fill and Dredging in Tidal, Coastal and Navigable Waters (Sections 25-7b through 25-7f and Sections 25-10 through 25-18. Connecticut General Statutes)	N	N	P	P	P	P
Stream Channel Encroachment Lines (Sections 25-41 through 25-4g, Connecticut General Statutes)	N	N	P	N	P	P
Water Discharge Permits (Section 25-54, Connecticut General Statutes)	N	P	P	N	P	P
Solid Waste Permit (Sections 19-524b and 19-524c, Connecticut General Statutes)	N	P	P	N	P	P
Air Compliance Permits (Sections 19-508-1 through 19-508-25, Connecticut General Statutes	N	N	N	N	P	N
Connecticut Environmental Policy Act (Sections 22a-1 through 22a-1f, C.G.S.)	P	P	P	P	P	P
Tidal Wetlands Protection Law of 1973 (Codified Laws of N.Y., Art. 25 SS 0101-0602)	P	P	P	P	P	P
Freshwater Wetlands Protection Act of 1975 (Codified Laws of N.Y., Art. 24 SS 0101-1303)	N	P	P	N	P	P
Stream Protection Law of 1966 (Codified Laws of N.Y., Art. 15 SS 0501-0515)	N	P	P	N	P	P
Environmental Quality Review Law of 1976 (Codified Laws of N.Y., SS 0101-0115)	P	P	P	P	P	P
Local Land Use Authority of 1926 (Codified Laws of N.Y., Art. 16 SS 260-284)	P	P	P	P	P	P
Rhode Island Coastal Management Program of 1978 (46-23-1 et seq.)	P	P	P	P	P	P
Hazardous Waste Regulations (R.I.G.L. ss 23-29.1)	P	P	P	N	P	P
Certification of Water Quality Standards (R.I.G.L. ss 46-12-2 ϵ C), 46-12-4, 46-12-3(k) and (l))	P	P	P	P	P	P
Freshwater Wetlands (R.I.G.L. ss 2-1-18 through 2-1-24)	N	P	P	N	P	P
Air Pollution Emission Control (R.I.G.L. ss 23-25-1 et seq.)	N	N	N	N	P	N

P Potential for Applicability
N Not Applicable

*State laws may be applicable to ultimate disposal, but may not fall under Federal jurisdiction.

SECTION I

ACTION

Long Island Sound is the 1300 square mile elongate body of water lying between the Southern New England coastline of Connecticut and Rhode Island and Long Island, New York (Figure 1). It has free connection with the North Atlantic Ocean on its eastern margin, where it merges with Block Island Sound. Its western connection to the sea is more restricted, passing through a series of narrows, and thence, down the East River to join New York Harbor and the New York Bight. Block Island Sound is open to the continental shelf water and, in comparison to Long Island Sound, is more exposed to the open ocean environment.

Both Long Island and Block Island Sounds lay adjacent to high-density population centers and heavy industry. As a result, ports in the region are exposed to a large amount of commercial, recreational and military traffic.

Harbors found at inlets or river mouths will tend to fill in with sediment from either river or open water sources. Agricultural development over the last 200 years has contributed to and accelerated this sedimentation process. To maintain these waterways for appropriate traffic, it has been necessary to periodically dredge these sediments from the harbors and deposit the material elsewhere. Maintenance and improvement of navigability of the various ports has been a responsibility of the U.S. Army Corps of Engineers since 1824 (4 Stat. 32). The Corps currently maintains 50 Federal Navigation Projects in the Long Island/Block Island Sound region (Figure 2, Tables 4a and 4b). Thirty-one are in Connecticut or Rhode Island waters under the authority of the New England Division of the Corps of Engineers (Table 4a). The remaining nineteen of these waterways are in New York waters under the authority of the New York District of the Corps (Table 4b).

Since 1890, a minimum of 100 million cubic yards (c.y.) (75 million m^3) has been dredged from Federally-maintained waterways bordering Long Island Sound. Most of this volume was from Connecticut, the remainder, from ports in Westchester County and along the north shore of Long Island. Commercial harbors usually generate the largest volumes. Past records indicate that the seven Federally maintained Connecticut commercial ports, listed in Appendix C of this report, have contributed about 84% of the total volume dredged from Connecticut since 1948. The remaining 16% originated from primarily recreational ports. Large Federal projects have included the Thames River, the Connecticut River and New Haven Harbor. Records of the volumes of privately dredged material are incomplete; however, it is known that about 75% of that volume originates from Connecticut. Approximately 25% of the Sound-wide private dredging is done in New York waters where the center of activity is in New Rochelle.

TABLE 4a

Federally Authorized Navigation Projects in the Long Island Sound Region, New England Division*

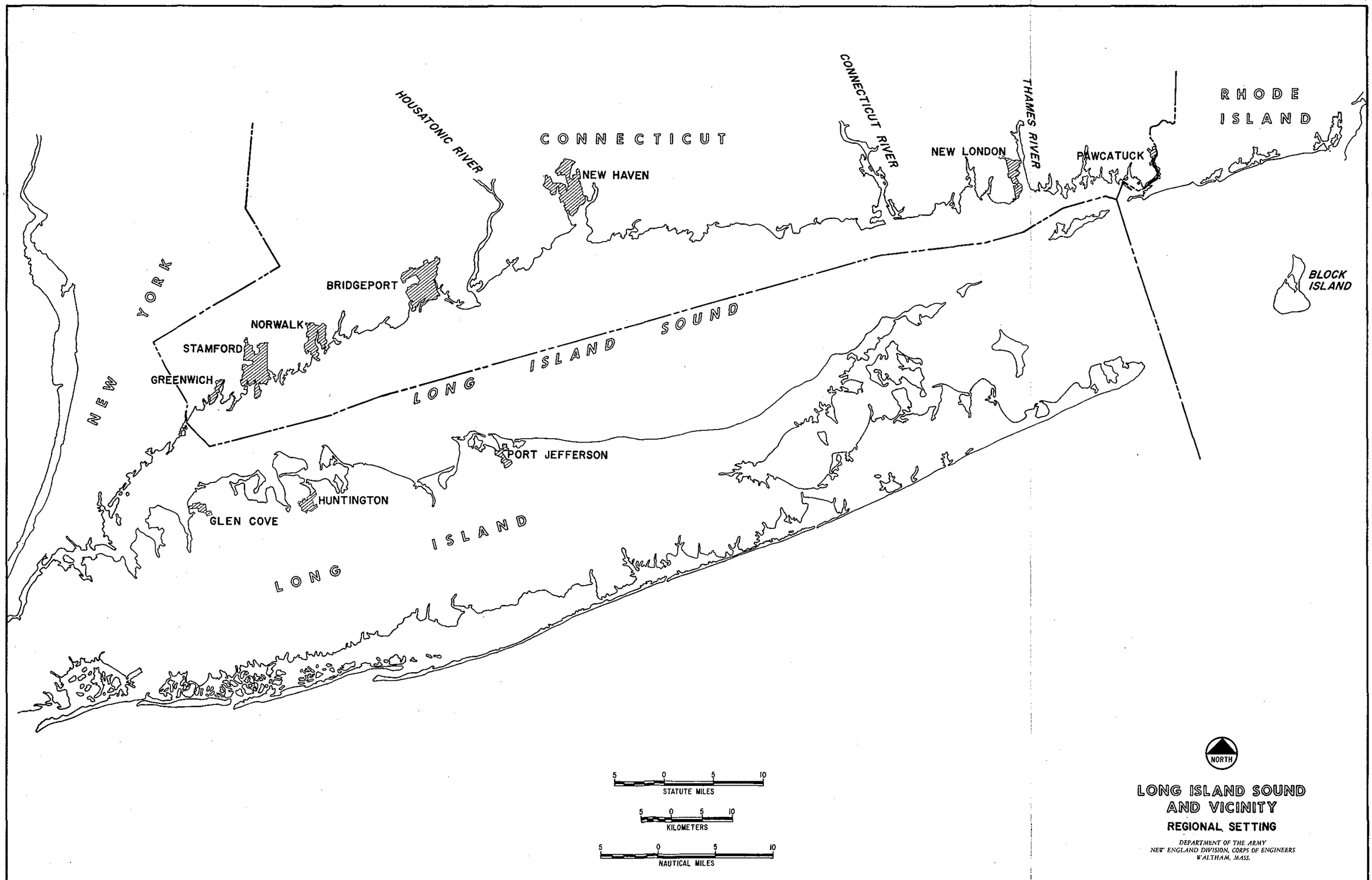
Western Long Island Sound
1. Greenwich Harbor
2. Mianus River
3. Stamford Harbor
4. Westcott Cove
5. Five Mile River
6. Wilson Point Harbor
7. Norwalk Harbor
8. Saugatuck River and Westport Harbor
9. Southport Harbor
10. Black Rock Harbor
11. Bridgeport Harbor
12. Housatonic River

Central Long Island Sound
13. Milford Harbor
14. New Haven Harbor
15. Branford Harbor
16. Stony Creek
17. Guilford Harbor
18. Clinton Harbor
19. Patchogue River
20. Connecticut River

Eastern Long Island Sound
21. Niantic Bay and Harbor
22. Upper Thames River
23. New London Harbor
24. Mystic River
25. Stonington Harbor
26. Little Narragansett Bay
27. Watch Hill Cove
28. Pawcatuck River

Block Island Sound
29. Great Salt Pond
30. Block Island Harbor
31. Point Judith Harbor

*Locations are listed in Figure 2.



LONG ISLAND SOUND AND VICINITY

REGIONAL SETTING

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

FIGURE 1

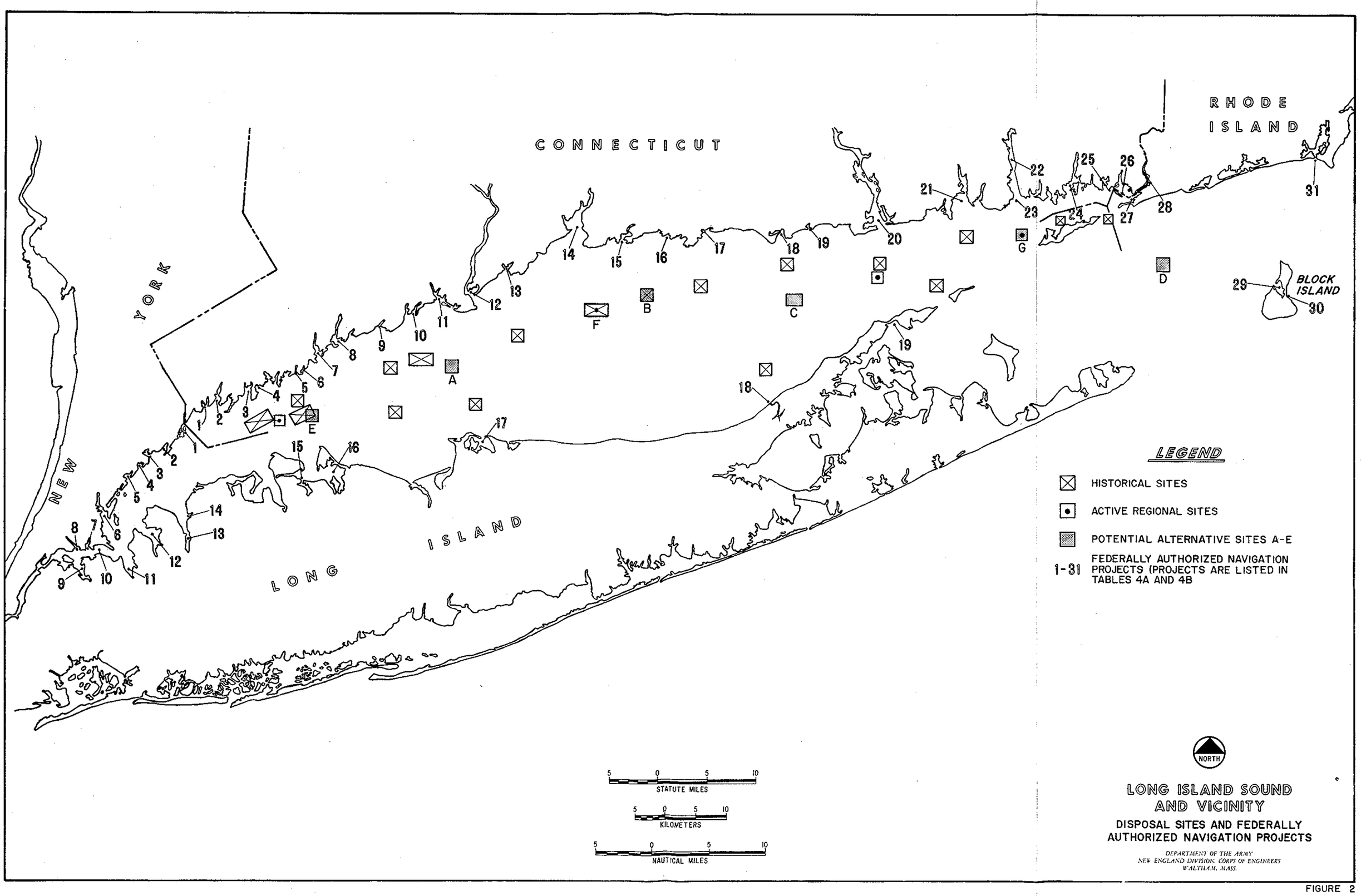

CONNECTICUT
RHODE ISLAND
NEW YORK
LONG ISLAND
BLOCK ISLAND
LEGEND
HISTORICAL SITES
ACTIVE REGIONAL SITES
POTENTIAL ALTERNATIVE SITES A-E
1-31 FEDERALLY AUTHORIZED NAVIGATION PROJECTS (PROJECTS ARE LISTED IN TABLES 4A AND 4B
NORTH
5 0 5 10
STATUTE MILES
5 0 5 10
KILOMETERS
5 0 5 10
NAUTICAL MILES
LONG ISLAND SOUND AND VICINITY
DISPOSAL SITES AND FEDERALLY AUTHORIZED NAVIGATION PROJECTS
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

FIGURE 2

TABLE 4b

Federally Authorized Navigation Projects in the Long Island Sound Region, New York District*

Western Long Island Sound
1. Port Chester Harbor
2. Milton Harbor
3. Mamaroneck Harbor
4. Echo Bay Harbor
5. New Rochelle Harbor
6. East Chester Creek
7. West Chester Creek**] Tributary to the East River
8. Bronx River**]
9. Flushing Bay**]
10. East River**
11. Little Neck Bay
12. Manhasset Bay
13. Hempstead Harbor
14. Glen Cove Creek and Harbor
15. Huntington Harbor
16. Northport Harbor

Central Long Island Sound
17. Port Jefferson Harbor
18. Mattituck Harbor

Eastern Long Island Sound
19. Greenport Harbor

*Locations are listed in Figure 2.

**Dredged material from commercial harbors west of Throgs' Neck Bridge, New York, would not be disposed in Long Island Sound pursuant to a 1981 Connecticut-New York agreement (Letter dated 9 December 1981 Connecticut Department of Environmental Protection).

It is estimated that future dredging in the Long Island Sound region will involve approximately 79.9 million cubic yards of material over the next 50 years (Appendix C). This estimate is primarily dependent on the economic growth of individual harbors and the region and is discussed in Appendix C as the most probable growth scenario. Table 22 in Appendix C indicates that under the most probable future, 22,997,000 cubic yards would originate from Federal maintenance dredging, 13,610,000 cubic yards from Federal improvement dredging and 43,325,000 cubic yards from non-Federal dredging. The majority of the volumes from Federal maintenance and improvement dredging again will be generated from commercial ports: 86% of maintenance and 91% of improvement. The remaining volumes represent maintenance and improvement dredging in recreational harbors.

A. Dredging Methods Employed in Long Island Sound

Historically, two general methods of dredging have been employed in Long Island Sound: mechanical and hydraulic.

The most common dredging method utilized in Long Island Sound is the mechanical bucket and scow. Here, the material is "scooped" from the bottom by a jaw shaped apparatus called a clamshell mounted on a barge and then deposited into a scow for transport to the disposal site. The material is discharged via bottom-opening doors which allows the entire load to be dropped essentially as one mass. This provides for minimal dispersion of the sediments into the surrounding environment at both the dredge and disposal site because the material remains cohesive and is mixed with little water. It also allows relatively accurate placement of the load. Its mobility and low cost makes this method highly suited to the small-scale operations most prevalent in the Sound.

A hydraulic dredge operates similar to a vacuum cleaner. A suction tube equipped with rotating cutter heads dislodges the sediments, and travels along the bottom at the desired depth. The suction provided by large pumps in the dredge remove the dislodged sediments, along with about 4 to 5 times as much water, and deposits the slurry into a disposal site via pipelines.

Hopper dredges are another form of hydraulic dredge. A suction plate is extended to the bottom and suction is provided by large pumps aboard the vessel. The dredged material is brought aboard in a slurry and placed in hoppers within the vessel. The dredge then takes the material to the disposal site and releases it through bottom opening doors. Hopper dredges also have the capability to pump the dredged material to disposal sites via pipelines.

Hopper dredges have been used occasionally for larger projects such as the Connecticut River dredging in 1970. The pipeline dredge has been used more frequently than the hopper dredge in LIS but considerably less than bucket and scow.

Another method of hydraulic dredging available is the side cast dredge. In this instance the vessel is self propelled. Suction plates extract the material in a slurry which is pumped out of the vessels system via a telescoping discharge pipe along side of the channel. The side cast dredge operates by making as many passes along the area of channel being dredged as needed.

B. Disposal of Long Island Sound Dredged Materials

Dredged material from Long Island Sound is placed in at least five kinds of disposal areas: (1) upland or marsh sites most often adjacent to the dredging area, (2) the Mud Dump Site in the New York Bight, (3) in open-water sites in Long Island Sound proper, (4) beach extension and (5) beach nourishment. Historical data on the partitioning of the total volume of dredged material among these three disposal alternatives are incomplete. Upland disposal was probably used extensively in the early decades of this century prior to the heavy industrialization of many areas bordering the Sound and before the ecological value of near-shore areas and marshes was recognized. The viability of upland disposal has decreased in recent years because of a lack of suitable sites. At present this alternative is used infrequently for larger projects in the Sound, and is primarily restricted to maintenance dredging of several Connecticut rivers and small recreational harbors. The Mud Dump Site in the New York Bight is occasionally used for the disposal of material dredged from a number of ports in western Long Island Sound, particularly Flushing Bay, Bronx River and East Chester and West Chester Creeks. A recent agreement between the States of Connecticut and New York has stipulated that dredged materials from harbors west of Throg's Neck Bridge will continue to use the Mud Dump. The majority of the material dredged from within the Sound has been dumped at the 19 historic open-water sites within the Sound (see Figure 2). In 1973 the number of open water sites in the Sound was reduced from 19 to 3. This action was reflected in a joint management plan originally developed by the states of Connecticut and New York and finally published under the auspices of the New England River Basins Commission (NERBC) as the Interim Plan (NERBC, 1980).

The major objectives of the interim plan include expediting review of individual projects, providing additional guidance for the management of dredged material disposal and increasing public understanding of dredging and the disposal of dredged material. The plan acknowledges the need for cooperation among the concerned Federal and State agencies as well as the efforts undertaken by the Corps and others to increase our knowledge of dredging and disposal processes. The Corps' regulatory program and the State's water quality certification process for disposal activities are complemented through the provisions of the interim plan.

C. Authority for Dredging and Disposal

Maintaining and improving congressionally authorized navigation projects, evaluating permit applications and issuing permits for non-Corps work are Corps of Engineers responsibilities. These statutory responsibilities have been molded by regulation and policy to afford the states control over work in waters under their jurisdiction. A Corps permit may not be issued and a Federal project may not begin without State Water Quality Certification and confirmation of consistency with approved coastal zone management (CZM) programs. Through their water quality certification and coastal zone management (CZM) programs the states can prohibit any work which may violate its water quality standards or is not consistent with approved CZM plans except in National emergencies. Connecticut and Rhode Island have CZM plans in effect at this time.

Statutory limitations of jurisdiction allow the Corps to select and manage disposal sites for dredged material in open water only. The Corps evaluation includes all viable alternatives but cannot require specific upland site to be used. However, when upland sites are available and the evaluation shows them to be more suitable than open-water, the Corps of Engineers can deny an open water disposal permit.

SECTION II

NEED FOR THE ACTION

The various bays and harbors along the LIS coastline serve the area's economic, recreation and national defense needs. Free access to these ports is necessary for the continued well-being of the region.

Ten major ports in LIS provide facilities for both domestic and foreign waterborne commerce. Approximately 70% of the total short tonnage shipped through LIS ports are petroleum products including residual and distillate fuel oils and gasoline. Residual fuel oil is used primarily for power generation, distillate fuel oil for homeheating and industry, and gasoline for a variety of self-propelled vehicles. Although no significant increase in such commodities is projected within the next 20 years due to limited supply, increased price and consumer conservation, it may be offset by the projected increase in the use of coal in existing and new regional power facilities. The most probable future indicates that coal conversion is likely for both the Norwalk and Bridgeport plants; other facilities may also be required to convert (Appendix C).

Based on an economy of scale, the most cost-effective means of transporting oil or coal is by the large deep draft vessel. Use of smaller vessels or other means of transport would increase the cost of the commodity. If the deeper draft vessels are used, safe passage will require improvement and maintenance dredging in the affected harbors.

The other major commodities in the LIS region include construction materials (sand, gravel, stone), chemicals and chemical products and iron and steel scrap. As with petroleum products, waterborne transport is more cost effective than other modes. Assuming the maintenance of lower costs for these commodities is desirable, future reliance on shipping will continue.

The recreation industry is also an important factor in the regional economy. The New England River Basins Commission in 1975 reported that an estimated 80,000 recreational craft are berthed in the LIS bays and harbors (NERBC, 1975a). The same report projected that with the expected increase in population and leisure time, 15,000 new slips and moorings will be required by 1990 and 46,000 by 2020. Most of this increased demand will be located in the western Sound which is already heavily used. To keep up with this increased demand and to maintain boating safety, the smaller harbors will require both improvement and maintenance dredging in the future. Maintaining clear passage is not only necessary for continuation of recreational activities such as boating and fishing but also the economic health of associated smaller businesses such as marinas, boat dealers, and bait and tackle shops.

Commerical fishing, although not a large industry in the LIS region, is nevertheless important to the local economies. Unpublished data from the National Marine Fisheries Service indicates that a value of $5.9 million in total landings were taken during 1977 (cited by Schubel et al., 1979). Of the $5.9 million, 46% was derived from oysters, 32% from lobsters and 9.5% from finfish (mainly scup and shad). Maintenance and some improvement dredging will be required to continue this activity at the smaller harbors.

The Thames River in the New London/Groton area is an important home base port for the manufacturing of our Atlantic submarine fleet. Improvement and maintenance of this waterway to serve the fleet's activities is necessary for national defense.

Clear access to the waterways of LIS is necessary for the continued well-being of the region's economy, defense, and general public. Cessation or a severe reduction in dredging activities would allow the bays and harbors to shoal eventually creating obstructions for general passage. The impedance to traffic could increase the risk of collisions and groundings, create hardships to large and small businesses, increase the cost of commodities, and compromise our defense capabilities. Continued dredging in LIS harbors will require some means of disposal of the dredged material. Controversy over the environmental soundness of open water disposal has resulted in the closure of all but three interim dump sites within LIS. The lack of such a site in the Western Sound is delaying private and Federal navigation projects.

When open water disposal is considered as an option for the discharge of dredge material regulation of that action is the responsibility of the Corps of Engineers.

Inherent in that responsibility is adherence to the guidance of the National Environmental Policy Act of 1969 (NEPA). In conformance with NEPA this EIS presents the impacts of open water disposal and alternative measures of open water disposal in Long Island Sound and displays other disposal alternatives not within the regulatory responsibilities of the Corps of Engineers.

In full compliance with NEPA the Corps has undertaken exhaustive nationwide research into the various alternative measures of dredge disposal and their environmental impacts under the Dredge Management Research Program (DMRP).

To further meet the requirements of managing disposal of dredged material the Corps of Engineers, New England Division, has funded and directed the Disposal Area Monitoring System (DAMOS).

SECTION III

ALTERNATIVE METHODS OF DREDGED MATERIAL DISPOSAL

This section displays the various disposal alternatives available in the Long Island Sound study area. Alternatives are identified, described, and the generic feasibility of each alternative is discussed relative to engineering and economic considerations. The relationships between the alternatives and the various laws and regulations are presented next. The generic feasibility and legal constraints are summarized in Table 7 at the end of this section.

A. IDENTIFICATION OF ALTERNATIVES.

Basic alternatives for dredged material disposal discussed in this report are listed below.

Alternative	Type
1. Open Water:	a. Deep Ocean b. Near Shore c. In River/Harbor
2. Upland:	a. No Further Use Intended b. For Construction c. For Habitat or Recreation Development
3. Containment:	a. For Construction b. For Habitat or Recreation Development
4. Beach Restoration	
5. Incineration	
6. Resource Relamation	
7. No Action	

B. FEASIBILITY.

1. Open Water Disposal.

Open water disposal is the most common method of disposal for dredged material in the Long Island Sound area. The dredged materials are transported to and discharged at a designated disposal site. The relative ease of this method and its relative low cost compared to alternative disposal methods has historically made this the favored method for larger projects in New England.

Concern over environmental issues and management problems led to closure of 15 of the 19 historical open water sites in 1973. With the subsequent closure of the Eatons Neck Disposal site in 1974, no open water sites were available in Western Long Island Sound. As a result, much of the western Sound and New York dredged sediments were forced to utilize the New York Bight or containment areas. Economic factors limited use of these alternatives to those permittees who could afford transportation costs and Federal projects.

a. Deep Ocean Disposal.

The disposal of dredged material in the deep ocean involves use of an offshore location, which for purposes of this document is beyond the limits of the continental shelf with depths ranging from one to two miles. For material dredged in Long Island Sound, this would involve transport of material approximately 100 miles beyond the limits of the Sound.

Engineering considerations are likely to limit deep ocean disposal with present equipment. Additional and larger barges would be required to maintain the present rate of dredging because of the increased time required for the trips. Larger ocean-going barges could be readily constructed; however, the cost of this option would be relatively high and time required for implementation may be a problem unless cost-saving improvement in the dredging-disposal process are brought forth. Disregarding the initial investment, the transportation component of disposal would increase the overall cost by $6.00/cu yd, assuming a transporation cost of $.06/mile (Conner et al., 1979). Also, significant expenses would be incurred for time and resources of other Federal agencies in performing their monitoring and surveillance responsibilities, i.e. U.S. Coast Guard and Food & Drug Administration. This cost would be an unseen cost to the tax payers and a considerable burden for the agencies involved due to reductions in budget and staff. Further discussion of the average transportation cost of ocean disposal is contained in Section 3 of Appendix C.

b. Near Shore Disposal.

This alternative would involve the transport of dredged material to disposal sites in Long Island Sound or Block Island Sound.

Historically, about 60% or at least 35 million cubic yards (c.y.) of material dredged from the Long Island Sound Area has been deposited at 19 open water dumping grounds located throughout the Sound (Figure 2). It is estimated that at least this quantity would be disposed of in the Sound during the next 50 years with present technology and policies.

The past convenience of open water disposal has resulted in an established technology that has been used at least since the beginning of this century. Two basic techniques are available to transport and deposit dredged material to near-shore open water sites as discussed in Section II of this report: (1) bucket and scow, and (2) hopper dredges.

The most widely used system in Long Island Sound is the bucket and scow. Dredged material is deposited on scow or barge by a clam shell or bucket dredge and is towed to an appropriate dump site. This dredging method is suited for working in large and small areas such as harbors and slips. Transport may be limited by large waves developed in relatively exposed areas. Disposal is usually accomplished by release through bottom-opening doors on the scow.

Hydraulically dredged material is transported in seagoing vessels with interior hoppers and bottom opening doors. This method has been used occasionally for a few Long Island Sound projects involving large amounts of dredged material, e.g. the Connecticut River dredging in 1970 and New Haven in 1979. The nearest available Corps of Engineers hopper dredge, is located in Philadelphia. The hopper dredge is mobile and provides a minimum of interference with passing vessels while operating in the channel to be dredged. Currently this type of dredge is capable of moderately rough water operation. Use of this system could be more advantageous for deposition in Block Island Sound and projects involving large amounts of dredged sediment. Transportation costs for both methods, in general, average about $0.062/c.y./mile (Appendix C).

Transportation of dredged material from its source to a regional disposal site is most cost effective because of the generally shorter transport distance. Presently, three interim sites have been designated for near-shore disposal in Long Island Sound: the New Haven, Cornfield Shoal and New London sites. In addition, Dames and Moore, under contract with the Corps of Engineers, New England Division, has proposed four new candidate sites (A, B, C, and D) which were selected from areas of highest environmental suitability in relation to the location of sources of dredged material in the Long Island Sound Region (Appendix A). The selection process and characteristics of these sites are addressed in Section IV of this report as well as in Appendix A. The Final Environmental Impact Statement for the Designation of a Disposal Site for Dredged Material in Western Long Island Sound - WLIS III released by the Corps of Engineers, New England Division, in February 1982, dealt with the specifics of a fifth new site west of the discontinued Eatons Neck Disposal site.

c. River/Harbor Disposal.

Under this alternative, the disposal of dredged material would be made in the river or harbor where the dredging takes place. Assuming a similar transportation cost of $0.06/c.y./mile, the cost of disposal would be low in comparison with other open water disposal due to lessened

transport distance. Hydraulic pipeline or sidecast dredging may even prove less expensive but can present environmental difficulties due to the increased suspended sediments.

Engineering and economic considerations would not be limiting for disposal in rivers and harbors. Such disposal operations were common in the major rivers of Long Island Sound in the past. For various reasons including regulations, lack of sites, public opposition and economics, these operations have dwindled.

River/harbor disposal is applicable in limited situations -- but cannot be considered a significant large scale disposal alternative to most other methods of disposal. This alternative must be considered as applicable only on projects with relatively clean material.

2. Upland Disposal.

Upland disposal involves the transport of the dredged material to a site on land. The feasibility of this alternative is highly dependent upon the availability of a site, the nature of the site and dredged materials and the management of the site.

Transportation of the material to the site is a significant factor. If not within hydraulic pumping distance, the material would have to be dewatered and hauled by truck or rail -- the problems associated with these are detailed in Appendix C.

While a detailed engineering evaluation is beyond the scope of this report, pertinent aspects of upland disposal are summarized below.

Dikes can be constructed to contain the dredged material if suitable diking materials are available. The site must generally be within an economically feasible distance and elevation from the dredging site.

However, if the site is to be managed for another use such as a construction site, recreation, or wildlife habitat, the characteristics of the dredged material become a constraint. Generally only coarse grained material is suitable for construction purposes; however, a mixture of various materials may be used when proper foundation design critera are followed. Disposal of fine sediments on land ususally requires retaining structures to prevent erosion of the material. Coarse to fine may be used to create recreation and wildlife habitat. Treatment of the sediment and selection of appropriate food and cover vegetation should be considered. The area may be managed as a wetland or upland habitat for a variety of wildlife species (Smith, 1978; Lunz et al., 1978). The Corps of Engineers is currently studying, under DMRP, an experimental upland habitat area for geese created with dredged material at Nott Island along the Connecticut River (Hunt et al., 1978a).

General engineering and vegetation planting considerations have been reviewed by Environmental Laboratory (1978) and Hunt et al. (1978b).

Utilization of upland disposal sites usually requires that local interests be responsible for the site once the deposition is complete. The chief economic constraint to post-dump management is the lack of local interest to fund the operation and maintenance of the site. However, when local interests participate in management significant public benefits can accrue to the project.

Upland disposal of dredged material is not within the Corps of Engineers jurisdiction. States and/or local authorities designate upland sites. For example, the Corps of Engineers experimental site at Nott Island, Connecticut (Hunt et al., 1978a) and the upland site near the Taunton River, Massachuetts (CE, 1978a) are sites designated for use by the concerned states. State and local approval was necessary for land disposal used for the Corps Connecticut River Navigation Projects (CE, 1978b). However, these sites are generally designated for one time use for clean coarse dredged material from nearby sand bars and would not be available for disposal of general LIS derived sediments. Site selection for such disposal has not been done on a regional basis in the New England area. The State of Connecticut is currently investigating the feasibility of upland disposal (CT Department of Environmental Protection, letter dated 23 July 1981) which is funded under the authority of the Water Resources Planning Act of 1965. When information pertinent to this programmatic action becomes available, the PEIS would be supplemented. The New York District of the Corps of Engineers did a preliminary site selection in the metropolitan New York area including Long Island and New Jersey (Leslie et al., 1980). Fifteen sites were chosen for evaluation including one in North Hempstead, Long Island which would be available for LIS derived sediments. Barren land, wetlands, crop and pasture land were given particular emphasis as potential sites. The site selection methodology was similar to that used by Dames and Moore in their study for open water disposal (Appendix A). A comprehensive screening effort of all sites will be accomplished this year. However, no decision on a particular site is expected until mid-1985 or later (New York District, personal communication).

3. Containment.

Dredged material can be deposited within dikes or behind bulkheads constructed offshore or adjacent to land. Construction of an offshore facility is more feasible in shallow water. Once full, the site could serve as substrate for construction of industrial or residential complexes, recreational areas and wildlife habitat depending upon the type of material used. At least 70 such facilities have been built or are being planned by State, local, or Federal authorities throughout the country. The Corps of Engineers, New England Division, is currently studying the feasibility of establishing containment facilities in Long Island Sound (CE, 1979a, 1980a, 1981). Two prototype study sites are

currently being investigated: Clinton Harbor and Black Ledge near Groton. Several aspects of this investigation have been completed: geotechnical and environmental data collection, economic and social impacts analysis and a market user survey. Additional sites will be investigated upon completion of these prototype studies.

The major cost components of a facility would be associated with dike construction. Costs would generally vary with the type of construction material used, location and size of the facility, and the subsurface foundation conditions. Two basic construction materials have been considered: rock and sheet-pile cofferdams. Rock structures are more feasible than the latter because of the higher construction and maintenance costs associated with sheet-pile facilities. Coarser dredged material also may be used as a "core" of the dike structure and would be faced with riprap. Shoreline extension facilities are less costly than island structures because of the greater construction costs associated with constructing offshore on a cost per cubic yard of storage volume. The cost of construction per cubic yard of disposal area generally decreases as the size of the facility increases. Based on current information facilities in Long Island Sound region would probably range from 100,000-1,000,000 cubic yards in capacity. However, larger facilities with capacities up to 10,000,000 cubic yards are also being considered. The nature of the subsurface conditions can also effect project cost. Subsurface conditions govern the design of the dike cross-section. A low bearing capacity (i.e. a soft substrate) would necessitate widening of the dike cross-section and therefore increase its volume and cost of construction.

Within the Long Island Sound region, use of containment sites has occurred in New York City for port facilities and warehouses, in the Bronx for high rise apartments and on Long Island itself for single family homes. One potential use could involve the diked and filled area as an "industrial island." The island would act as a deepwater complex, handling deep draft tankers carrying oil or liquified natural gas.

If the site is to be maintained for recreation or habitat development purposes, any type of material may be deposited rather than the coarser or specially treated sediments necessary for construction uses. Vegetation should be encouraged and the site would then provide habitat for various wildlife species native to the area. Offshore islands would be particularly valuable for such purposes because isolation from human activity is important to many species of birds that nest in the area. As such, benefits would accrue to natural resources, rather than to economic

sectors. Section 150, of Public Law 94-587, provides for up to $400,000 to be expended by the United States to create wetlands from dredged material. Utilization of dredged material for other uses may be undertaken provided extra cost to the United States is not incurred.

Other engineering and design considerations have been reviewed by Walsh and Malkasian (1978) and Palermo and Poindexter (1978).

Under present authorities the cost of the retaining structures would have to be born by a local interest. However when the present feasibility study is completed in 1984, and if a regional facility is recommended, authority could be provided for Federal funding by Congress for construction of containment facilities in Long Island Sound.

4. Beach Restoration.

This alternative involves the deposition of dredged sands onto beaches. Beach nourishment is not a new disposal alternative and is a common practice wherever clean dredged sands are available and nearby beaches require nourishment. The acceptability of sand for use in beach nourishment is dependent upon its similarity in grain size composition to that of the receiving beaches (Conner et al., 1979).

The disposal of contaminated sediment in a moderate or high energy intertidal area would be undesirable because of the increased potential for transport and release of contaminants in particular or soluble forms into adjacent waters by wave action (Gambrell et al., 1978). Similarly, silty sediments would be quickly eroded and deposited in lower energy areas offshore. However, clean silty sediments may be suitable for disposal in low energy intertidal areas to enhance or replenish mudflats.

Depending upon the type of material being dredged and the location of the dredging, the engineering limitations associated with the use of dredged material for beach nourishment would vary. The economic cost of beach nourishment is site specific but maybe about the same as that of open water disposal. It is considered more desirable in view of the associated benefits. The major factors limiting beach nourishment as a dredged material disposal option are the availability of suitable material among dredged materials and the distance from the dredging area to the beach.

5. Incineration.

Incineration (combustion under atmospheric conditions) or pyrolysis (heat treatment without an atmosphere) has been proposed as a method of detoxication of contaminated dredged sediments (EPA, 1981).

Such processes would reduce the volume of organic substances such as PCB, DDT or petroleum hydrocarbons found in dredged sediments. Inorganic contaminants such as metals would not be eliminated by incineration but would be in transformed to a nontoxic solid phase by pyrolyis.

This alternative, however, is not currently feasible for the Long Island Sound area. Presently, there is no facility that could handle the projected volumes generated by Long Island Sound projects (Appendix C) in the northeast. The cost of implementing such a facility would have to borne by non-Federal interests. In addition, the cost of treatment which is approximately $100/cy of sediment (Malcom Pirnie, Inc., 1980), would be prohibitive to most large projects. However, the implementation of such a facility and improvement of the technology could make this alternative feasible in the future. At that time, acceptability of this alternative would have to be determined on a case by case basis.

6. Resource Reclamation.

The potential reclamation uses of dredged material are many. However, such uses as individual recovery of trace metals, chemicals or nutrients for other uses though possible, are not economically justified. Probably the only uses of the dredged material resource remotely viable in the Long Island Sound Area are: Sanitary landfill cover (Bartos, 1977); agricultural land enhancement, where the material is dredged and plowed into the existing soil to improve organic and nutrient content of the soil (Gupta et al., 1978); or similarly, as a soil enhancer for general landscaping purposes (A.D. Little, Inc., 1975; Spaine et al., 1978) although a high salt content could make the sediment useless for this purpose. However, none of these methods are presently economically marketable as the drying treatment, and transport costs are excessive. Although Long Island Sound sediments are predominantly fine grained, there is a possibility of combining this material with other solid "wastes" to create a suitable material for various construction uses (Bartos, 1977). Advances in technology could make the latter feasible and cost effective.

7. No Action.

A no action alternative would mean that no disposal of dredged material would take place. This implies that Long Island Sound Harbors could not be dredged and the waterways would eventually fill in. Passage of vessel traffic would be impaired. This is the least expensive alternative but socioeconomic hardships caused by interference with military, interstate and foreign trade activities would offset the savings of disposal costs by a large degree. A more detailed discussion is presented in Section V of this report and Appendix C.

C. RELATIONSHIP TO LAWS AND REGULATIONS.

Laws and implementing regulations that provide guidance, criteria, and restrictions upon the programmatic action are in existance and will continue regardless of the disposal method anticipated and the amount and nature of materials to be disposed of. Early consideration of the many legal requirements and guidelines is required to ensure that project decisions recognize and are based on an analysis of the impacts and alternatives associated with a proposal. This helps to avoid legal problems through early modification and coordination of a project. Table 5 summarizes the relationship of the Federal laws to disposal operations. Table 6 presents a matrix that matches the disposal options with the various Federal laws related to dredged material disposal for the Long Island Sound Area. Applicable Federal environmental laws are described in Appendix D.

Perhaps the three most significant laws regarding disposal of dredged material are the National Environmental Policy Act, the Clean Water Act, and the Marine Protection, Research and Sanctuaries Act. They provide guidelines designed to determine environmental impacts and to prevent unacceptable degradation of environmental and socio-economic resources.

The legal considerations for each disposal alternative must be applied on a case-by-case basis. Any one of the applicable laws may be a limiting factor and could restrict consideration or use of an alternative depending on the disposal situation, the need for dredging and disposal, the nature and quantity of materials, the availability of disposal options and the economic impacts on commerce.

Table 5

Summary of Federal Environmental Statutes and Relationships to Dredged Material Disposal in the Long Island Sound Region

LAWS AND REGULATIONS	OBJECTIVE	RELATIONSHIP	ADMINISTRATIVE AGENCY
National Environmental Policy Act of 1969	To insure that all actions having a significant effect on the human environment receive appropriate consideration in decisionmaking process.	This document -- aid decisionmaking by allowing all factors to be considered -- social, economic, and environmental concerns.	Environmental Protection Agency (EPA)
Fish and Wildlife Coordination Act of 1958	Protection of valuable fish and wildlife habitat from unacceptable degradation.	Consultation and coordination with Fish and Wildlife Agencies when dredging or filling.	U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS)
Endangered Species Act of 1973	To insure that actions do not critically endanger the existence of rare or endangered species.	Endangered species list consulted before action -- impacts assessed, Sec. 7 consultation if necessary.	FWS, NMFS
Coastal Zone Management Act of 1972	Requires coordination and compliance with approved Coastal Zone Management Plans -- to protect coastal environments.	Comply with existing State Coastal Zone Management Plans for projects having direct effect on LIS.	State Coastal Zone Management Office, Dept. of Commerce - Office of Coastal Zone Management
Rivers and Harbors Act of 1899, (Sec. 10)	To maintain navigable integrity of waters of the United States.	Construction, dredging, or fill in navigable waters require permit under Section 10.	Corps of Engineers (CE)
National Historic Preservation Act of 1962	Protection of cultural features of national significance.	National Register of historic places consulted for any project -- impacts avoided, mitigated.	Advisory Council on Historic Preservation
Marine Protection, Research and Sanctuaries Act of 1972 (Ocean Dumping Act)	Protection of valuable marine sources and designation of marine sanctuaries and disposal areas (Section 103).	Applies to Block Island Sound and seaward; also, applies to LIS projects larger than 25,000 cubic yards. Prohibits unacceptable adverse effects of disposal on ocean environment.	CE, and NMFS, EPA
Federal Water Pollution Control Act of 1972, (Clean Water Act)	Protection of integrity of waters of the United States, especially wetlands, water quality, fisheries, recreation.	All dredged material disposal in LIS is within jurisdiction must comply with regulations of Sec. 404 for discharge of dredged or fill material.	CE and EPA, and State Water Quality Certification (Sec. 401)
Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)	Provide for a development, recovery and management of all nonagricultural materials which have been historically discarded -- emphasis on safe disposal or reuse.	Would provide emphasis to be given for reuse of dredged material, or safe upland disposal.	EPA
Safe Drinking Water Act of 1972	Protection of potable water supplies -- in use and potential -- from unnecessary degradation.	Protection against contamination of fresh water considered especially important in some upland disposals.	EPA
National Shellfish Sanitation Program	Combines State and Federal resources to preserve and manage shellfish resources -- classifications and monitoring of shellfish areas.	Does not allow shellfish harvesting at disposal sites -- desire limit to open water disposal and careful monitoring.	U.S. Public Health Service, State Department of Health/ Environmental Protection
Clean Air Act amended 1977.	For the protection of the nation's air for the public health and welfare, prevents significant deterioration of air quality.	This Act would only apply in the case of incineration of dredged material.	EPA

Table 6*

Relationship of Federal Environmental Statutes to Disposal Alternatives

Law and Regulations	Deep Ocean Disposal	Near Shore Disposal	River/Harbor Disposal	Upland Disposal (All Purposes)	Containment (All Purposes)	Beach Restoration	Incineration	Resource Reclamation
National Environmental Policy Act of 1969	X	X	X	X	X	X	X	X
Fish and Wildlife Coordination Act of 1958	X	X	X	X	X	X	X	X
Endangered Species Act of 1973	X	X	X	X	X	X		
Coastal Zone Management Act of 1972	X	X	X	X	X	X	X	X
Rivers and Harbors Act of 1899, (Sec. 10)	X	X	X	X	X	X		
National Historic Preservation Act of 1962	X	X	X	X	X	X	X	X
Marine Protection, Research and Sanctuaries Act of 1972 (Ocean Dumping Act)	X	X			X			
Clean Water Act of 1977		X	X	X	X	X		
Resource Conservation and Recovery Act of 1976 (Solid Waste Disposal Act)				X				X
Safe Drinking Water Act of 1972				X	X			X
National Shellfish Sanitation Program		X	X		X			
Clean Air Act, as amended 1977							X	

*The matrix displays the laws that are, or could, be important in considering the various alternatives above.

Table 7

Summary of Considerations for the Feasibility of Dredged Material Disposal Alternatives in Long Island Sound

ALTERNATIVES	ENGINEERING	ECONOMIC	LEGAL
Open Water, Deep Ocean	Feasible, but would require modification of existing methods & equipment.	Could cost more than nearshore (below).	Criteria of EPA under Marine Protection Research, & Sanctuaries Act (MPRSA), Section 103.
Open Water, Near Shore	Existing equipment & methods established.	The least expensive method in most instances.	Clean Water Act (CWA), Section 404, MPRSA, State Water Quality Certifications, and Coastal Zone Mgmt. Act. (CZM)
Open Water, River/Harbor	Existing equipment & methods established. Must consider resedimentation in channel.	The least expensive method in many instances: Same as above, but less transport.	404 CWA - CZM more likely to affect this alternative & State regulations probably more stringent than Federal.
Upland, no future intended use	Feasible, but complicated and sensitive to capacity & logistic constraints.	More expensive than open water, plus cost of land & loss for other uses.	404, CZM, Fish and Wildlife Conservation Act (FWCA), and Safe Drinking Water Act (SDWA) each could restrict this alternative.
Upland, for Construction	As above; but need coarse material.	Expensive, but benefit could exceed cost if marketable.	404, CZM, FWCA & SDWA considered.
Upland, for Habitat or Recreational Development	As above; need special rehandling and management.	Expensive, but benefits are intangible.	404, CZM, FWCA probably favor this alternative in most instances. Must consider SDWA.
Containment, for Construction	Construction of facility more feasible in shallow waters or adjacent to land. Would require coarse-grained material. Easiest if adjacent to land.	More expensive than open water due to structural facilities and any rehandling - but benefit would mitigate cost, creating "land", for new use.	404 - CWA and CZM limiting legal considerations; Resource Conservation & Recovery Act (RCRA) would favor, but FWCA may not favor this alternative.
Containment for Habitat or Recreational Development	As above, but may use any kind of dredged material.	As above-but benefits are intangible.	As above; FWCA may favor in this case.
Beach Restoration	As above; usually limited by logistics and material.	Expensive - but benefits may mitigate cost.	RCRA & CZM probably favor this alternative; CWA may favor or restrict; others unlikely to restrict.
Incineration	May be feasible pending advancements in technology and construction of a facility.	Expense is presently prohibitive.	Would have to consider local Air Quality Regs. Other laws generally inapplicable.
Resource Reclamation	Feasible for some uses -- but require extensive rehandling.	Expensive, but benefits may mitigate costs.	RCRA & CZM favor this alternative. Others unlikely to affect.
No Action	Would require modification of port facilities. Not generally feasible in short term - perhaps in long term.	Would cause severe short term hardship. Long term modifications of ports would then reduce hardship.	Laws are written to provide for dredging, i.e. Rivers & Harbors Act. None encourage "No Action".

SECTION IV

THE AFFECTED ENVIRONMENT

A. OCEANOGRAPHY.

Long Island Sound was created during the last major continental glacial age, which climaxed roughly 15,000 years ago. It was formed of several terminal moraines that mark the southern-most extension of the ice sheets which covered and sculpted the New England bedrock that now forms the Connecticut shore of the Sound.

The floor of Long Island Sound can be classified into three general physiographic provinces; the western, central and eastern basins on the basis of circulation patterns and sediment characteristics. The western basin is characterized by few tributaries, irregular relief, poor circulation and water quality, greater human use than the rest of the Sound, and shallow depths. The bottom sediments are predominantly muds, and the basin is joined to the deeper central province by a narrow gap in the Stratford Shoals. The central basin, displays a smooth bottom that slopes gently to the south. Average depths are about 30 meters, and basin floor sediments are dominated by muds. The boundary between this basin and the irregular eastern basin is provided by the Mattituck Sill, a gravel ridge running between Duck Pond Point on Long Island and Hammonaset Point in Connecticut. This feature in part restricts circulation in the deeper portions of the central basin. The eastern basin, which in places is as much as 100 meters deep, has highly irregular bottom relief as a result of the strong currents passing between Long Island Sound and Block Island Sound to the east. The currents also account for the coarse nature of the sediments in this basin.

Water motion in Long Island Sound is dominated by tidal currents acting through exchange with the Atlantic Ocean. By far the strongest currents are found in the area of The Race, between Block and Long Island Sounds and at Six Mile Reef. The circulation is generally a westward spread of cooler, more saline bottom waters entering from Block Island Sound. Surface currents generally run from west to east as a result of prevailing winds and the balance of motion required by the westerly flow of bottom waters. This two-layered transport with major eddies in Long Island Sound helps maintain a nutrient budget a bit higher than that found in adjacent waters.

Block Island Sound circulation is largely controlled by tidal currents augmented by wind-driven flow. Unlike Long Island Sound, which displays varying degrees of stratification, Block Island Sound has a fairly well-mixed water column. General circulation consists of the eastward-flowing surface waters which leave Long Island Sound and spread out over Block Island Sound waters. The greatest flow then veers south and west around Montauk Point to form a coastal current along the southern shore of Long Island.

Temperature and salinity vary widely, and Block Island Sound displays values typical of the shallow southern New England continental shelf. Once into Long Island Sound, however, the estuarine situation becomes more dominant and salinities generally are lower as one moves westward.

A detailed description of the physical oceanography of LIS and Block Island Sound may be found in Riley (1955, 1956) and Williams (1969), respectively.

Nutrient levels exhibit seasonal cycles similar to those that occur in temperate open coastal waters. Large regional differences are not readily identifiable; however, there may be differences in maximum concentrations at times. Overall the concentrations of phosphate and nitrate decrease from west to east. Ammonia and dissolved organic nitrogen exhibit similar west to east gradients (Harris, 1959). Observed seasonal cycles have been attributed to phytoplankton use, excretion, regeneration and enrichment.

B. BIOLOGY.

1. Plankton.

Phytoplankton are floating microscopic plants which form the basis of the food chain in aquatic ecosystems. The phytoplankton in Long Island Sound exhibit regional and seasonal differences similar to those found for nutrients. A major bloom occurs in winter between January and March and is regulated by light and temperature. This bloom almost exhausts the nitrate levels in three to four weeks and is just about depleted afterward until an increase in the fall. Minor blooms occur during the spring and summer. The magnitude of this flowering depends upon available inorganic nitrogen and vernal temperatures. An autumn bloom, a result of strong vertical mixing may occur and is followed by very low growth until the winter. This cycle in Long Island Sound is similar to the rest of New England marine waters.

In Block Island Sound, there is a minor phytoplankton spring bloom in February-March followed by a moderately large population in late summer. This is typical of coastal temperate waters.

Listings of Long Island Sound phytoplankton can be found in Conover (1956), Riley and Conover (1967), TRIGOM/PARC (1974), and Nuzzi (1977).

Zooplankton are floating microscopic animals which feed on phytoplankton and other zooplankton. The major abiotic factors limiting the production and dispersal of estuarine zooplankton are temperature and salinity. Peak numbers of zooplankton produced annually are usually observed following the seasonal phytoplankton flowering described above.

The major zooplankton species and their seasonal distributions in Long Island Sound and Block Island Sound can be found in Deevey (1952a, b) Conover (1956) TRIGOM/PARC (1974), and Caplan (1977).

2. Benthos.

Long Island Sound supports an assemblage of both mature and immature forms of benthic invertebrates made up mainly of polychaetes (marine worms), amphipods (small laterally compressed crustacea) and molluscs (bivalves, snails, etc.). The distribution of these is governed mainly by different sediment compositions. Most of these benthic organisms are prey for larger predators, such as crabs, fish, lobsters and starfish, that feed on or near the bottom.

The biologic community in fine deep-water sediments is characterized by a polychaete-bivalve community. The coarse shallow-water sediment type generally has the greatest biomass of polychaetes; the surf clam is the most conspicuous mollusc.

The coarse deep-water sediments are generally lower in numbers of species and individuals than the coarse shallow area described above. However, the median diversity is greater than that in the soft sediments in the western basin.

Overall it appears that western Long Island Sound is more often dominated by polychaetes, many of which are typical stress-tolerant species. The abundance of species and individuals of molluscs and amphipods increases to the east.

More detailed descriptions of the benthic communities and sediments existing in Long Island Sound may be found in Sanders (1956), MACFC (1974) and Appendix A.

3. Fisheries and Shellfisheries.

Generally the fish occurring in Long Island Sound year-round are small euryhaline species: juvenile fishes that use the system as nursery grounds; or diadromous species that use the area to migrate to and from spawning grounds.

Two major species which remain in the Sound all year are the tautog and the blackback flounder. Most other major species appear in Long Island Sound only in certain seasons. Many are summer migrants which appear in May and usually leave in October. Typical are black sea bass, scup, northern puffer, menhaden, silver hake, red hake and butterfish. A complete list may be found in Richards (1963), Wise (1974), Valenti and Peters (1977), Thomson et al. (1971) and TRIGOM/PARC (1974).

The commercial fishery in the Long Island Sound is small in comparison to Block Island and Rhode Island Sounds. The standing crop of demersal fish is less than that recorded for Block Island Sound (Oviatt and Nixon, 1973).

Sport finfishing is usually concentrated around ledges, shoals, banks and other places where habitat and water depth changes induce fish to congregate. Major species sought by the recreational industry are winter flounder, fluke, striped bass, bluefish, tautog and cunner. The distribution of finfishes in Long Island Sound are exhibited in Figure 3.

The shellfisheries of importance within Long Island Sound are generally near shore resources (Figure 4). They consist of species such as oyster, bay and sea scallop, bay and ocean quahog, mussels, crabs and conch. The oyster fishery is the most economically important fishery in Long Island Sound.

The lobster is the second most important fishery within the Sound. The total value of landings in 1978 was in excess of $2 million (Connecticut DEP, 1979; in Appendix A). Their distribution as indicated in Figure 3 basically covers all of western Long Island Sound and the central area of central and eastern Long Island Sound. Densities and landings are greatest in western Long Island Sound and decrease to the east towards Block Island Sound.

The fisheries of Long Island Sound exhibit life cycle events which can be sensitive to man's activities. The timing of these events, such as migration or spawning, are generally related to water temperature and the animal's annual reproductive cycle.

A number of finfish in Long Island Sound exhibit migratory behavior. Examples such as menhaden and herring travel northward along the coastline as the water temperature warms and southward as it cools. Long Island Sound is also a major pathway for seasonal movements of adult bluefish which appear in May and remain until fall when the water temperature decreases. Young bluefish or "snappers" exhibit southward migration along the coast during the fall to join southern populations.

There are a number of anadromous fishes which migrate and spawn in freshwater tributaries to Long Island Sound. These would include alewife, herring, shad, striped bass, smelt and Atlantic salmon. Spawning adults generally migrate upstream during spring and summer depending on the species. Spawning takes place at an appropriate site during spring and summer for most species except Atlantic salmon and sea-run brown trout which spawn in the fall. The downstream emigration of juveniles or smolts (salmon) generally overlaps with the adult upstream migrations.

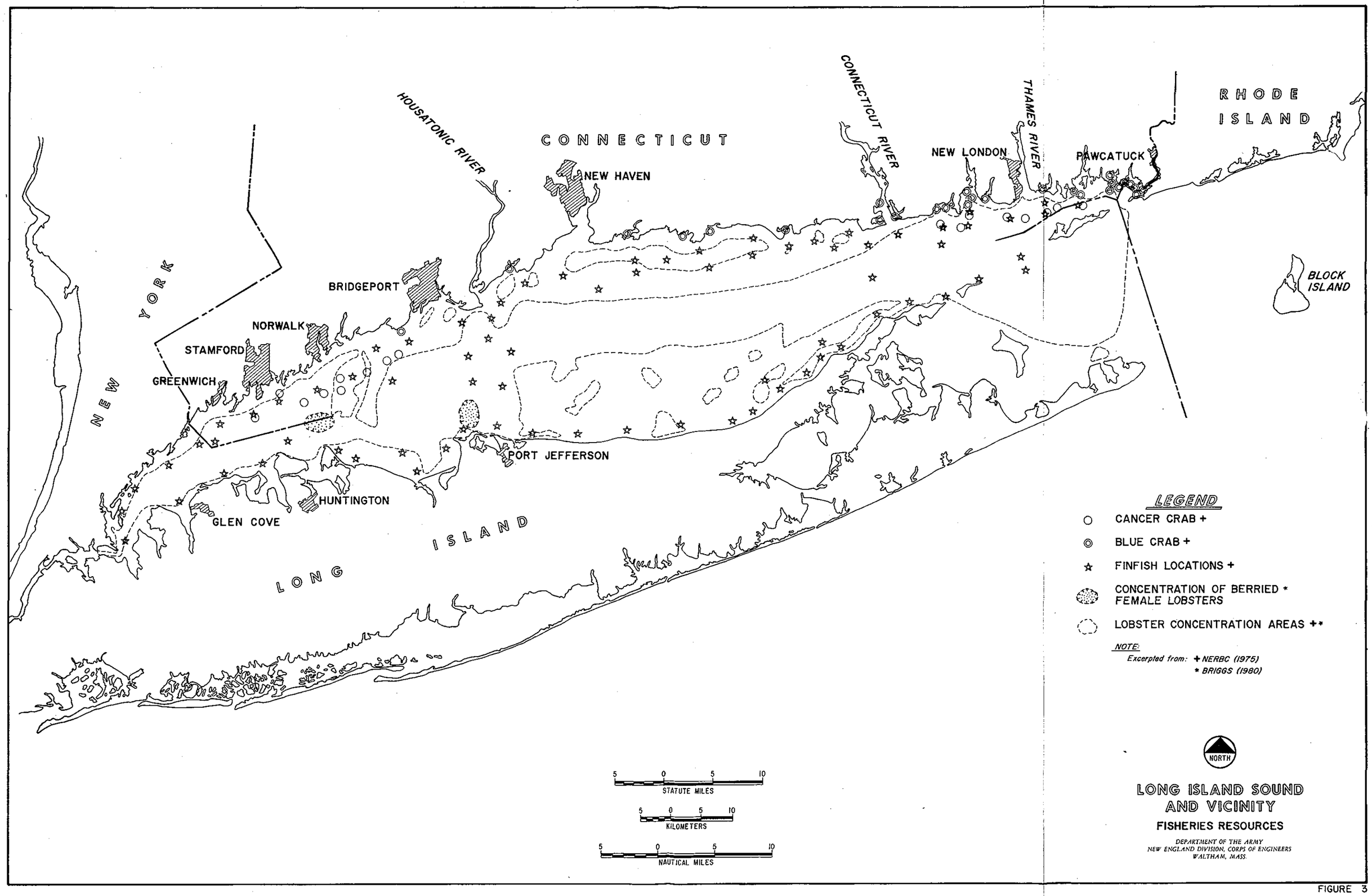

CONNECTICUT
HOUSATONIC RIVER
CONNECTICUT RIVER
THAMES RIVER
RHODE ISLAND
NEW LONDON
PAWCATUCK
NEW HAVEN
BLOCK ISLAND
NEW YORK
BRIDGEPORT
NORWALK
STAMFORD
GREENWICH
PORT JEFFERSON
HUNTINGTON
GLEN COVE
LONG ISLAND
LEGEND
CANCER CRAB +
BLUE CRAB +
FINFISH LOCATIONS +
CONCENTRATION OF BERRIED * FEMALE LOBSTERS
LOBSTER CONCENTRATION AREAS +*
NOTE:
Excerpted from: + NERBC (1975)
* BRIGGS (1980)
NORTH
5 0 5 10
STATUTE MILES
5 0 5 10
KILOMETERS
5 0 5 10
NAUTICAL MILES
LONG ISLAND SOUND AND VICINITY
FISHERIES RESOURCES
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

FIGURE 3

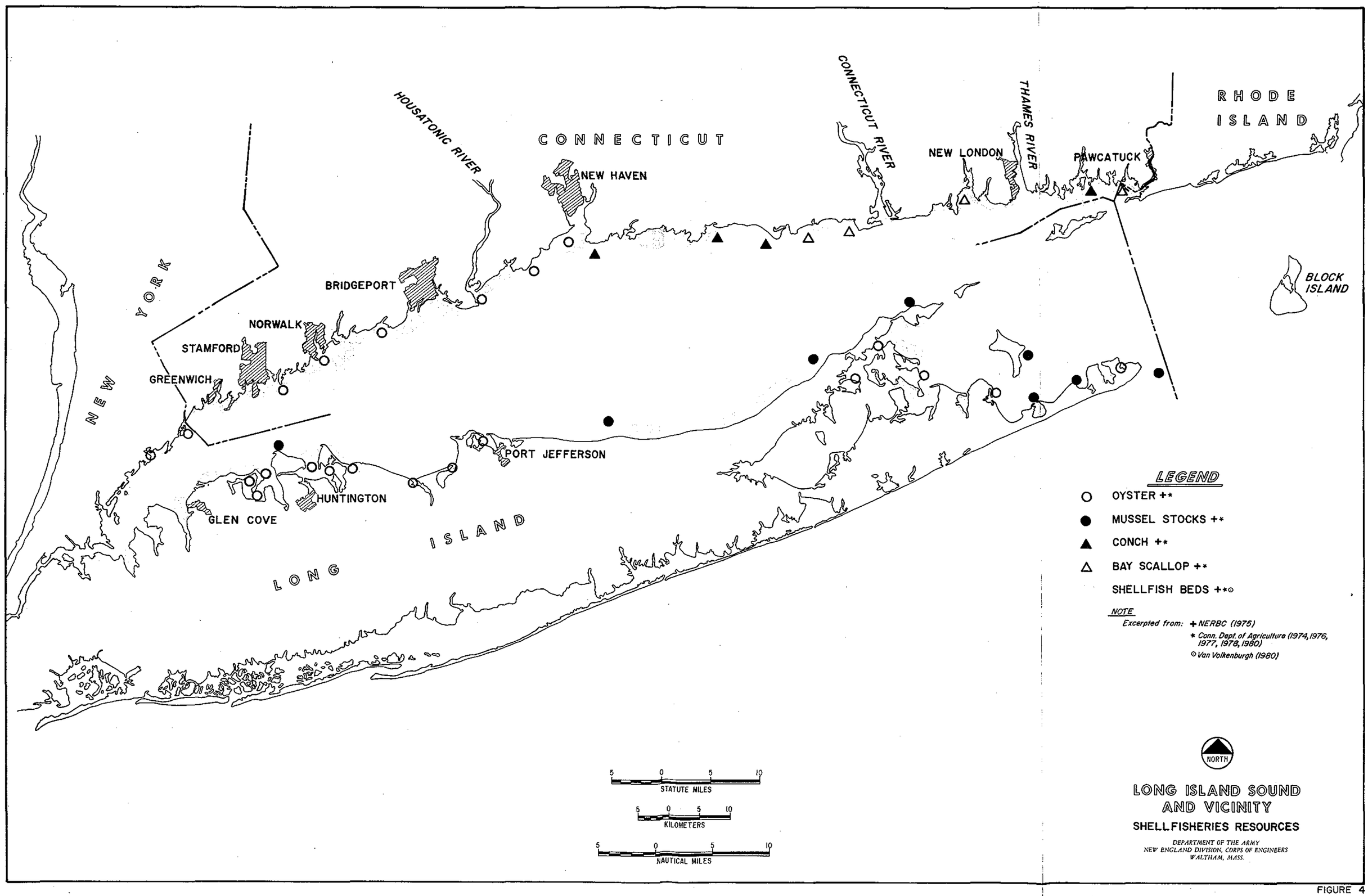

CONNECTICUT
RHODE ISLAND
NEW YORK
HOUSATONIC RIVER
CONNECTICUT RIVER
THAMES RIVER
NEW HAVEN
NEW LONDON
PAWCATUCK
BLOCK ISLAND
BRIDGEPORT
NORWALK
STAMFORD
GREENWICH
PORT JEFFERSON
HUNTINGTON
GLEN COVE
LONG ISLAND
LEGEND
OYSTER +*
MUSSEL STOCKS +*
CONCH +*
BAY SCALLOP +*
SHELLFISH BEDS +*⊙
NOTE
Excerpted from: + NERBC (1975)
* Conn. Dept. of Agriculture (1974, 1976, 1977, 1978, 1980)
⊙ Van Volkenburgh (1980)
5 0 5 10
STATUTE MILES
5 0 5 10
KILOMETERS
5 0 5 10
NAUTICAL MILES
NORTH
LONG ISLAND SOUND AND VICINITY
SHELLFISHERIES RESOURCES
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

FIGURE 4

The spawning period of shellfisheries also are a sensitive life cycle event. Oysters in the Long Island Sound spawn from mid July to early October in the brackish waters of bays and inlets in the Sound (Loosanoff, 1965). The less utilized soft-shelled clam spawns from June through September deeply buried in mud flats associated with brackish water (Wallace et al., 1965). The hardshell clam or quahog spawns in bay and cove waters during neap tides in July and August (Sinderman, 1969).

4. Threatened and Endangered Species.

An endangered species is one which has been determined by the Secretary of the Interior to be in danger of becoming extinct and has been placed on the list of species to receive protection. A species may also be considered as threatened or rare if its population becomes notably decreased because of the development of any number of limiting factors leading to a deterioration of the environment. Species which fall into these categories and have the potential for occurrence in Long Island Sound are found in Appendix A.

The shortnose sturgeon (Acipenser brevirostrum) is an endangered species which probably utilizes portions of Long Island Sound as it has been recorded in the Connecticut River (Shortnose Sturgeon Recovery Team, 1977). Since it is an anadromous species, it can be inferred that it enters coastal rivers to spawn, however very little is known about its distributional habits.

The hawksbill turtle, leatherback, Atlantic Ridley, green and loggerhead turtles may enter the Long Island Sound, although they are normally found in tropical and subtropical waters. The loggerhead turtle, green turtle and leatherback turtle have been reported on rare occurrences along the Connecticut shore.

Of the marine mammals listed in Appendix A, the finback whale and humpback whale are the most likely to occur near the coast. On extremely rare occasions whales have been reported in the Sound, as in 1975 when a finback whale beached itself near Groton. NERBC (1975) also identified the Atlantic right whale as a species which might occasionally occur near the eastern end of the Sound.

The bald eagle is another endangered species found around Long Island Sound. The bald eagle's range includes all of North America, with preferred habitat confined to the coastal zones, internal lakes, rivers and reservations, and along mountain ridges during migration.

The Arctic and American peregrine falcons are endangered migrant species which fly over the Sound area during the fall and spring. While most American peregrine falcons move down the interior of the United States, the major flyway of the Arctic peregrine falcon is along the east coast of the United States (Nature Conservancy, 1976; in Appendix A). The falcons commonly use coastal barrier islands for feeding and resting

during migration due to their remoteness and extensive marshes, which provide vast feeding areas for the falcons, which prey primarily on ducks and other shorebirds. The U.S. Fish and Wildlife Service has recently reintroduced the American peregrine falcon in the northeastern United States. Presently, breeding areas exist in New Jersey and New Hampshire.

Ospreys have been declining nationwide in recent years. Although not on the Federal list of endangered or threatened species, this bird is on the Audubon Blue List (Arbib, 1977; cited in Appendix A).

C. PREHISTORIC/HISTORIC RESOURCES.

1. Prehistoric Background.

Human occupation of the LIS region is believed to have commenced shortly after the retreat of the last glacial advance, at least 12-14000 years before present (B.P.). Since that time - the natural human environment and consequently population and cultural manifestation has changed substantially. Archaelogists along with other scientists (including paleo-ecologists, geologists, etc.) are slowly reconstructing the physical and cultural changes for the last 14 millennia (DOI, 1979). Therefore, many of the prehistoric occupation areas have been minimally investigated while others such as locations in LIS currently underwater or in heavily developed areas (cities, harbors) exist primarily in theory.

Because of our lack of information about past environmental changes, and human adaptation to those changes and because of the ongoing destruction of many sites as in urban areas, each intact site discovered that can be preserved until proper excavation can take place becomes significant as a key to the past.

In the LIS area, numerous prehistoric occupation sites from many time periods are known to exist along the shore and inland in both Connecticut and New York. Unfortunately, few of these sites retain enough site integrity to contribute to reconstruction of past cultures. More are expected to exist in those areas of the Sound that were once dry land before the marine transgression, which began at 12,000 years B.P. However, much of this area has been disturbed by wave action or other natural processes associated with transgression. It is estimated that only 5-40% of the former dry land surface remains intact in the Sound today (DOI, 1979).

Therefore, intact sites may be encountered on the Sound floor, and these should be avoided if at all possible to prevent further destruction of the archaeological record.

2. Historic Background.

Historic exploitation of various areas of the LIS and adjacent shoreline has occurred since the 17th century. The intensity and nature of this exploitation is varied over space and time, and much evidence remains for historians and archaeologists to reconstruct.

Along the shore and adjacent uplands historic materials include structures and sites of former structures associated with rural and urban development, manufacturing and trade.

In the Sound itself - there exists the possibility of encountering sunken ships dating from the 17th century to the present (DOI, 1979). The significance of these sites is highly variable, depending on age, type, and conditions.

D. SOCIOECONOMIC ENVIRONMENT.

This profile is part of a report prepared for the Corps of Engineers by the Center for the Environment and Man, Inc. (CEM) (1981).

1. Population.

The Long Island Sound shoreland had a 1980 population of almost 8.5 million people living on an area of about 4,000 sq. mi. This computes to a combined average population density of 2,125 persons/sq. mi. The average population density in the four Connecticut shore counties is 853 persons/sq. mi.,. while in the five New York shore counties it is 3,600 persons/sq. mi. These high population densities contribute to the importance of the Sound as an avenue for commercial shipping as well as the basis for, and regional variations in, demand for high quality, water-based recreation.

The 1980 Census Data shows the Long Island Sound region's population dropped by more than 5% in just 10 years. Most of this loss occurred in the New York City metropolitan area and is generally due to the impacts of the high costs of energy and living, crowding, and the decline in trade, manufacturing and employment. There are indications that Connecticut's modest population and employment growth is at the expense of New York City. Connecticut's high per capita income and ability to maintain its manufacturing base and increases in non-manufacturing (i.e., service) employment appears to provide support for continued, moderate growth. There exists a significant and growing middle income populace to realize recreational benefits through boating on Long Island Sound.

2. Recreational Boating Demands.

There is a very strong demand for recreational boating facilities. Most marinas report waiting lists for available slips. This demand is a definite trend towards sailboats as opposed to powerboats.

This trend is based, in part, on higher fuel costs as evidenced also by a perceived trend of shorter trips by powerboats. The fixed keel of a sailboat draws more water than a powerboat, necessitating deeper or more frequently maintained channels and marina areas.

3. Economic Activity.

Shipping is the most prevelant economic activity in the Long Island Sound. The ports in the region are primarily characterized as petroleum ports; other important commodites include sand and gravel, chemicals and chemical products, and iron and steel scrap.

Overall commercial tonnage has decreased during the past decade and Long Island Sound ports (excepting the New York City area) are not expected to capture a significant portion of future new commercial shipping volumes. However, commercial shipping will continue to provide an important and economical basis for movement of commodites.

There is also a tremendous demand for shorefront real estate, particularly in western Long Island Sound. There is a general lack of developable land in the great majority of harbors, and real estate value escalation is putting even available land out of reach of all but high value condominiums. Many marine-related enterprises have been brought out and many others are having difficulty hanging on. This also creates a shortage of land available for land disposal sites for material dredged from Long Island Sound.

Community plannning authorities in many Long Island Sound ports and harbors seem to be seeking to realize multiple-use benefits from their ports and harbors. Redevelopment of aged facilities to support varieties of commercial, and recreational uses is being promoted. Municipal zoning ordinances have been implemented in many harbors in order to promote marine related land development.

E. CHARACTERISTICS OF THE DREDGING AND DISPOSAL SITES.

1. Long Island Sound Harbor Sediment Characteristics: the Source Sediments.

The type of material dredged significantly influences the acceptability of the method of disposal and concern for impacts (see Section VI). There are two basic types of material: silty fine grained and sandy coarse grained. In general the silty material is more heavily laden with contaminants, has higher water content and is a less suitable substrate for all purposes. The coarser grained sediments are usually less contaminated, well drained, and are more useful for fill material for beaches and construction substrate. The Environmental Atlas (CE, 1980b) provides a harbor by harbor description of the sediments found in the Connecticut harbors of Long Island Sound including the levels of contaminants found in the sediments based upon sediment analyses

accumulated from past Federal project testing. Roughly two thirds of the sediments dredged for the Long Island Sound area are of the fine-grained category. Most of these are along the Connecticut coast, whereas Long Island harbors are more apt to have the more sandy, coarse grained material. The presence of various contaminants found in the sediments, e.g., PCB's, heavy metals, and organic materials, reflect this difference as well.

Harbor sediments in the eastern sound are relatively clean -- with progressively more contamination toward the western Sound (CE, 1980b). This distribution reflects the amount of pollutants entering the rivers and harbors and is generally concomitant to the amount of industry and concentration of human population of the area. When the goals of the EPA or State enforced point discharge permit programs are realized, the general water and sediment quality will eventually improve over the long term by limiting or prohibiting introduction of contaminants by industry and businesses.

2. Long Island Sound Disposal Sites.

Figure 2 indicates the 19 historical dump sites used in the Long Island Sound Region. Presently, dumping is prohibited at all but three interim sites at New Haven, Cornfield Shoal (near the Connecticut River) and New London. To meet the needs of future dredging activity in the region, the Corps of Engineers, New England Division,, contracted Dames and Moore to identify and assess the most environmentally suitable open water disposal sites in the vicinity of Long Island Sound.

The Dames and Moore Study (Appendix A) used a computerized spatial analysis to determine the relative environmental suitability of disposal site locations within Long Island Sound, Block Island Sound and seaward to the continental shelf. The criteria used to identify site areas and sites were based on those outlined in the EPA Ocean Dumping Regulations, Sections 228.5 and 228.6 and are found in Appendix A. These criteria were incorporated at various points into the site selection/evaluation process.

The Environmental Suitability Map (Figure II B-6, Appendix A) portrays a small area of high suitability in Long Island Sound and a larger area on the Outer Continental Shelf, separated by a bank having a lower suitability on the inner to middle Continental Shelf Region. Shelf areas were not recommended for further study. The availability of sites with the same suitability class ratings within Long Island and Block Island Sounds as well as the economics associated with the use of Continental Shelf sites were the primary factors behind this recommendation.

Four candidate sites (A, B, C, and D) were selected from the areas of highest suitability in relation to the location of sources of dredged material in the Long Island Sound Region (Figure 2).

Site Area A is located off Bridgeport Harbor and includes a portion of the old Bridgeport site.

Site Area B is located in the central LIS area and includes the abandoned Branford disposal site.

Site Area C is centered in an area offshore from Clinton Harbor and within reasonable distance of the Connecticut River sources of dredged materials.

Site Area D is located in Block Island Sound at the Connecticut-Rhode Island border (Pawcatuck River).

Site E, which includes part of the recently abandoned Eaton's Neck site, was added for potential disposal in Western Long Island Sound. Due to subsequent objections primarily based on the importance of the on-site lobster fishery, this site will not be considered as a potential disposal site although it is assessed in this report and Appendix A. The need for an open water site in Western Long Island Sound has led to the identification and selection of the aforementioned WLIS III which is addressed in the separate Final EIS (CE, 1982).

In addition to the above, the present Central Long Island Sound and New London Disposal Sites, F and G, respectively, were included in the impact evaluation to provide a comparison with the candidate sites recommended by Dames and Moore (Appendix A). Complete descriptions and maps of each site are found in Section IIIB of Appendix A. For the purposes of this report, Tables 8 and 9 summarizes location, physical and biological characteristics of sites A-G.

Table 8

Location and Physical Characteristics of the Candidate Sites*

Selected Characteristics	Site A	Site B	Site C	Site D	Site E	Site F	Site G
Location	Western Long Island Sound	Central Long Island Sound	Central Long Island Sound	Block Island Sound	Western Long Island Sound	Central Long Island Sound	Eastern Long Island Sound
Latitude (N)	41°0.3.7′	41°10.3′	41°10.5′	41°14.5′	40°59.6′	41°08.9′	41°16.3′
Longitude (W)	73°09.7′	72°47.5′	72°30.5′	71°48.0′	73°25.0′	73°53.1′	72°04.6′
Area (Sq. Naut. Mi.)	1	1	1	1	1	2	1
Depth (Range in Meters)	21-25	18-23	15-33	31-34	15-58	15-23	14-25
Disposal History	Discontinued Site Adjacent to NW	Discontinued Site	No Known Disposal	No Known Disposal	Discontinued Site NW Corner	Interim Regional Site	Interim Regional Site
Est. Disposal							
Cubic Yards	--	432,000	--	--	13 Million	5.7 Million	7.9 Million
Years	--	1956-1973	--	--	1955-1971	1955-1978	1955-1978
Est. Capacity (Mill. Cubic Yards)	33.0	21.3	44.6	74.0	91.7	42.4	21.3
Predominant Sediment Type	Silt-Clayey Silt Soft	Silt-Clayey Silt Soft	Fine Medium Sand Hard	Silty Sand ?	Sands, silty sand gravelly sand, Hard to Soft	Silt-Clayey Silt Soft	Clayey Site (spoil) Silty Sand/Soft
Max. Average near-surface tidal current (cm/sec)	25-35	28-33	60-70	45-50	33-38	25-30	60-70
Interpolated Near Bottom							
Current Velocity (cm/sec)	20-25	25-30	50-55	35-45	28-33	27-31	40-45
Direction	W to SW	E to ENE	E	E to SE	W to SW	W	E to NE

*Modified from Table III.B-1, Appendix A.

Table 9
Biological Resources On and Around Candidate Sites.*

	Benthic Community	Shellfish	Lobsters	Commercial Finfish	Recreational Finfish
A Bridgeport	low diversity mud species	-	fishery 0.5 miles W	fluke, scup, flounder around and on site	-
B Branford	low diversity mud species	-	North fringe of distribution 2 miles S of fishery	-	bluefish, blackfish, shark
C Six Mile Reef	low diversity sand species	may be blue mussles NE of site	fishery S & W adjacent to site	-	tautog, flounder, blackfish, bluefish
D Block Island Sound	no data sand species	ocean quahog		heavily fished for yellowtail flounder, fluke, scup, butterfish, cod, haddock, whiting and hake	-
E Eaton's Neck	moderate diversity mud and sand species	oyster beds 1.5 miles N of site	prime lobster habitat	winter flounder - January windowpane flounder - April; Red Hake - June; Scup - Fall	-
F New Haven	moderate diversity mud species	-	fishery 0.6 miles S	fluke, scup, flounder, menhaden W&E (removed from site)	bluefish, blackfish, sharks N, W, & E (removed from site)
G New London	high diversity mud species	ocean quahog, surf clam, mussels, rock crab	fishery S & E within area of low distribution	summer & winter flounder during summer; blueback herring in fall	party boats for flounder, scup, fluke, adjacent W & N; tautog E

*Appendix A

SECTION V

ENVIRONMENTAL EFFECTS

This section discusses the generic environmental, socioeconomical and historical/archaelogical impacts of the following disposal alternatives described earlier:

A. Open Water Disposal
B. Upland Disposal
C. Containment
D. Beach Restoration
E. Incineration
F. Resource Reclamation
G. No Action.

In general, impacts to Federally listed threatened or endangered species would have to be determined when a supplemental environmental impact statement/assessment is developed. Coordination, in accordance with Section 7 of the Endangered Species Act, would be carried out at that time.

Generic impacts of the disposal alternatives are summarized in Table 11 at the end of this section.

A. OPEN WATER DISPOSAL.

1. Environmental Impacts.

a. Generic Impacts of Open Water Disposal.

The generic environmental impacts of open water disposal are summarized with regard to the physical and chemical alterations to the environment and associated biological ramifications. These are interrelated and produce combined short-term (<2 years) and long term (>2 years) impacts to the aquatic environment. A more detailed discussion may be found in Appendices A and B.

(1) Generic Short-Term Impacts.

The disposal of dredged material causes two major physical impacts: increased turbidity in the water column and burial of benthic organisms. These impacts are generally short term and are local to the disposal site area.

Disposal of sediment in open water will temporarily increase the amount of suspended solids in the water column. Although most of the large sized particles will fall immediately, silt-clay size particles as well as particulate organic material will remain suspended for longer periods of time. Turbidity studies have shown that a large

percentage of the fine-grained sediments placed in suspension settle within a few hours after disposal thereby reducing the duration of adversity. Increased suspended solids can impact resident aquatic organisms. The cloudiness can cause a temporary reduction in light penetration through the water column. This would temporarily reduce photosynthetic activity of phytoplankton as well as shallow water benthic algae. Such reduced activity, if occurred, would return to normal as the water cleared through settling or mixing by currents. Increased suspended solids may interfere with feeding patterns of marine organisms by either reducing visibility for predator species, such as fish or crabs, or clogging filter-feeding apparatus of more sessile forms. It may also affect respiratory functions by clogging gill filaments. Fish and certain crustacea are mobile and therefore can avoid the area if irritation occurs. Studies by Peddicord et al. (1978) for the Corps of Engineers DMRP have shown that fish, crabs and juvenile lobsters are generally tolerant of increases in turbidity and will move if irritated.

Benthic organisms at the disposal site would be buried once the dredged material hits on the bottom. The extent of burial will depend on the amount and type of sediment, the rate of disposal and settling, and whether the sediment is point dumped or dispersed around the site. Burrowing sediment-feeding organisms, especially the deep burrowing forms have a better chance of survival than the non-motile forms living on the surface (Maurer et el., 1978). Burial of the weaker juvenile forms or eggs of demersal fish will probably result in death. Therefore, known spawning areas should be avoided whenever possible during the spawning period.

The action of open water disposal would introduce the natural and man-made constituents of the dredged sediment into the water column and onto the bottom sediments. The constituents may include nutrients, organic compounds, heavy metals, and coliform bacteria which may be injurious to the health of plant, animal and human populations. This is especially true for organic compounds such as polychlorinated biphenyls (PCB), DDT and heavy metals such as mercury and cadmium. Specific discussions on each of these constituents may be found in Section IV - G of Appendix A.

Hydraulic dredging mixes the sediment with large amounts of water during its operation and could result in release of contaminants which could degrade the quality of water. For example, high quantities of nutrients such as phosphates, nitrates, or toxic ammonium-nitrogen could cause increases in the biochemical oxygen demand (BOD) which, in turn, could cause localized reductions in dissolved oxygen or localized plankton blooms which could have the same resulting effect. Increases in dissolved organic compounds or heavy metals might become toxic to marine organisms.

The elutriate test was developed jointly by the EPA and CE to determine the concentration of contaminant release in the water column by a particular dredged sediment. The procedure basically involves

mixing the dredged sediment with seawater collected from the disposal site. A chemical analysis of the seawater for various contaminant is then carried out to determine contaminant release. Guidelines for such tests are outlined in the EPA/CE publication "Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters" (1977). Testing would be done on an individual basis for each dredging project.

Release of contaminants may cause lethal or sublethal effects on organims exposed to the contaminated water. The potential for short-term lethal effects may be determined by the bioassay test. Guidelines for this test are included also in the EPA/CE 1977 manual. Such tests may be required for all projects in Long Island Sound larger than 25,000 cy. The contaminants released in the liquid or suspended solids phases could be toxic to water column exposed organisms, especially to gill breathers or filter-feeders which pass water through their systems to breath and eat. The acceptability of ocean disposal includes a consideration of significance of mortalities of the test organims exposed to liquid, suspended solid or solid phases of dredged material mixed with seawater collected at the disposal site. However, the concentration of the contaminants are diluted during disposal operations so that organisms at the site are not exposed to the same concentrations as those in the laboratory tanks. Thus, significant mortality in the liquid and suspended solid phases may not indicate true impact on the in-situ organisms. Dilution of the phases which exhibited significant mortality are calculated to determine the "limiting permissible concentration" of that phase. To date no Long Island Sound liquid and suspended phase bioassays have exceeded the "limiting permissable concentration" (CE, 1980b). To exceed the "limiting permissible concentration" would give the Regional Administrator of EPA cause to recommend against ocean disposal.

The disposal of contaminated dredged material would introduce contaminants into the bottom sediments. Benthic organisms intimately associated with these sediments potentially can have the same impacts as those organisms exposed to the water column. The solid phase bioassay is intended to indicate the potential for lethal effects of contaminated sediments. Mortalities that are statistically significant and 10% greater than that of the "reference" sediments is a basis for consideration of rejection of open water disposal. Contaminants in fine-grained dredged sediment are generally stable in a oxygen-deficient environment at a near-neutral pH. The initial settling of the sediment, and/or resuspension by currents or invading organisms can expose the sediment to higher levels of oxygen so that the generally stable contaminants may be mobilized into the pore water or water column. The mobilized contaminants are then potentially available to exposed organisms. Recent studies by Neff et al. (1978) for the Corps of Engineers have questioned the ecological significance of direct uptake of sediment contaminants by burrowing benthic organisms.

The 1977 EPA/CE guidelines manual also described the bioaccumulation test. This test measures the short-term uptake of potential sediment contaminants of test organisms in the solid phase bioassay. Statistically higher concentration of contaminants in test animal tissues in comparison with those exposed to a reference sediment indicates a positive bioaccumulation. Such results could again indicate chemical impact on aquatic organisms and could lead to rejection of ocean disposal. Short-term sublethal effects such as impairment of reproduction and growth and behavioral deviations are more difficult to detect and are not as clearly defined. Such effects are usually observed during the bioassay/bioaccumulation tests (behaviorial) or during long-term laboratory studies (reproduction and growth).

(2) Generic Long-Term Cumulative Impacts.

Although there is no evidence to show unacceptable detrimental impacts at open water dredged material disposal sites, the pervasive argument exists that unacceptable effects may yet accrue with continued disposal. Appendix B attempts to define and describe specific long-term impacts of open water disposal in Long Island Sound. As this study concludes, identification of such impacts is difficult due to complex and interrelated environmental factors. The following discussion is provided as a generic overview of potential long term effects due to long term open water disposal of dredged material in Long Island Sound.

The increased sedimentation associated with open water disposal may have two direct long-term physical effects. Mounding of the disposed sediment would permanently alter the bottom topography and could alter the local habitat.

Mounding would cause secondary impacts such as changes in water circulation patterns, temperatures and salinities if disposal occurred in a shallow water area. Such impacts would not be significant for deep ocean disposal or the proposed candidate sites and the interim sites (Appendix A). Such impacts could become a problem in a River/Harbor disposal site.

Disposal could permanently alter the benthic habitat within the affected discharge area. If the dredged sediment is markedly different from the disposal site sediment, the benthic habitat will be altered. Bottom communities are closely associated with sediment type (McNulty et al., 1962); therefore, the resulting community at a disposal site may be different from the original or surrounding community. Sediment feeders, for example, are more common in muddy sediments whereas filter-feeders are more common to sandy substrates. Dumping mud on a sand bottom would change the community type inhabiting the dump site and reduce the species diversity because the source of recolonizing animals, i.e. the areas adjacent to the dump site, are a different substrate, and therefore, of different species composition. Dumping on a past disposal site or matching dredge and disposal site sediments could mitigate this impact.

Recolonization by small, short-lived pioneering species will occur soon after disposal. Studies of disposal sites have shown that successions of benthic colonies occur until a climax community of long lived larger species become established. The time required for achievement of such a climax community depends on the sediment quality and the availability of organisms in the immediate area. Continuous long-term disposal may temporarily enhance productivity by keeping the pioneer recolonizing species in dominance but it may impact on community stability (Appendix B). The long-term effects of this instability on the ecosystem are not predictable and of a localized nature (less than 1% of Long Island Sound). Benthic impacts would be monitored by the DAMOS.

Alteration of sediment type and bottom topography may enhance the potential or resuspension of the deposited sediment. If not properly confined, resuspension can further destabilize colonizing benthic organisms and/or surrounding populations.

Displacement of sediments by dredging and disposal may introduce persistent foreign substances (heavy metals, petroleum hydrocarbon residues, chlorinated hydrocarbons) into the disposal site environment. However, such substances could remain unavailable over the long term if the disposal mound remains undisturbed. In general, most heavy metals in a reducing environment at a near-neutral pH are sequestered in insoluble geochemical forms. Petroleum and chlorinated hydrocarbons are mostly insoluble in water and are generally tightly bound to organic particulates and clay. The surface sediments of the mound are adjacent to the water column so that sporadic disturbances by short term, localized currents or biological activity (microorganisms, burrowing, sediment feeding, etc.) could cause minor releases into the pore water and water column. Any such releases would be quickly diluted by the water column and therefore rendered harmless. Eventually the sediment contaminant levels down to the depth limit of biological activity (10-25 cm) would reach an equilibrium with the water column. The contaminants below this depth would remain sequestered.

The long term exposure or accumulation of contaminants by organisms may cause reproductive, developmental and growth impairment, deviations in behavior, or cause mutagenic or carcinogenic abnormalities. Synergistic effects of contaminants can cause death to an individual or whole local populations. At least one persistent contaminant (DDT) has been shown to be magnified through an aquatic food chain (Jarvenin et al., 1977) such that sublethal and lethal effects have been spread throughout the ecosystem via the food web. However, such impacts, although theoretically possible, have not been related to the disposal of dredged material.

Impacts to organisms have been suggested to be related with solid waste disposal in the New York Bight (Pearce, 1970). Contaminated dredged sediments are only one element in the existing myriad of contaminants entering the Bight. Scientific studies to date have not

demonstrated that dredged material alone is the causative agent for these impacts. The East River as well as industrial and sewage discharge, and runoff contribute to the contaminant loading of the Sound (Fitzgerald et al., 1974). Studies by Valenti and Peters (1977) have indicated that the finfish and lobster populations at the Eaton's Neck disposal area were viable in spite of the years of disposal activities that occurred at the site. In fact, Cobb et al. (1977) concluded that the abundance of suitable sediments (mainly dredged material), building rubble, and other materials for burrow construction is probably responsible for the abundance of lobsters. The benthic forage must also be considered adequate and healthy to support these populations.

b. Deep Ocean Disposal.

The generic impacts of deep ocean disposal have been reviewed by Pequegnat et al. (1978). The authors suggested that potential impacts related to deep ocean disposal generally may be less significant than impacts associated with shallow water disposal based on the sparseness of the biota as well as the larger dilution factor. Pelagic life, including those of fishery importance, is reduced in oceanic vs. nearshore waters. The deep ocean pelagic fishery, which is composed primarily of tunas and sharks, forms less than 5 percent of the tonnage of the continental slope bottom catch in New England waters (Pequegnat et al., 1978). Similarly, the relative abundance of bottom dwelling life becomes reduced as one moves from shore into deeper water. Except for submarine canyons and the recently discovered, highly productive communities associated with subsurface volcanic vents, the deep ocean supports a small biomass, most of which consists of burrowing sediment feeders.

Open water disposal in depths of one to two miles would probably not allow mound formation. Thus, the sediments would probably be dispersed on the abyssal plain. Depending on the nature of the sediments and conditions at the disposal site, impacts associated with turbidity, depletion of dissolved oxygen and contaminant release could be minimal or non-existent based on the large dilution factor and the relative sparseness of potentially affected organisms.

Deep ocean disposal also may result in beneficial impacts. The introduction of organic matter in fine sediments may increase benthic productivity whereas the introduction of coarse sediments can increase habitat diversity.

However, little is known of the ecology of deep ocean communities and therefore the nature and ecological significance of potential impacts from disposal remain ill-defined. If a deep ocean site is to be chosen, careful monitoring would be necessary to insure the integrity of the environment. Such monitoring would be more difficult and expensive than at a near shore disposal site.

c. Near Shore Disposal.

The potential for environmental impacts associated with disposal in nearshore sites from man's perspective is generally greater than for deep ocean disposal. The affected biological resources important to man are in greater numbers and the overall productivity is generally higher near shore. The following discussion is a summary of potential adverse impacts and mitigation measures at the candidate sites proposed in Appendix A.

(1) Impacts and Mitigating Measures at the Candidate Sites.

The specific impacts of dredged material disposal at the various sites are a function of the chemical and physical characteristics of the dredged material and the characteristics of the site. Impacts associated with open water disposal of dredged material would be most likely from fine-grained materials that are contaminated as defined by the criteria set forth by EPA with respect to DDT, PCB's; trace metals, and nutrients.

In general, no significant adverse water quality effects, including turbidity, are expected during disposal of materials which have passed the appropriate testing procedures. However, dumping at Eatons Neck East (Site E) and Bridgeport (Site A) during the summer has the potential for locally reducing the already low dissolved oxygen levels which exist in the western Long Island Sound area. This potential problem could be avoided by limiting disposal activities at these sites to cool periods not characterized by low dissolved oxygen levels.

Use of the seven sites for disposal of dredged material would result in a localized depletion of benthic species diversity at the site as a direct result of bottom disturbances. In no case would dumping at any site result in a significant loss to regional populations.

Relative differences in local losses due to burial can be assessed among the sites. Estimated losses would range from high at Site E to moderate at Six Mile Reef (Site C) and Block Island Sound (Site D). Losses at Site A would range from low to moderate, and would be low at New Haven (Site F) and New London (Site G).

Two management techniques are available to mitigate the potential impact of resource depletion. Consideration of spawning and nursery areas is incorporated into the site selection analysis, thereby reducing the effect. Consideration of the spawning periods would also be incorporated as restrictions placed upon the particular dredging project. State Water Quality Certification would restrict disposal during the summer months.

Management considerations have been proposed (Appendix A) which suggest that disturbances from significant dumping occur at the appropriate season to maintain an increased level of productivity of opportunistic species (Rhoads et al., 1978). To achieve this effect, it has been suggested by Rhoads et al., (1978) that for the deeper areas of Long Island Sound (greater than 20 meters) where storm effects are minimal, dumping be accomplished between January and April which is a period of low recruitment and low bottom temperatures, and be suspended during the period of May through December a period of intense recruitment and population growth. This suggestion does not take into consideration the effects of weather and seasonal temperatures on dredging and disposal operations. These impacts would tend to create a backlog of work and increase the costs and decrease the safety aspect of the operation.

Muddy materials dumped at Sites C and D and the sandy portions of Site E would probably result in recolonization by polychaete-dominant communities different from the existing communities. Presuming that such differences are not desirable, measures to mitigate these effects could include restricting the disposal of muddy materials to the muddy bottom areas of Site E and allowing only sandy dredged materials to be deposited at Sites C and D.

An exception to the concept of placing similar grain size material a disposal site may be justified where it has been determined that a community change is desired and productivity would be enhanced. In such cases, the concept of confined disposal, developed for most of the impact considerations in this document, would give way to a concept of spreading the materials over a large site area. Assurance would be necessary that potential contamination from PCBs and other organohalogens, petroleum hydrocarbons, and trace metals, all of which have an affinity for fine-grained organic sediments, was not high. This would appear to be unlikely for typical western LIS harbor dredged materials which are exposed to many sources of pollution but may be feasible for eastern LIS sediments (CE, 1980b). Also, relatively uncontaminated organic fine-grained materials may characterize some future new dredging work from deeper, less contaminated areas. Such sediments may be appropriate for spreading at the sandy areas of Sites C, D, and E.

The major variables in the long term release of contaminants have been identified as:

- The degree of contamination and nature of the contaminants;
- The level of biological productivity and sensitivity to the disposal areas; and,
- The degree of hydraulic and geochemical stability of the disposal site area.

Dredged materials contaminated with significant levels of organohalogens, (especially PCBs) and trace metals are of particular concern. Environmental damages are reduced to low levels if site conditions favor confinement in low energy settings where the effects of storm currents will be minimal. Candidate sites in western and central Long Island Sound (Sites A, B, E, and F) are effective confinement sites which would retain depositional mounds of material in place.

A layer of non-cohesive, fluffy, silty material, similar to the naturally occurring "fluff" layer in the Sound, would also be found on the disposal mounds. Some slight and infrequent resuspension of this upper layer can be expected. If low cohesion fine-grained materials with high water content are deemed suitable for open water disposal, but have high levels of contaminants, capping of such deposits with cleaner material should be a consideration in project planning. Capping would help isolate contaminated material from occasional dispersion by strong currents. The increased diffusion coupled with the immobilization processes created by the clean layer will effectively prevent passive transport of trace amounts of contaminants from the depression or mounds by diffusion.

Effective capping operations to isolate contaminated sediments from the water column were performed at this site in 1979. Close monitoring by DAMOS, however, revealed that about 2 meters of a silt-covered mound had eroded whereas a higher sand covered mound remained unchanged. This anomaly was attributed to the passing of Hurricane David and the greater surface roughness of the silt covered mound.

Since long-term exposure of bottom oxygen demanding substances may provide a critical added stress on the bottom areas of Site E, and at Site A, capping with low oxygen demanding clean sandy materials can be used for these sites as a mitigation measure.

Capping may be desirable at Sites B, E, and F for contaminated materials such as the fine-grained muds from Stamford Harbor. These materials have high water content and contaminant concentrations which are of concern because of potential long-term effects on water quality and benthic systems. Moderately contaminated cohesive materials have low environmental risk at these sites due to good confinement characteristics. Contaminated materials if deposited at Site G and Site D would provide increased environmental risk due to the potential for resuspension and proximity to commercial fishing areas. Only dredged materials with low levels of PCBs, mercury, cadmium and lead should be disposed of without consideration of a capping program. The high mobility expected at Site C would seem to preclude capping, and disposal at this site should be limited to materials which, upon spreading, would provide no potential for long-term uptake or other effects on the ecosystem.

The impacts associated with use of the WLIS III disposal site in Western Long Island are evaluated in the Final EIS issued in February 1982 (CE, 1982b).

No adverse impacts are anticipated for the endangered species listed in Section IV from dredged material disposal at the candidate sites.

Not much is known of the movements of the shortnose sturgeon when it is outside of the coastal rivers and lower estuaries. The population in the Connecticut River which may possibly wander out through the Sound, is mobile and would be accustomed to waters with increased levels of suspended sediments. Any impacts from dredged material disposal would be unlikely. The sea turtle and marine mammals whose range would extend into the Sound are also mobile and would be likely to avoid areas of disposal. Any impacts to the turtles would probably be the result of increased boat traffic.

The bald eagle and peregrine falcons are birds which may pass over the study area during their seasonal migrations. However, they do not utilize the area on a long-term basis or for breeding. The likelihood of being impacted here by the uptake of contaminants (insecticides, pesticides) is very small. The osprey, which breeds in the area, is dependent on fish as a food source. Chlorinated hydrocarbons have been considered as a major reason (besides habitat destruction) for the reduction in osprey populations in coastal regions of the U.S. like Long Island Sound. Dredged material to be disposed of in Long Island Sound may require bioassay/bioaccumulation tests, in which consideration of chlorinated hydrocarbons such as DDT would assist in determining the impact upon these species.

The predicted impacts and suggested mitigation measures for the candidate sites are summarized below and in Table 10.

(2) Conclusions

Site A has the potential to serve western LIS and as an alternate to Site F should one be needed. Sites B and D offer no clear advantages over existing disposal Sites F and G, therefore, the latter sites will continue to be used as regional disposal sites and managed under DAMOS. If and when capacities or other factors diminish the suitability of these sites, Sites B and D would be considered for use. A comparison of projected quantities of dredged material (Appendix C) and estimated site capacities (Appendix A) indicate that the limits of these sites will not be reached in the forseeable future. Other factors which would affect a decision to initiate use of a new site include short and long term environmental impacts, particularly to fisheries, development of other feasible alternatives, notably upland and containment facilities, and changes in public and political priorities. Extensive field studies of historic dump sites in western LIS (Eaton's Neck) and Rhode Island Sound (Brenton Reef) have revealed no identifiable, significant, long term impacts other than physical changes in bottom topography. Extensive and continuous studies of Sites F and G under DAMOS and by

Table 10

Summary of Potential Impacts and Available Mitigation Measures for Candidate Sites*

Candidate Sites	Near Site Short-Term Water Column Effects	Near Site Short-Term Physical Effects on Benthos	Potential Long-Term Effects on Aquatic Ecosystem Due to Chemical Contamination
A. Bridgeport East			
Impacts	Potential problem of summer oxygen depletion and potential for nitrogen release to stimulate agal blooms	Low to Moderate	Low (for contaminants) Moderate for oxygen depletion
Mitigative Measures	Limit disposal to cool periods when low bottom D.O. not present	Avoid disposal during spawning periods on spawning areas	Capping highly contaminated materials with cleaner cover; capping of high oxygen demanding materials; sequential placement of cleaner material
B. Branford			
Impacts	Not Significant	Low	Low (Confinement site)
Mitigating Measures	Not Applicable (N.A.)	Avoid disposal during spawning periods on spawning areas	Capping of highly contaminated materials with cleaner cover; sequential placement of cleaner material
C. Six Mile Reef			
Impacts	Not Significant	Moderate	High (Dispersal site)
Mitigating Measures	N.A.	Avoid disposal during spawning periods on spawning areas	Restrict disposal to cleaner materials (spread fine organics)
D. Block Island Sound			
Impacts	Not Significant	Moderate	Low-Moderate (Moderate confinement site)
Mitigating Measures	N.A.	Avoid disposal during spawning periods on spawning areas	Capping of moderately to highly contaminated material with cleaner cover; sequential placement of cleaner material
E. Eatons Neck East			
Impacts	Potential problem of summer oxygen depletion and potential for nitrogen release to stimulate agal blooms	High	Low for contaminants (Confinement site) moderate for oxygen depletion
Mitigating Measures	Limit disposal to cool periods when low bottom D.O. not present	Avoid disposal during spawning periods on spawning areas	Capping highly contaminant materials with clean cover; capping of high oxygen demanding materials; sequential placement of cleaner material
F. New Haven			
Impacts	Not Significant	Low	Low (Confinement site)
Mitigating Measures	N.A.	Avoid disposal during spawning periods on spawning areas	Capping of highly contaminated materials with cleaner cover; sequential placement of cleaner material
G. New London			
Impacts	Not Significant	Low	Low-Moderate (Moderate confinement site)
Mitigating Measures	N.A.	Avoid disposal during spawning periods on spawning areas	Capping of moderately to highly contaminated materials with clean cover; sequential placement of cleaner material

*Modified from Appendix A - Figure V.A-1, p. V-2.

others have shown only short term impacts which are limited to site boundaries, which encompass a total area of 3 square N-miles or <0.3% of the bottom area of LIS. As discussed previously, the DAMOS program monitors environmental impacts and as this program continues, progressively longer term impacts, or the lack thereof, will be observed.

According to Dames and Moore (Appendix A), Site C may be considered as a dispersal site for clean material. However, the existing Cornfield Shoal Site near the Connecticut River (Figure 2) adequately serves this purpose and will continue to be used until a need for another site is established. Site E is not recommended for future use based on the on-site lobster fishery, potential for seasonal water quality impacts, and considerable public opposition. However, at the request of certain communities in Western Long Island Sound, the States of Connecticut and New York suggested a site, WLIS III, in the western Sound. This was evaluated in the recently released Final EIS (CE, 1982b). The area was determined to be suitable based on the existing site characteristics and limited fishery use. Water quality certification would restrict summer disposal and therefore would mitigate any potential seasonal water quality problems.

(3) Future Studies.

The processes that govern long-term stabilization of dredged materials are discussed in Appendix B. This discussion indicates that continuing and additional research is necessary to address the problems posed by long-term dredged material disposal in Long Island Sound and to avoid unacceptable impacts to the environment.

The Corps of Engineers, New England Division, is currently sponsoring a program to address this concern. The Disposal Area Monitoring System (DAMOS) provides a long term monitoring program to evaluate disposal activities at specific open water sites. On-going sampling and evaluation of environmental data of past and present dump sites (including four in Long Island Sound) is providing insight into the following areas of concern: bathymetric changes, turbulence and erosion relationships, suspended sediments, sediment chemistry, bioaccumulation of contaminants, benthic ecology and fisheries. The specific programs designed to study these concerns are provided by the Naval Underwater Systems Center (NUSC, 1979) and Science Applications, Incorporated (SAI, 1980a) and are briefly described below.

Under the bathymetric study, the physical dimensions of the sediment mound are defined using high precision bathymetric and navigational instruments linked to a computer. Changes in the bottom profile are monitored before and after disposal as well as over the long term. This method has been used to assess the effectiveness of capping at the Central Long Island Sound dump site (NUSC, 1979; Morton and Miller, 1980; Morton 1980a; Morton, 1980b).

The Boundary Layer Turbulence System (BOLT) and suspended sediment programs will employ multisensory bottom-mounted instruments to continuously monitor and analyze bottom current velocities, directions, suspended sediments and periodically photograph sediment movements. This information is combined with periodic site inspections including diver observation. Such long term monitoring will increase understanding of currents and their effects on the erosion and general stability of the disposal mound.

The benthic ecology program of the DAMOS is compiling species and community data on the various dump sites to study long term changes in community structure, and recolonization processes (SAI, 1980a). This study is also augmented by diver observations (SAI, 1980a).

The DAMOS chemistry program is currently studying changes in disposal site sediment chemistry. Present studies show potential for evaluating the effectiveness of capping for the sequestering of contaminants. Recent expansion of this program to include water column chemistry will aid in assessing potential water quality impacts associated with disposal of dredged material.

DAMOS is a participant in the International Mussel Watch program and has been testing mussels in the vicinity of disposal sites for potential accumulation of sediment contaminants and abnormal growth (SAI, 1980a, b). Mussels are filter-feeders which are particularly sensitive to water quality deterioration.

The DAMOS fisheries program is designed to maintain an awareness of the commercial fisheries existing in the near shore waters of New England (NUSC, 1979). Conferences are held with fishing interests in order to minimize any adverse effects and maximize the advantages of disposal relative to the fishing industry.

Information gathered under DAMOS forms the data base on which seasonal changes are assessed and compared with nearby virgin areas and will ultimately lead to a more complete understanding of long term impacts.

d. River/Harbor Disposal.

The types of potential environmental impacts associated with this option would be as described in Section"a." However accretion of disposed material could cause navigation hazards in shallow areas. Natural movement of sediments after disposal might result in the deposition of dredged material back into dredged channels, thus requiring more frequent maintenence dredging. For example, the disposal site for dredged material in the Delaware River has been changed from the mouth of the river to a containment site. Since this change of site, operation and maintenance work has been reduced by approximately one half solely due to the reduced movement of sediments back into the channel after disposal.

The potential for changes in circulation and salinity patterns is greater in the shallow waters associated with river and harbor inlets. Changes in the estuarine circulation can alter the distribution of aquatic organisms. Harbor or river spawning areas for fish, shellfish beds, and other critical habitats also may be adversely affected.

2. Socioeconomic Impacts.

a. Deep Ocean Disposal - Because deep water disposal sites are generally far removed from any economic activity and the material disposed of is lost for any future use, very little impact on the regional or national economy would be expected. Any temporary increase in employment or additional income generated due to the actual disposal operation would be very short-term in nature, and may be considered insignificant because the most frequently used methods of deep water disposal are highly capital intensive. The total cost impact may be higher than other disposal methods because of the greater transport distance.

Social impacts resulting from deep ocean disposal are also minor because of the distance between sites and human population centers. In general, this disposal method is not well enough understood to generate widespread public approval or disapproval. Problems with noise, odors, or aesthetics are not generally associated with deep ocean disposal operation.

b. Near Shore Disposal - Both economic and social impacts of open water disposal at a near land site are similar to those of a deepwater site. Cost impacts are not as significant because of shorter transport distances. Some temporary negative social impacts may be expected if the site is close enough to shore to raise noise levels or create unpleasant odors on shore (none of the candidate sites nor the existing sites are close enough), or if it infringes upon normal recreational boating activity. If the material is known to contain contaminants, the public may perceive it as a potential health or safety hazard. In general, near shore disposal would be expected to be slightly less socially acceptable than deep ocean disposal.

c. River/Harbor Disposal - Open water disposal at a site located in a river or harbor would result in economic and social impacts very similar in nature to near land disposal. Although the cost of transporting dredged material would be minimized, a negative impact on the regional economy may result if waterfront property values suffer due to the undesirability of a nearby disposal site. This type of negative economic impact would most likely be short-term, limited to a period of time approximating the actual period of active disposal and associated turbidity. A long-term negative effect on property values may result if the material disposed of is known to be or perceived to be heavily contaminanted, or if the site is large enough to sustain multiple disposal operations over time, particularly if the use of the property is even partially related to water dependent recreational activities.

Social acceptability of river or harbor disposal would probably be lower than either near shore or deep water ocean disposal because the actual site would generally be closer to population centers. Noise levels and any unpleasant odors (if present) associated with the disposal, though strictly temporary, could be significant. Recreational boating in the vicinity of the site may be adversely affected during active disposal, and over the long run if water depths became inadequate for larger vessels. However, a site would not be designated for disposal if it posed a hazard to boating safety or any other aspect of public health and safety.

3. Historical/Archaelogical Impacts.

Disposal of dredged material on prehistoric or archaelogical sites can have either adverse or positive effects.

Dredged material disposal would cover the site, limiting access to and in many cases, preventing its discovery. Secondly - the weight of the dredged material may compress the soil, mixing artifacts from several discrete cultural strata and irreversibly confusing the archaelogical record. Thirdly - chemicals or minerals in the dredged material may change the chemical characteristics of the site - affecting the quality of artifact preservation and altering chemical evidence of human occupation.

Underwater sites might actually be protected from erosion or accidental destruction by man or nature by the overburden. However, the impacts on underwater sites are not well understood because of the lack of data presently collected on underwater prehistoric sites.

Historical sites may be significantly altered or destroyed by the disposal of dredged material. Sunken ships could be severely impacted by the disposal of dredged material. The wrecks might be covered by the material and crushed or dispersed. Salvage or retrieval of any available historical information would be rendered difficult if not impossible.

a. Deep Ocean Disposal.

No prehistoric sites are expected to occur off the continental shelf. If a historic shipwreck should be encountered within a disposal area, it should be avoided and assessed for its historical significance.

b. Near Shore Disposal.

Because human groups occupied the now submerged continental shelf during the last glacial retreat, sites may be encountered on the continental shelf. However, much of the original surface has been destroyed during the subsequent rise in sea level. Therefore, each disposal site must be considered separately.

Proposed disposal Sites A and B fall approximately within the limits of a glacial lake which occurred between 14,000-8,000 years before present and consequently, would not be expected to contain prehistoric sites (DOI, 1979).

Proposed areas C and D are within areas where only 5-40 percent of the former dry land surface is predicted to remain. The predicted site density for this area is low to moderate for small fishing camps or habitation sites (DOI, 1979).

If one of these sites is selected for disposal the condition of the former dry land should be determined before archaelogical resource management plans are formulated.

The possibility of encountering historical shipwrecks in the proposed disposal areas is low, but an inventory of known shipwrecks should be consulted before final decisions are made. Remote sensing of the shelf floor would assist in the location of sunken historic debris.

c. River/Harbor Disposal.

Historical background data and paleoenvironmental reconstruction of the area would indicate the possibility of encountering cultural resources within a specific project area.

Determination of impacts to historic and prehistoric resources cannot be assessed until specific disposal sites are indicated. At that time, coordination with appropriate State Historical Preservation Office's will be initiated.

B. UPLAND DISPOSAL.

1. Environmental Impacts.

Generic environmental impacts at land disposal sites can be separated into on-site and off-site effects. Major on-site impacts would be: (1) loss of existing habitat; (2) alteration of existing habitat e.g. modification of site topography, soil characteristics and drainage regime; (3) plant uptake of potential dredged sediment containments and subsequent transfer to grazing animals and (4) direct uptake of contaminants by soil associated animals and their predators.

The existing habitat of the disposal site would be lost. However, the land may be reclaimed for recreation or wildlife management purposes which could replace the lost habitat. Modification of the existing vegetation or topographical, geological, or hydrological conditions at a site could be beneficial or adverse depending on the nature of the site and the perspective from which the modification is viewed. The degree of impact due to habitat alteration is site specific and, in cases such as old borrow pits, strip mines, old landfills, construction sites, or abandoned industrial areas, the deposition of dredged material may offer opportunities for habitat restoration or development. Dredged Materials Research Program (DMRP) literature on upland and wetland habitat development with dredged material have demonstrated that properly planned disposal sites can be both visually and functionally compatable with

natural habitats (Environmental Laboratory, 1978; Hunt et al., 1978b). In cases where it is not possible to avoid high-value areas, proper restoration would mitigate adverse impacts.

On-site chemical impacts involve the introduction of contaminants in the disposed dredged material to the dump site area and its subsequent transfer to organims using the area as a habitat. After disposal is accomplished, revegetation by pioneering plants would occur soon after disposal is accomplished. The plants will serve as interim habitat and food for certain wildlife species.

Plants are well known for absorbing mineral-laden pore water through their root systems and incorporating these minerals into their tissues. Dredged sediments under acid conditions can release contaminants and in particular heavy metals into the interstitial or pore water and thus make the contaminant available for plant absorption (Gambrell et al., 1978). Plant-eating animals could ingest such a plant and incorporate the contamimant into their own tissue. This acquired contaminant may be accumulated and passed up the food chain to affect other animals. The same scenario may begin with direct uptake of soil contaminants by soil associated animals.

Uptake of sediment contaminant by pioneering plants and soil animals may be mitigated by covering the dredged material to isolate the contaminants. The cover material should be relatively clean and thick enough to prevent contact with roots or burrowing organims; measures should also be taken to prevent erosion. If the sediments are not covered, they may have to be chemically treated to insure a proper pH and appropriate growing environment for invading or planted vegetation.

Off-site effects may include contaminated water effluents, infiltration of contaminants or air contamination at the disposal site. Although soluble fractions of most contaminants are low, total effluent concentrations may be quite high due to the presence of suspended fine material which has an affinity for various contaminants. Efficient removal of this suspended material by extended settling time, secondary settling basins or filtering over vegetated areas has effectively reduced most effluent contaminants to acceptable levels.

The effluent may have a high Biological Oxygen Demand (BOD) unless clean sand has been dredged. Therefore, the potential consequences of lowered oxygen levels must be considered when designing the effluent release structure. Care must be taken to insure adequate diffusion of the effluent to minimize adverse effects of reduced oxygen in the receiving waters.

Since the disposal site may represent a concentrated source of various pollutants, leaching into surface or groundwater resources is possible. Specific areas of consideration are discussed in Chen et al. (1978). Proper site selection and development may/or may not overcome

problems in this area, but no general guidelines can be given that are applicable to all sites or disposal. This would be a critical issue and would require a clear engineering evaluation prior to project initiation.

2. Socioeconomic Impacts.

a. No Further Use Intended - Since upland disposal with no intended use produces no economic gain, the only economic advantage may be a cost savings over some alternative methods in cases where the transport distance was short. Upland disposal may be the least costly method when a site is available in close proximity and its elevation does not exceed +40 feet of the dredging operation, and provided the material is not heavily contaminated, which would require costly measures to contain it and prevent leachate problems.

Social impacts of upland disposal of dredged material for no particular use are more readily identifiable. It is not uncommon for proposals that use upland disposal to meet with strong public opposition, particularly when the proposed site is near a residential area. Public health and safety concerns center around several issues: potential release of contaminants into water supply sources; possible problems created by providing breeding areas for mosquitos and other insects; and accidental injuries to persons entering the site. However, each of these potential problems can be mitigated with proper management. Education of the public may lessen any opposition to land disposal.

Another potential social impact of upland disposal is objectionable odors. Unpleasant odors may arise from confined dredged material if the sediments are composed of highly organic silty material. Even capping of the material may not totally eliminate the odor problem so the significance of this impact would depend on the concentration of organic compounds in the dredged material and the proximity of the site to populated areas.

A negative impact on the aesthetic value of an area designated as a disposal site must be recognized as a potential reason for social concern, particularly while the material is dewatering. This impact can often be mitigated by selecting sites surrounded by thick vegetation or by planting vegetative boundaries.

b. For Construction - Any economic impacts associated with upland disposal for construction site use would depend upon the type of activities the structures or facilities would be utilized for. For example, use of dredged material to create a site for an industrial park may generate substantial employment and tax revenues, while construction of a residential area would allow only temporary employment benefits (during the active construction period) and some property tax revenues. Determination of use would be dependent upon compatability with the surrounding land uses and physical characteristics of the dredged material.

Social impacts of upland disposal for construction are also highly site specific, varying with population density and type of development in the area. It is doubtful that odors due to high concentrations of organic materials or problems with contamination of water supplies would be important considerations because dredged material that would pose those threats would probably not be designated as suitable for construction purposes. Other social impacts, such as noise, dust, traffic, and disruption of normal patterns of activity in a community would be important considerations, but site specific in nature. Public acceptance or disapproval would be in response to these site specific conditions.

c. For Habitat or Recreation Development - Economic impacts resulting from creation of wildlife habitats or recreation areas through upland disposal of dredged material are difficult to define because they do not lend themselves to quantification in monetary terms. Creation of wildlife or recreation areas would be of particular value in those upland regions where open space is scarce, as is often the case along Long Island Sound. Temporary employment benefits would probably result for grooming of the terrain, for planting, and for general landscaping. Some employees may be permanently retained to manage the areas.

Those social impacts described in association with all other upland disposal methods would also be common to creation of upland wildlife and recreation areas. Once again, highly contaminated material would probably not be utilized for this purpose, minimizing the potential for odor problems and contamination of water supplies. Properly selected sites would preclude these impacts. Because of the nature of use, noise or traffic problems would not be major considerations, except possibly during the active construction period. Aesthetic appeal of the site would generally be enhanced by this disposal option, and public acceptability should be high.

3. Historical/Archaelogical Impacts

Disposal of dredged material on prehistoric or archaelogical sites can have either adverse or positive effects.

For upland areas, dredged material disposal would cover the site, limit access to and, in many cases, prevent its discovery. Secondly the weight of the dredged material may compress the soil, mixing artifacts from several discrete cultural or strata irreversibly confusing the archaelogical record. Thirdly, chemicals or minerals leaching out of the dredged material and into the prehistoric site may change the chemical characteristics of the site affecting the quality of artifact preservation and altering chemical evidence of human occupation. Finally, earthmoving activities associated with disposal could physically destroy archaelogical sites.

Upland historic sites may be significantly altered or destroyed by the disposal of dredged material. Sites may be covered by overburden, eliminating access to the site, or may be damaged by disposal activities or preparation of the disposal area.

The possibility of impacting historic or prehistoric archaelogical resources on land varies according to exact location. The consideration of three variables will indicate the archaelogical sensitivity of any specific area:

(1) Historic background of site - historical activities

(2) Condition of post glacial surface - intact/destroyed

(3) Environmental history - advantages/disadvantages for habitation, available food resources.

When specific disposal sites are designated, a determination of impacts to the resources can be made in coordination with the appropriate State Historic Preservation Office.

C. DISPOSAL IN CONTAINMENT FACILITIES.

1. Environmental Impacts.

Containment facilities for disposed dredged materials may be located in open water (island creation) or adjacent to a shoreline, either on the mainland or on an existing island. Development of the site may result in the creation of new or improved marsh and/or upland areas. Marshes generally create open space for wildlife habitat whereas upland areas can be used for wildlife habitat or for construction purposes. Because construction and use of the area involves both deposition of fill in nearshore or intertidal areas and the creation of intertidal and upland areas, the general impacts are associated with nearshore and River/Harbor open water disposal and upland disposal. The impacts of disposal on these areas have been discussed in Sections A and B. In comparison with each, containment offers environmental advantages over the major impacts of both open water and upland disposal. Since the material is contained, the release of contaminants into the aquatic environment is minimized and of lesser concern. In comparison to upland disposal, aquatic containerization can create rather than displace land for future use. Other impacts peculiar to containment sites are discussed below.

Construction of the dike would involve either deposition of rock material in the case of a rock dike, or placement of wooden or metal sheeting in the case of a coffer dike. Deposition and work in the area would probably cause some turbidity and disruption of sediments in the project area and surrounding waters.

Once the structure is in place, its presence may cause additional impacts. The most obvious impact is the replacement of the existing aquatic or intertidal environment with that of the containment structure. This impact can be minimized through proper selection of sites that do not impact significant marine resources. Lost habitat may be compensated by the eventual development of the site as a marsh or wildlife management area. This is being done at Corps of Engineers' facilities in the Great Lakes Region.

The continuous filling of the structure with dredged sediments will require dewatering of the facilities which could impact on the surrounding surface water quality. Proper design, site selection and monitoring of the leachate should mitigate this impact. Such a facility would also have some form of impermeable barrier, natural or manmade, to prevent seepage of leachate into the groundwater. Once full, the facility may require several years before the sediment becomes stabilized.

The presence of a containment facility may also modify circulation patterns and salinity characteristics of the surrounding water especially in estuarine situations. Such changes may have adverse impacts on the distribution of aquatic resources; this should be a major consideration for site selection.

A feasibility report for the two Long Island Sound prototype containment facilities will be available in the near future. Site selection for any other facilities in the LIS region would be subjected to extensive engineering and environmental evaluation. Specific Environmental Impact Statements will be developed when sites are identified.

2. Socioeconomic Impacts.

a. For Construction - Economic and social impacts of containment of dredged material for subsequent use as a construction site would obviously vary according to location and size of the site, quality and physical characteristics of the dredged material, and type of facilities constructed. The value of bottom materials from Long Island Sound ports for use as foundation material for structures must be determined. If suitable, valuable and productive real estate could be developed for a mixture of industrial, commercial, or residential, purposes. In general, prevailing trends in industrial development in the Long Island Sound area would indicate that the types of industry located in the area may not be dependent on a waterfront location. On the other hand, the popularity of waterfront land use for a combination of commercial and residential purposes is increasing throughout the area. Public acceptance of utlization of land created for these latter purposes would depend on the quality of the material and adequate education of the public. Overall, social acceptability could be high for the creation of usable waterfront land.

b. For Habitat or Recreation Development - Although economic return on an investment in a containment area for dredged material is difficult to assess when the ultimate use of the land created is for enhancement of wildlife or development of recreational opportunities, the value of additional open spaces in a densely populated area would generally be recognized by the public. Should the material be silty or fine-grained the use of containment areas for wildlife and recreation would be the only practical possibility. Successful development of similar areas in other parts of the country would contribute to the education of the public and overall social acceptability, expected to be high.

3. Historical/Archaeological Impacts.

Impact to significant historical/archaeological site due to containment site development could be involved with near shore and river/harbor sites as well as upland sites. The discussion of impacts in both Sections A and B apply to this alternative. Impacts will depend on the specific site and coordination with the appropriate State Historic Preservation Office would be initiated upon site designation.

D. BEACH RESTORATION.

1. Environmental Impacts.

The impacts associated with the nourishment of beaches with dredged material are generally short-term and physical in nature and limited to beach area. Chemical impacts to the sediment and water column environments as well as associated organisms would not be expected if the deposited sediments are dredged from a clean source.

As discussed in Section A (Open Water Disposal), disposal operations will bury resident organisms at the disposal site and thus temporarily reduce the beach's benthic populations. The less mobile and juvenile forms, especially those that live on the sediment surface, would probably not survive the impact of disposal operations. However, intertidal organisms are generally adapted to a constantly changing environment and some forms would be able to survive mechanical disturbance (Thompson, 1973). Maurer et al. (1978) in their laboratory investigation, found that mobile burrowing species were able to migrate through a sediment overburden to reach the sediment surface. Burrowing response and survival were dependent upon sediment type, sediment depth, duration of burial and temperature.

Once disposal operations are completed settling planktonic larvae and organisms in adjacent areas would recolonize the deposited substrate levels after disposal occurred (Parr et al., 1978). The time neccessary for benthic repopulation would depend on the time of year of disposal, and the degree of textural and geochemical similarity between the dredged and beach sediments. The resulting profile of the nourished beach would

affect the zonation of recruited organisms. A change in the profile would alter the general distribution of benthic organisms. The grade of the beach slope will determine the extent of inundation that a given beach area receives during the ebb and flood tides. Many benthic organisms are dependent upon a particular tidal regime and may not compete or survive under a changed regime.

There are mitigation measures that can be considered with this alternative. Disposal operations would cause less impact to the existing benthic community during winter or early spring when the intertidal populations are generally lowest in numbers. The intense reproduction and recruitment that normally takes place during the following warmer months could optimize recovery of the benthic population. Disposal operations should also be scheduled to avoid the reproductive seasons of sensitive species which may use the beach as a nesting area, e.g. terns. In addition, a beach nourishment project may be managed to develop or enhance a beach's attractiveness to beach-nesting birds.

2. Socioeconomic Impacts.

The economic and social impacts of beach nourishment could generally be characterized as favorable in the Long Island Sound area, where beach space is frequently overcrowded during peak summer months. The economic well-being of several coastal communities is dependent on the maintenance of waterfront areas to promote tourism. Many tourist related commercial activities, such as boat rentals, fishing charters, restaurants, nightclubs, movie theaters, and various other recreational opportunities, are indirectly benefitted by beach improvements because beaches are a major tourist attraction of the area. Beach conditions also affect nearby property values and the tax revenues collected on those properties.

The social impacts of beach restoration would be positive in almost all cases because they would enhance recreational opportunities. Although the public sometimes expresses concern over perceived negative impacts including unpleasant odors, dust, or lack of aesthetic appeal, selection of the proper, clean materials should prevent problems of this nature. In some cases, newly deposited beach sand has a muddy appearance and may provide a coarser, less desirable beach substrate than that found under natural conditions. Although this potential impact is of concern, it is generally temporary and of little consequence over the long term.

3. Historical/Archaelogical Impacts.

Historical or archaelogical sites in or adjacent to intertidal areas are probably subject to erosion by wave action. Deposition of dredged material for the purpose of beach restoration may actually protect the site from further erosion and damages. On the other hand secondary impacts may result to adjacent historical/archaelogical sites if the beach

nourishment results in increased use and development in the area. Again, as specific sites are designated, coordination with the State Historical Preservation Office will be initiated.

E. INCINERATION.

1. Environmental Impacts.

As previously mentioned in Section IV, the volume of dredged material can be reduced by incineration or evaporation of the organic substances and water. The resulting inorganic residue mainly consists of minerals and inorganic contaminants such as heavy metals not broken down by the process. The residue and the gaseous combustion products must then be disposed of in an appropriate fashion.

Volatilization or breakdown of organic compounds such as PCB's, DDT and organic-metal complexes may make the residue more environmentally acceptable for disposal, although the heavy metals themselves would remain in an oxidized form. The impacts of disposal will depend on the type of disposal chosen. Appropriate methods would include open water, upland, containment or even beach nourishment depending on the quality of the material in terms of sediment size and constituents. The environmental impact of these alternatives have been discussed in Sections A, B, C and D, respectively.

The organic substances present in dredged material would be released in gaseous form upon incineration. The Environmental Protection Agency regulates the monitoring of stack emissions of incineration facilities. The emissions must conform with Federal and State standards under the Clean Air Act, as amended and applicable State laws. In addition, EPA has set standards on emissions for toxic substances. The standard for PCB's, for example, is 0.001 gPCB/kg PCB introduced into the incinerator (Federal Register, February 17, 1978). Incineration of highly contaminated dredged material may exceed this standard and therefore may not be an acceptable alternative.

2. Socioeconomic Impacts.

Incineration of dredged material to reduce its total volume or make it suitable for a variety of uses is generally not a cost efficient method of disposal because of the large investment in facilities necessary to complete the operation. The incinerated material may have some resale value for use such as sanitary landfill cover or in construction.

Social impacts of the incineration of dredged material would be expected to be minimal. Any public objection would be dependent upon the location of the plant, the possible deterioration of air quality, and arrangement for disposal of incinerated product.

3. Historical/Archaelogical Impacts.

The impacts to historical/archaelogical resources would depend on the method of disposal of the incinerated residue. These impacts have been discussed in Sections A, B, C, and D.

F. RESOURCE RECLAMATION.

1. Environmental Impact.

The reclamation use of dredged material in the Long Island Sound area is for sanitary land fill cover or enhancement of soil for agriculture or landscaping purposes. The material is used to cover solid waste or to enrich the soil nutrients to improve plant productivity. Similarity of soil characteristics and low level of contaminants should be of primary consideration in the use of this alternative. The environmental considerations concerning land application of dredged material have been addressed above in Section V-B.

2. Socioeconomic Impacts.

Since resource reclamation is, by definition, the conversion of dredged material to a condition in which it can be used productively, it would be expected that the resulting economic and social impacts would be favorable. Since the cost of recovering trace metals, chemicals, and nutrients from sediments has proven prohibitive in the past, a possible use in the Long Island Sound region is for agricultural land enhancement. Although this can also be a costly process, the negative cost impact is at least partially offset by the economic gains achieved through more productive use of the land. If dredged material is utilized for commercial agriculture and results in greater income to farmers, the social impact would also be beneficial by allowing a higher standard of living.

The possiblity also exists for combining dredged material with other substances to form a substance suitable for land fill which can support structures (Bartos, 1977). The creation of productive real estate is obviously economically advantageous, as described in relation to containment and upland disposal. Social impacts are also favorable because this use of dredged material could also provide a partial solution to the problem of disposal of other waste materials.

3. Historical and Archaelogical Impacts.

The potential impacts associated with the use of dredged material, especially as a soil enhancer, would be the same as discussed in Section B (upland disposal). However, if the sediments are properly chosen in terms of sediment characteristics and low level of contaminants, no impact to historical/archaeological resources would be expected.

L2: City of Glen Cove, Department of Public Works, Glen Cove, NY - 9 June 1981

COMMENT:

Listed in the report as a Federally authorized navigation project is Glen Cove Creek and harbor. Dredging of this creek was to have taken place in 1979, with disposal of the dredged material at an upland site provided by the city. Dredging has been suspended due to concern expressed by the local Nassau County Health Department and the New York State Department of Environmental Conservation concerning contaminants present in the sediment. Further investigation by the State has resulted in a determination that this material is considered a hazardous waste. This in effect prohibits any land disposal alternative.

At the present time the city has been informed by the Corps of Engineers, New York District, that dredging will commence only after the city agrees to pay the disposal costs for ocean disposal of this material. This is a financial impossibility for the city and appears to differ with the Federal regulations for disposal should an environmentally unacceptable land disposal site be provided by the local cooperating agency. It would seem that situations such as the above be formally addressed in the Environmental Impact Statement.

RESPONSE:

Your material may be suitable for disposal at a regional site in Long Island Sound. This alternative should be explored through the New York District Corps office.

L3: Westchester County Executive Office - 22 June 1981

Comments and Responses are the same as letter SC1.

L4: City of New Rochelle, NY - 23 June 1981

COMMENTS 1-6:

Comments and Responses are the same as letter SC1.

COMMENT 7:

Upland disposal sites in the Westchester area are virtually non-existent for either governmental or non-governmental potential dredging projects. The only two alternatives are ocean disposal or Long Island Sound disposal. Ocean disposal requires a specific type of barge equipment which has limited availability in New York. The cost of using such equipment is significantly more expensive than other types of barge disposal equipment. Also, limitation on the number of trips per day and

disincentive for commercial and industrial growth. Similar effects could be anticipated even if widespread conversion to coal for electrical generation becomes a reality, and also for receivers of other petroleum products, particularly distillate fuel for home heating and gasoline for automotive use.

The significance of recreational boating to the regional economy is a major consideration in the limited dredging future that would arise from the no action alternative. Inadequate channel conditions would cause the growing number of recreational boat owners in Long Island Sound to realize a lower return on their investment (particularly on larger, deeper draft vessels). Owners of well established yacht clubs and marinas may suffer serious economic losses if channels are not maintained to adequate depths to allow unimpeded passage. The number of groundings would be likely to increase, causing further economic losses. Several ancillary businesses, such as sporting goods stores, dockside gasoline dealers, and bait and tackle shops would also be negatively impacted by a decrease in boating activity.

Social impacts resulting from no action would also be adverse in the Long Island Sound region. Long-term effects on employment and income would be negative due to decreased commercial activity in waterfront areas. As recreational boating opportunities diminished in quality, interest in this major regional pleasure activity would decrease. In those communities which rely heavily on tourism and recreational boating, typical community patterns of social activity would be disrupted. The overall social character of many cities and towns would be modified to some degree.

In summary, the no action alternative can be considered undesirable. Limited dredging may offer some advantages in some situations -- but not until desirable alternative transfer facilities can be provided. There are no short term plans for such facilities. It is therefore desirable, that in the foreseeable future, dredging continue at a rate compatible with existing uses of the Long Island Sound area.

3. Historical/Archaelogical Impacts.

As with environmental impacts, no impacts are expected accrue to historical/archaeological resources due to a lack of disposal.

Table 11

Summary of Potential Impacts of Dredged Material Disposal in the Long Island Sound Region

ALTERNATIVES	ENVIRONMENTAL	SOCIO-ECONOMIC	HISTORICAL/ARCHAELOGICAL
Open Water, Deep Ocean	Deep ocean impacts may be less severe than near shore or river/harbor. Little or no mounding of sediments would occur. The large dilution factor and the lack of biomass of potentially affected organisms would minimize impacts of increased turbidity, anoxia and released contaminants. The introduction of fine and coarse sediments could increase the organic content and habitat diversity, respectively. Ecology of deep ocean communities is less understood. Monitoring of ecological effects would be expensive.	Major impact would be high cost of transporting material for greater distances. Very little impact on regional socio-economic environment. Not yet well enough understood for general public acceptance.	Prehistoric sites: no impact since sites do not occur. Historic sites: remote possibility of adverse impact if shipwreck is located in disposal area.
Open Water, Near Shore	Alternation of topography and sediment habitat, temporary adverse effect on water quality (increase turbidity, anoxia, contaminant release). Modification of sediment quality, burial of benthic organisms, changes in benthic communities, short-term accumulation by benthic organisms. Impact may be more severe and/or noticeable than deep ocean because of greater biomass and proximity to man utilized natural resources. Proper site selection, capping and management control are available tools for mitigation.	As above; but direct impact due to transport cost would be lower. Greater social concern because of proximity to people, especially recreational users.	Prehistoric: impacts may be adverse if disposal covers sites; change in chemical character of sediment environment at the site may affect artifact preservation. Positive impact may result in protection from erosion; reduction in site accessibility (less change of accidental destruction). Historic: adverse impacts by covering or crushing artifacts.
Open Water, River/Harbor	As above; potential for changes in estuarine circulation and salinity patterns which could alter distribution of aquatic organism; may impact finfish and shellfish in inlet area; sedimentation may require more frequent dredging.	Transportation costs minimized but social acceptability very low. May have negative impact on regional economy if values of waterfront property suffer due to undesirability of nearby disposal site.	Prehistoric: As above; possibility of erosion. Historic: As above; possible adverse impact to historic wharf/pier sites.
Upland, No Further Use Intended	Displacement of existing resources - undesirable if natural resources are significant; alteration of existing habitat e.g. modification site topography, soil characteristics and drainage regime; uptake of sediment contaminants by plants or soil animals and subsequent transfer through food web; contamination of nearby ground or surface waters by disposal leachate. Proper site selection, covering with cleaner material and management control may mitigate above impacts.	Impact on regional economy is negligible because material is not utilized for any productive purpose. Social acceptability may be low due to concern over potential release of contaminants into water supply sources, possible propogation of insects, accidental injuries to persons entering the site, objectionable odors, dust, or lack of aesthetic appeal. Acceptance may be gained through education of public, adequate mitigation measures.	Same as Open Water, Near Shore; compression of temporally discreet cultural deposits, physical destruction of site by earth moving activities. Same as open water.
Upland, for Construction	As above.	Possible beneficial economic effects due to creation of valuable and productive real estate, depending on physical character of material. Social acceptability high when public adequately informed.	As above.
Upland, for Habitat or Recreation Development	As above; benefits to environment may exceed loss through enhancement of habitat availability.	Economic impact slight because benefits of use area nonquantifiable. Social acceptability high.	As above.
Containment, for Construction	Potential for generic impacts discussed in open water, near shore - river/harbor and upland. Displacement of significant natural resources at site is undesirable. Contaminants should be contained to site and and not as easily as in open water.	As described above in "Upland, for Construction."	As above.
Containment, for Habitat or Recreation Development	As above; benefits to environment may exceed loss through enhancement of habitat availability.	As described above in "Upland, for Wildlife or Recreation."	As above.
Beach Restoration	Burial of existing beach organisms - this would result in temporary reduction in population which would recolonize. Seasonal scheduling should be considered if shore birds nest on or near the site. Little change in habitat if sediments are appropriate.	Economic and social impacts generally desirable due to increased quality of recreational opportunities. Tourist area maintain attractiveness, thus benefitting related commercial activities in the region.	May positively impact site protection from erosion; but increased use may cause secondary adverse impacts to site integrity.
Incineration	Residue must be disposed; combustion of volatile organics may make residue more acceptable for disposal - gaseous by products may degrade local air quality.	Major economic impact would be large cost involved in constructing necessary facilities. Incinerated product may have some commerical value if suitable for use in construction or as landfill. Public acceptability dependent of air quality, location of plant, and arrangements for disposal of remaining ash.	Deposition of incinerated residue may have the same impacts described for various above alternatives.
Resource Reclamation	Positive impact would be temporary enrichment of soil for agricultural or landscaping purposes; similarity of soil quality should be considered - contaminants could be passed through food chain or impact ground or surface waters.	Economic and social impacts similar to various containment and upland disposal alternatives. Beneficial impacts on income and employment over the long run as a result of increased productivity of agricultural land, creation of commerical land (in combination with other materials). Social acceptability high with proper education of public.	No impact would be anticipated.
No Action	The secondary reduction of vehicle traffic would slow down deterioration of harbor inlet environment. Grounding of vessels may increase potential of toxic substance spills. Reduction or lack of disposal would decrease past or present sediment and contaminant loading of the Sound.	Economic and social effects generally undesirable. Port conditions would decline, with a resulting increase in the cost of transporting petroleum products and bulk cargo. Quality of recreational boating opportunities would decline. Damages to commerical and recreational vessels may increase. Economic losses expected by yacht clubs, marinas, and supporting commerical enterprises. Long Term effects on employment and income would be negative.	As above.

SECTION VI

COORDINATION

A. GENERAL.

Coordination between the New England Division Corps of Engineers and concerned Federal, State and local agencies has been ongoing since the study was initiated in 1978. In addition, coordination efforts were carried on with various private individuals and organizations.

A compilation of coordination documents is contained in Appendix E of this report. These documents include a distribution list, public scoping meeting summaries and other documents released to the Federal, State and local agencies and to the general public for review and comment.

B. FEDERAL AND STATE AGENCIES.

Although a continuous dialogue was maintained with other Federal agencies, formal coordination began in April 1979 when the following agencies were requested to be "Cooperating Agencies" to aid in the development of this document: U.S. Environmental Protection Agency (Regions I and II), the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the U.S. Coast Guard (Districts I and III) and the Food and Drug Administration (Region I).

Coordination with the involved states has been carried out through the Connecticut Department of Environmental Protection including the Coastal Area Management Office and the New York Department of Environmental Conservation. The states of Rhode Island and Massachusetts were also involved however, most responses have been from the former states due to their direct involvement in the study area.

The New England River Basins Commission (NERBC) has provided a forum for concurrent State and Federal agency review via its subcommittee, the Dredging Management Work Group (DMWG). Representatives of this group include Federal and State Agencies (listed in Appendix E) concerned with dredging and the disposal of dredged material. Meetings of the DMWG were held at critical stages of development to discuss comments and objections to the efforts of Dames & Moore, the Corps' contractor, to assess the open water disposal alternative and the overall PEIS. The results of these meetings as well as other comments submitted were incorporated into the final report on this alternative (Appendix A) and are reflected in this document.

C. PUBLIC PARTICIPATION.

Efforts to bring private sector interests actively into the planning process began in March 1979. These efforts have resulted in a broadened base of public understanding of the issues and a more accurate perception of public concerns by government personnel.

Included in our public participation efforts were personal interviews, public scoping meetings and various public releases requesting review and comment. Personal interviews were conducted by Dames & Moore early in their effort to assess open water disposal. Included in these interviews were Federal and State agency personnel involved with dredged material, planning and environmental groups, fishermen, marine trade associations, and other organizations and individuals with direct concern with dredged material. These interviews are summarized in Appendix A.

Three public scoping meetings were held in May of 1979 at Warwick, R.I., New Haven, Conn. and Huntington, N.Y. Written and oral statements presented at these meetings were summarized and released again to the public for comment to ensure an accurate understanding of public concerns. These summaries, the actual meeting notes and other public releases are included in Appendix E.

Coordination meetings were held with the regional chapter of the Oceanic Society of Stamford, Connecticut (Long Island Sound Task Force). One such meeting was held in Stamford, Connecticut to discuss this document. Present at that meeting were the Corps and other parties of the out of court agreement. Many concerns were addressed regarding the content and format of this document. Other informal meetings were held to discuss specific points in the document.

D. COMMENTS AND RESPONSES

The Draft PEIS was distributed to all parties listed in Attachment III of Appendix E for a 45 day review and comment period. Comment letters on the Draft PEIS were received by the following elected officials, agencies, organizations and individuals. The commenters are listed according to Federal, State, county/local, private interests. Each is given a code designation for identification and cross-referencing: FC (Federal Congressional), F (Federal Agency), SC (State Congressional), S (State Agency), L (County/Local), and P (Private). The order of appearance in each subdivision denotes order of receipt in this office.

Federal Elected Officials and Agencies

FC1: Richard L. Ottinger, U.S. House of Representatives, 24th District, NY
F1: U.S. Department of Energy, Boston, MA
F2: U.S. Department of Housing and Urban Development, Hartford, CT
F3: U.S. Department of Interior, Boston, MA
F4: U.S. Department of Agriculture, Forest Service, Broomall, PA
F5: U.S. Department of Commerce, National Marine Fisheries Service, Gloucester, MA
F6: U.S. Environmental Protection Agency, Region I, Boston, MA
F7: U.S. Department of Transportation, Third Coast Guard District, Governors Island, NY
F8: U.S. Department of Transportation, First Coast Guard District, Boston, MA
F9: U.S. Department of Commerce, General Counsel, Washington, D.C.
F10: U.S. Department of Commerce, General Counsel, Washington, D.C.

State Elected Officials and Agencies

SC1: Joseph R. Pisani, State Senate, 36th District, NY
S1: Rhode Island Historic Preservation Commission
S2: Connecticut State Historic Preservation Officer
S3: New York Department of Environmental Conservation (Memorandum)
S4: Rhode Island Statewide Planning Program
S5: New York Department of Environmental Conservation, Albany, NY
S6: Connecticut Department of Environmental Protection

County/Local Elected Officials and Agencies

L1: Suffolk County Department of Health Services, Central Islip, NY
L2: Glen Cove Department of Public Works, Glen Cove, NY
L3: Westchester County Executive Office, White Plains, NY
L4: City of New Rochelle, NY
L5: City of Port Chester, NY
L6: Village of Mamaroneck, NY
L7: Westchester County, Department of Parks, Recreation and Conservation, NY
L8: Westchester County Board of Legislators, White Plains, NY
L9: Town of Rye, Office of Supervisor, Port Chester, NY
L10: City of Rye, NY
L11: Town/Village of Harrison, NY

Private Organizations and Individuals

P1: Shore Acres Point Corporation, Daniel Natchez, Mamaroneck, NY
P2: Harbor Island Boat Club Incorporated, Mamaroneck, NY
P3: Mamaroneck Chamber of Commerce, Inc., Mamaroneck, NY
P4: J.D. Brophy, Inc., Harrison, NY
P5: Roger M. Spoto, New Rochelle, NY
P6: Neil Underberg, New York, NY
P7: Family Circle Magazine, New York, NY
P8: Fehlhaber Corporation, New Rochelle, NY
P9: Goeffrey L. Phillips, Scarsdale, NY
P10: Mary Monte-Sano, Mamaroneck, NY
P11: The Mautner Company, Inc., Yonkers, NY
P12: Victor J. Fink, Mamaroneck, NY
P13: Bevin D. Koeppel, New York, NY
P14: Vincent Monte-Sano, Mamaroneck, NY
P15: Mr. and Mrs. T. Uchida, Mamaroneck, NY
P16: Leonard M. Feltman, Rye, NY
P17: Nichols Yacht Yards, Mamaroneck, NY
P18: Basil P. Tangredi, Greenlawn, NY
P19: Finley, Kumble, Wagner, Heine, Underberg and Casey, New York, NY
P20: Elizabeth R. Pennington, Larchmont, NY
P21: T. Charles Lee, New York, NY
P22: Kinne S. Yon, New York, NY
P23: C. Birge Sigety, Mamaroneck, NY
P24: Robert G. Sigety, Mamaroneck, NY

FC1: Congressman Ottinger - 17 July 1981

COMMENT 1:

It is the purpose of this letter to advise you of my support of the comments which you have received from a number of my constituents urging the Corps to study and open environmentally acceptable dumping sites in the western portion of the Sound. In order to accomplish this end, it has been suggested that the eastern portion of Eaton's Neck be reopened immediately and that the Corps evaluate additional dumping sites in the western New York State Long Island Sound waters. Such sites might include the Stamford-Norwalk-Eaton's Neck triangle, Eaton's Neck West, and Throgs Neck Bridge, between Execution Rock and Larchmont Harbor, near David Island.

RESPONSE:

In recognition of the current need, the Corps has undertaken steps to select a site in the western Sound. Assessment of the site is included in Final EIS for the Designation of a Disposal Site for Dredged Material in Western Long Island Sound released in February 1982.

COMMENT 2:

I formally request that your ongoing DAMOS (Disposal Area Monitoring System) study include these and other appropriate disposal areas located in the western portions of the Sound.

RESPONSE: The site is being monitored by the DAMOS program.

COMMENT 3:

Further it is my hope that the New England Division will coordinate its efforts with the New York District Corps which has direct jurisdiction over the Westchester communities.

RESPONSE:

All actions regarding this site have been coordinated with the New York District.

COMMENT 4:

Finally, I urge the Corps to move as expeditiously as is possible to establish the western Sound disposal areas.

RESPONSE 4:

See response to Comment 1.

COMMENT 5:

I am hopeful that the years of examination of this issued have yielded sufficient amounts of environmental and other critical evidence to preclude further lengthy and time-consuming hearings. If additional hearings are required, I request that they be held in Westchester.

RESPONSE:

A meeting was held in Mamaroneck, NY on 29 October 1981. Also see response to Comment 1.

F1: Department of Energy - 16 June 1981

Non-Specific Comment

RESPONSE:

The EIS preparation staff thanks you for your review and acknowledges your support of our effort.

F2: Department of Housing and Urban Development - 24 June 1981

Non-Specific Comment

RESPONSE:

The EIS preparation staff thanks you for your review and acknowledges your support.

F3: United States Department of the Interior - 2 July 1981

COMMENT 1:

Our concerns center primarily on the potential long-term cumulative impacts of open water disposal on the aquatic ecosystem. The documents do not critically review the alternatives to open water disposal but instead promote the expansion of the three existing disposal sites to the possibility of seven open water disposal sites.

RESPONSE:

Our analysis of alternatives to open water disposal is based on information available at the time. The open water sites were proposed based on the site selection study done under contract to the Corps by Dames and Moore (Appendix A). Two other alternatives, namely, containment and upland disposal are currently being analyzed by our Planning Division and the State of Connecticut, respectively. When site-specific information for these two alternatives is made available these alternatives would also be included in the determination for the most suitable disposal method.

COMMENT 2:

The Corps appears to be treating all classes of dredged material as waste with no indepth analysis of the use of uncontaminated dredged material as a beneficial resource. We prefer the beneficial use of uncontaminated dredged material, such as habiat development beach restoration, land reclamation, or building aggregate.

RESPONSE:

We do indicate in our alternatives section a number of potential uses for "clean" dredged material. Clean silty material may be used for (1) creation or reclamation of fish and wildlife habitat such as inland or coastal marshes, upland habitat or island creation etc.; (2) restoration of beaches which has been a traditional use of clean sands; (3) production of construction material; and (4) a sanitary landfill cover and other land reclamation. Such uses may be deemed feasible but would require an in-depth analysis when a specific project is proposed and the need for a use of the material has been established. Hence, they were dealt in a generic way.

COMMENT 3:

For contaminated material, we recommend upland and/or aquatic containment. Although aquatic containment is the subject of a separate Corps study, there is no analytical investigation of upland containment in the region.

RESPONSE:

There are references to upland containment in the upland disposal section of the alternative section. Analytical discussion would not be productive until a specific site is designated. The site would not be within the jurisdiction of the Corps of Engineers and therefore, would have to be implemented by local or State interests.

COMMENT 4:

As acknowledged in the reports, the potential long-term impacts of open water disposal of contaminated dredged material on the aquatic ecosystem are not well understood. The discussion of these long-term impacts is centered on heavy metals, chlorinated hydrocarbons, and oil and grease. These substances are only a small subgroup of the 129 compounds that have been listed by the Environmental Protection Agency as toxic substances. We recommend that these priority pollutants be investigated in any disposal of contaminated material.

RESPONSE:

The choice of the general categories (heavy metals, chlorinated hydrocarbons, etc.) used in the discussion of long term impacts (pp VI-9 to II, PEIS; Section IV, Appendix A and pp B-18-44, Appendix B) were based on the constituents of concern listed in the Ocean Dumping Criteria (Federal Register, January 11, 1977, Section 227.6). The general category of petroleum hydrocarbons, as described under the term "oil and grease", include all hexane-extractable organic compound which include a wide variety of toxic organics (Appendix B). This, together with the chlorinated hydrocarbons and heavy metals comprised a majority of the listed toxic substances.

We feel it is generally unrealistic to require a screening analysis of the all 129 toxic substances for two reasons:

(1) The cost of testing would be prohibitive to most private permit applicants. The cost of bulk chemical analysis of the usual list of contaminants are already very expensive. Analysis for many of the toxic substances require special equipment and procedures which have not been standardized. (2) It is likely that most of the substances are not present in dredged material. Young (1979) found in his California study that of the EPA list of priority pollutants, less than 5 percent were quantified in the San Diego primary effluents and about 10 percent were present in the Orange and Los Angeles County effluents. On the whole less than 10 percent of the priority pollutants were found to be present at levels above the quantification limit of 10 ppb. Given that these effluents are the major source of harbor sediment pollution, it is unlikely that the sediment would contain the entire suite of priority pollutants if the major input source (effluents) did not have them in the first place. We feel that the added expense to the applicant of analyzing all toxic would not be justified. However, if there was reason to believe that any of these substances were present in the sediment through past NPDES permits, spills or other historical data, we would test for such substances.

COMMENT 5:

The subject of long-term impacts is being studied by the Corps' DAMOS program at the three interim sites in Long Island Sound. Since these impacts are not fully understood and the efficiency of capping as a mitigative measures has not been established, we recommend against the expansion of disposal sites in Long Island Sound.

RESPONSE:

Your opinion and recommendation is noted. It is not our intention to expand disposal sites in Long Island Sound beyond that which is needed to serve the area. We have been disposing of dredged material in many areas throughout the country and the monitoring of these areas has shown no

evidence that the open water disposal of dredged material has caused long term impacts at sites where dredged material was the only discharge. Monitoring of capping through DAMOS indicates that capping operations have been effective in sequestering the disposed material. These sites will continue to be monitored.

COMMENT 6:

Mineral Resources

From the information provided in Appendix A, Environmental Impact Report, it is difficult to assess the project impacts on mineral resources. Mineral resources are listed as a study criteria in the Open Water Disposal Study Data Structure Diagram, but in Section II. B-3, Rating of the Issues, were considered of low importance. We contend that, environmental and technical problems not withstanding, offshore sand/ gravel deposits exist in the LIS and that the disposal of dredged sediments may preclude specific sites from future development . Rapid depletion of land sources of these materials in the LIS region justifies serious consideration of recovering abundant near shore deposits.

We suggest that the report address more directly the conflict of disposal sites and potential resources. Specifically, mineral resources should be included in Table III.b-1 in the Site Use Value Considerations.

RESPONSE:

The Connecticut Department of Environmental Protection which regulates subaqueous mining of materials from the State's tidal, coastal and navigable waters, has indicated in a letter dated 2 December 1981, that dredged material disposal at the sites would not be expected to impact known sand and gravel resources since they are located in deep offshore waters. Further, since heavy mineral resources would be associated with the sand and gravel deposits, these resources would not be affected by disposal at existing or proposed sites.

COMMENT 7:

A statement should be included in each of the Physical Characteristics sections for the seven proposed sites that would provide an indication of the relative marketability of the sediments present, based on available data such as particle size distribution and clay content.

RESPONSE:

The cost of recovery or mining of the sediment now present at the disposal sites would be prohibitive. The marketability or potential use of a dredged sediment would best be considered at the time of permit application. Then, a cost-effective use of the material can be determined.

COMMENT 8:

We recommend inclusion of measures such as sediment curtains to control the migration of resuspended fine-grained sediments during dredging and open-water disposal operations (pg. V-13).

RESPONSE:

Sediment curtains have been used effectively to reduce the areal extent of turbidity plumes caused by open water disposal via pipelines. This method of disposal is not employed in Long Island Sound although potentially avialable. Turbidity generally has not been a significant problem when material is dredged by a clam-shell and disposed of by bottom-dump scows. Dredging in LIS is limited to avoid sensitive spawning periods, via the Water Quality Certification, thereby reducing the need for extraordinary means of protection. However, silt curtains would remain available if circumstances determined the need.

COMMENT 9:

We consider this programmatic statement to be inadequate in regards to the long-term impacts of open water disposal and the alternatives to open water disposal. These inadequacies will remain until the questions on long-term impacts are answered and the attitude that dredge material is a waste product prevails.

RESPONSE:

The EIS preparation staff acknowledges your concern but does not agree with your opinion.

F4: Department of Agriculture - 21 July 1981

COMMENT 1:

As this document is now written, it is difficult to determine what, if any, decision is being made on the disposal of dredged material. Since this is a programmatic statement, we would look for the document to set out overall program direction. In Section IV, Alternative Methods of Dredged Material Disposal, there should be an indication of which one or more alternatives is (are) preferred. This would effectively reject the "no action" alternative and establish the feasible methods of disposal.

RESPONSE:

An environmental impact statement does not make a decision rather it provides information to the decision maker for his/her determination. The circumstances of a site specific project will determine which alternative is preferred for that project. The preferred alternative would depend on

the availability of sites (open water, upland, containment, etc.) and the type of material a site specific project will generate. The disposal of dredging material at sites other than open water or beach restoration is not within the Corps of Engineers jurisdiction. Upland sites have to be designated by local or State authorities. Whether or not these sites would be preferrable to open water or beach restoration would depend on the nature of the material.

COMMENT 2:

Criteria and methodology should be developed for evaluating which disposal method should be used when site-specific projects are analyzed. On page ii there is mention of the development of consideration tables, but no discussion of this subject is contained in the body of the document. If this is proposed as an evaluation method, then more explanation is needed on the considerations to be used in rating alternatives.

RESPONSE:

The criteria and methodology of choosing a preferrable disposal alternative is best kept open and flexible to meet the needs of a particular project. A good and objective decision should be the result of whatever criteria or methodology used. The suggested Matrix Tables are a standard method of multi-factor analysis and should need no further explanation.

COMMENT 3:

In Section V, The Affected Environment, a general description of upland sites and wetlands should be added to adequately describe all areas where dredged material could be disposed.

RESPONSE:

The disposal of dredged material in upland areas is not within the jurisdiction of the Corps of Engineers. The State of Connecticut is currently studying the feasibility of upland disposal site designation in their state. Such a designation would be project specific and would involve any number of considerations which would be futile to mention without a specific site. We would only consider wetland areas feasible if there was a potential to reclaim or enhance an existing wetland. This would be done in cooperation with the State and local government. No sites have been considered at this time.

F5: Department of Commerce - 22 July 1981

COMMENT 1:

In our opinion the DEIS fails to address the problems associated with disposal of polluted material in Long Island Sound. It is our understanding that the problems this document was to address include:

a. The continued use of the New London site which has depths less than the desirable level of twenty meters and so could be subject to storm induced erosion.

b. Identification of an alternative site to the New London site.

c. The use of Cornfield Shoals area allows dispersal of dredged material dumped there, yet the impact on the resources of Long Island Sound by such action has never been determined.

d. The mud cap covering the heavily polluted Stamford material at the New Haven dump has lost at least twelve percent of its volume while the sand structure remains stable. What has been done to recap the mud cover with sand or further stabilize this or any other disposal site with an entombment activity?

e. Capping as a disposal option for entombment of heavily polluted material is being developed an an implementable technique but the issues of insuring accurate placement and coverage on a routine basis continue to hamper broad acceptance of the techniques. Can these problems be resolved and if so when?

f. What are the ramifications of open water disposal of material laden with man-made contaminants?

We find little in the present documents that deals with these managerial issues which we believe are central to the assessment of impacts related to the management of dredged material disposal in Long Island Sound.

RESPONSE:

a. The shallow area of the dump site which has a depth of about 15 m (Figure III. B-10, Appendix A) would not be used for disposal. This area is relatively small comprising only 1/25 of the total area of the disposal site. Progressive bottom surveys have shown that the mound is relatively stable despite the evidence of minor episodic erosion (lag deposits) seen at the surface.

b. Site D in Block Island Sound has been identified as a suitable site (Appendix A) and may be considered for use should an alternative to the New London site be necessary. Section V of the PEIS concluded that use of Site D offered no advantages to use of the previously-used New London Disposal Site (Site G).

c. You are correct in stating that the impacts of dispersion have never been studied. However, DAMOS monitoring at the site following long term disposal have not indicated any long term environmental problems (NUSC, 1979). Impacts to water quality which were reflected in raised tissue levels in mussels at the site were localized and temporary.

Contaminant levels in the mussel tissues returned to baseline level soon after disposal operations ceased. Because it is considered a high energy site, i.e. bottom current would not allow for stable mound formation, only clean sediment would be considered for disposal. The site has been used for relatively few projects in the past and there is no reason to expect anything different in the future. Most projects were relativley small with only a few approaching 50,000 cy. The area may benefit from an increase in nutrients to increase its currently low bottom productivity.

d. Although 12% of the cap material was removed, the cap is still considered viable and the dredged material remains sequestered. Recapping of the site is not necessary.

e. Monitoring has indicated the placement and coverage have been effective in all cases. Also, improved navigational controls have enhanced our capability to locate a taut-wired buoy.

f. This issue has been discussed in Section V of PEIS as well as Appendices A and B.

COMMENT 2:

Appendix B (Long Term Impacts of Open Water Disposal of Dredged Material) and Appendix C (Economic Analysis of Future Dredged Material Disposal in Long Island Sound) at Section V, begin to deal with these pivotal issues. However, the main body of the document lacks site specific determinations regarding the real and potential problems of using the specified dump sites.

RESPONSE:

Site specific determinations would be made at the time the specific dredging proposal comes forward. Pages V-7-12 of the main document summarize the potential generic impacts and mitigation measures at the candidate sites based on the analysis provided by Dames & Moore (Appendix A). Appendix A deals with the site impacts in more detail.

COMMENT 3:

Appendix A to the DEIS is thorough, but does not correspond well to the main document on several points. These include the impacts of use of Cornfield Shoals and the New London site, as well as the need for determining area sensitivity at all dump sites. None of these issues is addressed in the DEIS; however, that document refers to Appendix A which identifies the existence of these problems.

RESPONSE:

Cornfield Shoals sites: see response to Comment 1c. New London Site: see pages V-7-12 in PEIS and Sections V and VI of Appendix A. The relative sensitivities of the disposal sites were the results of the computer analysis performed by Dames & Moore (Figures II-B-2-6, Appendix A).

COMMENT 4:

Appendix A is based on a contractor's data analysis that attempted to weigh relative values of the resources of Long Island Sound. NMFS staff members who attended some meetings during its development raised numerous questions about the basis for the evaluation. To date those questions have gone unaddressed.

RESPONSE:

Correspondence with NMFS representatives (letter dated 12 December 1979) shows that most concerns are resolved in the draft Environmental Impact Report (Appendix A). A special meeting of the Dredging Management Work Group was held on February 1980 to afford the group members (including NMFS) a chance to discuss their concerns directly with the contractor, Dames and Moore. Although concern over the evaluation process was noted, no specific questions were raised by NMFS. NMFS with other group members were invited to visit the Contractor's office to review the voluminous materials in the site selection analysis. Further, as a cooperating agency NMFS was always able to express their views and provide substantive input to the document throughout its development.

COMMENT 5:

The statement that the entire DEIS was closely coordinated with NMFS and other Federal agencies is incorrect. Except for the limited coordination on Appendix A, opportunities for NMFS input to the DEIS were confined to attendance at two hearings.

RESPONSE:

See response to Comment 4.

COMMENT 6:

In our opinion these factors seriously fault the document. To correct the problems, we believe it would be advisable to withdraw them from circulation and redraft the EIS, using the contents of Appendices B and C as the basis for addressing the disposal of dredged material in Long Island Sound.

RESPONSE:

The EIS preparation staff notes your opinion and does not concur.

F6: Environmental Protection Agency - 22 July 1981

Non-Specific Comments

RESPONSE:

The EIS preparation staff acknowledges your comments and appreciates your review.

Specific Comments

COMMENT 1:

Page IV-8 -- The EIS uses the creation of the Smith Point Park parking lot as a good example of the productive use of dredge spoil. This project is approximately 20 years old, destroyed productive barrier island habitat and is not on Long Island Sound. The Corps should try to come up with an example of dredge spoil use that is non-harmful, more up to date, and witin the project area.

RESPONSE:

The example has been deleted from the text.

COMMENT 2:

Page IV-13 -- Mudflats are accretion areas and do not need "replenishment."

RESPONSE:

Although mudflats are accretion areas, major storms or changes in currents due to coastal alterations can erode fine sediments in shallow water or intertidal areas. We are suggesting the potential use of clean silt for replenishment or creation of such a habitat. Such disposal could also be used to enhance intertidal marsh areas from shallow subtidal areas for habitat management purposes.

COMMENT 3:

Page IV-15 -- This discussion on the use of L.I.S. dredged spoil for agricultural enhancement should mention that the high salt content will make these spoils useless for this purpose.

RESPONSE:

Your suggestion has been added to the discussion.

COMMENT 4:

Page VI-2, para. 2 -- Please note that habitat alteration is not a short-term impact.

RESPONSE:

The discussion has been changed at your suggestion.

COMMENT 5:

Page VI-7 -- The discussion on solid phase bioassay on line 4 should read "Statistically significant mortality and greater than 10% of the control sediment."

RESPONSE:

The use and meaning of "reference" and "control" has been the subject of significant discussion among all the Federal agencies. The result was that the "control" is merely a quality assurance measure to assess specimen vitality and general health. The "reference" is used in the comparison and evaluation in biological testing. Unfortunately the word "control" has been used in both contexts in the manual and should be clarified in a future document.

COMMENT 6:

Page VI-10, lines 4 and 3 should read "mostly insoluble." The heavy metals and organochlorides found in dredge spoil are not completely insoluble by any means.

RESPONSE:

The statements have been changed.

COMMENT 7:

Page VI-10, para. 2 -- This paragraph uses the term "highly contaminated dredged material." The Corps should define the term "highly contaminated" in the EIS. Regardless of the definition, the intent of the Clean Water Act is to avoid the discharge of highly contamined material into the aquatic environment.

RESPONSE:

The discussion has been removed from the text. For the purpose of this document, "contaminated" sediments are those which have constituents in unnatural amounts.

COMMENT 8:

Page VI-11, para. 1 -- The East River should not have been singled out as the only river contributing to LIS. There are industrial rivers in Connecticut which add to the high loads of pollution to the Sound.

RESPONSE:

The statement did not mean to imply that the East River was the only source of contaminants loading in the Sound. The "industrial and sewage discharges and runoff" associated with rivers in Connecticut in the same statement certainly makes a contribution to contaminant loading. However, the "relative" contribution of the East River compared with other rivers still justify the statement. Fitzgerald et al. (1974) indicated that approximately 67 percent of the Cu and 58 percent of the Zn loading of the Sound is contributed by the East River. Studies by Bowman (1977) and Jay and Bowman (1975) have concluded that the East River is the main contributor to nutrient loading to the western end of the Sound. The pattern of contaminants in the basin surface sediments across the length of the Sound support these suggestions (Greig et al., 1977; Reid et al., 1979). Bowman, in a 1976 paper, went so far as to propose that a tidal lock be installed across the upper East River. The lock would close during ebb tide thereby preventing the contaminated East River waters from entering the Sound. He calculated that the resultant flushing of the western sound with the central basin waters would reduce concentrations in the western sound by about 88% within a month of operation.

COMMENT 9:

Page VI-14, para. 2 -- The Corps notes that it will use spawning areas for dumping on a seasonally restricted basis. If the spawning site is at all valuable ecologically and/or commercially, the area should not be used as a dump site.

RESPONSE:

Predisposal studies of any new dumps should identify any ecologically and/or commercially valuable spawning areas prior to disposal. If such an identification was made, provisions would be made to relocate the discharge area.

COMMENT 10:

Page VI-16, bottom para. -- The Corps should define the term "high levels of contaminants" in the EIS. The Corps should explain how these spoils are "deemed" suitable for open-water disposal.

RESPONSE:

See response to Comment 7. The elutriate and bioassay/bioaccumulation tests are designated to indicate the potential for impact. The results of these tests, together with bulk sediment analysis and data on the conditions at the disposal site, aid the decisionmaker (i.e., Regional Administrator and the Division Engineer) to make a reasonable determination on acceptability for open water disposal.

COMMENT 11:

Page VI-17, bottom para. -- The Corps should also define the term "high risk contaminated materials" which are to be dumped in open-water.

RESPONSE:

The phrase "high risk" has been removed from the text.

F7: Department of Transportation: U.S. Coast Guard Third District - 23 July 1981

COMMENT 1:

Statements are made on pages III-1 and VI-51 that the use of deep draft vessels necessitates regular maintenance dredging; without this dredging, the risk of chemical/oil spills from both groundings and additional transfer of supplies (lightering) would increase. We strongly agree with these statements and appreciate your efforts in resolving the tremendously complex issue of dredge spoil disposal in this region.

RESPONSE:

The EIS preparation staff appreciates your support.

COMMENT 2:

The alternative method of Deep Ocean Disposal is discussed on page IV-3 et seq. Among the conclusions reached is that the cost of this option would be relatively high. To this we would like to add the significant amount of time and resources that we would be required (under the Marine Protection, Research and Sanctuaries Act) to expend on surveillance of deep ocean disposal operations. The use of the Coast Guard-developed Ocean Disposal Surveillance System (ODSS) would have provided a very effective, reliable substitute for surveillance currently performed by our vessels, helicopters and shipriders; unfortunately, an ODSS unit would cost $10,000 if any company had been willing to manufacture it, which they were not. The Coast Guard subsequently withdrew

proposed rules to require an ODSS on waste transporter operations. In short, existing disposal operations in the New York Bight are already straining our resources. We ask that this be included as a factor in choosing appropriate disposal sites.

RESPONSE:

The discussion has been revised to include this factor.

COMMENT 3:

In the discussion of the Incineration alternative (p. IV-14), it is stated that "inorganic contaminants, such as heavy metals, would not be eliminated by incineration although some inorganic compounds may be degraded by high temperatures." It may be worthwhile to investigate the use of pyrolysis in place of incineration because of the former's superior retention of toxic heavy metals in the solid phase.

RESPONSE:

Theoretically, both pyrolysis and incineration have been shown to have potential for detoxification of dredged materials. However, the cost of such an operation would be about $100/cy of sediment (Malcolm Pirnie, Inc., 1980) and therefore would not be cost effective for most projects. Also, there is currently no incineration facility in the northeast which could handle the volume of material produced by a modest LIS dredging project.

COMMENT 4:

Recognizing that this is a programmatic and not a site-specific EIS, we would like to see a discussion of potential impacts on navigational safety from dredge disposal in open waters, e.g. where the disposal sites are in relation to the main shipping channels in Long Island Sound and beyond, reduction in water depths from the creation of mounds, and additional vessel traffic from disposal operations. We would be glad to assist you in exploring these potential problems.

RESPONSE:

These factors were discussed through your office and with your New Haven regional office in the development of Appendix A. Should a new candidate site be pursued we will coordinate further on these potential problems.

F8: Department of Transportation - U.S. Coast Guard 1st C.G. District, Boston, MA - 27 July 1981

COMMENT 1:

I concur with the need to maintain adequate channel depth to allow passage of commercial and recreational vessels into developed harbors. The document provides a useful discussion of environmental issues and mitigating measures related to the disposal of dredge materials.

RESPONSE:

The EIS preparation staff appreciates your support.

COMMENT 2:

Proposed dredge Site D is the only site which is within the First District boundaries. I note that this site is not being actively pursued as an alternative at this time. If this site is given further consideration, I request that the location be coordinated with CDR George F. Ireland, Captain of the Port of Providence. The proposed site is currently approximately one (1) mile south of the busy shipping route connecting Long Island Sound with Buzzards Bay and the Cape Cod Canal. A greater separation between these activities is desirable as indicated by the previous Captain of the Port letter dated 24 January 1980.

RESPONSE:

If Site D is pursued, its specific location would be coordinated through your office and at your request the Captain of the Port of Providence.

F9: Department of Commerce National Oceanographic and Atmospheric Administration (National Ocean Survey) - 22 June 1981

COMMENT 1:

The circulation, tide and flushing materials are adequate for the purpose intended. The bibliography to which the text is referred, contains all the significant physical oceanographic literature. The geology and oceanography portions are particularly well done.

RESPONSE:

Your comment is noted and appreciated.

F9: Office of Marine Pollution Assessment - Stony Brook, NY - 29 June 1981

COMMENT 1:

Subject document, it should be noted, is an EIR. It is being used also as a Draft Programmatic Environmental Impact Statement for the Disposal of Dredged Material in the Long Island Sound Region. This confusing matter is even more confused because the EIR is to "serve as part of the basic information for a Composite Environmental Impact Statement (CEIS) and an overall Dredging Management Plan (DMP) for dredging and the disposition of dredged materials for the total geographic region of Long Island Sound." The CEIS and DMP are to address the deposition of dredged material on land, habitat development, island creation, productive uses, and other alternatives. The EIR is supposed to provide the basis for considering the open water disposal alternative . . . the overall Dredging Management Plan should attempt to determine more precisely the effects of dredged material disposal in the Sound.

RESPONSE:

The various disposal alternatives and associated impacts are discussed in the main report. It is obvious that you only received Appendix A of the Programmatic EIS which, as stated, is "to serve as a part of the basic information." We apologize for the fact that the commentor was not on the mailing list, although Mr. Stanley Chanesman of your office should have received a complete set of documents. We have sent the commentor a complete set of the final document.

The following will hopefully clarify the confusion of the documents. We agreed in the 1977 out of court agreement (Appendix E) to prepare a "Composite Environmental Impact Statement (CEIS)." Subsequent review of the terminology indicated that the term Composite EIS was a nebulous one. We decided to use the term Programmatic EIS because (1) it fit our implementation regulations for the National Environmental Policy Act (ER-200-2-2) and (2) the concept of a Programmatic EIS was more amenable to the needs of a "management plan" in relation to our jurisdiction. The Programmatic EIS offers a generic framework for what the "CEIS" and "Dredging Management Plan" were to address.

COMMENT 2:

It is most difficult to examine just the EIR, and provide substantive comments regarding the overall problem -- comparisons, evaluations, assessments, etc. Much of the information and techniques used to prepare the "Issue Maps" and to support other heavily-weighted issues is not summarized in the EIR.

The EIR does make a commendable attempt to synthesize the existing information on the development, biota, and most probable impacts of dredged material disposal. For the most part the Management Summary and Recommendations (pp. V-5ff) seem reasonable, based upon a brief review of the EIR.

RESPONSE:

The site selection process is summarized in Chapter II of the EIR and is presented in greater detail in "Appendix A" of that report.

F10: U.S. Department of Commerce General Counsel - 5 August 1981

Comments and Responses are the same as letter F5.

SC1: The Senate to State of N.Y., Honorable Joseph Pisani - 16 July 1981

COMMENT 1:

Western Long Island Sound should be re-opened for dumping of dredged spoils at least from the adjacent areas.

RESPONSE:

See response to Comment 1, Congressman Ottinger, FC1.

COMMENT 2:

Specifically, Site E (identified in the Draft EIS and known as that portion of Eatons Neck East lying in Connecticut State Waters) should be re-opened immediately to dumping of dredged spoils.

RESPONSE:

Site E is not recommended for use as a disposal site. Another site in Western Long Island Sound, WLIS III, however, is assessed in the Environmental Impact Statement for the designation of a disposal site in Western Long Island Sound (CE, 1982b) and has been selected for use.

COMMENT 3:

Additional EIS's should be undertaken by the Army Corps of Engineers to locate additional dumping sites in Western Long Island Sound waters. Deep hole areas which should be considered include Throgs Neck Bridge, between Execution Rock and Larchmont Harbor, near Davis Island, and Eatons Neck West dump site.

RESPONSE:

See response to Comment 1, letter FC 1. Disposal in the deep hole areas suggested is not recommended by the State of New York nor by the Corps. Available data indicate these areas are actively fished for lobster and finfish and are likely the result of scour by strong bottom currents. Additionally, the potential for adverse impacts to navigation and aesthetics is significant at these areas.

COMMENT 4:

That the concept of non-Federal dredging between the Federal maintenance areas and shoreline be given more emphasis and consideration in long range planning for the dumping of dredged spoils.

RESPONSE:

To the maximum extent practicable, the Corps includes nearby and adjacent non-Federal projects in the planning, processing and review undertaken for a Federal project. This has been done in various New England harbors and was originally planned for Mamaroneck Harbor.

COMMENT 5:

More emphasis be given to the needs of the Sound Shore Communities of Western Long Island Sound encompassing lower Conn., Westchester County as well as those portions of L.I. Sound and New York City in same vicinity.

RESPONSE:

Your comment is noted.

COMMENT 6:

The figures of estimated dredging for the next fifty years in the Draft EIS for the Westchester area be increased from 250,000 cubic yards to 1,000,000 cubic yards for Federal maintenance dredging and an additional 4,000,000 cubic yards be included representing maintenance dredging by entities other than the Federal government.

RESPONSE:

It cannot be assumed that what is the case for Mamaroneck is the case for every harbor in Westchester County regarding the relationship between private and Federal dredging. There is no data to support the claim that the ratio of non-Federal dredging to Federal maintenance dredging is 4:1 for Westchester County. Historical figures for material dredged in Westchester County indicate an annual average of 16,000 cys for non-Federal dredging compared to a 9,580 average for Federal maintenance dredging, a ratio of 1.67:1. The projections for the next 50 years have been updated to 1982 (See Table C-22 of Appendix C).

S1: Rhode Island Historical Preservation Commission - 3 June 1981

General comment.

RESPONSE:

The EIS preparation staff appreciates your review.

S2: Connecticut State Historic Preservation Office - 7 July 1981

COMMENT 1:

The State Historic Preservation Officer has reviewed the "Draft Programmatic Environmental Impact Statement for the Disposal of Dredged Material in the Long Island Sound Region." This office understands that this draft document provides a generic treatment of the impacts of seven dredged material disposal alternatives for the Long Island Sound Region. In the opinion of the State Historic Preservation Officer, this programmatic plan will have no effect upon historical, architectural or archaeological resources listed on or eligible for the National Register of Historic Places.

RESPONSE:

Thank you for your review and comment.

COMMENT 2:

This office notes that this draft documentation does discuss the potential existence and impact of the disposal alternatives upon the area's cultural resources. This office suggests that this section would be strengthened through reference to the following study undertaken by the Institute for Conservation Archaeology on behalf of the Bureau of Land Management. This study is entitled "Summary and Analysis of Cultural Resources Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras: Final Report

Volume I - Physical Environment
Volume II - Archaeology and Palaeontology
Volume III - Historic Shipping
Volume IV - Management

This office believes that this study provides a basis for the establishment of a comprehensive framework with respect to paleoenvironmental reconstruction and historical maritime data.

RESPONSE:

The "Final Report" was used in the preparation of the analysis but notation of the reference was inadvertently left out during reproduction. The references have been included in the text.

COMMENT 3:

Specific plans and specifications forthcoming from this programmatic plan should be submitted to the State Historic Preservation Office for a cultural resource review in accordance with the National Historic Preservation Act of 1966 and Advisory Council guidelines 36 CFR 800.

RESPONSE:

Specific plans will be coordinated in accordance with all applicable laws and regulations.

S3: New York State Department of Environmental Conservation (Memo) - 16 July 1981

COMMENT 1:

Throughout this EIS many possible impacts, possible alternatives, etc. are mentioned but no thorough discussion or summary and reference to pertinent studies is made that would serve to evaluate the issues. In order for a generic/programmatic EIS to be useful there must be some substantive evaluations.

RESPONSE:

The purpose of the program EIS was to discuss general alternatives and their potential impacts. Because of the numerous Federal projects and many potential permits evaluation of the alternatives and impacts were done on a generic basis. The given circumstances of each project will dictate which alternatives would be the most suitable and what impact would be expected.

The substantive evaluations will be made at that time.

COMMENT 2:

The PEIS falls far short of what we expected. It is not an EIS based on total management proposals for LIS dredged material, but is basically a document to be used in selecting open water dump sites. It notes that additional studies of land based disposal, containment sites, etc. are underway. Programmatic examination of alternatives, comparison of their costs, discussion of how they could be implemented, and decision-making procedures must be included in a PEIS. More attention should be given to

other alternatives such as managing dredging (sequencing, reducing volume, abandonment of some dredging areas) to mitigate disposal impacts. Mitigation of impacts at disposal sites also requires more attention.

RESPONSE:

The PEIS makes a presentation of the alternatives based on the current available information. Comparison of the cost of alternatives in aspects other than transportation, are difficult to present. Cost evaluation of disposal methods involve complex calculations which can vary from project to project within the same alternative (Appendix C). Transportation costs are discussed in Section III and Appendix C.

Implementation of any disposal alternatives would have to be pursued in conjunction with all applicable Federal, State and local environmental statutes. Below the ordinary high water mark disposal would be within the jurisdiction of the Corps of Engineers. Monies for implementation of open water disposal of maintenanced dredged materials and for beach restoration would be available from separate Corps of Engineers continuing authorities. Implementation of open water disposal of channel improvement project derived materials and aquatic containment facilities would require special Congressional authorization. Above the ordinary high water mark any other disposal options would be in the jurisdiction of the State and local authority. Implementation would require compliance with appropriate State and local environmental laws (Table 3, PEIS) and sanction of the local authorities. This includes any required land, easements and rights-of-way.

The decision making process for the Corps of Engineers would be based only on our regulatory authority (CFR 33, Parts 320-329 and CFR 40, Part 230). Alternatives would be assessed on a case by case basis at the time a project is proposed. A suggested multi-factor analysis has been presented in the preface.

The use of mitigating measures such as sequential disposal, avoidance of spawning times and areas are discussed in Section V of the main report. These will be considered and used appropriately on a project specific basis. It would be difficult in the context of this document to designate which navigation areas we would abandon or designate a shallower channel. Each harbor would have to be evaluated on a myriad of complete social and economic issues and would be subject to approval by Congreess in the case of Federally authorized channels.

COMMENT 3:

Because so much more detail is devoted to open water disposal, the PEIS concludes that alternative disposal methods must be determined by case-by-case (Conclusion #2, P. I-2). This is an unacceptable conclusion, and was one of the principal issues in the New London litigation. Open

water disposal will always appear as the only viable alternative until comprehensive analysis of other alternatives is conducted. This study and PEIS was to have included such analysis. It does not.

RESPONSE:

The comment reflects the opinion of the author. The memorandum of understanding entered into among the parties in 1977 charges the Corps with the responsibility of (a) preparing a composite Environmental Impact Statement; (b) considering the availability of disposal sites in Block Island Sound and other nearby ocean waters; (c) seeking funding from Congress for additional studies of alternate dumping sites; and (d) designating an alternate to the New London dumping site. We have fulfilled each term of the agreement:

(a) This document and its appendices represent the composite Environmental Impact Statement.

(b) and (d) Appendix A of this document addressed potential sites in Block Island Sound, and its adjacent waters and an alternative to the New London Disposal Site (Site D).

(c) The Corps of Engineers, New England Division, is currently studying the feasibility of aquatic containment facilities in the Long Island Sound region. Further, the State of Connecticut and the New York District are studying potential upland sites available to the region.

Indepth analysis does require information not currently available at this time. As stated in the preface this is a "living" document which will be amended as this new information becomes available.

COMMENT 4:

Figure 2 - An additional candidate site that should be evaluated is northwest of Site E located between the three historical sites. It was determined at a meeting of Federal and State officials on May 13, 1981 that this area may be far preferable for a Western LIS dredge material disposal site.

RESPONSE:

This area has been recommended by your office and the CT DEP as an acceptable site. It has been assessed in a separate EIS on WLIS III and has been selected for use.

COMMENT 5:

Page V-15 & Figure 2 - The reasons for excluding the current interim Cornfield site should be specified.

RESPONSE:

The Cornfield Shoals disposal site, although not named on page V-15, is identified on Figure 2 as an "Interim Regional Dredged Material Disposal Site." The sites identified on page V-15 were those evaluated by Dames and Moore in Appendix A which did not include the Cornfield Shoals area.

COMMENT 6:

Page VI-7 - Contrary to the statement at the bottom of this page, it is our opinion that the techniques used during current bioassays are not able to detect sub-lethal effects.

RESPONSE:

Your point is noted. The statement should read "Such effects can be observed during bioassay/bioaccumulation tests (behavorial effects) or during long-term laboratory studies (reproduction and growth effects)." We maintain that certain behavorial deviations with respect to burrowing, sediment feeding, etc. can be detected during the 10 day bioassay test period.

COMMENT 7:

Page VI-9, last para. - This is not an adequate assessment of potential dredge material toxicity. A review of established literature on acute toxicity, bioaccumulation and biomagnification is required. See, for example, Appendix C of the Mitre Corp. Report for N.Y. District Corps of Engineers.

RESPONSE:

The paragraph and the discussion that follows represents a summary of the more detailed discussion presented in Appendix B. We feel that the near-shore open water disposal section was long enough in the context of the main document. Information used in Appendix C of the Mitre Report has been incorporated into Appendix B of this report.

COMMENT 8:

Page VI-10, line 7 - "Highly" contaminated dredged material should not be disposed of in LIS unless it can be rendered harmless. At any rate, this term has no technical or legal meaning and should not be used.

RESPONSE:

The word has been removed from the discussion.

COMMENT 9:

Page VI-10, last para. - What contaminant has been shown to magnify through the (aquatic?) food chain? (We assume it is mercury.) The ultimate concern here is not for the minimal impact on benthos populations, but the contamination of human food resources.

RESPONSE:

The pesticide DDT has been shown to biomagnify (i.e. increased its concentration to higher tropic levels in whole numbers) through an aquatic food chain (Jarvenin et al., 1979). Evidence of biomagnification of other suspected contaminants such as mercury and PCB's, is not as clear. You are correct in that the ultimate concern is the contamination of human food resources.

COMMENT 10:

Page VI-11, 1st para. - Clarify the context of this paragraph. Long Island Sound and the New York Bight are dissimilar.

RESPONSE:

The main point of the paragraph was the fact that the impacts most often associated with ocean dumping in the northeast U.S. have been based on the numerous studies done in N.Y. Bight area. Studies by Pearce (1969, 1970), Mahoney et al. (1973) and Sinderman (1976) have indicated impacts such as fin rot, behavorial deviations, reproduction and growth impairment and the like. The New York Bight area has been a dumping ground for large amounts of sewerage sludge and acid waste as well as dredged material. Such impacts have not been detected in Long Island Sound where open water disposal has primarily consisted of dredged material. Your point is well taken: Long Island Sound and the New York Bight are dissimilar. But some people are still making analogies with regard to impacts.

COMMENT 11:

Page VI-35 - Regarding the sentence "However, . . . proper management.", statements of this sort require more support than is given. For example, specifically how can such problems be mitigated?

RESPONSE:

Proper site selection and/or design of upland facilities could prevent the potential for contamination of water supply by use or of an impermeable layer of substrate or creation of such a layer. Appropriate design and grading of the property may be used to minimize potential stagnant waters which would be used by breeding pests. Fencing or barriers around the site would prevent access to the site by children or other interested parties.

COMMENT 12:

Page VI-39 Containment Facilities - DEC recently reviewed and commented on NED studies which identified proposed containment sites. A discussion of these sites and comment on them must be included here.

RESPONSE:

The discussion will be included in this comment and response section. The Corps of Engineers (NED) issued an Addendum to Interim Report for Dredge Material Containment in Long Island Sound in March 1981. The report ranked the top 20 sites (10 in NY and 10 in CT) from a preliminary site screening of 133 potential sites. The 10 NY sites were presented to the NY DEC for review and comment. All sites were rejected based on proximity to significant resources such as duck wintering habitat, tidal wetlands and shellfish beds. These sites are not currently being considered although one or more may be reassessed in detail at a later stage of planning.

COMMENT 13:

Page VI-41, last para. - It seems premature to consider two prototype facilities when all the dredge material from LIS may take many years to fill one.

RESPONSE:

Two facilities are being planned to demonstrate the feasibility of (1) island creation and (2) shoreline extension. Based on current information the facilities would be small ranging in capacity from 1 to 10 million cy. The time needed to fill such facilities would be determined at a later stage of planning.

COMMENT 14:

Page VI-42, end of last para. - This discussion is conclusory and may very well not be able to be substantiated.

RESPONSE:

The statement is changed to read: ". . . social acceptability could be high for the creation of usable waterfront land."

COMMENT 15:

Page VI-49, last para. - Refer to EPA standards for soil applications (e.g., TSCA regulations for Cd, PCB and RCRA regulations for hazardous wastes). More importantly, the USDA regulations must be discussed.

RESPONSE:

Applications of dredged material must follow the criteria established by EPA and the USDA (1979) under the sections 1008(a)(3) and 4004(a) of the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976 (42 USC 6907 and 6944) as well as Section 405(d) of the Clean Water Act as amended (42 USC 345). Briefly the regulations set limits on the Cd and PCB levels for application on land. Special considerations are also outlined for effects on flood plains, endangered species, surface and groundwaters and agricultural land.

COMMENT 16:

Page VI-50, last para. - Has the possibility of combining dredge material and fly ash been studied? If so, summarize and discuss the implications.

RESPONSE:

The combination of fly ash and dredged material has never been studied. However, Dr. I. Duedall, of the Marine Science Institute of the State University of NY, Stony Brook, NY, indicated that the concept is worth attention. Studies concerning the combination of fly ash with sludge have indicated feasibility but the moisture content of the sludge was a limiting factor. Dr. Duedall indicated that such technological problems may not be insurmountble. However, this process would only be feasible for small amounts of dredged material (500-1000 cy/day) because of the limited amount of fly ash generated. Thus, this concept has potential but is not feasible for most LIS projects which would generate much more volume.

COMMENT 17:

Page VI-52, 2nd para. - Discuss what legal constraints mandate cessation of dredging should there be no management plan.

RESPONSE:

There are no legal constraints mandating a cessation of dredging.

S4: State of Rhode Island, Statewide Planning Program, Providence - 21 July 1981

COMMENT 1:

The Technical Committee of the Statewide Planning Program was presented the staff findings as a result of the review at its meeting of July 3, 1981. The report suggests the need for further study of the Block Island Sound site and evaluation of open water sites further east in Rhode Island since most dredging occurs in the eastern portion of the state.

This study would compare new sites with those already used, such as Brown's ledge and an area near Conimicut Light. Such a study would be initiated by a dredging project in Rhode Island for which an economical and environmentally safe disposal site is not available. The Technical Committee recommends that the study be conducted and that this study be coordinated with the Fall River Dredging Project.

RESPONSE:

An EIS addressing the Fall River dredging project is in progress and is being coordinated through the appropriate state offices. That study will consider potential sites in this region.

COMMENT 2:

The site chosen, which is near New London, is a longer distance from possible dredging sites in Eastern R.I. Further study is recommended, for the discarded site nine miles out from the mouth of the Pawcatuck River, and to compare sites previously used in Eastern R.I. with possible new sites. We also recommend that such a study be conducted.

RESPONSE:

We know of no such disposal site in that location. Comparison of sites in eastern R.I. is beyond the scope of this document.

COMMENT 3:

Since Rhode Island is in need for dredging its waters in order to maintain and improve its commercial, recreational and fishing ports and various channels leading to them; we agree with the concept of the project. However, we do recommend that all alternatives be considered for disposal of the materials. Deep Ocean Disposal appears to be the more favorable method for large volumes of dredged material, provided the area for disposal is not a prime fishing ground and that the dredged spoils be dumped only within the confines of the approved site.

RESPONSE:

We would hope that the framework provided by the PEIS would lend itself to consideration of all the alternatives. Deep ocean disposal would be a consideration but has economic drawbacks which are related in Section III of the PEIS.

State of Rhode Island, Coastal Resources Management Council

COMMENT 1:

The draft has noted that detailed information is lacking for Site D in Block Island Sound, the alternative site most affecting Rhode Island. The site does appear to have potential environmental disadvantages. Moreover, since most of the Rhode Island dredging projects are located in the eastern portion of the state, in the mid to upper bay, Site D does not appear to be an economical alternative. We concur with the Corps finding that "evaluation of the environmental suitability of potential open water disposal sites further east in Rhode Island Sound could provide meaningful assessments upon which to make recommendation for this region."

RESPONSE:

No response necessary.

COMMENT 2:

Also, we recommend that if Sites F and G which "will continue to be used as regional disposal sites," are abandoned, closed, or otherwise fall into disuse, the Corps not consider opening Site D until the general and specific levels of information on the impacts assocatied with disposal at that site have been thoroughly upgraded. This applies particularly to impacts on commercial fishing and the ability of the site to retain the material without interference from currents.

RESPONSE:

The DAMOS program will be used to gather the necessary baseline information. Any decision on potential use of the site would be fully coordinated with your office.

S5: State of NY, Department of Environmental Conservation, Albany, NY

COMMENT 1:

Of important note in this Draft is the lack of any reference in the Summary to the establishment of a fourth disposal site in Long Island Sound. In our estimation it is apparant that this is one of the intentions of this document since Figure 2 in Section II indicates candidate sites and Appendix A defines the site selection process.

RESPONSE:

The establishment of a fourth disposal site, WLIS III, is the subject of a Final EIS released in February 1982.

COMMENT 2:

From an environmental viewpoint, the Department would not support the establishment of a fourth dredge spoil disposal site in Western Long Island Sound but we recognize that the increasing financial impact on commercial, recreational and private interests created by lack of suitable and convenient sites may be detrimental to overall State interests.

RESPONSE:

No response required.

COMMENT 3:

The EIS appears to indicate that open water disposal is more cost effective and has the least environmental impact. If this is so, the preferred site from our viewpoint is Site A (Bridgeport). However, we are concerned that alternative means of disposal of dredged material are only identified and not evaluated to any extent in the EIS. These alternatives require evaluations before decisions can be made.

RESPONSE:

The reason that alternative methods of disposal are not evaluated to the extent of the open water alternative is primarily based on the fact that the Corps has only studied the alternatives in detail which have been historically within its jurisdiction. The other alternaties such as containment and upland disposal are the subjects of current study. Their feasiblity as a option will be evaluated when the information becomes available. Upland disposal, beach restoration and some resource reclamation require a project specific site which would be designated by the State. Evaluations of these potential alternatives cannot be made in the context of the current document. Other alternatives such as incineration or potential use of dredged material in a combination with other material to form construction material are options that have potential but require a technology not yet achieved to be cost effective.

COMMENT 4:

In general the Programmatic EIS seems to provide a reasonably good analysis of open water disposal and virtually nothing on other alternatives.

RESPONSE:

See response to Comment 3.

COMMENT 5:

Also, the main EIS should be more forceful in presenting the findings of the Appendices (particularly Appendix A, which has some very good reviews of literature on impacts).

RESPONSE:

The language used and conclusions drawn in the contract report is not necessarily the opinion of this agency. We are not in full agreement with some of the conclusions and requirements expressed in Appendix A. Thus the discussion in the main document is similar in content, but the "loaded adjectives" have been removed for the sake of objectivity.

COMMENT 6:

The main EIS is also weak on the economic and social aspects.

RESPONSE:

The economic and social analyses were prepared adequately according to standards set forth in EIS preparation guidelines. However, a general socioeconomic profile of the Long Island Sound Region was added to the main document. Since the impacts of site specific projects range substantially, the detailed socioeconomic analysis should be done at the time of a site specific project is developed. Any specific weaknesses should be commented upon.

COMMENT 7:

Of the sites in the western basin, we feel that Site A is preferable. There has been some discussion that Site E has a potential for clean materials but there is not sufficient confidence that restrictions can be maintained well enough to support that site.

RESPONSE:

Subsequent correspondence with NY DEC staff have indicated that another site in Western Long Island Sound is acceptable to the DEC. This site was assessed in the Final EIS for the designation of WLIS III.

COMMENT 8:

Chapter II of Appendix A contains Dames and Moore's environmental suitability study. In the past the Department has expressed concern over the ranking methodology which gives greater weight to the distance traveled to a sample station than it gives to the effect of disposal on water quality. (Correspondence re. this point is attached). It is our

view that in the event another site is to be selected that studies be done relative to current patterns, benthic organisms, water quality, etc. in order to have comprehensive background information prior to any disposal program.

RESPONSE:

We concur.

COMMENT 9:

Main EIS, Page VI-2 - The categorization of short and long-term impacts as being less than or more than two years would, I believe, place most of the DAMOS work in the long-term impact data category. However, we don't believe that there is general agreement that the DAMOS data does represent long-term data.

RESPONSE:

While there is no general agreement on the "line" dividing short and long-term impacts, the DAMOS program is designed to provide data on short term impacts which if continuity is maintained will result in long term information.

COMMENT 10:

Main EIS, Page VI-22 - Future studies should include the long-term impact of contaminated material disposal at the historic Stamford and Eaton's Neck sites.

RESPONSE:

The Eatons Neck site was studied under the Corps WES (DMRP) in 1974 after the cessation of many years of disposal. Their findings suggested that long term disposal has not caused adverse impacts to the benthic and fisheries communities and may have enhanced the lobster fishery in the area.

COMMENT 11:

Appendix A, Page IV-11 thur 21 - The information on water quality and ecological impacts of dumping has not been forcefully and clearly expressed in the Main EIS (see Comments A and D).

RESPONSE:

See response to Comment 5.

COMMENT 12:

Page I-3 - The regulatory role of the State could be better explained here and in Appendix A (Page I-6). This should include Connecticut's primacy in certifying the interim and proposed sites.

RESPONSE:

A revised discussion appears in the summary and on page I-5.

COMMENT 13:

Page II-7, para. 1 - This discussion should be expanded to cover suitability of methods for dredging in confined areas and shallow draft harbors.

RESPONSE:

Work in shallow, confined areas usually requires the use of a small hydraulic dredge, which can pump material to a nearby disposal site.

COMMENT 14:

Page II-8, para. 3 - The possibility of additional congressional authorization of Corps jurisdiction in specific projects should be mentioned (per Page I-5, para. 1).

RESPONSE:

Your comment is noted. Corps jurisdiction would also apply to projects with special congressional authorization.

COMMENT 15:

Chapter IV - The entire chapter presentation would be improved by comparison tables of disposal alternative economics, on both a general basis and by comparison of specific projects.

RESPONSE:

Tables comparing the economic features of disposal alternatives cannot be presented in a site specific form in Chapter III because the EIS was not prepared to be site specific in nature. Even in a general way, it is virtually impossible to compare costs because of all the variables associated with each alternative.

COMMENT 16:

Page IV-13 - Use as landfill cover could probably come under resource reclamation (when compared to several of those presented), by making alternate landfill cover materials available for other purposes.

RESPONSE:

Your point is noted. See page III-8.

COMMENT 17:

Page IV-18, NEPA - is the objective limited only to the effect on human environment?

RESPONSE:

The "human environment," as defined in the Rules and Regulations of the NEPA, "shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with the environment.

COMMENT 18:

Page V-2 - The general counterclockwise circulation exhibited by the littoral drift might be mentioned.

RESPONSE:

Your comment is noted. Riley (1952) describes such a circulation pattern for the surface waters in Long Island Sound. The inflow of surface waters combined with basin characteristics are responsible for the pattern.

COMMENT 19:

Page V-13, line 10 - The use of coarser grained (when less contaminated) sediments are also useful for spoil mound capping in significant quantities.

RESPONSE:

Your comment is noted.

COMMENT 20:

Page V-16 - Site E (Stamford/Eatons Neck) might still be considered as potential site if limited to clean spoil and Westchester pressures increase.

RESPONSE:

Your comment is noted. However, WLIS III which has been recommended by NYDEC & CT DEP is assessed in the Final EIS for WLIS III and has been selected for use by the Corps.

COMMENT 21:

Page VI-6, para. 1 - In addition to dilution, there is also buffering and sorption (Appendix B, Page IV - 11 through 21.

RESPONSE:

Your point is noted. However, presently there exists no means of quantifying such factors into the initial mixing analysis.

COMMENT 22:

Page VI-8, para. 2 - If the attempted site study was Eatons Neck, it should be named. Also, it should be clarified that it was not the attempt to determine long-term impacts that was unsuccessful, but the attempt to conduct the study to do so.

RESPONSE:

The statement was nebulous and has been changed. Paragraph 2 reflects a general observation from a review of the current literature. As indicated in Appendix B, long term studies are just beginning. However, one can draw certain conclusion from the study of sites such as Eatons Neck which has been used as a disposal site on a long term basis.

COMMENT 23:

Page VI-8, Long term impacts - The discussion has a generally negative tone. The positive side, such as desirable lobster habitat, should also be discussed (as well as in situ contaminant removal).

RESPONSE:

Your comment is acknowledged. The discussion has been revised. In situ contaminant removal at the dredge site is a beneficial impact. However, the impacts of dredging are not the subject of this document.

COMMENT 24:

Page VI-30, para. 1 - The erosion issue is questionable. One would think that most erosion at these sites, in the long term, would already have occurred by now.

RESPONSE:

Your comment is noted.

COMMENT 25:

Page VI-34, para. 1 - Could also include pH management.

RESPONSE:

Your comment is acknowledged. See p. V-17.

COMMENT 26:

Para. 4 - Based on the title of the 1978 Smith reference, it is not clear whether anything more than "interest" has been generated. If there are no significant findings (e.g. guidelines), then it may not be worth mentioning.

RESPONSE:

Your comment is noted. The text has been revised.

COMMENT 27:

Page VI-51, para. 3 - There may be continuous, unreduced contaminant releases in situ, which are probably in more ecologically sensitive areas.

RESPONSE:

Your comment is acknowledged.

COMMENT 28:

Page VI-52, para 1 - natural river-borne loading and resuspension of (contaminated) harbor sediments are likely to continue regardless of the State and Federal point discharge program accomplishments.

RESPONSE:

Your comment is noted. The text has been changed.

COMMENT 29:

Page VI-55, Table II - Table should be checked to make sure relative impacts are clear. For example, environmental impacts of open water alternatives (deep ocean, near shore, and river/harbor) do not really provide guidance on relative impacts (especially the latter two).

RESPONSE:

The table has been modified.

COMMENT 30:

Page 1-13, 14 - Tables I.D-3 and I.D-4 should have same percentages for each basin (as do tables I.D-5 and I.D-6).

RESPONSE:

The percentages are correct. It is coincidental that Tables 5 & 6 have the same values for Federal and non-Federal dredging.

COMMENT 31:

Page IV-7, para. 2 - Lobster habitat relative to bottom contours should be mentioned.

RESPONSE:

Lobsters have a tendency to concentrate a long topographic features such as an "edge" at the 20 meter contour. Examples of this occur in Western Long Island Sound in the vicinity of the Eatons Neck Disposal site.

S6: State of Connecticut Department of Environmental Protection - 23 July 1981

COMMENT 1:

Currently, of the four major groups of disposal alternatives, three are actively being studied: open water disposal, disposal in containment facilities and upland disposal. Information on the fourth "general" group comes chiefly from site-specific studies on an as-needed basis. While the document under review gives a general overview, it is geared primarily towards investigation of the open water disposal alternative. Appropriately, the Corps' ongoing study of containment facilities is cross-referenced. However, please note that my Department is currently evaluating the upland disposal alternative in Connecticut, a task funded under the authority of the Water Resources Planning Act of 1965. Until proven otherwise, we can only say land disposal "may not be viable option" (Table 1, P. 1-4). It is DEP's position to examine all possible alternatives for each project, rather than rely solely on open water disposal.

RESPONSE:

Your comment is acknowledged.

COMMENT 2:

Table 3 on p. 1-8 should contain all of the Connecticut laws which may apply to dredged material disposal alternatives. These laws are:

Tidal Wetlands Statutes (Sections 22a-28 through 22a-35, Connecticut General Statutes) pertinent to all alternatives except open water.

Inland Wetlands and Water Courses Act (Sections 22a-36 through 22a-45, Connecticut General Statutes) pertinent to all alternatives except open water.

Structures, fill and Dredging in Tidal, Coastal and Navigable Waters (Sections 25-7b through 25-7f and Sections 25-10 through 25-18, Connecticut General Statutes) pertinent to all alternatives except open water and upland.

Stream Channel Encroachment Lines (Sections 25-4a through 25-4g, Connecticut General Statutes) pertinent to containment and, depending on where material is stored, incineration and resource reclamation.

Water Discharge Permits (Section 25-54, Connecticut General Statutes) pertinent to upland, containment and, depending on where the material is stored, incineration and resource reclamation.

Solid Waste Permit (Sections 19-52b and 19-524c, Connecticut General Statutes) pertinent to upland, containment, incineration and resource reclamation alternatives.

Air Compliance Permits (Sections 19-508-1 through 19-508-25, Connecticut General Statutes) pertinent to incineration.

Connecticut Environmental Policy Act (Sections 22a-1 through 22a-1f, C.G.S.) pertinent to state actions on any disposal alternative.

RESPONSE:

Table 3 has been revised.

COMMENT 4:

Rhode Island's laws should also be included to complete the list.

RESPONSE:

They also have been included.

COMMENT 5:

With regards to statutory authority, the third sentence of the first full paragraph on p. II-8 is not wholly accurate and therefore misleading ("The states have total control ... waters."). Although it is true that a disposal site in State waters cannot be used without issuance of a Section 401 Water Quality Certificate from the respective states, there is no institutionalized mechanism to control project priorities. The Dredging Management Work Group provides the opportunity to manage the disposal of dredged material at the disposal sites so as to link projects to facilitate capping, and, to consolidate information about dredging needs. Available funding also affects project priorities.

On the other hand, because the state laws applicable to dredging and dredged material disposal are geared to habitat and species protection, conditions are often placed on the Water Quality Certification. The conditions restrict the timing and location of dredging activities. Hence, valuable benthic habitat and sensitive periods in shellfish and andromous fish life cycles are protected. Any proposal for dredging or dredged materials disposal which would adversely impact our fisheries, shellfisheries or coastal waters resources would be inconsistent with our coastal management program.

RESPONSE:

The paragraph has been revised. See response to comment 12 in letter S5.

COMMENT 6:

Although maintenance of existing channels, basins and anchorages is anticipated for the future, it is a Connecticut Coastal Management Act (CCMA) policy to discourage future new work dredging of federal projects in Connecticut harbors. Given that the level of petroleum imports is stabilizing and than any coal imports would likely be shipped by barge, it may be possible to utilize existing channel depths in the major ports. Therefore the volume of material to be expected from Federal projects may be closer to the Minimum Growth Scenario of Appendix C. However, even without any major new work dredging, maintenance work in the western basin of Long Island Sound and in the fast-shoaling recreational harbors east of New Haven will continue to tax existing disposal options. This need is reflected in our recommendations for location of disposal sites.

RESPONSE:

The minimum growth scenario of Appendix C is designed to reflect the environmentalist's point of view and the effect of any trade slowdowns. However, in overall terms, that is only one prediction of future dredging, and the most conservative. The other two scenarios reflect larger growth in improvement dredging as well as in the other dredging categories.

COMMENT 7:

In Connecticut, dredging and dredged material disposal is timed to avoid shellfish spawning seasons and anadromous fish runs. In your discussion of Fisheries and Shellfisheries in Section V of the draft PEIS, it is advisable to mention the occurrence of these sensitive life cycle events for informational purposes. A discussion of life cycles and migration is important for a basic understanding of the Sound's estuarine ecosystem.

RESPONSE:

A discussion of both topics has been included in the text.

COMMENT 8:

Under Rare and Endangered Species, no mention is made of existing State programs for rare and endangered species. In Connecticut, the Natural Resources Center of my Department administers a program to protect rare and endangered plants, animals and habitats. Some of the natural areas to be protected are along the shoreline and on offshore islands. Please contact Les Mehrhoff (203-566-3540) for more information. Osprey are nesting along Connecticut's shoreline and are monitored by Tom Hoehn of my Wildlife Unit (203-566-4683). Future plans for dredged material disposal should include protection of these sites and coordination with the respective states which conduct such programs.

RESPONSE:

The Corps recognizes State programs to protect its designated rare, endangered species and their critical habitats. Disposal activities above the ordinary high water mark are not within the jurisdiction of the Corps of Engineers and would require State and/or local designation/approval. Disposal activities within Corps jurisdiction also would require coordination with the appropriate State authorities. Consideration for Connecticut State "critical habitats," such as Bird-Breeding Islands, Coast Sand Beaches and Dunes, and Coastal Salt marsh and mudflats (Dowhan and Craig, 1976) and osprey nests should and would be criteria for initial site selection. Since upland or containment sites have not yet been selected, enumeration of State designated "critical" habitats is not necessary within the context of this PEIS.

COMMENT 9:

A major defect in the Draft PEIS is the lack of a management concept for the operation of open water disposal sites. In the absence of such a long-range dredging management plan, Federal and State agencies involved in the open water disposal of dredged material have agreed to abide by the terms of the Interim Plan. Because the Interim Plan is an element of Connecticut's Coastal Management Program, its guidelines apply to all dredging or disposal activities within the coastal boundary. If it was intended that the NERBC Interim Plan continue as the management document, then this should be made clear. The Interim Plan should either be attached to the PEIS as an appendix, or at least discussed under Section 1, Summary.

RESPONSE:

Your comment is noted. The Interim Plan is now discussed in Section I and the Summary.

COMMENT 10:

The Interim Plan guidelines provide for a dredged material classification system based on percentages of oil and grease, volatile solids, water and silt-clay particles in samples of the material to be dredged. Classification of sediments by this method is in keeping with the analyses presented in Appendix B. Further sediment testing by bulk chemical analysis for metals, elutriate tests and bioassay/bioaccumulation studies can refine or confirm the initial classification of sediments. Sediment classification is important for determination of an appropriate disposal option and development of mitigation techniques.

RESPONSE:

Your comment is acknowledged. The Interim Plan classification system has proved to be a useful screening tool when used in concert with other parameters to assess the environmental and management issues of dredged material disposal.

COMMENT 11:

The consultant failed to provide the initial work or source data maps from which all the composite maps were derived. The value of the suitability map is wholly dependent on the accuracy of the data mapped on those maps. Therefore it is impossible for a reviewer to independently confirm the results of the site selection procedure. Nevertheless, the EIR does provide valuable information about the characteristics of the disposal sites selected by the process. It is this type and degree of anlaysis that is expected for any site proposed for an open water disposal site.

RESPONSE:

The data and work maps compiled by Dames & Moore were quite voluminous and therefore not amenable to presentation and explanation at the coordination meetings. The contractor instead produced "higher" levels maps and discussed their development. Their task was to perform an extensive literature review and compile that information. The data input to the maps can be evaluated by reviewing the references and personal interviews used by the contractor. Additionally all work group members were invited to visit the offices of Dames & Moore to review the entire process first hand. Presently these maps are at the Corps Waltham office if further review is desired.

COMMENT 12:

New London Disposal Area (Site G). This site should be designated as the Eastern Long Island Sound Regional Disposal Area.

RESPONSE:

The current name of this site will remain the "New London Disposal Site." However such a name change could be the subject of further discussion.

COMMENT 13:

Connecticut River Regional Disposal Area (Cornfield Shoal). We concur with the Draft PEIS that use of the Six Mile Reef Site (Site C) offers no obvious benefits over continued use of the existing Connecticut River site. However, the Draft PEIS fails to conclusively show that a better site does not exist which may more econmically serve the Clinton Harbor area. Clinton dredgers have repeatedly expressed the need to reopen the historical Clinton dumping grounds. The relative merits of establishing a site off Clinton versus maintaining the disposal site at Cornfield Shoal should be explored and decided in the revised draft.

RESPONSE:

The distribution of sources of material was a consideration in Dames & Moore's evaluation process and Site C was their recommendation for this region. However because this site offerred no clear advantages over the existing Cornfield Shoal site, it is not recommended. The PEIS is an initial screening tool and not designed to "conclusively show" the existence or non-existence of suitable disposal sites. If an additional or alternative site to Cornfield Shoals is desired the PEIS would be supplemented with additional data, coordination and review as was done for WLIS III (CE, 1982b).

COMMENT 14:

Central Long Island Sound Regional Disposal Area (Site F). We concur that relocating this site to the Branford Site (Site B) offers no obvious benefits at this time. Relocation would significantly increase disposal management costs as monitoring at both old and new sites would be required.

RESPONSE:

No response required.

COMMENT 15:

Bridgeport Regional Disposal Area (Bridgeport East - Site A). We concur with the Draft PEIS that this site appears to be a suitable disposal area. However, the relative merits of opening a new site versus reopening the historical Bridgeport Dumping Ground should be more fully evaluated in the revised draft.

RESPONSE:

A site in this area is not recommended at the present time. The recently identified WLIS III site was found to be more suitable for the needs of the region in the Final EIS issued February 1982.

COMMENT 16:

Western Long Island Sound Regional Disposal Area. The Draft PEIS fails to address the Western Long Island Sound dredgers or provide them with a realistic disposal option. We hold the opinion that the Bridgeport site will not be economically viable for most private recreational projects in western Fairfield and Westchester Counties, or the nearby north shore of Long Island due to the long distance hauling required. This Department has supported establishing a site to serve Western Long Island Sound in the past and will continue to do so in the future until it is conclusively shown that a suitable site does not exist. In light of the user interest in establishing a site in the western part of the Sound and the fact that the Corps has had several alternative sites under consideration for several years, the revised PEIS Draft should decide the matter of establishing a Western Long Island Sound open water disposal area. In the past, the Department has advocated locating a site in Connecticut waters northwesterly of the historical Eastons Neck Disposal Area. Indeed, the Corps held public hearings several years ago on this proposed disposal area, but never brought the matter to a conclusion one way or another. Revision of the Draft PEIS provides an opportunity to decide the suitability of this proposed site as well as the others under consideration for the area.

RESPONSE:

Such a site has been assessed a Final EIS for WLIS III released in February 1982. The States of NY and CT both agreed on establishment of the site at a 22 October 1981 meeting.

COMMENT 17:

With regard to the December 28, 1976 agreement in settlement of the matter of Navy dredging of the Thames River, the Department finds that the PEIS adequately addresses the issue of availability and suitability of disposal sites in Block Island Sound and nearby ocean waters. However, the Dames and Moore report (Appendix A) is insufficient for our purposes to draw a similar conclusion for Long Island Sound. We do concur that the existing New London disposal site should continue to be used for disposal of materials suitable for open water disposal. As noted above, we believe that previously identified sites to serve Western Long Island Sound should be thoroughly evaluated and determined in the revised PEIS.

RESPONSE:

The efforts of Dames and Moore was limited to the use of existing information. Where data were abundant, assessments were more complete. The relative quality of the data used to assess the candidate sites is presented in Table III.B-2 of Appendix A. Absolute conclusions cannot be made without supplemental data as appropriate.

L1: County of Suffolk, Department of Health Services, Suffolk County, MS - 8 June 1981

COMMENT:

Cursory review of the above referenced material reveals that much information concerning the Block Island Sound region has been omitted. In particular, I refer to the work performed at the New York Ocean Science Laboratory with which, for obvious reasons, I am familiar. Included among this work are:

Alexander, J.E. and T.T. White 1974. An interdisciplinary study of the estuarine and coastal oceanography of Block Island Sound and adjacent New York coastal waters: ground truth. Part III. Chemical Oceanography NYOSL Tech. Rept. No. 27.

Austin, H.M. and P.M. Stoops 1973. A synoptic study of the surface waters of Block Island Sound and surrounding waters. NYOSL Tech. Rept. No. 24.

Hollman, R. 1976. Environmental atlas of Block Island and Long Island Sound waters. Vol. II. Physical and chemical data base at observed and standard depths. 1970-73. NYOSL Tech. Rept. No. 35.

Hollman, R. and S. Gill 1974. An interdisciplinary study of the estuarine and coastal oceanography of Block Island Sound and adjacent New York coastal waters: ground truth. Part II. Physical oceanography. NYOSL Tech. Rept. No. 27.

Nuzzi, R. 1973. A synoptic study of the surface waters of Block Island Sound and surrounding waters. Part I. NYOSL Tech. Rept. No. 19.

Nuzzi, R., S.F. Bruno and R.D. Staker 1978. Environmental atlas of Block Island and Long Island Sound Waters. Volume V. Phytoplankton Data Base 1970-1973. NYOSL Tech. Rept. No. 38.

Nuzzi, R. and U.G. Perzan 1974. An interdisciplinary study of the estuarine and coastal oceanography of Block Island Sound and adjacent New York coastal waters: ground truth. Part IV. Phytoplankton and suspended particles. NYOSL Tech. Rept. No. 27.

Staker, R.D. and S.F. Bruno and R. Nuzzi 1978. The phytoplankton of Block Island Sound: 1970-73. Nova Hedwigia 30: 697-724.

Yost, E., R. Hollman, J. Alexander and R. Nuzzi 1973. An interdisciplinary study of the estuarine and coastal oceanography of Block Island Sound and adjacent New York coastal waters. NASA Tech. Rept., Greenbelt Md. 178 pp.

Any work map composed without reference to these investigations must be considered as unacceptable for the Block Island Sound region as the above works probably constitute a portion of the most comprehensive data set available for Block Island Sound.

RESPONSE:

Although works listed are not specifically referenced in Appendix A, much of the oceanographic material is covered and listed in the reference section under the New York Ocean Science Lab, FEB 1974.

The biological data discussed in some of the reports was too detailed and specific to include in the overall analyses since similar data were available no where else in the study area.

In addition, a disposal site in Block Island Sound is not being pursued via this report. Certainly the references listed would be consulted in potential future efforts to evaluate the Block Island and Rhode Island Sound areas.

L2: City of Glen Cove, Department of Public Works, Glen Cove, NY - 9 June 1981

COMMENT:

Listed in the report as a Federally authorized navigation project is Glen Cove Creek and harbor. Dredging of this creek was to have taken place in 1979, with disposal of the dredged material at an upland site provided by the city. Dredging has been suspended due to concern expressed by the local Nassau County Health Department and the New York State Department of Environmental Conservation concerning contaminants present in the sediment. Further investigation by the State has resulted in a determination that this material is considered a hazardous waste. This in effect prohibits any land disposal alternative.

At the present time the city has been informed by the Corps of Engineers, New York District, that dredging will commence only after the city agrees to pay the disposal costs for ocean disposal of this material. This is a financial impossibility for the city and appears to differ with the Federal regulations for disposal should an environmentally unacceptable land disposal site be provided by the local cooperating agency. It would seem that situations such as the above be formally addressed in the Environmental Impact Statement.

RESPONSE:

Your material may be suitable for disposal at a regional site in Long Island Sound. This alternative should be explored through the New York District Corps office.

L3: Westchester County Executive Office - 22 June 1981

Comments and Responses are the same as letter SC1.

L4: City of New Rochelle, NY - 23 June 1981

COMMENTS 1-6:

Comments and Responses are the same as letter SC1.

COMMENT 7:

Upland disposal sites in the Westchester area are virtually non-existent for either governmental or non-governmental potential dredging projects. The only two alternatives are ocean disposal or Long Island Sound disposal. Ocean disposal requires a specific type of barge equipment which has limited availability in New York. The cost of using such equipment is significantly more expensive than other types of barge disposal equipment. Also, limitation on the number of trips per day and

number of barges per day that can go through Hell's Gate further increases the costs of dredging. In a recent project in Westchester, costs were estimated to be increased by over 50% as the result of ocean disposal.

If one turns from ocean disposal to Long Island Sound, the distance from Westchester Sound Shore Communities to the nearest approved active dredged site is off of New Haven, Connecticut some 45-50 miles away. The cost savings for Westchester or nearby Long Island projects using New Haven vs. ocean disposal should be $2.00 to $4.00 per cubic yard. However, if this excessive distance were reduced by a closer site - such as Site E (Eaton's Neck East) the cost savings should be increased an additional $1.50 to $3.00 per cubic yard. This could mean a total savings of $3.00 to $7.00 per cubic yard over ocean disposal or $300,000 to $700,000 for each 100,000 cubic yards dredged. (This cost information was estimated within the last three months by two dredge contractors certified for both ocean and Long Island Sound dumping). It should be noted that opening if Site E (Eaton's Neck East) would mean that the distance from the Westchester and nearby Long Island Sound Shore Communities to the nearest approved disposal area would be in line with distances to other regional sites from neighboring Long Island Sound Communities. (This can be seen from Figure 2 of the Draft EIS).

RESPONSE:

No response required.

COMMENT 8:

We are further concerned that very little emphasis has been given to the needs of the Western area of Long Island Sound. In short, one can feel like an unwanted child. We suggest that the EIS be finalized without delay and that additonal EIS' be commenced on additional dumping sites in Western Long Island Sound - New York State waters. This search should include a review of such deep hole areas as Throgs Neck Bridge, between Execution Rock and Larchmont Harbor, near Davids Island off New Rochelle, and Eatons Neck West.

RESPONSE:

See response to Comments 3 and 5, letter SC1.

COMMENT 9:

Two major shortcomings of the present Draft EIS are that (1) only Federal maintenance dredging is considered, thus exluding other non-Federal maintenance dredging figures, and (2) the extremely low estimates for the next fifty years of the amount of Federal maintenance dredging that will be done in the Westchester area. It is shortsighted at best to look only at Federal projects. Unless the area from the shore line to the channel and Federal anchorage areas is dredged, boats will not be able to

get to shore. Therefore, the Federal dredging is only partially solving the problems that exist and the amount of non-Federal dredging in many cases will be four times or more than of the Federal projects. In Mamaroneck, the Federal project just completed was approximately 20,000 cubic yards and the amount of non-Federal dredging will be approximately 80,000 cubic yards. Table C-15 grossly understates the amount of Federal maintenance dredging to be undertaken in the next fifty years. Mamaroneck Harbor (based upon the just completed project) should run approximately 120,000 cubic yards. Milton Harbor, Larchmont Harbor, and Echo Bay show no dredging over the next fifty years. Yet the Federal government is going to public notice shortly for a large project in Milton Harbor. New Rochelle shows nominal dredging as does Portchester. In short the total figures for the Federal maintenance dredging should be estimated at over 1,000,000 cubic yards without any of the non-Federal work which could run over four times the Federal projections, or 4,000,000 cubic yards.

RESPONSE:

The two mentioned shortcomings can be responded to as follows:

(1) Projections for non-Federal dredging are made in Table C-18.

(2) The projections for the amount of dredged material from the Westchester area are based on the historical amount of dredging performed. The minimum and maximum growth scenarios are designed to reflect possible changes in market conditions, both positive and negative. Table C-15 of Appendix C of the projected Federal maintenance dredging -- Minimum Growth Scenario 1985-2035. The minimum growth scenario is designed to reflect the quanity of material that would be dredging if the economy remains recessionary for an extended period of time. This would be reflected by: (1) proposed Federal maintenance or improvement not being implemented; (2) a decline in the recreational boating industry; (3) additional disposal sites not being activated; or (4) waterbourne commerce becoming outmoded due to changes in New England's economic base. The projections for the next 50 years have been updated to 1981 (See Table C-22). The new projections of dredged material from Federal maintenance projects for Westchester County have increased to 310,000 cys (Minimum Growth Scenario), 410,000 cys (Most Probable Future) and 530,000 cys (Maximum Growth Scenario). The projections for Westchester's non-Federal dredging have increased to 640,000 cys (Minimum Growth Scenario), 800,000 cys (Most Probable Future) and 960,000 cys (Maximum Growth Scenario). These projections are based on historical data and other available information.

L5: Village of Port Chester - 23 June 1981

Comments and Responses are the same as letter SC1.

L6: Village of Mamaroneck - 24 June 1981

Comments and Responses are the same as letter SC1.

L7: Westchester County, Department of Parks, Recreation and Conservation - 23 June 1981

Comments and Responses are the same as letter SC1.

L8: Westchester County Board of Legislators - 29 June 1981

General Comment.

RESPONSE:

The EIS preparation staff acknowledges your comments.

L9: Town of Rye, Office of the Supervisor - 29 June 1981

Comments and Responses are the same as letter SC1.

L10: City of Rye, NY - 30 June 1981

Comments and Responses are the same as letter SC1.

L11: Town/Village of Harrison - 1 July 1981

Comments and Responses are the same as letter SC1.

RESPONSE:

The EIS preparation staff acknowledges your comments.

P1: Shore Access Point Corporation, Mamaroneck, NY - 16 June 1981
P2: Harbor Island Boat Club Incorporated - 15 June 1981
P3: Mamaroneck Chamber of Commerce, Inc. - 24 June 1981

Comments and Responses are the same as letter SC1.

P4: J.D. Brophy, Inc. Harrison, NY - 15 June 1981

COMMENTS 1-6:

Comments and Responses are the same as letter SC1.

COMMENTS 7-9:

Comments and Responses are the same as letter L4.

P5: Roger Spoto, New Rochelle, NY - 24 June 1981

COMMENT 1:

Mr. Robert Kohlasch, owner of Echo Bay Boat Yard in New Rochelle has attempted to have the Corps declare the west branch of Echo Bay as Federal Channel to allow his customers access to the Sound at any tide. After a lengthy study, the Corps has determined that the project is not economically justified because the cost/benefit ratio is unfavorable. It is due to the fact that ocean disposal was the only option left. There are no upland sites available and Long Island Sound sites have been closed for some time.

RESPONSE:

Your situation may have been improved through recent developments which led to the authorization of private individuals in the Village of Mamaroneck to use a disposal site in Western Long Island Sound. Your pursuit of this matter through the Corps New York District is recommended. Provided the material to be dredged is judged suitable and all applicable permits and certifications are received, this site may be available to projects in New Rochelle.

COMMENT 2:

If dumping sites in the western portion of Long Island Sound are not opened, it will be a major setback for many people. What about alternatives? The Corps has mentioned "capping" procedures in its various reports on the Sound over the years. Has this been taken into account? Could this be instituted at Site E (as identified in the Draft EIS) to prevent harm to the marine environment? If volume dumping is seen as a problem, why not ask (or empower) the governors of New York and Connecticut (or the DEP and DEC agency commissioners) to review on a case-by-case basis any request to dump at an approved disposal area in Western Long Island Sound.

RESPONSE:

See response to Comments 2 and 3, letter SC1.

COMMENT 3:

In addition, we feel that there is a need and an obligation to create EIS's for alternative sites such as Execution Light and Eatons Neck West. Table C-15 of the Draft EIS shows no project or projected volume of dredged material for Echo Bay. Is this not cart before the horse thinking? The aforementioned project to extend Federal Channel into the west branch of Echo Bay was denied because of a lack of dump sites in Western Long Island Sound. Give me that site and I'll give you some volume figures. Towing dredge spoil to New Haven or the ocean dump site

is economically impossible for most small operators in Westchester. There are alternative sites and methods of disposal. It is the obligation of the Corps of Engineers to find them.

RESPONSE:

Alternative Western Long Island Sound disposal sites were addressed in the Final Environmental Impact Statement for Disposal in Western Long Island Sound released in February 1982. The projections in Tables C-15, C-16, and C-17 which represent the minimum, most probable and maximum growth scenarios for Federal maintenance dredging are not "hard" figures and are subject to change with a change of conditions and priorities. Based on past records, the Federal channel in Echo Bay was dredged last in 1931 for a total volume of 7,000 cubic yards (cy) (Table C-13). This figure was used to project one project in the next fifty years involving 10,000 cy in Table C-17. This frequency of dredging and volume of material taken from Federal projects in Echo Bay did not justify inclusion in Tables C-15 or C-16 compared with other Federal channels. We realize that these projections are subject to change and would appreciate any information in this regard.

P6: Neil Underberg, New York, NY - 25 June 1981
P7: Family Circle, New York, NY - 24 June 1981
P8: Fehlhaber Corporation, New Rochelle, NY - 27 June 1981
P9: Geoffrey L. Phillips, Scarsdale, NY - 2 July 1981
P10: Mary Monte-Sano, Mamaroneck, NY - 30 June 1981

Comments and Responses are the same as letter SC1.

P11: The Mautner Company, Inc., Yonkers, NY - 22 June 1981

COMMENTS 1-6:

Comments and Responses are the same as letter SC1.

COMMENTS 7-9:

Comments and Responses are the same as letter L4.

P12: Victor J. Fink, Mamaroneck, NY - 29 June 1981
P13: Bevin D. Koeppel, New York, NY - 30 June 1981
P14: Vincent Monte-Sano, Mamaroneck, NY - 30 June 1981
P15: Mr. & Mrs. T. Uchida, Mamaroneck, NY - 1 July 1981
P16: Leonard M. Feltman, Rye, NY - 15 June 1981
P17: Nichols Yacht Yards, Mamaroneck, NY - 25 June 1981

Comments and Responses are the same as letter SC1.

P18: Basil Tangredi D.V.M., Greenbaum, NY - 14 July 1981

COMMENT:

While I am generally philosophically opposed to open water dumping, I realize that dredging must take place on both shores of Long Island Sound and that disposal is thus inevitable. The identification of several sites for such disposal in the PEIS would be acceptable for the cleaner materials (Classes I and II). For dredge materials containing significant toxic substances I would endorse the containment facilities outlined in the workshop given last spring in conjunction with the L.I. Sound Task-force. I realize this latter method entails considerable expense, and the dikes would require ongoing maintenance. However, I believe that any alternative that would expose the marine environment to contamination with these substances would entail greater expense to the economy and public health.

RESPONSE:

No response required.

P19: Finley, Kumble, Wagner, Heine, Underberg and Casey, New York, NY - 23 July 1981
P20: Elizabeth R. Pennington, Larchmont, NY - 23 July 1981
P21: T. Charles Lee, New York, NY - 23 July 1981
P22: Kinne S. Yon, New York, NY - 23 July 1981
P23: C. Birge Sigety, Mamaroneck, NY - 21 July 1981
P24: Robert G. Sigety, Mamaroneck, NY - 23 July 1981

COMMENTS 1-6:

Comments and Responses are the same as letter SC1.

COMMENTS 7-9:

Comments and Responses are the same as letter L4.

SECTION VII

LIST OF PREPARERS AND CONTRIBUTORS

The following people were primarily responsible for contributions to this Programmatic Environmental Impact Statement and Appendices:

Name	Professional Discipline	Education	Experience	Contribution
Christopher Lindsay	Civil Engineer	B.S. Civil Engineering	Dredged Material Management, Regulatory Branch, Corps of Engineers (CE), 4.5 years*	Project Manager, Appendix E and EIS preparation.
B.E. Barrett	Ecologist	Ph.D. Zoology M.S. Zoology B.A. Zoology	Fisheries Research, 3 years Fisheries Management, 3 years Supervisor, Environmental Studies+ Planning Division CE, 7 years*	EIS Project Manager
David Tomey	Ecologist	M.S. Zoology B.A. Biology	Fisheries Research, 1 year Environmental Studies, Planning Division CE, 2.5 years*	Appendix B, EIS preparation and coordination staff.
John Barry**	Economist	M.S. Candidate, Economics B.S. Political Science/Biology	Economic Studies, Planning Division, CE 3 years*	Appendix C and EIS preparation.
Jane Wermuth**	Economist	B.S. Candidate, Economics	Economic Studies, Planning Division, CE 1 year*	Appendix C and EIS preparation.
Robert E. Adler	Civil Engineer	M.S. Marine Sciences B.S. Civil Engineering	Civil Engineering, 1.5 years Engineer Consultant, 2 years Environmental Studies, Planning Division CE, 6.5 years*	Appendix D preparation.
John Wilson	Archaeologist	M.A. Anthropology B.A. Anthropology	Staff Archaeologist, 1 year Archaeologist Consultant, 3 years Division Archaeologist+, Planning Division CE 4 years*	EIS preparation.
T.F. McKinney	Marine Geologist	Ph.D. Geological Oceanography and Geochemistry	Senior Marine Geologist+, Dames and Moore	Appendix A, Project Manager
Theodore Smolen	Attorney	Juris Doctor B.S. Naval Science	Staff Attorney, Environmental Law, 3 years Assistant Division Counsel CE, 6 years*	Legal Consultant
Richard Semonian	Geologist	B.S. Geology	Supervisory Geologist Chief, Dredged Material Management+, Program Manager of DAMOS, Operations Division, 27 years*	Technical Consultant on DAMOS.
William Lawless	Civil Engineer, P.E.	M.S. Civil Engineering B.S. Civil Engineering	Engineering Consultant, 15 years Chief, Regulatory Branch, Operations Division CE+, 9 years*	Regulatory Consultant
Vyto Andreliunas	Civil Engineer, P.E.	B.S. Civil Engineering	Chief, Operations Division+, CE, 26 years*	Policy Consultant
William McCarthy	Civil Engineer, P.E.	B.S. Civil Engineering	Chief, Impact Analysis Branch+, Planning Division, CE, 24 years*	Policy Consultant

+Current Position
*Total years with Corps of Engineers
**No longer employed at CE

SECTION VIII

REFERENCES

Arbib, R. 1977. The Blue List for 1977. American Birds 30: 1031-1039.

Arthur D. Little, Inc. 1975. A Feasibility Study of Lawn Sod Production and/or Related Activities on Dredged Material Disposal Sites. DMRP Contract Report D-75-1 Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Bokuniewicz, H.J., J. Gebert, and R.B. Gordon. 1976. Sediment Mass Balance of a Large Estuary, Long Island Sound. Estuarine and Coastal Marine Science. 4:523-536.

Bokuniewicz, H.J., J. Gebert, R.B. Gordon, P. Kaminsky, C.C. Pilbeam, M. Reed, and C. Tuttle. 1977. Field Study of the Effects of Storms on hte Stability and Fate of Dredged Material in Subaqueous Disposal Areas. DMRP Technical Report D-77-22. Environmental Laboratory, U.S. Army Engineers Waterways Experiment Station, Vicksburg, Miss.

Bowman, M.J. 1976. Tidal Locks Across the East River: an Engineering Solution to the Rehabilitation of Western Long Island Sound. Pages 28-43 in M. Wiley ed. Estuarine Processes. Volume I, Uses, Stresses and Adaptations to the Estuary. Academic Press, New York.

Bowman, M.J. 1977. Nutrient Distributions and Transport in Long Island Sound. Est. and Coast. Mar. Sci. 5:531-548.

Bartos, M. J., Jr. 1977. Classification and Engineering Properties of Dredged Material, DMRP Technical Report D-77-18. U.S. Army Engineer Waterways Experiment Station Vicksburg, Miss.

Briggs, P.T. 1980. Letted dated 21 October 1980. N.Y. State Department of Environmental Conservation, Stony Brook, N.Y.

Caplan, R.L. 1977. Aquatic Disposal Field Investigation, Eatons Neck Disposal Site, Long Island Sound; "Appendix E: Predisposal Baseline Conditions of Zooplankton Assemblages." DMRP Technical Report D-77-6 Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Center for the Environment and Man (CEM). 1972. Dredging in Long Island. Prepared for Nassau/Suffolk Regional Planning Board. Sea Grant Project GH-63. 43 pp.

Center for the Environment and Man (CEM). 1981. Market User Survey for Selected Long Island Sound Ports (Draft). Report prepared for the Corps of Engineers, NED, Waltham, Mass. 155 pp.

Chen, K.Y., J.L. Mang, B. Eichenberger, and R.E. Hoeppel. 1978. Confined Disposal Area Effluent and Leachate Control (Laboratory and Fluid Investigations). DMRP Technical Report DS-78-7 U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Cobb, S.P., J.R. Reese, M.A. Granat, B.W. Holliday, E.H. Klehr, and J.H. Carroll. 1977. Aquatic Disposal Field Investigations, Eaton's Neck Disposal Site, Long Island Sound - An Environmental Inventory. DMRP Technical Report D-77-6. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Connecticut Department of Agriculture. 1974, 1976, 1977, 1978, 1980. Maps of Shellfish Grounds. Connecticut Department of Agriculture -- Aquaculture Division, Milford, Connecticut.

Connecticut Department of Environmental Protection. Logbook Statistics Fishery Data. 1979. 1 January 1978 through 31 December 1978. Unpublished data.

Conner, W.G., D. Aurand, M. Leslie, J. Slaughter, A. Amr, and F.I. Ravenscroft. 1979. Disposal of Dredged Material within the New York District: Volume 1, Present Practices and Candidate Alternatives. Prepared for New York District. U.S. Army Corps of Engineers. New York, N.Y.

Conover, S. 1956. Oceanography of Long Island Sound, 1952-1954. IV. Phytoplankton, Bull. Bingham Oceanogr. Coll. 15: 62-112.

Corps of Engineers (CE). 1978a. Environmental Assessment and Federal Water Pollution Control Act 404 Evaluation for Maintenance Dredging of the Fall River Harbor Turning Basin with Confined Upland Dredged Material Disposal. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Corps of Engineers (CE). 1978b. Environmental Assessment and Federal Water Pollution Control Act 404 Evaluation for Maintenance Dreding of the Connecticut River Navigation Channel from the Lyme Railroad Bridge to Hartford, Connecticut. Corps of Engineers, New England Division, Waltham, MA.

Corps of Engineers (CE) 1979a. Reconnaissance Report: Dredged Material Containment in Long Island Sound. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Corps of Engineers (CE) 1980a. Interim Report, Dredge Material Containment in Long Island Sound. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Corps of Engineers (CE) 1980b. Environmental Atlas of New England Channel and Harbor Bottom Sediments. Volume I. Federal projects within Long Island Sound and Fishers Island Sound. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Corps of Engineers (CE). 1981. Addendum to Interim Report. Dredged Material Containment in Long Island Sound (with Special Emphasis on Eastern New York Waters). U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Corps of Engineers (CE) 1982a. Dredged Material Research Notes, News, Reviews etc. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Miss. D-82-1

Corps of Engineers (CE) 1982b. Final Environmental Impact Statement for the Designation of a Disposal Site for Dredged Material in Western Long Island Sound - WLIS III. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Deevey, G.B. 1952a. A Survey of the Zooplankton of Block Island Sound. 1943-1946. Bull. Bingham Oceanogr. Coll. 13: 65-119.

Deevey, G.B. 1952b. Quantity and Composition of the Zooplankton of Block Island Sound, 1949. Bull. Bingham Oceanogr. Coll. 13: 120-164.

Department of Commerce (DOC). 1978. State of Rhode Island Coastal Management Program and Final Environmental Impact Statement. National Oceanic and Atmospheric Administration, Office of Coastal Zone Management.

Department of Commerce (DOC). 1980. State of Connecticut Coastal Management Program and Final Environmental Impact Statement. National Oceanic and Atmospheric Administration, Office of Coastal Zone Management.

Department of Interior (DOI), Bureau of Land Management, NYOCS Office. 1979. A Summary & Analysis of Cultural Resource Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras. Vol. 1-4. Institute for Conservation Archaeology Report #88. Peabody Museum, Harvard University, Cambridge, MA.

Dowhan, J.J. and R.J. Craig. 1976. Rare and Endangered Species of Connecticut and Their Habitats. State Geological and Natural History Survey of Connecticut. Report of Investigations No. 6, the Nature Resources Center. Connecticut Department of Environmental Protection. 137 pp.

Environmental Laboratory. 1978. Wetland Habitat Development with Dredged Material: Engineering and Plant Propogation. DMRP Technical Report DS-78-16 Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material. 1977. Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters. Environmental Effect Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Environmental Protection Agency (EPA). 1981. Draft Environmental Impact Statement for the Hudson River PCB Demonstration Reclamation Project. U.S. Environmental Protection Agency. Region II New York.

Fitzgerald, W.F., R.J. Szechtman and C.D. Hunt. 1974. A Preliminary Budget for Cu and Zn in Long Island Sound. Chapter II in Investigations on Concentrations, Distributions, and Fates of Heavy Metal Wastes in Parts of Long Island Sound Final Report to the Office of Sea Grant Programs. NOAA Rockville, Maryland.

Gambell, R.P., R.A. Khalid, and W.H. Patrick, Jr. 1978. Disposal Alternatives for Contaminated Dredged Material as a Management Tool to Minimize Adverse Environmental Effects. DMRP Technical Report DS-78-8, Environmental Laboratory. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Greig, R.A., R.N. Reid, and D.R. Wenzloff. 1977. Trace Metal Concentrations in Sediments for Long Island Sound. Mar. Pollut. Bull. 8:182-187.

Gupta, S.C., W.E. Larson, R.C. Gast, S.M. Combs, and R.H. Dowdy. 1978. The Agricultural Value of Dredged Material. DMRP Technical Report D-78-36. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Harris, E. 1959. The Nitrogen Cycles in Long Island Sound. Bull. Bingham Oceanogr. Coll. 17: 31-65.

Hunt, L.J., B.R. Wells, and A.W. Ford. 1978a. Habitat Development Field Investigations, Nott Island Upland Habitat Development Site, Connecticut River, Connecticut. Summary report DMRP Technical Report D 78-25. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Hunt, L.J., A.W. Ford, M.C. Lardin, and B.R. Wells. 1978b. Upland Habitat Development with Dredged Material: Engineering and Plant Propagation. DMRP Technical Report DS-78-17 Environment Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Jay, D.A. and M.J. Bowman. 1975. The Physical Oceanography and Water Quality of New York Harbor and Western Long Island Sound. Technical Report #23 Marine Sciences Research Center, State University of New York, Stony Brook, New York. 71 pp.

Jarvinen, A.W., M.J. Hoffman, T.W. Thorslund. 1977. Long-Term Toxic Effects of DDT Food and Water Exposure on Fathead Minnows (Pimephales promelas). J. Fish. Res. Brd. Can. 34:2089-2103.

Leslie, M., D. Aurand, D. Schultz, and R. Holman. 1980. Disposal of Dredged Material within the New York District: Volume II, Preliminary Evaluation of Upland Disposal. U.S. Army Corps of Engineers, N.Y. District, New York, N.Y.

Loosanoff, V.L. 1965. The American or Eastern Oyster. U.S. Fish and Wildlife Service. Circular 205. 36 pp.

Lunz, J.D., R.J. Diaz, and R.C. Cole. Upland and Wetland Habitat Development with Dredged Material: Ecological Considerations. DMRP Technical Report DS-78-15. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Malcolm Pirnie, Inc. 1980. PCB Hot Spot Dredging Program, Upper Hudson River, New York. Draft Environmental Impact Statement Prepared for the New York State Department of Environmental Conservation, Albany, NY.

Maurer, D.L., R.T. Keck, J.C. Tinsman, W.A. Leathern; C.A. Wethe, M. Huntzinger, C. Lord, T.M. Church. 1978. Vertical Migration of Benthos in Simulated Dredged Material Overburdens. Vol. 1: Marine Benthos. DMRP Technical Report D-78-35. Environmental Laboratory. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

McNulty, J.K., R.C. Work, and H.B. Moore. 1962. Some Relationships Between the Infauna of the Level Bottom and the Sediment in South Florida. Bull. Mar. Sci. Gulf Carib. 12: 322-332.

Middle Atlantic Coastal Fisheries Center (MACFC) 1974. Environmental Baselines in Long Island Sound, 1972-1973 Final Report. Information Report No. 42, Ecosystems Investigations, National Marine Fisheries Service (NOAA) Northeast Region, Sandy Hook, N.J.

Morton, R.W. 1980a. The Management and Monitoring of Dredge Spoil Disposal and Capping Procedures in Central Long Island Sound. DAMOS Contribution #8. Presented at Second International Ocean Dumping Symposium/Woods Hole, MA 16 April 1980.

Morton, R.W. 1980b. "Capping" Procedures as an Alternative Technique to Isolate Contaminated Dredge Material in the Marine Environment. DAMOS Contribution #11. Written Statement Submitted to U.S. House of Representatives, Committee on Merchant Marine & Fisheries, 21 May 1980.

Morton, R.W. and M.C. Miller. 1980. Stamford-New Haven Disposal Operation. Monitoring Survey Report #7. Unpublished Report New England Division, U.S. Army Corps of Engineers, Waltham, MA

Nature Conservancy. 1976. Virginia Coast Reserve Study. Volumes 1-3, Arlington, Virginia.

Naval Underwater Systems Center (NUSC). 1979. DAMOS - Disposal Area Monitoring System. Annual Data Report - 1978 New England Division, Corps of Engineers, Waltham, MA.

Neff, J.W., R.S. Foster, J. Frank Slowey. 1978. Availability of Sediment-Absorbed Heavy Metals to Benthos with Particular Emphasis on Deposit-Feeding Infauna. DMRP Technical Report D-78-42 Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

New England River Basins Commission (NERBC). 1975a. People and the Sound: Outdoor Recreation. NERBC, Boston, MA.

New England River Basins Commission. 1975b. People and the Sound: Fish and Wildlife. NERBC, Boston, MA.

New England River Basins Commission. 1980a. Narragansett Bay Case Study Progress Report. 87 pp.

New England River Basins Commission (NERBC). 1980b. Interim plan and Final Environmental Impact Statement for Disposal of Dredged Material in Long Island Sound.

Nuzzi, R. 1977. Aquatic Disposal Field Investigation Eatons Neck Disposal Site, Long Island Sound; Appendix F: Predisposal Baseline Conditions of Phytoplankton Assemblages. DMRP Technical Report D-77-6 Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Oviatt, C.A. and S.W. Nixon. 1973. The Demersal Fish of Narragansett Bay: An Analysis of Community Structure, Distribution and Abundance. Graduate School of Oceanography, NOAA Sea Grant University of Rhode Island Marine Report #19.

Palermo, M.R. and M.E. Poindexter. 1978. Guidelines for Designing, Operating, and Managing Dredged Material Containment Areas. DMRP Technical Report DS-78-10. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Parr, T., D. Diener, and S. Lacy. 1978. Effects of Beach Replenishment on the Nearshore Sand Fauna at Imperial Beach, California. Miscellaneous Report No. 78-4. U.S. Army Corps of Engineers. Coastal Engineering Research Center, Fort Belvoir, VA

Pearce, J.B. 1969. The Effects of Waste Disposal in the New York Bight. Sandy Hook Marine Laboratory, U.S. Bureau of Sport Fisheries and Wildlife, Highlands, New Jersey.

Pearce, J.B. 1970. The Effects of Solid Waste Disposal on Benthic Communities in the New York Bight. FAO Technology Conference on Marine Pollution and its Effects on Living Resources and Fishing, Rome, Food and Agriculture Organization of the United Nations, Rome, Italy.

Peddicord, R.C. and V.A. McFarland. 1978. Effects of Suspended Dredged Material on Aquatic Animals. DMRP Technical Report D-78-29. Enviromental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Pequegnat, W.E. in collaboration with D.D. Smith, R.M. Darnell, B.J. Presley, and R.O. Reid. 1978. An Assessment of the Potential Impact of Dredged Material Disposal in the Open Ocean. DMRP Technical Report D-78-2. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Reid, R.N., A.B. Frame and A.F. Draxler. 1979. Environmental Baselines in Long Island Sound. 1972-1973. NOAA Technical Report NMFS SSRF-738 U.S. Department of Commerce. NOAA 31pp.

Richards, S.W. 1963. The Demersal Fish Population of Long Island Sound. Bull. Bingham Oceanogr. Coll. Vol. 18.

Riley, G.A. 1952. Hydrography of the Long Island and Block Island Sounds. Bulletin of the Bingham Oceanographic Collection 13:5-39.

Riley, G.A. 1955. Review of the Oceanography of Long Island Sound. Deep Sea Res. Suppl. 3: 224-238.

Riley, G.S. 1956. Oceanography of Long Island Sound, 1952-1954. II Physical Oceanography. Bull. Bingham Oceanogr. Coll. 15; 15-46.

Riley, G.A. and S.M. Conover. 1967. Phytoplankton of Long Island Sound 1954-1955. Bull. Bingham Oceanogr. Coll. 19: 5-34.

Sanders, H.L. 1956. Oceanography of Long Island Sound. X. The Biology of Marine Bottom Communities. Bull. Bing. Oceanogr. Coll. 15: 354-414.

Saucier, R.T., C.C. Calhoun, Jr., R.M. Engler, T.R. Patin, and H.K. Smith. 1978. Execution Overview and Detailed Summary. DMRP Technical Report DS-78-22. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Schubel, J.R., W.M. Wise and J. Schouf. 1979. Questions about Dredging and Dredged Material Disposal in Long Island Sound. Special Report 28. Marine Sciences Research Center, State University of New York, Stony Brook, NY. 136 pp.

Science Applications, Inc. (SAI). 1980a. Disposal Area Monitoring System Progress Report. March 15-May 15, 1980 DAMOS Contribution #13. New England Division, Corps of Engineers, Waltham, MA.

Science Applications, Inc. (SAI). 1980b. Changes in the levels of PCB's in Mytilus edulis Associated with Dredge Spoil Disposal. DAMOS Contribution #10. New England Division, Corps of Engineers, Waltham, MA.

Seavey, G.L. and S.D. Pratt. 1979. The Disposal of Dredged Material in Rhode Island: An Evaluation of Past Practices and Future Options. Coastal Resources Center. University of Rhode Island. Marine Technical Report 72.

Shortnose Sturgeon Recovery Team. 1977. A Compendum of Recent Records of Shortnose Sturgeon from Canada, Florida, and Philadelpia, PA 8/31-9/1/77.

Sindermann, C.J. 1969. Clams In Our Changing Fisheries. BCF Publications.

Smith, H.K. 1978. An Introduction to Habitat Development on Dredged Material. DMRP Technical Report DS-78-19, Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Spaine, P.A., I.L. Llopis and E.R. Perrier. 1978. Guidance for Land Improvement Using Dredged Material. DMRP Technical Report DS-78-21. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

The Research Institute of the Gulf of Maine (TRIGOM) and Public Affairs Research Center (PARC). 1974. A Socio-Economic and Environmental Inventory of the North Atlantic Region, including the Outer Continental Shelf and Adjacent Waters from Sandy Hook, New Jersey to the Bay of Fundy. 3 Volumes. Books submitted to Bureau of Land Management, Marine Minerals Division.

Thompson, J.R. 1973. Ecological Effects of Offshore Dredging and Beach Nourishment: A Rview. Miscellaneous Paper No. 1-73. U.S. Army Corps of Engineers. Coastal Engineering Research Center, Fort Belvoir, VA.

Thomson, K.S., W.H. Weed III, and A.G. Taruski. 1971. Saltwater Fishes of Connecticut. State Geol. and Natur. Hist. Surv. of Conn. Bull. 105. 165 pp.

U.S. House of Representatives. 1976. The Environmental Effects of Dumping in the Oceans and Great Lakes. U.S. Government Printing Office, Washington, D.C.

Valenti, R.J. and S. Peters. 1977. "Aquatic Field Investigations, Eatons Neck Disposal Site, Long Island Sound. Appendix E: Predisposal Baseline Conditions of Demersal Fish Assemblages." DMRP Technical Report D-77-6. Environmental Laboratory. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

VanVolkenburgh, P. 1980. Letter dated 27 October 1980. N.Y. Department of Environmental Conservation, Stony Brook, N.Y.

Wallace, D.E., R.W. Hanks, H.T. Pfitzenmeyer and W.R. Welch. 1965. The Soft-Shelled Clam. Marine Resources of the Atlantic Coast. Leaflet No. 3 Atlantic States Marine Fisheries Commission.

Walsh, M.R. and M.D. Malkasian. 1978. Productive Land Use of Dredged Material Containment Areas: Planning and Implementation Considerations. DMRP Technical Report DS-78-20. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Williams, R.G. 1969. Physical Oceanography of Block Island Sound. Navy Underwater Sound Laboratory New London, Conn. 50 pp.

Wise, W.M. 1975. The Fisheries and Fisheries Resources of Long Island Sound. Master's Thesis, Marine Sciences Research Center, SUNY at Stony Brook, 122 pp.

Young, D.R. 1979. Priority Pollutants in Municipal Wastewaters. Page 103-112 in Annual Report of the Southern California Coastal Water Research Project for the Year 1978, El Segundo, CA.