



**US Army Corps
of Engineers**
Engineer Institute for
Water Resources

Beach Nourishment with Dredged Material

**A Study of the Institutional Constraints to the Use of
Dredged Material for Beach Nourishment Purposes
on the Seacoasts and Great Lakes Shorelines**

Policy Study 81-0110

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of Dredged Material for Beach Nourishment Purposes
on the Seacoasts and Great Lakes Shorelines

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PREFACE

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I. EXECUTIVE SUMMARY

This study assesses the contribution of institutional constraints to limiting the use for beach nourishment purposes of material dredged from the navigation projects of the U.S. Army Corps of Engineers. Investigation was limited to Corps navigation projects on the seacoasts and Great Lakes shorelines.

The purpose of this study is as follows:

- To quantify the frequency with which constraints other than institutional constraints prevent detailed consideration or implementation of opportunities to use dredged material for beach nourishment;
- To quantify the frequency with which institutional constraints prevent implementation of the remaining opportunities to use dredged materials for beach nourishment, and to identify such institutional constraints which consistently recur; and
- To evaluate alternatives for remedying recurrent institutional constraints, if any, to using dredged material for beach nourishment.

Data concerning the methods of dredged material disposal and the constraints to beach nourishment were collected from the 18 districts and 2 divisions responsible for dredging on the seacoasts and Great Lakes shorelines. Data was obtained from 25 navigation projects in planning or under construction, 45 existing navigation projects requiring nonannual dredging, and 141 existing navigation projects requiring annual dredging, for a total of 211 projects.

Major findings are as follows:

- Institutional factors are infrequently major or decisive constraints to the use of dredged material for beach nourishment purposes.
- There are no institutional factors which consistently recur as major or decisive constraints to the use of dredged material for beach nourishment purposes.
- Corps districts and divisions responsible for dredging routinely evaluate beach nourishment as a dredged material disposal alternative.
- For approximately half of dredging projects, beach nourishment does not merit consideration as a method of dredged material disposal. Dredged material from approximately one-fourth of dredging projects is used for beach nourishment purposes. For the remaining one-fourth of projects, beach nourishment is decisively constrained by cost-related factors, lack of need and/or institutional factors.
- New work navigation projects differ from maintenance dredging projects in the mix of constraints to beach nourishment. In

particular, beach nourishment using material from maintenance dredging is more likely to merit consideration but is also more likely to be decisively constrained by cost-related factors or lack of need. These findings probably reflect the more deliberate and detailed planning scrutiny given to new work projects.

- For the maintenance projects for which beach nourishment is decisively constrained by cost and/or lack of need, it is difficult to identify post facto the respective roles of the Corps of Engineers and of non-Federal governments in determining that beach nourishment is not needed and/or is too expensive.
- Most of the navigation projects using dredged material for beach nourishment are located in the Jacksonville, Mobile, Los Angeles and Detroit Districts.
- Most uses of dredged material for beach nourishment do not involve financial participation by entities other than the Corps.
- The methods of on-land nourishment and of deposition of material in the littoral zone are used equally frequently to nourish beaches with dredged material.
- Section 145 of the 1976 Water Resources Development Act has had little effect outside the State of Florida in inducing non-Federal financing for any incremental costs of using dredged material for beach nourishment, largely because Section 145 does not represent any major departures from previous practice.

The study reached three conclusions, as follows:

- By and large, Corps of Engineers districts and divisions responsible for dredging have implemented a high proportion of suitable opportunities to use dredged material for beach nourishment.
- Corps of Engineers districts and divisions responsible for dredging may be able to increase the frequency with which material from maintenance dredging projects is used for beach nourishment. This may be done by assuring, when beach nourishment merits consideration as a disposal alternative, that prompt, focused and continuous communication is undertaken with the affected non-Federal units of government regarding incremental costs, beach nourishment needs and institutional constraints. Amendment of Section 11 of ER 1130-2-307, "Project Operation: Dredging Policies and Practices," 31 October 1968, to emphasize improved communication may be warranted.
- Detailed study of potential modifications to cost-sharing policy for the purpose of increasing the frequency with which dredged material is used for beach nourishment is not warranted at this time.

II. STUDY DESCRIPTION

The public harbors, rivers and waterways of the Nation are developed and maintained for navigation by the U.S. Army Corps of Engineers. Achieving and maintaining project depths usually require initial dredging and periodic dredging of accumulated sediments. While selecting the methods and sites for disposal of dredged material is often a difficult task, dredged material can frequently serve a variety of beneficial and productive purposes.

Beach nourishment is the deposition of unconfined sandy material on beaches and dunes or in the littoral zone (see Figure I). Beach nourishment can provide significant erosion protection and recreation benefits. In many areas of the Nation, beach nourishment appears to offer distinct advantages as a form of dredged material disposal. For any particular project, however, disposal of dredged material for beach nourishment purposes may be subject to a number of major constraints.

This study assesses the contribution of institutional constraints to limiting the use for beach nourishment purposes of material dredged from the navigation projects of the U.S. Army Corps of Engineers. Investigation was limited to Corps navigation projects on the seacoasts and Great Lakes shorelines.

Study Background

In a letter to the Director of Civil Works, dated 15 April 1980, Major General Bennett L. Lewis, Division Engineer, North Atlantic Division (NAD), expressed his concern that material technically and environmentally suitable for beach nourishment was being wasted by deep ocean disposal in the Atlantic Ocean. From calendar year 1976 through calendar year 1979, 26.6 million cubic yards of material from NAD dredging projects were disposed of in the deep ocean.¹ MG Lewis estimates that approximately 10 percent (or over 2 million cubic yards from 1957 to 1979) of the material dredged by NAD and disposed of in the deep ocean is suitable for beach nourishment. He requested the assistance of the Director of Civil Works to review institutional constraints to material disposal for beach nourishment from a national standpoint, and to review potential remedies, if needed. The Army Engineer Institute for Water Resources was subsequently given the assignment of conducting a policy study in fiscal year 1981 to address this issue.

Hypothesis

Institutional constraints frequently preclude the use of dredged material for beach nourishment purposes when no other constraint or set of constraints precludes such use.

Definitions

a. Beach nourishment is the deposition of unconfined sandy material on beaches and dunes or in the littoral zone.

¹Source: U.S. Army Corps of Engineers, Report to Congress on Administration of Ocean Dumping Activities, 1976 to 1979.



Courtesy: Jacksonville District, U.S. Army Corps of Engineers

FIGURE I

BEACH NOURISHMENT MATERIAL BEING PUMPED
FROM THE DREDGE GOETHALS, MAYPORT, 1974

b. An institutional constraint to the use of dredged material for beach nourishment is a legal, attitudinal, financial, procedural or related constraint to such use and specifically includes the requirements of state laws which exceed Federal water quality standards and the unwillingness of non-Federal governments to finance incremental costs, but specifically excludes the preference of non-Federal interests for an alternative use of dredged material, the physical unsuitability of dredged material for beach nourishment, unacceptable adverse environmental impacts under Federal standards, and operational constraints related to physical conditions, equipment availability, incremental costs, and lack of need for beach nourishment. (See Part V for classification of constraints.)

Study Purposes

The study has three major purposes:

a. To quantify the frequency with which constraints other than institutional constraints prevent detailed consideration or implementation of opportunities to use dredged material for beach nourishment;

b. To quantify the frequency with which institutional constraints prevent implementation of the remaining opportunities to use dredged material for beach nourishment, and to identify such institutional constraints which consistently recur; and

c. To evaluate alternatives for remedying recurrent institutional constraints, if any, to using dredged material for beach nourishment.

Study Method

Execution of the study involved three major tasks:

a. A review of previous findings;

b. A review of existing applicable law and policy; and

c. A survey of 211 dredging projects on the seacoasts and Great Lakes shorelines to identify the opportunities for using dredged material for beach nourishment and the decisive constraints to such use.

Since the study focuses on the use of dredged material, this survey of projects was limited to navigation projects and did not include beach nourishment projects. In addition, projects surveyed were limited to the seacoasts and Great Lakes shorelines, where recreational beaches and shore erosion problems are common. Projects on the inland waterways or located on major estuaries such as the Chesapeake Bay and a great distance from the surf zone were excluded from the survey.

The survey had two phases. In Phase I, a detailed questionnaire was mailed to offices of the 18 Corps of Engineers districts and the 2 divisions (New England Division and Pacific Ocean Division) having responsibility for harbor and waterway dredging projects on the seacoasts and Great Lakes shorelines. To limit administrative burdens for the districts and divisions, and to measure the effects, if any, of Section 145 of the 1976 Water Resources

Development Act (see Part IV), information in Phase I was requested only for projects recently in some stage of planning or construction (i.e. "new work" projects), or projects for which maintenance dredging has recently been resumed after a hiatus (i.e. "nonannual" O&M projects).

Specifically the following projects were studied in Phase I:

- Survey reports for coastal/shoreline navigation projects received by the Board of Engineers for Rivers and Harbors in calendar years 1978, 1979 and 1980.
- Detailed project reports for coastal/shoreline small navigation ("Section 107") projects received by the Office of the Chief of Engineers in calendar years 1978, 1979 and 1980.
- Coastal/shoreline navigation projects for which appropriations were received and expended for advanced engineering and design in fiscal years 1978, and 1979 and/or 1980.
- Coastal/shoreline maintenance dredging projects which are identified in congressional committee reports on appropriations for fiscal years 1978, 1979 and 1980, but not in reports on appropriations for fiscal year 1977, and which were conducted in fiscal years 1978, 1979 or 1980.

The questionnaire for Phase I is reproduced in Appendix A.

Information on maintenance dredging projects requiring annual dredging during the period (i.e. "annual" O&M projects) was deferred to the more abbreviated Phase II, a telephone survey.

Once a majority of survey responses from Phase I was received, Phase II was undertaken. Updating and clarification of Phase I data was undertaken at the same time. Data gathered in the two phases are compatible.

Applications

The U.S. Army Corps of Engineers has responsibilities, among others, to provide for the navigation needs of the Nation, to protect the quality of the human and natural environments, and to protect life and property from natural hazards. This study, to the extent that it can enhance the appropriate uses of dredged material for beach nourishment to provide shore protection and recreation benefits, will contribute to those missions.

III. HISTORICAL BACKGROUND

Beach nourishment is a potential form of disposal for tens of millions of cubic yards of dredged material per year. However, the decisions to use or not to use dredged material for beach nourishment are made incrementally, case by case. As discussed below, the factors affecting those decisions have been changing since the 1960's.

Although the principal purpose of dredging is for navigation, it is often required for flood control, shore protection and other Federal purposes. Throughout the 1960's and 1970's, the Corps of Engineers annually dredged an average of approximately 350 million cubic yards of material for navigation purposes. Historically, most dredging has taken place in the Lower Mississippi River and in the deep-draft channels providing access to the larger ocean ports. Maintenance dredging has predominated, with new work constituting a declining proportion of the effort since the 1960's. Table I and Figure II display dredging activity of the Corps of Engineers from 1963 to 1981.

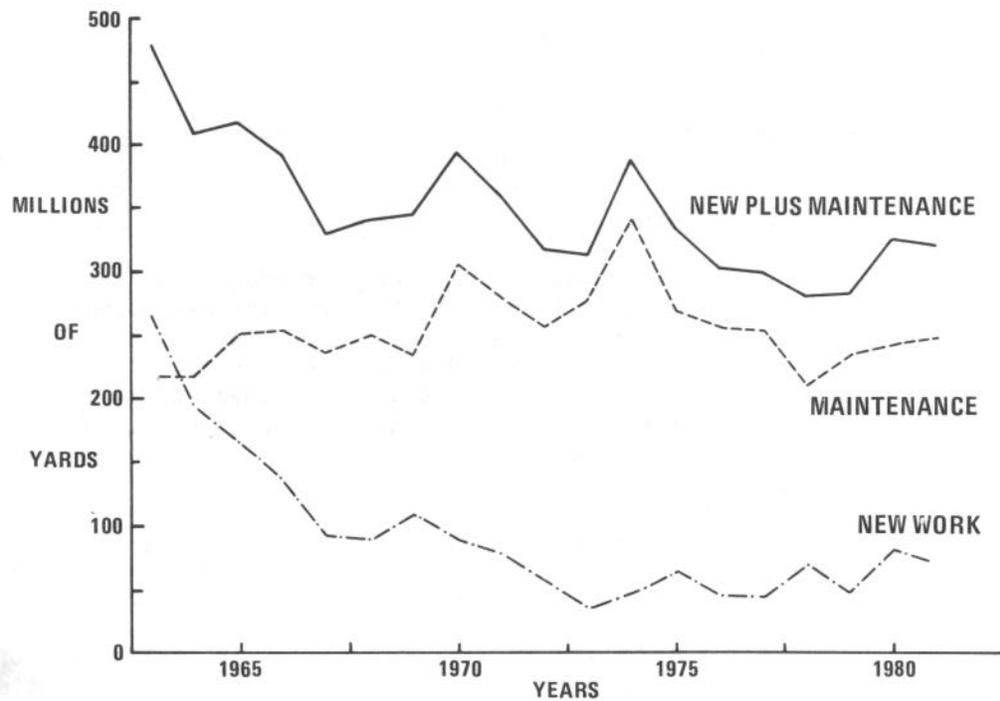
The environmental legislation of the 1970's has had a significant effect on dredging practices. Until the 1970's, material dredged for navigation purposes was usually disposed of in the open waters (e.g. rivers, backwaters, bays and estuaries, shallow ocean and lake environments) near the location of the channel being dredged. Disposal in wetland or upland areas accounted for most of the remaining quantities. Today, however, greater consideration of the environmental effects of dredging is required. The National Environmental Policy Act (NEPA) assures full consideration of environmental and socioeconomic effects of dredging and the other environmental activities of the Federal Government. The "Ocean Dumping Act," the Clean Water Act, and various state laws provide for protection of water quality, living resources and wetlands. (These and other statutes are discussed in Part IV.)

Environmental constraints, cost constraints, the declining availability of sites and other factors have made it difficult to resolve site-specific dredged material disposal issues and have created conflict and delays in dredging. Each form of dredged material disposal has the potential for adverse environmental or water quality effects. Contained (diked) upland sites are often preferred for material disposal because when filled they can be used for productive purposes such as recreation and port development. However, contained upland disposal often involves high construction and material transfer costs (particularly for severely polluted material), and sites are often difficult to secure. Open water disposal in rivers and shallow waters is relatively inexpensive but can have harmful environmental and water quality effects if dredged material is polluted and/or the disposal site is biologically sensitive. Deep ocean disposal is often quite costly and its effects are sometimes difficult to assess; however, in the absence of acceptable inland or nearshore disposal areas, the deep ocean has sometimes served as the disposal site of last resort.

To help alleviate long-term siting and disposal problems in particular locations, Corps of Engineers district offices in Portland, San Francisco, Philadelphia, Rock Island, and New York are undertaking regional planning studies in an attempt to locate acceptable sites for future dredged material

TABLE I
SUMMARY OF DREDGING ACTIVITY, 1963 TO 1981

FISCAL YEAR	CUBIC YARDS DREDGED (MILLIONS)		
	MAINTENANCE	NEW WORK	TOTAL
1963	217	263	480
1964 (EST)	217	192	409
1965 (EST)	250	166	416
1966 (EST)	253	137	390
1967	235	92	327
1968	249	89	338
1969	233	109	342
1970	303	89	392
1971	278	79	357
1972	256	59	315
1973	276	36	312
1974	338	48	386
1975	267	65	332
1976 + T	319	57	376
1977	253	45	298
1978	210	70	280
1979	234	48	282
1980 (EST)	243	82	325
1981 (EST)	248	72	320
TOTAL	4,879	1,798	6,677
ANNUAL AVERAGE (19.25 yr.)	253.5	93.4	346.9



SOURCE: U.S. Army Corps of Engineers, Water Resources Support Center, Dredging Division, 'Summary of Activities, Corps and Industry, Dollars and Yards (millions),' April 1980.

FIGURE II
ANNUAL YARDAGE DREDGED BY CORPS AND INDUSTRY

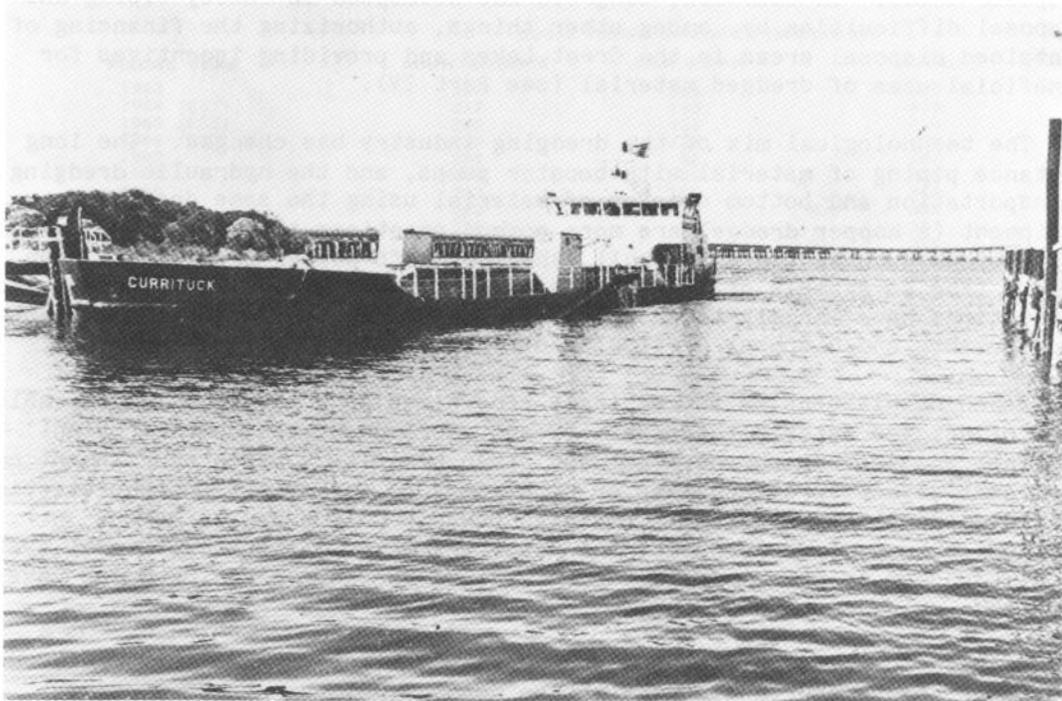
disposal needs. In addition, Congress has attempted to remedy siting and disposal difficulties by, among other things, authorizing the financing of contained disposal areas in the Great Lakes and providing incentives for beneficial uses of dredged material (see Part IV).

The technological mix of the dredging industry has changed. The long distance piping of material with booster pumps, and the hydraulic dredging, transportation and bottom dumping of material using the same dredging equipment (a hopper dredge) are more common practices today. Technological innovations such as the split-hull, shallow draft hopper dredge have been made. (For an example of such a dredge, see Figure III.) These trends and innovations have largely taken place in response to the recent environmental requirements and disposal difficulties.

Beach nourishment is increasingly recognized as a potentially desirable form of dredged material disposal. Beach nourishment can abate erosion problems and provide recreational and other benefits. Beach nourishment can be a cost-effective alternative or complement to structural shore protection. Unlike disposal of material in the deep ocean or diked areas, beach nourishment use of dredged material keeps the material in the littoral system (i.e., subject to wave-induced currents along the open ocean or Great Lakes coasts).

Despite these advantages and the overall availability of suitable dredging equipment, beach nourishment may not be needed, and the use of dredged material for beach nourishment may be subject to physical, environmental, technical and cost-related constraints. At times, institutional factors prevent otherwise feasible and needed beach nourishment. Table II shows that in recent years, beach nourishment has remained a relatively infrequent method of dredged material disposal.

Part IV seeks to identify the constraints which are decisive in preventing dredged material disposal for beach nourishment, and to measure the relative contribution of institutional constraints.



Courtesy: Wilmington District, U.S. Army Corps of Engineers

FIGURE III

THE DREDGE CURRITUCK

TABLE II¹
DISPOSAL METHODS FOR MATERIAL FROM MAINTENANCE DREDGING
1973 to 1977

METHOD OF DISPOSAL	AVERAGE ANNUAL DISPOSAL - U.S.		AVERAGE ANNUAL DISPOSAL - COASTAL SEGMENTS ²	
	Million Cubic Yards	Percent	Million Cubic Yards	Percent
Open Water ³	97.7	33.6	22.2	17.3
Ocean ³	51.1	17.6	33.3	26.0
Contained ³	50.1	17.2	35.1	27.4
Beach Nourishment	12.5	4.3	10.5	8.2
Agitation ⁴	21.2	7.3	.0	.0
Other	58.3	20.0	27.0	21.1
TOTAL	290.9	100.0	128.1	100.0

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Notes to Table II:

1. SOURCE: U.S. Army Corps of Engineers, Water Resources Support Center, Institute for Water Resources, "Inventory of Waterway Physical Characteristics," data file, 1979.
2. Includes and is limited to segments: #28, #29, #30, #31, #32, #33, #34, #39, #40, #42, #44, #46, #47, #48, #49, #53, #56, #57, #58, #59 and #60. See source for description of segments.
3. See discussion for definitions.
4. Mechanical resuspension of sediment at mouth of Mississippi River, mouth of Columbia River and selected locations.

IV. REVIEW OF APPLICABLE POLICY AND PRACTICE

This part reviews existing policy and practice which are pertinent to the discussion of findings in Part IV, particularly the discussion relating to institutional constraints to the use of dredged material for beach nourishment. Cost sharing, estimation of the incremental costs and benefits of beach nourishment, and project planning considerations are reviewed.

Cost Sharing

For new navigation projects, a Federal cost share may be authorized in some circumstances for any incremental costs (i.e. costs above the least-cost environmentally acceptable alternative) of using the dredged material for beach nourishment. For maintenance dredging, non-Federal interests usually bear the incremental costs, if any. A detailed description of basic cost-sharing policies and their implications is provided below.

New Navigation Projects

Cost sharing for new navigation projects varies according to the language of the authorizing legislation for each project. However, under ordinary cost-sharing arrangements, the cost of structures for commercial navigation is borne entirely by the Federal Government. For recreational harbors and channels, the Federal Government bears one-half of the cost of general navigation structures. Other costs and the costs of lands, easements, rights-of-way and relocations, including for dredged material containment areas, are borne by non-Federal interests.

Shore Protection Projects

Under Title 33, Section 426 et seq. of the United States Code (33 USC 426 et seq.), the U.S. Army Corps of Engineers may provide a cost share for the construction of shore protection projects authorized by Congress. Up to 50 percent of construction costs for public beach protection, 70 percent of construction costs for protection of public parks and public conservation areas, and 70 percent of construction costs for hurricane protection of public and private property may be borne by the Federal Government.

Periodic Beach Nourishment

Once shore protection facilities are in place, maintenance costs are borne entirely by non-Federal interests. Federal involvement in beach nourishment for maintenance purposes is not authorized. However, when periodic beach nourishment is the selected plan for shore protection, it is considered to be "construction" and is eligible for Federal cost shares. Congress, in Section 156 of the 1976 Water Resources Development Act (42 USC 1962d et seq.), authorized the Chief of Engineers to extend nourishment at any authorized project up to a total nourishment period of 15 years.

Maintenance Dredging

Currently, the costs of maintenance dredging are usually borne entirely by the United States. In the instances of projects constructed after the early 1970's, the methods and sites of dredged material disposal are specified in

authorizing documents. When the dredged material confinement facilities for these recent projects are approaching capacity, new lands, easements and rights-of-way are sought from non-Federal interests in accordance with the original authorizing documents. For older projects, the site is often not specified and the least cost environmentally acceptable material disposal alternative is usually selected. Where the requirements of recent environmental statutes necessitate diked disposal for the material from older projects, the Corps has borne the added costs of diking as an operating expense. Diked disposal facilities on the Great Lakes were authorized in 1970 in Section 123 of Public Law 91-611. In 1972, with passage of the Federal Water Pollution Control Act amendments, diked disposal areas became necessary in many other areas of the United States. Additional costs beyond actual dredging and, at older projects, the provision of diked areas to protect water quality are borne by non-Federal interests.

Incremental Costs of Beach Nourishment

The present Corps policy on incremental costs is contained in ER 1130-2-307, "Project Operation: Dredging Policies and Practices" (31 October 1968, Section 11):

It is the policy to secure the maximum practicable benefits through the utilization of materials dredged from authorized navigation channels and harbors, provided extra cost to the government is not incurred. Such use of dredged materials will include nourishment of beaches, erosion control of river banks, and land reclamation. If it is evident during the initial planning of dredging operations that additional costs would be incurred, local interests will be given reasonable opportunity to finance the additional costs.

In 1976, Congress passed the 1976 Water Resources Development Act (PL 94-587, October 22, 1976, 90 Stat. 2931). Various sections of the Act encourage the beneficial use of dredged material. Section 145 (33 USC 426) specifically addressed the incremental costs of beach nourishment using dredged material:

The Secretary of the Army, acting through the Chief of Engineers, is authorized upon the request of the State, to place on the beaches of such State beach-quality sand which has been dredged in constructing and maintaining navigation inlets and channels adjacent to such beaches, if the Secretary deems such action to be in the public interest and upon payment of the increased costs thereof above the cost required for alternative methods of disposing of such sand.

A number of the provisions of Section 145 require further definition:

- a. Does a "state" include a subdivision of a state?
- b. Are findings that sand is of "beach quality" and nourishment is in the "public interest" identical to similar findings under other Corps of Engineers planning and permit procedures?
- c. Which "alternative methods" for disposal are the basis for cost comparison?

d. How close is "adjacent?"

Neither Section 145 nor ER 1130-2-307 restricts the selection of dredged material disposal sites, nor specifically requires the consideration of beach nourishment as a dredged material disposal alternative. Together, they encourage states to participate in disposal planning and the Corps to discuss beach nourishment with states.

Mitigation of Erosion Caused by Authorized Projects

Section 111 of the 1968 Rivers and Harbors Act created a continuing authority for the Corps to mitigate the erosion effects of authorized navigation works on downdrift shorelines at up to 100 percent Federal cost. Frequently, mitigation is accomplished by beach nourishment using material dredged from the navigable channel or using material impounded by the navigation works.

Summary

Among the various policies and laws, a consistent set of cost-sharing principles emerges. These principles are summarized in Table III.

Estimating Incremental Costs and Benefits

Methods to estimate the incremental costs and benefits using dredged material for beach nourishment differ markedly between new navigation projects and maintenance dredging.

New Work

Since the early 1970's, planning for new work has been subject to requirements of the Principles, Standards and Procedures for Water Resource Planning and of the National Environmental Policy Act, and to other detailed requirements for public participation and technical review. Although many of these requirements are being amended or replaced, a set of planning practices has been institutionalized. Under these practices the nature, severity and distribution of the effects of dredged material disposal alternatives are explored fully. Economic, social, environmental and regional effects are weighed over a lengthy planning period, and the optimal methods for disposal of both material from project construction and material from future project maintenance are determined.

Maintenance Dredging

Planning for maintenance dredging operations is conducted under greater time pressure because budgeting and priority-setting decisions are made on an annual basis and because, to protect navigation, the needs for removal of shoals and deposited sediments must be met as they arise. No detailed analysis of benefits is possible and detailed comparison among alternatives is not conducted. However, costs can be estimated, the physical need for beach nourishment assessed, and the willingness of non-Federal interests to finance incremental costs ascertained. In accordance with ER 1130-2-307 and the 1976 Water Resources Development Act, efforts should be made or entertained to find beneficial uses for dredged material.

TABLE III

PRINCIPLES FOR PAYING THE INCREMENTAL COSTS OF BEACH NOURISHMENT

TYPE OF PROJECT	RESPONSIBILITY FOR INCREMENTAL COSTS
1. Dual-purpose navigation/ shore protection; beach nourishment not selected protection plan	Non-Federal
2. Dual-purpose navigation/ shore protection; beach nourishment authorized	50-70% Federal
3. Single-purpose navigation project; disposal at authorized beach nourishment project	50-70% Federal up to the point where incremental disposal cost equals the cost of alternative nourishment material of comparable effectiveness for the authorized project; non-Federal interests responsible for additional costs
4. Single-purpose navigation project; erosion mitigation originally authorized or authorized under Section 111	100% Federal to the extent necessary to mitigate erosion; non-Federal interests responsible for additional costs
5. Single-purpose navigation project; beach nourishment is least-cost environmentally acceptable and feasible alternative	No incremental costs
6. Other single-purpose navigation project	Non-Federal

Project Planning

Apart from cost-sharing considerations and estimation of the relative benefits and costs of beach nourishment, a number of additional procedural and substantive considerations may affect the decision whether or not to use dredged material for beach nourishment. These considerations include state law, public acceptance and non-Federal cooperation.

State Law

The principal Federal environmental statutes governing dredged material disposal are the National Environmental Policy Act (42 USC 7321 et seq.), the Clean Water Act of 1977 (33 USC 1341 et seq.), and the Marine Protection Research Sanctuaries Act of 1972 (33 USC 1413, "Ocean Dumping Act").

In the navigable waters subject to the Clean Water Act, state law may prohibit beach nourishment which is environmentally acceptable under Federal standards. Under Section 404(t) and related sections of the Act, states may adopt more stringent water quality standards and enforce them against the Federal Government as well as other public and private entities. In some states, beach nourishment and other forms of unconfined disposal of dredged material are prohibited entirely.

Public Acceptance

Public acceptance is an important factor in the selection of dredged material disposal sites and methods. Public concerns over costs, aesthetics, safety and other issues may significantly reduce the desirability of a particular disposal alternative.

Non-Federal Cooperation

Non-Federal cooperation is essential where lands, easements or rights-of-way are required or other incremental costs are to be incurred. Except in the instance of mitigation, some non-Federal financial participation is required if incremental costs are identified. In addition, although beach nourishment using dredged material may not require free and clear title to real estate, unimpaired easements must be obtained.

V. FINDINGS AND CONCLUSIONS

Introduction

In Phases I and II, 211 projects were surveyed. To determine the nature and relative severity of constraints to the use of dredged material for beach nourishment, an attempt was made to identify the "major" and "decisive" constraints to each project.

"Major" constraints are the one, two, or three most influential factors, as identified by survey respondents, which prevented the use of dredged material for beach nourishment in each instance. If beach nourishment was the form of dredged material disposal selected for a particular project, there were by definition no major constraints.

The various constraints to the use of dredged material for beach nourishment are identified and may play decisive roles at different times during the planning of new work or maintenance dredging operations. In the classification which follows, 14 potential constraints are classified into 7 groups and 2 classes, and appear in the approximate sequence in which they are identified and considered in planning. For any particular project, the "decisive" constraint or constraints are those "major" constraints which are applicable to the project and which are among the group of constraints appearing first in the classification.

The constraints are classified as follows:

A. CONSTRAINTS TO CONSIDERATION OF BEACH NOURISHMENT

1. Other Use Preferred. Non-Federal sponsor prefers another use for dredged material.
2. Unsuitable Material. Grain size of material (e.g. silt, clay, mud, rock) is inappropriate for beach nourishment.
3. Environmental and technical constraints are unacceptable
 - a. Unacceptable water quality impacts expected;
 - b. Unacceptable turbidity and fish and wildlife impacts expected;
 - c. Shore physiography and use (shore character) is not suited for beach nourishment (i.e., beach nourishment would be inappropriate);
 - d. A more suitable and/or less expensive source of beach nourishment material is available for use at beaches under consideration (and there is an alternative form of dredged material disposal which is of lesser cost and is environmentally acceptable);
 - e. Ocean wave or current conditions are hazardous to the use of equipment for beach nourishment.

TABLE IV
 DISTRIBUTION OF MAJOR¹ AND DECISIVE² CONSTRAINTS AMONG PROJECTS³

Constraint Group	Distribution of Major Constraints (Percent) ⁴		Total	Distribution of Decisive Constraints (Percent) ⁵		Total
	New Work	Non-Annual		Annual	New Work	
Other Use Preferred	12	0	3	12	0	3
Unsuitable Material	36	47	34	36	47	34
Environmental/Technical	28	36	36	24	20	14
(Constraints to Consideration)	--	--	--	(72)	(67)	(43)
State Law	0	0	3	0	0	3
High Incremental Cost	12	27	20	0	16	14
No Need	0	11	10	0	0	8
(High Cost & No Need)	--	--	--	(0)	(16)	(22)
Other Institutional	8	4	5	8	2	4
(Constraints to Implementation) ¹	--	--	--	(8)	(18)	(24)
Beach Nourishment	20	16	25	20	16	25

Notes to Table IV

1. For any project, the number of constraints recorded as "major" was limited to 3 or less (0 if beach nourishment was implemented).
2. For any project, a constraint group is "decisive" and precludes beach nourishment if no constraint group above it is decisive.
3. Sample size: 25 new work; 45 non-annual maintenance; 141 annual maintenance; 211 total.
4. The vertical sum exceeds 100% because any project may encounter more than one major constraint.
5. Does not sum to 100% due to rounding.

TABLE V
DECISIVE CONSTRAINTS TO THE USE OF DREDGED MATERIAL
FOR BEACH NOURISHMENT PURPOSES

DISTRICT OR DIVISION	NUMBER OF PROJECTS(2)		DECISIVE CONSTRAINTS															
	REMAINING	DECISIVELY CONSTRAINED	CONSTRAINTS TO CONSIDERATION							CONSTRAINTS TO IMPLEMENTATION								
			ENVIRONMENTAL, TECHNICAL							COST-RELATED OPERATIONAL								
			SPONSOR PREFERS ANOTHER USE FOR DREDGED MATERIAL.	INAPPROPRIATE GRAIN SIZE (silt, clay, mud, rock, etc.)	UNACCEPTABLE WATER QUALITY IMPACTS EXPECTED.	UNACCEPTABLE TURBIDITY AND FISH AND WILDLIFE IMPACTS EXPECTED.	SHORE PHYSIOGRAPHY AND USE NOT SUITED FOR NOURISHMENT.	MORE SUITABLE AND/OR LESS EXPENSIVE SOURCE AVAILABLE.	OCEAN WAVE OR CURRENT CONDITIONS HAZARDOUS TO EQUIPMENT.	ADVERSE EFFECTS ON NAVIGATION AND WATER USES EXPECTED.	SUBTOTAL(3)	STATE LAW PROHIBITS BEACH NOURISHMENT.	MATERIAL TRANSPORT COST TOO HIGH.	MOBILIZATION, DEMOBILIZATION AND/OR PUMPING COSTS TOO HIGH.	EQUIPMENT FOR NOURISHMENT NOT AVAILABLE.	SUBTOTAL(3)	NOURISHMENT NOT NEEDED.	OTHER INSTITUTIONAL CONSTRAINTS.
NEW ENGLAND (NED)	0	9					1	1	0		2		2	0	1	2	15	
NEW YORK (NAN)	0	8						0	0	1	2		2	0	1	2	13	
PHILADELPHIA (NAP)	0	1						0	0			3	3	0	0	0	4	
BALTIMORE (NAB)	0	0						0	0				0	0	0	1	1	
NORFOLK (NAO)	0	3	3	3				3	0			1	1	0	1	0	8	
WILMINGTON (SAW)	0	0						0	0	5	2	2	7	0	0	3	10	
CHARLESTON (SAN)	0	1					1	1	2	0	2		2	0	0	0	5	
SAVANNAH (SAS)	0	1					1	1	0				0	0	1	0	3	
JACKSONVILLE (SAS)	2	7						0	0				0	0	0	9	18	
MOBILE (SAM)	1	5						0	0				0	0	3	6	15	
NEW ORLEANS (LMN)	0	8						0	0				0	0	0	0	8	
GALVESTON (SWG)	1	0						0	0	1	4		4	3	1	1	10	
LOS ANGELES (SPL)	0	1		1				1	2	0			0	0	0	6	9	
SAN FRANCISCO (SPN)	0	3			2	1		1	4	0			0	0	0	3	10	
PORTLAND (NPP)	0	0			1			1	0				0	7	0	1	9	
SEATTLE (NPS)	0	0						0	0	1	1		1	0	0	1	2	
ALASKA (NPA)	1	3	1	2	1	1	2	4	0				0	0	0	0	8	
PACIFIC OCEAN (POD)	0	5						0	0				0	0	0	0	5	
BUFFALO (NCB)	0	11	1		1			2	0		2		2	1	1	2	19	
DETROIT (NCE)	1	6	10					10	4		3		3	0	0	15	39	
FORM OF DISPOSAL										0	3	5	4	10	3	4	0	17
OPEN WATER										0	1	1		2	0	1	0	3
SHALLOW OCEAN/BAY										0	1	7	2	10	10	3	0	23
DEEP OCEAN/GREAT LAKE										4	4	4		7	2	2	0	15
UPLAND CONTAINED										0	2	2		2	0	0	0	2
ON-LAND UNCONFINED										0	0	0		0	0	0	32	32
ON-LAND NOURISHMENT										0	0	0		0	0	0	31	31
LITTORAL NOURISHMENT										0	0	0		0	0	0	31	31
TOTAL (4)										4				31	15	10	63	123

NOTES TO TABLE V

- (1) Any constraint group (columns 1, 2, 9, 10, 14, 15 and 16) is "decisive" and precludes beach nourishment if no constraint group to its left is decisive.
- (2) When one project involved both disposal for beach nourishment and another form of disposal, the project was recorded as two projects. Projects with two forms of non-beach nourishment disposal or two forms of beach nourishment were recorded as one project. New work dredging and maintenance dredging done at the same site were recorded as two projects.
- (3) The horizontal sums of columns 3 through 8 and 11 through 13 may exceed the subtotals (columns 9, 14) because a project or projects may face multiple major constraints within the constraint group or may involve multiple forms of disposal.
- (4) The vertical sum of forms of disposal may exceed the total number of projects because any one project may involve multiple forms of disposal.

f. Adverse effects on navigation and water uses are expected.

B. CONSTRAINTS TO IMPLEMENTATION OF BEACH NOURISHMENT

4. State law prohibits beach nourishment.
5. Beach nourishment is undesirable from the standpoint of high incremental cost.
 - a. Transport cost for dredged material is too high;
 - b. Per unit mobilization, demobilization and/or pumping costs are too high;
 - c. Dredging plant of least cost or equipped for beach nourishment is not available, and costs otherwise would have been acceptable.
6. There is no need for beach nourishment, although shore character is suited to nourishment.
7. Other institutional constraints (varying case by case) apply.

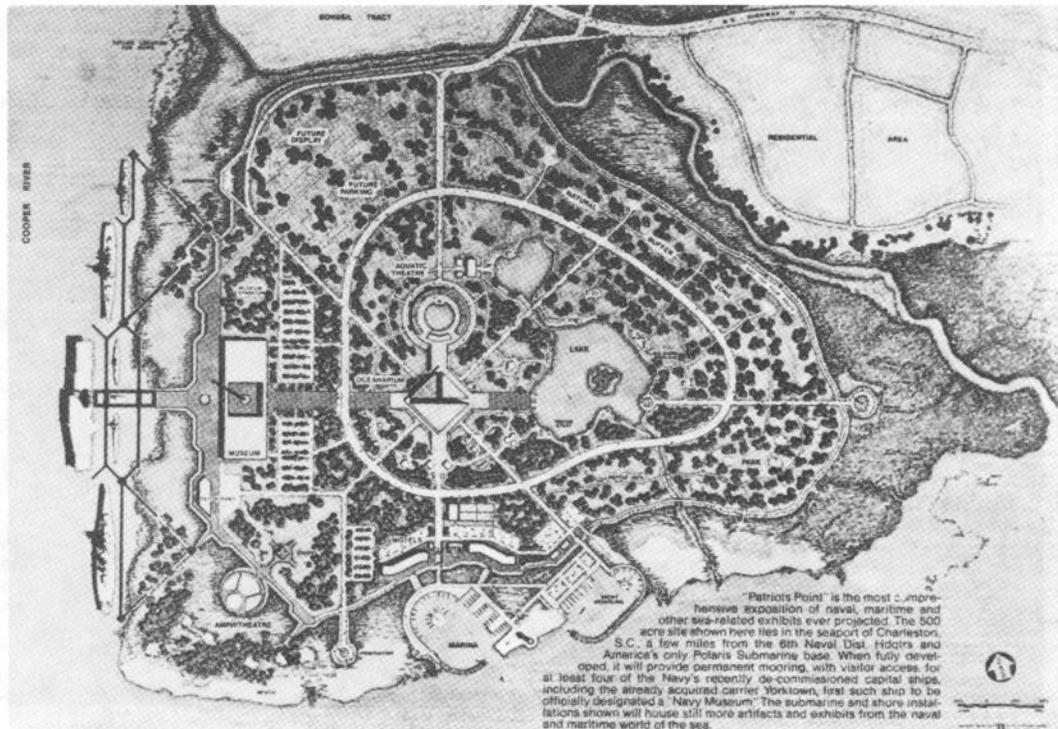
Data on the major and decisive constraints as classified and ordered above are displayed in Tables IV and V, and findings regarding specific constraints are discussed in the text which follows. Subsequently, comparative analyses among project types, districts and divisions, financing methods and nourishment methods are performed, and the effects of Section 145 of the 1976 Water Resources Development Act are reviewed. Finally, findings are summarized and conclusions are drawn.

Constraints to Consideration of Beach Nourishment

This section discusses the frequency with which the preference for another use, physical unsuitability of dredged material and environmental and technical constraints were found to be decisive and consequently to preclude beach nourishment. In general, such constraints are identified relatively early in planning. Where such constraints are decisive, beach nourishment is considered, for purposes of this study, not to merit detailed consideration as a dredged material disposal alternative.

Preference for Another Use

For 6 of the 211 projects surveyed, non-Federal sponsors preferred to use the dredged material for a productive or beneficial use other than beach nourishment, and were willing to finance any incremental costs of that use. Examples of such uses are fill for port and industrial development and creation of recreational islands (see Figure IV). For new work projects, the alternative use was or would be specified in authorizing documents (see Part IV). (Note: In cases where other beneficial uses of dredged material are not preferred, but other decisive constraints preclude beach nourishment, the dredged material may often be used for beneficial purposes nonetheless.)



Courtesy: Waterways Experiment Station, U.S. Army Corps of Engineers

FIGURE IV
 PROPOSED RECREATIONAL USE OF A DREDGED
 MATERIAL DISPOSAL SITE



Courtesy: Waterways Experiment Station, U.S. Army Corps of Engineers

FIGURE V
INDUSTRIAL DEVELOPMENT ON DREDGED MATERIAL,
COLUMBIA RIVER, PORTLAND, OREGON

Physically Unsuitable Material

To be practicable and effective, beach nourishment requires the use of nourishment material (fill) of appropriate physical composition and grain size. Coarse, sandy material which approximates the characteristics of the native material is optimal. Mud, silt, clay, rock, sludge and other materials are inappropriate for beach nourishment.

For 72 of the 205 projects for which another use was not preferred, beach nourishment was decisively constrained by the physical composition and grain size of the dredged material. In effect, for more than one in every three projects, beach nourishment was an impracticable or inappropriate form of dredged material disposal. A relatively high number of prospective beach nourishment opportunities in the New England and Pacific Ocean Divisions and the New York, New Orleans and Buffalo Districts were precluded by the unsuitability of the dredged material.

Environmental and Technical Constraints

As displayed in Tables IV and V, there were major environmental and technical constraints to beach nourishment confronting 76 projects; however, in 46 of these cases the material was also physically unsuitable and the constraints were not decisive.

Of the 50 projects facing environmental problems, (i.e., water quality impacts, turbidity and impacts on fish and wildlife), 17 were decisively constrained by these problems. In the Detroit District, where sediments are frequently contaminated with industrial wastes, it is notable that anticipated water quality impacts quite frequently preclude beach nourishment.

Of 26 projects facing technical problems (i.e. unsuitable shore character, superior source of nourishment material, hazardous ocean wave or current conditions and adverse effects on water uses), 13 were decisively constrained by those problems.

Analysis

Remedies for the frequent constraints to consideration of beach nourishment as a dredged material disposal alternative are widely recognized to involve distinct monetary and environmental tradeoffs or substantial uncertainty. Research pertinent to the effectiveness of beach nourishment techniques and to the environmental impacts of dredged material disposal has been and is being conducted by the Coastal Engineering Research Center and the Waterways Experiment Station, respectively (see References). Otherwise, there is little prospect under existing law for greatly increasing the frequency with which the use of dredged material for beach nourishment merits consideration.

Constraints to Implementation of Beach Nourishment

This section discusses the frequency with which state laws, high incremental costs, lack of need for beach nourishment, and other institutional constraints were found to be decisive and consequently to preclude selection of beach nourishment alternatives which otherwise merited consideration. In

general, such constraints are identified relatively late in the planning process.

For 103 or 211 navigation projects surveyed, beach nourishment merited consideration as a dredged material disposal alternative. In 51 cases, the constraints discussed in this section precluded beach nourishment, while in 52 cases there were no major (and therefore no decisive) constraints and beach nourishment was the selected method of dredged material disposal.

Prohibitions of State Law

For 7 projects located in the State of Wisconsin, beach nourishment using dredged material was prohibited by state law. For 4 of the 7 projects, beach nourishment would have been acceptable under Federal water quality standards and was therefore decisively constrained by state law.

Cost and Need

Cost-Related and Operational (Equipment) Constraints. There were major cost-related and operational constraints in 42 cases. In 27 cases, these constraints were determined to be decisive.

Detailed cost data relating to incremental costs could not be obtained in the survey of dredging projects. In many cases, incremental costs had not been estimated. In others, obtaining the cost data would have been difficult for respondents. Although some cost data was gathered, it is of little use alone because projects are not comparable, incremental costs may vary substantially within the confines of one project, and grain size, nourishment requirements and other related factors which are instrumental in case-by-case decisions are also not addressed in sufficient detail in a survey of this type.

There were 21 projects decisively constrained by cost alone, irrespective of the prospective availability of least-cost equipment. Specific constraints were transport distance and cost (5 cases), per-unit costs for mobilization, demobilization and pumping (11 cases), and both transport and per-unit costs (5 cases). The per-unit cost constraints usually arose because the volume of material to be dredged was relatively small or the pumping distance from the dredge to the nourishment area was too great. In fewer cases, the location of the dredging site was quite remote. In order to reduce mobilization and demobilization costs sufficient to economically justify dredging in the latter cases, each project was "packaged" with other projects not involving beach nourishment; consequently, equipment appropriate for beach nourishment was not necessary to meet the specifications of the overall dredging contract. It should be noted that these per-unit costs, particularly for mobilization and demobilization, are frequently the reason why a navigation project with polluted material in the inner harbor and cleaner material in the inlet cannot be dredged in two operations.

In 6 of the 27 cases, the unavailability of equipment for beach nourishment or of beach nourishment equipment of suitable cost was cited as the decisive factor. Under current operating practice, dredging either is reserved for dredging equipment operated by the Corps of Engineers or is opened to competitive bidding under the Industry Capability Program (ICP). In

the 6 cases discussed here, the dredging was reserved for Corps-operated plant. In 4 cases, the volume of dredging was low, and the Currituck, (a split-hull shallow draft hopper dredge with low mobilization costs) was not available. In 2 cases, the dredge utilized lacked pumpout capability and deposited the dredged material in the deep ocean.

Cost-related and operational constraints were particularly frequent in the Wilmington and Galveston Districts.

Lack of Need for Beach Nourishment. For 22 projects, beach nourishment was determined not to be needed. In 11 cases this constraint was decisive. (In most of the 11 other cases, the material was unsuitable or the incremental cost was too high.) Most of the projects for which a lack of need was reported were in the Portland District (7); other districts reporting this constraint were Galveston (3) and Buffalo (1).

Uncertainties Relating to Cost and Need. "High cost" and "lack of need" are two complementary aspects of the same issue, namely "is beach nourishment worthwhile?" (Statistics on the two constraints together are displayed in Table IV.) The relative merits of beach nourishment as form of disposal are subject to individual judgment and governmental discretion. Under Section 145 of the 1976 Water Resources Development Act and related policy, non-Federal interests may request beach nourishment if they are willing to pay the incremental costs. A number of respondents to the survey were asked to describe discussions with non-Federal interests concerning the financing of incremental costs. Most could not recall whether such discussions had taken place. As a result, case-by-case data on non-Federal preferences was not developed in the survey. This lack of information, coupled with the lack of data on incremental costs, made it difficult to identify the respective roles of the Corps of Engineers and of non-Federal governments in determining that beach nourishment was not needed and/or too expensive.

Other Institutional Constraints

For the remaining 61 projects, beach nourishment was needed and the physical, environmental, technical, legal, cost-related and operating constraints discussed were not decisive. For nine of these projects, beach nourishment was precluded by various decisive institutional constraints. Each project is discussed below.

a. Wellfleet Harbor (New England Division; maintenance). Local citizens objected to beach nourishment because of aesthetics and windblown dust. Use of only the coarser material from the inlet would have required two dredging operations. Material was deposited in Cape Cod Bay.

b. Ambrose Channel (New York District; maintenance). Dredged material has the potential for use at Rockaway Beach, an authorized beach nourishment project. Constraints cited include: relatively small volume of dredged material compared to nourishment needs; need to change the environmental impact statement to modify disposal location; difficulty in coordinating contracting procedures and timing of dredging work and beach nourishment work; restrictions on overdredging of the navigation channel; probable increase in total cost of dredging and nourishment. The dredged material may also be used to nourish beaches on the New Jersey shoreline; however, the affected

communities are unwilling to pay incremental costs because of the magnitude of costs. Material was deposited in the ocean. In the future, the material may be used to "cap" the "Mud Dump" disposal site or other disposal sites for polluted material.

c. Lynnhaven Inlet (Norfolk District; new work). The prospective non-Federal sponsor responsible for incremental costs had difficulty establishing clear title to the property to be nourished. In addition, there was local opposition to the financing of the incremental costs. Material is to be deposited in open water.

d. Brunswick Harbor (Savannah District; maintenance). Nourishment was proposed for a private beach with limited public access. For this reason, public interests were not willing to pay the incremental costs, nor were the private property owners willing to participate. Material was deposited in the ocean.

e. Dauphin Island Bay (Mobile District; maintenance). The Chamber of Commerce which had acted as non-Federal sponsor for beach nourishment is no longer eligible as a sponsor. The local unit of government does not have the fiscal resources to finance incremental costs. Material is to be deposited in open waters.

f. Panama City (Mobile District; maintenance). The State of Florida refused to pay for incremental costs, asserting that it owns the dredged material and may dictate its disposal location. (It now appears that in the future appropriations for incremental costs will be made by the state Legislature.) Material was deposited in the open waters.

g. Port Saint Joe (Mobile District; maintenance). Local interests were unwilling to pay incremental costs because of the magnitude of costs. Delays in permitting and site selection and the limited planning time frame limited the opportunity to remedy local resistance to cost sharing. (It now appears that in the future appropriations for incremental costs will be made by the state Legislature.) Material was deposited in the open waters.

h. Freeport Harbor (Galveston District; maintenance). Non-Federal interests did not express an interest in beach nourishment. Material was deposited in the ocean and in diked facilities.

i. Port Ontario (Buffalo District; new work). Local citizens are afraid that sediment dredged from an area heavily used by fishermen may contain fishhooks and pose a public health threat. Material is to be deposited in open water.

The following constraints were decisive for more than one project:

- Public opposition to possible adverse effects (2);
- Problems of title and property ownership, along with public opposition to financing incremental costs (2);
- Limited time for project planning (2); and

- Unwillingness to finance incremental costs due to the magnitude of costs (2).

Other decisive constraints were specific to one project.

Beach nourishment using dredged material from at least 6 of the 9 projects would probably have involved incremental costs and consequently required non-Federal financial participation. However, the lack of fiscal capability was a constraint for only one project, and non-Federal concern over the magnitude of the incremental cost was a constraint only twice. For 3 of the 6 projects, the lack of a non-Federal cost share was a result of a separate institutional constraint.

In sum, among the institutional constraints to the 9 projects above, there are none which consistently recur.

Analysis

Among the 103 dredging projects surveyed for this study and for which beach nourishment merited consideration as a dredged material disposal alternative, half, or 51, are constrained by state law, cost-related and operating constraints, lack of need for beach nourishment and other institutional constraints. The only consistently recurrent constraints relate to cost and need. The prohibitions of state law were a major constraint in Wisconsin and would have a comparable effect in other states which restrict dredged material disposal. Otherwise, constraints to implementation of beach nourishment opportunities varied on a case-by-case basis.

Comparative Analysis

This section uses the data collected in the survey of dredging projects to provide comparative analyses between new work and maintenance dredging and among Corps of Engineers districts and divisions, and to review the distribution of financing methods and methods of beach nourishment.

New Work Versus Maintenance Dredging

Data pertinent to differences between the new work projects surveyed and the maintenance projects surveyed are displayed in Table IV. Note that because of the limited number of new work projects surveyed (25), most comparisons are not statistically significant.

Compared to maintenance dredging projects, new work projects more frequently (72 percent of the time) encountered early decisive constraints, i.e. constraints precluding consideration of beach nourishment as a dredged material disposal alternative. In particular, the non-Federal sponsors of 12 percent of the new work preferred other productive uses for the dredged material, and most (6 of 7) major environmental/technical constraints to new work were independent of grain size. These findings probably reflect the more detailed and deliberate planning scrutiny given to new work.

In contrast to the incidence of the above constraints, further decisive constraints, i.e., constraints to the implementation of beach nourishment, affected relatively few new work projects (8 percent.) None of those decisive

constraints related to a determination of too high cost or lack of need, whereas high incremental cost and lack of need were the predominant decisive constraints to implementation of beach nourishment at maintenance dredging projects. However, most of the constraints relating to cost and need were in the Galveston, Portland and Wilmington Districts; in the Wilmington and Portland Districts no data on new work projects are available for comparison. These findings, consequently, may reflect the relatively great time pressure affecting operations personnel as they seek sites for disposal of material from maintenance dredging, or may reflect the distinctive constraints encountered in the three districts.

No great differences exist between new work and maintenance projects in the proportion of projects involving beach nourishment.

In sum, the constraints to new work differed from constraints to maintenance work in their mix, but the overall proportion of projects involving beach nourishment were comparable for new work and maintenance dredging. The differences among constraints reported may be in part attributed to the differences in project planning procedures, considerations and time frames.

Comparison Among Districts

Data for comparing constraints among Corps districts and divisions are displayed in Table V.

Projects from the New Orleans District and Pacific Ocean Division are characterized by fine sediments (Mississippi River silt and volcanic silt, respectively). Fine and/or polluted sediments are frequently found in other districts.

Among the 16 districts or divisions reporting 5 or more projects, beach nourishment merited consideration as a disposal alternative the majority of the time in 7 districts. Among those 7 districts, 4 (Jacksonville, Mobile, Los Angeles and Detroit), frequently implemented the beach nourishment opportunities. Although those 4 districts accounted for only 81 of the 211 projects surveyed, 36 of the 52 uses of dredged material for beach nourishment were in those districts. The other 3 districts (Wilmington, Portland and Galveston) with numerous and frequent potentially implementable beach nourishment opportunities encountered frequent constraints relating to cost and lack of need.

Cost Sharing for Implemented Beach Nourishment

Data on the cost shares for the incremental costs, if any, of beach nourishment are displayed in Table VI.

In only 9 of 52 cases did entities other than the Corps participate in financing the incremental costs of beach nourishment operations using dredged material. Among the 9 cases, 1 involved the Navy and 1 involved both the Navy and non-Federal governments. In 7 of the 43 cases involving financing only by the Corps, Federal financing was provided under Section 111 of the 1968 River and Harbor Act. In the other 36 cases (4 new work, 32 maintenance) nourishment was financed out of construction or maintenance funds.

TABLE VI

METHODS USED TO FINANCE THE INCREMENTAL COSTS OF BEACH NOURISHMENT

TYPE OF WORK/FINANCING METHOD ¹	FORM OF BEACH NOURISHMENT (52 PROJECTS):			Total
	On Land	Littoral	Both	
New Work:				
Federal-Sec. 111 \$	0	0	0	0
Federal-other \$	0	4	0	4
Non-Federal \$	1	0	0	1
Total	1	4	0	5
Nonannual O&M:				
Federal-Sec 111 \$	0	0	0	0
Federal-other \$	3	1	1	5
Non-Federal \$	2	0	0	2
Total	5	1	1	7
Annual O&M:				
Federal-Sec. 111 \$	0	1	6	7
Federal-other \$	11	13	3	27
Non-Federal \$	4	1	1	6
Total	15	15	10	40
All Work:				
Federal \$	14	19	10	43
Non-Federal \$	7	1	1	9
Total	21	20	11	52

Notes to Table VI:

1. "Federal \$" means that incremental costs, if any, were entirely financed by the U.S. Army Corps of Engineers, "Non-Federal \$" means that entities other than the Corps financed the incremental costs. See text for discussion.

For each of the 36 cases involving financing only by the Corps other than under Section 111, at least one of the following explanations for the lack of non-Corps financial participation is likely:

1. Beach nourishment is the least-cost environmentally acceptable alternative (i.e. the least-cost alternative permissible under Federal and state law) or is one among a number of environmentally acceptable alternatives of comparable cost;
2. Beach nourishment is required in the authorizing documents for mitigation purposes;
3. Beach nourishment provides navigation benefits or reduces future maintenance costs by removing the material from areas where it can reshore; or
4. The incremental costs, if any, are not known.

Because detailed cost data could not be obtained for the projects surveyed (see discussion of "cost and need" above), the explanations particular to each project are not known.

Almost all of the beach nourishment operations involving financing by interests other than the Corps were on land. This finding reflects the fact that nourishment on beaches and dunes often costs more than littoral nourishment, depending on the physiography of the affected area, piping distances, dredging plant utilized, the need for temporary dikes, and other factors.

By comparison, among the mitigation activities financed under Section 111, none relied exclusively on on-land nourishment. This finding may reflect the relative costs of on-land and littoral nourishment, or may reflect specific opportunities and constraints in the Detroit District, where all the Section 111 projects surveyed are located.

Methods of Beach Nourishment

Data pertaining to beach nourishment methods are displayed in Table VI. Overall, on-land nourishment methods and littoral nourishment methods were used equally frequently. This finding may indicate that littoral nourishment methods have gained wide acceptance, at least within the Corps.

Effects of Section 145 of the 1976 Act

As part of Phase I of the survey, "contact persons" were asked to describe the effects of Section 145 of the 1976 Water Resources Development Act, which authorizes the Corps at the request of a state to undertake beach nourishment using dredged material if no incremental cost to the United States is incurred. Contact persons were asked to describe why (or why not) Section 145 has had a noticeable effect on new work dredging and maintenance dredging. Responses were 13 in number.

Regarding new work, contact persons generally indicated that Section 145 has had no effect. Reasons are summarized as follows:

1. There has been no new work or no feasible opportunity to implement beach nourishment in new work since 1976 (9 responses).
2. Beach nourishment has always been considered for disposal of material from new work and, where needed and feasible, is implemented with non-Federal financing if appropriate (4 responses).

Regarding maintenance dredging, Section 145 has had little or no effect in any responding district or division except those with jurisdiction in Florida. Reasons cited by the 11 districts and divisions outside Florida are summarized below (total is greater than 11 due to multiple responses).

1. Beach nourishment has always been considered for disposal of material from maintenance dredging and, where needed and feasible, is implemented with non-Federal financing if appropriate (4 responses).
2. There are few locations where material is physically suitable for nourishment (3 responses).
3. There are few projects for which the incremental costs would not be higher than the willingness or capability of local sponsors to finance (6 responses).
4. There is little opportunity or need for beach nourishment (3 responses).
5. State agencies' policies discourage beach nourishment (1 response).
6. There is usually a less costly or better source of nourishment material than dredged material (1 response).

The State of Florida has maintained that it owns the material being dredged. The State has refused to issue water quality certifications for maintenance dredging which would dispose of the dredged material offshore, insisting that the material be used to nourish beaches at full Federal expense. This complex controversy over cost sharing has apparently been resolved through the action of the Florida Legislature appropriating funds for the incremental costs. In the future, it is likely that financing for the incremental costs of beach nourishment using material from maintenance dredging will be in accordance with Section 145.

The intent of Congress with regard to incremental costs as expressed in Section 145 may have affected the position of the State of Florida.

Summary of Findings

The findings of this study are applicable to the seacoasts and Great Lakes shorelines. The findings are summarized below.

a. Institutional factors are infrequently major or decisive constraints to the use of dredged material for beach nourishment purposes. For the 211 navigation projects surveyed, institutional factors, including the requirements of state law which exceed Federal water quality standards and the

unwillingness of non-Federal sponsors to finance incremental costs, were major constraints only 18 times and were decisive only 13 times. In contrast, the preference on non-Federal sponsors for an alternative use of dredged material, the physical unsuitability of dredged material for beach nourishment, the expectation of environmental impacts unacceptable under Federal standards, the technical infeasibility or inappropriateness of beach nourishment, factors relating to incremental cost and equipment availability and the lack of need for beach nourishment were together decisive in precluding beach nourishment in 146 of the 211 cases surveyed.

b. There are no institutional factors which consistently recur as major or decisive constraints to the implementation of beach nourishment opportunities using dredged material. Although the restrictions of state law which exceed Federal standards were decisive in four cases studied, the cases were all located in Wisconsin, and this constraint is limited to the few states which regulate dredged material under water quality standards exceeding Federal standards. Among the other institutional constraints, none was decisive more than twice. In particular, the inadequate fiscal resources of non-Federal governments were a decisive constraint only once, and concern over the magnitude of incremental costs was a decisive constraint twice. In other cases, the unwillingness of non-Federal governments to finance incremental costs was a symptom of other constraints such as limited time for planning, public concerns over perceived impacts, or difficulties in arranging easements and rights-of-way.

c. Although neither Section 145 of the 1976 Water Resources Development Act, ER 1130-2-307, nor other law or policy specifically requires the consideration of beach nourishment as a dredged material disposal alternative, Corps districts and divisions responsible for dredging routinely evaluate beach nourishment as a dredged material disposal alternative.

d. Beach nourishment did not merit consideration as a method of disposal for the dredged material from approximately one-half (108) of the 211 projects surveyed. The most frequent major constraints to such consideration were the physical unsuitability of the dredged material for beach nourishment and the expectation of environmental impacts unacceptable under Federal environmental standards. These two constraints often occurred together. Among the beach nourishment opportunities which merited consideration (103), 38 opportunities were decisively constrained by cost-related factors and lack of need. Among the 65 remaining opportunities, 13 were decisively constrained by institutional factors and the Corps implemented 52, or 80%.

e. New work navigation projects differ from maintenance dredging projects, not in the proportion of beach nourishment opportunities implemented, but in the mix of major and decisive constraints to beach nourishment. In particular, beach nourishment using material from maintenance dredging is more likely to merit consideration but is also more likely to be decisively constrained by incremental cost and lack of need. All 38 projects for which the opportunities were thus constrained were maintenance dredging projects. These findings probably reflect the more deliberate and detailed planning scrutiny given to new work projects.

f. Data on the incremental costs of beach nourishment as a form of dredged material disposal and data on the attitudes of non-Federal governments

regarding the need for and relative cost of beach nourishment are difficult to develop post facto. Consequently, for the maintenance projects for which beach nourishment is decisively constrained by cost and/or lack of need, it is difficult to identify the respective roles of the Corps of Engineers and of non-Federal governments in determining that beach nourishment is not needed and/or is too expensive.

g. Four Corps districts surveyed were favored with relatively numerous opportunities for, and relatively few constraints to, beach nourishment using dredged material. The Jacksonville, Mobile, Los Angeles and Detroit Districts were responsible for 36 of the 52 implemented beach nourishment operations using dredged material, although only 81 of the 211 projects surveyed were located in those districts.

h. Only 9 of 52 implemented beach nourishment operations using dredged material involved financial participation by entities other than the Corps. Those operations which involved non-Corps financing were likely to involve on-land deposition of dredged material.

i. The methods of on-land nourishment and of deposition of material in the littoral zone are used equally frequently to nourish beaches with dredged material.

j. Section 145 of the 1976 Water Resources Development Act has had little effect outside the State of Florida in inducing non-Federal financing of the incremental costs of using dredged material for beach nourishment, largely because Section 145 does not represent any major departures from previous practice.

Conclusions

a. By and large, Corps of Engineers districts and divisions responsible for dredging have implemented a high proportion of the opportunities to use dredged material for beach nourishment which have merited consideration and which have been needed and cost-effective.

b. The Corps of Engineers districts and divisions responsible for dredging may be able to increase the frequency with which material from maintenance dredging projects is used for beach nourishment. This may be done by assuring, when beach nourishment merits consideration as a disposal alternative, that prompt, focused and continuous communication is undertaken with affected non-Federal units of government regarding incremental costs, beach nourishment needs and institutional constraints. Such communication would have the following objectives:

- To define the extent of need for beach nourishment for shore protection, recreation and other purposes;
- To estimate the incremental costs, if any, of alternative methods to use the dredged material for beach nourishment which are physically and technically feasible and are acceptable under Federal and state law;

- To evaluate the effectiveness of those alternative beach nourishment methods in meeting the defined needs;
- To obtain necessary financial commitments, if required, in an orderly and timely manner; and
- To promptly resolve remediable uncertainties about property rights, environmental effects, aesthetics, safety and other issues.

Although beach nourishment is the major beneficial use of dredged material, there are other possible uses, such as recreational islands, industrial development and marsh creation. Comparable improvements in communication when these other beneficial uses are possible may improve the frequency with which they are implemented. Consequently, the amendment of Section 11 of ER 1130-2-307 (which discusses beneficial uses of material from maintenance dredging operations) to emphasize improved communication may be warranted. Such an amendment involves little implementation cost and may be adapted to the availability of time and resources.

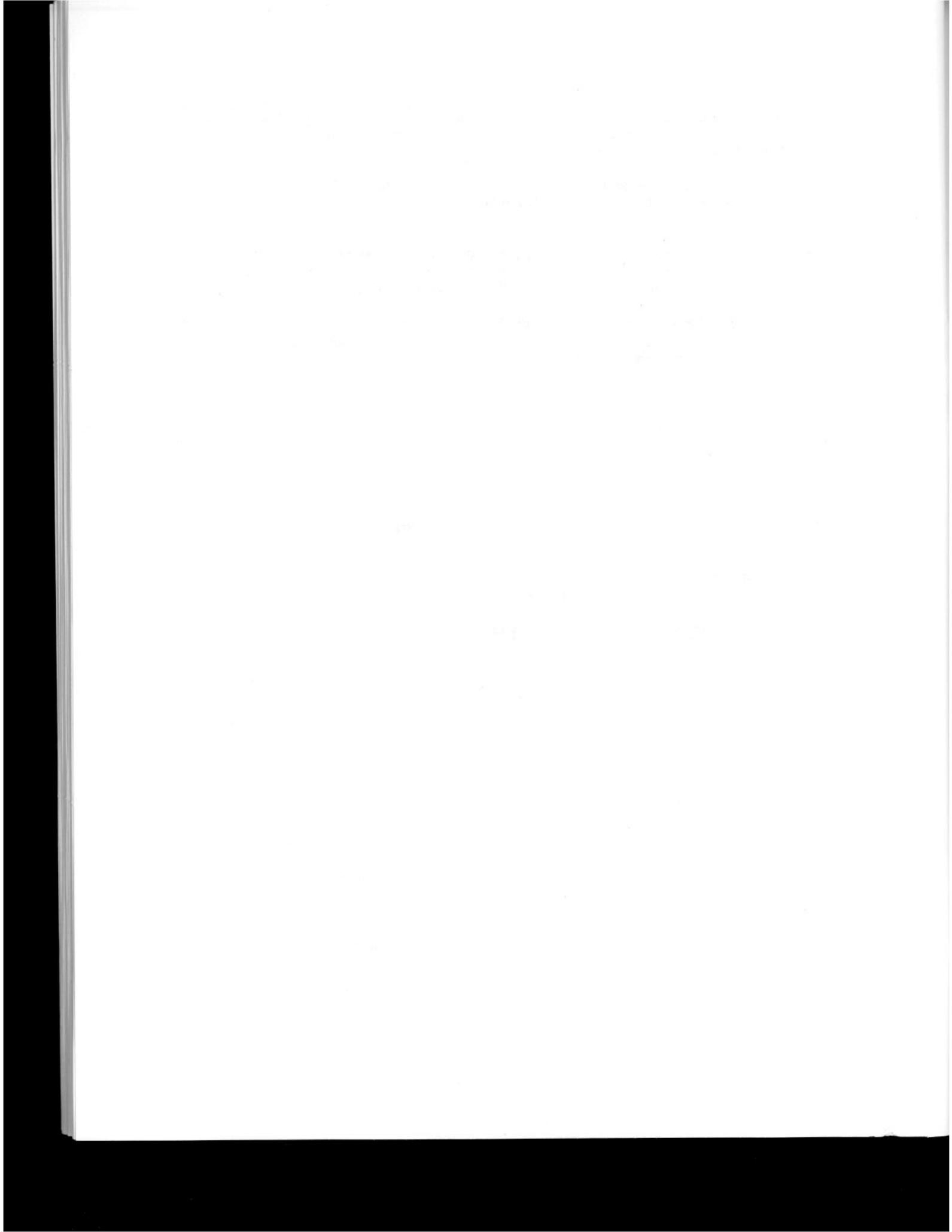
c. Detailed study of potential modifications to cost-sharing policy for the purpose of increasing the frequency with which dredged material is used for beach nourishment is not warranted at this time because major and decisive institutional constraints are relatively infrequent and because there are no consistently recurring constraints relating to financing which are not actually symptoms of other constraints. For the same reasons, any modification to cost-sharing policy, short of Federal financing for all incremental costs, is likely to remedy few institutional constraints.

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APPENDIX A: PHASE I QUESTIONNAIRE



DEPARTMENT OF THE ARMY
WATER RESOURCES SUPPORT CENTER, CORPS OF ENGINEERS
KINGMAN BUILDING
FORT BELVOIR, VIRGINIA 22060

REPLY TO
ATTENTION OF:

WRSC-IWR

23 March 1981

SUBJECT: Policy Study, "Constraints to Use of Dredged Material for Beach Nourishment"

SEE DISTRIBUTION

1. The purpose of this letter is to request information to assist in completing the subject Policy Study undertaken by the Water Resources Support Center, Institute for Water Resources (WRSC-IWR) in FY 81 for the Office of Policy, Directorate of Civil Works. The purposes of the study are to determine whether there have been recent opportunities to use dredged material from harbors and waterways as a source of beach nourishment material, to determine the extent to which these opportunities have been utilized, and to identify institutional and related financing and regulatory constraints which limit the use of dredged material for beach nourishment. The study was originated through a request by Major General Lewis, Division Engineer, North Atlantic Division to the Director of Civil Works that alternative cost-sharing and institutional arrangements be considered in order to increase the usage of suitable dredged material for beach nourishment.

2. Your assistance is requested through designation of a "contact person" to coordinate responses to the survey (Incl. 1) and to work with the WRSC-IWR study manager (Mark Mugler, 202-325-0574). The survey concerns recent proposed and actual dredging projects for the period 1977 to 1980. Survey reports recommending federal action, authorized projects in stages of advanced engineering and design, small boat harbor projects and maintenance dredging projects in eighteen Districts and two Divisions with jurisdiction on the seacoasts and Great Lakes are being reviewed. The survey has been designed to minimize administrative burdens to the Districts and Divisions. The study manager is available to discuss measures to achieve this objective.

3. The survey is essential to determine whether changes in national policy on dredged material disposal are needed. Your assistance in the survey is greatly appreciated. Any further opinions or information regarding the use of dredged material for beach nourishment are welcome.

FOR THE COMMANDER/DIRECTOR:

1 Incl
as

A handwritten signature in dark ink, appearing to read "Jim Hanchey", is written over the typed name of James R. Hanchey.

JAMES R. HANCHEY
Acting Director
Institute for Water Resources

WRSC-IWR

23 March 1981

SUBJECT: Policy Study, "Constraints to Use of Dredged Material for Beach
Nourishment"

DISTRIBUTION:

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Division Engineer, Pacific Ocean
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District Engineer, Portland
District Engineer, Seattle
District Engineer, Alaska
District Engineer, Buffalo
District Engineer, Detroit

DREDGED MATERIAL DISPOSAL/BEACH NOURISHMENT SURVEY

GENERAL INTRODUCTION

This survey is the major part of a study of recent navigation dredging projects. The purposes of the survey are: (a) to determine whether there have been opportunities since approximately 1977 for the Corps of Engineers to use clean and suitable dredged material from the harbors and waterways as a source of beach nourishment material on nearby beaches; (b) to determine to what extent the Corps has utilized these opportunities; and (c) to identify the constraints (with focus on institutional, financial and regulatory constraints) which limit the use of dredged material for beach nourishment. The results of the survey will be incorporated into a policy study being conducted in FY 81 by the Water Resources Support Center, Institute for Water Resources (WRSC-IWR) for the Office of Policy, Directorate of Civil Works (DAEN-CWR).

For purposes of the survey, beach nourishment is defined as the deposit of materials, unconfined, on or near the shoreline, and includes beach building and fill, dune creation, nourishment of barrier islands, and replenishment of littoral material by deposition in nearshore waters. The purposes of beach nourishment include but are not limited to recreation and shore protection.

Each District Engineer or Division Engineer in seacoast and Great Lakes Divisions and Districts has been requested to designate a contact person to coordinate responses to the survey. Contact persons may telephone Mark Mugler, Policy Analyst, WRSC-IWR at (202) 325-0574 to discuss the questionnaire.

The survey is divided into two parts. Contact persons are requested to complete Part I. Contact persons are also requested to review Part II and to obtain, for each coastal project identified in Part I, the assistance of a respondent to complete Part II.

Contact persons are requested to return the completed survey by 17 April 1981 to Mark Mugler, WRSC-IWF, Kingman Building, Fort Belvoir, Virginia 22060.

PART I: PROJECT SCREENING
(Continued)

Further Instructions: Section 145 of the 1976 Water Resource Development Act authorizes the Corps of Engineers to deposit clean and suitable dredged material on adjacent beaches if state or local sponsors pay the incremental cost. In effect, Section 145 offers blanket authorization to modify dredging projects to accomplish beach nourishment if no extra cost to the U.S. is incurred.

Has Section 145 had a noticeable effect on new work dredging practices?
Please provide reasons why or why not:

Has Section 145 had a noticeable effect on maintenance dredging practices?
Please provide reasons why or why not:

Further Instructions: For each project circled above, a respondent should complete Part II. Please obtain the assistance of knowledgeable individuals to act as respondents, and assign the response for each project to the appropriate individual. Multiple copies of the General Introduction and Part II are attached for this purpose.

DREDGED MATERIAL DISPOSAL/BEACH NOURISHMENT SURVEY

GENERAL INSTRUCTIONS FOR PART II.

In Part I of this survey, coastal dredging projects since approximately 1977 were identified. The contact person who completed Part I has obtained the assistance of a respondent to complete Part II for each project in Part I.

Part II has four subparts.

In Subpart A, technical constraints to using the dredged material for beach nourishment are identified for the project in question. If beach nourishment was technically infeasible, no further Subparts need to be completed for the project in question.

In Subpart B, basic dredging and disposal data are requested for the project.

In Subpart C, a description of the leading opportunity to use the project's dredged material for beach nourishment is requested.

In Subpart D, various non-technical constraints to using the project's dredged material for beach nourishment are ranked. Subpart D is the crucial part of the survey.

Each respondent is requested to answer to the best of his or her ability, using readily available information and without spending a great deal of time researching the answers. Each respondent is requested to provide personal opinions in response to opinion questions; responses to all questions will be kept in confidence and will be documented in aggregate form. Each respondent should return completed survey forms to the contact person in his or her District or Division by 15 April 1981.

Thank you for your assistance.

DREDGED MATERIAL/BEACH NOURISHMENT SURVEY

SUBPART II A: SELECTION OF PROJECTS FOR FURTHER STUDY

Instructions: Respondents are requested to complete this Part for each project. Please note that the definition of "beach nourishment" for this survey is the deposit of material, unconfined, on or near the shoreline, and includes beach building and fill, dune creation, nourishment of barrier islands, and replenishment of littoral material by deposition in nearshore waters.

1. Project Name: _____
2. Project Location: City or County: _____
State: _____
Division/District: _____
3. Respondent: Name: _____
Title: _____
Branch: _____
Division: _____
Telephone: _____
(Commercial)

Further Instructions: For the project named above, please answer the following questions. Provide information current as of 31 December 1980. For projects in planning or advanced engineering, refer to dredging pending as of 31 December 1980. For projects under construction or maintenance dredging, refer to most recent or current dredging as of 31 December 1980.

4. Please check applicable project authority and status.

- _____ A. Survey report; authorization pending
- _____ B. Authorized project:
 - _____ 1. Advanced engineering and design underway
 - _____ 2. Under construction
- _____ C. Section 107 continuing authority:
 - _____ 1. Detailed project report under review or approved
 - _____ 2. Final planning or construction underway
- _____ D. Maintenance dredging:
 - _____ 1. Underway
 - _____ 2. Initiated after 9/30/77 and completed
- _____ E. Other authority/status (specify): _____

SUBPART II A: SELECTION OF PROJECTS FOR FURTHER STUDY
(Continued)

5. Please check the applicable description of the dredged material:

- Mud, clay, silt, topsoil, shale
- Sand, gravel, shell
- Silt and sand mixtures
- Organic muck, peat, sludge, municipal/industrial waste
- Mixed

6. Was beach nourishment at any time considered as a dredged material disposal alternative for this project? YES

NO

NOTICE: If the answer is "NO", do not complete the remainder of this Subpart and do not complete remaining Subparts. If the answer is "YES", proceed.

7. Ranking of technical constraints. Please rank the following technical constraints to using the material dredged from this project as beach nourishment on nearby beaches. Rank only those items that were actual constraints. Place a "1" next to the most important constraint, a "2" next to the second most important, etc. (Note: institutional, environmental and other non-technical constraints should not be discussed here, but in Subpart D.)

- a. No demonstrable need for beach nourishment
- b. Unsuitable grain size or composition for beach nourishment.
- c. Quantity of material needed at potential beach nourishment site or sites or available from project is too small for efficient disposal
- d. Least-cost or most suitable equipment for beach or nearshore disposal is not available
- e. Distance to potential sites too great
- f. Incremental transport costs too high
- g. Difficult water access to potential sites due to shallow water, etc.
- h. Handling and pumping costs at potential sites too high
- i. Material from inland or offshore borrow areas is superior in grain size and composition
- j. Material from inland or offshore borrow areas is superior in cost
- k. Other (specify): _____
- l. Other (specify): _____

8. Did beach nourishment continue to receive consideration as a dredged material disposal option despite the technical constraints? YES

NO

NOTICE: If the answer is "NO", do not complete Subparts B through D for this project. If the answer is "YES", proceed to Subpart B for this project.

DREDGED MATERIAL/BEACH NOURISHMENT SURVEY

SUBPART II B: PROJECT DESCRIPTION

Project Name: _____

Division or District: _____

Instructions. Please complete a column to describe each method and site selected for dredged material disposal for the project named above. Provide information current as of 31 December 1980.

	<u>Site/Method #1</u>	<u>Site/Method #2</u>
<p>1. Please identify the actual or likely disposal site:</p>		
Name	_____	_____
City/County	_____	_____
State	_____	_____
Site owner (indicate public or private)	_____	_____
Local Sponsor if any, (name)	_____	_____
<p>2. Please check the actual or likely disposal method:</p>		
Agitation/resuspension	_____	_____
Open Water	_____	_____
Ocean	_____	_____
Beach nourishment: on-land	_____	_____
Beach nourishment: littoral enrichment	_____	_____
Marsh creation	_____	_____
Confined (aquatic)	_____	_____
Confined (upland)	_____	_____
Stockpiling	_____	_____
Other (specify) _____	_____	_____
<p>3. Please identify the type of dredges(s) used or likely to be used for dredging (e.g. cutterhead, hopper): _____</p>		
<p>4. Please identify the additional equipment (e.g. booster pumps, pipelines) used or likely to be used for material handling and disposal: _____</p>		

SUBPART II B: PROJECT DESCRIPTION
(Continued)

Site/Method #1 Site/Method #2

5. Please check the anticipated uses of disposal site (if known):

Recreation	_____	_____
Industry/commercial/port	_____	_____
Residential	_____	_____
Institutional	_____	_____
Transportation fill	_____	_____
Agricultural fill	_____	_____
Land reclamation fill	_____	_____
Stockpiling & multiple reuse	_____	_____
Shore protection	_____	_____
Wildlife habitat	_____	_____
River control/flood control structures	_____	_____
Aquatic habitat	_____	_____
Other (specify) _____	_____	_____
Not known	_____	_____

6. Please indicate the approximate annual volume of dredged material disposed of at site (cubic yards):

7. Please indicate the approximate average costs per cubic yard (over life of disposal area, if confined; in most recent, current or pending dredging if unconfined):

Total (\$/cubic yard)	_____	_____
Federal (\$/cubic yard)	_____	_____
Non-Federal (\$/cubic yard)	_____	_____
Allocable to dredging (\$/cy)	_____	_____
Allocable to handling and disposal (including diking) (\$/cubic yard)	_____	_____

8. Please indicate the frequency of dredging at project:

_____ Annual
_____ Every _____ years (specify)

Further Instructions: If, for the project described in this Subpart, beach nourishment is a selected method of dredged material disposal, skip Subpart C and complete Subpart D only. If, for the project described in this Part, beach nourishment is not a selected method of disposal, complete both Subparts C and D.

DREDGED MATERIAL DISPOSAL/BEACH NOURISHMENT SURVEY

SUBPART II C: DESCRIPTION OF BEACH NOURISHMENT OPPORTUNITIES

Instructions: Please provide information as requested below for each dredging project for which Subpart B was completed and for which beach nourishment is not a selected method of dredged material disposal. Provide information current as of 31 December 1980.

1. Project Name: _____

2. Division or District: _____

3. Candidate beach nourishment site. Please provide the following information on the potential site for beach nourishment for which the demonstrable need for beach nourishment material is greatest in relation to the likely added cost of beach nourishment.

Name: _____

City/County: _____

State: _____

Site Owner (indicate public or private): _____

Potential Local Sponsor (if any): _____

Present Uses: _____

4. Please check the likely method of beach nourishment at candidate beach nourishment site:

- _____ On-land beach nourishment
_____ Placement in nearshore region

5. Please estimate average costs per cubic yard of dredging and beach nourishment at candidate beach nourishment site:

- _____ Total (\$/cubic yard)
_____ Federal (\$/cubic yard)
_____ Non-Federal (\$/cubic yard)
_____ Allocable to dredging (\$/cubic yard)
_____ Allocable to handling and disposal (\$/cubic yard)

6. Please check the principal uses supported by beach nourishment at candidate beach nourishment site:

- _____ Recreation
_____ Shore protection
_____ Wildlife habitat
_____ Other (specify) _____

7. Additional Comments:

DREDGED MATERIAL DISPOSAL/BEACH NOURISHMENT SURVEY

SUBPART II D: RANKING OF CONSTRAINTS

Project Name: _____

District or Division: _____

Instructions: Potential constraints to the use of dredged material for beach nourishment are listed below, in four categories (Environmental and Socioeconomic, Institutional and Planning, Permitting, and Legal).

For the project named above, please rank the four categories. Place a "1" next to the category posing the most severe constraints, a "2" next to the category posing the second most severe constraints, etc. Make sure to consider constraints only to use of the dredged material for beach nourishment. Do not rank constraints to dredging per se.

Also, please rank the constraints within each of the four categories, with the most severe constraint ranked as "1". Please note that probably only some of the items in each category were actual constraints in the case of each project. Assign a rank only to those items that were actual constraints for the project. In some cases, an entire category of constraints may not even have come into play.

_____ A. Environmental and Socioeconomic Constraints

- _____ a. Pollution of potable waters
- _____ b. Other water pollution
- _____ c. Turbidity and resuspension of sediment
- _____ d. Contaminant uptake by benthic organisms
- _____ e. Pathogens, disease, public health threats at disposal site
- _____ f. Destruction of aquatic plants during disposal
- _____ g. Adverse effects on fish, wildlife, and endangered species
- _____ h. Physical effects on navigation or other water uses
- _____ i. Degradation of aesthetic, conservation or recreation values
- _____ j. Objectionable sensory effects
- _____ k. Problems of public safety; nuisances
- _____ l. Adverse effects on community image and values
- _____ m. Other (specify): _____
- _____ n. Other (specify): _____

SUBPART II D: RANKING OF CONSTRAINTS
(Continued)

 B. Institutional and Planning Constraints

- a. Affected resource (beach, shoreline, island) is not public
- b. State/Federal disagreement over ownership of dredged material
- c. State royalties or severance fees for dredged material
- d. Unwillingness of potential sponsors to pay incremental costs of beach nourishment
- e. Lack of authority of potential sponsors to commit funds for incremental costs
- f. Corps of Engineers budgetary limitations
- g. Public opposition to possible environmental effects
- h. Public opposition to possible socioeconomic effects
- i. Public opposition to local cost-sharing
- j. Lack of awareness of disposal alternatives on the part of potential sponsors and public
- k. Inability of potential sponsors to commit funds in a timely fashion; short planning period
- l. Poor coordination of disposal planning and local/state planning
- m. Procedural delays in planning, coordination and public participation
- n. Lack of long-term disposal planning
- o. Other (specify): _____
- p. Other (specify): _____

 C. Permitting Constraints

- a. Testing and data collection requirements
- b. Monitoring requirements
- c. Procedural delays resulting from agency conflicts
- d. Conflict between regulatory requirements and Corps role as contracting (bid-letting) officer
- e. Costs and delays for environmental assessments
- f. Other procedural delays (specify): _____
- g. Threatened or actual lawsuits
- h. Other (specify): _____
- i. Other (specify): _____

SUBPART II D: RANKING OF CONSTRAINTS
(Continued)

_____ D. Legal Constraints

a. Federal Environmental Law and Regulations:

- _____ 1. NEPA
- _____ 2. Section 404
- _____ 3. Ocean Dumping Act
- _____ 4. Fish and Wildlife Coordination Act
- _____ 5. Endangered Species Act
- _____ 6. Other (specify): _____
- _____ 7. Other (specify): _____

b. State Law and Regulations:

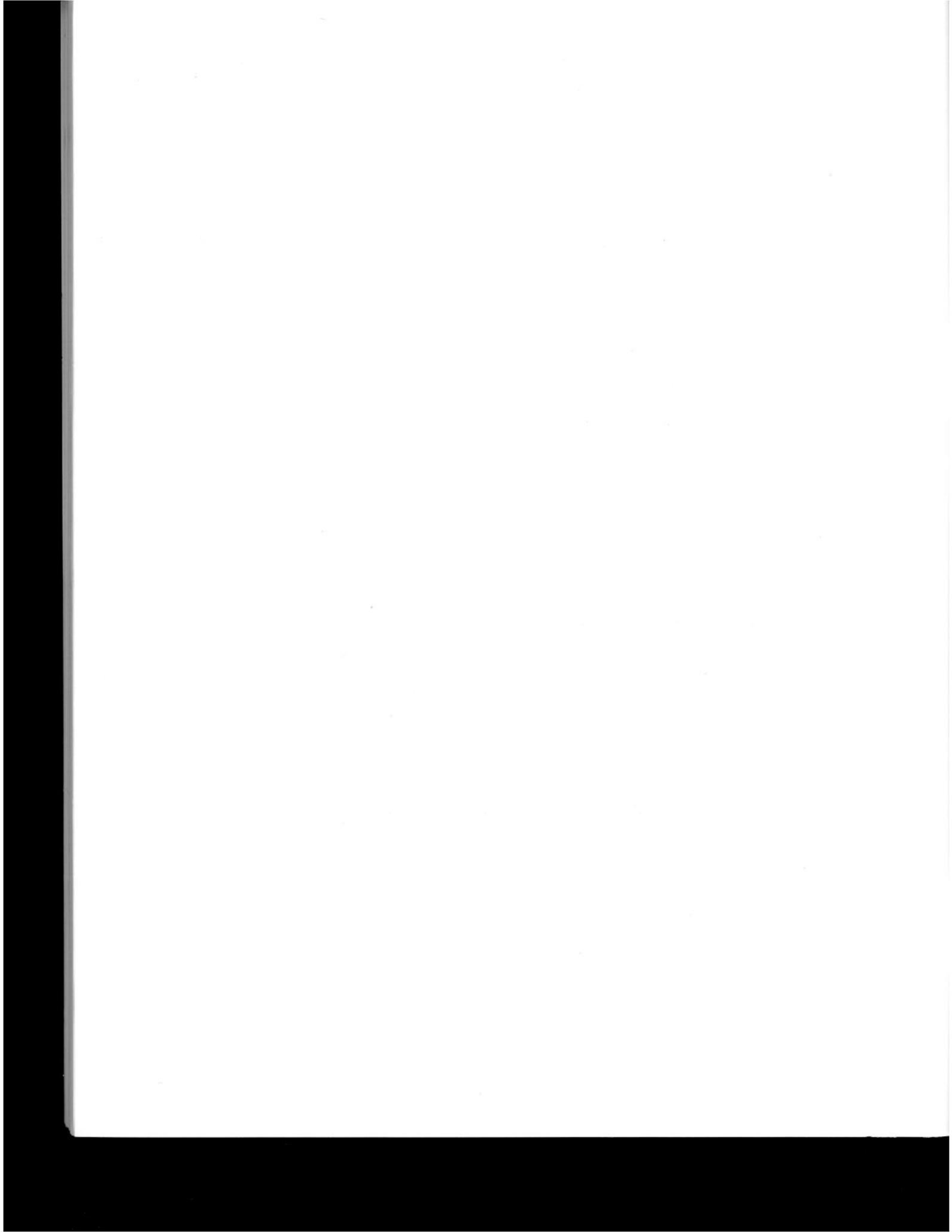
- _____ 1. Land Use
- _____ 2. Public and submerged lands

- 3. Environmental:
 - _____ (a) Water quality
 - _____ (b) Environmental statements
 - _____ (c) Fish and game habitat protection
 - _____ (d) Erosion and sedimentation
 - _____ (e) Other (specify): _____
 - _____ (f) Other (specify): _____
- _____ 4. Other state law or regulations (specify): _____

c. Local law and regulations:

- _____ 1. Land use
- _____ 2. Environmental
- _____ 3. Other local law or regulations (specify): _____

Further Instructions: In the space below, please provide additional comments, if any, on environmental, socioeconomic, institutional, planning, permitting and legal problems encountered in attempting to use dredged material from this project for beach nourishment purposes.



APPENDIX B
LIST OF PROJECTS SURVEYED

NEW WORK

New England Division

Bristol Harbor

New York District

Moriches Inlet
Kill Van Kull and Newark Bay

Norfolk District

Thimble Shoal
Lynnhaven Inlet

Charleston District

Charleston Harbor

Savannah District

Savannah Harbor Entrance Channel

Jacksonville District

Manatee Harbor
Crown Bay Channel
Ponce Harbor
Pt. Everglades Harbor

Galveston District

Brazos Island Harbor

Los Angeles District

Los Angeles Harbor

Alaska District

Kake Harbor
Cordova Small Boat Harbor

Pacific Ocean Division

Apra Harbor
Kikiaola Harbor

Buffalo District

Cattaraugus Harbor
West Harbor
Port Ontario

MAINTENANCE DREDGING

New England Division

Cape Cod Canal
Connecticut River (mouth)
Bridgeport Harbor
Clinton Harbor
Norwalk Harbor
Westcott Cove - (diked disposal)
Westcott Cove - (beach nourishment)
Isle au Haut
Kennebec River
Saco River (diked disposal)
Saco River (beach nourishment)
Annisquam River
Wellfleet Harbor
Mystic River

New York District

Jones Inlet
Ambrose Channel
New York and New Jersey Channels
Newark, Hackensack and Passaic River
New Town Creek
Keyport/Matawan
Bronx River
Mamaroneck
Westchester Creek
Bay Ridge and Red Hook
Shrewsbury River

Philadelphia District

Absecon Inlet
Barnegat Inlet
Cold Spring Harbor
Lewes Harbor of Refuge

Baltimore District

Ocean City

Norfolk District

Norfolk Harbor
Tangier Channel
Chincoteague Inlet
Greensvale Creek
Winter Harbor
Queens Creek

Wilmington District

Okracoke Inlet
Silver Lake Harbor
Wilmington Harbor
Atlantic Intracoastal Waterway
Beaufort
Channel Back Sound to Lookout Bight
Lockwoods Folly
Manteo (Shallowbag) Bay
Morehead City

Charleston District

Charleston Harbor
Pt. Royal Harbor
Twon Creek
Atlantic Intracoastal Waterway

Savannah District

Savannah Harbor Entrance Channel
Atlantic Intracoastal Waterway
Brunswick Harbor

Jacksonville District

Canaveral Harbor
Charlotte Harbor
Fernandina
Jacksonville Harbor
Palm Beach
Ponce de Leon Harbor
St. Augustine
St. Lucie Inlet
Tampa Harbor
Arecibo
Mayaguez Harbor
Longboat Pass
Johns Pass

Mobile District

Appalachicola Entrance Channel
East Pass Channel
Panama City
Pensacola Harbor
Bayou La Batre
Bon Secour
Dauphin Island Bay
Gulf Intracoastal Waterway
Perdido Pass
Bayou Coden
Biloxi Harbor Inlet
Cadet Bayou Inlet
Gulfport Bayou
Pascagoula Harbor Inlet
Port Saint Joe

New Orleans District

Atchafalaya River
Barataria Bay
Calcasieu River and Pass
Freshwater Bayou
Houma Navigation Channel
Mississippi River - Baton Rouge to Gulf
Mississippi River Outlets Vicinity of Venice

Galveston District

Brazos Island
Pt. Bolivar
Corpus Cristi Ship Channel
Freeport Harbor
Galveston Harbor
Matagorda Ship Channel
Sabine Neches
Gulf Intracoastal Waterway - Tributary Channel to Pt. Mansfield
Gulf Intracoastal Waterway

Los Angeles District

Channel Island Harbor
San Diego Harbor
Oceanside Harbor
Ventura Marina
Redondo Beach
Santa Barbara
Morro Bay Harbor
Newport Bay Harbor

San Francisco District

Humboldt
Noyo River
Oakland Harbor
Redwood City
Richmond Harbor
San Francisco Harbor Channel
San Pablo-Mare
Santa Cruz Harbor
Suisun Bay
Bodega Bay

Portland District

Chetco River
Columbia River Mouth
Coos Bay
Coquille River
Pt. Orford
Rogue River
Suislaw River
Umpqua River
Yaquina Bar and Harbor

Seattle District

Grays Harbor - Chehalis
Quillayute River

Alaska District

Anchorage Harbor
Dillingham Harbor
Homer Harbor
Ninilchik Harbor
Nome Harbor
Wrangell Narrows

Pacific Ocean Division

Hilo Harbor
Kahului Harbor
Manele Harbor

Buffalo District

Buffalo Harbor
Oswego Harbor
Rochester (Charlotte)
Erie Harbor
Ashtabula Harbor
Cleveland Harbor
Conneaut Harbor
Fairport Harbor
Lorraine Harbor
Sandusky Harbor
Toledo Harbor
Vermilion Harbor
Olcott Harbor
Brunswick Harbor
Barcelona Harbor

Detroit District

Arcadia
Charlevoix
Channels of Lake St. Clair
Detroit Harbor
Frankfort Harbor
Grand Haven Harbor
Harbor Beach
Holland Harbor
Inland Route
Little Lake (Lake disposal)
Little Lake (beach nourishment)
Ludington Harbor
Manistee Harbor
Monroe Harbor
Muskegon Harbor
Pentwater

Rouge River
Sebewaing
Saint Clair
St. Joseph Harbor
Big Bay
Kewaunee Harbor
Manitowoc Harbor
Pt. Washington
Sheboygan Harbor
Saginaw
Bolles Harbor
New Buffalo

APPENDIX C
CONTACT PERSONS AND RESPONDENTS

NEW ENGLAND DIVISION

Contact Person: Don Martin
Respondents: Carl Boutliere
Don Martin

NEW YORK DISTRICT

Contact Person: Joseph J. Debler
Respondents: Pete Puglese
Bob Dieterich
Joseph J. Debler

PHILADELPHIA DISTRICT

Contact Person: Walter Sgrignuoli
Respondents: Walter Sgrignuoli
Sue Casper

BALTIMORE DISTRICT

Contact Person: H. Glenn Earhart
Respondents: Monty Franklin
H. Glenn Earhart

NORFOLK DISTRICT

Contact Person: Charles E. Hicks
Respondents: T. D. Woodward
Samuel E. McGee

WILMINGTON DISTRICT

Contact Person: Barry Holliday
Respondents: Barry Holliday

CHARLESTON DISTRICT

Contact Person: Larry Casbeer
Respondents: Larry Casbeer
Braxton Keyser

SAVANNAH DISTRICT

Contact Person: Wade Seyle, Jr.
Respondents: Wade Seyle, Jr.

JACKSONVILLE DISTRICT

Contact Person: Phipps Hager
Respondents: Phipps Hager

MOBILE DISTRICT

Contact Person: Walter W. Burdin
Respondents: Jim Walker
Jim Baxter

NEW ORLEANS DISTRICT

Contact Person: Robert Gunn/Tom F. Pendergraft
Respondents: Tom F. Pendergraft

GALVESTON DISTRICT

Contact Person: Carlos Aquilar
Respondents: Rick Medina
Noah New

LOS ANGELES DISTRICT

Contact Person: Tad Nizinski
Respondents: Tad Nizinski

SAN FRANCISCO DISTRICT

Contact Person: John Sustar
Respondents: John Sustar

PORTLAND DISTRICT

Contact Person: Harold Herndon
Respondents: Jack Beckly
Ron Smith

SEATTLE DISTRICT

Contact Person: Alex Sumeri
Respondents: Alex Sumeri
Dave Schultz

ALASKA DISTRICT

Contact Person: Orson Smith
Respondents: Orson Smith

BUFFALO DISTRICT

Contact Person: Denton Clark, Jr.
Respondents: Denton Clark, Jr.
Jim Brady
Vince Montani

DETROIT DISTRICT

Contact Person: Steve Bolla
Respondents: Don Billmaier
William W. Willis
Richard Price
Tom Marchinda
Ross Lunetta

PACIFIC OCEAN DIVISION

Contact Person: James Hatashima
Respondents: James Hatashima

APPENDIX D
 PARTIAL LIST OF U.S. ARMY CORPS OF ENGINEERS PROJECTS USING
 DREDGED MATERIAL FOR BEACH NOURISHMENT PURPOSES

<u>CHANNEL/HARBOR</u>	<u>STATUS</u> ⁽²⁾
<u>New England Division</u>	
Green Harbor	O&M
Clinton Harbor	O&M
Menemsha Creek	O&M
Westcott Cove	O&M
Saco River	O&M
<u>New York District</u>	
Sandy Hook	O&M/BEC
Fire Island to Jones Inlet	O&M
East Rockaway Inlet	O&M/BEC
Moriches Inlet	new
Jones Inlet	O&M
Fire Island Inlet	O&M
Moriches Inlet	O&M
Lake Montauk Harbor	new
<u>Baltimore District</u>	
Ocean City Inlet Channel Sec. 2	O&M
<u>Norfolk District</u>	
Lynnhaven Inlet	pending
Thimble Shoal Channel	demonstration

(1) Sources: U.S. Army Corps of Engineers, Waterways Experiment Station, Dredged Material Research Program, Productive Uses Project; data collected as part of the survey for this policy study; Aston (1974); Baskette (1975); U.S. Army Corps of Engineers, Water Resources Support Center, Institute for Water Resources (1979).

(2) "O&M" means maintenance dredging. "New" means new work. "Pending" means the survey report is complete but new work dredging has not begun. "BEC" means beach erosion control. "Sec 111" means mitigation under Section 111 of the 1968 Water Resources Development Act.

Wilmington District

Channel to Hatteras Inlet	O&M
Atlantic Intracoastal Waterway	O&M
Channel Back Sound to Lookout Bight	O&M
Morehead City	new

Charleston District

Little River Inlet	pending
Murrell's Inlet	new
Little River Inlet	emergency

Savannah District

Longboat Pass	O&M
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Jacksonville District

Johns Pass	O&M
Palm Beach Harbor	O&M
Fort Pierce Harbor	O&M
AIWW - Jacksonville to Ft. Pierce	O&M
Charlotte Harbor	O&M
St. Johns River to Port of Jacksonville	O&M
Jacksonville Harbor	O&M
Mayport Harbor	O&M
Canaveral Harbor	new
Fernandina Harbor	O&M
Palm Beach Harbor	O&M
Ponce de Leon	O&M
St. Augustine	O&M
St. Lucie Inlet	O&M
Longboat Pass	O&M

Mobile District

Pass Christian Harbor	O&M
Panama City Harbor	O&M
Fly Creek	O&M
Appalachicola Entrance Channel	O&M
Pensacola Harbor	O&M
Perdido Pass	O&M
Biloxi Harbor Inlet	O&M
Gulfport Bayou	O&M
Pascagoula Harbor Inlet	O&M

Galveston District

Port Mansfield	O&M
GIWW - Tributary Channel to Pt. Mansfield	O&M

Los Angeles District

Morro Bay Harbor	O&M
Santa Barbara Harbor	O&M
Ventura Marina	O&M
San Diego Harbor	O&M
Channel Island Harbor	O&M
Anaheim Bay	O&M
Oceanside Harbor	O&M
Redondo Beach	O&M
Newport Bay Harbor	O&M

San Francisco District

San Francisco Harbor Channel	O&M
Santa Cruz Harbor	new

Portland District

Columbia River Mouth	O&M
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Seattle District

Quillayute River	O&M
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Alaska District

Buffalo District

West Harbor	pending
Cattaraugus	pending

Detroit District

Grand Haven Harbor Modifications	pending
New Buffalo Harbor	O&M
Cross Village Harbor	pending
Arcadia Harbor	O&M
Frankfort Harbor	Sec. 111
Grand Haven Harbor	Sec. 111
Holland Harbor	Sec. 111
Little Lake	O&M
Ludington Harbor	Sec. 111
Manistee Harbor	Sec. 111
Muskegon Harboe	Sec. 111
Pentwater Harbor	O&M
St. Joseph Harbor	Sec. 111
Keweenaw Waterway	O&M
Alpena Harbor	O&M
Saginaw River	O&M
Lexington Harbor	O&M
Eagle Harbor	O&M
Manistique Harbor	O&M
Cedar River	O&M